Jane's

ALL THE WORLD'S AIRCRAFT

1995-96

Edited by Paul Jackson MRAeS

Eighty-sixth year of issue


Air Atlantic
ROYAL THAI
BM

Jane's

ALL THE WORLD'S AIRCRAFT

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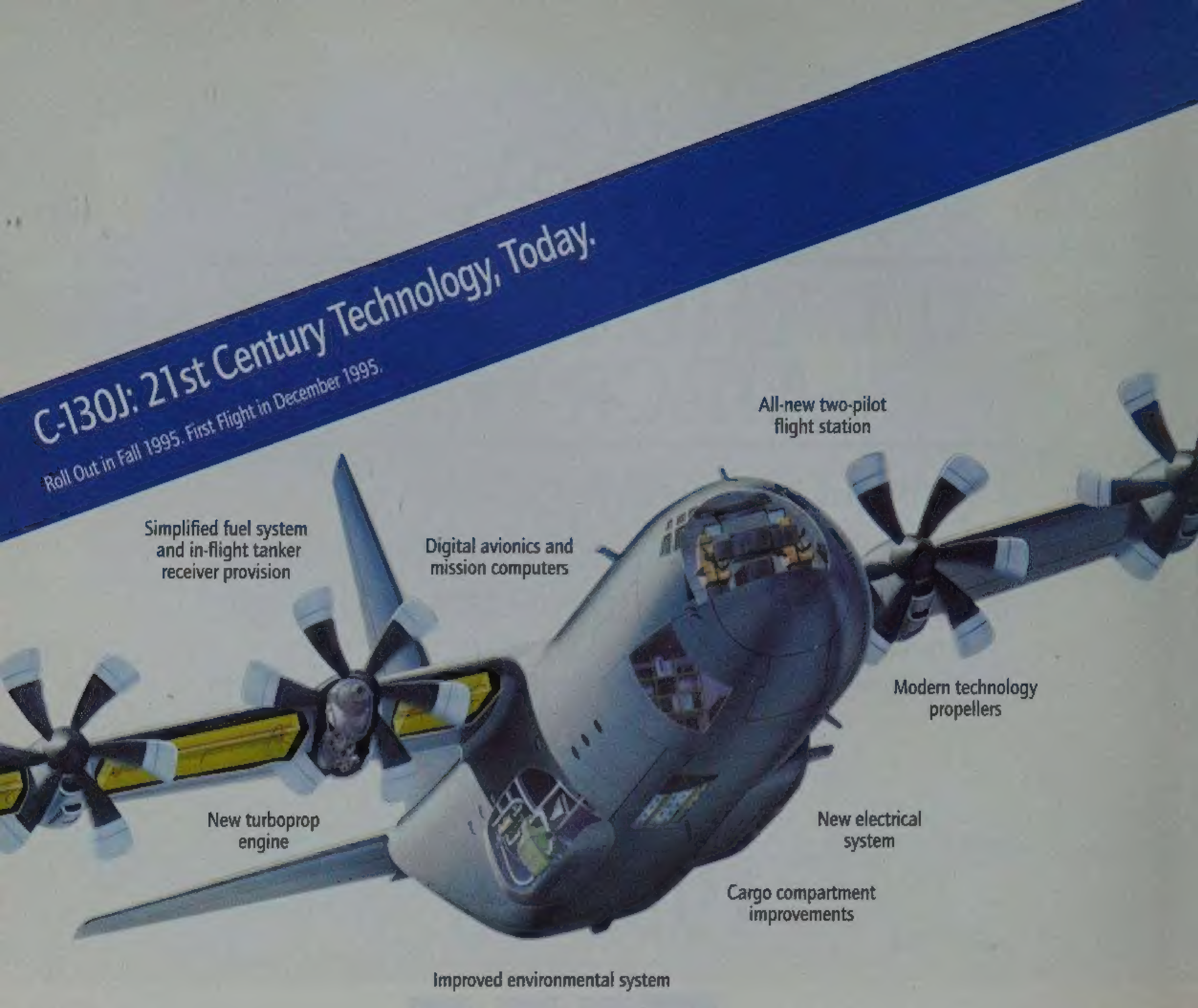

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LOCKHEED MARTIN

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Dr John W.R. Taylor, OBE, Hon DEng, FRAeS, FRHistS, AFAIAA	AIRCRAFT: RUSSIA, UKRAINE and UZBEKISTAN; OFFICIAL RECORDS

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EDITORIAL OFFICES

Jane's Information Group Limited, Sentinel House,
163 Brighton Road, Coulsdon, Surrey CR5 2NH, UK

Tel: 0181 700 3700 International +44 181 700 3700
Telex: 916907 Janes G
Fax: 0181 763 2582 International +44 181 763 2582
e-mail:yearbook@janes.co.uk

SALES OFFICES

Send enquiries to International Sales Manager:
Fabiana Angelini (UK/MoD, Europe)
David Eaton-Jones (Middle East, Asia Pacific, Africa, Austria, Germany, Greece, Switzerland, Eastern Europe)
Jane's Information Group Limited, UK address as above

Tel Enquiries: 0181 700 3700 International: +44 181 700 3700
Fax Enquiries: 0181 763 1006 International: +44 181 763 1006
Fax Orders: 0181 763 0276 International: +44 181 763 0276

Send USA enquiries to:
Joe McHale, Senior Vice-President Product Sales,
Jane's Information Group Inc, 1340 Braddock Place, Suite 300, Alexandria, Virginia 22314-1651

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Tel: 0181 700 3700 International +44 181 700 3700
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USA and Canada: Kimberley S Hanson, Advertising Sales and Marketing Director, Jane's Information Group Inc, 1340 Braddock Place, Suite 300, Alexandria, Virginia 22314-1651

Tel: +1 703 683 3700
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Fax: +1 703 836 0029

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F-22
LOCKHEED MARTIN · BOEING
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How To Use This Book

On the following pages are described all known powered aircraft, of which details have been received, currently in, or anticipating, commercial production in all countries of the World, apart from rapidly dismantled, ultralight recreational machines. Exceptions to these criteria are made in the cases of 'one off' aircraft of technical interest — for example those undertaking pioneering work with NASA — and Russian combat aircraft. Inclusion of the latter makes this book a one-stop reference to the subject. Many other of the World's aircraft remaining in service, but no longer being built, will be found in *Jane's Aircraft Upgrades*

Entries in this book are in alphabetical order (a) by country (including International) and then (b) by manufacturer's name. For those manufacturers producing a diversity of aircraft, those of obvious military potential are presented first. However, it should be noted that a few of the larger constructors are divided into operating divisions within which individual aircraft types are arranged.

Company entries begin with a brief introduction, including address, telephone/fax numbers and the names of some significant executives. The last-mentioned listing is by no means exhaustive, and further details will be found in *Jane's International ABC Aerospace Directory*.

For ease of access to information, entries on individual types of aircraft are subdivided under the following headings

TYPE: A brief description of the aircraft's function

PROGRAMME: A record of key events in an aircraft's production history.

CURRENT VERSIONS: Where applicable, details of available models (marks) and cross-reference to earlier versions now out of production.

CUSTOMERS: Present total on order and produced, often in tabular form, for military aircraft and those civil types for which such a list would not be of prohibitive length.

COSTS: Price (dollars are US unless stated otherwise) per unit or programme price, plus any other disclosed information on R&D expenditure.

DESIGN FEATURES: Where appropriate, opens with a broad statement of design objectives and the means by which they were achieved. This is followed by details such as aerofoil section and helicopter rotor speeds.

FLYING CONTROLS: Here is described the method of controlling the aircraft, it being assumed that the reader has a basic understanding of the function of ailerons, flaps, rudders, trim tabs and the other conventional manoeuvring surfaces. Descriptions are concerned with the method by which the controls are operated (manual/powered) and appropriate control inputs determined (autopilot/fly-by-wire, for example).

STRUCTURE: Configuration, materials and any special manufacturing methods; details of subcontractors or partners producing significant elements of the airframe

LANDING GEAR: Includes tyre sizes and pressures for wheeled aircraft, as well as ground turning circle. Braking parachutes, where fitted

POWER PLANT: Number and power of engines; helicopter transmission ratings; fuel capacity. Further details in the Engines section.

ACCOMMODATION: Seating arrangements, access, environment and, for transport aircraft, cargo loading capacity; type of ejection seat, if fitted

SYSTEMS: Power generation provisions, de-/anti-icing equipment, pressurisation/air conditioning and similar equipment

AVIONICS: The entry is subdivided into communications, radar, flight aids, instruments, mission equipment (mostly military or law-enforcement) and self-defence (military)

EQUIPMENT: Cargo-handling aids, spraying/firefighting apparatus and similar items

ARMAMENT: Fixed and air-dropped/launched weapons listed by the manufacturer as actual or potential armament. Not all items may have been cleared for carriage and not all operators will use those which have. Refer also to Missiles section, where appropriate

DIMENSIONS, EXTERNAL: Includes door sizes and certain ground clearances

DIMENSIONS, INTERNAL: Includes areas and volumes where relevant

AREAS: Wings, fixed tail surfaces and control surfaces.

WEIGHTS AND LOADINGS: As supplied by the manufacturer; individual aircraft may vary

PERFORMANCE: Observations as above; all speeds assumed TAS unless stated otherwise

OPERATIONAL NOISE LEVELS: Internationally recognised measurements of landing and take-off sound at airports

Measurements of all types are given in both SI (metric) and Imperial units, the more common conversion factors for which are in the glossary. Performance details are quoted in good faith and certain critical conversions 'rounded' to give a margin of safety, although *Jane's* does not purport to be an alternative to the manufacturer's operating notes

Following the main section on aeroplanes and helicopters are others detailing with Lighter than Air craft, Air-Launched Missiles and Aero-Engines, the first and last also arranged alphabetically by country. Lighter than Air covers commercially and military-operated airships, and vehicles of special technical interest, but not recreational balloons. Air-Launched Missiles is a rapid reference which seeks not to duplicate the separate and vastly more detailed *Jane's Air-Launched Weapons* binder, but to indicate how the potential of aircraft described is augmented by the weapons they carry. Aero-Engines are those power plants fitted to aircraft in the main section, each described in minute detail.

Addenda are correct to July 1995, contents including new companies and aircraft as well as important additions to existing entries in the main part of the book. Researchers into all types of aircraft are advised to refer to the Addenda for any last-minute news.

At the end of the book, Indexes are arranged to speed reference to both current and past aircraft The first index, on white paper, deals with aircraft in this volume only and is followed by a second, on grey-tinted pages, covering the past ten editions of the book. Further listings are given for those types of aircraft no longer included in *Jane's*, such as sailplanes, hang gliders and homebuilts constructed from sets of plans. Engines and Lighter than Air have their separate indexes, but Air-Launched Missiles is a self-indexing entry with multiple cross-references

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Each entry for a company, aircraft or engine is annotated to indicate whether or not it has been altered since the last edition was published Three descriptions are employed, as under:

● ***VERIFIED*** The editor has made a detailed examination of the entry's content and checked its relevancy and accuracy for publication in the new edition to the best of his ability

● ***UPDATED*** During the verification process, significant changes to content have been made to reflect the latest position known to Jane's at the time of publication.

● ***NEW ENTRY*** Information on new equipment and/or systems appearing for the first time in the title

Drawings, photographs and diagrams are tagged with the date on which they first appeared in *Jane's All the World's Aircraft*. Some drawings will have been modified during their lifetime on these pages and, from 1995 onwards, that will be reflected in re-dating of existing three-view illustrations

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USA	American Eurocopter	company details
USA	American General	company details
USA	American General	Tiger
USA	Basler	company details*
USA	Basler	Turbo-67*
USA	Basler	Turbo-34*
USA	Bell	UH-1HP
USA	Boeing	Model 707
USA	Boeing	E-X
USA	Boeing Product Support	division details
USA	Boeing	KC-135 Stratotanker
USA	Boeing	707 Tanker-Transport
USA	Bowers	company details
USA	Bowers	Fly Baby 1-A
USA	Bowers	Fly Baby 1-B
USA	Global	company details*
USA	Global	Huey 800*
USA	Hamilton	company details
USA	Hamilton	A-II
USA	Heli-Air	company details*
USA	Heli-Air	Bell 222*
USA	Isolair	company details
USA	Isolair	Terminator
USA	Kaman	Seasprite*
USA	Lockheed Martin	Viking*
USA	Marsh	company details*
USA	Marsh	TS-2F Turbo Tracker*
USA	Melex	Turbine Dromader
USA	Melex	Wilga 80-550
USA	Melex	M-26 Iskierka
USA	Mustang	company details
USA	Mustang	M-II Mustang II
USA	Newcal	company details
USA	Newcal	DHC-4T Caribou
USA	Nordam	company details*
USA	Pemco	company details*
USA	Pemco	BAe 146 200*
USA	Pemco	Boeing 737*
USA	Pemco	Boeing 747*
USA	Pemco	Boeing 757*
USA	Pemco	Lockheed TriStar*
USA	Pemco	McDonnell Douglas DC-9*
USA	Raisbeck	company details*
USA	RAM	company details*
USA	Rogerson	RH-1100
USA	Sabreliner	company details*
USA	Sadler	company details
USA	Sadler	A-22 LASA
USA	Toyota/Rutan	Light Aircraft
USA	Rutan	Pond Racer
USA	Rutan	Boomerang
USA	Sherpa	company details
USA	Sherpa	Sherpa
USA	Sport Aircraft	company details
USA	Sport Aircraft	S-18
USA	Starpac	company details
USA	Starpac	Phoenix Flyer
USA	Tridair	company details*
USA	Tridair	Bell 206 Gemini*

Country	Manufacturer	Entry
USA	Turbotech	company details*
USA	UNC	company details*
USA	UNC	Ultra Huey*
USA	USAF	ATA
USA	USAF	JSSA
USA	USAF	JAF
USA	USAF	MAF
USA	USAF	VC-X
USA	USAF	OC-135*
USA	USN	A/F-X
USA	USN	E-X
USA	VAT	Elite*
USA	VAT	S-55/H-19*
USA	VAT	S-58/H-34*
USA	Vector	company details
USA	Volmer	company details
USA	Volmer	VJ-22 Sportsman
USA	Volpar	company details
USA	Wipaire	company details*
Yugoslavia	Utva	Lasta
Yugoslavia	Utva (Soko)	Super Galeb*
Yugoslavia	Utva (Soko)	Gazelle*
Yugoslavia	VTI	Novi Avion

Country	Manufacturer	Entry
Lighter Than Air		
Canada	Pan Atlantic	Magnus 60
Germany	Zeppelin	N05
Russia	Thermoplane	ALA-[illegible]00 and -300
UK	Colt	GA42
USA	Aeros	Model 500
USA	Ulita	VM30-71
USA	WAI	Skyship 500HL
Aero Engines		
Canada	P&WC	PW300
France	SNECMA/MTU/PW/GE	Project Blue
Germany	BMW RR	BR715
Russia	Soyuz	TV1-6
Sweden	Volvo	RM 8
Ukraine	ZMKB	D-227
USA	Garrett	company details
USA	Garrett	ATF3
USA	Garrett	TPE109
USA	Garrett	TPF351
USA	GE	GLC38
USA	GE	JT8D
USA	Textron Lycoming (Turbine Engine)	division details

Upwardly mobile. The three newest products of McDonnell Douglas Helicopter Systems at Mesa, Arizona – all, it will be noted, employing NOTAR technology – are the MD Explorer (top), MD 520N and MD 600N. First flown in secret during November 1994, the last-mentioned received production approval from the management board in the following March

Jane's

ALL THE WORLD'S AIRCRAFT

1995-96

Jane's Information Group Limited, Sentinel House, 163 Brighton Road, Coulsdon, Surrey CR5 2NH, UK
Jane's Information Group Inc, 1340 Braddock Place, Suite 300, Alexandria, VA 22314-1651, USA


MiG-29
MAPO "MIG
Tel: 095/252-8441 · Fax: 095/250-8819

FOREWORD: Good times just around the corner

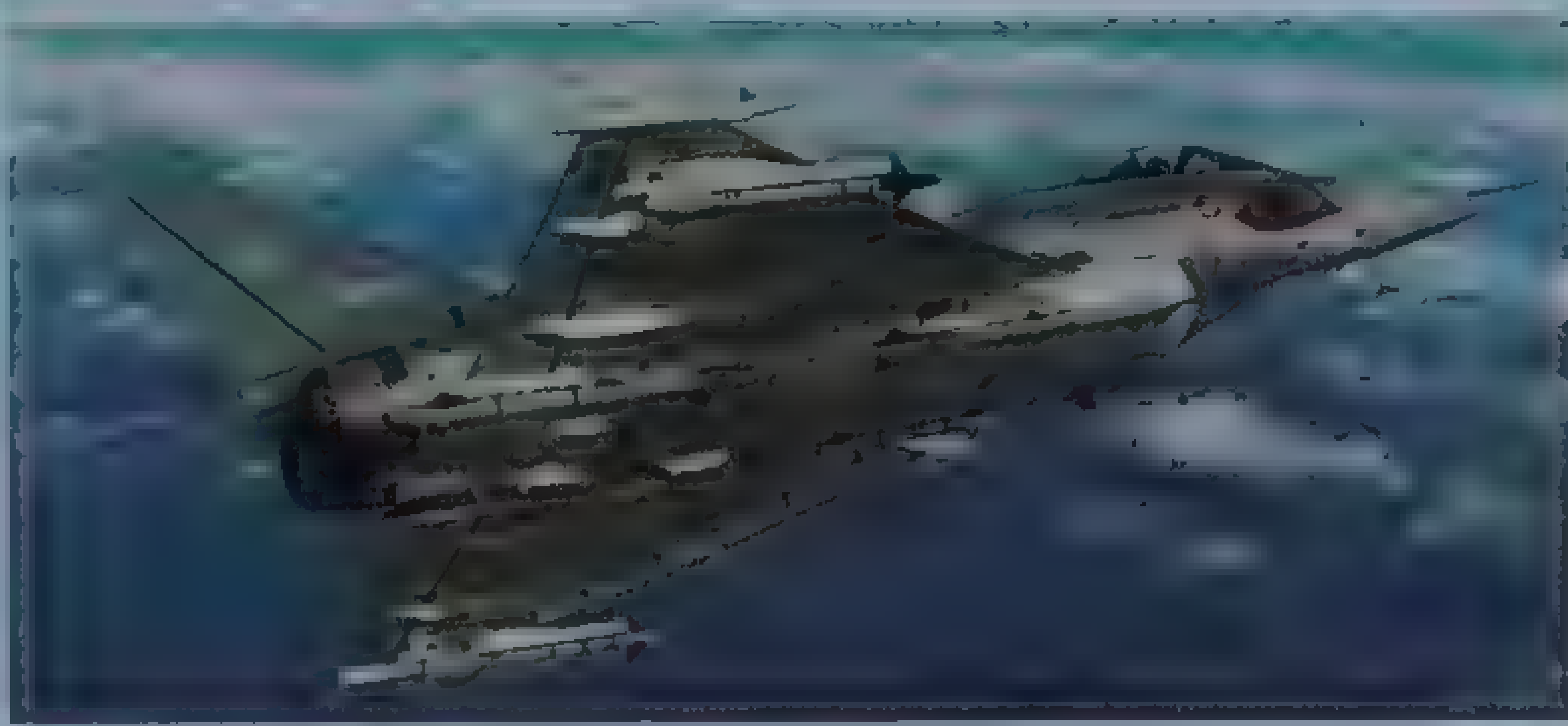
"The rule is, jam tomorrow and jam yesterday — but never jam today."
(*Lewis Carroll,* Through the Looking Glass)

Although firmly established over nine decades as an incomparable technical reference to the World's aircraft, *Jane's* has never highlighted its secondary role as a monitor of the aerospace industry's financial health. Such a measurement is not immediately apparent to readers who may consult the pages which follow, yet it is obvious to the team responsible for compiling this volume. Almost as soon as one edition is published, *Jane's* begins the process of contacting manufacturers for new information around which the next book will be built. The resultant editorial workload reflects directly the confidence which aircraft constructors have in the future — because drawing a line through the entry for a machine which has run out of customers is far quicker than constructing the new entry for a modified version, or even a brand new design.

This year has witnessed an encouraging boost to the number of new aircraft described for the first time in these pages (a significant number of them described for the first time *anywhere*). Still more have had a *Jane's* entry for some years, the difference this time being that the phrase "awaiting launch decision" no longer appears. Commercial aircraft naturally form the bulk of this category, yet there are military examples, too. None is more dramatic than the Boeing Sikorsky RAH-66 Comanche combat helicopter, which ended 1994 as an R & D programme with no promise of production and within a few weeks was enjoying a full commitment to funding and US Army demands for six to be used in field trials as soon as possible. Not all stories have such apparently happy endings, but it is pleasing to be able to report an upsurge in confidence at almost all levels of aerospace. For every Dash 300 version of Boeing 777 or Sikorsky S-92 Helibus to be launched, there seems to be half a dozen business aircraft and a score of plastic kitplanes taking to the skies — or, at least, the blue backwash of the 'impressionist' artist's canvas.

Several of the above-mentioned new ventures emerged at the Paris Air Show in June 1995. Exactly two years before that, press conferences at Le Bourget appeared to be dominated by sober gentlemen espousing fiscal rectitude: specifically, the reduction of their reliance on military revenues and marking time with new programmes until a more favourable moment. By 1995, the previously all-dominating pie-charts of shareholders' return on investment and graphs of restructuring plans shown to journalists had, to some extent, been replaced by some pictures of "our newest model".

Regrettably, financial prudence appears to have pervaded all conceivable corners of the Western aerospace world. Disappointment was in store for any busy aviation journalist spending most of show week in the halls and chalets, but looking forward to watching the flying display in its entirety during the final two (public) days. Having concluded (not entirely erroneously) that the citizens of Paris had come to gaze not to buy, the majority of exhibitors grounded their aircraft for the final weekend of the Salon. It was left in no small measure to the Russians to present some heavy metal to the onlookers, supported by the traditional and patriotic Dassault circus and padded out by an almost endless procession of aerobatic lightplanes.



Eurofighter 2000 made its public debut, albeit briefly, at the Paris Air Show in June 1995. Despite funding and flight control system delays, all seven development aircraft should be flying soon

When aircraft companies were still influenced by founders who had turned their caps back-to-front and staggered uncertainly into the air a few steps behind the Wrights, such indifference would have been unthinkable. Now that each five-minute demonstration flight must be weighed against the prospects of a sale, the whole of aviation has become the poorer. Brand reinforcement (as the advertising business calls it) appears to be a declining priority and will doubtless continue until the general public has had all wonder and awe of aviation drained out of it. When that public then behaves and legislates in the manner of one who knows aircraft only as noisy, polluting nuisances, it will be too late to salvage the situation.

Airports and airlines must also take a share of the blame. It is an inexpensive and harmless pleasure for many to visit a local airfield to gaze at the flying, yet more than a few UK airports are slightly less tolerant of onlookers than Groom Lake. Travellers, too, are not encouraged to ask too many questions about the type of aircraft in which they will fly, and at major airports may not even see the machine from the outside. The first formal indication of whether the aircraft is an Airbus, a Boeing or a Douglas will be obtained from the flight safety leaflet in the seat-pocket. It may be that in persuading the public that boarding an aircraft is as natural and easy as catching a bus, the airlines and manufacturers are fostering a familiarity that will have its inevitable consequence in contempt.

Restructuring for efficiency and profit

Having enjoyed "jam yesterday", when East-West confrontation was the norm, aerospace is now reorganising itself to ensure an adequate supply of preserves for tomorrow. The raw fruit is that of amalgamation. Whilst careful companies have sought refuge from financial heavy weather by retrenchment, the more ambitious have gone one stage further. The immediately previous *Jane's* required last- minute cutting and pasting as news was received of the Northrop

A Jetstream that survived. The J41 (seen here in the colours of Johannesburg-based SA Airlink) will join Avro RJs and ATR 42 and 72 in a new, Anglo-Franco-Italian marketing alliance which will eventually design its own aircraft

Grumman amalgamation. This year, it is Lockheed Martin which is the 'new' entry with a distinct air of *déja vu*. Glenn Martin's last complete production aircraft was the B-57 Canberra, although the company subsequently became a major player in numerous other branches of the defence industry before accepting that its future lay in merger with the successors of the brothers Loughead

At a stroke, Lockheed Martin has leapfrogged McDonnell Douglas to become not only the largest US Department of Defense contractor, but also the largest NASA supplier. With annual sales of some $23 billion, 170,000 personnel and a backlog of $42 billion at the end of 1994, this new giant appears invulnerable in the military field. The accepted view in US military and political circles is that only two large defence companies will make the transition into the third millenium and, privately, it is suggested that to have a name beginning with 'L' or 'Mc' could be a distinct advantage. Whether Northrop Grumman will confound those commentators remains to be seen

The regional airliner world is also judged to have participants which could benefit from or — on the reverse of the coin — be swallowed up by amalgamations. In Europe, the manufacturers of some regional transports have already reached a similar conclusion and others are, perhaps, taking a little longer to accept a painful truth. The new year began with British Aerospace, specifically in the forms of Avro and Jetstream, pooling resources with Franco-Italian ATR. Formalised on 6 June and due to come into force in January 1996, the agreement falls short of financial merger but specifies a development, marketing and customer support strategy identical to that which would be practised by a single company. Immediate casualties, as surplus to requirements, are the Jetstreams 51, 61 and 71. The J61 had flown just a few months before, and only a handful (already partly complete) will be built. Aero International Regional (AIR), as the new Anglo-Franco-Italian venture is named, now promotes the 29-seat Jetstream 41, 40-seat ATR 42 and 70-seat ATR 72 turboprop twins, then switches to four turbofans for the Avro RJ family, seating between 70 and 115. When a new aircraft is developed to follow one or more of these, it is likely to be a tripartite venture with an AIR name Germany's DASA and its Fokker satellite are now looking to the Far East, where they hope to become involved in a 100/120-seat regional airliner project also involving China and South Korea. This venture is intended to complement the Airbus family and develop into a series of its own, but Boeing and others also have their eyes on 'Asian mini-airbus' participation.

Termination of the Jetstream 61 was but an inadequate sacrifice to the evil god of European aerospace overcapacity, who may not even be appeased by demise of the CASA 3000. Admittedly, the regional airliner market is one of the few aerospace areas not showing an upturn, so this judgement could be overtaken by a belated change of fortune. Should that not come to pass, more aircraft and, even, more companies, may have to be led to the sacrificial altar before Europe matches production lines with markets

Lenin's legacy

Such difficulties pale before the problems being faced in Russia. One of the legacies of Communism has been entirely separate aircraft design and production centres. Under the old system, offices such as MiG, Mil, Sukhoi and Yakovlev produced prototypes, the plans for which were then issued to unrelated GAZ, or State Aircraft Factories (sometimes thousands of miles distant) for series manufacture. Two years ago, Mikoyan reported production of 2,000 MiG-29s, but has corrected this to a more believable 1,200 in the past few months. No Cold War disinformation appears to have been intended, merely, it seems, one hand did not know what the other was doing.

For the first time, *Jane's* is this year presenting details of some of the major Russian aircraft production centres, now that they are financially accountable and operating as businesses. The result may initially confuse some readers (as it did the editorial team) when they discover that the Technoavia SM-94 is no more than a modified version of the aircraft long known as a Yak-18T, or that what is an Aeroprogress/ROKS-Aero T-602 Orel on paper becomes a Khrunichev T-430 Sprinter when plans are transformed into metal.

It is, however, financial realities more than confusing designations, which are forcing ever-closer alliances between Russian design offices and factories. Some of the latter have traditionally had close associations with particular examples of the former and these liaisons are developing into firmer bonds. In the last few months, the Voronezh factory has shed the title of GAZ 40 and become the Ilyushin Aircraft Production Association. Equally recently, the Moscow Aircraft Production Company (MAPO) has taken the obvious step of merging with MiG to produce the first Russian defence company authorised to provide clients (including export customers) with a complete service from artist's impression to after-sales support. This will initially centre on the MiG-29 'Fulcrum', for no other reason than that these are produced in Moscow, whereas MiG-31 'Foxhounds' come from the Sokol works at Nizhny Novgorod.

In common with Western Europe, Russia appears to be hoping that financial mergers will solve the problem of empty assembly sheds. Compounding the problem is Moscow's failure to deliver the promised support. Under the 1992-2000 plan for civil aircraft, government assistance for 1994 was set at R1,400 billion for R & D, plus R2,000 billion for production. In actuality, design received a mere R143 billion and production was, comparatively, even worse-served with a paltry R147 billion. Thus far, the 1995 promise of R820 billion for R & D has brought only R425 billion Even worse is the government's inability to pay its bills. Accounts for 1994 show R160 billion owing for civil aircraft supplied to the State, plus R40 billion unpaid from the MiG-29 invoice. Little wonder, therefore, that some aircraft workers have not received pay for months and 84 per cent of aircraft companies are technically insolvent.

At the start of this year, Russia's aircraft industry comprised 778,200 personnel at 111 design offices and 134 production plants, supported by a further 3,770,000 workers at subcontractors. During 1994, this vast organisation, which once so alarmed NATO with its potential, produced just 151 aircraft, of which 94 were helicopters. Of these, under 50 were ordered for military use, whilst in the civil sector, several of the modest totals of 10 Tu-154s and 10 Yak-42Ds went straight to 'White Tail Airlines'.

A further tier of industry organisation is now coalescing in Russia. In what could be the genesis of an equivalent to the SBAC or GIFAS, the Russian Aviation Consortium formed in June to provide financial and industrial support for Tu-204 airliner production. Members are the Tupolev design bureau, Aviastar aircraft factory, Perm engine plant and intended leading customer, ARIA (Aeroflot-Russian International Airlines). The Consortium's *raison d'etre* was government foot-dragging in its support of the Tu-204 programme, but the fact that a Presidential decree was required for the Consortium's foundation indicates that the dead hand of bureaucracy still has not completely released its grip on aerospace's trachea.

ARIA, itself, is an instructive example of what can be achieved. The 'old' Aeroflot was an incredibly diverse civil flying organisation (crop spraying to supersonic airliners; 32 major divisions; 100 branches), sponge for surplus aircraft production and a thinly disguised extension of the air force transport arm, occupying acres of airport ramp space with infrequently flown aircraft. Today, just 116 airliners serve 154 cities in 108 countries, many hundreds of other aircraft having been claimed by the 260 airlines which sprang directly from the corpse of the former giant. Recent fleet additions have included a few Airbus A310s and Boeing 767s, but indigenous types such as Ilyushin Il-96 and Tu-204 are to play a more prominent part in the future. Following a collapse of revenues after 1990, ARIA's 1994 performance, including an operating margin of almost 17 per cent, suggests it has endured the worst and can look forward to steady improvement which will gather momentum — if and when its reputation for abysmal passenger relations can be shaken off

The striking power of this Eurocopter Tiger was as nothing compared with the Franco-German assault on the United Kingdom when rival McDonnell Douglas AH-64D Apaches were chosen to equip the British Army. Is the primary function of a weapon to defeat one's enemies or provide jobs for one's friends?

Airliners fighting over a growing market

Likewise, some Western airlines are cautiously optimistic. An early attack on overcapacity in the USA is yielding positive results, with all major carriers recording comfortable profits in the second quarter of 1995. Ever speedy to kick a fallen man just as he is rising to his feet, Washington has imposed an additional tax on jet fuel from 1 October 1995, adding $530 million per year to airline costs and nullifying many of the savings made so painfully a few months ago.

Airliner manufacturers are, perforce, a few steps behind the operator's market. New orders for 1994 were the worst for a decade, but showed some 'negatively encouraging' signs in that the rate of cancellations slowed noticeably. Airbus, for example, ended 1993 with 31 fewer orders than it began with, but finished 1994 with plus 71. Boeing, the European company's main rival, improved by 74, but Airbus seized upon the fact that it had taken orders for 125 new aircraft, whereas Boeing pocketed only 120 deposits. With a logic learned from politicians explaining how polling the smallest number of votes in an election is a resounding success, Airbus was able to make headlines out of its supposed trouncing of Boeing — at least until 1995 first half figures became available.

In addition to confirming Boeing's convincing command of the airliner business (with a backlog of 973 aircraft worth $63.5 billion, compared with 584 Airbuses worth $41 billion), 1995 data show a more significant trend. With 149 gross (133 net) orders booked between January and June, the Seattle company sold significantly more jets than in the whole of the previous twelvemonth. Airbus took 59 orders (47 net) to reveal its 1994 figures as atypical. Well down in third place, McDonnell Douglas nevertheless was buoyed by 42 orders (less only one cancellation), compared with 23 gross and just four net for 1994.

It is dispiriting to report an element of acrimony entering the airliner marketplace, most noticeably at Farnborough in 1994 and at Paris in 1995, when the heads of the two leading manufacturers each descended to making attacks upon the other and his products, assisted by some compliant airline pilots. Airbus Industrie has been forced to straighten the record in the technical press by comparing the number of crashed Boeings with quantity of Airbuses lost in accidents. The popular media are always ready to pick up such stories of smoking holes in the ground, add ignorance and sensationalism in equal measure, and broadcast the results to every household in the West. Captains of industry should know better. To wash one's dirty linen in public is socially unacceptable; to soil it first, in the glare of publicity, is suicidal.

Fortunately for all, new studies have shown a promising market for airliners extending well into the 21st Century. Airbus predicts 13,400 aircraft with over 100 seats (average 251) will be delivered between 1992 and 2011, their value in the region of $1,000 billion. Of these, 52 per cent will be replacements and 48 per cent will be required to meet a business expanding at a global average of 5.4 per cent annually. McDonnell Douglas, in a separate study, looks forward to 13,272 new airliners worth $1,024.3 billion by 2013, at which time the current World fleet will have doubled to 18,014.

Widebodies will provide 71 per cent of the seat capacity delivered up to 2011, almost certainly justifying plans for a new airliner substantially larger than the Boeing 747. Separately and together, the major manufacturers have been examining the prospects for this UHCA (Ultra High Capacity Airliner) as described in the International section. A joint report released in July by Boeing and the four Airbus Industrie participants concludes that there are no technical obstacles to designing and building aircraft with 700 or more seats. Market conditions are not yet judged to be favourable for a launch, it adds, not least because of fears that the initial estimate of 1,000 sales is over-optimistic. Despite setting a date early in 1996 for a further review, Boeing is proceeding with schemes to stretch the 747, and Airbus is pursuing its own A3XX.

The new supersonic airliner is farther over the horizon, yet its established entry in the International pages of *Jane's* has needed thorough revision since last year. Such are the costs associated with ultra-large and supersonic next-century transport aircraft programmes, that it is predicted the World will be big enough for only one giant design and construction consortium for each. These will be the first aircraft built by truly global companies involving a large number of nations. (As an interesting aside, *Jane's* first carried an International section in the 1966-67 edition, when Concorde, Jaguar, Transall and the soon-to-be-cancelled AFVG occupied all of three pages. In the current volume, 76 pages are devoted to their successors.)

Some light relief for Cessna and Piper

At the lighter and slower end of the scale, good news continues to flow. America's General Aviation Manufacturers' Association reports deliveries up by 12.1 per cent in the first half of 1995, at 445 (worth $1,271 million) compared with 405 for the same period of 1994. This is, of course, a mere fraction of the 18,000 built during the single year 1978, before the 'no win, no fee' lawyers intensified their assault on general aviation. Increasingly bizarre product liability suits stretched the concept of blame far beyond the bounds of sanity, forcing Cessna and Piper out of light aircraft manufacture, and the latter into Chapter 11 bankruptcy.

On 17 August 1994, President Clinton signed the General Aviation Revitalization Act which, in effect, limits makers' liability to 18 years and removes around 60 per cent of the GA fleet of 180,000 aircraft from the lawyers' grasp. As a consequence, manufacturers will be able to reduce their insurance premiums, with Piper, for example, cutting its $40 million quote by 85 per cent. The latest *Jane's* is therefore pleased to return to its pages the Piper lightplanes removed during the 1980s and report that 1995 first-half deliveries included eight Warriors, 15 Archers, four Dakotas, 12 Saratogas and 15 Senecas. The company also emerged from Chapter 11 in July 1995 and is looking forward to further improvements in the second half. Cessna's entry in the US section records plans for a new lightplane production factory to open on 4 July 1996 and be producing annually 2,000 aircraft of previously discontinued types by 1998.

The effect which this will have upon smaller manufacturers could be unfortunate. To circumvent pernicious liability legislation, kitplane makers have mushroomed in recent years, allowing competent home constructors to produce 51 per cent of their own machines and thereby gain a personal aircraft at reduced cost. Non-availability of Cessnas and Pipers has greatly swelled the numbers of do-it-yourself aircraft produced from plastics, metal and traditional wood. The air safety saying, "I learned about flying from that," is nowhere more true than when applied to a prospective pilot creating a future mount in the family garage. Such a literally 'hands-on' approach to aviation is to be applauded, and it must be hoped that this sector of the market endures the restart of manufacture by the two former monopoly producers.

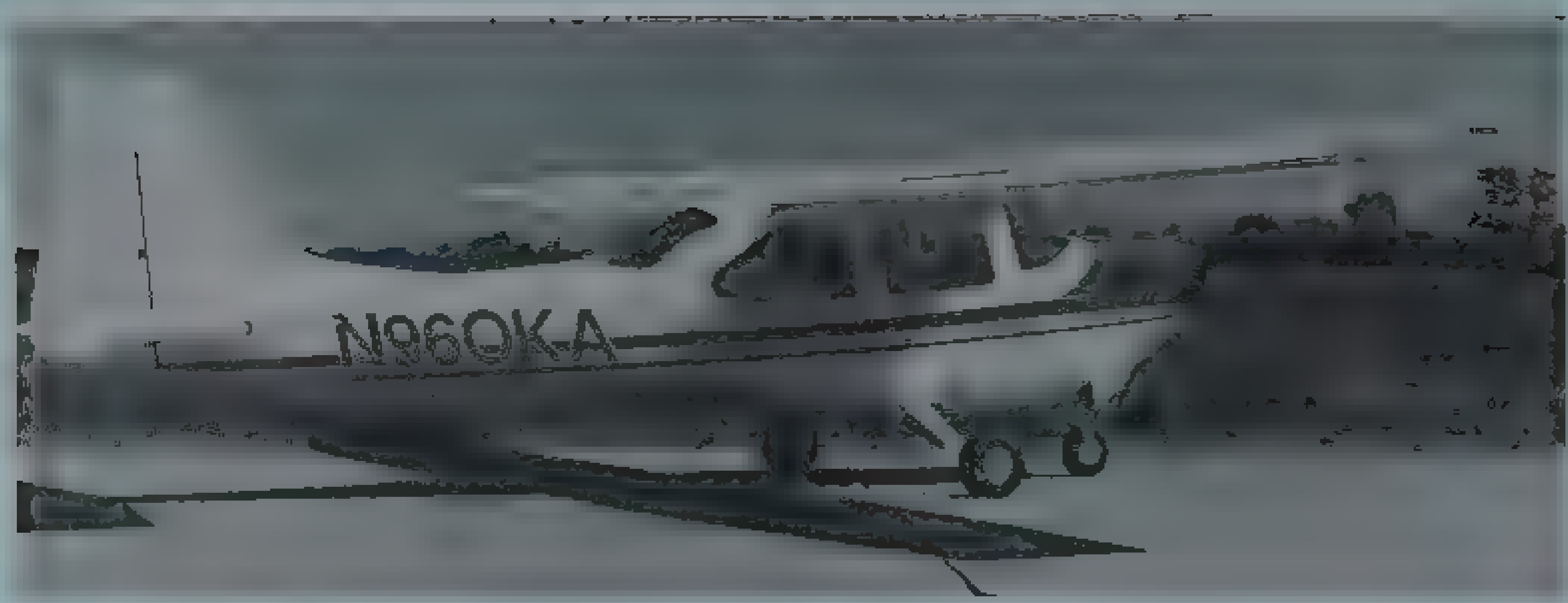
New confidence in the helicopter market has resulted in the launch of two new models from Bell (407 and 430), the McDonnell Douglas MD600 and Sikorsky S-92, amongst others. A somewhat older re-entry is the Hiller UH-12, resumed production of which has just begun by a company run by Jeffrey Hiller. The latter has reacquired the production rights to the helicopter designed by his father, Stanley, and has arranged outlets in the Far East for this evergreen rotorcraft.

Manufacturers of executive jets have been looking into a more confident future with both short- and long-term plans. Raytheon, which is in the process of transferring Hawker (BAe 125) production from Chester to the United States, has revealed details of the new PD373 twin-jet, and Swearingen has finally succeeded in acquiring launch capital for the SJ30. Raytheon had intended to terminate manufacture of the Hawker 1000, but a surge in demand caused that decision to be reversed and Hawker 800 production rates increased. Both Cessna and Dassault have made rapid-fire announcements of upgraded models, with the Citation Bravo, Citation Excel, Falcon 900EX and Falcon 50EX following on each other's heels during the Autumn and Winter. Announcement by Cessna of a new executive jet may not be far away.

Protectionism blunts competition

Military aviation has less to look forward to than its civil counterpart, although all manufacturers concerned have had sufficient warning of

The Molniya-1 light/executive transport epitomises Russian innovation, technical expertise and enthusiasm for foreign trade. Regrettably lacking is marketing expertise, which Western businessman would arrive in a aircraft resembling a winged box and sounding like a tractor — however well designed and built? *(Paul Jackson)*



Absence of Cessna and Piper from the light aircraft business has made room for dozens of new types of kit-built and factory-produced surrogates, such as the Kestrel KL-1A, which makes its debut in this edition of *Jane's* The General Aviation Revitalization Act of August 1994 has awakened the sleeping lightplane giants, perhaps threatening a difficult future for smaller rivals

reduced Western markets to take evasive action Sales prospects continue to exist in the Middle and Far East, and there will always be a Western demand for combat aircraft; the only factor which is showing an increase is the acrimony displayed during and after competitions. Three recent examples in the United Kingdom have shown how bitter and twisted the home military market is becoming.

First came the replacement of half the RAF's force of 60 Lockheed C-130K Hercules, finally decided in December 1994. Having had 30 years to plan for the event, Europe's aircraft industry had nothing to offer, being geared to producing a follow-on (EuroFLA) to the Transall C-160 for France and Germany in about 2009. Needing an aircraft by 1998 and unable to accept the BAe promise of EuroFLA in 2002 (an impossibly tight timetable), the UK Government selected the RAF-preferred C-130J but felt constrained to re-join the EuroFLA consortium, using taxpayers' funds channelled through BAe. It has never been adequately explained by the Government or BAe what prevents the RAF, should it want FLAs in a few years' time, from flying a Hercules full of used notes down to Toulouse and buying a fleet over the counter.

FLA-versus-Hercules II was a selection process played out in the UK's national newspapers with emotive arguments which those knowledgeable in aviation matters found alternately vacuous and hypocritical. Threats that BAe would be frozen out of further participation in Airbus wing design if the RAF bought the C-130J brought into question the business acumen of partners with whom the UK seeks further involvement. BAe designs and builds the best airliner wings in Europe; deliberately to pass over such expertise on the next Airbus in order to punish the UK is a prime example of self-disfiguring spite.

In March, the RAF was partly overruled, when it was told by the Government to order 22 EH 101 transport helicopters and 14 CH-47D Chinooks, instead of placing the all-Chinook order it wanted. Consequently, obtaining the desired level of airlift capability is costing the RAF £300 million more than would have been necessary. It must be presumed that those funds will have to come out of the MoD's budget - in other words, money voted by Parliament for defence of the realm is, in effect, being switched to the Social Security department (in that Somerset aircraft workers will not now suffer unemployment). On the topic of such unauthorised transfers of public money, the normally watchful Opposition is silent.

A further round of newspaper advertisements accompanied the final stages of the Army's combat helicopter competition, culminating in a June victory for the Westland-built McDonnell Douglas AH-64D Apache over BAe/Eurocopter Tiger and GEC/Bell AH-1W Viper. The UK came under intense political pressure from France and Germany to order Tiger but, to its credit, backed the armed forces in their preference for Apache. It was clear from questions asked during an immediately previous visit to *Jane's* offices by a TV news company that sections of the media regard the UK armed forces as having an illogical preference for all things American. Such a view is both ill-informed and an affront to the intelligence of uniformed personnel.

The sole preference of fighting men is for the piece of kit — from whichever manufacturer — which gives them the best chance of returning home in one piece to their wives and children when the war is over. The prospect of death as the penalty for a wrong decision concentrates the mind wonderfully, so it is both foolish and immoral to deny professional combatants the equipment their experience tells them is right for the job. No French or German Government dare announce to its electorate that it would be sending its troops into battle with second-best equipment they did not want, in order to give British workers a job; they should understand that the UK has no less a concern for the lives of its own fighting men.

As a political tiff, the episode will soon be forgotten, but there are wider considerations for Europe's aerospace industry in all three of these procurement sagas, notably the last. The names of Mirage, Falcon, Alouette, Ecureuil, Puma, Dauphin and Airbus have demonstrated unquestionably that France can produce aircraft capable of competing with great success on the World market. Europe needs more machines of that calibre and, as yet (though it may later do so), the Tiger has not yet proved itself to be one.

However, if manufacturers begin to believe that they can produce substandard aircraft and sell them to their neighbours by sole virtue of their government's bullying, they will very soon find the rest of their World sales disappearing and profits plummeting. The argument that, "You've got to buy it because it's made in Europe," is the direct route to a small, closed marketplace in which only shoddy wares are on sale. Ask any Russian.

Military market malaise

Several instances of rationalisation in the US military market have already been mentioned. It will be seen from this year's entries on the USAF and US Navy that there has been an official weeding-out of 21st Century combat aircraft programmes which has left JAST (Joint Attack Strike Technology) as the main project currently in search of a contractor. JAST swallowed up the STOVL Strike Fighter late in 1994, but that has not changed plans to evaluate relevant technology on the vertical aspects of flight. Partners in that venture include the UK, specifically BAe (a long-term Harrier collaborator) and Rolls-Royce engines. Last June, it was announced that Yakovlev has been contacted by the Lockheed Martin team and asked to provide data on its abandoned Yak-141 to assist the evaluation of different lifting systems for JAST. How the World has changed!

The processes by which the government of the United States decides whether or not to proceed with the procurement of certain military aircraft remains, for outsiders, one of the mysteries of the Universe. The Boeing Sikorsky RAH-66 Comanche has recently benefited from this process in an abrupt reversal of fortune, and production facilities for the Northrop B-2A have been put into mothballs just in case Congress approves a further batch. One analysis of military requirements says more B-2s are not needed — and in most countries, that would be that. However, senators and congressmen who sit on committees allocating defence funds appear to consider that military equipment built in their state is the most vital to national defence. Despite the regular allegations that the wasteful military demands more than it needs, it is the US Congress which is now trying to force upon the Pentagon more weapons than it has requested.

Closely related to this incongruous situation is the saga of JPATS, which was supposedly resolved, after repeated procrastination, when the Beech Mk II was named competition winner in June. For the benefit of the uninitiated, the Beech Mk II is a Pilatus PC-9, a very good trainer over whose Swiss origins Raytheon thought best to draw a veil. PC-9 was strongly favoured by the RAF in the mid-1980s and will serve the USAF and US Navy well in its role as the Joint Primary Aircraft Training System. Predictably, however, part 2 of the JPATS selection process may now be activated — in the courts. Ranged against the PC-9 were the Northrop Grumman/Embraer Tucano (the only other turboprop), Cessna CitationJet, Lockheed/Aermacchi T-Bird II, Northrop Grumman/Agusta S.211, Rockwell/DASA Ranger 2000 and Vought/FMA Pampa 2000. As this edition closed for press, some of the unsuccessful candidates were assessing the possibility of a legal challenge to the decision.

Selection of an aircraft from a field of competitors is a complex matter and involves subjective judgements such as whether slightly more difficult handling is offset by cheaper maintenance costs. Considerations of this kind provide fertile ground for the legal profession to question *ad nauseam*, and if this is to be the norm in future, it may be simpler to omit the fly-off and technical assessment and directly award the contract to the aircraft manufacturer with the smartest lawyer. In this instance, however, the JPATS decision will probably stand.

As recompense for not winning, some of the unsuccessful JPATS contenders are demanding — at the very least — compensation in the form of a refund of their development and promotional costs, their argument being that they were misled by a contrary customer. What has happened in the land renowned for aggressive, adventuristic, take-the-knocks-on-the-chin capitalism? If losing brings the same reward as winning, what stimulus is there to adopt, adapt and improve? Ask any subsidy-laden southern European farmer.

It is more difficult to obtain news on some other aircraft which the US armed forces allegedly are operating. The recent return to service of three previously stored Lockheed SR 71A strategic reconnaissance aircraft suggests that the

supposed Aurora successor has failed to enter service. For some years, *Jane's* has carried an entry on the USAF's reported Aurora programme and this is maintained in the current edition. There, we report additional security measures at the Groom Lake site traditionally associated with 'black' programmes, these introduced in an attempt to close even the most distant public vantage point. Quite clearly, something is going on in the Nevada desert, but it may be that the answer belongs more properly to *Jane's Unmanned Aerial Vehicles and Targets*.

When (if) details become known, they will appear in these pages in a similar manner to our description of the German Lampyridae 'stealth' aircraft developed during the 1980s and only just revealed. Although merely a manned wind tunnel model, the Lampyridae is significant in that it provides an indication of military aeronautical thinking at that time. Recently, British Aerospace has acknowledged that it is building a purpose-designed low-observables research facility at Warton, the site which will almost certainly be the home of the UK's next combat aircraft, whatever it may be.

Paul Jackson
Pulham Market, Norfolk, July 1995

Acknowledgements

The 86th edition of this annual brings several changes; some planned, some not. In the second category, we must record two deaths of valued compiling team members. Mark Lambert, on standing down from the editorship last year, had intended to retain responsibility for some entries in this book whilst in semi-retirement. His closing words in the foreword of the 1994-95 edition took on an additional, poignant meaning when news of his death was received within days of its publication. Mike Keep's sudden and unexpected loss in November 1994 deprived *Jane's* of an enthusiastic assistant and valued technical illustrator.

A more pleasant duty is to welcome new members to the compiling team. Mike Jerram has been tempted back after a four-year absence, so that we may again make use of his long experience of working on these pages. Lindsay Peacock is known as a specialist writer on military subjects, particularly the United States, and appropriately assumes responsibility for most of that subject. James Goulding is now our principal technical illustrator, the detailed line drawings he has prepared for this edition representing only a small corner of the wider field of his capabilities.

Amongst those with a longer association with this book, Editor Emeritus, John Taylor has provided readers with another masterful analysis of the rapidly changing face of Russian and Ukrainian aviation, adding many types of new aircraft hitherto unknown in the West. Ian Strachan's interest in light aviation is reflected in a realignment of compiling duties to give him responsibility for a high proportion of those covered in the Aircraft section. As always, Bill Gunston has revised the Glossary and single-handedly reviewed aircraft engines with a command of the subject denied to most; and Maurice Allward conducted the painstaking task of index compilation. Keith Fretwell has produced inspiring drawings of future aircraft for which no models exist.

It is a singular honour for the writer of this foreword to be chosen as only the sixth Editor-in-Chief of the aeronautical institution that is *Jane's All the World's Aircraft*. No amount of experience in the ranks of compilers is adequate preparation for the editorial task, and for that reason, the phrase last-but-not-least is genuinely deserved by Deputy Editor, Kenneth Munson. Under three editors, Ken has worked with undiminished enthusiasm in a ceaseless quest for accuracy, establishing himself as the guiding light of *Jane's* and always imparting his vastly superior knowledge with tact and courtesy. His decision not to claim the editor's chair by right of succession was typically unselfish and has immeasurably assisted the new incumbent.

Regular readers will note some small changes in the format of *All the World's Aircraft* this year. As part of a general policy affecting all *Jane's* yearbooks, entries are now tagged to indicate whether they are new; updated; or accurate as they stand, and therefore verified. Dates have been added to photographs and drawings to show when they first appeared. Illustrating the magnitude of the task facing the compiling team, of some 1,130 aircraft entries carried forward from the previous edition, more than 970 (86 per cent) have been updated with new information or, in some cases, virtually rewritten. Furthermore, there are 156 new aircraft entries in this *Jane's*, including 30 new companies and 115 new aircraft. These totals do not include minimal-change new marks of existing types, which would further increase the tally.

There is a record number of deletions this year as the last entries on aircraft upgrades are transferred to their new home in *Jane's Aircraft Upgrades*. In our family of aerospace books the latter is subtitled as Volume 2 of *All the World's Aircraft*, whilst Volume 3, to appear later in 1995, is *Jane's World Air Forces*, a binder (updated every four months) giving inventories and orders of battle for all the World's military air arms.

Aircraft sections of the previous edition of *All the World's Aircraft* contained 936 photographs; the 1995-96 edition introduces over 710 new pictures of aircraft — in effect, a 76 per cent change. To these are added 49 additional cutaway drawings, exploded views and diagrams. Three-view general arrangement drawings are a more stable element of the book, yet it has been necessary to modify 46 of those which have previously appeared, as well as commission 71 entirely new drawings showing three or more aspects of an aircraft.

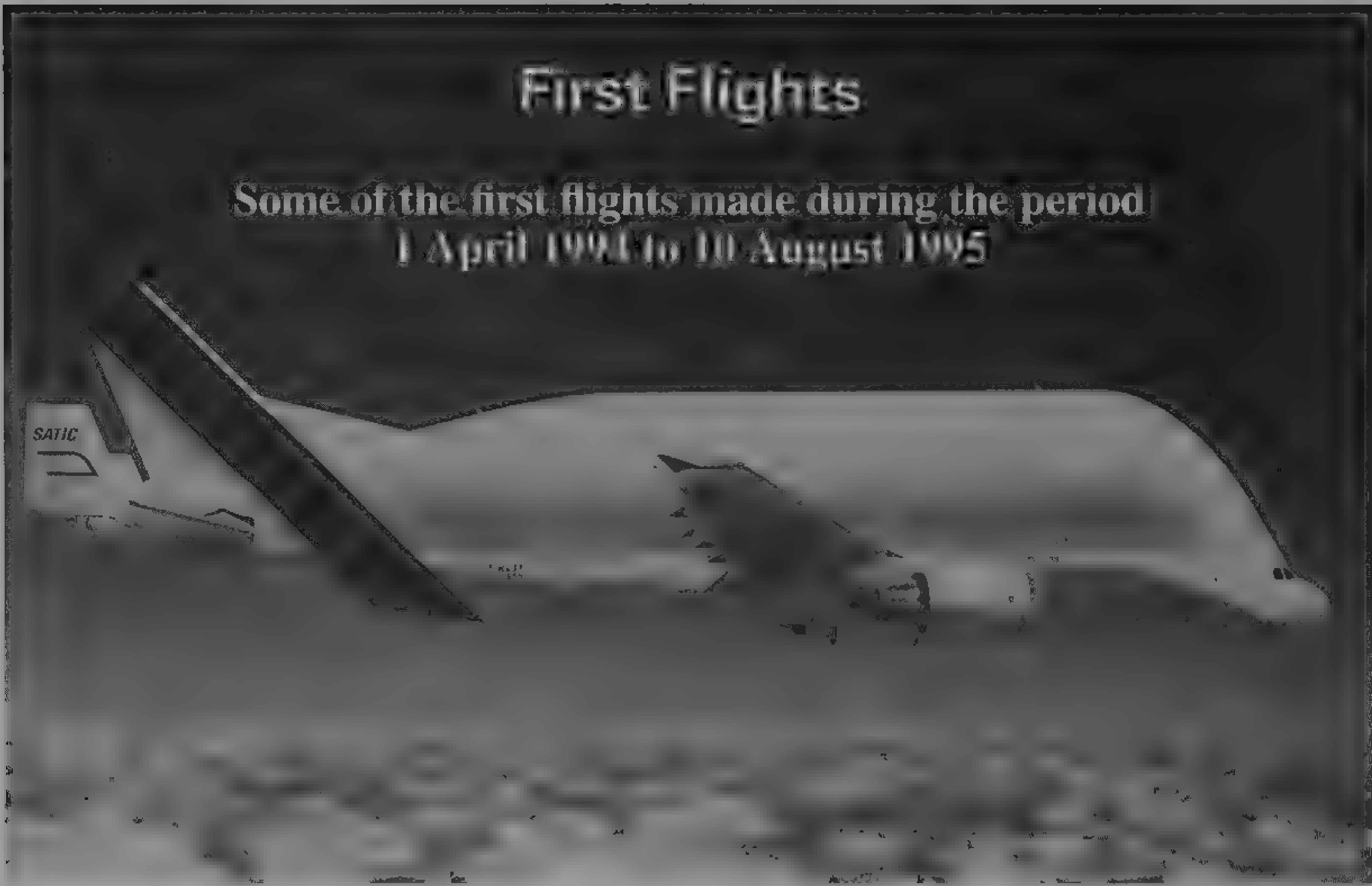
Within individual aircraft descriptions, information is presented as before, apart from a rationalisation of the avionics paragraph. Some of those, particularly for large civil aircraft and military combat machines, had grown labyrinthine, but all have now been subdivided into smaller sections relating to individual aspects of electronic systems. A more detailed breakdown is to be found in the nearby section 'How to use this book', which we trust will instruct the novice reader whilst reminding the more experienced of our intentions.

Jane's is fortunate in having many friends willing to contribute information and photographs and offer advice. These include Piotr Butowski, Peter J. Cooper, Paul R. Duffy, John Fricker, Jean-Louis Gaynecoetche, Yefim Gordon, J M. Gradidge, Geoffrey P. Jones, Vaclav Jukl (Letectvi + Kosmonautika), Ryszard Jaxa-Malachowski, Jim Thorn (Australian Aviation) and Mark Wagner (Flight). The names of other photographers, whose contributions are no less valued, appear beneath their work.

The acquisition of the vast amount of data forming a new edition of *All the World's Aircraft* represents only half the story, for it must be laid on the page and printed. Responsibility for this vital stage is in the joint hands of Ruth Simmance, Yearbook Editorial Production Manager; Sulann Staniford, Senior Production Editor; Sarah Erskine, Senior VDU/Typesetter and Chrissie Richards and Jack Brenchley in the page composition department. Publishing Director is Bob Hutchinson and operational control of aerospace yearbooks is the responsibility of Managing Editor, Ruth Jowett. All have shown great patience with an editor ascending a learning curve which, at times, seemed asymptotic. Thanks; we must do it again.

First Flights

Some of the first flights made during the period 1 April 1994 to 10 August 1995



A new shape in the skies which is unlikely to be misidentified, the SATIC A300-600ST Beluga first flew on 13 September 1994

Australia

Gippsland GA-8 Airvan	3 Mar 95
Goair Trainer (VH-BBB)	(early) 95
Skyfox CA-25N Gazelle (VH-CAL)	17 Dec 94

Austria

HB-Flugtechnik HB-207 Alfa (OE-CHC)	14 Mar 95

Canada

21st Century Airships SPAS-13 (C-FRLM	10 Jun 94

Bell 430 (converted 230, C-GBLL)	25 Oct 94
Bell 430, second prototype	19 Dec 94
Canadair Challenger 604 (converted 601-3R, C-GLYA/C-FTBZ)	17 Sep 94
Canadair Challenger 604, first flight with CF34-3B engines (C-FTBZ)	12 Mar 95
Canadair Regional Jet SE (C-FMLO)	26 May 95
Diamond DA 20A1 (HOAC DV 20) Katana, first Canadian built (C-FSQN)	29 Jun 94

China

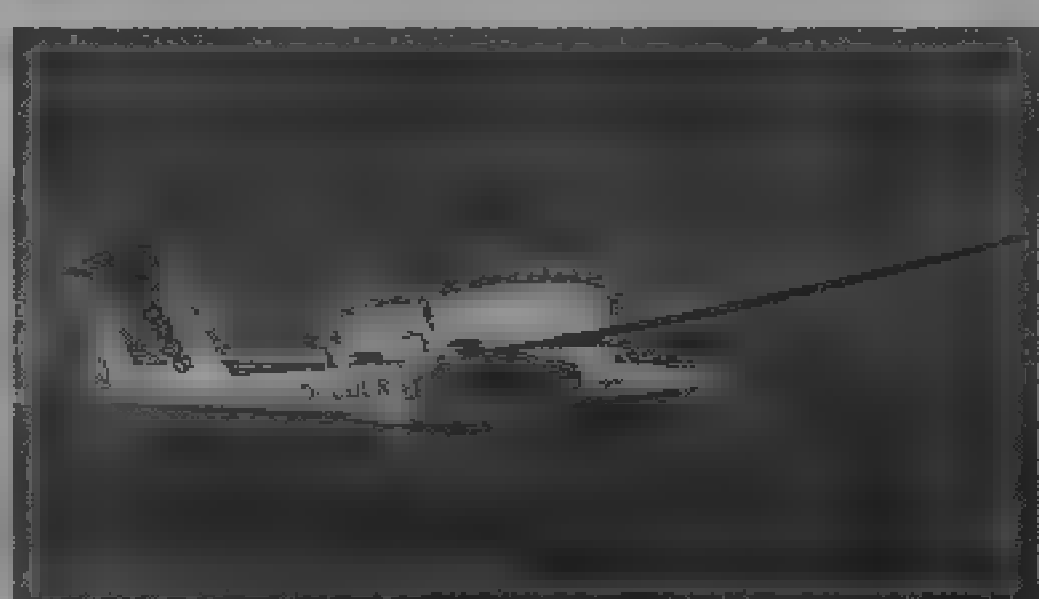
XAC Y-7E	5 Jul 94

France

Dassault Falcon 2000, third aircraft (second to fly) (F-WWFA)	10 May 94
Dassault Falcon 2000, second aircraft (third to fly) (F-WNEW)	11 Jul 94
Dassault Falcon 900, laminar flow aerofoil testbed	12 Apr 94
Dassault Falcon 900EX (F-WREX)	1 Jun 95
Jurca MJ100 Spitfire (F-WGML)	14 Oct 94

Mudry CAP 232 (F WZCH)	7 Jul 94
Robin DR 400/185 V6 (F WGXT)	6 Jun 95

Germany



Grob G-820 Strato 2C (D-CDLR)	31 Mar 95

Indonesia

IPTN N 250 (PK-XNG)	10 Aug 95

International

ATR 42-400	12 Jul 95
ATR 42-500 (F-WWEZ)	16 Sep 94

Eurocopter EC 120 (F WWPA)	9 Jun 95
Eurocopter EC 135, second prototype (S-02/D-HECY)	16 Apr 94
Eurocopter EC 135, third prototype (S-03/D-HECZ)	28 Nov 94
Eurocopter Tiger/Tigre, fourth prototype, HAP configuration (PT4/F-ZWWW)	15 Dec 94
Eurofighter 2000, second prototype (DA2/2H588)	6 Apr 94
Eurofighter 2000, third prototype (DA3)	4 Jun 95
Eurospace F.15F Excalibur (OE-VPY)	Sep 94
McDonnell Douglas/BAe Harrier T. Mk 10 (ZH653)	7 Apr 94
Rockwell/DASA Ranger 2000, third prototype (D-FANC)	20 Jun 94
SATIC A300-600ST Super Transporter/'Beluga' (F-WAST)	13 Sep 94

Israel

IAI Astra SPX (4X WIX)	18 Aug 94
Israviation ST-50 (in USA) (N50ST)	7 Dec 94

Italy

Agusta A 129 International (converted A 129, MMX592/EI 902)	9 Jan 95

Japan

Mitsubishi RP-1 (JQ6001)	14 Sep 94

Netherlands

Fokker 70, first production (PH-MKS)	12 Jul 94

Poland

PZL Mielec I-22 Iryda M-93V, with RR Viper engines (SP-PWE)	26 Apr 94
PZL Mielec I-22 Iryda M-93S, with SAGEM avionics suite (SP-PWD)	24 May 94

Russia

Aeroprogress/ROKS-Aero T-101 Gratch	7 Dec 94
Aerostatica-01 airship	12 Aug 94
Avia Accord	Apr 94
Ilyushin Il-76MF	1 Aug 95
Ilyushin Il-103 (RA-10300)	17 May 94

Ilyushin Il-103, second prototype (RA-10303)	30 Jan 95
Myasishchev M-101 Gzhel (RA-15001)	31 Mar 95
Reda Pony	Dec 94
Sukhoi Su-32FN, third aircraft (45)	28 Dec 94
Technoavia SM-92 Finist (RA-44484)	(May ?) 94
Yakovlev Yak-58 (c/n 05, second to fly)	10 Oct 94

Sweden

Saab 340AEW&C, with Erieye dorsal radar (SE-042)	1 Jul 94
Saab 2000, with PECS powered elevator control system (SE-003)	19 May 94
Saab 2000, first production aircraft with PECS (SE-010)	2 Dec 94

Ukraine

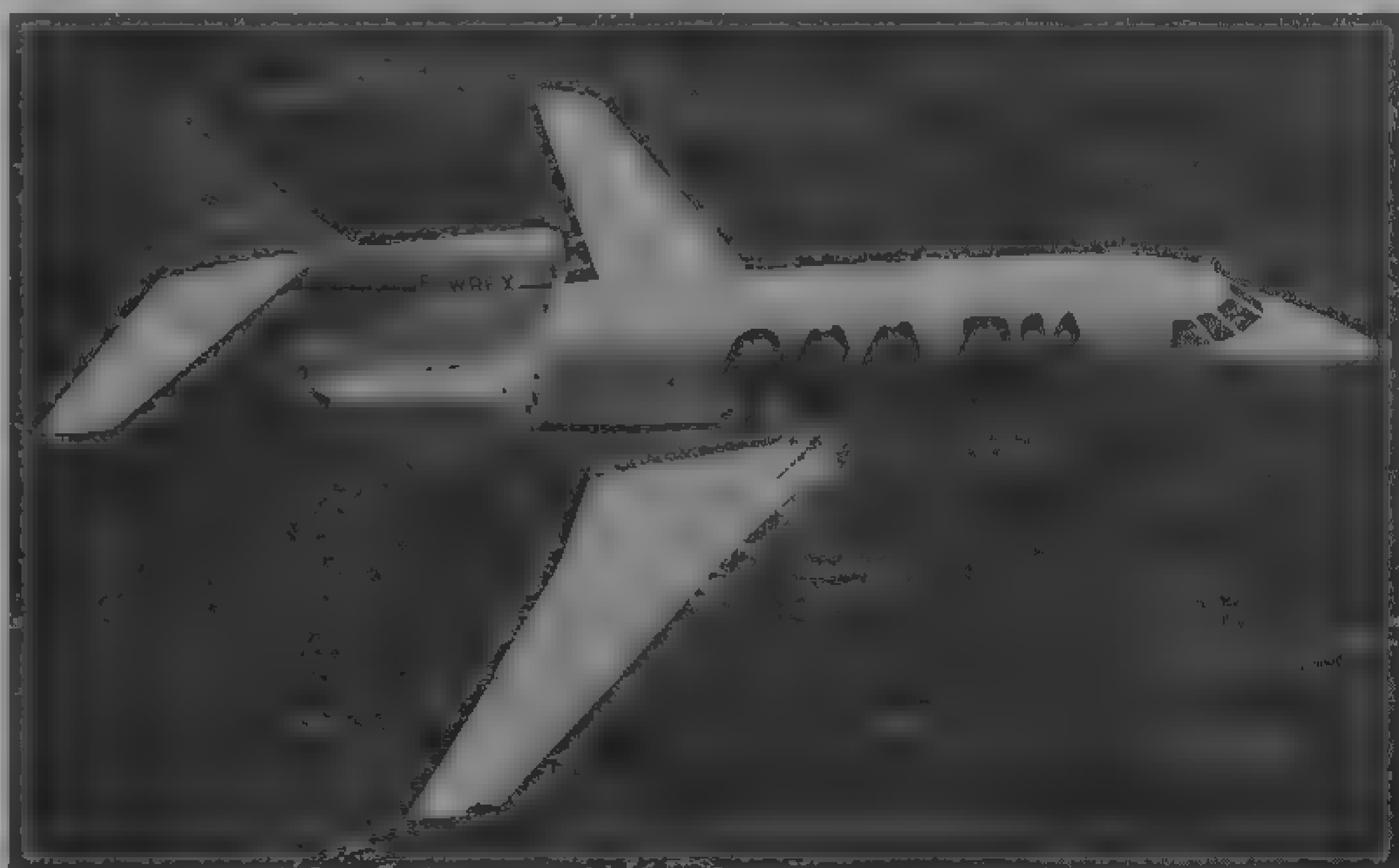
Antonov An-38 (c/n 10001)	23 Jun 94
Antonov An-70	16 Dec 94

UK

BAe Harrier T. Mk 8, first conversion from T. Mk 4N (ZB605)	27 Jul 94
BAe Hawk Mk 208, first for Royal Malaysian Air Force (M40-021)	4 Apr 94
Jetstream 61 (G-JLXI)	10 May 94
Lockheed Hercules, 'single engine demonstrator' for C-130J (converted RAF C. Mk 1, XV181)	19 Mar 94
Pilatus Britten-Norman BN2T-4S Defender 4000 (G-SURV)	17 Aug 94
Raytheon Hawker 800 MP, first U-125A for Japan (G-JHSX/52-3001)	19 Jul 94

USA

Bell 407, concept demonstrator (converted 206L-4, N407LR)	21 Apr 94
Boeing 767-27C, first for conversion to JASDF AWACS E-767 (N60697/N767JA)	19 Oct 94
Boeing 767-300F	20 Jun 95
Boeing 777 (N7771)	12 Jun 94
Boeing 777, second aircraft, first for United Airlines (N771UA)	15 Jul 94
Boeing 777, third aircraft (N772UA)	2 Aug 94
Boeing 777, fourth aircraft (N773UA)	28 Oct 94
Boeing 777, first with GE90 engines (N77779/G-ZZZA)	2 Feb 95
Boeing 777, first with Trent 800 engines (N77772/VR-HNA)	26 May 95
Cessna 172, first new production 'Restart' (N6786R)	19 Apr 95
Cessna Citation Bravo (N550BB)	25 Apr 95
Cessna Citation X, first preproduction (N751CX)	27 Sep 94
Cessna Citation X, second preproduction (N752CX)	11 Jan 95
Cirrus Design SR-20 (N200SR)	31 Mar 95
Hiller UH-12E3, first new production (N1018X)	2 Jun 95
Lockheed P-3C/III Orion, first for South Korea (950901)	12 Dec 94
Lockheed Fort Worth F-16ES (83-1120, converted F-16C)	5 Nov 94
McDonnell Douglas MD-90, first production (c/n 53385)	20 Sep 94
McDonnell Douglas F-15S Eagle, first for Saudi Arabia	19 Jun 95
McDonnell Douglas F-18D Hornet, first for Finland (HN-461)	21 Apr 95
McDonnell Douglas MD 600N (N630N)	22 Nov 94
McDonnell Douglas Explorer, first production (N92011)	3 Aug 94
Peregrine Falcon/Bede BD-10, production prototype (lost in crash 31 Dec 94)	11 Nov 94
Peregrine Falcon/Bede BD-10, second production prototype (lost in crash 4 Aug 95)	21 Jun 95
Raytheon Beechcraft King Air C90SE (N15599)	(mid) Jul 94
Schweizer RU-38A Twin Condor (N61428)	31 May 95
StarKraft 700 (N700SK)	Dec 94
Stoddard-Hamilton GlaStar (N824G)	29 Nov 94



Just in time to make its debut at the Paris Air Show, the prototype Dassault Falcon 900EX was airborne on 1 June 1995

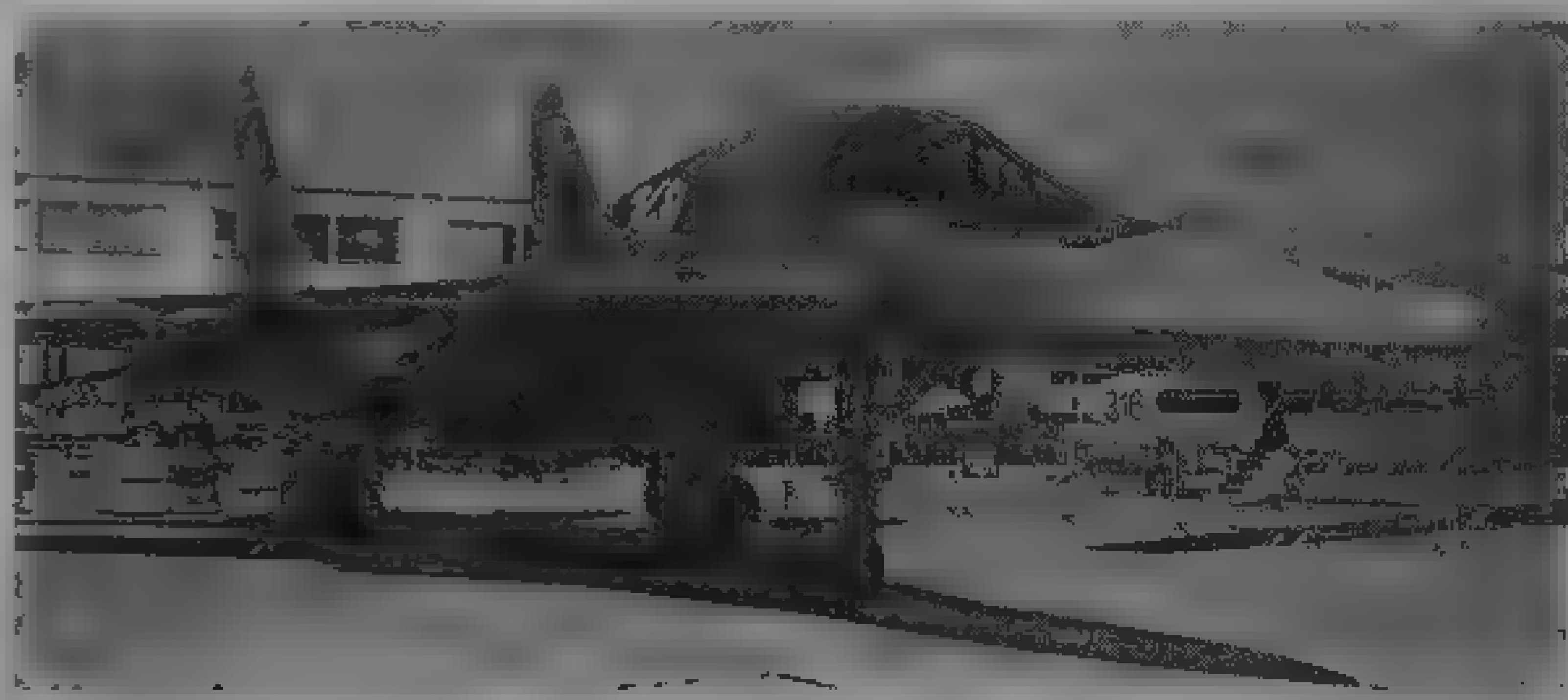
Aerospace Calendar

Some significant aerospace events, August 1994 to July 1995
F/F indicates first flight

1994

	Military aviation	Civil aviation
1 Aug	F-16A: first ex-USAF to Israel	
2 Aug		Boeing 777, third aircraft F/F
3 Aug		MD Explorer: first production F/F
9 Aug	ASTOVL: ARPA and UK MoU signed	
12 Aug		Aerostatika 01 airship F/F
17 Aug	B-2A: second delivery to USAF	SF.260E/F: FAA certification Defender 4000 F/F General Aviation Revitalization Act signed by President Clinton
18 Aug		Astra SPX F/F
30 Aug	Lockheed and Martin announce intent to merge	

	Military aviation	Civil aviation
2 Sep	JAST concept definition and design research RFP issued	
8 Sep	Hawk: Saudi purchase finalised under Al Yamamah II agreement	
13 Sep		SATIC Belouga F/F
14 Sep		Mitsubishi RP-1 F/F
16 Sep		ATR 42-500 F/F
18 Sep		Challenger 604 F/F
20 Sep		MD-90 first production F/F
21 Sep	Karakorum-8, first delivery to Pakistan	
23 Sep	F/A-18E production line begun	
27 Sep		Citation X preproduction F/F
29 Sep	Euromil Mi-38 agreement	
14 Oct		Fokker 70 type certification Jurca Spitfire replica F/F
19 Oct		Boeing 767AWACS F/F 'green'
25 Oct	An-28TD: first delivered to Polish Air Force	Fokker 70 first delivery (Ford Motors) Bell 430 F/F
3 Nov		Do 228-110 certification
4 Nov		Do 228-110 FAA certification
5 Nov	F-16ES proof of concept F/F	
7 Nov	PC-7 Astra roll-out	
11 Nov		BD-10 first production F/F
16 Nov		MD 90 FAA certification
22 Nov		MD 600N F/F
24 Nov		EH 101 CAA/RAI certification
25 Nov		EH 101 FAA certification
28 Nov		EC 135 third prototype F/F ATR 42/active noise control. F/F
29 Nov		Stoddard-Hamilton GlaStar F/F
30 Nov		Falcon 200 JAA certification (first executive jet by JAA)
1 Dec	SH-60F: 82nd and last delivery	
2 Dec		Saab 2000 with PECS F/F production aircraft
7 Dec	AV-8B company testbed F/F	ST 50 F/F T-101 Grach F/F
8 Dec	CN-235 MP: Irish delivery	
11 Dec		Raytheon U-125A: first delivery
12 Dec	P-3C Orion: first Korean F/F	
15 Dec	Tiger fourth prototype F/F	
16 Dec	An-70 F/F C 130J: UK announces purchase EuroFLA: UK to re-join in 1996	
17 Dec	Gulfstream IV selected for Japanese U-X requirement	Skyfox CA-25N Gazelle F/F
19 Dec		Bell 430 second prototype F/F
22 Dec		A330/Trent engine: certification



	Military aviation	Civil aviation
28 Dec	Su-32FN third prototype F/F	
1995		
1 Jan	Ching Kuo operational	
9 Jan	A 129 International F/F	
11 Jan		Citation X second production F/F
12 Jan	FS-X rolled out	Tu-204 type certification
18 Jan	Tucano, hand over first two production for France	
19 Jan	X-31 crashed near Edwards AFB	
20 Jan		A320/321 500th delivery
25 Jan	Karakorum-8 service entry with Pakistan AF Academy RAH-66 Comanche front and rear sections joined	
26 Jan		BAe announces Avro/Jetstream merger with ATR
30 Jan	Harrier T. Mk 10: first delivery to RAF	Il-103 second prototype F/F
1 Feb		Do 328-110 begins commercial service
2 Feb		Falcon 2000: FAA certification
10 Feb	An-70 prototype crashed	
14 Feb	Denel ACE prototype crashed	
16 Feb		Falcon 2000: first delivery (F-WNEW)
21 Feb	Hawk Mk 63C deliveries to UAE	
24 Feb		MD 90: first delivery to Delta (N902DA)
3 Mar		Gippsland GA-8 F/F

	Military aviation	Civil aviation
8 Mar		CitationJet: 100th roll-out
9 Mar	EH 101, RAF order announced for 22 (plus 14 Chinooks)	
13 Mar		DHC-8-200 certification Falcon 900EX revealed
14 Mar		HB 207 Alfa F/F
15 Mar	Lockheed and Martin shareholders vote for merger	
16 Mar		A340/CFM-56 engine: DGAC certification
17 Mar	Harrier FRS Mk 1 last withdrawn from RN service	Challenger 604/CF34-3B engines: F/F
20 Mar		Saab 2000 Deutsche BA first delivery
23 Mar		A319: assembly of first begun
26 Mar		HAMC Y 12 (IV): FAA certification

	Military aviation	Civil aviation
28 Mar		MD 600N receives production approval
29 Mar		A340-300/CFM-56-5C4 engines first delivery (Kuwait Airways)
31 Mar		Cirrus SR-20 F/F
		Grob Strato 2C F/F
2 Apr		MD 90 service entry (Delta)
5 Apr	P-3C: first Korean delivery	
6 Apr	L-159: Czech government go-ahead given	Tu 204 freighter: first delivery to Aeroflot
18 Apr		Fokker 70 CAA certification
19 Apr		Boeing 777: design and production certification, USA and Europe
		'Restart' Cessna 172 F/F
2. Apr	MiG-29 received by Malaysia	Kestrel KL-1 roll-out
25 Apr	F-18D for Finland F/F	Citation Bravo F/F
26 Apr	MiG-29 sets Class C-1h record of 27,460 m (90,092 ft) without payload	Falcon 50EX launched
28 Apr		CFM56-7 engine: first ground test
2 May	IAI Phalcon delivery to Chile	
15 May		100/120-seat transport: South Korean, Chinese, German and Netherlands MoU
17 May		Boeing 777 first delivery (United)
		Taiwan government approval for AIDC to become Han Hsiang and add civil aircraft design and production
18 May	MiG-AT roll-out	Jetstream 41 Cat II certification
24 May	AH-64 Apache: Netherlands order	
25 May	RAH-66 Comanche roll-out	
26 May		Canadair Regional Jet SE F/F
		Boeing 777/Trent engines: F/F

29 May	Yak-130 roll-out	

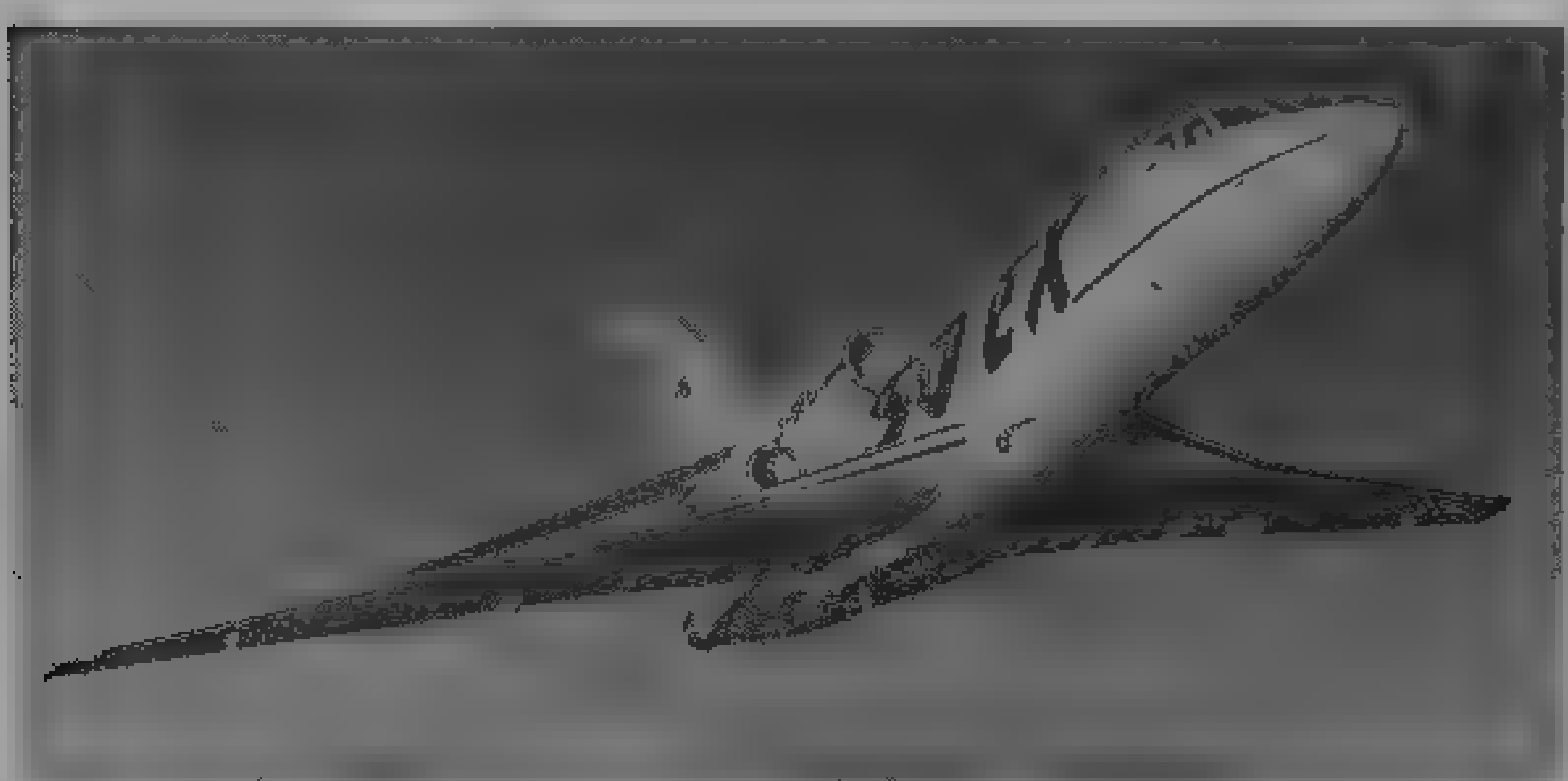
	Military aviation	Civil aviation
30 May		Boeing 777/PW4084 engine: FAA ETOPS
31 May		Schweizer RU-38A Twin Condor F/F
1 Jun		Falcon 900EX F/F
2 Jun		Hiller UH-12E3 F/F restarted production
4 Jun	Eurofighter 2000 F/F of DA3	
6 Jun		Aero International Regional formed (Avro/Jetstream/ATR)
		Robin DR 400 Remo V6 F/F
7 Jun	F 18 first Finnish roll out	Boeing 777: first revenue flight
8 Jun	Rafale (M01) first launch of Mica AAM using RBE2 radar	
9 Jun		EC 120 F/F
10 Jun	Falcon 50: five naval versions to be ordered for France	Kazan Ansat helicopter revealed
	FC-1 fighter revealed by China	A 109 Koala revealed

	B-2A first overseas mission (lands Paris 11 June)	Socata Tangara revealed
12 Jun	JAS 39 Gripen marketing agreement with BAe	DHC-8 launch of Srs 400
		Sikorsky S-92 launch
13 Jun	B-2A first drop of GAM bomb	Nurtanio N-250 to be built at Mobile, USA, by American Regional Aircraft Industries
14 Jun	Formation of Airbus Military Company	
	Ka-52 revealed	
15 Jun		Jetstream 61 CAA type certificate
19 Jun	F-15S Saudi Arabia. F/F	
20 Jun		Boeing 767-300F freighter F/F
22 Jun	PC-9 wins JPATS competition	
26 Jun		Boeing 777: launch of Srs 300
7 Jul	Tornado F. Mk 3: first delivery to Italy	
10 Jul	JAST. Lockheed Martin model begins hovering trials	VLCT feasible, but no market yet exists, reports Boeing/Airbus
		Piper emerges from Ch 11 bankruptcy
13 Jul	AH-64D selected by UK	
20 Jul		Schweizer RU-38A public debut

Future Programme Milestones

First Dassault Rafale deliveries are due in February 1998 to the French Navy

Canada		
Bell 407	Certification	Late 1995
Bell 407T	Certification	Early 1997
Bell 430	First flight, production	Oct 1995
Canadair Global Express	First flight	Autumn 1996
Canadair Global Express	Certification	May 1998
DHC-8-400	First flight	Third qtr 1997
DHC-8-400	Deliveries	1998
Chile		
Enaer Ñamcu	Certification	Late 1996
Colombia		
Gavilán 358 second proto	First flight	Apr 1996
Czech Republic		
Aero L-610G/CT7 engines	Certification	Late 1996
Aero Ae 270	Certification	Late 1996
Aero L-159 (two-seat)	First flight	Second half 1996
Aero L-159 No. 2 (single-seat)	First flight	First qtr 1997
France		
Dassault Rafale M	First deliveries	Feb 1998
Dassault Rafale B/C	Service entry	2002
Dassault Falcon 50EX	First flight	Early 1996



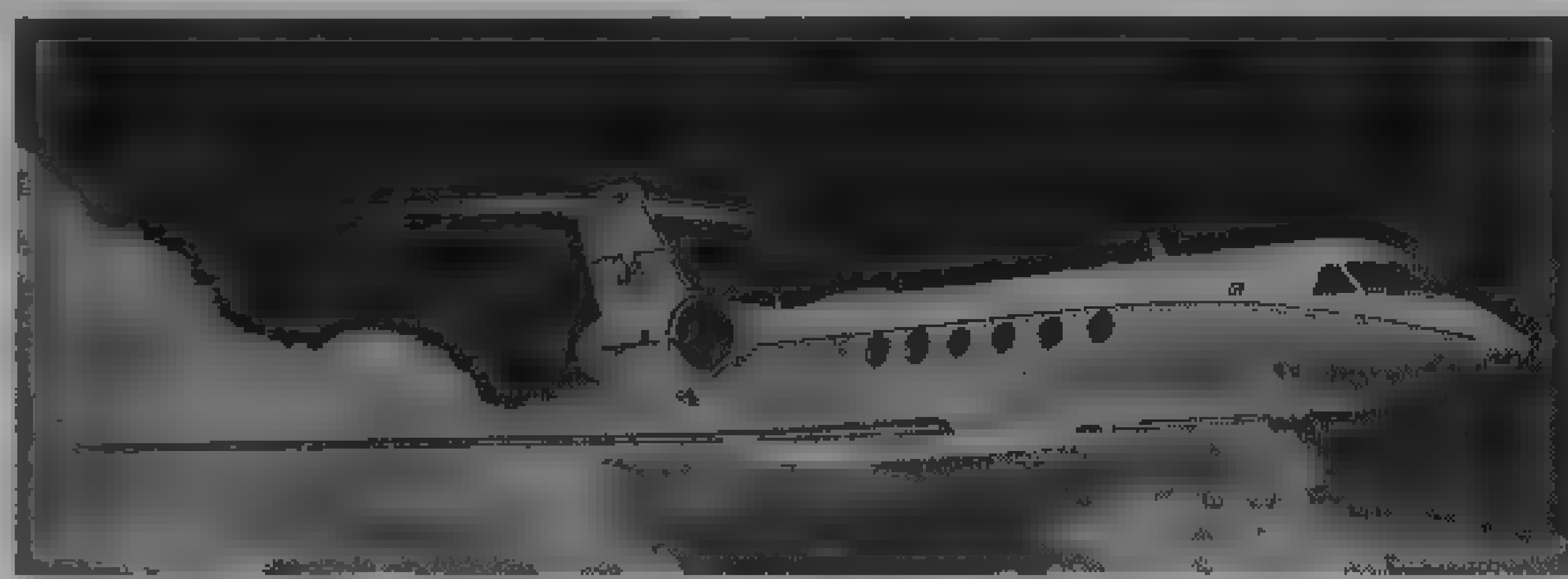
Dassault Falcon 50EX	Certification and deliveries	1997
Dassault Falcon 900EX	Certification	Mar 1996
Germany		
Grob GF 200	Certification	Mid-1996
Grob Strato 2C	Delivery	Late 1996
Ruschmeyer R 95	First flight	1999
Zeppelin N 07	First flight	Early 1997
Hungary		
Ganzavia Dinó, fourth proto	First flight	Mid-1996
International		
Airbus A319	Certification	Mar 1996
Airbus A319	Service entry (Swissair)	Apr 1996
EHI EH 101, first Royal Navy	First flight	Mid-1996
Eurocopter EC 120	Deliveries	Second half 1997
Eurocopter EC 135	Certification	Early 1996
Euromil Mi-38	Deliveries	1999
NHI NH 90	First flight	Dec 1995
NHI NH 90 No 2	First flight	Mid-1996
NHI NH 90 No 3	First flight	Second half 1996
NHI NH 90 No 5 (NFH proto)	First flight	Early 1997
NHI NH 90 No 4 (TTH proto)	First flight	Late 1997
NHI NH 90 production	First flight 2000	
Israel		
IAI Astra Galaxy	First flight	Early 1996
Italy		
Sivel SD28	First flight	Late 1995
Japan		
Kawasaki OH X	First flight	Mid-1996

Kawasaki OH-X	Deliveries	2000

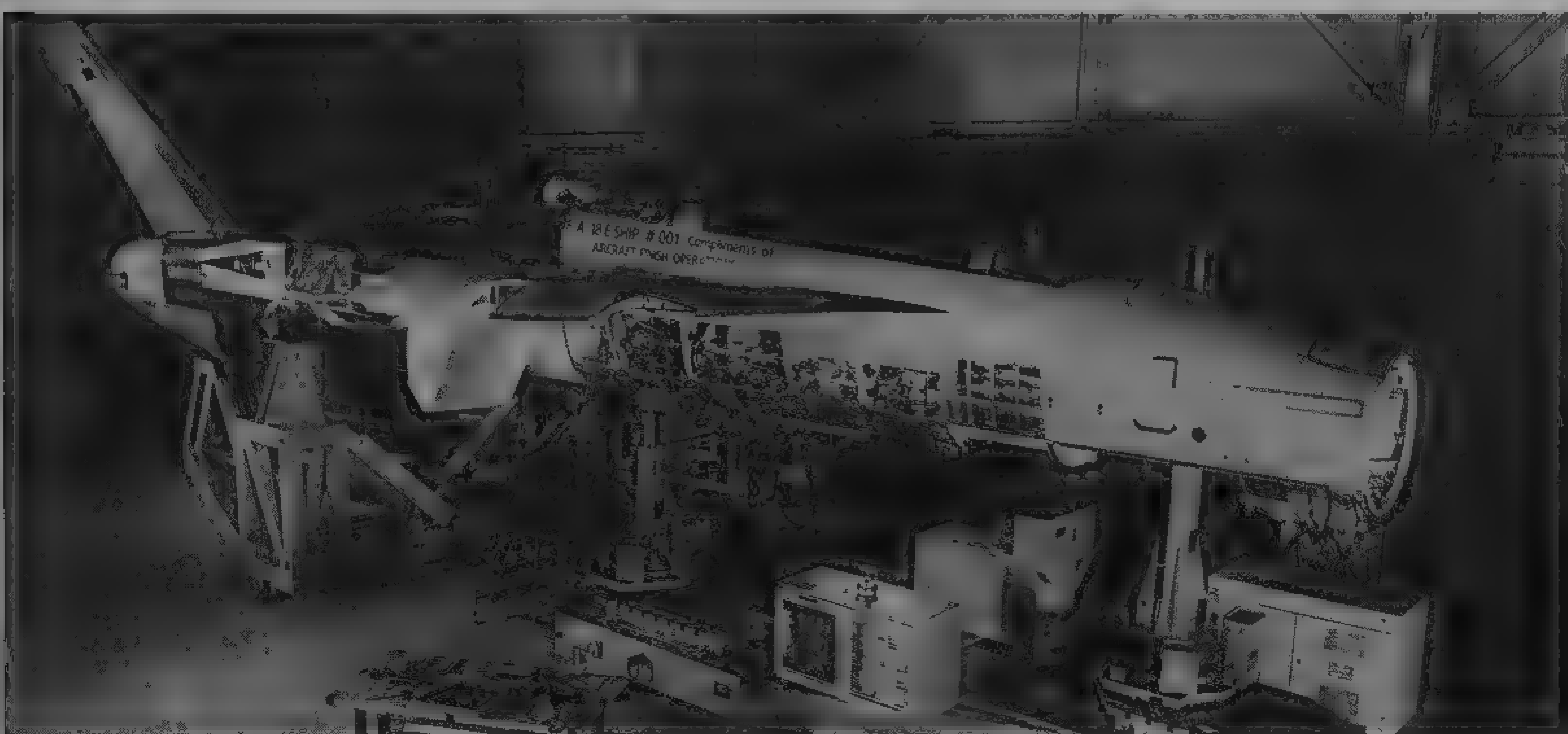
Mitsubishi FS-X prototype	Delivery to JDA	Mar 1996
Mitsubishi FS-X	IOC	1999
Korea, South		
Daewoo KTX-I	Deliveries	Jan 1998
Samsung/LM F-16C/D	Last delivery	1999
Netherlands		
Fokker 60	Delivery (RNethAF)	May 1996
Poland		
PZL-Swidnik SW-4	First flight	Nov 1995
PZL-Swidnik SW-4	Certification	Jul 1997
Romania		
CPCA Dracula	First flight	May 1996
Russia		
Aeroprogress T-130	First flight	Nov 1995
Aeroprogress T-203	First flight	Oct 1995
Aeroprogress T-274	First flight	1996
Aeroprogress T-401	First flight	Oct 1995
Aeroprogress T-407	First flight	1995
Aeroprogress T-610	First flight	Mar 1996
AeroRIC Dingo (MAPO)	First flight	1995
Aviaspetztrans Yamal	First flight	Early 1998
Beriev Be-32	Certification	1995
Beriev Be-200	First flight	Nov 1995
Beriev Be-200	Certification/deliveries	1997
Kamov Ka-62	Certification	1996
Khrunichev T-420	First flight	Spring 1996
Mil Mi-34 VAZ	IOC	1996
Mil Mi-38	First flight	1997
Mil Mi-46T	IOC	2000
Mil Mi-54	IOC	1998
Tupolev Tu-34	First flight	Late 1997
Tupolev Tu-34	Certification	1998
Tupolev Tu-130	First flight	1996
Tupolev Tu-330	First flight	1996
Tupolev Tu-330	Service entry	1997
Yakovlev Yak-77	First flight	1996
Yakovlev Yak-242	First flight	First half 1997
Sweden		

IG JAS 39	Pilot conversion training	Oct 1995
IG JAS 39	IOC	Apr 1996

USA		
Bell-Boeing MV-22 No. 7	First flight	Dec 1996
Bell-Boeing MV-22 No. 8	First flight	Feb 1997
Bell-Boeing MV-22 No. 10	First flight	Apr 1997
Bell-Boeing MV-22 No. 9	First flight	May 1997
Boeing 737-700	Roll-out	Dec 1996
Boeing 737-700	Deliveries	1997
Boeing 737-800	Deliveries	1998
Boeing NSA	Service entry	2002
Cessna Citation X	Certification	Nov 1995
Cessna Citation X	Deliveries	Apr 1996
Cessna Citation XL	First flight	Mar 1996
Cessna Citation XL	Certification	Mar 1997
Cessna Citation XL	Deliveries	Dec 1997
Gulfstream V	First flight	Nov 1995



Gulfstream V	Certification	Oct 1996
Learjet 45	Certification	Dec 1996
Learjet 45	First deliveries	Jan 1997
McDD F-18	Deliveries to Finland	Nov 1995
McDD F/A-18E	First flight	Dec 1995
McDD F/A-18E	Service entry	2001
McDD C-17A	Milestone 3B decision	Nov 1995
McDD MD-95	First flight	1997
McDD MD-95 production	First flight	Jan 1998
McDD MD-95	Certification	Mar 1998
McDD MD-95	Deliveries	Aug 1998
McDD MD 600N	Certification/deliveries	Third qtr 1996
Northrop B-2A	20th delivery to USAF	1998
Raytheon Beech Mk II JPATS	First flight	Dec 1998
Raytheon Beech Mk II JPATS	IOC with USAF	1999
Raytheon Beech Mk II JPATS	IOC with US Navy	2002
Sikorsky S-92	First flight	Second qtr 1998
Sikorsky S-92C	Certification	First qtr 2000
Sikorsky S-92IU	Certification	Third qtr 2000
Swearingen SJ30	Deliveries	1997
-?- C-32A	Deliveries to USAF	1997



The prototype McDonnell Douglas F/A-18E Hornet nears completion

Still to be bettered is the 1938 distance record established by Short Mayo S 20 *Mercury* G ADHJ after launch from 'mother' ship S 21 *Maia* G-ADHK

1995

ABSOLUTE WORLD RECORDS

(Corrected to 20 April 1995)

CLASS A (Free Balloons)

Three records are classed as Absolute World Records for free balloons by the Fédération Aéronautique Internationale, as follows·

Duration (USA)
Richard Abruzzo and Troy Bradley in a Cameron R-77, from Bangor, Maine, USA, to Ben Slimane, Morocco, on 16-22 September 1992 144 h 16 min

Distance (USA)
B. L. Abruzzo, L. M. Newman, R Aoki and R. Clark in the gas balloon *Double Eagle V*, from Nagashima, Japan, to Covello, California, USA, on 9-12 November 1981. 4,526.21 n miles (8,382.54 km, 5,208.67 miles).

Altitude (USA)
Cdr M. D. Ross and Lt Cdr V. A. Prather in a gas balloon on 4 May 1961. 34,668 m (113,740 ft)

CLASS C (Aeroplanes)

Seven records are classed as Absolute World Records for aeroplanes by the Fédération Aéronautique Internationale, as follows.

Distance in a straight line (USA), and **Distance in a closed circuit** (USA)
Dick Rutan and Jeana Yeager in the Voyager, on 14-23 December 1986. Circumnavigation of the World, starting and finishing at Edwards AFB, California. 21,712 816 n miles (40,212.139 km, 24,986 664 miles).

Height (USSR)
Alexander Fedotov in an E-266M (MiG-25) on 31 August 1977. 37,650 m (123,523 ft)

Height in sustained horizontal flight (USA)
Captain Robert C. Helt and Major Larry A. Elliott (USAF) in a Lockheed SR-71A on 28 July 1976 at Beale AFB, California. 25,929.031 m (85,069 ft).

Height, after launch from a 'mother-plane' (USA)
Major R. White, USAF, in the North American X-15A-3 on 17 July 1962, at Edwards AFB, California 95,935 99 m (314,750 ft)

Speed in a straight line (USA)
Captain Eldon W. Joersz and Major George T Morgan Jr (USAF) in a Lockheed SR-71A on 28 July 1976 over a 15/25 km course at Beale AFB, California. 1,905.81 knots (3,529 56 km/h, 2,193 17 mph)

Speed in a closed circuit (USA)
Major Adolphus H. Bledsoe Jr and Major John T. Fuller (USAF) in a Lockheed SR-71A on 27 July 1976, over a 1,000 km closed circuit from Beale AFB, California. 1,818.154 knots (3,367.221 km/h, 2,092.294 mph).

WORLD CLASS RECORDS

Following are details of some of the more important world class records confirmed by the Fédération Aeronautique Internationale

CLASS C, GROUP 1 (Landplanes with piston engines)

Distance in a straight line and Distance in a closed circuit
See Absolute World Records.

Height (Italy)
Mario Pezzi, in a Caproni Ca 161*bis*, on 22 October 1938 17,083 m (56,046 ft)

Speed in a straight line (USA)
Lyle Shelton in a modified Grumman F8F Bearcat, with a 2,833 kW (3,800 hp) Wright R-3350 engine, on 21 August 1989, over a 3 km course at Las Vegas, New Mexico 459 10 knots (850 25 km/h, 528.33 mph)

CLASS C, GROUP 2 (Landplanes with turboprop engines)

Distance in a straight line (USA)
Lt Col E L. Allison and crew in a Lockheed HC-130H Hercules, on 20 February 1972. 7,587 99 n miles (14,052 95 km, 8,732 098 miles).

Distance in a closed circuit (USA)
Cdr Philip R. Hite and crew in a Lockheed RP-3D Orion, on 4 November 1972 5,455.46 n miles (10,103 51 km; 6,278 03 miles).

Height (USA)
Einar Enevoldson in an Egrett-1, on 1 September 1988, at Majors Field, Greenville, Texas 16,329 m (53,573 ft).

Speed in a straight line (USA)
Cdr Donald H. Lilienthal and crew in a Lockheed P-3C Orion, over a 15/25 km course on 27 January 1971. 435.26 knots (806 10 km/h; 500 89 mph).

Speed in a closed circuit (USSR)
Ivan Sukhomlin and crew in a Tupolev Tu-114, on 9 April 1960, carrying a 25,000 kg payload over a 5,000 km circuit. 473 66 knots (877 212 km/h, 545.07 mph)

CLASS C, GROUP 3 (Landplanes with jet engines)

Distance in a straight line (USA)
Major Clyde P. Evely, USAF, in a Boeing B-52H Stratofortress, on 10-11 January 1962, from Okinawa to Madrid, Spain. 10,890.27 n miles (20,168 78 km, 12,532.3 miles).

Distance in a closed circuit (USSR)
Vladimir Terski and crew in an Antonov An-124, on 6-7 May 1987. Moscow-Astrakhan-Tashkent-Lake Baikal-Petropavlovsk-Chukot Peninsula-Murmansk-Zhdanov-Moscow. 10,880 625 n miles (20,150 921 km; 12,521.201 miles).

Height, speed in straight line and speed in 1,000 km closed circuit
See Absolute World Records

Speed over a 3 km course at restricted altitude (USA)
Darryl Greenamyer in the modified Red Baron F-104RB Starfighter, on 24 October 1977, at Mud Lake, Tonopah, Nevada. 858 77 knots (1,590 45 km/h, 988 26 mph).

Speed in a 100 km closed circuit (USSR)
Alexander Fedotov in a Mikoyan E-266 (MiG-25) on 8 April 1973. 1,406 641 knots (2,605.1 km/h; 1,618.734 mph)

Speed in a 500 km closed circuit (USSR)
M Komarov in a Mikoyan E-266 (MiG-25), on 5 October 1967, near Moscow. 1,609 88 knots (2,981.5 km/h; 1,852 62 mph)

Speed around the world (France)
Claude Delorme and Jean Boye in a Concorde, westbound, on 11-13 October 1992. 664 75 knots (1,231.12 km/h, 765 00 mph).

Greatest mass carried to a height of 2,000 m (USSR)
Alexander V. Galunenko in an Antonov An-225 Mriya, on 22 March 1989. 508,200 kg (1,120,370 lb).

CLASS C.2, ALL GROUPS (Seaplanes)

Distance in a straight line (UK)
Capt D. C. T. Bennett and First Officer I. Harvey, in the Short-Mayo *Mercury*, on 6-8 October 1938, from Dundee, Scotland, to the Orange River, South Africa. 5,211.66 n miles (9,652 km; 5,997 5 miles).

Height (USSR)
Georgi Buryanov and crew of two in a Beriev M-10, on 9 September 1961, over the Sea of Azov 14,962 m (49,088 ft)

Speed in a straight line (USSR)
Nikolai Andrievsky and crew of two in a Beriev M-10, on 7 August 1961, at Joukovski-Petrovskoe, over a 15/25 km course. 492 44 knots (912 km/h; 566.69 mph)

CLASS D.1 (Single-seat sailplanes)

Distance in a straight line (Germany)
Hans W. Grosse in a Schleicher ASW 12, on 25 April 1972. 788.77 n miles (1,460 8 km; 907.70 miles)

Height (USA)
Robert R. Harris in a Grob G 102, on 17 February 1986 14,938 m (49,009 ft)

CLASS D.2 (Two-seat sailplanes)

Distance in a straight line (France)
Gérard Herbaud and Jean-Noel Herbaud in a Schleicher ASH 25, on 17 April 1992, from Vinon, France, to Fez (Morocco). 746 76 n miles (1,383 00 km; 859.38 miles).

Height (USA)
Laurence E. Edgar and Harold E. Klieforth in a Pratt-Read PR-G1 on 19 March 1952, at Bishop, California. 13,489 m (44,256 ft).

CLASS E.1 (Helicopters)

Distance in a straight line (USA)
R. G. Ferry in a Hughes OH-6A, on 6-7 April 1966. 1,923 08 n miles (3,561 55 km; 2,213 miles)

Height (France)
Jean Boulet in an Aerospatiale SA 315B Lama on 21 June 1972. 12,442 m (40,820 ft)

Speed in a straight line (UK)
Trevor Egginton in a Westland Lynx, on 11 August 1986, over a 15/25 km course. 216.45 knots (400 87 km/h, 249.09 mph).

Speed in a 100 km closed circuit (USSR)
Boris Galitsky and crew of five in a Mil Mi-6, on 26 August 1964, near Moscow. 183.67 knots (340 15 km/h, 211 36 mph)

Speed in a 500 km closed circuit (USA)
Thomas Doyle in a Sikorsky S-76A, at West Palm Beach, Florida, on 8 February 1982. 186.68 knots (345.74 km/h, 214.83 mph)

CLASS E.3 (Autogyros)

Height (UK)
Wing Cdr K. H. Wallis, in a Wallis WA-121/Mc, on 20 July 1982. 5,463.7 m (18,516 ft)

Distance in a straight line (UK)
Wing Cdr K. H. Wallis, in a Wallis WA-116/F, from Lydd Airport, Kent, to Wick, Scotland, on 28 September 1975. 472.092 n miles (874 315 km, 543.274 miles)

Distance in a closed circuit (UK)
Wing Cdr K. H. Wallis, in a Wallis WA-116/F/S on 5 August 1988. 541.44 n miles (1,002.75 km, 623 08 miles)

Speed in a straight line (UK)
Wing Cdr K. H. Wallis, in a Wallis WA-116/F/S, over a 3 km course, on 18 September 1986. 104 5 knots (193.6 km/h; 120.3 mph)

Lockheed's still futuristic SR-71A has been withdrawn from USAF service and recently reinstated, but its records live on *(Paul Jackson)*

1995

SPACE RECORDS (Spacecraft and Aerospacecraft)

The section of the FAI Sporting Code that deals with Space Records was amended in 1994. There are no longer absolute records for Class K (Spacecraft) and P (Aerospacecraft), but a single list taking into account the best performances from both of these former classes

Duration (USSR)
Vladimir G. Titov and Musa H. Manarov, from 21 December 1987 to 21 December 1988 365 days, 22 h 39 min 47 s.

Greatest mass lifted to altitude (USA)
Frank Borman, James A. Lovell Jr and William Anders, on the Apollo 8 mission, on 21-27 December 1968. 127,980 kg (282,143 lb).

Accumulated space flight time (USSR)
Valeri Poliakov; 677 days to March 1995

Extravehicular duration in space (USA)
Thomas D. Akers, Richard J Hieb and Pierre J. Thuot, mission specialists from the Space Shuttle Orbiter OV-105 *Endeavour*, on 13 May 1992 8 h 20 min

A few additional records will be added after the relative dossiers have been checked to ensure a proper reclassification

Glossary of aerospace terms in this book

AAM Air-to-air missile.
AAR Air-to-air refuelling
AATH Automatic approach to hover.
absolute ceiling Greatest altitude attainable by aircraft in unaccelerated flight.
AC Alternating current.
ACC Air Combat Command.
ACE Actuator control electronics.
ACLS Automatic carrier landing system.
ACMI Air combat manoeuvring instrumentation.
ACN Aircraft classification number (ICAO system for aircraft pavements).
ADC Air data computer.
ADF Medium frequency automatic direction-finding (equipment).
ADG Accessory-drive generator
ADI Attitude/director indicator.
aeroplane (N America, airplane) Heavier-than-air aircraft with propulsion and a wing that does not rotate in order to generate lift.
AEW Airborne early warning
AFB Air Force Base (USA).
AFCS Automatic flight control system.
AFRP Aramid fibre-reinforced plastics.
afterburning Temporarily augmenting the thrust of a turbofan or turbojet by burning additional fuel in the jetpipe.
AGM Air-to-ground missile
AGREE Advisory Group on Reliability in Electronic Equipment.
Ah Ampère-hours.
AHRS Attitude/heading reference system.
AIDS Airborne integrated data system.
aircraft All man-made vehicles for off-surface navigation within the atmosphere, including helicopters and balloons.
airstair Retractable stairway built into aircraft.
AIS Advanced instrumentation subsystem.
ALARM Air-launched anti-radiation missile
ALCM Air-launched cruise missile
AM Amplitude modulation.
AMAD Airframe-mounted accessory drive.
AMC Air Mobility Command.
AMRAAM Advanced Medium-Range AAM.
ANG Air National Guard.
anhedral Downward slope of wing from root to tip
ANVIS Aviator's night vision system
AoA Angle of attack (see 'attack' below)
AOP Air observation post.
APFD Autopilot flight director.
approach noise Measured 1 n mile from downwind end of runway with aircraft passing overhead at 113 m (370 ft)
APR Auxiliary power reserve
APS Aircraft prepared for service; a fully equipped and crewed aircraft without usable fuel and payload
APU Auxiliary power unit (part of aircraft)
ARINC Aeronautical Radio Inc, US company whose electronic box sizes (racking sizes) are the international standard
ARM Anti-radiation missile.
ArNG Army National Guard
ARPA Advanced Research Projects Agency.
ARV Air recreational vehicle or air reconnaissance vehicle, according to context.
ASE (1) Automatic stabilisation equipment; (2) Aircraft survivability equipment.
ASI Airspeed indicator.
ASIR Airspeed indicator reading.
ASM Air-to-surface missile
aspect ratio Measure of wing (or other aerofoil) slenderness seen in plan view, usually defined as the square of the span divided by gross area.
ASPJ Advanced self-protection jammer.
AST Air Staff Target (UK).
ASTOVL Advanced STOVL.
ASUW Anti-surface unit warfare.
ASV Anti-surface vessel
ASW Anti-submarine warfare.
ATA Air Transport Association of America
ATC Air traffic control
ATDS Airborne tactical data system
ATHS Airborne target handover (US, handoff) system.
ATR Airline Transport Radio ARINC 404 black box racking standards
attack, angle of (alpha) Angle at which airstream meets aerofoil (angle between mean chord and free-stream direction). Not to be confused with angle of incidence (which see)
augmented Boosted by afterburning (turbofan)
autogyro Rotary-wing aircraft propelled by a propeller (or other thrusting device) and lifted by a freely running autorotating rotor
AUW All-up weight (term meaning total weight of aircraft under defined conditions, or at a specific time during flight). Not to be confused with MTOGW (which see)
avionics Aviation electronics
AWACS Airborne warning and control system (aircraft).

bar Non-SI unit of pressure adopted by this yearbook pending wider acceptance of Pa. 1 bar = 10^5 Pa. ISA pressure at S/L is 1013.2 mb or just over 1 bar. ICAO has standardised hectopascal for atmospheric pressure, in which ISA S/L pressure is 101.32 hPa
basic operating weight MTOGW minus payload (thus, including crew, fuel and oil, bar stocks, cutlery etc).
BCAR British Civil Airworthiness Requirements (see JAR)
bearingless rotor Rotor in which flapping, lead/lag and pitch change movements are provided by the flexibility of the structural material and not by bearings. No rotor is rigid
Beta mode Propeller or rotor operating regime in which pilot has direct control of pitch
birotative Having two components rotating in opposite directions.
BITE Built-in test equipment.
bladder tank Fuel (or other fluid) tank of flexible material.
BLC Boundary-layer control.
bleed air Hot high-pressure air extracted from gas turbine engine compressor or combustor and taken through valves and pipes to perform useful work such as pressurisation, driving machinery or anti-icing by heating surfaces
blisk Blade plus disc (of turbine engine) fabricated in one piece.
blown flap Flap across which bleed air is discharged at high (often supersonic) speed to prevent flow breakaway
BOW Basic operating weight (which see).
BPR Bypass ratio.
BRW Brake release weight, maximum permitted weight at start of T-O run.
BTU Non-SI unit of energy (British Thermal Unit) = 0 9478 J
bulk cargo All cargo not packed in containers or on pallets.
bus Busbar, main terminal in electrical system to which battery or generator power is supplied.
BVR Beyond visual range.
bypass ratio Airflow through fan duct (not passing through core) divided by airflow through core.

C^3 Command, control and communications.
C^3CM Command, control, communications and countermeasures.
CAA Civil Aviation Authority (UK).
cabin altitude Height above S/L at which ambient pressure is same as inside cabin.
CAD/CAM Computer-assisted design/computer-assisted manufacture.
canards Foreplanes, fixed or controllable aerodynamic surfaces ahead of CG
CAN 5 Committee on Aircraft Noise (ICAO) rules for new designs of aircraft.
capacity The volume swept out on each stroke by the pistons of a piston engine. It is expressed in cc (cubic centimetres) for small engines and in litres (1 litre = 1,000 cc) for larger ones. Also known as displacement.
CAR Civil Airworthiness Regulations.
carbonfibre Fine filament of carbon/graphite used as strength element in composites.
CAS (1) Calibrated airspeed, ASI calibrated to allow for air compressibility according to ISA S/L; (2) close air support.
casevac Casualty evacuation
CBR California bearing ratio, measure of ability of airfield surface (paved or not) to support aircraft.
CBU Cluster bomb unit
CCV Control configured vehicle.
CEAM Centre d'Expériences Aériennes Militaires
CEAT Centre d'Essais Aéronautiques de Toulouse
CEP Circular error probability (50/50 chance of hit being inside or outside) in bombing, missile attack or gunnery
CEV Centre d'Essais en Vol
CFE Conventional Forces in Europe
CFRP Carbonfibre-reinforced plastics.
CG Centre of gravity

chaff Thin slivers of radar-reflective material cut to length appropriate to wavelengths of hostile radars and scattered in clouds to protect friendly aircraft.
chord Distance from leading-edge to trailing-edge measured parallel to longitudinal axis.
CIS Commonwealth of Independent [ex-USSR] States
CKD Component knocked down, for assembly elsewhere.
clean (1) In flight configuration with landing gear, flaps, slats etc retracted; (2) Without any optional external stores.
c/n Construction (or constructor's) number.
COIN Counter-insurgency.
COINS Computer operated instrument system.
collective pitch Controls pitch of all blades of helicopter main rotor in unison.
combi Civil aircraft carrying both freight and passengers on main deck.
comint communications intelligence.
composite material Made of two constituents, such as filaments or short whiskers plus adhesive forming binding matrix.
constant-speed Propeller, electric generator or other device whose rotational speed is held constant.
contrarotating Propellers on same axis turning in opposite directions (compare C/R).
CONUS Continental USA (ie, excluding Hawaii, etc).
convertible Transport aircraft able to be equipped to carry passengers or cargo
core Gas generator portion of turbofan comprising compressor(s), combustion chamber and turbine(s).
C/R Counter-rotating; propellers of multi-engined aircraft turning in opposite directions on different axes (compare contrarotating).
CRT Cathode-ray tube.
CSAS Command and stability augmentation system (part of AFCS).
CSD Constant-speed drive (output shaft speed held steady, no matter how input may vary).
CSRL Common strategic rotary launcher (for air-launched missiles of various types).
CVR Cockpit voice recorder.
cyclic pitch Controls variation of pitch as helicopter rotor blade makes each revolution

DADC Digital air data computer.
DADS Digital air data system.
daN Decanewtons (Newtons force × 10); thus, torque measured in daN-metres.
databus Electronic highway for passing digital data between aircraft sensors and system processors, usually MIL-STD-1553B or ARINC 419 (one-way) and 619 (two-way) systems.
dB Decibel.
DC Direct current.
DECU Digital engine (or electronic) control unit.
dem/val Demonstration, validation.
derated Engine restricted to power less than potential maximum (usually such engine is flat rated, which see).
design weight Different authorities have different definitions; weight chosen as typical of mission but usually much less than MTOGW.
DF Direction-finder, or direction-finding
DGAC Direction Générale à l'Aviation Civile.
dihedral Upward slope of wing from root to tip.
DINS Digital inertial navigation system
disposable load Sum of masses that can be loaded or unloaded, including payload, crew, usable fuel etc; MTOGW minus OWE
DLC Direct lift control.
DME UHF distance-measuring equipment; gives slant distance to a beacon; DME element of Tacan.
DoD Department of Defense.
dog-tooth A step in the leading-edge of a plane resulting from an increase in chord (see also saw-tooth)
Doppler Short for Doppler radar — radar using fact that received frequency is a function of relative velocity between transmitter or reflecting surface and receiver; used for measuring speed over ground or for detecting aircraft or moving vehicles against static ground or sea
double-slotted flap One having an auxiliary aerofoil ahead of main surface to increase maximum lift.
dP Maximum design differential pressure between pressurised cabin and ambient (outside atmosphere).

DRA Defence Research Agency.
DS Directionally solidified.

EAA Experimental Aircraft Association (divided into local branches called Chapters).
EAS Equivalent airspeed, RAS minus correction for compressibility.
EB welding Electron beam welding.
ECCM Electronic counter-countermeasures
ECM Electronic countermeasures.
ECS Environmental control system.
EEZ Economic exclusion (or exclusive-economic) zone.
EFIS Electronic flight instrument(ation) system, in which large multifunction CRT displays replace traditional instruments
EGT Exhaust gas temperature
ehp Equivalent horsepower, measure of propulsive power of turboprop made up of shp plus addition due to residual thrust from jet.
EICAS Engine indication (and) crew alerting system.
EIS Entry into service
ekW Equivalent kilowatts, SI measure of propulsive power of turboprop (see ehp).
elevon Wing trailing-edge control surface combining functions of aileron and elevator
ELF Extreme low frequency
elint electronics intelligence.
ELT Emergency locator transmitter, to help rescuers home on to a disabled or crashed aircraft.
EMP Electromagnetic pulse of nuclear or electronic origin.
EO Electro-optical
EPA Environmental Protection Agency.
EPNdB Effective perceived noise decibel, SI unit of EPNL.
EPNL Effective perceived noise level, measure of noise effect on humans which takes account of sound intensity, frequency, character and duration, and response of human ear.
EPU Emergency power unit (part of aircraft, not used for propulsion).
ESA European Space Agency.
ESM (1) Electronic surveillance (or support) measures; (2) Electronic signal monitoring
ETOPS Extended-range twin (engine) operations, routing not more than a given flight time (120 min or 180 min) from a usable alternative airfield
EW Electronic warfare.
EWSM Early-warning support measures.

FAA Federal Aviation Administration.
FAC Forward air control (or controller).
factored Multiplied by an agreed number to take account of extreme adverse conditions, errors, design deficiencies or other inaccuracies.
FADEC Full authority digital engine (or electronic) control
FAI Féderation Aéronautique Internationale.
fail-operational System which continues to function after any single fault has occurred.
fail-safe Structure or system which survives failure (in case of system, may no longer function normally).
FAR Federal Aviation Regulations.
FAR Pt 23 Defines the airworthiness of private and air taxi aeroplanes of 5,670 kg (12,500 lb) MTOGW and below.
FAR Pt 25 Defines the airworthiness of public transport aeroplanes exceeding 5,670 kg (12,500 lb) MTOGW
FBL Fly-by-light (which see).
FBW Fly-by-wire (which see).
FDR Flight data recorder.
FDS Flight director system
feathering Setting propeller or similar blades at pitch aligned with slipstream to give resultant torque (not tending to turn shaft) and thus minimum drag
FEL Fibre elastomeric rotor head.
fence A chordwise projection on the surface of a wing, used to modify the distribution of pressure.
Fenestron Helicopter tail rotor with many slender blades rotating in short duct (registered name).
ferry range Extreme safe range with zero payload.
FFAR Folding fin (or free-flight) aircraft rocket.
field length Measure of distance needed to land and/or takeoff; many different measures for particular purposes, each precisely defined.
fixed-pitch Propeller whose blades are fixed to the hub.

flaperon Wing trailing-edge surface combining functions of flap and aileron.
flat-four Engine having four horizontally opposed cylinders; thus, flat-twin, flat-six etc.
flat rated Propulsion engine capable of giving full thrust or power for take-off to high airfield height and/or high ambient temperature (thus, probably derated at S/L)
flight-data recorder Crash-protected recorder of dynamic/static pressure, air temperature, control-surface and slat/flap positions, 3-axis accelerations, engine parameters and possibly other variables.
FLIR Forward-looking infra-red.
FLOT Forward line of own troops
fly-by-light Flight control system in which signals pass between computers and actuators along fibre optic leads
fly-by-wire Flight control system with electrical signalling (ie, without mechanical interconnection between cockpit flying controls and control surfaces)
FM Frequency modulation.
FMCS Flight management computer system.
FMS (1) Foreign military sales (US DoD); (2) Flight management system
FOD Foreign-object damage.
FOV Field of view
footprint (1) A precisely delineated boundary on the surface, inside which the perceived noise of an aircraft exceeds a specified level during take-off and/or landing; (2) Dispersion of weapon or submunition impact points.
Fowler flap Moves initially aft to increase wing area and then also deflects down to increase drag.
FRADU Fleet Requirements and Air Direction Unit.
free turbine Turbine mechanically independent of engine upstream, other than being connected by rotating bearings and the gas stream, and thus able to run at its own speed.
frequency agile (frequency hopping) Making a transmission harder to detect by switching automatically to a succession of frequencies.
FSD Full-scale development
FSED Full-scale engineering development
FSW Forward-swept wing.
FY Fiscal year; in US government affairs, runs from 1 October to 30 September (FY96 begins 1 October 1995); in Japan, from 1 April (FY8 or FY96 begins 1 April 1996).

g Acceleration due to mean Earth gravity, ie of a body in free-fall; or acceleration due to rapid change of direction of flight path.
gallons Non-SI measure; 1 Imp gallon (UK) = 4.546 litres, 1 US gallon = 3.785 litres
GCI Ground-controlled interception.
GFRP Glassfibre-reinforced plastics.
glide slope Element giving vertical (height) guidance in ILS.
glove (1) Fixed portion of wing inboard of variable sweep wing; (2) additional aerofoil profile added around normal wing for test purposes.
GPS Global Positioning System, US military/civil satellite-based precision navaid.
GPU Ground power unit (not part of aircraft).
GPWS Ground-proximity warning system.
green aircraft Aircraft flyable but unpainted, unfurnished and basically equipped.
gross wing area See wing area
GS Glideslope, of ILS.
GSE Ground support equipment (such as special test gear, steps and servicing platforms)
GTS Gas turbine starter (ie starter is miniature gas turbine)
gunship Aircraft designed for battlefield attack, helicopter gunships normally with slim body carrying pilot and weapon operator only

h Hour(s).
handed Rotating in opposite direction.
hardened Protected as far as possible against nuclear explosion.
hardpoint Reinforced part of aircraft to which external load can be attached, eg weapon or tank pylon.
HASC US House Armed Services Committee.
HBPR High bypass ratio (engine).
head-down display On the cockpit instrument panel (as distinct from a HUD).
head-level display Immediately below HUD.

hectopascal (hPa) Unit of pressure, Pa × 100
helicopter Rotary-wing aircraft both lifted and propelled by one or more power-driven rotors turning about substantially vertical axes.
HF High frequency.
HMD Helmet-mounted display; hence HMS = sight
HOCAC Hands on cyclic and collective.
homebuilt Aircraft built/assembled from plans or kits
hot and high Adverse combination of airfield height and high ambient temperature, which lengthens required TOD
HOTAS Hands on throttle and stick
hovering ceiling Ceiling of helicopter (corresponding to air density at which maximum rate of climb is zero), either IGE or OGE
HP High pressure (HPC, compressor; HPT, turbine).
hp Horsepower.
HSI Horizontal situation indicator.
HUD Head-up display (bright numbers and symbols projected on pilot's aiming sight glass and focused on infinity so that pilot can simultaneously read display and look ahead).
HVAR High velocity aircraft rocket.
Hz Hertz, cycles per second.

IAS Indicated airspeed, ASIR corrected for instrument error.
IATA International Air Transport Association.
ICAO International Civil Aviation Organisation
ICNIA Integrated communications, navigation and identification avionics
IDG Integrated-drive generator
IFF Identification friend or foe.
IFR Instrument flight rules (compare VFR); also in-flight refuelling
IGE In ground effect: helicopter performance with theoretical flat horizontal surface just below it (eg mountain).
IIR Imaging infra-red
ILS Instrument landing system
IMC Instrument meteorological conditions Meteorological conditions too poor for pilot to fly without reference to blind-flying instruments.
IMK Increased manoeuvrability kit
Imperial gallon 1 20095 US gallons, 4 546 litres.
IMS Integrated multiplex system
INAS Integrated nav/attack system
incidence Strictly, the angle at which the wing is set in relation to the fore/aft axis. Wrongly used to mean angle of attack (which see).
inertial navigation Measuring all accelerations imparted to a vehicle and, by integrating these with respect to time, calculating speed at every instant (in all three planes) and by integrating a second time calculating total change of position in relation to starting point
INEWS Integrated electronic warfare system
INS Inertial navigation system.
integral construction Machined from solid instead of assembled from separate parts.
integral tank Fuel (or other liquid) tank formed by sealing part of structure.
intercom Wired telephone system for communication within aircraft.
inverter Electric or electronic device for inverting (reversing polarity of) alternate waves in AC power to produce DC.
IOC Initial operational capability
IP (1) Intermediate pressure; (2) initial point in attack manoeuvre
IPC, IPT Intermediate-pressure compressor, turbine.
IR Infra-red
IRAN Inspect and repair as necessary
IRCM Infra-red countermeasures
IRLS Infra-red linescan (builds TV-type picture showing cool and hot regions as contrasting light).
IRS Inertial reference system
IRST Infra-red search and track.
ISA International Standard Atmosphere.
ISIS Integral spar inspection system.
IVSI Instantaneous VSI.

J Joules, SI unit of energy.
JAA Joint Airworthiness Authorities
JAR Joint Airworthiness Requirements, agreed by all major EC countries (JAR Pt 25 equivalent to FAR Pt 25).
JASDF Japan Air Self-Defence Force.
JATO Jet-assisted take-off (actually means rocket-assisted).
JCAB Japan Civil Airworthiness Board
JDA Japan Defence Agency.
JGSDF Japan Ground Self-Defence Force.
JMSDF Japan Maritime Self-Defence Force.
joined wing Tandem wing layout in which forward and aft wings are swept so that the outer sections meet.
JPATS Joint Primary Aircraft Training System.
J-STARS US Air Force/Navy Joint Surveillance Target Attack Radar System in Boeing E-8A.
JTIDS Joint Tactical Information Distribution System

kbit One thousand bits of memory
Kevlar Aramid fibre used as basis of high-strength composite material
kg Kilogramme (2.20462 lb)
km/h Kilometres per hour.
kN Kilonewtons (N×10^3).
kitbuilt Prefabricated aircraft for amateur assembly.
knot 1 n mile per hour (1.852 km/h; 1.15078 mph).
Krueger flap Hinges down and then forward from below the leading-edge.
kVA Kilovolt-amperes.
kW Kilowatt, SI measure of all forms of power (not just electrical)

LABS Low-altitude bombing system designed to throw the bomb up and forward (toss bombing)
LAMPS Light Airborne Multi-Purpose System.
LANTIRN Low-altitude navigation and targeting infra-red, night.
LAPES Low-altitude parachute-extraction system.
LARC Low-altitude ride control
LBA Luftfahrtbundesamt (German civil aviation authority)
lb Pounds of thrust
LCD Liquid crystal display, used for showing instrument information.
LCN Load classification number, measure of 'flotation' of aircraft landing gear linking aircraft weight, weight distribution, tyre numbers, pressures and disposition
LED Light-emitting diode.
Lidar Light detection and ranging (laser counterpart of radar).
lift dumper Spoiler designed to open on landing to reduce lift and thus increase effectiveness of wheel braking
litre SI unit of volume (0.264177 US gallon; 0.219975 Imp gallon)
LLTV Low-light TV (thus, LLLTV, low-light level)
load factor (1) percentage of max payload; (2) design factor for airframe.
LO Low-observables (stealth), which see.
LOC Localiser (which see).
localiser Element giving steering guidance in ILS
LOH Light observation helicopter
loiter Fly for maximum endurance, such as supersonic fighter on patrol.
longerons Principal fore-and-aft structural members (eg in fuselage).
Loran Long-range navigation; family of hyperbolic navaids based on ground radio emissions, now mainly Loran C.
LOROP Long-range oblique photography
LOS Line of sight
low-observables Materials and structures designed to reduce aircraft signatures of all kinds.
lox Liquid oxygen
LP Low pressure (LPC, compressor; LPT, turbine).
LRMTS Laser ranger and marked-target seeker.
LRU Line-replaceable unit

m Metre(s), SI unit of length (3.28084 feet)
M or Mach number The ratio of the speed of a body to the speed of sound (1,116 ft; 340 m/s in air at 15°C) under the same ambient conditions.
MAC Mean aerodynamic chord
MAD Magnetic anomaly detector.
Madar Maintenance analysis, detection and recording
Madge Microwave aircraft digital guidance equipment.
marker, marker beacon Ground beacon giving position guidance in ILS.
mass flow Mass of air passing per second (usually at T-O, S/L).
MAWS Missile-approach warning system.
mb Millibars, bar × 10^{-3}.
MBR Marker beacon receiver.
MCM Mine countermeasures.
medevac Medical evacuation.
MEPU Monofuel emergency power unit.
METO Maximum except take-off
MF Medium frequency.
MFD Multifunction (electronic) display.
mg Milligrammes, grammes × 10^{-3}.
MLS Microwave landing system.
MLU Mid-life update.
MLW Maximum landing weight.
mm Millimetres, metres × 10^{-3}.
MMH Monomethyl hydrazine
M_{MO} Maximum operating Mach number.
MMS Mast-mounted sight.
MNPS Minimum navigation performance specification.
MoD Ministry of Defence.
monocoque Structure with strength in outer shell, devoid of internal bracing (semi-monocoque, with some internal supporting structure)
MoU Memorandum of understanding
MPA Maritime patrol aircraft.
mph Miles per hour.
MPR Military power reserve
MRW Maximum ramp weight
MSIP US armed forces multistaged improvement programme
MTBF Mean time between failures.
MTBR Mean time between removals.
MTI Moving-target indication (radar).
MTOGW Maximum take-off gross weight (MRW minus taxi/run-up fuel).
MTTR Mean time to repair.
MZFW Maximum zero-fuel weight.

N Newton, SI unit of force, =0 22480455 lb force
NAS US Naval Air Station
NASA National Aeronautics and Space Administration.
NASC US Naval Air Systems Command (also several other aerospace meanings)
NATC US Naval Air Training Command or Test Center (also several other aerospace meanings)
NATO North Atlantic Treaty Organisation.
NBAA US National Business Aircraft Association
NBC Nuclear, biological, chemical (warfare).
NDB Non-directional beacon
NDT Non-destructive testing
NGV Nozzle guide vane.
n mile Nautical mile, 1 852 km, 1.15078 miles.
NOAA US National Oceanic and Atmospheric Administration
NOE Nap-of-the-Earth (low flying in military aircraft, using natural cover of hills, trees etc).
NOS Night observation surveillance.
NO_x Generalised term for oxides of nitrogen
Ns Newton-second (1 N thrust applied for 1 second)
NVG Night vision goggles

OAT Outside air temperature
OBOGS Onboard oxygen generating system.
OCU Operational Conversion Unit
OEI One engine inoperative
OEU Operational Evaluation Unit
offset Workshare granted to a customer nation to offset the cost of an imported system
OGE Out of ground effect, helicopter hovering, far above nearest surface
Omega Long-range hyperbolic radio navaid
OMI Omni-bearing magnetic indicator
omni Generalised word meaning equal in all directions (as in omni-range, omni-flash beacon)
on condition maintenance According to condition rather than at fixed intervals
Opeval Operational evaluation.
optronics Combination of optics and electronics in viewing and sighting systems.
OTH Over-the-horizon (OTHT adds targeting).
OTPI On top position indicator (indicates overhead of submarine in ASW).
OWE Operating weight empty. MTOGW minus payload, usable fuel and oil and other consumables.

PA system Public or passenger address.
pallet (1) for freight, rigid platform for handling by forklift or conveyor; (2) for missile, mounting and electronics box outside aircraft.
Pascal SI unit of pressure =1 Nm^{-2}.
payload Disposable load generating revenue (passengers, cargo, mail and other paid items), in military aircraft loosely used to mean total load carried of weapons, cargo or other mission equipment.
PBW Power-by-wire
PD radar Pulse Doppler.

penaids Penetration aids, such as jammers, chaff or decoys to help aircraft fly safely through hostile airspace.
PFCS Primary flight computer system.
PGM Precision-guided munition.
phased array Radar in which the beam is scanned electronically in one or both axes without moving the antenna.
PHI Position and heading (or homing) indicator.
plane A lifting surface (eg wing, tailplane).
plug door Door larger than its frame in pressurised fuselage, either opening inwards or arranged to retract parts prior to opening outwards.
plume The region of hot air and gas emitted by a helicopter jetpipe.
pneumatic de-icing Covered with flexible surfaces alternately pumped up and deflated to throw off ice.
port Left side, looking forward.
power-by-wire Using electric power alone (not electro-hydraulic) to drive control surfaces and perform other mechanical tasks.
power loading Aircraft weight (usually MTOGW) divided by total propulsive power or thrust at T-O.
prepreg Glassfibre cloth or rovings pre-impregnated with resin to simplify layup.
pressure fuelling Fuelling via a leakproof connection through which fuel passes at high rate under pressure.
pressure ratio In gas turbine engine, compressor delivery pressure divided by ambient pressure (in supersonic aircraft, divided by ram pressure downstream of inlet).
primary flight controls Those used to control trajectory of aircraft (thus, not trimmers, tabs, flaps, slats, airbrakes or lift dumpers etc).
primary flight display Single screen bearing all data for aircraft flight path control.
propfan A family of new technology propellers characterised by multiple scimitar-shaped blades with thin sharp-edged profile. Single and contrarotating examples promise to extend propeller efficiency up to about Mach 0.8.
proprotor Large propeller, tilting for forward or vertical flight.
pulse Doppler Radar sending out pulses and measuring frequency-shift to detect returns only from moving target(s) in background clutter.
pylon Structure linking aircraft to external load (engine nacelle, drop tank, bomb etc).

radius In terms of performance, the distance an aircraft can fly from base and return without intermediate landing.
RAI Registro Aeronautico Italiano.
RAM Radar absorbent material.
ram pressure Increased pressure in forward-facing aircraft inlet, generated by converting (relative) kinetic energy to pressure.
ramp weight Maximum weight at start of flight (MTOGW plus taxi/run-up fuel).
range Too many definitions to list, but essentially the distance an aircraft can fly (or is permitted to fly) with specified load and usually whilst making allowance for specified additional manoeuvres (diversions, standoff, go-around etc).
RANSAC Range surveillance aircraft.
RAS Rectified airspeed, IAS corrected for position error.
raster Generation of large-area display, eg TV screen, by close-spaced horizontal lines scanned either alternately or in sequence.
RAT Ram air turbine.
RCS Radar cross-section, apparent size of echo on surveillance radar.
redundant Provided with spare capacity or data channels and thus made to survive failures.
refanned Gas turbine engine fitted with new fan of higher BPR.
RFP Request(s) for proposals.
rigid rotor (see bearingless rotor).
RLD Rijksluchtvaartdienst, Netherlands civil aviation department.
RMI Radio magnetic indicator; combines compass and navaid bearings.
R/Nav Calculates position, distance and time from groups of airways beacons.
RON Research octane number.
roving Multiple strands of fibre, as in a rope (but usually not twisted).
rpm Revolutions per minute.
RPV Remotely piloted vehicle (pilot in other aircraft or on ground).
RSA Réseau du Sport de l'Air.
ruddervators Flying control surfaces, usually a V tail, that control both yaw and pitch attitude.
RVR Runway visual range.
RWR Radar warning receiver.

s Second(s).
safe-life A term denoting that a component has proved by testing that it can be expected to continue to function safely for a precisely defined period before replacement.
SAM Surface-to-air missile.
SAR (1) Search and rescue; (2) synthetic aperture radar.
SAS Stability augmentation system.
SATCOM Satellite communications.
sawtooth Same as dog-tooth, also flight profile of motor glider.
SCAS Stability and control augmentation system.
second-source Production of identical item by second factory or company.
semi-active Homing on to radiation reflected from target illuminated by radar or laser energy beamed from elsewhere.
SENSO ASW sensor operators.
SENTAC Sensor operator (tactical).
service ceiling Usually height equivalent to air density at which maximum attainable rate of climb is 100 ft/min.
servo A device which acts as a relay, usually augmenting the pilot's efforts to move a control surface or the like.
SFAR Special Federal Aviation Regulation(s).
sfc Specific fuel consumption.
shaft Connection between gas turbine and compressor or other driven unit. Two-shaft engine has second shaft, rotating at different speed, surrounding the first (thus, HP surrounds inner LP or fanshaft).
shipment One item or consignment delivered (by any means of transport) to customer.
Shoran Short range navigation (radio).
shp Shaft horsepower, measure of power transmitted via rotating shaft.
sideline noise EPNdB measure of aircraft landing and taking off, at point 0.25 n mile (2- or 3-engined) or 0.35 n mile (4-engined) from runway centreline.
sidestick Control column in the form of a short hand-grip beside the pilot.
SIF Selective identification facility.
sigint Signals intelligence.
signature Characteristic 'fingerprint' of all acoustic or electromagnetic radiation (radar, IR etc).
single-aisle Passenger cabin has seats on each side of a single aisle along or near the centre.
single-shaft Gas turbine in which all compressors and turbines are on common shaft rotating together.
S/L Sea level.
SLAR Side-looking airborne radar.
snap-down Air-to-air interception of low-flying aircraft by AAM fired from fighter at a higher altitude.
soft target Not armoured or hardened.
SONAR, sonar Sound navigation and ranging.
specific fuel consumption Rate at which fuel is consumed divided by power or thrust developed, and thus a measure of engine efficiency. For jet engines (air-breathing, ie not rockets) unit is mg/Ns, milligrams per Newton-second, for shaft engines unit is μg/J, micrograms (millionths of a gram) per Joule (SI unit of work or energy).
specific impulse Measure of rocket engine efficiency, thrust divided by rate of fuel/oxidant consumption per second, the units for mass and force being the same so that the answer is expressed in seconds.
SPILS Spin prevention and incidence-limiting system.
spoiler Plank-like surface normally recessed into top of wing, hinged up under power to reduce (spoil) lift and increase drag. Used asymmetrically for lateral control.
spool One complete axial compressor rotor; thus a two-shaft engine may have a fan plus an LP spool.
SSB Single-sideband (radio).
SSR Secondary surveillance radar.
SST Supersonic transport.
st Static thrust.
stabiliser Fin (thus, horizontal stabiliser = tailplane).
stall strips Sharp-edged strips on wing leading-edge to induce stall at that point.
stalling speed Airspeed at which aircraft stalls at 1g, ie wing lift suddenly collapses.
standard day ISA temperature and pressure.
starboard Right side, looking forward.
static inverter Solid-state inverter of alternating wave-form (ie, not rotary machine) to produce DC from AC.
STC Supplementary Type Certificate.
stick pusher Stall-protection device that forces pilot's control column forward as stalling angle of attack is neared.
stick-shaker Stall-warning device that noisily shakes pilot's control column as stalling angle of attack is neared.
STOL Short take-off and landing. (Several definitions, stipulating allowable horizontal distance to clear screen height of 35 or 50 ft or various SI measures.)
store Object carried as part of payload on external attachment (eg bomb, drop tank).
STOVL Short take-off, vertical landing.
strobe light High-intensity flashing beacon.
substrate The underlying layer on which something (such as a solar cell or integrated circuit) is built up.
supercritical wing Wing of relatively deep, flat-topped profile generating lift right across upper surface instead of concentrated close behind leading-edge.
sweepback Backwards inclination of wing or other aerofoil, seen from above, measured relative to fuselage or other reference axis, usually measured at quarter-chord (25%) or at leading-edge.

t Tonne, 1 Megagram, 1,000 kg.
tabbed flap Fitted with narrow-chord tab along entire trailing-edge which deflects to greater angle than main surface.
tabs Small auxiliary surfaces hinged to trailing-edge of control surfaces for purposes of trimming, reducing hinge moment (force needed to operate main surface) or in other way assisting pilot.
Tacan Tactical air navigation UHF military navaid giving bearing and distance to ground beacons, distance element (see DME) can be paired with civil VOR.
TACCO Tactical commander, ASW aircraft.
taileron Left and right tailplanes used as primary control surfaces in both pitch and roll.
tailplane Main horizontal tail surface, originally fixed and carrying hinged elevator(s) but today often a single 'slab' serving as control surface.
TANS Tactical air navigation system, Decca Navigator or Doppler-based computer, control and display unit.
TAS True airspeed, EAS corrected for density (often very large factor) appropriate to aircraft height.
TBO Time between overhauls.
t/c ratio Ratio of the thickness (aerodynamic depth) of a wing or other surface to its chord, both measured at the same place parallel to the fore-and-aft axis.
TCAS Traffic-alert and collision-avoidance system.
Tercom Terrain-comparison (or contour-matching), navigation aid which compares relief of terrain with profile stored in memory.
TET Turbine entry temperature (of the gas), also turbine inlet temperature (TIT), inter-turbine temperature (ITT) and turbine gas temperature (TGT).
TFR Terrain-following radar (for low-level attack).
thickness Depth of wing or other aerofoil; maximum perpendicular distance between upper and lower surfaces.
tilt-rotor Aircraft with fixed wing and rotors that tilt up for hovering and forward for fast flight.
T-O Take-off.
T-O noise EPNdB measure of aircraft taking off, at point directly under flight path 3.5 n miles from brakes-release (regardless of elevation).
TOD Take-off distance.
TOGW Take-off gross weight (not necessarily MTOGW).
ton Imperial (long) ton = 1.016 t (Mg) or 2,240 lb, US (short) ton = 0.9072 t or 2,000 lb.
track Distance between centres of contact areas of main landing wheels measured left/right across aircraft (with bogies, distance between centres of contact areas of each bogie).
transceiver Radio transmitter/receiver.
transponder Radio transmitter triggered automatically by a particular received signal as in civil secondary surveillance radar (SSR).
TRU Transformer/rectifier unit.
TSFC Thrust specific fuel consumption of jet engine (turbojet, turbofan, ducted propfan or ramjet).
TSO Technical Standard Order (FAA).
turbofan Gas-turbine jet engine generating most thrust by a large-diameter cowled fan, with small part added by jet from core.
turbojet Simplest form of gas turbine comprising compressor, combustion chamber, turbine and propulsive nozzle.
turboprop Gas turbine in which as much energy as possible is taken from gas jet and used to drive reduction gearbox and propeller.
turboshaft Gas turbine in which as much energy as possible is taken from gas jet and used to drive high-speed shaft (which in turn drives external load such as helicopter transmission).
TVC Thrust vector control.
TWT Travelling-wave tube.
tyre sizes In simplest form, first figure is rim diameter (in or mm) and second is rim width (in or mm). In more correct three-unit form, first figure is outside diameter, second is max width and third is wheel diameter.

UAV Unmanned aerial vehicle.
UHCA Ultra-high capacity airliner.
UHF Ultra-high frequency.
unfactored Performance level expected of average pilot, in average aircraft, without additional safety factors.
upper surface blowing Turbofan exhaust vented over upper surface of wing to increase lift.
usable fuel Total mass of fuel consumable in flight, usually 95-98 per cent of system capacity.
useful load Usable fuel plus payload.
US gallon 0.83267 Imperial gallon, 3.785 litres.
UV Ultra-violet.

variable geometry Capable of grossly changing shape in flight, especially by varying sweep of wings.
variable pitch Propeller whose blades are held in rotary bearings in the hub, so that pitch (of all blades in unison) can be altered in flight.
Vd Maximum permitted diving speed.
VDU Video (or visual) display unit.

vectored Capable of being pointed in different directions
vertrep Vertical replenishment.
VFR Visual flight rules.
VHF Very high frequency.
VLF Very low frequency (area-coverage navaid).
VMC Visual meterological conditions.
V_{MO} Maximum permitted operating flight speed (IAS, EAS or CAS must be specified).
VMS Vehicle management system.
V_{NE} Never-exceed speed (aerodynamic or structural limit).
VOR VHF omnidirectional range (VHF radio beacons providing bearing to or from beacon).
vortex generators Small blades attached to wing and tail surfaces to energise local airflow and improve control
vortilion Short-chord fence ahead of and below leading-edge.
VSI Vertical speed (climb/descent) indicator.
V/STOL Vertical/short take-off and landing.

washout Inbuilt twist of wing or rotor blade reducing angle of incidence towards the tip.
WDNS Weapon delivery and navigation system.
wet Housing fuel, wet wing often has extra connotation of integral tankage. Wet pylon can accommodate external fuel tank.
wheelbase Minimum distance from nosewheel or tailwheel (centre of contact area) to line joining mainwheels (centres of contact areas).
wide body Passenger aircraft with cabin wide enough to have two longitudinal aisles between seats.
wing area Total projected area of clean wing (no flaps, slats etc) including all control surfaces and area of fuselage bounded by leading- and trailing-edges projected to centreline (inapplicable to slender-delta aircraft with extremely large leading-edge sweep angle) Described in *Jane's* as gross wing area; net area excludes projected areas of fuselage, nacelles, etc.
wing loading Aircraft weight (usually MTOGW) divided by wing area.
winglet Small auxiliary aerofoil, usually sharply upturned and often sweptback, at tip of wing.

zero-fuel weight MTOGW minus usable fuel and other consumables, in most aircraft imposing severest stress on wing and defining limit on payload
zero/zero seat Ejection seat designed for use even at zero speed on ground.
ZFW Zero-fuel weight.

µg Microgrammes, grammes × 10^{-6}.

Airline Fleet Lists

This listing of the fleets of world airlines was extracted from the *Jane's World Airlines* database, which is compiled by **Paul Portnoi**. Updates are published quarterly. The list includes information up to 30 June 1995. The purpose of including it here is to allow the reader a different approach to locating information in the main part of the book. Readers often need to know which types an airline operates before seeking aircraft details.

Data in the four columns of figures comprise the number of aircraft in current service; how many of those are operated under lease; number on order and options held. Quantities in the first and second columns should not be added. Space considerations preclude identification of second-hand acquisitions and the organisations from which aircraft are leased. Therefore, these actual fleet lists will differ from data in the main aircraft section, which sometimes provide sales to leasing organisations, but not the airlines which subsequently leased them.

Tails from Toulouse. Cathay Pacific Airways, Malaysia Airlines, Thai Airways International and Airlanka all operate Airbuses

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
ACES (AEROLINEAS CENTRALES DE COLOMBIA SA) (Colombia)					
727-100	P&W JT8D-7B	4	3		
727-200	P&W JT8D-17	2	2		
ATR 42-320	P&WC PW120	4	4		
DHC-6 Twin Otter 300	P&WC PT6A-27	10	1		
ADRIA AIRWAYS (Slovenia)					
A320-200	IAE V2500-A1	3			
DC-9-30	P&W JT8D-9A	2			
DHC-7 Dash 7-100	P&WC PT6A-50	2			
MD-80	P&W JT8D-217	1	1		
AER LINGUS PLC (Ireland)					
737-200 Advanced	P&W JT8D-9A	3			
737-400	CFMI CFM56-3B2	6	2		
737-500	CFMI CFM56-3B1	10	10		
747-100	P&W JT9D-7A	3	2		
767-300ER	P&W PW4060	2	2		
A330-300	GE CF6-80E1	3	3		
BAe 146-300	AS ALF502R 5	3	3		
Fokker 50	P&WC PW125	6			1
Saab 340B	GE CT7-9B	4	4		
AERO CALIFORNIA (Mexico)					
DC 9-15	P&W JT8D-7B	11	10		
DC-9-32	P&W JT8D-7B	7	7		
AERO LLOYD (Germany)					
A320	IAE V2500-A5			6	6
A321	IAE V2500-A5			10	
MD 82	P&W JT8D-219	15	7		
MD 83	P&W JT8D-219	3	3		
MD 87	P&W JT8D-219	2	2		
AEROCANCUN (Mexico)					
A310-300	P&W PW4152	3	3		1
MD-83	P&W JT8D-219	4	4		
AEROFLOT - RUSSIAN INTERNATIONAL AIRLINES (Russia)					
767 300	GE CF6-80			6	
A310-300	GE CF6-80C2A2	5	5		5
DC-10-30F	GE CF6-50C2	1	1		1
Il-62M	Aviadvigatel D-30	27			
Il-76	Aviadvigatel D-30	19			
Il-86	KKBM NK-86	19			
Il-96-300	Aviadvigatel PS-90A	4			
Il-96M	P&W PW2337			20	
Tu-134-3	Aviadvigatel D-30	8			
Tu-154B	KKBM NK-8-2	4			
Tu-154C	KKBM NK-8-2	3			
Tu-154M	Aviadvigatel D-30	30			
AEROLINEAS ARGENTINAS (Argentina)					
727 200 Advanced	P&W JT8D-17	1			
737-200	P&W JT8D-9A	4			
737-200 Advanced	P&W JT8D-9A	6			
737-200C	P&W JT8D-9A	2			
747-200B	P&W JT9D-7Q	6	1		
A310-300	P&W PW4152	3	3		
Fokker F28-1000	RR Spey 555-15	3			
MD-83	P&W JT8D-217	1			
MD-88	P&W JT8D-219	4		3	
AEROMEXICO (Mexico)					
757-200	P&W PW2040	6	6		10
767-200ER	P&W PW4060	1	1		
767-300ER	P&W PW4060	2	2		
DC 9-31	P&W JT8D-17	3	2		
DC-9-32	P&W JT8D 17	15	13		
MD-82	P&W JT8D-217	10	10		
MD-83	P&W JT8D-219	3	3		
MD-87	P&W JT8D-219	2	2		
MD-88	P&W JT8D-219	10	10		
AEROPERU (Peru)					
727-100	P&W JT8D-7B	2			
727-100C	P&W JT8D-7A	1			
727-200 Advanced	P&W JT8D-17R	2	2		
DC-10-15	GE CF6-50C2F	2	2		
DC-8-61	P&W JT3D-3B (Q)	1			
DC-8-62	P&W JT3D-3B (Q)	2			
DC-8-62	P&W JT3D-7	1			
Fokker F28 1000	RR Spey 555 15	2			
AEROPOSTAL - LINEAS AEROPOSTAL VENEZOLANA (Venezuela)					
DC-9-31	P&W JT8D-17	3			
DC 9-34CF	P&W JT8D-17	1			
DC-9-51	P&W JT8D-17A	3	3		
DC-9-51	P&W JT8D-17	6			
MD 83	P&W JT8D 219	3			
AEROVIAS NACIONALES DE COLOMBIA SA - AVIANCA (Colombia)					
707 300B	P&W JT3D-3B (Q)	3			
727-100	P&W JT8D-7	5	1		
727-100	P&W JT8D-7B	5	5		
727 100	P&W JT8D-7A	1			
727-200 Advanced	P&W JT8D-17	7	7		
727-200 Advanced	P&W JT8D-15	1	1		
747 200 (SCD)	P&W JT9D 7Q	1	1		
757-200	RR RB211-535E4	2	2		
767-200ER	P&W PW4056	2			
Fokker 50	P&WC PW127B	6		4	
MD-83	P&W JT8D-219	10			
AIR 2000 LTD (UK)					
757-200	RR RB211-535E4	15	15		
A320-200	IAE V2500-A1	4	4		
AIR AFRIQUE (Cote d'Ivoire)					
A300-600R	GE CF6-50C2A5	2	2		
A300B4-203	GE CF6-50C2	3			
A310-300	GE CF6-80C2A2	4			
DC-10-30	GE CF6-50C	3	2		

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
AIR ALGERIE (Algeria)					
727 200	P&W JT8D-9	2			
727 200 Advanced	P&W JT8D-15	9			
737 200 Advanced	P&W JT8D-15	10			
737 200 Advanced	P&W JT8D 17	3			
737 200C Advanced	P&W JT8D-9	1			
737 200C Advanced	P&W JT8D-15	1			
767-300	GE CF6-80C2B2F	3			
A310-203	GE CF6-80A3	2			
Fokker F27-400M	RR Dart 536-7R	7			
L-382G Hercules	Allison 501 D22A	2			
737-200C Advanced	P&W JT8D 15	1			
AIR BELGIUM (Belgium)					
737 400	CFMI CFM56-3C1	2	2		
757-200	RR RB211-535E4	1	1		
AIR CALEDONIE (New Caledonia)					
ATR 42	P&WC PW120	3	3		
Dornier 228-2.2	AS TPE331 5 252D	2	1		
Dornier 328	P&WC PW119B			1	1
AIR CALEDONIE INTERNATIONAL (New Caledonia)					
737 300	CFMI CFM56-3B2	1	1		
DHC 6 Twin Otter 300	P&WC PT6A-27	1			
AIR CANADA (Canada)					
747-100	P&W JT9D-7	3			
747-200C	P&W JT9D-7Q	3	3		
747-400	P&W PW4056	3			
767 200	P&W JT9D-7R4D	12	11		
767 200ER	P&W JT9D 7R4D1	8	8		
767-300ER	P&W PW4060	2		5	12
A319	CFMI CFM56-5B6			35	
A320-200	CFMI CFM56-5A1	34	13	6	
A340-300	CFMI CFM56-5C4			6/2	3

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
Canadair Regional Jet	GE CF34-3A	9	9	15	
DC-9-30	P&W JT8D-7A	35	9		
L1011 TriStar 1/.50	RR RB211 22B	3			
AIR CHINA (People's Republic of China)					
707-300	P&W JT3D-7 (Q)	2			
737-200 Advanced	P&W JT8D-17A	4			
737 300	CFMI CFM56-3B1	14		1	
737-300	CFMI CFM56-3B2	3			
747-200B (SCD)	P&W JT9D-7R4G2	3			
747-200F	P&W JT9D-7R4G2	1			
747-400	P&W PW4056	5			
747-400 (SCD)	P&W PW4056	3			
747SP	P&W JT9D-7J	4			
767-200ER	P&W PW4052	2			
767-200ER	P&W JT9D-7R4E4	4			
767-300	P&W PW4056	3		1	
An-12	ZMKB AI-20M	2			
BAe 146-100	AS ALF502R-5	4			
L 382G Hercules	Allison 501-D22A	2			
Xian Y 7	WJ 5A-1	3			
Xian Y-7-100	WJ 5A-1	3			
AIR CREEBEC INC (Canada)					
BAe (HS) 748 200 Srs 2	RR Dart 534-2	4			
Beech Super King Air 200	P&WC PT6A-41	1			
DHC-8 Dash 8 100	P&WC PW120	1			
DHC-8 Dash 8 300	P&WC PW123B	1	1		
AIR EUROPA (AIR ESPANA, SA) (Spain)					
737-300	CFMI CFM56-3B1/3B2	10	10		
757-200	RR RB211-535E4	3	3		
AIR EUROPE SPA (Italy)					
767-300ER	P&W PW4060	1	1		
767 300ER	GE CF6-80C2B6	2	2		
AIR FOYLE LIMITED (UK)					
737-300	CFMI CFM56-3B2	1			
A320-200	IAE V2500-A1	2	2		
An-124-100 Ruslan	ZMKB D-18T	3	3		1
BAe 146-200QT	AS ALF502R-5	3	3		
BAe 146 300QT	AS ALF502R-5	4	4		
BAe Jetstream 31	AS TPE331 10UF 513H	1	1		
Beech Super King Air 200	P&WC PT6A 41	1			
AIR FRANCE (France)					
727-200 Advanced	P&W JT8D-15	7			
737-200	P&W JT8D-15	19	2		
737-300	CFMI CFM56 3B1	6	4		
737-500	CFMI CFM56-3C1	16	12	8	
747-100	P&W JT9D-7	13	6		
747-200	GE CF6-50E	2	1		
747-200B (SCD)	GE CF6-50E2	10	5		
747-200F (SCD)	GE CF6-50E2	10	7		
747-300 (SCD)	GE CF6 50E2	2			
747-300 (SCD)	GE CF6-50E2	2			
747-400	GE CF6-80C2B1F	7	3		
747-400 (SCD)	GE CF6-80C2B1F	7			
747-400C	GE CF6 80C2B1F	1			
767-300ER	P&W PW4060	3	3	7	
A300B2-101	GE CF6-50C	4			
A300B4 203	GE CF6-50C2	11			
A310-200	GE CF6 80A3	7			
A310 300	GE CF6 80C2A2	4			4
A320-100	CFMI CFM56-5A1	6			
A320-200	CFMI CFM56-5A1	19			17
A321	CFMI CFM56-5B			8	
A340 200	CFMI CFM56 5C2	3	3		
A340-300	CFMI CFM56-5C2	5			3
Concorde	RR Olympus 593-610	7			
DC-10-30	GE CF6-50C2R	5	2		
Fokker F27 500	RR Dart 532-7	15	15		
AIR GABON (Gabon)					
737-200	P&W JT8D-17	1			
747-200 (SCD)	GE CF6-50E2	1			
ATR 72	P&WC PW124				

Gabon's national airline operates one Fokker 100

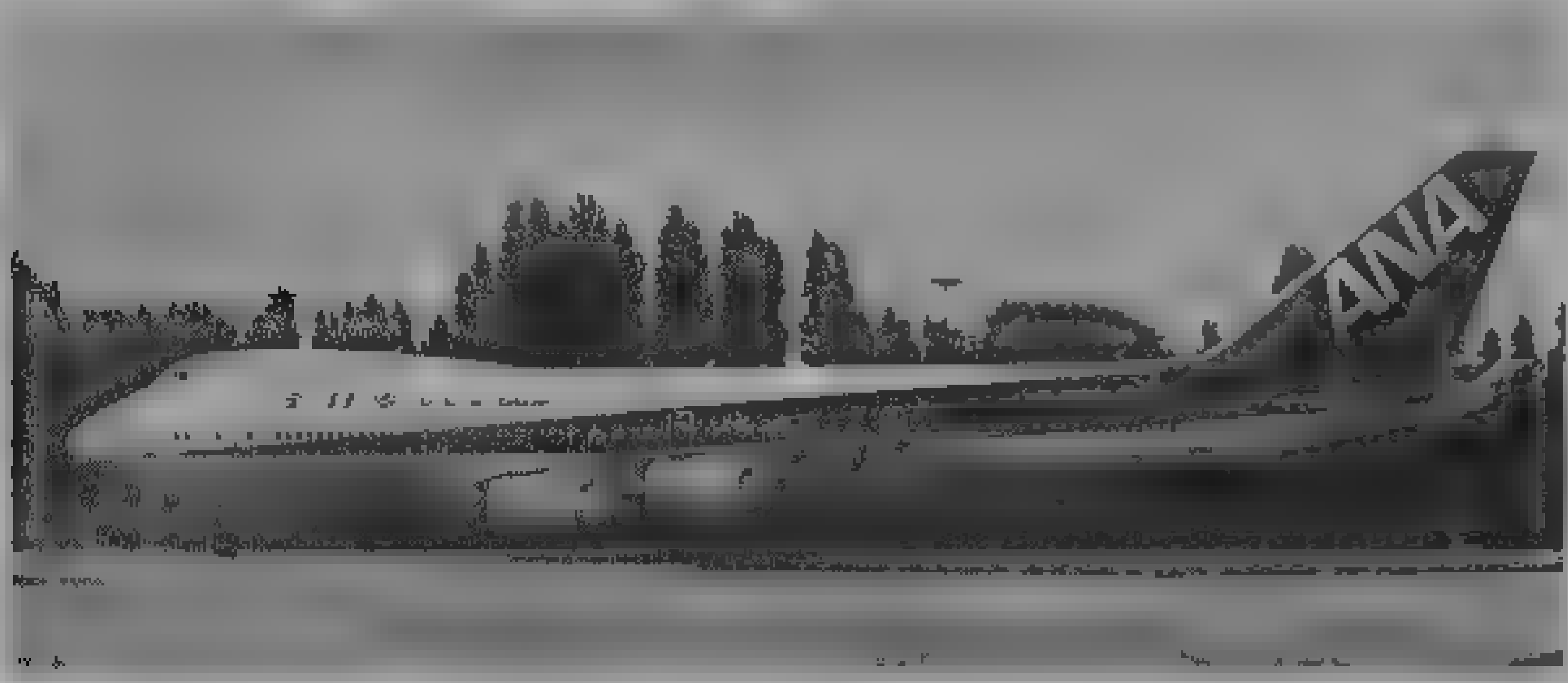
Notes: SCD = Side cargo door   TBD = To be decided   EUD = Extended upper deck   Q = Hush kitted   SR = Short range   LR = Long range   F = Freighter

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
Fokker 100	RR Tay 620-15	1	1		
Fokker F28-1000	RR Spey 555-15	1			
Fokker F28 2000	RR Spey 555 15	2	1		
L-382G Hercules	Allison 501 D22A	1			
AIR INDIA LIMITED (India)					
747 200B	P&W JT9D-7J	4			
747-200B	P&W JT9D-7Q	5			
747-300C	GE CF6-80C2B1	2	1		
747 400	P&W PW4056	4		2	
A300B4-203	GE CF6-50C2	3			
A310-300	GE CF6-80C2A2	8	2		
DC-8 73F	CFMI CFM56-2	1	1		
Il 62M	Aviadvigatel D-30	1	1		
AIR INTER (France)					
A300B2 1	GE CF6-50C2R	13	3		
A300B2-K3C	GE CF6-50C2R	1			
A300B4-2C	GE CF6-50C2R	4	1		
A319	CFMI CFM56-5B6			9	9
A320 100	CFMI CFM56-5A1	6			
A320-200	CFMI CFM56-5A1	28	9		
A321-100	CFMI CFM56-5B	2		5	8
A330-300	GE CF6-80E1	5		8	[illegible]
Fokker 100	RR Tay 650-15	5	5		
AIR IVOIRE (Cote d Ivoire)					
Beech Super King Air 200	P&WC PT6A 41	2	1		
Fokker 100	RR Tay 620-15	2	2		
Fokker F27-600	RR Dart 536-7B	1			
Fokker F28-1000C	RR Spey 555-15	[illegible]	1		
Fokker F28-4000	RR Spey 555 15H	2			
AIR JAMAICA LIMITED (West Indies)					
727 200 Advanced	P&W JT8D-15	5	5		
A300B4-203	GE CF6-50C2	5	5		
AIR LIBERTE (France)					
A300-600R	P&W PW4158	2	2		
A310-300	P&W PW4158		1		

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
MD-83	P&W JT8D-219	6	4		
AIR LITTORAL (France)					
ATR 42-300	P&WC PW120	5			
ATR 72-201	P&WC PW123	1			
Canadair Regional Jet	GE CF34-3A	4	4	2	6
EMB 120RT Brasilia	P&WC PW118	9			
Fokker 100	RR Tay 650-15	4	4		
Fokker 70	RR Tay 620	7	2	3	
Fokker F28-1000	RR Spey 555-15	2	2		
AIR MADAGASCAR (Madagascar)					
737-200	P&W JT8D-9	1			
737-200 Advanced	P&W JT8D-15	1			
737-300	CFMI CFM56-3B2	1			
747-200B (SCD)	P&W JT9D 70A	1			
BAe (HS) 748 Srs 2B	RR Dart 536-2	2			
DHC-6 Twin Otter 300	P&WC PT6A-27	4			
AIR MALAWI (Malawi)					
737 300	CFMI CFM56-3C1	1			
ATR 42-320	P&WC PW121	1			
Dornier 228	AS TPE331 5 252D	1			
AIR MALTA CO LTD (Malta)					
737-300	CFMI CFM56-3C1	5	2		
A320-200	CFMI CFM56-5A1	2			1
BAe RJ70 Avroliner	AS LF507 1F	4			
AIR MAURITIUS LIMITED (Mauritius)					
747SP	P&W JT9D-7FW	[illegible]	1		
767-200ER	GE CF6-80C2B4	2			
A340 300	CFMI CFM56 5C3	2	2	3	
ATR 42	P&WC PW120	2			
Bell 206B JetRanger	Allison 250-C20	2			
AIR NAMIBIA (Namibia)					
737-200 Advanced	P&W JT8D-15	1			
747SP	P&W JT9D-7FW	1	1		
Beech 1900C Airliner	P&WC PT6A-65B	3			
AIR NEW ZEALAND LTD (New Zealand)					
737-200 Advanced	P&W JT8D-15	13	7		
737-300	CFMI CFM56-3C1			6	

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
747-200	RR RB211-524D4	5	1		
747-400	RR RB211 524G	5	2	1	2
767 200ER	GE CF6-80A2	6	3		
767 300ER	GE CF6-80C2	5	3	2	
AIR NIPPON CO LTD (Japan)					
737 200 Advanced	P&W JT8D 9A	1	1		
737-200 Advanced	P&W JT8D-17	9	9		
737-500	CFMI CFM56-3C1			7	8
A320-200	CFMI CFM56-5A1	[illegible]	1		
DHC-6 Twin Otter 300	P&WC PT6A 27	2			
NAMC YS-11-100	RR Dart 543 10J/K	5			
NAMC YS 11-200	RR Dart 543 10J/K	14			
NAMC YS 11A 500	RR Dart 543 10J/K	7	7		
AIR NIUGINI (Papua New Guinea)					
DHC 7 Dash 7-100	P&WC PT6A 50	3	1		
A310-300	P&W PW4152	2	1		
Fokker F28-1000	RR Spey 555-15	7			
Fokker F28-4000	RR Spey 555-15	2	2		
AIR PACIFIC LIMITED (Fiji)					
737-300	CFMI CFM56-3B1		1		
737-500	CFMI CFM56-3B1	[illegible]	1		
747-200	RR RB211 524D4		1		
767-300ER	GE CF6-80C2B4		1	2	
AIR SEYCHELLES (Seychelles)					
757 200ER	RR RB211-535E4	1	1		
767-200ER	GE CF6-80C2B4	1	1		
BN-2A Islander	Lyc O-540-E4C5	1			
DHC 6 Twin Otter 300	P&WC PT6A 27	4			
AIR TAHITI (Polynesie Francaise)					
ATR 42 300	P&WC PW120	3	3		
ATR 42 500	P&WC PW127E			3	
ATR 72	P&WC PW124	2	2	1	
DHC-6 Twin Otter 300	P&WC PT6A-27				
Dornier 228-200	AS TPE331-5A-252D		1		
AIR TANZANIA (Tanzania)					
737-200C Advanced	P&W JT8D-17	2			
Fokker F27-600CF	RR Dart 536-7R	2			
AIR UK (LEISURE) LIMITED (UK)					
737-400	CFMI CFM56-3C1	7	3		
AIR UK LTD (UK)					
BAe 146-100	AS ALF502R-5	1			
BAe 146 200	AS ALF502R-5	1	1		
BAe 146-300	AS ALF502R 5	10	8		
Fokker 100	RR Tay 620-15	9	9		
Fokker 50	P&WC PW125B	9	9		8
Fokker F27-100	RR Dart 514-7	1			
Fokker F27 200	RR Dart 528-7E	10			
Fokker F27 500	RR Dart 532-7	5	3		
Fokker F27-600	RR Dart 528 7E	1			
Shorts 360	P&WC PT6A-6	2	1		
AIR WISCONSIN AIRLINES CORPORATION (UNITED EXPRESS) (USA)					
BAe 146-100A	AS ALF502R 5	2	2		
BAe 146-200A	AS ALF502R-5	5	5		
BAe 146 300A	AS ALF502R-5	5	5		
AIR ZAIRE, SOCIETE (Zaire)					
737-200 Advanced	P&W JT8D-15	2			
DC 10-30	GE CF6-50C	1			
DC 8 54F	P&W JT3D-3B (Q)	1			
AIR ZIMBABWE (Zimbabwe)					
707 300B	P&W JT3D-7	2			
737 200 Advanced	P&W JT8D-15	3			
767-200ER	P&W PW4056	2			
BAe 146-200	AS ALF502R 5	1	1		
Fokker 50	P&WC PW125	2			
AIRLANKA (Sri Lanka)					
A320-200	IAE V2500-A1	7	2		
A340 300	CFMI CFM56-5C2			[illegible]	1
L1011 TriStar 100	RR RB211 22B-02	1			
L1011 TriStar 200	RR RB211 524B 02	2	2		
L1011 TriStar 50	RR RB211 22B 02	[illegible]			
L1011 TriStar 500	RR RB211-524B4	2	2		
AIRTOURS INTERNATIONAL AVIATION (GUERNSEY) LTD (UK)					
757-200	RR RB211-535E4	6	6		
767 300ER	GE CF6-80C2B7F	2	2		
A320 200	IAE V2500 A1	3	3		
MD-83	P&W JT8D-219	7	7		
ALASKA AIRLINES, INC (USA)					
737 200C Advanced	P&W JT8D 17	8	4		
737-400	CFMI CFM56 3C1	24	22		4
MD-82	P&W JT8D-217	4	1		
MD-82	P&W JT8D-217	4			
MD-82	P&W JT8D-219	2	2		
MD-83	P&W JT8D-219	28	4		

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
ALITALIA - LINEE AEREE ITALIANE, SPA (Italy)					
747-200B	GE CF6-50E2	7			
747-200B (SCD)	GE CF6-50E2	5			
747-200F (SCD)	GE CF6-50E2	2			
767-300ER	GE CF6-80C2	2	2		
A300B2 200	GE CF6-50C2	2	2		
A300B4 100	GE CF6-50C2	4	3		
A300B4 200	GE CF6-50C2	8	6		
A321-100	CFMI CFM56-5B	5		35	
DC 9-32	P&W JT8D-9A	34	27		
Fokker 70	RR Tay 620			15	
MD-11C	GE CF6-80C2D1F	6	2	2	5
MD-82	P&W JT8D-217C	36	3		
MD-82	P&W JT8D-217A	39	2		
ALL NIPPON AIRWAYS CO, LTD (Japan)					
737-200 Advanced	P&W JT8D-17	9			



Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
747-200B	GE CF6-50E2	6	2		
747-400	GE CF6-80C2	16	4	4	
747SR	GE CF6-45A2	14	3		
767-200	GE CF6-80C2	25	12		
767-300	GE CF6-80C2B2	31	10	5	
767-300ER	GE CF6-80C2B6	6	2		
777-200	P&W PW4084			18	
A320-200	CFMI CFM56-5A1	18	5	4	
A321-100	TBD			10	
A340-300	TBD			5	
L1011 TriStar 1	RR RB211-22B	4	4		
NAMC YS-11A 500	RR Dart 543-10J K	7			
AMERICA WEST AIRLINES (USA)					
737-100	P&W JT8D-9A	1			
737-200 Advanced	P&W JT8D-9A	6	5		
737-200 Advanced	P&W JT8D-15	15	11		
737-300	CFMI CFM56-3B2	15	9		
737-300	CFMI CFM56-3B1	20	15		
757-200	RR RB211-535E4	14	12		
A320-200	IAE V2500-A1	16	16	24	
A320-200	IAE V2500-A5	2	2		
AMERICAN AIRLINES, INC (USA)					
727-200 Advanced	P&W JT8D-15	22			
727-200 Advanced	P&W JT8D-9/9A	86			
757-200	RR RB211-535E4B	77	43	14	18
767-200	GE CF6-80A	8			
767-200ER	GE CF6-80A2	22	13		
767-300ER	GE CF6-80C2B6	35	30	6	4
A300-605R	GE CF6-80C2A5	35	25		
DC-10-10	GE CF6-6K	46	1		
DC-10-10ER	GE CF6-6K2	3			
DC-10-30	GE CF6-50C2	9	1		
Fokker 100	RR Tay 620-15	75	11		75
MD-11	GE CF6-80C2D1F	17			15
MD-82	P&W JT8D-217	234	141		
MD-83	P&W JT8D-219	26			
AMR EAGLE (USA)					
ATR 42	P&WC PW120	47	20		10
ATR 72-200	P&WC PW124	33	26		48
BAe Jetstream 41	AS TPE331-14GR/HR				20
BAe Jetstream Super 31	AS TPE331-10UR-513H	50	50		
Saab 2000	Allison AE 2100				30
Saab 340A	GE CT7-5A2	16	16		
Saab 340B	GE CT7-9B	100	91		
Saab 340BPlus	GE CT7-5A2			25	
Shorts 360-200	P&WC PT6A-6	25	21		
Shorts 360-300	P&WC PT6A-6	4			
ANSETT AUSTRALIA (Australia)					
727-200 Advanced	P&W JT8D-15	5			
727-200F Advanced	P&W JT8D-15	1			
737-300	CFMI CFM56-3B1	21	4		
747 300M	P&W JT9D-7R4G2	2	2		
767-200	GE CF6-80A	6	1		
A320-200	CFMI CFM56-5A1	14		5	
BAe 146 200A	AS ALF502R 5	6			
BAe 146-200QT	AS ALF502R 5	2			
BAe 146 300	AS ALF502R-5	6			

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
Fokker 50	P&WC PW125	11			
Fokker F28-1000	RR Spey 555-15	4			
Fokker F28-3000	RR Spey 555-15	2			
Fokker F28 4000	RR Spey 555-15P	7			
ANSETT NEW ZEALAND (New Zealand)					
BAe 146 200QC	AS ALF502R-5	1	1		
BAe 146 300	AS ALF502R 5	8	8		
DHC 8 Dash 8 100	P&WC PW120	3	1		
AOM FRENCH AIRLINES (France)					
DC-10-30	GE CF6-50C2B	2	1		
DC-10-30	GE CF6-50C	4	4		
DC-10-30	GE CF6-50C2	5	3		
DC-8-62	P&W JT3D-3B (Q)	1			
MD-83	P&W JT8D 219	7	1		
ARIANA AFGHAN AIRLINES (Afghanistan)					
727-100C	P&W JT8D-7	1			
727-100C	P&W JT8D-9	1			
727-200	P&W JT8D-7	3			
An-24RV	ZMKB AI-24	2			
An-26	ZMKB AI 24	2			
Tu-154M	Aviadvigatel D-30	2			
Yak-40	ZMKB AI-25	2			
ASIANA AIRLINES (Republic of Korea)					
737-400	CFMI CFM56-3C1	16	13	7	
737 500	CFMI CFM56-3C1	3	3		
747-400	GE CF6-80C2B1F	5			
747-400C (SCD)	GE CF6-80C2B1F	3			
747-400F (SCD)	GE CF6-80C2B1F	1		2	
767-300	GE CF6-80C2BF	4		4	
767-300ER	GE CF6-80C2B6F	3	1		
767-300ER	P&W PW4060	2	2		
767-300F	GE CF6-80C2B7F			2	
AUSTRIAN AIR SERVICES (Austria)					
Fokker 50	P&WC PW125	6	1	1	
AUSTRIAN AIRLINES, OSTERREICHISCHE LUFTVERKEHRS AG (Austria)					
A310-300	P&W PW4152	4	3		
A320-200	CFMI CFM56-5B4			7	13
A321-100	CFMI CFM56-5B			6	
A340-200	CFMI CFM56-5C2	2			2
Fokker 70	RR Tay 620			4	
MD-81	P&W JT8D-209	7			
MD-82	P&W JT8D-217	6			
MD-83	P&W JT8D-219	2	2		
MD-87ER	P&W JT8D-219	2	2		
MD-87SR	P&W JT8D-217	3			
AVIACO - AVIACION Y COMERCIO, SA (Spain)					
DC 9-32	P&W JT8D-9A	14			
DC-9-34	P&W JT8D-17	3			
DC-9-34F	P&W JT8D-17	2			
MD-88	P&W JT8D-217	13			
AVIANOVA SPA (Italy)					
ATR 42 300	P&WC PW120	9	4		
ATR 72-210	P&WC PW127	3			4
AVIOGENEX (Serbia)					
727-200	P&W JT8D-15	3			
737-200	P&W JT8D 15	4			
BALAIR-CTA SA (Switzerland)					
A310-300	P&W PW4156	4	2		
MD-82	P&W JT8D-217	2			
MD-83	P&W JT8D-219	2	1		
MD-87	P&W JT8D-217	4			
BALKAN BULGARIAN AIRLINES (Bulgaria)					
737-500	CFMI CFM56-3C1	3	3		
767-200ER	P&W PW4060	2	2		
A320-200	IAE V2500-A1	4	4		
An-12 (F)	ZMKB AI 20K	3			
An-24V-2	ZMKB AI-24	14			
Il 18D	ZMKB AI 20	2			
Il-18E	ZMKB AI-20	2			

Notes: SCD = Side cargo door   TBD = To be decided   EUD = Extended upper deck   Q = Hush kitted   SR = Short range   LR = Long range   F = Freighter

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
Il-18V	ZMKB AI 20	2			
Tu-134A-3	Aviadvigatel D-30	5			
Tu-154B-2	KKBM NK-8-2	17			
Tu-154M	Aviadvigatel D-30	5			
BALTIC INTERNATIONAL AIRLINES (Latvian Republic)					
727-100	P&W JT8D-7	2	2		
Tu-134A	Aviadvigatel D-30	2			
BELAVIA (Belarus)					
An-24B	ZMKB AI 24 II	8			
An-24RV	ZMKB AI 24VT	10			
An-26 (F)	ZMKB AI-24VT	4			
An-26B (F)	ZMKB A-24VT	4			
Tu-134A	Aviadvigatel D-30	19			
Tu-154B	KKBM NK-8-2	17			
Tu-154M	Aviadvigatel D-30KU-154	3			
Yak-40	ZMKB AI 25	8			
BIMAN BANGLADESH AIRLINES (Bangladesh)					
A310-300	TBD			2	
BAe ATP	P&WC PW126	2			
DC-10-30	GE CF6-50C2	6	2		
Fokker F28-4000	RR Spey 555-15H	2			
BINTER (Spain)					
ATR 72	P&WC PW124	6			
CASA/IPTN CN 235-10	GE CT7-7A	4			
CASA/IPTN CN 235 200	GE CT7 9C	5			
CASA/IPTN CN-235-QC	GE CT7-9	1	1		
DC-9-30	P&W JT8D-17	2	2		
BRAATHENS S.A.F.E. A/S (Norway)					
737-200 Heavy Advanced	P&W JT8D-17	2			
737-400	CFMI CFM56-3C1	7	5		
737-500	CFMI CFM56-3C1	20	5	2	2
BRIT AIR (France)					
ATR 42 300	P&WC PW120	14	7		
ATR 72-101	P&WC PW125	2		2	
Canadair Regional Jet	GE CF34-3A	1	1	5	
Saab 340A	GE CT7 5A2	6			
BRITANNIA AIRWAYS LTD (UK)					
757-200	RR RB211-535E4	1	1		
757 200ER	RR RB211-535E4	19	4		2
767-200	GE CF6-80A	2	1		
767-200ER	GE CF6 80A2	5	1		
767-200ER	GE CF6-80C2B4	2			
767-300ER	GE CF6-80C2B4			4	4
BRITISH AIRWAYS (UK)					
737-200	P&W JT8D-15	37	6		
737-400	CFMI CFM56-3C1	36	6		
747-100	P&W JT9D-7A	15	1		
747-200	RR RB211-524D4U	13	3		
747-200B (SCD)	RR RB211-524DX	3			
747-400	RR RB211-524G	28	13	34	15
757-200	RR RB211-535C	34	1		
757-200	RR RB211-535E4	10		1	
767-200ER	GE CF6-80C2B2	3	3		
767-300ER	RR RB211-524H	23	7	5	
777-200/200ER	GE GE90-B4			5.10	15
A320-100	CFMI CFM56-5A1	5			
A320-200	CFMI CFM56-5A1	5			
BAe ATP	P&WC PW126	14	14		2
Concorde	RR Olympus 593-610	7			
DC-10-30	GE CF6-50C	7	2		
DHC-7 Dash 7 100	P&WC PT6A 50	5	1		
DHC-8 Dash 8-100	P&WC PW120	2			
DHC-8 Dash 8-300	P&WC PW123	2			
L1011 TriStar 1/100	RR RB211 22B	5			
BRITISH MIDLAND AIRWAYS LTD (UK)					
737-300	CFMI CFM56-3B1	4	4		
737 300	CFMI CFM56-3B2	1	1		
737-400	CFMI CFM56-3C1	8	6		
737-500	CFMI CFM56-3B1	12	12	2	
BAe ATP	P&WC PW126	3	3		
BAe Jetstream 41	AS TPE331 14GR/HR	1			
DC-9-14	P&W JT8D 7A	1	1		
DC 9 15	P&W JT8D 7A	1			
DC 9 32	P&W JT8D-11	1			
DC 9 32	P&W JT8D-9	3	3		
DHC-7 Dash 7-100	P&WC PT6A 50	2			
Fokker 100	RR Tay 650-15	4	4		
Fokker 70	RR Tay 620	2	2	3	
Shorts 360	P&WC PT6A-65R	1			
BUSINESS EXPRESS (USA)					
BAe RJ70 Avroliner	AS LF507-1F	6		10	3
BAe 146-200A	AS ALF502R 5	5	5		
Beech 1900C Airliner	P&WC PT6A 65B	21	13		
Beech 1900C 1 Airliner	P&WC PT6A 65B	2			
Saab 2000	Allison AE 2100				0
Saab 340A	GE CT7-5A2	17	17		
Saab 340B	GE CT7 9B	22	22	20	
Shorts 360	P&WC PT6A 6	8	8		
CALEDONIAN AIRWAYS (UK)					
757 200ER	RR RB211 535E4	3	3		
A320 200	CFMI CFM56-5A1	3			
DC-10-30	GE CF6-50C2	2			
L1011 TriStar 1	RR RB211 22B	1			
L1011 TriStar 100	RR RB211 22B	4			
CANADA 3000 AIRLINES LIMITED (Canada)					
757-200ER	RR RB211-535E4	8	8		
A320 200	CFMI CFM56 5A1	4	4		
CANADIAN AIRLINES INTERNATIONAL LTD (Canada)					
737 200 Advanced	P&W JT8D 9A	19			
737-200 Advanced	P&W JT8D-15	1			
737-200 Advanced	P&W JT8D-17	4			
737-200 Advanced (ER)	P&W JT8D-17	7			
737 200C	P&W JT8D 9A	2	2		
737 200C Advanced	P&W JT8D-17	2			
737-200C Advanced	P&W JT8D-9A	4			
747 400	GE CF6 80C2B1F	4			2
767-300ER	GE CF6 80C2B6	1	1		1
A320 200	CFMI CFM56 5A1	12	12	8	7
DC-10-30	GE CF6-50C2	3			
DC-10-30ER	GE CF6 50C2	5			
CANADIAN REGIONAL AIRLINES (Canada)					
ATR 42-300	P&WC PW120	5			
DHC-8 Dash 8 100	P&WC PW120	2			
DHC 8 Dash 8 300	P&WC PW123	14			
Fokker F28 1000	RR Spey 555-15	1			
Shorts 360	P&WC PT6A-65R	3			
CARNIVAL AIR LINES INC (USA)					
727-200	P&W JT8D 9A	2	2		
727-200	P&W JT8D-1A	2	2		
737-200	P&W JT8D 9A	5	5		
737 400	CFMI CFM56 3B2	3	3		
CATHAY PACIFIC AIRWAYS LTD (Hong Kong)					
747 200	RR RB211 524C2	5	1		
747-200	RR RB211 524D4	2			
747-200F	RR RB211 524D4	4	1		
747-300	RR RB211-524C2	6	5		
747 400	RR RB211 524H2	14	3		11
747 400	RR RB211 524G2	[illegible]	1		
747-400F	RR RB211-524H2	[illegible]	1	1	
777 200/200ER	RR Trent 871				1
A330-300	RR Trent 772	3	[illegible]	[illegible]	8
A340-200	CFMI CFM56 5C2	4	4		
A340-300	CFMI CFM56-5C4			6	
L1011 TriStar 1	RR RB211 22B	12	8		
L1011 TriStar 100	RR RB211 22B	2	2		
CHINA AIRLINES LTD (Taiwan)					
737-200 Advanced	P&W JT8D 9A	3			
747 200B	P&W JT9D-7Q	2			
747 200B	P&W JT9D 7AW	1			
747-200F (SCD)	P&W JT9D-7A	6	4		
747 400	P&W PW4056	5	5		
747SP	P&W JT9D 7A	4	2		

Leading Chinese airlines show little enthusiasm for former Communist Bloc equipment, much to the benefit of Airbus and other Western manufacturers

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
A300-600R	P&W PW4158	6	5	2	1
A300B4-200	P&W JT9D-59A	6	5		
A320-200	IAE V2500-A1	2			
MD-11	P&W PW4460	4	2		
CHINA EASTERN AIRLINES (People's Republic of China)					
A300-600R	GE CF6-80C2A5	7	7	3	
A310-300	GE CF6-80C2A2	5	5		
A340-300	CFMI CFM56-5C2			5	
BAe 146-100	AS ALF502R-5	3			
Fokker 100	RR Tay 650-15	10	1		
MD-11	GE CF6-80C2	5	5		
MD-11F	GE CF6-80C2D1F	1	1		
MD-82	P&W JT8D-217	2	2		
MD-82 / MD/SAIC MD-82	P&W JT8D-217	11	4		
SAC Y-8	WJ 6	2			
Shorts 360	P&WC PT6A-6	2			
Xian Y-7	WJ 5A-1	9			
CHINA NORTHERN AIRLINES (People's Republic of China)					
A300-600R	P&W PW4158	3	3	5	9
Il-86	KKBM NK-86	2	2		
Learjet 55	AS TPE731-3AR-2B	1			
MD-82 / MD/SAIC MD-82	P&W JT8D-217	24	19	8	5
Xian Y-7	WJ 5A-1	5			
Xian Y 7-100	WJ 5A-1	6			
CHINA NORTHWEST AIRLINES (People's Republic of China)					
A300-600R	GE CF6-80C2A5	4	2	4	
A310-222	P&W JT8D-7R4E1	3	3		
An-24	ZMKB AI-24	2			
BAe 146-100	AS ALF502R-5	3			
BAe 146-300	AS ALF502R-5	8			
Shijiazhuang Y-5	HS 5	12			
Tu-154M	Aviadvigatel D-30	10			
Xian Y-7-100	WJ 5A-1	7			
CHINA SOUTHERN AIRLINES (People's Republic of China)					
737-200 Advanced	P&W JT8D-17	7			
737-300	CFMI CFM56-3B1	20	16		
737-500	CFMI CFM56-3B1	14	9		
757-200	RR RB211-535E4	19			
767-300ER	GE CF6-80C2B6	6	6		
777-200ER	GE GE90-B3			6	
A340-300	CFMI CFM56-5C2			6	
An-24	ZMKB AI-24	5			
BN-2B-20 Islander	Lyc IO-540-K1B5	5			
Saab 340B	GE CT7-9B	4			
Shorts 360	P&WC PT6A-6	3			
Xian Y-7	WJ 5A-1	5			
CHINA SOUTHWEST AIRLINES (People's Republic of China)					
707-300	P&W JT3D-7	4			
737-300	CFMI CFM56-3B1	13			
737-300	CFMI CFM56-3B2	4			
757-200	RR RB211-535E4	7	3	5	
Harbin Y-12II	P&WC PT6A-27	4			
Saab 340B	GE CT7-9B			4	
Tu-154M	Aviadvigatel D-30	5			
Xian Y 7-100	WJ 5A-1	3			
CONDOR FLUGDIENST GMBH (Germany)					
737-300	CFMI CFM56-3B2	4	4		
757-200	P&W PW2040	16	5	1	
757-200	RR RB211-535E4	1	1		
767-300ER	P&W PW4060	6	1		
DC-10-30	GE CF6-50C2	3			
CONTINENTAL AIR LINES, INC (USA)					
727-100	P&W JT8D-9	3			

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
727-200 Advanced	P&W JT8D-9A	53	27		
727-200 Advanced	P&W JT8D-15	25	15		
737-100	P&W JT8D-7A	13			
737-200	P&W JT8D-9A	24	16		
737-200 Advanced	P&W JT8D-9A	1			
737-300	CFMI CFM56-3B1	73	63	50	50
747-200B	P&W JT9D-7A	2	2		
747-200B	P&W JT9D-7F	3	3		
757-200	RR RB211-535E4	5	5	20	25
767-300ER	GE CF6-80C2			12	18
777-200	GE GE90-B4			5	5
A300B4-103	GE CF6-50C	6	6		
A300B4-203	GE CF6-50C2	5	15		
DC-10-10	GE CF6-6D	6	6		
DC-10-30	GE CF6-50C2	13	13		
DC-9-30	P&W JT8D-9A	34	28		
MD-81	P&W JT8D-217	5	3		
MD-82	P&W JT8D-219	4	4		
MD-82	P&W JT8D-217	18	18		
MD-82	P&W JT8D-217A	36	29		
MD-83	P&W JT8D-219	2	2		
CONTINENTAL EXPRESS (USA)					
ATR 42	P&WC PW120	42	42		
ATR 72-210	P&WC PW127	2	2		
Beech 1900C Airliner	P&WC PT6A-65B	5	5		

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
Beech 1900C-1 Airliner	P&WC PT6A-65B	10	10		
DHC-7 Dash 7 100	P&WC PT6A-50	5	5		
EMB-120RT Brasilia	P&WC PW118	38	10		
CROATIA AIRLINES (Croatia)					
737-200 Advanced	P&W JT8D-15	5	5		
ATR 42-300	P&WC PW120	2		1	
C 310R2	Cont IO-520-MB	1			
C 402C Utililiner II	Cont TSIO-520-VB	3			
CROSSAIR (Switzerland)					
BAe RJ100 Avroliner	AS LF507-1F			12	
BAe RJ85 Avroliner	AS LF507-1F	4			8
BAe 146-300	AS ALF502R-5	1	1		
Fokker 50	P&WC PW125	1			
Saab 2000	Allison AE 2100	5		15	25
Saab 340A	GE CT7-5A2	10			
Saab 340B	GE CT7-9B	15	4		

Notes: SCD = Side cargo door TBD = To be decided EUD = Extended upper deck Q = Hush kitted SR = Short range LR = Long range F = Freighter

CSA - CESKOSLOVENSKE AEROLINIE (Czech and Slovak Republics)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737-500	CFMI CFM56-3B1	5			4
A310-300	GE CF6-80C2A2	2	2		
ATR 42-320A	P&WC PW120		4	2	
ATR 72	P&WC PW125	4			
Il-62	KKBM NK 8-4	2			
Tu-134A	Aviadvigatel D-30	5			
Tu-154M	Aviadvigatel D-30	4			

CUBANA DE AVIACION (Cuba)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
An-24RV	ZMKB AI-24	7			
An-24V	ZMKB AI-24	5			
DC-10-30	GE CF6-50C2B	2	2		
Fokker F27-600	RR Dart 532-7	8	8		
Il-62M	Aviadvigatel D-30	10			
Tu-154M	Aviadvigatel D-30	4			
Yak-40	ZMKB AI-25	8			

CYPRUS AIRWAYS LTD (Cyprus)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
A310-203	GE CF6-80A3	3			
A310-204	GE CF6-80C2A2	1			
A320-200	IAE V2500-A1	8			
BAe (BAC) One-Eleven 500	RR Spey 512-14DW	3			

DELTA AIR LINES INC (USA)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
727-200 Advanced	P&W JT8D-15	133	31		
727-200 Advanced	P&W JT8D-9	14	10		
737-200 Advanced	P&W JT8D-15	10	9		
737-200 Advanced	P&W JT8D-17	2			
737-200 Advanced	P&W JT8D-15A	46	46		
737-300	CFMI CFM56-3B1	18		30	78
757-200	P&W PW2037	84	37	6	38
767-200	GE CF6-80A	13			
767-200	GE CF6-80A2	2			
767-300	GE CF6-80A2	25	23	5	
767-300ER	P&W PW4060	14	9		11
A310-200	P&W JT9D-7R4E1	7			
A310-300	P&W PW4152	13			
L1011 TriStar 1	RR RB211-22B	32			
L1011 TriStar 200	RR RB211-524B	1			
L1011 TriStar 250	RR RB211-524B	6			
L1011 TriStar 500	RR RB211-524B	17			
MD-11	P&W PW4360	11	9	6	29
MD-88	P&W JT8D-219	117	57	8	
MD90-30	IAE V2525-D5	3		28	106

DELTA AIR TRANSPORT NV (Belgium)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
BAe (BAC) One-Eleven	RR Spey 511-14	3	3		1
BAe 146-200	AS ALF502R-5	7			
EMB-120RT Brasilia	P&WC PW118	9			
Fokker F28-1000	RR Spey 555-15H	4	4		1
Fokker F28-3000	RR Spey 555-15H	1			
Fokker F28-4000	RR Spey 555-15P	3	1		1

DEUTSCHE BA LUFTFAHRTGESELLSCHAFT MBH (Germany)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737-300	CFMI CFM56-3B2	7	7		
Fokker 100	RR Tay 650-15	5	5		
Saab 2000	Allison AE 2100	3	3	2	5
Saab 340A	GE CT7-5A2	5	5		

DRAGONAIR (HONG KONG DRAGON AIRLINES LIMITED) (Hong Kong)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
A320-200	IAE V2500-A1	7	7		
A330-300	RR Trent 768	1	1	2	
L1011 TriStar 1	RR RB211-22B	2	2		

ECUATORIANA (Ecuador)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
707-300B	P&W JT3D-3B (Q)	2			
707-300B	P&W JT3D-3B	1			
707-300C (F)	P&W JT3D-3B (Q)	1			
A310-300	P&W PW4152			2	
DC-10-30	GE CF6-50C	1	1		

EGYPTAIR (Egypt)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
707-300C (F)	P&W JT3D-7	1			
737-200 Advanced	P&W JT8D-17	3			
737-500	CFMI CFM56-3C1	5			
747-300 (SCD)	P&W JT9D-7R4G2	2			
767-200ER	P&W JT9D-7R4E	3			
767-300ER	P&W JT9D-7R4G2	2			
A300-600R	P&W PW4158	9			
A300B4-203	GE CF6-50C2	5			
A320-200	IAE V2500-A1	7			
Fokker F27-500	RR Dart 532-7	2			

EL AL - ISRAEL AIRLINES LTD (Israel)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737-200 Advanced	P&W JT8D-17	2	2		
747-[illegible]00 (SCD)	P&W JT9D-7J	1			
747-200	P&W JT9D-7J	4			
747-200C	P&W JT9D-7J	3			
747-200F	P&W JT9D-7	1			
747-200F	P&W JT9D-7Q	2			
747-[illegible]00	P&W PW4056	2		1	
757-200	RR RB211-535E4	7			
[illegible]	P&W JT9D-7R4G2	2			
767-200ER	P&W JT9D-7R4D	2			

EMIRATES (United Arab Emirates)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
727-200 Advanced	P&W JT8D-17	2			
777 200/200ER	RR Trent 871			3	7
777-200ER	RR Trent 884			4	
A300-600R	GE CF6-80C2A5	6			
A310-300	GE CF6-80C2A2	10			

ESTONIAN AIR (Estonia)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737-500	CFMI CFM56-3B1	1		1	
PZL Mielec (Antonov) 2	Aviadvigatel ASh-621R	2			
Tu-134A	Aviadvigatel D-30	6			
Yak 40	ZMKB AI-25	4			

ETHIOPIAN AIRLINES CORPORATION (Ethiopia)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
707-300B (F)	P&W JT3D-3B	1			
737-200	P&W JT8D-17A	1			
757-200	P&W PW2040	4			1
757-200F	P&W PW2040	1			1
767-200ER	P&W JT9D-7R4E	3			
ATR 42	P&WC PW121	2			
DHC-5A Buffalo	GE CT64-820-4	1			
DHC-6 Twin Otter 300	P&WC PT6A-27	5			
L-382G Hercules	Allison 501-D22A	2			

EURALAIR INTERNATIONAL (France)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737-200	P&W JT8D-9A	5			
737-500	CFMI CFM56-3B1	3			
777-200ER	GE GE90-B4			2	
C 500 Citation I	P&WC JT15D-1A	2			
C 525 CitationJet	RR/Williams Int FJ44	1		3	
C 560 Citation V	P&WC JT15D-5A	2			
Dassault Falcon 10	AS TFE731-2-1C	1			
Dassault Falcon 20F-5	AS TFE731-5AR-2C	1			

EUROBELGIAN AIRLINES (Belgium)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737-300	CFMI CFM56-3C1	5	5		
737-300	CFMI CFM56-3B2	3	3		

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737-400	CFMI CFM56-3C1	3	3		

EUROPEAN AIR TRANSPORT NV/SA (Belgium)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
727-100F	P&W JT8D-7	6	6		
727-200F	P&W JT8D-7	6	4		
CV 580 (F)	Allison 501-D13	11			
SA226 Metro II	AS TPE331-3UW 303G	3			

EUROPEAN AIRLINES (Belgium)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
A300B4-100	GE CF6-50C2	1	1		
A300B4-200	GE CF6-50C2	2	2		

EUROWINGS (Germany)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
ATR 42	P&WC PW120	17	1		
ATR 72-200	P&WC PW124	6			
ATR 72-210	P&WC PW127	4			2
BAe 146-200	AS ALF502R-5	2	2		
BAe 146-200QT	AS ALF502R-5	2	2		

EXCALIBUR AIRWAYS LTD (UK)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737-300	CFMI CFM56-3B2	1	1		
A320-200	CFMI CFM56-5A3	4	4		

FAR EASTERN AIR TRANSPORT (Taiwan)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737-100	P&W JT8D-7A	2			
737-200	P&W JT8D-7A	1			
737-200	P&W JT8D-9A	3			
737-200 Advanced	P&W JT8D-9A	2			
757-200	P&W PW2037	2			
MD-82	P&W JT8D-217C	5			
MD-83	P&W JT8D-219	1			

FAUCETT PERU (Peru)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
A300B4K-103	GE CF6-50C2	1	1		
727-100	P&W JT8D-7B	1	1		
727-200	P&W JT8D-15	1			
737-100	P&W JT8D-9A	1	1		
737-200	P&W JT8D-9A	2	2		
737-200	P&W JT8D-17	1	1		
L1011 TriStar 1	RR RB211-22B	1	1		

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
FINNAIR OY (Finland)					
A300B4-203	GE CF6-50C2	2	2		
DC-10-30	GE CF6-50C2	3			
DC-10-30ER	GE CF6-50C2B	1	1		
DC-9-41	P&W JT8D-17	5			
DC-9-51	P&W JT8D-17	12			
MD-11	GE CF6-80C2D1BF	4			
MD-82	P&W JT8D-219	9	6		3
MD-83	P&W JT8D-219	5	4		
MD-87	P&W JT8D-219	3			
FINNAVIATION O/Y (Finland)					
Saab 340A	GE CT7-5A2	5	5		
Saab 340B	GE CT7-9B	1	1		
GARUDA INDONESIA PT (Indonesia)					
737-300	CFMI CFM56-3B1	8	8		
737-400	CFMI CFM56-3C1	7			
747-200	P&W JT9D-7Q	6	2		
747-400	GE CF6-80C2	2		7	
777	TBD			6	
A300-600R	P&W PW4158	10	10		
A300B4-220	P&W JT9D-59A	9			
A330-300	RR Trent 768			9	
DC-10-30	GE CF6-50C	6			
MD-11	GE CF6-80C2	6	6		
GB AIRWAYS (UK)					
737-200	P&W JT8D-15	4	4		
737-400	CFMI CFM56-3C1	2	2		
GULF AIR (Bahrain)					
757-200F	RR RB211-535E4	1	1		
767-300ER	GE CF6-80C2B4	18	2		

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
A320-200	CFMI CFM56-5A1	14		4	
A340-300	CFMI CFM56-5C2	4		2	6
HAPAG-LLOYD FLUG GMBH (Germany)					
A310-200	GE CF6-80C2A2	4			
A310-300	GE CF6-80C2A2	3			
737-400	CFMI CFM56-3C1	9			
737-500	CFMI CFM56-3C1	5			
737-800	CFMI CFM56-7			16	
HAWAIIAN AIRLINES (USA)					
DC-10-10	GE CF6-6K	6	6		
DC-9-51	P&W JT8D-17	13	12		
IBERIA - LINEAS AEREAS DE ESPANA, SA (Spain)					
727-200 Advanced	P&W JT8D-9	21	7		
747-200B	P&W JT9D-7A	1	1		
747-200B	P&W JT9D-7Q	2			
747-200B	P&W JT9D-7Q3	1			
747-200B (SCD)	P&W JT9D-7Q3	3			
757-200	RR RB211-535E4	8	8	15	
A300B4-100	P&W JT9D-59A	8			
A320-200	CFMI CFM56-5A1	22	6		10
A340-200	CFMI CFM56-5C2			8	
DC-10-30	GE CF6-50C	8			
DC-9-32	P&W JT8D-7	4			
DC-9-34	P&W JT8D-17	3			

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
MD-87	P&W JT8D-217C	24	5		
ICELANDAIR (Iceland)					
737-400	CFMI CFM56-3C1	4			
757-200ER	RR RB211-535E4	3			
Fokker 50	P&WC PW125	4	4		

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
INDIAN AIRLINES LIMITED (India)					
737-200	P&W JT8D-9A	4			
737-200 Advanced	P&W JT8D-17	14			
A300B2-101	GE CF6-50C	8			
A300B4-203	GE CF6-50C2	2			
A320-200	IAE V2500-A1	30			
Fokker F27-100	RR Dart 514-7	2			
Fokker F27-400	RR Dart 532-7	1			
IRAN AIR (Iran)					
707-300	P&W JT3D-3B	4			
727-100	P&W JT8D-7B	2			
727-200 Advanced	P&W JT8D-15	5			
737-200	P&W JT8D-15	3			
747-100	P&W JT9D-7F	1			
747-200	P&W JT9D-7F	2			
747-200F	P&W JT9D-7F	1			
747SP	P&W JT9D-7F	4			
A300-600R	GE CF6-80C2A5			2	
A300B2-203	GE CF6-50C2	5			
Fokker 100	RR Tay 650-15	6			
Tu-154M	Aviadvigatel D-30	6	6		
IRAQI AIRWAYS (Iraq)					
707-300C	P&W JT3D-3B	1			
707-300C	P&W JT3D-3B (Q)	1			
727-200 Advanced	P&W JT8D-17	6			
737-200C Advanced	P&W JT8D-15	2			
747-200C (SCD)	P&W JT9D-7FW	3			
A310-300	P&W PW4152			5	5
An-12 (F)	ZMKB AI-20	5			
An-24	ZMKB AI-24	1			
An-24T	ZMKB AI-24	2			
An-24TV	ZMKB AI-24	1			
An-24V	ZMKB AI-24	2			
Dassault Falcon 20F	GE CF700-2D2	2			
Dassault Falcon 50	AS TFE731-3-1C	3			
Il-76M (F)	Aviadvigatel D-30	12			
Il-76MD (F)	Aviadvigatel D-30	20			
L1329 JetStar II	AS TFE731-3	6			
Piaggio P166-DL2	Lyc IGSO-540-A1H	4			
JAPAN AIR SYSTEM CO LTD (NIHON AIR SYSTEM) (Japan)					
747-400	GE CF6-80C2B1F			4	
777-200	P&W PW4084			7	
A300B2 K3C	GE CF6-50C2R	9			
A300B4-2C	GE CF6-50C2R	8	6		
A300B4-622R	P&W PW4158	12	3	2	2
Beech Super King Air 200	P&WC PT6A-42	2			
DC-10-30	GE CF6-50C2	2	2		
DC-9-41	P&W JT8D-15	10			
MD-81	P&W JT8D-217	12		6	
MD-81	P&W JT8D-209	8			
MD-87	P&W JT8D-217	8			
MD90-30	IAE V2525-D5			10	
NAMC YS-11A-500	RR Dart 542-10J/K	15			
Saab 340B	GE CT7-9B	1		7	4
JAPAN AIRLINES COMPANY LTD - JAL (Japan)					
737-400	CFMI CFM56-3B2	1		10	
747-100 (LR)	P&W JT9D-7A	2			
747-100B (SR)	P&W JT9D-7A	3			
747-100B (SR/EUD)	P&W JT9D-7A	2			
747-200B	P&W JT9D-7R4G2	3			
747-200B	P&W JT9D-7Q	8			
747-200B	P&W JT9D-7A	1	1		
747-200B (F)	P&W JT9D-7AW	1			
747-200B (LR)	P&W JT9D-7AW	10			
747-200F (SCD)	P&W JT9D-7AW	1			
747-200F (SCD)	P&W JT9D-7Q	6	1		
747-200F (SCD)	P&W JT9D-7R4G2	2			
747-300 (LR)	P&W JT9D-7R4G2	9	2		
747-300 (SR)	P&W JT9D-7R4G2	4			
747-400	GE CF6-80C2B1F	24	4	10	34
747-400D	GE CF6-80C2B1F	8	3		
767-200	P&W JT9D-7R4D	2			
767-300	P&W JT9D-7R4D	16	4	3	
777-200	P&W PW4084			10	10
DC-10-40	P&W JT9D-59A	15			
MD-11	P&W PW4460	5	1	5	10
JAPAN ASIA AIRWAYS (NIHON ASIA KOKU) (Japan)					
747-100	P&W JT9D-7A	1			
747-200B	P&W JT9D-7AW	1			
747-200B	P&W JT9D-7Q	1			
747-300	P&W JT9D-7R4G2	1			
DC-10-40	P&W JT9D-59A	4			
JERSEY EUROPEAN AIRWAYS LTD (UK)					
BAe 146-100	AS ALF502R-5	1	1		
BAe 146-200	AS ALF502R-5	4	4		
BAe 146-300	AS ALF502R-5	2	2		
Fokker F27-100	RR Dart 532-7	1			

Notes: SCD = Side cargo door TBD = To be decided EUD = Extended upper deck Q = Hush kitted SR = Short range LR = Long range F = Freighter

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
Fokker F27-500	RR Dart 532-7	9	1		
Shorts 360 Advanced	P&WC PT6A 6	4	2		
JUGOSLOVENSKI AEROTRANSPORT - JAT (Yugoslavia)					
727-200 Advanced	P&W JT8D-9A	8			
737 300	CFMI CFM56-3B1	9	3		
ATR 72	P&WC PW124	3			
DC 10-30	GE CF6-50C1	3	2		
MD-11	P&W PW4460				3
KARAIR OY (Finland)					
ATR 72	P&WC PW124	6	6		2
KENYA AIRWAYS LTD (Kenya)					
737-200 Advanced	P&W JT8D-17	2	2		
A310-300	GE CF6-80C2A2	3	1		
Fokker 50	P&WC PW125	3			
KLM CITYHOPPER (The Netherlands)					
Fokker 50	P&WC PW125	10	10		
Fokker F28-4000	RR Spey 555-15P	4			
Saab 340B	GE CT7-9B	11	10		
KLM ROYAL DUTCH AIRLINES (The Netherlands)					
737-300	CFMI CFM56-3B1	15			
737-400	CFMI CFM56-3B2	12			
747-300	GE CF6-50E2	3			
747-300M (SCD)	GE CF6-50E2	10			
747-400	GE CF6-80C2	5			
747-400F	GE CF6-80C2B1F			2	2
747 400M (SCD)	GE CF6-80C2B1F	11			
767-300ER	GE CF6-80C2			7	
A310-200	GE CF6-80A3	10			
Fokker 100	RR Tay 620-15	6			
MD-11	GE CF6-80C2D1F	7		3	10
KOREAN AIR LINES CO LTD (Republic Korea)					
727 200 Advanced	P&W JT8D-9A	3			
747-200B	P&W JT9D-7R4G2	3	3		
747-200C (F)	P&W JT9D-7A	1			
747-200F	P&W JT9D-7Q	1	1		
747-200F (SCD)	P&W JT9D-7Q	4	1		
747-200F (SCD)	P&W JT9D-7A	2			
747-300	P&W JT9D-7R4G2	2			
747-300M	P&W JT9D-7R4G2	1			
747-400	P&W PW4056	17		11	
747-400C (SCD)	P&W PW4056	1		2	
747SP	P&W JT9D-7A	2			
777-200ER	TBD			8	8
A300-622	P&W PW4158	5			
A300-622R	P&W PW4158	16			
A300B4-103	GE CF6-50C2	8			
A300F4-203	GE CF6-50C2	2			
A330-300	TBD			7	8
DC-10-30	GE CF6 50C	3			
Fokker 100	RR Tay 650-15	12		3	
MD-11	P&W PW4360	5			
MD-82	P&W JT8D-217C	9		5	
KUWAIT AIRWAYS CORPORATION (Kuwait)					
707 300C	P&W JT3D-3B (Q)	2			
747-200B (SCD)	P&W JT9D 7J	4			
747-400M	GE CF6-80C2B1F	1		2	
A300-600R	GE CF6-80C2A5	5		3	
A310-222	P&W JT9D-7R4H	5			
A310-300	GE CF6-80C2A8	3			
A320-200	CFMI CFM56-5A1	3			
A321-100	CFMI CFM56-5B				2
A340-300	CFMI CFM56-5C4	1		3	4
BAe (HS) 125-700B	AS TFE731-3-1H	1			
LADECO - CHILEAN AIRLINES (Chile)					
707 300C	P&W JT3D 3B (Q)	1	1		
737-200	P&W JT8D-9A	1	1		
737-200 Advanced	P&W JT8D 9A	3	3		
737 200 Advanced	P&W JT8D-15	4	4		
737 300	CFMI CFM56-3B2	1	1		
757-200ER	P&W PW2040	2	2		
BAe (BAC) One-Eleven 200	RR Spey 511-14	2			
BAe (BAC) One-Eleven 300	RR Spey 511-14	2			
LANCHILE - LINEA AEREA NACIONAL CHILE (Chile)					
707 300C (F)	P&W JT3D 3B (Q)	1	1		
737-200 Advanced	P&W JT8D-17	1	1		
737-200 Advanced	P&W JT8D-17A	2	2		
737-200 Advanced	P&W JT8D-15	1	1		
767 200ER	GE CF6-80A2	2	2		
767-300ER	P&W PW4060	2	2		
BAe 146-200	AS ALF502R 5	2	2		
DC-8 71F	CFMI CFM56 2C1	2	2		
LAO AVIATION (Laos)					
ATR 72	P&WC PW124B	1			
An 24RV	ZMKB AI 24	3			
Harbin Y-12	P&WC PT6A-27	3			
Tu-154M	Aviadvigatel D-30	1			
Xian Y 7	WJ 5A 1	1			
LAUDA AIR LUFTFAHRT AKTIENGESELLSCHAFT (Austria)					
737-300	CFMI CFM56-3B1	2			
737-400	CFMI CFM56-3C1	2		1	
767-300ER	P&W PW4056	1			
767-300ER	P&W PW4060	3			
777-200ER	GE GE90-B3			4	
C550 Citation II	P&WC JT15D-4	1			
Canadair Regional Jet 100LR	GE CF34-3A	7			
Learjet 60	P&WC PW305A	1			
LEISURE INTERNATIONAL AIRWAYS LTD (UK)					
767-300ER	GE CF6-80C2	2	2		
LITHUANIAN AIRLINES (Lithuania)					
An-24RV	ZMKB AI-24	2			
An-24V	ZMKB AI-24	2			
An-26	ZMKB AI-24	3			
737-200	P&W JT8D-15	1	1		
Tu-134A	Aviadvigatel D-30	8			
Tu-134A-3	Aviadvigatel D-30	1			
Yak-42	ZMKB D-36	12			
LLOYD AEREO BOLIVIANO SAM (Bolivia)					
707-300	P&W JT3D-3B	1			
727-100	P&W JT8D-9A	2			
727-100C	P&W JT8D-9A	1			
727-200 Advanced	P&W JT8D-17R	3			
A310-304	GE CF6-80C2A2	1	1		
Fokker F27-200	RR Dart 536-7P	1			
Fokker F27-600	RR Dart 532-7P	1			
LOT - POLSKIE LINIE LOTNICZE (Poland)					
737-400	CFMI CFM56-3C1	4	4	1	
737-500	CFMI CFM56-3C1	6	6		
767-200ER	GE CF6 80C2B4	2	2		
767-300ER	GE CF6-80C2	2	2		1
ATR 72	P&WC PW124	4	4	1	
LTE INTERNATIONAL AIRWAYS SA (Spain)					
757-200	RR RB211-535C	3	3		
LTU - LUFTTRANSPORT UNTERNEHMEN GMBH (Germany)					
757-200	RR RB211-535E4	12	1	2	
767-300ER	P&W PW4060	4	4	2	
A330-300	P&W PW4164	1		5	
L1011 TriStar 100	RR RB211-22B	4			
L1011 TriStar 200	RR RB211-524B4	1			
L1011 TriStar 500	RR RB211-524B4	2			
MD 11	P&W PW4460	4			

Founded by a former racing motorist, Lauda Air's growing fleet includes seven Canadair Regional Jets

LTU SUD INTERNATIONAL AIRWAYS (Germany)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
757-200	RR RB211-535E4	9	9		
767-300ER	P&W PW4060	4	4		

LUFTHANSA CITYLINE GMBH (Germany)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
BAe RJ85 Avroliner	AS LF507 1F	7		3	
Canadair Regional Jet	GE CF34-3A	15	15	12	8
Fokker 50	P&WC PW125	25	25		

LUFTHANSA GERMAN AIRLINES - DEUTSCHE LUFTHANSA AG (Germany)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737-200 Advanced	P&W JT8D-15	35			
737 300	CFMI CFM56-3B1	31			
737-300QC	CFMI CFM56-3B1	2		5	
737-400	CFMI CFM56-3C1	7			
737-500	CFMI CFM56-3B1/3C1	32	7		5
747-200B	GE CF6-50E2	4			
747-200B (SCD)	GE CF6-50E2	10			
747-200F (SCD)	GE CF6-50E2	5	2		
747-400	GE CF6-80C2B1F	10	4		12
747-400 (SCD)	GE CF6-80C2B1F	7	3		
A300-600	GE CF6-80C2A3	11			
A310-200	GE CF6-80A3	13			
A310-300	GE CF6-80C2A2	12			14
A319	CFMI CFM56-5A			20	
A320-200	CFMI CFM56-5A1	33			6
A321-100	IAE V2530-A5	10		10	20
A340-200	CFMI CFM56-5C2	7			15
A340-300	CFMI CFM56-5C2	8		1	
Beech A36 Bonanza	Cont IO-550-B	9			
Beech Baron 58	Cont IO 540-C	19			
Beech F33A Bonanza	Cont IO 520-BA	59			
Beech T34 Mentor	P&WC PT6A-25	2			
DC-10-30	GE CF6-50C2	11	1		
PA-42-720 Cheyenne IIIA	P&WC PT6A-6	7			

MALAYSIAN AIRLINE SYSTEM (Malaysia)

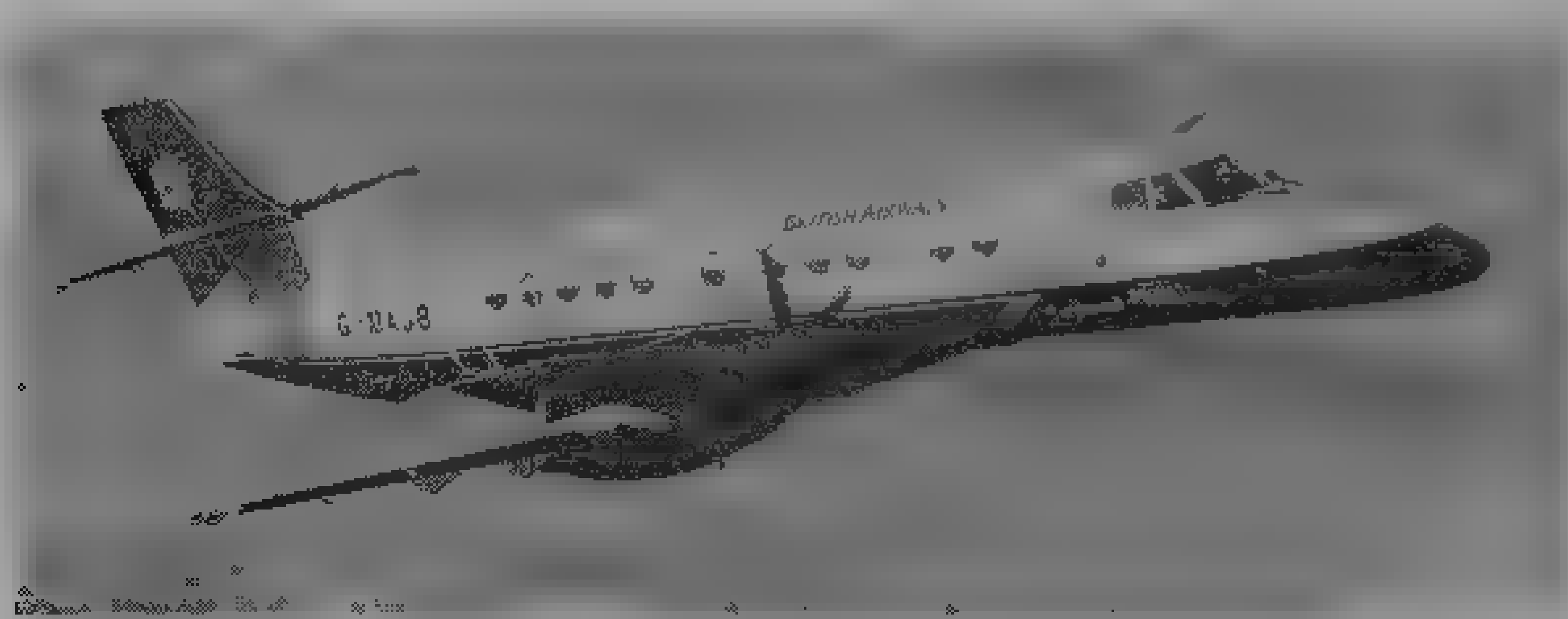
Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737-300F	CFMI CFM56-3C1	2			
737-400	CFMI CFM56-3C1	39		2	3
737-500	CFMI CFM56-3C1	9			
747 200B	RR RB211-524D4	2			
747-300 (SCD)	P&W JT9D-7R4G2	1			
747-400	GE CF6-80C2B1F	2			
747 400	P&W PW4056	8		1	5
747 400 (SCD)	GE CF6-80C2B1F	2			
A300B4-200	GE CF6-50C2	1			
A330-300	P&W PW4168	5		5	6
DC-10-30	GE CF6 50C2	4	4		
DHC-6 Twin Otter 300	P&WC PT6A-27	6			
Fokker 50	P&WC PW125	11			

MALEV - HUNGARIAN AIRLINES (Hungary)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737 200	P&W JT8D-17	4	4	2	
737-300	CFMI CFM56 3C1	4	4		
737-400	CFMI CFM56-3			2	
767 200ER	GE CF6 80C2	2	2		
Fokker 70	RR Tay 620			4	
Tu-134A-3	Aviadvigatel D-30-III	6			
Tu-154B-2	KKBM NK 8 2	10			

MANX AIRLINES LTD (UK)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
BAe 146-200	AS ALF502R 5	2	2		
BAe ATP	P&WC PW126	13	13		
BAe Jetstream 41	AS TPE331 14GR/HR	10	10		



MARTINAIR HOLLAND NV (The Netherlands)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
747-200C (SCD)	GE CF6-50E2	2			
A310-203C	GE CF6-80A3	1			
747-200F	GE CF6-50E2	1			
767-300ER	P&W PW4060	5		1	
MD-11CF	P&W PW4462	4			
MD-11F	P&W PW4462			1	2

MERPATI NUSANTARA AIRLINES PT (Indonesia)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
BAe ATP	P&WC PW125	5			
DC 9 32	P&W JT8D-9	6	6		
DHC-6 Twin Otter 300	P&WC PT6A 27	11			
Fokker 100	RR Tay 650-15	3		9	
Fokker 70	RR Tay 620			5	
Fokker F27-500	RR Dart 532-7	8			
Fokker F27-500	RR Dart 536-7	6			
Fokker F28-4000	RR Spey 555-15H	26	16		
IPTN N 250-100	Allison AE 2100			65	
IPTN/CASA 212 200 Aviocar	AS TPE331-10-511C	11			
IPTN/CASA CN 235 10	GE CT7-7A	14			
IPTN/CASA CN 235 200	GE CT7 9C			16	

MESA AIRLINES INC (USA)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
BAe Jetstream 31	AS TPE331 10UG-513H	21	21		
Beech 1900 Airliner	P&WC PT6A-65B	20	15		
Beech 1900D Airliner	P&WC PT6A-67D	91		28	
DHC-8 Dash 8-200	P&WC PW120A			25	25
DHC-8 Dash 8-300	P&WC PW123			6	
EMB-120RT Brasilia	P&WC PW118	41	41		
Fokker 70	RR Tay 620	2	2		6

MEXICANA (Mexico)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
727-200 Advanced	P&W JT8D-17R	26	4		
A320-200	IAE V2500-A1	14	6	6	14
DC-10-15	GE CF6-50C2F	6	5		
Fokker 100	RR Tay 620 15	10	10		8

MIDDLE EAST AIRLINES - AIRLIBAN (Lebanon)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
707-300C	P&W JT3D-3B (Q)	8			
747-200B	P&W JT9D-7FW	3	3		
A310-200	GE CF6-80A3	2	2		
A310-300	GE CF6-80C2A2	1	1		
B720B	P&W JT3D-1	2			

MONARCH AIRLINES LTD (UK)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
737 300	CFMI CFM56-3B1	4	2		
757-200	RR RB211-535E4	8	4		
A300-605R	GE CF6-80C2A5	4	4		
A320-200	CFMI CFM56-5A3	7	7		

MONGOLIAN AIRLINES - MIAT (Mongolia)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
727-200	P&W JT8D-9A	1			
An-24B	ZMKB AI-24	4			
An-24RV	ZMKB AI-24	8			
An 26	ZMKB AI-24	3			
An-30	ZMKB AI-24	1			
Harbin Y-12 II	P&WC PT6A-27	5			
Mil Mi-8	Klimov TV2-117A	3			
PZL Mielec An-2	Aviadvigatel ASh 621R	47			
Tu-154M	Aviadvigatel D-30	1	1		

NIGERIA AIRWAYS LTD (Nigeria)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
707-300C	P&W JT3D-3B	1			
737-200 Advanced	P&W JT8D-15	8			
A310 222	P&W JT9D-7R4E1	4			
DC-10-30	GE CF6-50C	2	1		

NORTHWEST AIRLINES (USA)

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
727-200	P&W JT8D-7B	15	5		
727-200 Advanced	P&W JT8D-17	15			
727 200 Advanced	P&W JT8D-15	25			
747-100	P&W JT9D 7A	2			
747-200B	P&W JT9D-7F	5			
747-200B	P&W JT9D-7Q	12			
747-200B	P&W JT9D-7R4G2	3			
747-200F (SCD)	P&W JT9D-7F	5			
747-200F (SCD)	P&W JT9D 7Q	1			
747-200F (SCD)	P&W JT9D-7R4G2	2			
747 400	P&W PW4056	10	10	2	
757 200	P&W PW2037	33		40	
A320-200	CFMI CFM56-5A1	50	28		
A330-300	P&W PW4164			6	
DC 10-30	GE CF6 50C	6	6		
DC-10-30	GE CF6-50C2B	1	1		
DC-10-30ER	GE CF6 50C2B	1	1		
DC-10-40	P&W JT9D-20	21	2		
DC-9-14	P&W JT8D-7A	1			
DC 9 14	P&W JT8D-7B	16			
DC-9 15	P&W JT8D 7B	4			
DC-9 31	P&W JT8D-15	7		18	
DC-9 31	P&W JT8D-7	1			
DC 9-31	P&W JT8D-7B	23			

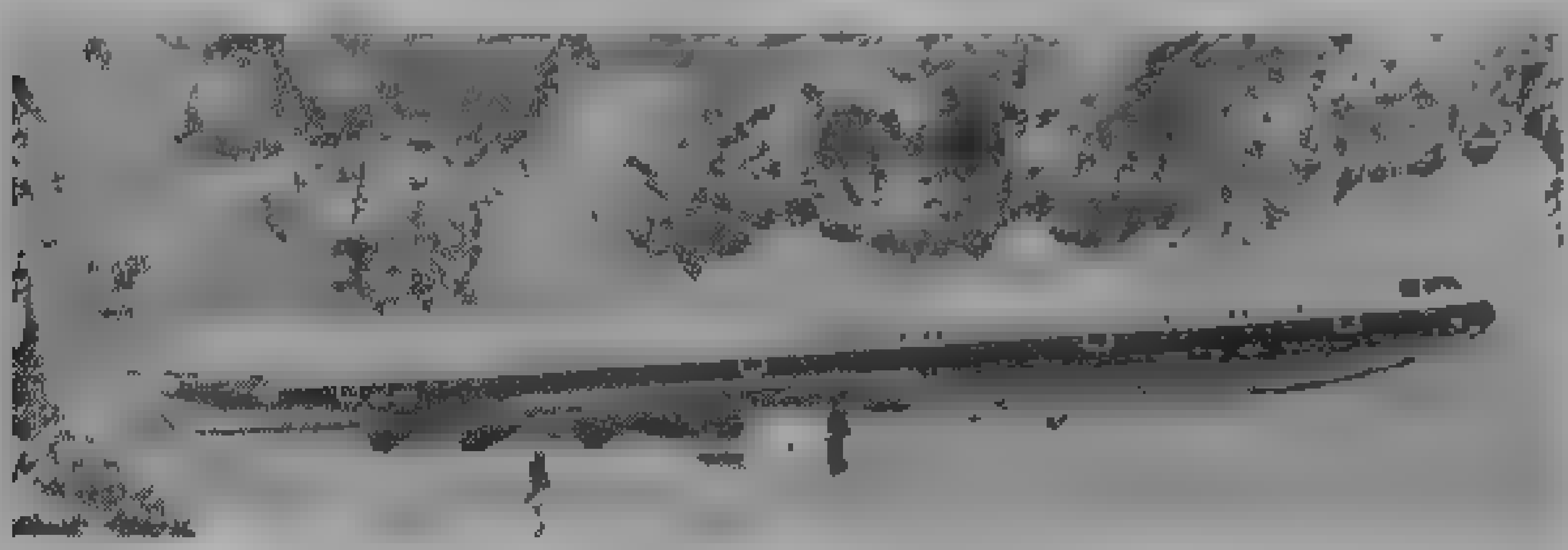
Notes. SCD = Side cargo door TBD = To be decided EUD = Extended upper deck Q = Hush kitted SR = Short range LR = Long range F = Freighter

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
DC-9-31	P&W JT8D-9	26	2		
DC-9-32	P&W JT8D-15	10			
DC-9-32	P&W JT8D-9A	10	6		
DC-9-41	P&W JT8D-11	12	12		
DC 9-51	P&W JT8D-17	34	12		
MD-82	P&W JT8D-217	8	2		
OLYMPIC AIRWAYS SA (Greece)					
727 200	P&W JT8D-9A	6			
727-200 Advanced	P&W JT8D-15	3			
737 200	P&W JT8D-15	11			
737-400	CFMI CFM56-3C1	7			
747-200B	P&W JT9D-7J	1			
747-200B	P&W JT9D-7Q	3			
A300-600R	GE CF6-80C2A5	3		1	
A300B4-103	GE CF6-50C2	6	6		
OLYMPIC AVIATION SA (Greece)					
ATR 42	P&WC PW121	4			
ATR 72	P&WC PW124B	6			
Agusta A 109 II	Allison 250-C20	1			
Dornier 228-200	AS TPE331-5-252D	7			
Eurocopter AS 355F2	Allison 250-C20F	2			
Shorts 330-200	P&WC PT6A-45B	4			
Shorts 330-200	P&WC PT6A-45R	1			
PAKISTAN INTERNATIONAL AIRLINES CORPORATION (PIA) (Pakistan)					
707-300C	P&W JT3D-3B	2			
737-300	CFMI CFM56-3B1	6			
747-200B	P&W JT9D-7A	6			
747-200B (SCD)	GE CF6-50E2	2			
A300B4-200	GE CF6-50C2	9	4		
A310-307	GE CF6-80C2A8	6			
DHC-6 Twin Otter 300	P&WC PT6A-27	2			
Fokker F27-200	RR Dart 532-7E	13			
PELITA AIR SERVICE (Indonesia)					
BAe RJ85 Avroliner	AS LF507-1F	1			
BAe (BAC) One-Eleven 400	RR Spey 511-14	1			
BAe (HS) 125-600B	RR Viper 601-22A	1			
BAe 146-200	AS ALF502R-5	1			
DHC-7 Dash 7-100	P&WC PT6A-50	5			
Eurocopter BO 105 C	Allison 250-C20	5			
Fokker 100	RR Tay 650-15	1			
Fokker 70	RR Tay 620			5	
Fokker F28-1000	RR Spey 555-15	2			
Fokker F28-4000	RR Spey 555-15P	5			
Gulfstream II	RR Spey 511-8	1			
Gulfstream III	RR Spey 511-8	1			
IPTN/CASA 212-100 Aviocar	AS TPE331-5-251C	4			
IPTN/CASA 212-200 Aviocar	AS TPE331-10-511C	8			
IPTN/Eurocopter NBO 105C B	Allison 250-C20	28			
IPTN/NAS SA330G Puma	TU Turmo IVA/IVC	4			
IPTN/NAS SA330J Puma	TU Turmo IVC	11			
IPTN/NAS SA332C S Puma	TU Makila 1A	2			
L-382G Hercules	Allison 501-D22A	3			
Sikorsky S-76A II	Allison 250-C30S20	4			
Transall C-160NG	RR Tyne 522	3			
Transall C-160P	RR Tyne 522	3			
PHILIPPINE AIR LINES, INC - PAL (Philippines)					
737-300	CFMI CFM56-3B1	12	11		
747-200B	GE CF6 50E2	6	6		
747-200B	P&W JT9D-7Q	3	3		
747-200B (SCD)	P&W JT9D-7Q	1	1		
747-200B (SCD)	P&W JT9D-7QA	1	1		
747-400	GE CF6 80C2	3	3		
A300B4-103	GE CF6-50C2	2			
A300B4-203	GE CF6-50C2	10	7		
A340-200	CFMI CFM56-5C2			4	
DC-10-30	GE CF6-50C2	1	1		
Fokker 50	P&WC PW125	10	10		
Shorts 360-300	P&WC PT6A 6	2	2		
PREMIAIR A/S (Denmark)					
A300B4-100	P&W JT9D-59A	3	3		
A320-200	IAE V2500-A1	6	6		
DC-10-10	GE CF6-6D1A	4	4		
PRIMERAS LINEAS URUGUAYAS DE NAVEGACION AEREA - PLUNA (Uruguay)					
707-300C	P&W JT3D-3B (Q)	1			
737-200 Advanced	P&W JT8D-9A	3			
DC-10-30	GE CF6-50C	1	1		
QANTAS AIRWAYS LTD (Australia)					
737-300	CFMI CFM56-3B2/3C1	16			
737 400	CFMI CFM56-3C1	18		3	1
747 200B	RR RB211 524D4	3			
747 200B (SCD)	RR RB211 524D4	2			
747 300	RR RB211 524D4	6			
747-400	RR RB211-524G	18	9		19
747SP	RR RB211 524D4	2			
767 200ER	P&W JT9D-7R4E	7			
767 300ER	GE CF6-80C2B6	15	5		5
A300B4 203	GE CF6 50C2	4			

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
BAe 146-100	AS ALF502R-5	1	1		
BAe 146-200	AS ALF502R-5	3	3		
BAe 146-300	AS ALF502R 5	2	2		
QATAR AIRWAYS (Qatar)					
747	TBD				2

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
A310-222	P&W JT9D-7R4E1	2	2		
ROYAL AIR MAROC (Morocco)					
707 300C	P&W JT3D-3B	2			
727-200	P&W JT8D-7B	1			
727-200 Advanced	P&W JT8D-15	6			
737-200 Advanced	P&W JT8D-15	4			
737-200C Advanced	P&W JT8D-15	2			
737-400	CFMI CFM56-3C1	6	2		5
737-500	CFMI CFM56-3C1	5	2		5
747-200B (SCD)	P&W JT9D-7F	1			
747-400	GE CF6-80C2B1F	1			
757-200	P&W PW2037	2	2		
ATR 42	P&WC PW120	2	2		
Beech Baron 95-B55	Cont IO-470-L	2			
Beech Super King Air 200	P&WC PT6A-41	2			
ROYAL BRUNEI AIRLINES (Brunei Darussalam)					
757-200ER	RR RB211-535E4	3			
767-300ER	P&W PW4056	6	1		
Fokker 50	P&WC PW125B	2			
ROYAL JORDANIAN (Jordan)					
707-300C	P&W JT3D-3B	3	3		
727-200A	P&W JT8D-17	2	2		
A310-300	GE CF6-80C2A2	5	5		
A320-200	CFMI CFM56-5A1	2	2	1	
L1011 TriStar 500	RR RB211-524B4	5	5		
ROYAL NEPAL AIRLINES CORPORATION (Nepal)					
727 100	P&W JT8D 9A	2			
757-200	RR RB211-535E4	2			
BAe (HS) 748 Srs 2A	RR Dart 543-2	2			
DHC-6 Twin Otter 300	P&WC PT6A-27	9			
Pilatus PC-6B Turbo Porter	P&WC PT6A-20	1			
RYANAIR LTD (Ireland)					
737-200 Advanced	P&W JT8D-15	6	6		
737-200A	P&W JT8D-17	1			
BAe (BAC) One Eleven 500	RR Spey 512 14DW	4	4		
Romaero One-Eleven 561RC	RR Spey 512-14DW	4	4		
SABENA (Belgium)					
737 200 Advanced	P&W JT8D-15	8			
737-200C Advanced	P&W JT8D-15	4			
737-300	CFMI CFM56-3B2	6	6		
737-400	CFMI CFM56-3C1	3	3		
737 500	CFMI CFM56-3B1	6	6	7	
747-200 (SCD)	GE CF6-50E2	1	1		
747-300C	GE CF6-50E2	2			
A310-200	P&W JT9D-7R4E1	2	2		
A310-300	P&W JT9D-7R4E1	1			
A340-200	CFMI CFM56-5C2	4			
DC-10-30	GE CF6 50C2	2	2		
SAS - SCANDINAVIAN AIRLINES SYSTEM (Sweden)					
737 500	CFMI CFM56-3B1	12	3	2	
737-600	CFMI CFM56-7			35	35
767-200ER	P&W PW4056			2	
767-300ER	P&W PW4050	12	11		
DC-9-21	P&W JT8D-11	2			
DC-9-41	P&W JT8D 11	25	5		
Fokker 50	P&WC PW125	22	9		
Fokker F28 1000	RR Spey 555-15N	3			
Fokker F28-4000	RR Spey 555-15P	16			
MD-81	P&W JT8D-217	31			
MD-82	P&W JT8D-219	15			
MD-87	P&W JT8D-217	16			
MD90-30	IAE V2525-D5			6	6
SAUDIA - SAUDI ARABIAN AIRLINES (Kingdom of Saudi Arabia)					
707-300C	P&W JT3D-3B (Q)	2			
737 200	P&W JT8D 15	20			
747-100	RR RB211-524C2-19	8			
747-200	P&W JT9D-7J	1	1		

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
747-200F	RR RB211 524D4	2	1		
747-300	RR RB211 524D4-19	11			
747SP	RR RB211 524C2-19	3			
A300-600	P&W JT9D-7R4H1	11			
Beech A36 Bonanza	Cont IO-550-B	6			
Beech King Air A100	P&WC PT6A-28	2			
C 550 Citation II	P&WC JT15D-4	2			
Dassault Falcon 900	AS TFE731-5AR 1C2	2			
DC-8-63F	P&W JT3D-7 (Q)	1	1		
DC-8-72	CFMI CFM56-2C5	1			
DHC-6 Twin Otter 300	P&WC PT6A 27	1			
Gulfstream II	RR Spey 511-8	4			
Gulfstream III	RR Spey 511-8	3			
Gulfstream IV	RR Tay 611-8	6			
L1011 TriStar 300	RR RB211-524B 02	17			
L1011 TriStar 500	RR RB211 524B4	2			
PA-28-181 Archer II	Lyc O 360 A4M	8			
SHANGHAI AIRLINES (People's Republic of China)					
757 200	P&W PW2037	6			
767 300	P&W PW4000			5	
SINGAPORE AIRLINES LIMITED (Republic of Singapore)					
737 300F	CFMI CFM56 3B2	1			
747-200	P&W JT9D-7Q	4			
747-300M	P&W JT9D-7R4G2	9			
747-300M (SCD)	P&W JT9D-7R4G2	3			
747-400	P&W PW4056	28		19	9
747-400F	P&W JT9D-7R4G2	3		2	2
A310-200	P&W JT9D-7R4E1	4			
A310-300	P&W PW4152	17			
A340-300	CFMI CFM56 5C4			17	20
Learjet 31A	AS TFE731-2-3B	4		2	
Learjet 45	AS TFE731-20			4	
SOUTH AFRICAN AIRWAYS (SAA) (Republic of South Africa)					
737-200 (F)	P&W JT8D-15	2			
737-200 Advanced	P&W JT8D-15	11			
747-200B	P&W JT9D-7R4G2	5			
747-200B (SCD)	P&W JT9D-7Q	1			
747-300	P&W JT9D-7R4G2	2			
747-400	RR RB211-524G	4			
747SP	P&W JT9D-7FW	5			
767-200LR	P&W PW4056	1	1		
A300B2-K3C	GE CF6-50C2R	4			
A300B4-203	GE CF6-50C2	3			
A300C4 203	GE CF6-50C2	1			
A320-200	IAE V2500-A1	7			
SWISSAIR (SOCIETE ANONYME SUISSE POUR LA NAVIGATION AERIENNE) (Switzerland)					
747-300	P&W JT9D-7R4G2	2	2		
747-300 (SCD)	P&W JT9D-7R4G2	3	1		
A310-322	P&W JT9D-7R4E1	5	1		2
A319	CFMI CFM56-5B2			5	5
A320-200	CFMI CFM56-5B4	1		6	26
A321-100	CFMI CFM56-5B	2		17	
Fokker 100	RR Tay 620-15	10			4



Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
MD-11	P&W PW4460	13	3	1	3
MD-81	P&W JT8D-209	17	10		
TAESA - TRANSPORTES AEREOS EJECUTIVOS SA (Mexico)					
727-100C	P&W JT8D-7B	6			
727-200A	P&W JT8D-7B	1	1		
737-200A	P&W JT8-15	3	1		
737-300	CFMI CFM56-3B1	11	6	7	
737 500	CFMI CFM56-3B1	5	3		
757-200	RR RB211-535E4	5	5	1	
767 300ER	P&W PW4060	1	1	1	
Learjet 35A	AS TFE731-2-2B	2			
TAME - TRANSPORTES AEREOS MILITARES ECUATORIANOS (Ecuador)					
727-100	P&W JT8D-7	1			
727 100	P&W JT8D-9A	2			
727-200 Advanced	P&W JT8D 17	1			
BAe (HS) 748 Srs 2A	RR Dart 534-2	1			
BAe (HS) 748 Srs 2A (SCD)	RR Dart 534 2	1			
Fokker F28-4000	RR Spey 555-15P	1			
TAP - AIR PORTUGAL (Portugal)					
737 200 Advanced	P&W JT8D 17	8	8		
737-300	CFMI CFM56-3B2	8	8		
A310 300	GE CF6-80C2A2	5			

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
A320-200	CFMI CFM56-5A1	6	6		
A340-300	CFMI CFM56-5C3	4	4		
L1011 TriStar 500	RR RB211 524B4-02	7			
TAROM ROMANIAN AIR TRANSPORT (Romania)					
707 300C	P&W JT3D-3B	3			
737 300	CFMI CFM56 3C1	5			6
A310-300	P&W PW4156	2			
An 24RV	ZMKB AI 24 II	14			
BAe (BAC) One-Eleven 475F	RR Spey 511 14	1			
BAe (BAC) One Eleven 500	RR Spey 511-14DW	7			
Il-18D	ZMKB AI-20M	2			
Il-18V	ZMKB AI-20K(M)	2			
Il-62	KKBM NK-8-4	1			
Il-62M	Aviadvigatel D-30KU	2			
Romaero One Eleven 561RC	RR Spey 511-14DW	6			
Tu 154B	KKBM NK 8-2U	1			
Tu 154B 1	KKBM NK 8 2	5			
Tu 154B 2	KKBM NK 8 2	2			
TAT EUROPEAN AIRLINES (France)					
737-200C	P&W JT8D-15A	4	4		
ATR 42-300	P&WC PW120	8	6		
ATR 72	P&WC PW124	6	6		
Beech King Air 200	P&WC PT6A-41	3	2		
EMB 120 Brasilia	P&WC PW118	2	2		
Fokker 100	RR Tay 620-15	14	14		
Fokker F28-1000	RR Spey 555-15	10	5		
Fokker F28-2000	RR Spey 555-15	4	1		
Fokker F28-4000	RR Spey 555-15H	5	5		
THAI AIRWAYS INTERNATIONAL (Thailand)					
737-200	P&W JT8D-15	3			
737-400	CFMI CFM56-3C1	7			
747-200	GE CF6-50F2	6			
747-300	GE CF6-50C2B1	2			
747-400	GE CF6-80C2B1F	7		5	
777-200	RR Trent 875			8	
A300-601	GE CF6-80C2A1	6			
A300-605R	GE CF6-80C2A5	2			
A300-622R	P&W PW4158	8			
A300B4-103	GE CF6-50C2	7	3		
A300B4-203	GE CF6-50C2	5	1		
A310-200	GE CF6-80C2A2	2			
A330-320	P&W PW4164	1		7	
ATR 42	P&WC PW121	2			
ATR 72	P&WC PW124	2			
BAe 146-300	AS ALF502R 5	5			
CL 601-3A ER Challenger	GE CF34-3A	1	1		
DC-10-30ER	GE CF6-502CB	3			
MD 11	GE CF6 80C2D1F	4			
TRANS WORLD AIRLINES, INC (USA)					
727-100	P&W JT8D-7	8			
727 200/200 Advanced	P&W JT8D-9A	41	8		
747-100	P&W JT9D-7A	8	2		
747-200	P&W JT9D-7A	3	1		
767-200ER	P&W JT9D-7R4D	10	6		
767 300	P&W PW4060	4	4		
A330 300	RR Trent 768			10	10
DC-9 10	P&W JT8D 7	7	7		
DC 9-31	P&W JT8D 9	18	18		
DC-9 32	P&W JT8D-9/-15	14	14		
DC-9-33	P&W JT8D-9	1	1		
DC 9-34	P&W JT8D 15	3	3		
DC-9 41	P&W JT8D-15	3	3		
DC-9-51	P&W JT8D-17	12	12		
L1011 TriStar 1	RR RB211-22B	10	4		
L1011 TriStar 100	RR RB211 22B	6	4		
MD-82	P&W JT8D-217	29	29		
MD 83 / SAIC/MD 83	P&W JT8D-217	16	16		
TRANSAERO AIRLINES (Russia)					
737 200 Advanced	P&W JT8D-15	2	2		
737 200 Advanced	P&W JT8D-15A	3	3		
757-200	RR RB211-535E4	3	3	1	
Il 86	KKBM NK 86	1			
TRANSASIA AIRWAYS (Taiwan)					
A320 200	IAE V2500-A1	3		3	
A321	IAE V2530-A5			4	
ATR 42 300	P&WC PW120	5			

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
ATR 72-200	P&WC PW124	11		1	

Notes. SCD = Side cargo door TBD = To be decided EUD = Extended upper deck Q = Hush kitted SR = Short range LR = Long range F = Freighter

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
TRANSBRASIL SA LINHAS AEREAS (Brazil)					
707-300C	P&W JT3D-3B	4	4		
737-300	CFMI CFM56-3B1	8	8		
737-300	CFMI CFM56-3B2	3	3		
737-400	CFMI CFM56-3C1	4	4		
767-200	GE CF6-80A	3			
767-200ER	P&W JT9D-7R4D	1	1		
767-200ER	P&W PW4056	2	2		
767-200ER	GE CF6-80A2	1	1		
767-300ER	P&W PW4060	1	1		
777-200ER	RR Trent 877			3	
EMB 145	Allison AE 3007A				8
TURKISH AIRLINES INC (TURK HAVA YOLLARI AO) (Turkey)					
A310-200	GE CF6-80A3	7			
A310-300	GE CF6-80C2A2	7	3		
A340-300	CFMI CFM56-5C2	3	3	2	5
BAe RJ100 Avroliner	AS LF507-1F	10	10		
727-200 Advanced	P&W JT8D-15	4			
727-200F	P&W JT8D-15	3			
737-400	CFMI CFM56-3C1	27	27	1	
737-500	CFMI CFM56-3C1	2	2		
UKRAINE INTERNATIONAL AIRLINES (Ukraine)					
737-400	CFMI CFM56-3C1	2	2		
767-300	TBD			2	
UNITED AIR LINES, INC (USA)					
727-200 Advanced	P&W JT8D-15	75	25		
737-200	P&W JT8D-7B	45			
737-200 Advanced	P&W JT8D-9A	7	7		
737-200 Advanced	P&W JT8D-17	17	17		
737-300	CFMI CFM56-3B1/3B2/3C1	101	91		
737-300/400/500	CFMI CFM56-3C				154
737-500	CFMI CFM56-3B1/3C1	57	30		
747-100	P&W JT9D-7A	15			
747-100	P&W JT9D-3A	3			
747-200B	P&W JT9D-7R4G2	2	2		
747-200B	P&W JT9D-7J	7	7		
747-400	P&W PW4056	24	21	2	43
747SP	P&W JT9D-7A	7	5		
757-200	P&W PW2037/2039	88	55	4	35
767-200	P&W JT9D-7R4D	11			
767-200ER	P&W JT9D-7R4D	8			
767-300ER	P&W PW4060	23	20		6
777-200A	P&W PW4073	1		33	34
A320-200	IAE V2527-A5	27	27	23	50
DC-10-10	GE CF6-6D	31	13		
DC-10-30	GE CF6-50C2	8	8		
USAIR, INC (USA)					
727-200 Advanced	P&W JT8D-15/15A	5	5		
737-200 Advanced	P&W JT8D-15/15A	47	7		
737-200 Advanced	P&W JT8D-9A	17	11		
737-300	CFMI CFM56-3B2	58	46	40	
737-300LR	CFMI CFM56-3B2	33	20		
737-400	CFMI CFM56-3B2	54	35		
757-200	RR RB211-535E4	34	21	8	
767-200ER	GE CF6-80C2B2	12	8		
BAe 146-200A	AS ALF502R-5	17	17		
DC-9-31	P&W JT8D-7B/9A	68	14		
Fokker 100	RR Tay 650-15	40	4		
Fokker F28-4000	RR Spey 555-15P	19	15		
MD-81	P&W JT8D-217	19	10		
MD-82	P&W JT8D-217	12	6		
VARIG - VIACAO AEREA RIO-GRANDENSE SA (Brazil)					
727-100C	P&W JT8D-7B	1			
727-100C	P&W JT8D-9A	4			
737-200 Advanced	P&W JT8D-17	17			
737-300	CFMI CFM56-3B2	25	25	12	7
747-200B (SCD)	GE CF6-50E2	3	3		
747-300	GE CF6-80C2B1	3	3		
747-300 (SCD)	GE CF6-50E2	2	2		
767-200ER	GE CF6-80C2B2	6	6		
767-300ER	GE CF6-80C2	4	4		
DC-10-30	GE CF6-50C2	8	5		
DC-10-30F (CF)	GE CF6-50C2	2	2		
MD-11	GE CF6-80C2D1F	6	6		
VASP - VIACAO AEREA SAO PAULO SA (Brazil)					
727-200 Advanced	P&W JT8D-17	13			
737-200	P&W JT8D-7	6			
737-200C Advanced (F)	P&W JT8D-17	2			
737-300	CFMI CFM56-3B1	2	2	10	
A300B2-203	GE CF6-50C2	3			
MD-11	GE CF6-80C2D1F	4	4	3	
VAYUDOOT (India)					
Dornier 228-201	AS TPE331-5-252D	4			
Fokker F27-100	RR Dart 514-7	4			
HAL/BAe (HS) 748 Srs 2	RR Dart 533-2	5			
HAL/BAe (HS) 748 Srs 2A	RR Dart 533-2	5			
HAL/Dornier 228-201	AS TPE331-5-252D	5			
VIETNAM AIRLINES (Vietnam)					
707-300C	P&W JT3D-3B	1	1		
737-300	CFMI CFM56-3B2	1	1		
767-200ER	GE CF6-80A	1	1		
A310-300	P&W PW4152	1	1		
A320-100	CFMI CFM56-5A1	7	7		
A320-200	CFMI CFM56-5A1	4	4		
ATR 72-202	P&WC PW124B	3	3	1	
An-2	Aviadvigatel ASh-621R	1			
An-24	ZMKB AI-24	5			
An-24V	ZMKB AI-24	7			
Il-18D	ZMKB AI-20M	3			
Tu-134A	Aviadvigatel D-30	5			
Tu-134B-3	Aviadvigatel D-30	4			
Yak-40	ZMKB AI-25	5			
VIRGIN ATLANTIC AIRWAYS (UK)					
747-100	P&W JT9D-7AH	1			
747-200B	P&W JT9D-7A/7J	5	4		
747-400	GE CF6-80C2	2	2	1	
777	TBD				6
A340-300	CFMI CFM56-5C3	4	4	1	
WIDEROE'S FLYVESELSKAP A/S (Norway)					
DHC-6 Twin Otter 300	P&WC PT6A-27	11	1		
DHC-7 Dash 7-100	P&WC PT6A-50	8	3		

Airline and aircraft	Power plant	Total fleet	Leased in	On order	Options
DHC-8 Dash 8-103B	P&WC PW121	4		11	
YEMEN AIRWAYS (Yemen)					
707-300C	P&W JT3D-3B	2			
727-200 Advanced	P&W JT8D-17	5			
737-200C Advanced	P&W JT8D-17A	2			
737-200C Advanced	P&W JT8D-15	1			
A310-200	P&W JT9D-7R4	2	2		
A310-300	GE CF6-80C2A2	1	1		
A310-300	P&W JT9D-7R4			2	
DHC-7 Dash 7-100	P&WC PT6A-50	4			
L-382C Hercules	Allison T56A-15	2			

AIRCRAFT

ARGENTINA

AERO BOERO

AERO BOERO SA

Brasil y Alem, 2421 Morteros, Cordoba
Telephone: 54 (562) 22690 and 22121
Fax: 54 (562) 2690 and 2121
PRESIDENT: Hector A. Boero
MANAGING DIRECTOR: Molina Gomez
OTHER WORKS: Av 9 de Julio 1101, 2400 San Francisco, Cordoba
Telephone: 54 (562) 22972 and 24118

Aero Boero had produced 556 aircraft of various models by January 1995. Work on the AB 155 and AB 180 was then proceeding at a combined rate of approximately 10 aircraft per month.

UPDATED

AERO BOERO 115

TYPE: Two/three-seat light aircraft.

PROGRAMME: Original AB 115 developed from AB 95 (1969-70 *Jane's*); subsequent variants included AB 115 BS ambulance and 112 kW (150 hp) AB 115/150 (1983-84 *Jane's*); current AB 115 Trainer ordered by Brazil in 1988 and 1989.

CURRENT VERSIONS: **AB 115 Trainer:** Standard version, *as described.*

CUSTOMERS: Total of 450 ordered by Brazilian government, mainly for civilian flying clubs, 307 delivered by mid-1994. Also sold in Argentina.

DESIGN FEATURES: High-wing cabin monoplane with V bracing struts, sweptback vertical tail and fixed incidence, non-swept tailplane. Wing section modified NACA 23012; 1° 45′ dihedral, incidence 3° at root, 1° at tip.

FLYING CONTROLS: Conventional, mechanically actuated, trim tab in port elevator.

STRUCTURE: Welded steel tube (SAE 4130) fuselage and tail unit with Dacron covering; wings, including skins and flaps/ailerons, of aluminium alloy. Wings strut braced, tailplane wire braced.

LANDING GEAR: Non-retractable tailwheel type with shock absorption by helicoidal springs inside fuselage; mainwheels carried on faired in V struts and half axles. Mainwheels and tyres size 6.00-6, tailwheel tyre size 2.80-2.50. Hydraulic disc brakes on main units; tailwheel steerable and fully castoring.

POWER PLANT: One 86 kW (115 hp) Textron Lycoming O-235-C2A flat-four engine, driving a Sensenich 72-CK-0-50 two-blade fixed-pitch propeller. Two aluminium fuel tanks in wings, combined capacity 128 litres (33.9 US gallons; 28.2 Imp gallons). Gravity refuelling point in top of each tank.

ACCOMMODATION: Pilot and one or two passengers in fully enclosed, heated and ventilated cabin.

SYSTEMS: 40 A alternator and 12 V battery.

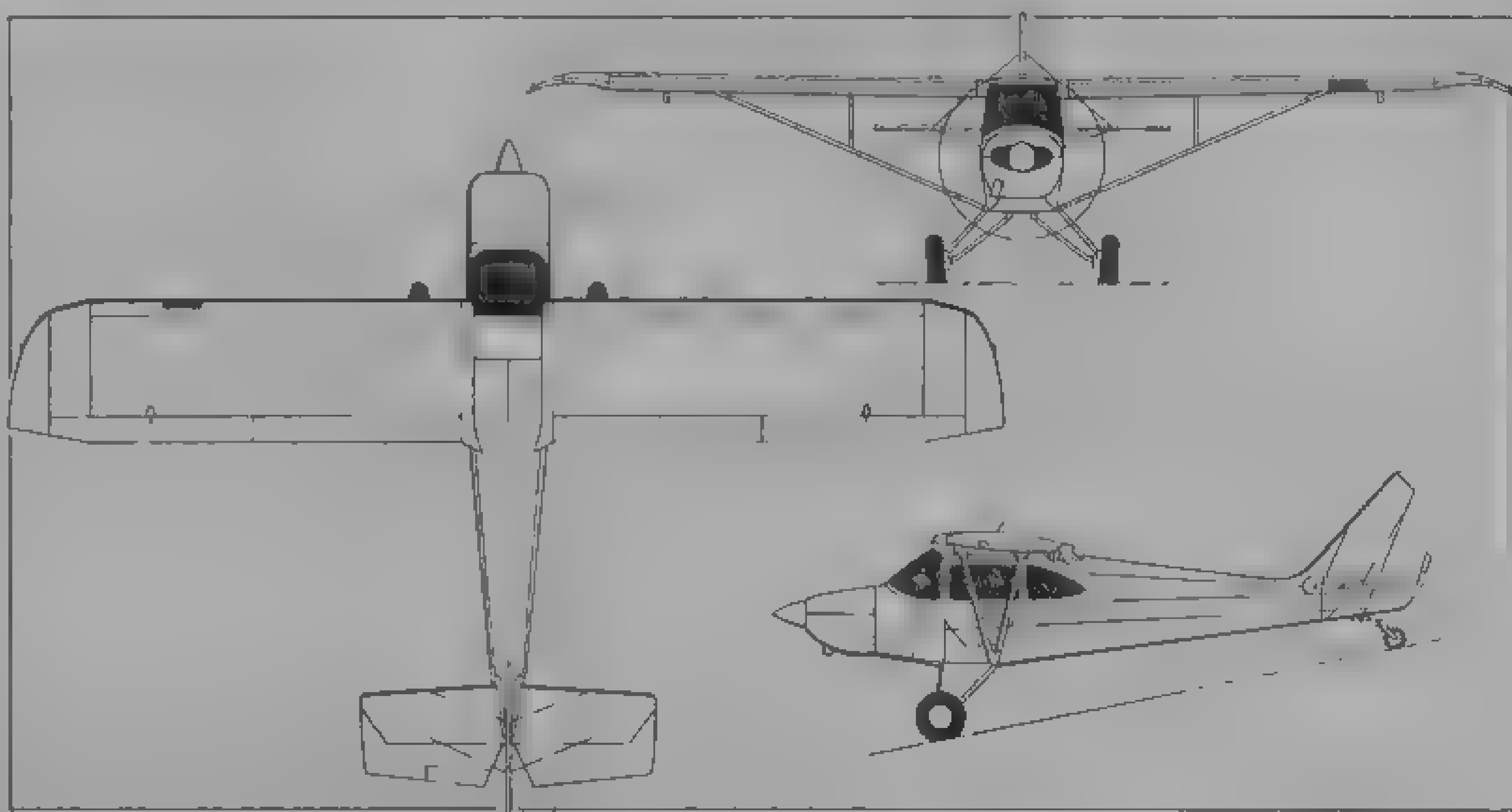
AVIONICS: *Comms:* Radio optional.
Instrumentation: Optional IFR instruments.

EQUIPMENT: Optional landing lights.

DIMENSIONS, EXTERNAL:

Wing span	10.78 m (35 ft 4½ in)
Wing chord, constant	1.615 m (5 ft 3½ in)
Wing aspect ratio	6.67
Length overall	7.08 m (23 ft 2¾ in)
Height overall	2.05 m (6 ft 8¾ in)
Tailplane span	3.20 m (10 ft 6 in)
Wheel track	1.76 m (5 ft 9¼ in)
Wheelbase	4.94 m (16 ft 2½ in)
Propeller diameter	1.93 m (6 ft 4 in)
Propeller ground clearance	0.58 m (1 ft 10¾ in)

Brazilian registered Aero Boero 115 two/three-seat lightplane 1995



Aero Boero 115 Trainer (Textron Lycoming O-235-C2A engine) *(Jane's/Mike Keep)* 1993

AREAS:

Wings, gross	17.41 m² (187.4 sq ft)
Ailerons (total)	1.84 m² (19.81 sq ft)
Trailing-edge flaps (total)	1.94 m² (20.88 sq ft)
Fin	0.93 m² (10.01 sq ft)
Rudder	0.41 m² (4.41 sq ft)
Tailplane	1.40 m² (15.07 sq ft)
Elevators (total, incl tab)	0.97 m² (10.44 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	556 kg (1,226 lb)
Max T-O weight	802 kg (1,768 lb)
Max wing loading	46.06 kg/m² (9.43 lb/sq ft)
Max power loading	9.36 kg/kW (15.37 lb/hp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (VNE)	118 kts (220 km/h; 136 mph)
Max cruising speed	91 kts (169 km/h; 105 mph)
Stalling speed, power off:	
flaps up	41 kts (75 km/h; 47 mph)
flaps down	35 kts (64 km/h; 40 mph)
Max rate of climb at S/L	204 m (669 ft)/min
T-O run	100 m (330 ft)
T-O to, and landing from, 15 m (50 ft)	250 m (820 ft)
Landing run	80 m (265 ft)
Range with max fuel	664 n miles (1,230 km; 3,765 miles)

UPDATED

Aero Boero 180 RVR glider tug 1995

AERO BOERO 150

TYPE: Two/three-seat light aircraft, similar to AB 115, but with a more powerful engine. *Description as AB 115 except where noted.*

POWER PLANT: One 112 kW (150 hp) Textron Lycoming O-320-A2B flat-four engine.

EQUIPMENT: Hopper for 280 litres (74.0 US gallons; 61.6 Imp gallons) of insecticide.

WEIGHTS AND LOADINGS:

Max power loading	7.17 kg/kW (11.79 lb/hp)

PERFORMANCE (at max T-O weight):

Cruising speed	97 kts (180 km/h; 112 mph)
Max rate of climb at S/L	240 m (787 ft)/min
T-O run	100 m (328 ft)
Landing run	75 m (246 ft)

NEW ENTRY

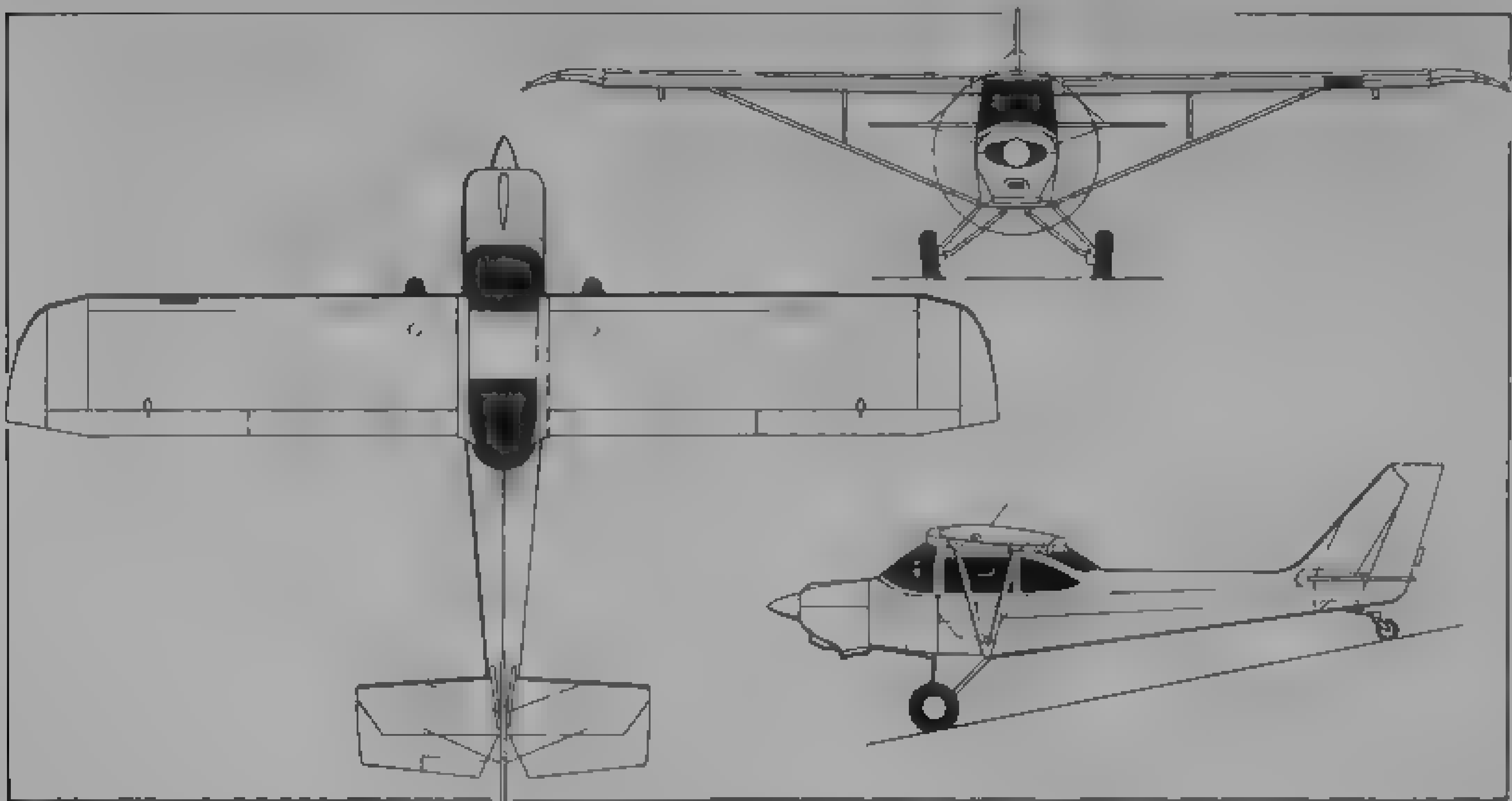
AERO BOERO 180 RVR and 180 AG

TYPE: Single/three-seat glider tug, agricultural and general purpose light aircraft.

PROGRAMME: AB 180 RV and AB 180 SP described in earlier editions; AB 180 RVR ordered by Brazil.

Aero Boero 180 AG with ventral chemical pod and spraybars

1995



Aero Boero 180 RVR (Textron Lycoming O-360-A1A engine) *(Jane's/Mike Keep)*

1993

CURRENT VERSIONS: **AB 180 RVR.** Standard version, *as described*

AB 180 AG. As AB 180 RVR but with provision for spraybars, agricultural chemicals and pod under fuselage

AB 180 PSA. Two-seat preselection version, described separately

CUSTOMERS: Total of 77 for Brazil, 60 delivered by early 1995, civil customers in Argentina

DESIGN FEATURES: As AB 115, stepped fuselage with added cabin rear window

FLYING CONTROLS: As AB 115, plus ground adjustable tab on rudder

STRUCTURE: As AB 115 except for Ceconite covering instead of Dacron

POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-A1A flat-four engine, driving a Sensenich 76-EM8 fixed pitch or Hartzell HC-92ZK-8D constant-speed two-blade propeller. Fuel capacity (two aluminium wing tanks) 200 litres (53 US gallons, 44 Imp gallons); oil capacity 8 litres (2.1 US gallons, 1.75 Imp gallons)

ACCOMMODATION: Pilot and two passengers

EQUIPMENT: Glider towing hook

DIMENSIONS, EXTERNAL: As for AB 115

AREAS: As for AB 115

WEIGHTS AND LOADINGS:

Weight empty	602 kg (1,327 lb)
Max T-O weight	890 kg (1,962 lb)
Max wing loading	51.12 kg/m² (10.47 lb/sq ft)
Max power loading	6.64 kg/kW (10.90 lb/hp)

PERFORMANCE (at max T-O weight except where indicated):

Never-exceed speed (VNE)	132 kts (245 km/h; 152 mph)
Max level speed at S/L	122 kts (225 km/h; 140 mph)
Max cruising speed at S/L	108 kts (201 km/h; 125 mph)
Stalling speed, flaps down	40 kts (73 km/h; 45 mph)
Max rate of climb at S/L	312 m (1,025 ft)/min
Rate of climb: with single-seat sailplane	more than 180 m (590 ft)/min
with two-seat sailplane	120 m (394 ft)/min
Time to 600 m (1,970 ft), 75% power, with Blanik two-seat sailplane	3 min 10 s
Service ceiling	more than 7,000 m (22,965 ft)
T-O run	100 m (330 ft)
T-O to 15 m (50 ft), two persons	188 m (615 ft)
Landing from 15 m (50 ft)	160 m (525 ft)
Landing run	60 m (195 ft)
Range with max fuel	636 n miles (1,180 km; 733 miles)

UPDATED

AERO BOERO 180 PSA

TYPE: Two-seat preselection aircraft (PSA), for assessment of potential pilots for training

PROGRAMME: First flight October 1992; tested for Argentine certification; customers and production plans not yet known

DESIGN FEATURES: Modified AB 180, *details as for AB 180 RVR except as follows*

POWER PLANT: Fuel capacity 176 litres (46.5 US gallons, 38.7 Imp gallons)

ACCOMMODATION: Tandem seats for instructor and pupil. Baggage compartment aft of seats, with external access

SYSTEMS: 12 V 35 Ah battery

AVIONICS: *Comms:* Bendix/King KX 155 VHF radio, and ATC transponder

Flight: Bendix/King VOR

DIMENSIONS, EXTERNAL:

Wing span	10.90 m (35 ft 9¼ in)

DIMENSIONS, INTERNAL:

Baggage compartment volume	0.21 m³ (7.42 cu ft)

AREAS:

Wings, gross	17.28 m² (186.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	640 kg (1,411 lb)
Max T-O weight	890 kg (1,962 lb)
Max wing loading	51.50 kg/m² (10.55 lb/sq ft)
Max power loading	6.64 kg/kW (10.90 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	132 kts (245 km/h; 152 mph)
Cruising speed	107 kts (198 km/h; 123 mph)
Landing speed	46 kts (84 km/h; 53 mph)
Stalling speed: flaps up	45 kts (82 km/h; 51 mph)
flaps down	43 kts (79 km/h; 49 mph)
Max rate of climb at S/L	312 m (1,023 ft)/min
T-O run	85 m (279 ft)
Landing run	88 m (289 ft)

UPDATED

AERO BOERO 260 AG

TYPE: Single-seat agricultural aircraft

PROGRAMME: Prototype first flown 23 December 1972; certification planned for 1983, but not achieved; project suspended. Marketing now resumed, intended production version has single seat

DESIGN FEATURES: Low-wing monoplane. Wings strut braced, leading-edge fence at about half span. Tailplane wire braced top and bottom. Wing dihedral 5°; no dihedral on tailplane

FLYING CONTROLS: Conventional mechanical controls. Trim tab in port elevator

LANDING GEAR: Non-retractable tailwheel type with large low-pressure mainwheel tyres

POWER PLANT: One 194 kW (260 hp) Textron Lycoming O-540-H2B5D engine. Fuel capacity 240 litres (63.4 US gallons, 52.8 Imp gallons)

ACCOMMODATION: Enclosed single-seat cabin, baggage space behind pilot

Aero Boero 180 PSA tandem-seat preselection aircraft

1995

Two-seat prototype of Aero Boero 260 AG agricultural aircraft

1995

SYSTEMS: Hydraulic mainwheel brakes; electrical system 12 V

AVIONICS: Customer specified

EQUIPMENT: Hopper for 550 litres (145.2 US gallons, 121 Imp gallons) of insecticide

DIMENSIONS, EXTERNAL:

Wing span	10.90 m (35 ft 9¼ in)
Wing aspect ratio	6.88
Length overall	7.30 m (23 ft 11¼ in)
Height overall	1.97 m (6 ft 5½ in)
Tailplane span	3.10 m (10 ft 2 in)
Wheel track	2.15 m (7 ft 0½ in)
Wheelbase	5.04 m (16 ft 6½ in)

AREAS:

Wings, gross	17.28 m² (186.0 sq ft)

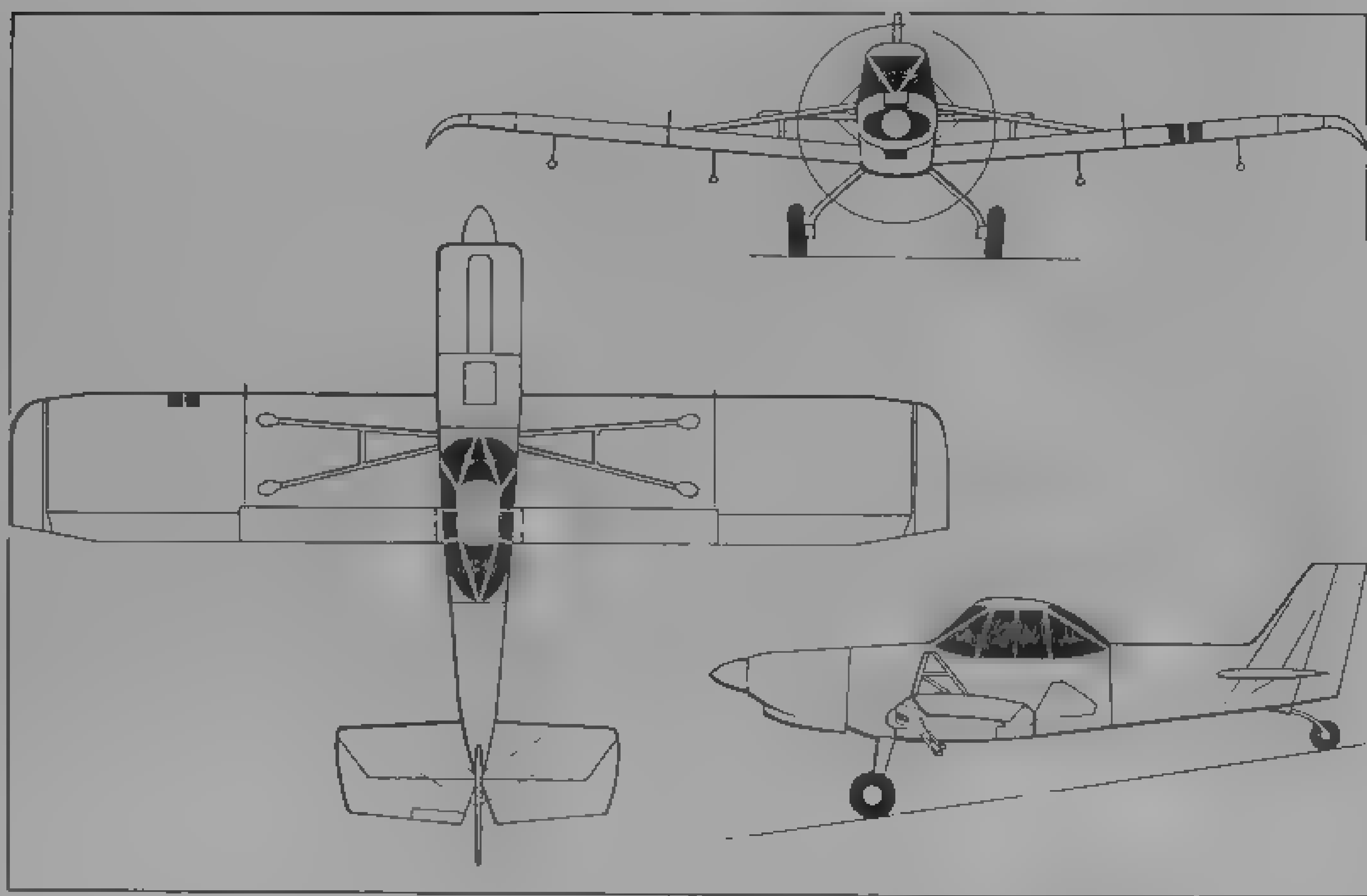
WEIGHTS AND LOADINGS:

Weight empty	690 kg (1,521 lb)
Max payload	660 kg (1,455 lb)
Max T-O and landing weight	1,350 kg (2,976 lb)
Max wing loading	78.1 kg/m² (16.0 lb/sq ft)
Max power loading	6.97 kg/kW (11.45 lb/hp)

PERFORMANCE (at max T-O weight):

Max level speed at S/L	135 kts (250 km/h; 155 mph)
Max cruising speed	119 kts (220 km/h; 137 mph)
Stalling speed, power off:	
flaps up	49 kts (90 km/h; 56 mph)
flaps down	43 kts (80 km/h; 50 mph)
Rate of climb at S/L	300 m (984 ft)/min
T-O run	270 m (886 ft)
Landing run	150 m (492 ft)

NEW ENTRY



Production version of Aero Boero 260 AG *(Jane's/James Goulding)*

1995

CHINCUL

CHINCUL S. A. C. A. I. F. I.

Licensed assembly of Piper aircraft has been terminated. Refer to 1993-94 and earlier *Jane's* for details.

UPDATED

FMA

FÁBRICA MILITAR DE AVIONES SA

Avenida Fuerza Aérea Argentina Km 5½, 5103 Córdoba

Telephone: 54 (51) 690594

Fax: 54 (51) 690698

Telex: 51965 AMCOR AR

BOARD OF MANAGEMENT:

Eng Hilario Francisco Luciano (Commercial) (President)

Eng Osvaldo Ricardo Giraudo (Production) (Vice-President)

Eng Alberto Osvaldo Buthet (Technical)

Jorge Alberto Carrizo (Finance)

Dr Juan Luis Smekens (Industrial Relations)

Original FMA (Military Aircraft Factory) came into operation 10 October 1927 as central organisation for aeronautical research and production, underwent several name changes (see 1987-88 and earlier *Jane's*) before reverting 1968 to original title as component of Area de Material Córdoba (AMC) of Argentine Air Force. Principal activities are aircraft design, manufacture, maintenance and repair, major current product being IA 63 Pampa jet trainer; laboratories, factories and other aeronautical division buildings occupy total covered area of 253,000 m² (2,723,275 sq ft); AMC had workforce of about 2,100 in early 1995, of whom about 1,300 engaged in design and manufacturing. Córdoba facility also accommodates Centro de Ensayos en Vuelo (Flight Test Centre), a separate division also controlled by Argentine Air Force, at which all aircraft produced in Argentina undergo certification testing.

Argentine government has legislated to privatise most national defence companies, including FMA; this required Argentine Air Force to convert FMA into a joint stock company from April 1992, Air Force buying 30 per cent of the shares to establish itself as FMA's holding and management authority; government would sell remaining 70 per cent to private investors at stock exchange valuation. In pursuance of this, as per Argentine Ministry of Defence (MoD) resolution, AMC control of FMA handed over to Planning Secretary of MoD on 20 December 1993. MoD and Lockheed Aircraft Argentina SA signed concession agreement on 15 December 1994, allocating management of FMA to Lockheed Martin from 1 July 1995.

UPDATED

FMA IA 63 Pampa two-seat basic and advanced jet trainer *(Jane's/Dennis Punnett)*

1983

FMA IA 63 PAMPA

TYPE: Basic and advanced jet trainer and ground attack aircraft.

PROGRAMME: Initiated by Fuerza Aérea Argentina (FAA) 1979, eventual configuration being selected over six other designs early 1980, with Dornier of Germany providing technical assistance (incl manufacture of prototypes' wings and tailplanes); two static/fatigue test airframes and three flying prototypes built (first flight by EX-01, 6 October 1984); first flight of production Pampa October 1987, first three production aircraft delivered (to IV Brigada Aérea at Mendoza) April 1988.

CURRENT VERSIONS: **Pampa**: Standard Argentine Air Force version, *detailed description applies to this version*. First six aircraft retrofitted with Argentine Air Force developed HUD (to become standard for all existing and future production Pampas); aircraft in service refitted with Elbit autonomous WDNS (weapon delivery and navigation system).

Naval version: Development in abeyance, Argentine Navy now interested in acquiring Air Force version.

Pampa 2000 International: Version proposed, with Vought (ex-LTV) and Loral as FMA's partners, for USAF/USN JPATS trainer programme; second prototype EX-02 and series aircraft E-812 supplied to USA for modification to Pampa 2000 configuration including TFE731-2-2B engine and Bendix/King avionics, E-814 delivered during 1992; EX-02 lost in aerobatics practice crash in UK 31 August 1992. Pampa eliminated from JPATS contest, November 1994.

CUSTOMERS: Firm orders for 18 for Argentine Air Force (14 delivered by 1 January 1994 to II Escuadron of 4 Grupo de Caza at El Plumerillo, Mendoza), follow-on order for 46 expected following privatisation. Argentine Navy considering an initial 14. Reported interest from Canada, Israel and Mexico.

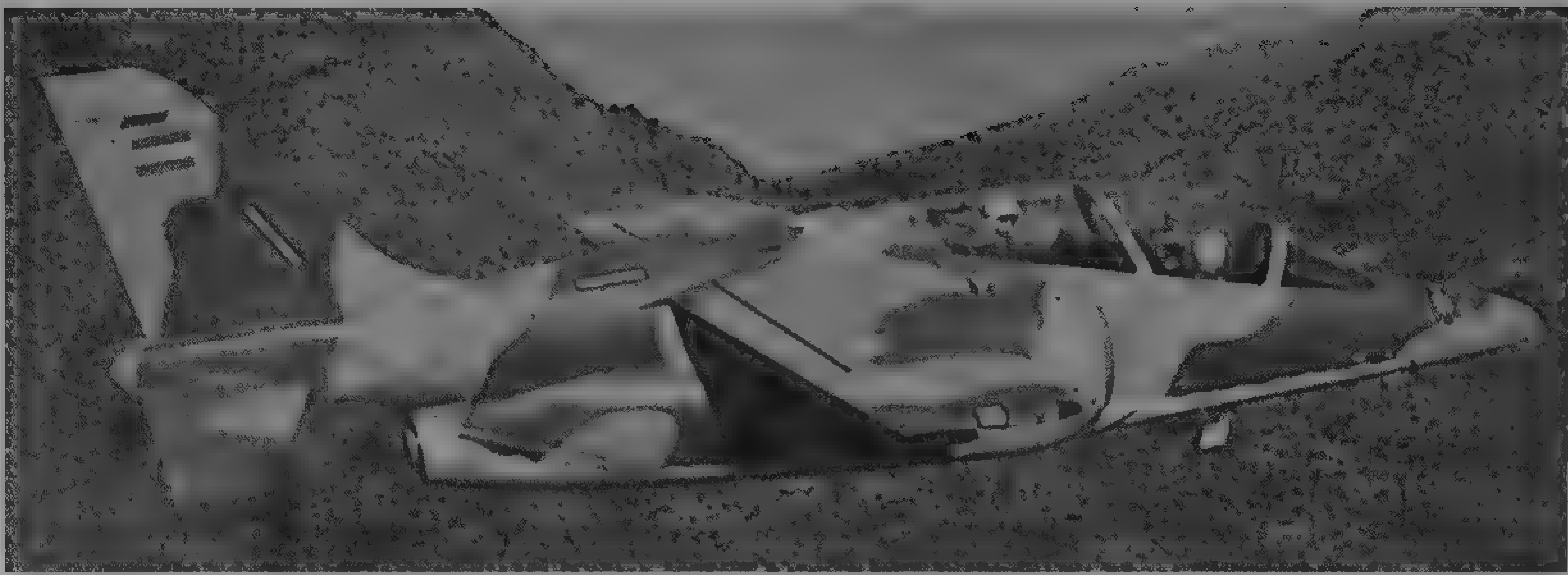
COSTS: Total Argentine Air Force programme $190 million, flyaway unit cost $3.5 million.

DESIGN FEATURES: Non-swept shoulder mounted wings and anhedral tailplane, sweptback fin and rudder; single engine with twin lateral air intakes. Wing section Dornier DoA-7/-8 advanced transonic; thickness/chord ratio 14.5 per cent at root, 12.5 per cent at tip; anhedral 3°.

FLYING CONTROLS: Hydraulically powered ailerons, rudder, all-moving tailplane, single-slotted Fowler flaps, and door type airbrake on each side of upper rear fuselage; primary surfaces have Liebherr tandem actuators and electromechanical trim.

STRUCTURE: Conventional all-metal semi-monocoque/stressed skin; two-spar wing box forms integral fuel tank.

LANDING GEAR: SHL (Israel) retractable tricycle type, with hydraulic extension/retraction and emergency free-fall extension. Oleo-pneumatic shock-absorbers. Single Messier Bugatti wheel and Goodrich (main) or Continental (nose) low-pressure tyre, nosewheel offset 10 cm (3.9 in) to starboard. Tyre sizes 6.50-10 (10 ply rating) on



IA 63 Pampa tandem-seat jet trainer in Argentine Air Force camouflage

1993

mainwheels, 380 × 150 mm (4 to 6 ply rating) on nosewheel, with respective pressures of 6 55 bars (95 lb/sq in) and 4 00 bars (58 lb/sq in). Nosewheel retracts rearward, mainwheels inward into underside of engine air intake trunks. Messier-Bugatti mainwheel hydraulic disc brakes incorporate anti-skid device; nosewheel steering (±47°). Gear designed for operation from unprepared surfaces

POWER PLANT: One 15 57 kN (3,500 lb st) AlliedSignal TFE731 2 2N turbofan (-2B in Pampa 2000) installed in rear fuselage. Standard internal fuel capacity of 968 litres (255 US gallons; 213 Imp gallons) in integral wing tank of 550 litres (145 US gallons, 121 Imp gallons) and 418 litre (110 US gallon, 92 Imp gallon) flexible fuselage tank with a negative *g* chamber permitting up to 10 seconds of inverted flight. Additional 415 litres (109 US gallons, 91 Imp gallons) can be carried in auxiliary tanks inside outer wing panels, to give a maximum internal capacity of 1,383 litres (364 US gallons, 304 Imp gallons). Single-point pressure refuelling, plus gravity point in upper surface of each wing

ACCOMMODATION: Tandem, rear seat elevated, on UPC (Stencel) S-III-S3IA63 zero/zero ejection seats. Ejection procedure can be preselected for separate single ejections, or for both seats to be fired from front or rear cockpit. Dual controls standard. One-piece wraparound windscreen. One-piece canopy, with internal screen, is hinged at rear and opens upward. Entire accommodation pressurised and air conditioned

SYSTEMS: AiResearch environmental control system, maximum differential 0.3 bar (4 35 lb/sq in), supplied by high or low pressure engine bleed air, provides a 1,980 m (6,500 ft) cockpit environment up to flight level 5,730 m (18,800 ft) and also provides ram air for negative *g* system and canopy seal. Oxygen system supplied by 10 litre (2 64 US gallon, 2 20 Imp gallon) lox converter. Engine air intakes anti-iced by engine bleed air. Two independent hydraulic systems, each at pressure of 207 bars (3,000 lb/sq in), each supplied by engine-driven pump. Each system incorporates a bootstrap reservoir pressurised at 4 bars (58 lb/sq in). No. 1 system, with flow rate of 16 litres (4 2 US gallons, 3 5 Imp gallons)/min, actuates primary flight controls, airbrakes, landing gear and wheel brakes. No. 2 system, with flow rate of 8 litres (2.1 US gallons, 1 75 Imp gallons)/min, actuates primary flight controls, wing flaps, emergency and parking brakes, and nosewheel steering. AiResearch ram air turbine provides emergency hydraulic power for No. 2 system if engine shuts down in flight and pressure in this system drops below minimum. Electrical system (28 V DC) supplied by Lear Siegler 400 A 11 5 kW engine driven starter/generator, secondary supply (115/26 V AC power at 400 Hz) from two Flite-Tronics 450 VA static inverters and two SAFT 27 Ah Ni/Cd batteries. Thirty minutes emergency electrical power available in case of in flight engine shutdown

AVIONICS: *Comms:* Two Collins VHF com transceivers, Becker intercom system

Flight: Collins VOR/ILS with marker beacon receiver, Collins DME, and Collins ADF. Navigation system allows complete navigation/landing training under IFR conditions. Attitude and heading information provided by Astronautics three-gyro platform, with magnetic flux valve compass for additional heading reference

ARMAMENT: Five stations for external stores, with maximum pylon load of 400 kg (882 lb) on centreline and each inboard underwing station, 250 kg (551 lb) each on outboard underwing pair. With a 30 mm gun pod containing 145 rounds on the fuselage station, typical underwing loads can include six Mk 81 bombs, two each Mk 81 and Mk 82 bombs, or one 7 62 mm twin-gun pod and one practice bomb/rocket training container. Gyrostabilised sighting system in front cockpit (optional in rear cockpit), with recorder in front sight. Weapon management system for several different configurations

DIMENSIONS, EXTERNAL:
Wing span 9 686 m (31 ft 9¼ in)
Wing aspect ratio 6 00
Length overall 10 90 m (35 ft 9¼ in)
Height overall 4 29 m (14 ft 1 in)
Tailplane span 4 576 m (15 ft 0⅛ in)
Wheel track 2 663 m (8 ft 8¾ in)
Wheelbase 4 418 m (14 ft 6 in)

AREAS:
Wings, gross 15.633 m² (168 27 sq ft)
Ailerons (total) 0 894 m² (9.62 sq ft)
Trailing-edge flaps (total) 2 928 m² (31.52 sq ft)
Fin 1.863 m² (20 05 sq ft)
Rudder 0 655 m² (7.05 sq ft)
Tailplane 4 354 m² (46 87 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 2,821 kg (6,219 lb)
Fuel load:
wings (incl auxiliary tanks) 780 kg (1,719 lb)
fuselage 338 kg (745 lb)
Max underwing load with normal internal fuel 1,160 kg (2,557 lb)
T-O weight, clean configuration:
968 l internal fuel 3,700 kg (8,157 lb)
1,383 l internal fuel 3,800 kg (8,377 lb)
Max T-O weight with external stores 5,000 kg (11,023 lb)
Typical landing weight 3,500 kg (7,716 lb)
Wing loading:
at clean T-O weight:
968 l internal fuel 236.72 kg/m² (48.51 lb/sq ft)
1,383 l internal fuel 243 12 kg/m² (49 82 lb/sq ft)
at max T-O weight with external stores 319 90 kg/m² (65 55 lb/sq ft)
Power loading:
at clean T-O weight:
968 l internal fuel 237 8 kg/kN (2.33 lb/lb st)
1,383 l internal fuel 244 2 kg/kN (2 39 lb/lb st)
at max T-O weight with external stores 321 4 kg/kN (3 15 lb/lb st)

PERFORMANCE (ISA, at 3,800 kg, 8,377 lb clean T-O weight with max internal fuel, except where indicated):
Max level speed at S/L 405 kts (750 km/h, 466 mph)
Approach speed at S/L, landing weight of 3,630 kg (8,000 lb) 120 kts (222 km/h, 138 mph)
Stalling speed 92 kts (171 km/h, 106 mph)
Max rate of climb: at S/L 1,560 m (5,120 ft)/min
at 4,575 m (15 000 ft) 1,215 m (3,990 ft)/min
Max rate of roll 150°/s
Service ceiling 12,900 m (42,325 ft)
T-O run at S/L, AUW of 3,700 kg (8,157 lb) 424 m (1,390 ft)
Landing run at landing weight of 3,500 kg (7,716 lb) 461 m (1,512 ft)
Typical mission radius:
air-to-air gunnery (hi-hi), T-O weight of 3,950 kg (8,708 lb) with 250 kg (551 lb) external load, 5 min allowance for dogfight, 30 min reserves 237 n miles (440 km, 273 miles)
air-to-ground (hi-lo-hi), T-O weight of 4,860 kg (10,714 lb) with 1,000 kg (2,205 lb) external load, 5 min allowance for weapon delivery, 30 min reserves 194 n miles (360 km; 223 miles)
Range at 300 kts (556 km/h, 345 mph) at 4,000 m (13,125 ft):
968 l internal fuel 540 n miles (1 000 km 621 miles)
1,383 l internal fuel 809 n miles (1,500 km, 932 miles)
Ferry range at 280 kts (519 km/h; 322 mph) at 10,060 m (33,000 ft), max internal/external fuel 1,000 n miles (1,852 km, 1,151 miles)
Max endurance at 300 kts (556 km/h, 345 mph) at 4,000 m (13,125 ft), 1,383 l internal fuel 3 h 48 min
g limits +6/−3 (+4.5 max sustained)

UPDATED

OTHER AIRCRAFT

Joint-venture **CBA-123 Vector** regional transport with Embraer of Brazil was terminated in 1994. Refer to International section of 1994-95 *Jane's*

NEW ENTRY

IA 63 being test-flown by Vought as Pampa 2000 JPATS candidate

1994

AUSTRALIA

AAI

AUSTRALIAN AIRCRAFT INDUSTRIES PTY LTD

25 Welsford Street (PO Box 814), Shepparton, Victoria 3630
Telephone: 61 (58) 31 1488
Fax: 61 (58) 31 1386
CEO: Brian Marrison
CHIEF ENGINEER: Jess Smith

AAI became responsible for Mamba aircraft programme in 1994 in succession to Aviation Industries of Australia (AIA).

AAI AA-2 MAMBA

TYPE: Two-seat light aircraft.

PROGRAMME: Initiated by Melbourne Aircraft Corporation, continued by AIA, currently developed by AAI. Prototype (VH-JSA) made first flight 25 January 1989, original 86.5 kW (116 hp) Textron Lycoming O-235 later replaced by O-320-D1A; first flight of preproduction Mamba December 1989; developmental C of A received 1991.

CURRENT VERSIONS: **AA-2A**: Basic model, with O-320 engine.
Detailed description applies to this version except where indicated.

AA-2C: Civil model.

AA-2M: Military model, more powerful IO-360 engine and additional instrumentation.

DESIGN FEATURES: Braced high-wing monoplane with extensively glazed cabin, slender fuselage and slightly sweptback vertical tail surfaces. Wing section NACA 4412 (constant); dihedral 1° 30′ from roots; stores hardpoint under each wing outboard of strut.

FLYING CONTROLS: Frise type differential ailerons, rudder and elevator, all mechanically actuated; electrically actuated split flaps on wing trailing-edges; servo tab in each aileron, trim tab in one elevator.

STRUCTURE: All-metal except for marine ply belly, with 4130 chromoly steel tube fuselage frame, two-spar wings and aluminium alloy skins; wings braced by single I strut each side.

LANDING GEAR: Non-retractable tricycle type. Cantilever self-sprung mainwheel legs, each with Cleveland wheel and Dunlop 6.00-6 × 4 tyre. Cleveland tailwheel has 5.00-5 × 4 Dunlop tyre and is steerable ±30°. Mainwheel brakes. Dual brakes (toe front/hand rear) standard in AA-2M. Wheel fairings optional.

POWER PLANT: One 119 kW (160 hp) Textron Lycoming O-320-D1A flat-four engine in AA-2A (149 kW, 200 hp IO-360-A1B6 in AA-2M), driving a Hartzell two-blade propeller. Internal fuel capacity 327 litres (86 US gallons, 72 Imp gallons); provision for auxiliary fuel tank under each wing inboard of strut. Inverted flight fuel system, turbocharging and (on AA-2A) fuel injection engine optional. Oil capacity 9.1 litres (2.4 US gallons, 2 Imp gallons).

Prototype AAI AA-2 Mamba two-seat light aircraft 1993

ACCOMMODATION: Two seats in tandem in heated ventilated cabin. Dual flight and engine controls standard. Door on starboard side. Space for 20 kg (44 lb) of baggage aft of seats. Rear baggage compartment on AA-2M.

SYSTEMS: 14 V or 28 V DC electrical system (50 A alternator).

AVIONICS: *Comms*: Radio to customer's requirements.
Instrumentation: Basic VFR in AA-2A, to which are added artificial horizon, directional gyro, clock, accelerometer and instrument panel lights in AA-2M.

EQUIPMENT: Flashing beacon and navigation/landing/taxi lights standard on AA-2M.

DIMENSIONS, EXTERNAL:

Wing span	8.36 m (27 ft 5 in)
Wing aspect ratio	7.52
Length overall	7.47 m (24 ft 6 in)
Height overall	2.74 m (9 ft 0 in)

AREAS:

Wings, gross	9.29 m² (100.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty (standard fuel):	
AA-2A, AA-2M	635 kg (1,400 lb)
Max T-O weight with external stores:	
AA-2A	907 kg (2,000 lb)
AA-2M	1,043 kg (2,300 lb)
Max wing loading: AA-2A	97.65 kg/m² (20.0 lb/sq ft)
AA-2M	112.30 kg/m² (23.0 lb/sq ft)
Max power loading: AA-2A	7.62 kg/kW (12.50 lb/hp)
AA-2M	7.00 kg/kW (11.50 lb/hp)

PERFORMANCE (estimated, at above max T-O weights, ISA):

Max level speed at S/L:	
AA-2A	125 kts (232 km/h; 144 mph)
AA-2M	135 kts (250 km/h; 155 mph)
Max cruising speed (75% power) at S/L:	
AA-2A	115 kts (213 km/h; 132 mph)
AA-2M	123 kts (228 km/h; 142 mph)
Max cruising speed (75% power) at 2,440 m (8,000 ft):	
AA-2A	120 kts (222 km/h; 138 mph)
AA-2M	125 kts (232 km/h; 144 mph)
Stalling speed, power off:	
flaps up:	
AA-2A, AA-2M	60 kts (111 km/h; 69 mph) EAS
flaps down:	
AA-2A, AA-2M	45 kts (84 km/h; 52 mph) EAS
Max rate of climb at S/L: AA-2A	335 m (1,100 ft)/min
AA-2M	610 m (2,000 ft)/min
Service ceiling: AA-2A	4,265 m (14,000 ft)
AA-2M	4,875 m (16,000 ft)
T-O run: AA-2A, 30° flap	153 m (500 ft)
AA-2M, 20° flap	92 m (300 ft)
T-O to 15 m (50 ft): AA-2A	305 m (1,000 ft)
AA-2M	214 m (700 ft)
Range at 2,440 m (8,000 ft) at max cruising speed (75% power), standard fuel, no reserves:	
AA-2A	684 n miles (1,267 km; 787 miles)
AA-2M	625 n miles (1,158 km; 719 miles)

NEW ENTRY

AIA

AVIATION INDUSTRIES OF AUSTRALIA PTY LTD

AIA renamed Australian Aircraft Industries (see above).

UPDATED

AIRCORP

AIRCORP PTY LTD

No further development work on the Bushmaster light aircraft has been reported. Refer to 1993-94 *Jane's* for details.

UPDATED

ASTA

AEROSPACE TECHNOLOGIES OF AUSTRALIA PTY LTD

Previously responsible for assembly and flight test of AF/ATF-18 Hornets for the RAAF (refer McDonnell Douglas in the US section). ASTA no longer produces complete aircraft, but participates in several subcontract programmes. Detailed company profile in 1994-95 *Jane's*. ASTA offered for sale by Australian government in October 1994; purchased by Rockwell Corporation of USA in 1995.

UPDATED

BAC

BUCHANAN AIRCRAFT CORPORATION LTD

Production plans for the BAC 204 Ozzie Mozzie very light aircraft apparently in abeyance. Last described in 1994-95 *Jane's*.

UPDATED

EAPL

EAGLE AIRCRAFT PTY LTD

PO Box 586, Fremantle, Western Australia 6160
Telephone: 61 (9) 410 1077
Fax: 61 (9) 410 2430
WORKS: Lot 700 Cockburn Road Henderson Western Australia 6166
CEO: Peter Schoonens

Eagle Aircraft Pty Ltd (EAPL) was incorporated in Australia on 18 June 1985 as Composite Technology Pty Ltd (CTPL), a subsidiary of Eagle Aircraft Australia (EAA). On 28 May 1993, with the buyout of EAA's shares in CTPL, ownership of EAPL was transferred to Eagle Aircraft Malaysia. See Malaysian section for further details. Up to early 1995, all activity in Australia only

UPDATED

First production Eagle X-TS, showing leading-edge stall strips and fences
1994

EAPL EAGLE X-TS

TYPE: Two-seat general aviation lightplane.

PROGRAMME: Launched 1981 with objective of producing first all-composites light aircraft in Australia, single-seat POC (proof-of-concept) aircraft now displayed at Power House Museum, Sydney; construction of two-seat preproduction prototype started fourth quarter 1987, first flight (VH-XEG) Spring 1988, with 58 kW (78 hp) Aeropower engine, replaced later by 74.5 kW (100 hp) Continental O-200; 200 hour test programme, meeting all original design criteria, completed by October 1988; plans for 1989 production start aborted (see 1991-92 *Jane's*), component manufacture began March 1991, production prototype (VH-XEP) made first flight 6 November 1992, certification by Australian CAA 21 September 1993. European JAR-VLA certificate not awarded and aircraft consequently redesigned with changes including IO-240-B engine and use of pre-impregnated composites. Series production launched August 1993; first flight by production X-TS (VH-AHH) made on 23 October 1993 and first customer delivery December 1993 (VH-FPO to Department of Conservation and Land Management in Western Australia). Initial production in Australia only, but using some Malaysian manufactured components.

CUSTOMERS: Five production aircraft completed by early 1995, nine on order, including six lease aircraft to replace Piper Super Cubs of Department of Conservation.

COSTS: Programme cost A$27 million, standard aircraft A$ 20,000 (1993).

DESIGN FEATURES: Intended primarily for *ab initio* training, recreational flying and surveillance. 'Tri-surface' configuration, with high-mounted mainplane, large low mounted foreplane, and tailplane. Stall strips on foreplane ensure that it stalls before the mainplane.

Mainplane of tailored Roncz aerofoil section, thickness/chord ratio 16 per cent, no sweep; no dihedral.

FLYING CONTROLS: Slotted ailerons on mainplane, elevators on tailplane, and rudder, all with normal manual/mechanical actuation. Pushrods on ailerons and elevators, cables on rudder. Electric pitch trim (tab in starboard elevator), manual roll trim, rudder tab. Electrically actuated single-slotted flaps on foreplane (full span) and mainplane (part span). Leading-edge stall strips, vortex generators and fences on mainplane, stall strips on foreplane. Flap and air flow control systems designed to achieve low stalling speed with relatively high wing loading, to provide good ride quality in turbulence.

STRUCTURE: Except for metal engine mounts and flight control rods, production X-TS built entirely of composites. Wings, fuselage and all control surfaces are Nomex honeycomb or high density foams, sandwiched between multiple layers of carbonfibre, Kevlar reinforcement around wing leading edges and shoulder of mainplane; cockpit is impact-resistant capsule of multilayered Kevlar and carbonfibre; carbonfibre spars. Entire structure uses Eagle-designed vinylester resins for strength/longevity/impact resistance and to minimise 'wet environment' problems inherent in standard epoxies.

LANDING GEAR: Non-retractable tricycle type, with glassfibre/epoxy self-sprung main legs and oleo nose leg. Cleveland 5.00-5 wheel on each unit, with optional speed fairings. Cleveland hydraulic single-disc brakes on mainwheels. Nosewheel steerable 17°. Minimum ground turning radius 5.21 m (17 ft 1 in). Brakes applied by pressure on rudder pedals.

POWER PLANT: One Teledyne Continental IO-240-A or -B flat-four engine (92.3 kW, 125 hp at 2,800 rpm), driving a two blade fixed-pitch wood or metal propeller. Fuel in single tank in fuselage with usable capacity of 97 litres (25.6 US gallons; 21.3 Imp gallons); single filler point in fuselage side. Oil capacity 5.7 litres (1.5 US gallons, 1.25 Imp gallons).

ACCOMMODATION: Two seats side by side with full dual controls. Bubble canopy hinged at front and opens upward.

SYSTEMS: Hydraulic system for manual brake actuation only. 12 V DC electrical system with 60 A alternator.

AVIONICS: *Flight:* Garmin GPS nav, plus standard avionics to customer's specification.

Instrumentation: Conventional flight instruments (all electric gyros), digital engine instruments.

DIMENSIONS, EXTERNAL:

Wing span	7.16 m (23 ft 6 in)
Wing chord, constant	0.74 m (2 ft 5 in)
Wing aspect ratio	9.77
Foreplane span	4.88 m (16 ft 0 in)
Foreplane chord, constant	0.74 m (2 ft 5 in)
Foreplane aspect ratio	6.65
Length overall	6.53 m (21 ft 5 in)
Height overall	2.26 m (7 ft 5 in)
Tailplane span	3.25 m (10 ft 8 in)
Wheel track	1.93 m (6 ft 4 in)
Wheelbase	1.52 m (5 ft 0 in)
Propeller diameter: wood	1.73 m (5 ft 8 in)
metal	1.80 m (5 ft 10¾ in)
Propeller ground clearance (min)	0.28 m (11 in)

DIMENSIONS, INTERNAL:

Cockpit: Length	1.37 m (4 ft 6 in)
Max width	1.07 m (3 ft 6 in)
Max height	0.86 m (2 ft 10 in)

AREAS:

Wings, gross	5.25 m² (56.5 sq ft)
Foreplanes, gross	3.58 m² (38.5 sq ft)
Ailerons (total)	0.40 m² (4.30 sq ft)
Trailing-edge flaps (total)	1.48 m² (15.90 sq ft)
Tailplane	0.93 m² (10.00 sq ft)
Elevators (total)	0.52 m² (5.60 sq ft)

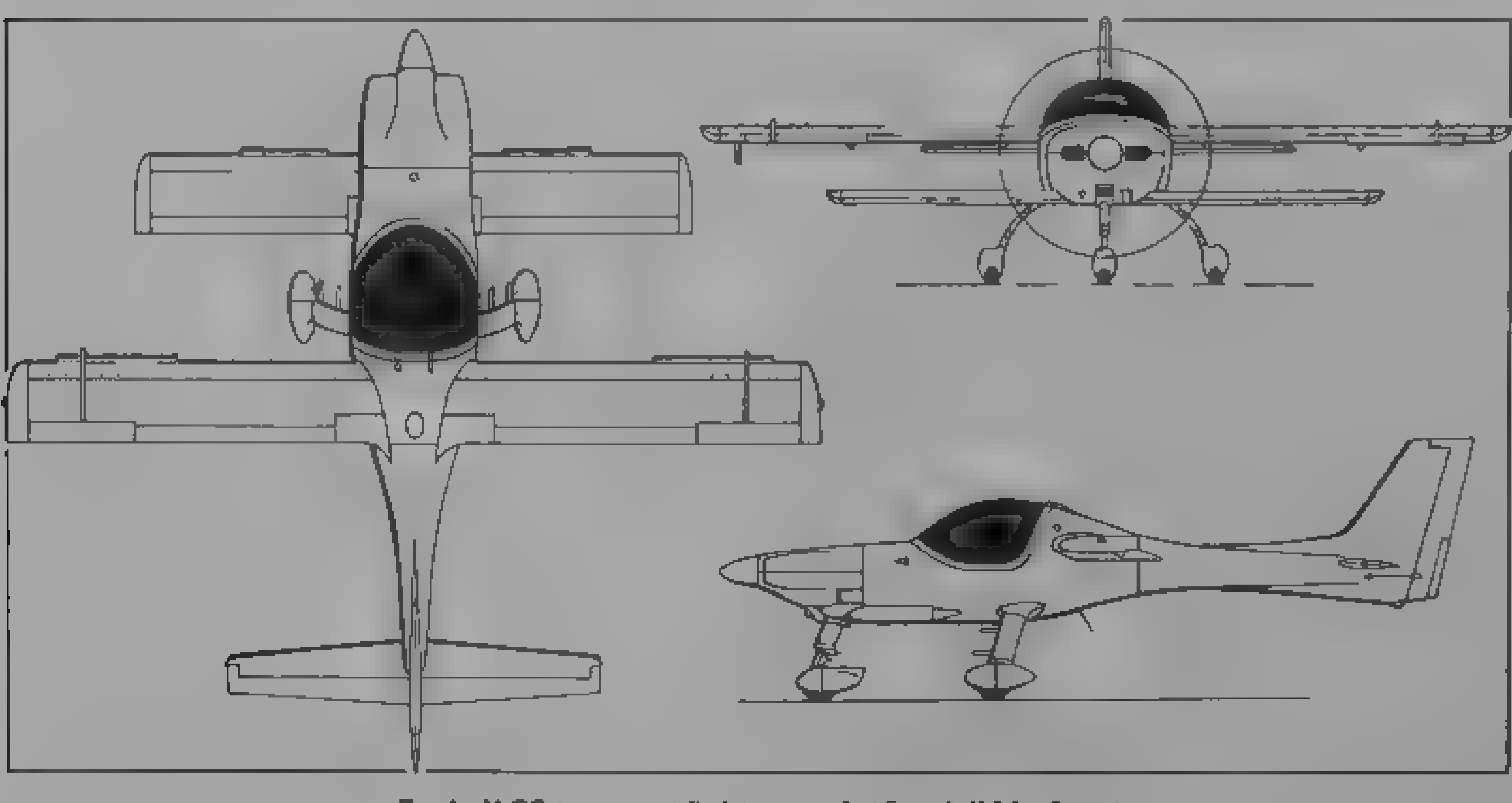
WEIGHTS AND LOADINGS:

Weight empty	422 kg (930 lb)
Max fuel weight	69 kg (152 lb)
Max T-O and landing weight	650 kg (1,433 lb)
Max wing/foreplane loading	73.65 kg/m² (15.08 lb/sq ft)
Max power loading	6.98 kg/kW (11.46 lb/hp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (VNE)	165 kts (305 km/h; 190 mph)
Max level speed at S/L	125 kts (231 km/h; 144 mph)
Max cruising speed (75% power) at 1,980 m (6,500 ft)	120 kts (222 km/h; 138 mph)
Econ cruising speed at 1,980 m (6,500 ft)	110 kts (204 km/h; 126 mph)
Stalling speed at S/L: flaps up	55 kts (102 km/h; 64 mph)
flaps down	45 kts (84 km/h; 52 mph)
Max rate of climb at S/L	193 m (630 ft)/min
Service ceiling	3,655 m (12,000 ft)
T-O run	371 m (1,215 ft)
T-O to 15 m (50 ft)	435 m (1,427 ft)
Landing from 15 m (50 ft)	355 m (1,165 ft)
Landing run	256 m (860 ft)
Range with max fuel	556 n miles (1,030 km; 640 miles)
Endurance (60% power)	5 h
g limits	+3.8/-1.9 (JAR-VLA)
	+8.55/-4.27 (ultimate)

UPDATED



Eagle X-TS two-seat light aircraft *(Jane's/Mike Keep)*
1994

GA

GIPPSLAND AERONAUTICS PTY LTD

PO Box 1478, Traralgon, Victoria 3844
Telephone: 61 (51) 747 855
Fax: 61 (51) 747 947
DIRECTORS:
George Morgan
Peter Furlong
ENGINEERING MANAGER: Bob MacGillivray

Involved since 1971 in modification programmes for wide range of aircraft, from wooden homebuilts to pressurised turboprops. Much of this work involved modifications to light agricultural types, prompting GA to regard these as prototypes' leading eventually to totally new design. Second Gippsland aircraft, GA-8, revealed early 1995.

UPDATED

GIPPSLAND GA-200 FATMAN

TYPE: Two-seat agricultural aircraft.

PROGRAMME: Based on Piper PA-25 Pawnee sprayer; prototype VH-BCE rebuilt from PA-25 (c/n 25-3729) and

registered April 1991; two similar rebuilds in 1992. Full Australian CAA certification in both Normal and Agricultural categories (to CAO 101.16 and 101.22 and FAR Pt 23 Amendment 23-36) awarded 1 March 1991

CURRENT VERSIONS: **Standard version:** *As described in detail.* Optional 0.76 m (2 ft 6 in) wingtip extensions available for short airfield or high-density operation

Ag-trainer: Training version, with dual controls, dual rudder pedals and smaller hopper

CUSTOMERS: Total 16 built by January 1995, including exports to China (six in 1993) and New Zealand (one in October 1994, one in January 1995). Sales totalled 20 by March 1995, including three more for China

DESIGN FEATURES: Braced low-wing design, with large integral hopper forward of cockpit, crash-resistant, corrosion-proofed structure, gap-sealed ailerons, detachable wing tips. Wing dihedral 7° from roots. Flaps and ailerons non-handed

FLYING CONTROLS: Mechanically actuated primary surfaces, single-slotted trailing-edge wing flaps. Interconnect system applies bias to elevator trim spring when flaps extended, to avoid pitch trim changes

STRUCTURE: Fuselage of welded SAE 4130 chromoly steel tube with removable metal side panels; wings (braced by overwing inverted V strut each side) and tail surfaces conventional all metal, wingtips detachable

LANDING GEAR: Non-retractable, with 6 in diameter Cleveland P/N 40-84A mainwheels mounted on tubular steel side Vs, rubber cord shock absorption with hydraulic dampers and Cleveland hydraulic disc brakes. Mainwheel tyres size 8.50 × 6 (6 ply). Scott 3200 steerable/castoring tailwheel, mounted on multileaf flat springs

POWER PLANT: One 194 kW (260 hp) Textron Lycoming O-540-H2A5 flat six engine, driving a McCauley 1A200/FA 84 52 two-blade fixed-pitch metal propeller, as standard; 186 kW (250 hp) O-540-A1D5 available optionally. Fuel in integral tank in each wing, combined usable capacity 200 litres (53 US gallons, 44 Imp gallons), plus small header tank in upper front fuselage. Oil capacity 11.4 litres (3 US gallons, 2.5 Imp gallons)

ACCOMMODATION: Two seats side by side (right-hand seat for loader/driver), dual controls and second set of rudder pedals for right-hand seat in Ag-trainer. Four-point restraint harness(es). Cockpit doors top-hinged, opening upward, with bubble window to improve shoulder room and outward view

Prototype Gippsland GA-200 Fatman agricultural aircraft

1991

SYSTEMS: 14 V 55 A automotive alternator and automotive or R-35 aviation battery for electrical power, 50 A circuit breaker switch serves as master switch

AVIONICS: *Instrumentation:* Basic VFR instruments only

EQUIPMENT: 800 litre (211 US gallon, 176 Imp gallon) capacity hopper in forward fuselage (approximately 50 litres, 13.2 US gallons, 11 Imp gallons less in Ag-trainer). Multi-role door/hopper outlet, eliminating need to change outlet when changing between solids and liquids, can also be used for fire bombing or laying of fire retardants. Spreader vanes can be added to increase swath width. 100 W landing light in each wingtip; 28 V night working lights system (two retractable underwing 600 W lights, powered by separate 55 A alternator) also available

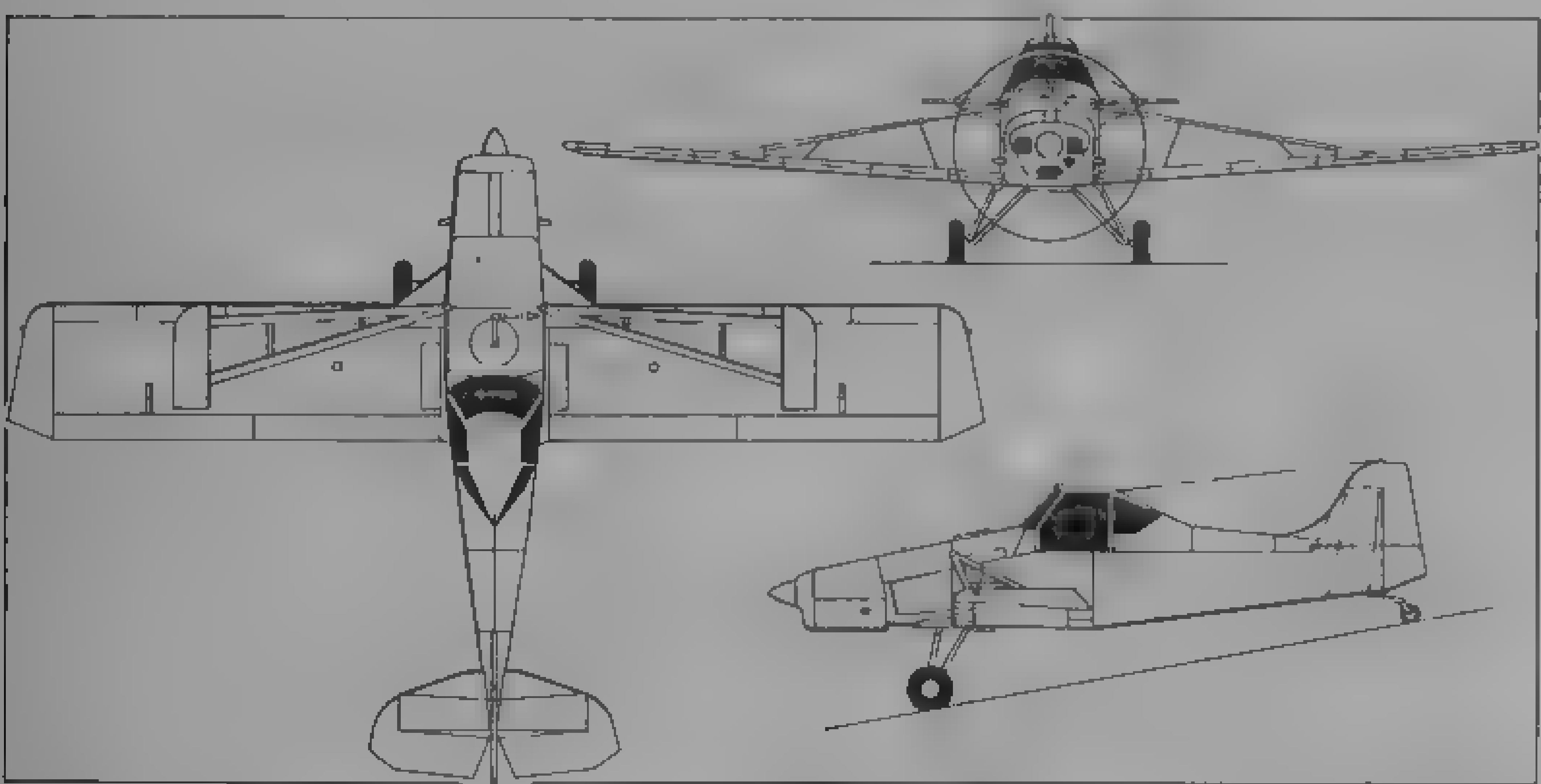
DIMENSIONS, EXTERNAL:
- Wing span, standard: 11.17 m (36 ft 7¾ in)
- Wing chord, constant: 1.60 m (5 ft 3 in)
- Wing aspect ratio: 6.82
- Length overall (flying attitude): 7.48 m (24 ft 6½ in)
- Height (static) over cockpit canopy: 2.33 m (7 ft 7¾ in)
- Tailplane span: 2.90 m (9 ft 6¼ in)
- Wheel track: 2.337 m (7 ft 8 in)
- Propeller diameter: 2.13 m (7 ft 0 in)

AREAS:
- Wings, gross: 18.3 m² (197.0 sq ft)

WEIGHTS AND LOADINGS:
- Operating weight empty: 770 kg (1,698 lb)
- T-O weight: certificated: 1,315 kg (2,899 lb)
  - typical agricultural: 1,700 kg (3,748 lb)
- Max wing loading:
  - certificated: 71.86 kg/m² (14.72 lb/sq ft)
  - typical agricultural: 92.90 kg/m² (19.03 lb/sq ft)
- Max power loading:
  - certificated: 6.78 kg/kW (11.15 lb/hp)
  - typical agricultural: 8.76 kg/kW (14.41 lb/hp)

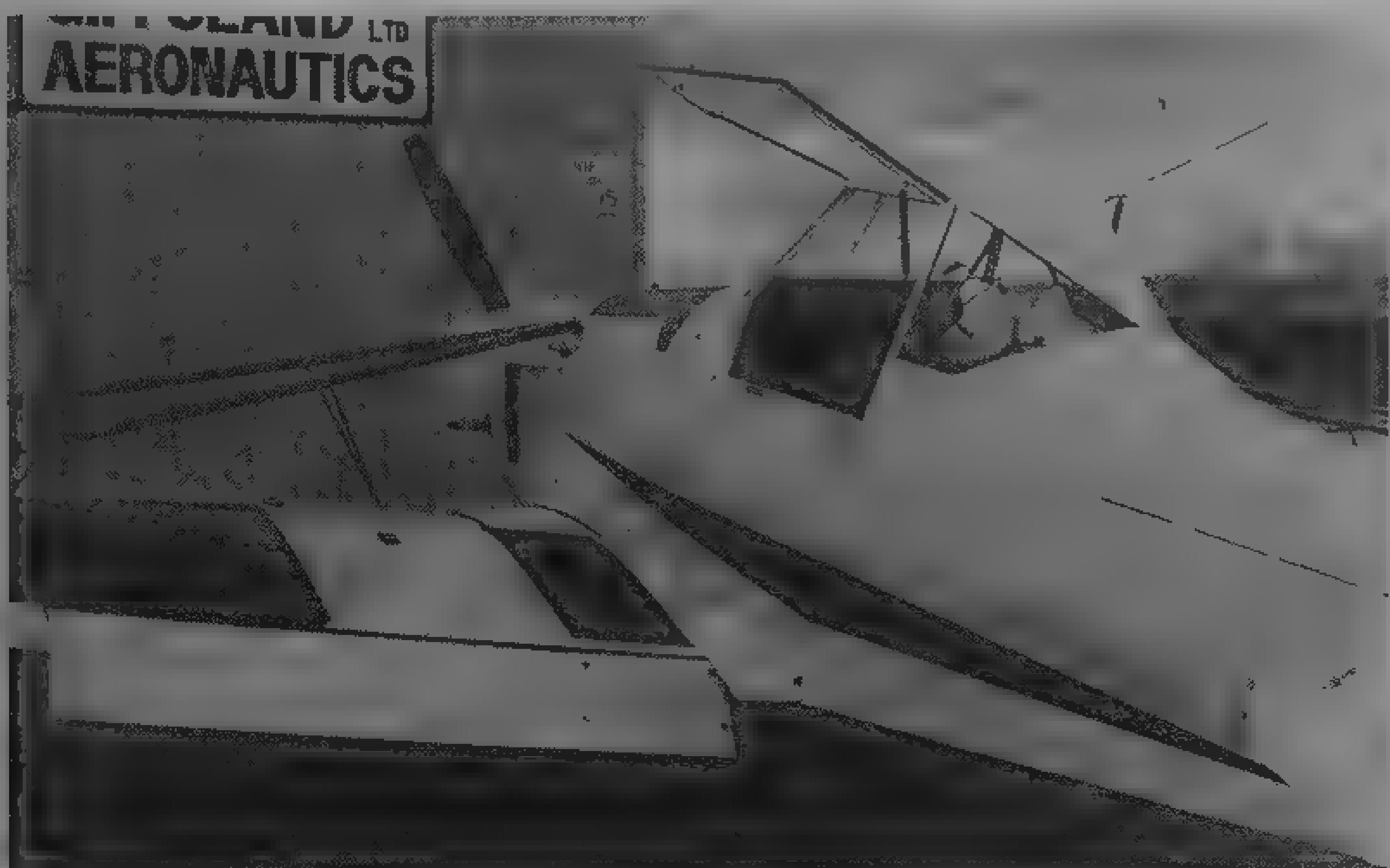
PERFORMANCE (at 1,315 kg, 2,899 lb weight except where indicated):
- Long-range cruising speed (clean) at 305 m (1,000 ft), ISA: 100 kts (185 km/h, 115 mph)
- Stalling speed: flaps up: 54 kts (100 km/h, 62 mph) IAS
  - flaps down: 49 kts (91 km/h, 57 mph) IAS
- Stalling speed at typical landing weight:
  - flaps up: 45 kts (84 km/h, 52 mph) IAS
  - flaps down: 41 kts (76 km/h, 48 mph) IAS
- Max rate of climb (clean) at S/L, ISA: 295 m (970 ft)/min
- T-O run at 1,600 kg (3,527 lb) AUW, 15° flap: 340 m (1,115 ft)

UPDATED



Gippsland GA-200 Fatman in standard two-seat form (*Jane's/Mike Keep*)

1993



Cockpit access and flap detail of the GA-200

1993

GIPPSLAND GA-8 AIRVAN

TYPE: Eight-seat utility aircraft

PROGRAMME: Prototype completed early 1995 and revealed at AirShows DownUnder, March 1995. See Addenda for description, photograph and general arrangement drawing

NEW ENTRY

HDH

HAWKER DE HAVILLAND LIMITED
(Member company of the BTR Group)

Following licensed production of Pilatus PC-9/A turbo-prop trainers and assembly of Sikorsky Black Hawk helicopters, HDH is currently engaged in subcontract work and overhauls of airframes and engines. Recent activities detailed in the 1994-95 *Jane's*

UPDATED

HUGHES

HOWARD HUGHES ENGINEERING PTY LTD

PO Box 89, 11 Smith Drive, Ballina, NSW 2478
Telephone: 61 (66) 86 3148
Fax: 61 (66) 86 8343

No completed examples of the homebuilt LightWing **GR-582, GR-912** and **GA-55** have been registered in Australia since 1992. All were last described in the 1994-95 *Jane's*

UPDATED

JABIRU

JABIRU AIRCRAFT PTY LTD

PO Box 5186, Bundaberg West, Queensland 4670
Telephone: 61 (71) 55 1778
Fax: 61 (71) 55 2669
JOINT MANAGING DIRECTOR: Phil Ainsworth

In conjunction with producing the LSA and ST, Jabiru has developed two engines of its own as alternative power plants.

UPDATED

AVTECH JABIRU LSA (LIGHT SPORT AIRCRAFT) and ST

TYPE: Two-seat very light aircraft.

PROGRAMME: Design started 1987, construction 1988, prototype (first of two, VH-JCX and VH-JQX) made first flight late 1989, first customer delivery April 1991, certificated to CAO 101 55 on 1 October 1991, type certification to US primary sportplane category and Canadian TP 10141E expected in 1995, marketing office opened at Aiken, South Carolina in anticipation of substantial US sales of at least 100 per year. More powerful (59 7 kW, 80 hp) Jabiru engine may be offered as option

CURRENT VERSIONS: **Jabiru**: Three (including prototypes) registered in Australia 1989-90

Jabiru ST: Production version from mid-1994

CUSTOMERS: First Jabiru ST to Townsville Aero Club; further six produced by January 1995 for Southern Skies Aviation, North Queensland Aero Club, Royal Aero Club of Western Australia and two private owners. Several 'subject to certification' orders placed by US Flying schools

COSTS: $52,000 (1994 flyaway)

DESIGN FEATURES: Unswept wing (braced) and tailplane swept fin, dorsal and ventral fins, all flying surfaces square tipped, wings detachable for storage and transportation. Designed to Australian CAO 101 55 and British BCAR Section S, with reference to FAR Pt 23 and JAR-VLA. Wing section NASA 4412, drooped wingtips, dihedral 1° 15', incidence 2° 30', no twist

FLYING CONTROLS: Conventional mechanical by push/pull cables, with in-flight adjustable pitch trim; wide span slotted flaps

STRUCTURE: All-GFRP except metal wing struts, nosewheel assembly and engine mount

LANDING GEAR: Non-retractable tricycle type, with 15° steerable nosewheel coupled to rudder. Cantilever self-sprung GFRP mainwheel legs, rubber block nosewheel shock absorption, speed fairing on each wheel. All three wheels and tyres size 11 × 4 in; tyre pressures 1 79 bars (26 lb/sq in) on main units, 1.03 bars (15 lb/sq in) on nose unit. Hydraulic disc brakes on mainwheels. Minimum ground turning radius (at nosewheel) 5.64 m (18 ft 6 in)

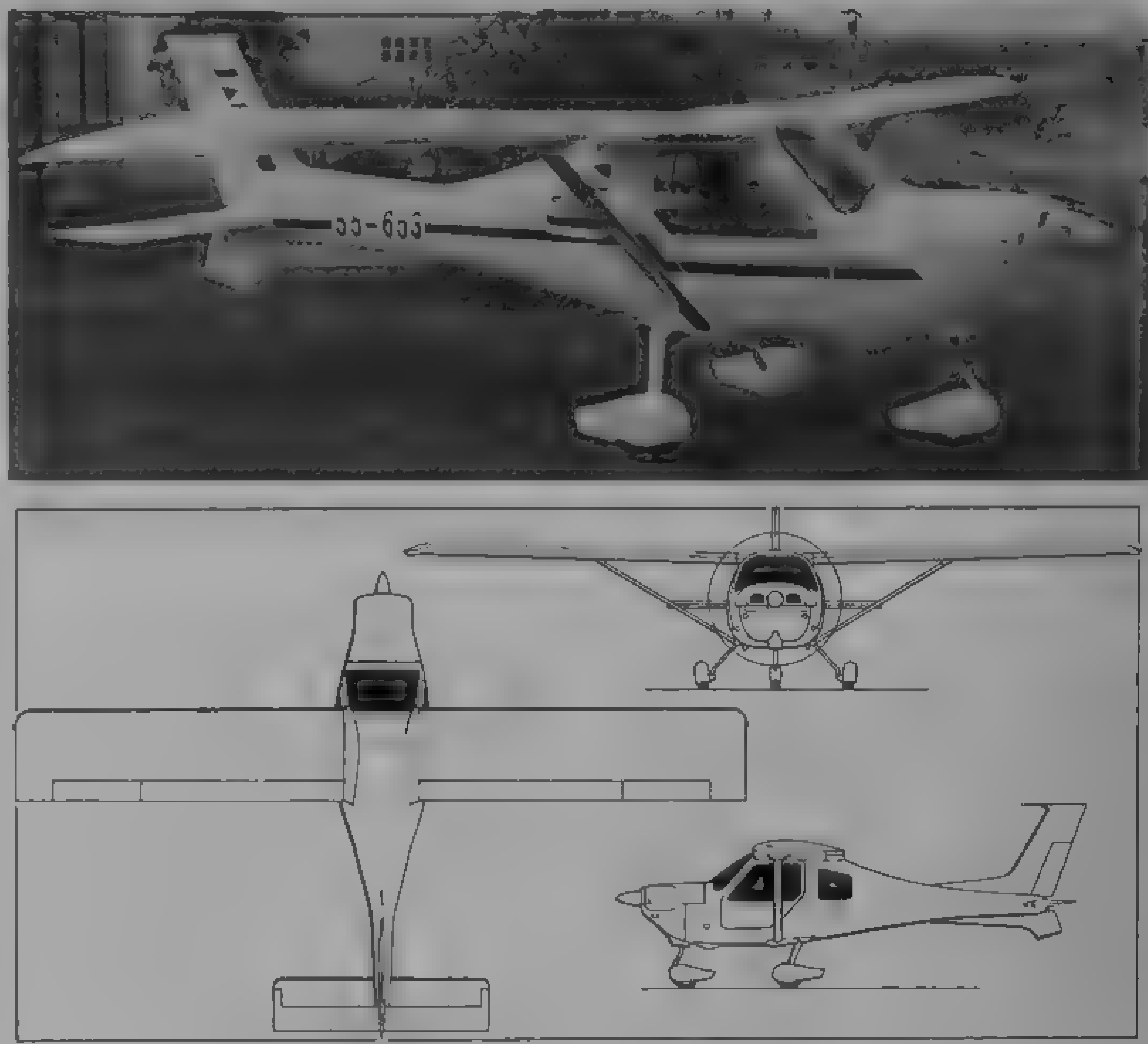
POWER PLANT: One 44.7 kW (60 hp) Jabiru 1600 flat-four engine, with electric starting; two-blade fixed-pitch wooden propeller. Fuel in single fuselage tank, capacity 50 litres (13.2 US gallons, 11 Imp gallons). Oil capacity 2 3 litres (0.61 US gallon, 0.51 Imp gallon)

ACCOMMODATION: Two seats side by side. Forward-opening door on each side. Dual controls and central control stick standard. Cabin heated and ventilated

SYSTEMS: 12 V DC electrical system with 100 W capacity. 20 Ah battery

AVIONICS: *Comms*: VHF antenna (inside fin) standard

Instrumentation: Standard VFR instrumentation and intercom; vacuum instruments optional



Three-view drawing *(Jane's/Mike Keep)* and photograph of the Jabiru LSA side by side two-seat light aircraft

1992

DIMENSIONS, EXTERNAL:	
Wing span	8.03 m (26 ft 4 in)
Wing chord, constant	0.99 m (3 ft 3 in)
Wing aspect ratio	8.16
Length overall	5.00 m (16 ft 5 in)
Fuselage: Max width	1.07 m (3 ft 6 in)
Height overall	2.01 m (6 ft 7 in)
Tailplane span	2.36 m (7 ft 9 in)
Wheel track	1.55 m (5 ft 1 in)
Wheelbase	1.22 m (4 ft 0 in)
Propeller diameter	1.37 m (4 ft 6 in)
Propeller ground clearance	0.28 m (11 in)
Cockpit doors (each): Height	0.69 m (2 ft 3 in)
Width	0.89 m (2 ft 11 in)
Height to sill	0.71 m (2 ft 4 in)
DIMENSIONS, INTERNAL:	
Cockpit: Length	1.22 m (4 ft 0 in)
Max width	1.07 m (3 ft 6 in)
Max height	1.07 m (3 ft 6 in)
Floor area	0.60 m² (6.5 sq ft)
AREAS:	
Wings, gross	7.90 m² (85.0 sq ft)
Ailerons (total)	0.37 m² (4.00 sq ft)
Trailing-edge flaps (total)	1.115 m² (12.00 sq ft)
Fins (total)	0.28 m² (3.00 sq ft)
Rudder	0.14 m² (1.50 sq ft)
Tailplane	0.72 m² (7.75 sq ft)
Elevators (total)	0.65 m² (7.00 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	235 kg (518 lb)
Max fuel weight	36 kg (79 lb)
Max T-O and landing weight	430 kg (948 lb)
Max wing loading	54.43 kg/m² (11.15 lb/sq ft)
Max power loading	9.62 kg/kW (15.80 lb/hp)
PERFORMANCE (at max T-O weight):	
Never-exceed speed (VNE)	113 kts (209 km/h, 130 mph) CAS
Max level speed	99 kts (182 km/h, 114 mph) CAS
Max cruising speed (75% power)	90 kts (167 km/h, 104 mph) IAS
Stalling speed: flaps up	45 kts (84 km/h, 52 mph) IAS
flaps down	40 kts (75 km/h; 47 mph) IAS
Max rate of climb at S/L	244 m (800 ft)/min
Service ceiling	4,575 m (15,000 ft)
T-O run	275 m (903 ft)
Landing run	160 m (525 ft)
Max range	360 n miles (667 km, 414 miles)
Max endurance	4 h
g limits	+6.6/−3.3 (ultimate)

UPDATED

SADLEIR (SVTOL)

SADLEIR VTOL AIRCRAFT CO PTY LTD

1 Winthrop Drive, Winthrop, Western Australia
Telephone: 61 (93) 10 2982
Fax: 61 (93) 10 2982
CEO: Kim Sadleir

SVTOL incorporated in 1990 to exploit patented fast VTOL aircraft technology developed from 1986 onwards by inventor and company founder, Kim Sadleir, and associates

Development has involved construction of six models and three full-scale test rigs, largest of latter, VX 3, built to prove lifting concept; powered by 1,300 cc turbocharged motor cycle engine and weighed approximately 330 kg (728 lb), rose 3.50 m (11 ft 6 in) in August 1992 within steel frame as substitute for pitch and roll controls. Tests of half-scale, radio-controlled model under way in 1995

Future strategy envisages approach to other companies with object of collaborative development and offer of technology to industry under licence

NEW ENTRY

SADLEIR VTOL CONCEPT

Fixed-wing aircraft with VTOL, STOL, STOVL and CTOL capabilities, company studies indicate potential to exceed substantially the transport efficiency of both helicopter and fixed-wing aircraft on most types of journey noise, safety, speed and comfort similar to those of commercial airliner allied to convenience of helicopter

Largely uses existing technologies, principal of which is patented fan-in-wing, with main unit being large diamond-shaped lift system, optimally located at wing/fuselage joint Single lift rotor at centre of fan unit, fuselage mounted below

In operation, lift fan draws air from top of wing, deflecting it into four large lift ducts and four smaller control ducts, latter provide vertical lift, initial forward thrust, braking control during hover and low speed flight Lift ducts shaped with S bends exhausting on each side of fuselage, shape allows full-length cylindrical, pressurised cabin below Inlets and exhausts of lift fan are closed for high-speed flight

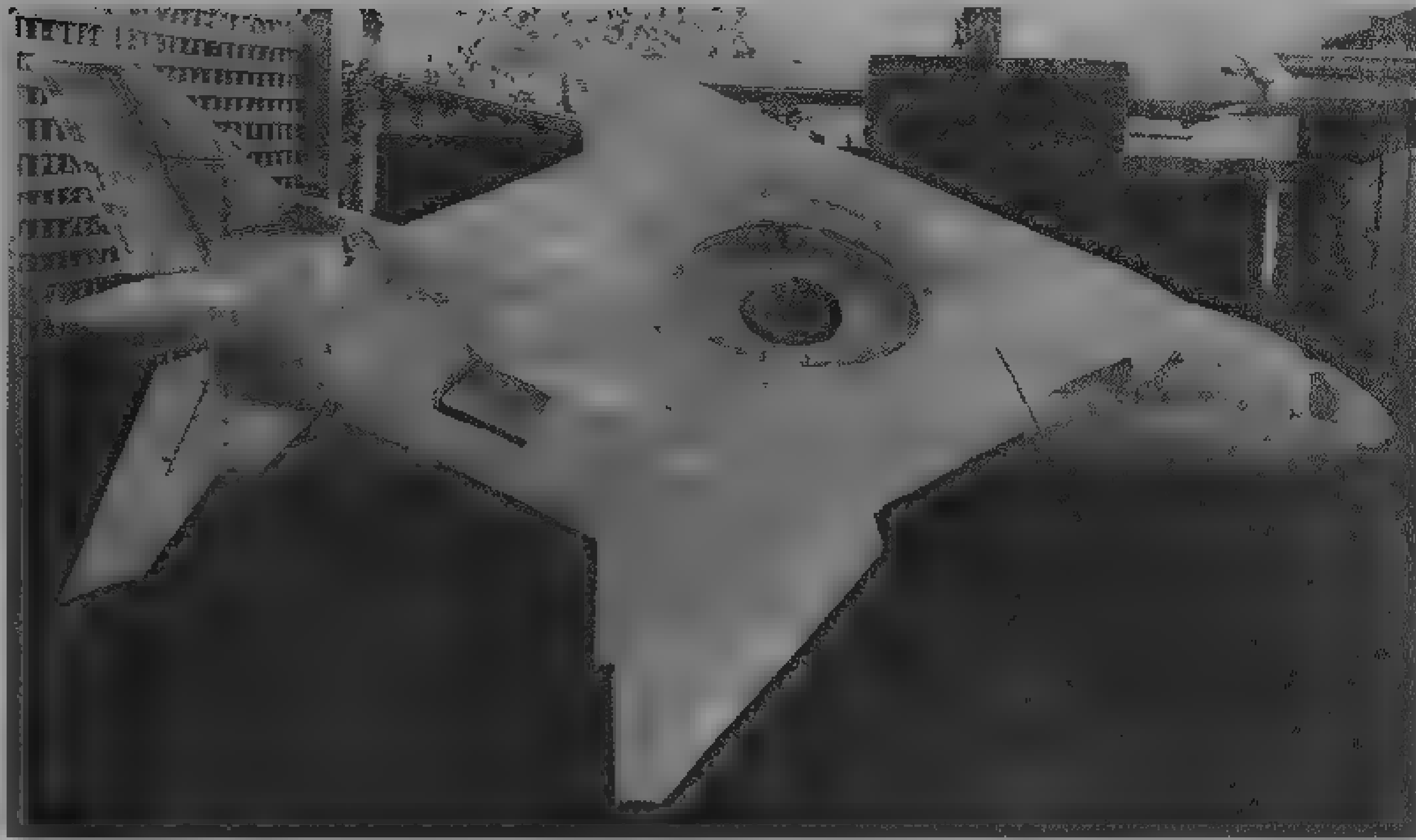
Rear fan is oversize, conventional turbofan; provides thrust for high-speed flight, passes high-velocity air over rear control surfaces for improved control at low airspeeds and during transition

Propulsion derived from two gas generators located in wings, variable volume of hot, compressed gases feeds turbines at both lift and propulsion fans Configuration offers high levels of redundancy, either engine capable of providing power for controlled flight using either lift fan system or prop fan system

Additional weight of VTOL systems expected to be offset completely through other weight savings, airframe weight saved by strong structure resulting from incorporation of lift fan in wingroot, Sadleir concept obviates large flaps and thrust reversers for total empty weight saving of 10 per cent, fixed-pitch fans, integral wing ducts and shared oversize engines also contribute to lightness. Useful weight component expected to be 40 to 45 per cent of maximum T-O weigh.

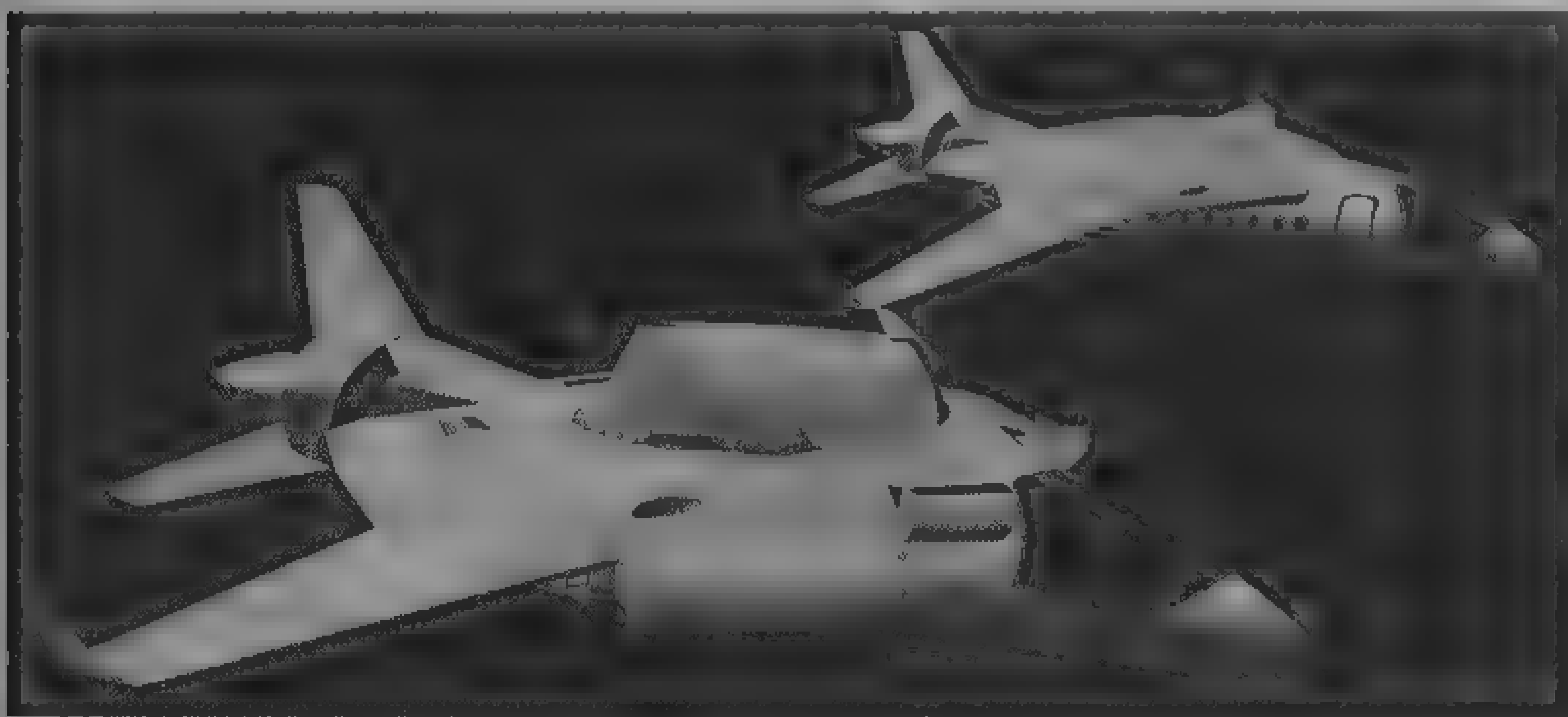
Fan-in-wing produces estimated 60 per cent penalty in drag and proportional range reduction, however, combination of VTOL capabilities, high subsonic speed and high useful load fraction expected to generate significant transport efficiency Initial application expected in business aircraft, potential for scaling-up to 250,000 kg (551,150 lb) for both civil and military aircraft

NEW ENTRY



Partly complete, half-scale, radio-controlled model of single-seat Sadleir aircraft

1995



Artist's impression of Sadleir Sa7 business aircraft in VTOL configuration, with possible 18-seat stretched version, configured for CTOL in background

1995

SADLEIR Sa7

TYPE Eight-seat, VTOL business aircraft

PROGRAMME Envisaged first commercial application of Sadleir concept

DESIGN FEATURES As described above, 50 per cent power reserve on VTO

POWER PLANT Two gas generators; combined output 10,700 kW (7,979 hp); static propeller element 59 0 kN (13,263 lb st) Lift fan exhaust velocity 130 m (427 ft)/s

ACCOMMODATION Eight passengers at 2 00 m (6 ft 6¾ in) seat pitch; maximum cabin pressure differential 0 65 bar (9 4 lb/sq in)

DIMENSIONS, EXTERNAL (approx)

Wing span	10 0 m (32 ft 3 in)
Wing aspect ratio	3 3
Length overall	11 9 m (39 ft 0 in)
Lift fan diameter	2 4 m (7 ft 9 in)
Propulsion fan diameter	1 8 m (6 ft 0 in)

DIMENSIONS, INTERNAL (approx)

Cabin Length	6 0 m (19 ft 6 in)
Useful height	2 0 m (6 ft 6 in)

AREAS (estimated)

Wings, gross	30 m² (325 sq ft)

WEIGHTS AND LOADINGS (estimated)

Weight, empty	3,700 kg (8,150 lb)
Max T-O weight VTO	6,750 kg (14,875 lb)
STO CTO	7,500 kg (16,525 lb)

PERFORMANCE (estimated)

Max cruising speed at 25% power	430 kts (796 km/h, 495 mph)
T-O speed, STO	40 kts (74 km/h, 46 mph)
CTO	135 kts (259 km/h 156 mph)
VTO transition speed	125 kts (232 km/h, 144 mph)
Max rate of climb at S/L	4,800 m (15,750 ft)/min
Service ceiling	12 000 m (39 370 ft)
T-O run STO	30 m (98 ft)
CTO	300 m (984 ft)
Range (no reserves)	
VTOL	1,612 n miles (2,986 km, 1,401 miles
CTOL, STOL	2 095 n miles (3,88 km; 2,411 miles

NEW ENTRY

SEABIRD

SEABIRD AVIATION AUSTRALIA PTY LTD

Hervey Bay Airport, PO Box 618, Hervey Bay, Queensland 4655

Telephone: 61 (71) 25 3144

Fax: 61 (71) 25 3123

MANAGING DIRECTOR Donald C Adams

MANAGER, FLIGHT OPERATIONS David P Eyre

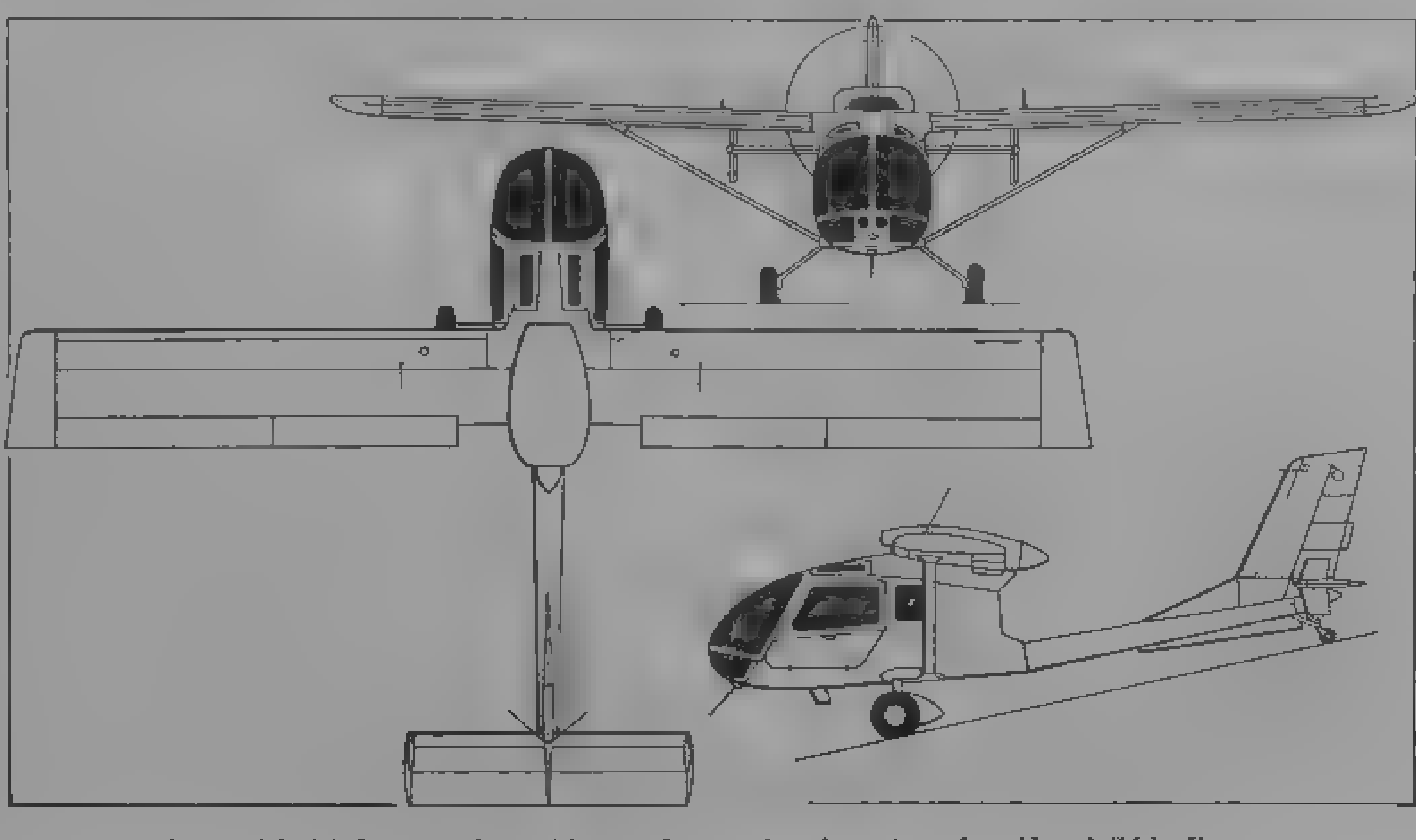
Despite having built Seekers for certification, Seabird Aviation's business plan is to market Seeker production capability, rather than individual aircraft, entire manufacturing equipment for Seeker production line may be forwarded in two standard-size ISO shipping containers

UPDATED

SEABIRD SB7L-360A SEEKER

TYPE Two-seat observation and reconnaissance lightplane.

PROGRAMME: Design began January 1985, construction January 1988, first flight of first (SB5N) prototype (VH-SBI, c/n 001, with Norton rotary engine) 1 October 1989, and of SB5E second prototype (VH-SBU, c/n 003, with Emdair engine) 11 January 1991 (c/n 002 was structural test airframe), fourth aircraft (c/n 004, VH-ZIG) is SB7L Seeker prototype, making first flight 6 June 1991, definitive SB7L-360A (VH-DPT; first flight early 1993), has Textron Lycoming O-360 engine for higher performance and



Seabird SB7L Seeker after addition of ventral and auxiliary fins ***(Jane's/Mike Keep)***

1993


Camouflaged fourth Seabird Seeker (*Dave Allport/Air International*)
1995

received Australian CAA certification to FAR Pt 23 on 24 January 1994, production aircraft then under construction. Design studies completed for four/six-seat military versions and for Allison 250 turboprop, wheeled floatplane version.

COSTS: VFR equipped SB7L-360A, $112,320 (domestic), $124,800 (export) (1994)

DESIGN FEATURES: Braced high-wing monoplane with pod and boom fuselage, extensively glazed cabin and slightly sweptback vertical tail. Primary applications are observation/reconnaissance, offering helicopter-like view from cockpit and good low-speed handling and loiter capabilities, training and agricultural use also foreseen. Wing section NACA 63_2-215 (modified), wedge tips; twist 3°; incidence 4° at root, 1° at tip, dihedral 2° 30′ from roots. Ventral and auxiliary fins added early 1993.

FLYING CONTROLS: Mechanically (rod) actuated slotted ailerons, one-piece horn balanced elevator (with trim tab) and horn balanced rudder; slotted flaps on wing trailing-edge; fixed incidence tailplane. Inboard stall strips; vortex generators on wing upper surface near leading-edge and lower surface forward of ailerons, elevator bias trim.

STRUCTURE: Front fuselage mainly of 4130 chromoly steel tube with Kevlar non-load-bearing skin, aluminium alloy tubular tailboom, wings and tail unit conventional aluminium alloy stressed skin structures, former with single bracing strut and jury strut each side.

LANDING GEAR: Non-retractable, with Cleveland 8.00-6 main wheels and fairings on cantilever spring steel legs; fully castoring Scott 8 in tailwheel with oil/nitrogen oleo strut and 210 × 65 mm McCreary tyre. Mainwheel tyre pressure 1.38 bars (20 lb/sq in). Cleveland disc brakes. Float gear to be developed. Minimum ground turning radius (at nose wheel) 4.60 m (15 ft 1 in).

POWER PLANT: One Textron Lycoming O-360-B2C flat-four engine derated to 125 kW (168 hp) from 134 kW (180 hp) with lower compression ratio of 7.5:1 for Mogas fuel. Low propeller tip speed for minimal noise; Bishton BB177 two-blade fixed-pitch wooden pusher propeller. Fuel in two 96 litre (25.4 US gallon; 21.1 Imp gallon) integral wing tanks, each with overwing gravity filling point. At maximum T-O weight of 897 kg (1,977 lb) with two 77 kg (170 lb) occupants, maximum fuel load 152 litres (40.2 US gallons; 33.4 Imp gallons); higher MTOW of 925 kg (2,040 lb) would permit this to be increased to 182 litres (48 US gallons; 40 Imp gallons). Provision for auxiliary fuel tanks on underwing hardpoints. Oil capacity 7 litres (1.85 US gallons, 1.54 Imp gallons).

ACCOMMODATION: Side by side seats, adjustable fore and aft, for pilot and co-pilot or observer/passenger in extensively glazed cabin. Dual controls standard. Split (upward/downward-hinged) door each side, both removable. Ram air cabin ventilation. Space for 43 kg (95 lb) of baggage aft of seats. Third seat with 90 kg (198 lb) load capacity under development.

SYSTEMS: 28 V electrical system, with 70 A alternator and 18 Ah Gill G-25 battery, for engine start, instruments and lighting.

AVIONICS: *Comms*: Bendix/King KY 97A VHF com, KT 76A transponder, AR 850 encoder and Sigtronics SPA 400 intercom standard.

Flight: Bendix/King nav/com, ADF, second com and ELT optional.

EQUIPMENT: Hardpoint for 60 kg (132 lb) of external stores beneath each wing. Quick-change photo/survey modules, stretcher or 100 litre (26.4 US gallon; 22 Imp gallon) spraytank optional in place of right-hand seat.

DIMENSIONS, EXTERNAL:

Wing span	11.07 m (36 ft 4 in)
Wing chord, constant	1.22 m (4 ft 0 in)
Wing aspect ratio	9.36
Length overall	7.01 m (23 ft 0 in)
Fuselage: Max width	1.14 m (3 ft 9 in)
Height overall, propeller vertical	2.49 m (8 ft 2 in)
Tailplane span	2.90 m (9 ft 6 in)
Wheel track	2.03 m (6 ft 8 in)
Wheelbase	4.50 m (14 ft 9 in)
Propeller diameter	1.78 m (5 ft 10 in)
Cabin doors (two, each): Height	0.83 m (2 ft 8¾ in)
Width	0.97 m (3 ft 2¼ in)
Height to sill	0.97 m (3 ft 2¼ in)

DIMENSIONS, INTERNAL:

Cabin, incl baggage space:	
Length	2.21 m (7 ft 3 in)
Max width	1.12 m (3 ft 8 in)
Max height	1.09 m (3 ft 7 in)
Baggage compartment volume	0.42 m³ (15 cu ft)

AREAS:

Wings, gross	13.10 m² (141.0 sq ft)

WEIGHTS AND LOADINGS:

Basic weight empty: prototype	604 kg (1,332 lb)
production	approx 590 kg (1,301 lb)
Max fuel weight	115 kg (254 lb)
* Max T-O weight	897 kg (1,977 lb)
Max wing loading	68.5 kg/m² (14.0 lb/sq ft)
Max power loading	7.52 kg/kW (12.36 lb/hp)

* *Analysis undertaken early 1994 to assess increase to 925 kg (2,040 lb)*

PERFORMANCE (at 897 kg, 1,977 lb max T-O weight):

Never-exceed speed (VNE)	133 kts (246 km/h; 153 mph) IAS
Cruising speed (75% power)	112 kts (207 km/h; 129 mph)
Patrol speed	65 kts (120 km/h; 75 mph) CAS
Stalling speed: flaps up	58 kts (108 km/h; 67 mph)
flaps down	53 kts (99 km/h; 61 mph)
Optimum rate of climb, ISA:	
at S/L, 12.68% gradient	288 m (944 ft)/min
at 610 m (2,000 ft), 10.58% gradient	248 m (813 ft)/min
at 1,220 m (4,000 ft), 8.67% gradient	210 m (688 ft)/min
at 1,830 m (6,000 ft), 6.92% gradient	173 m (567 ft)/min
T-O run, ISA (grass, zero wind):	
at S/L	265 m (867 ft)
at 610 m (2,000 ft)	310 m (1,016 ft)
at 1,220 m (4,000 ft)	364 m (1,194 ft)
at 1,830 m (6,000 ft)	429 m (1,407 ft)
T-O to 15 m (50 ft), ISA (grass, zero wind):	
at S/L	513 m (1,683 ft)
at 610 m (2,000 ft)	606 m (1,986 ft)
at 1,220 m (4,000 ft)	721 m (2,365 ft)
at 1,830 m (6,000 ft)	871 m (2,856 ft)
Range, with reserves (two crew and 152 l fuel):	
at 75% power (94 kW; 126 hp)	394 n miles (730 km; 453 miles)
at patrol speed power (50.7 kW; 68 hp)	449 n miles (832 km; 517 miles)
Endurance, with reserves (two crew and 152 l fuel):	
at 75% power (94 kW; 126 hp)	3 h 33 min
at patrol speed power (50.7 kW, 68 hp)	6 h 54 min
g limits	+3.8/−1.52

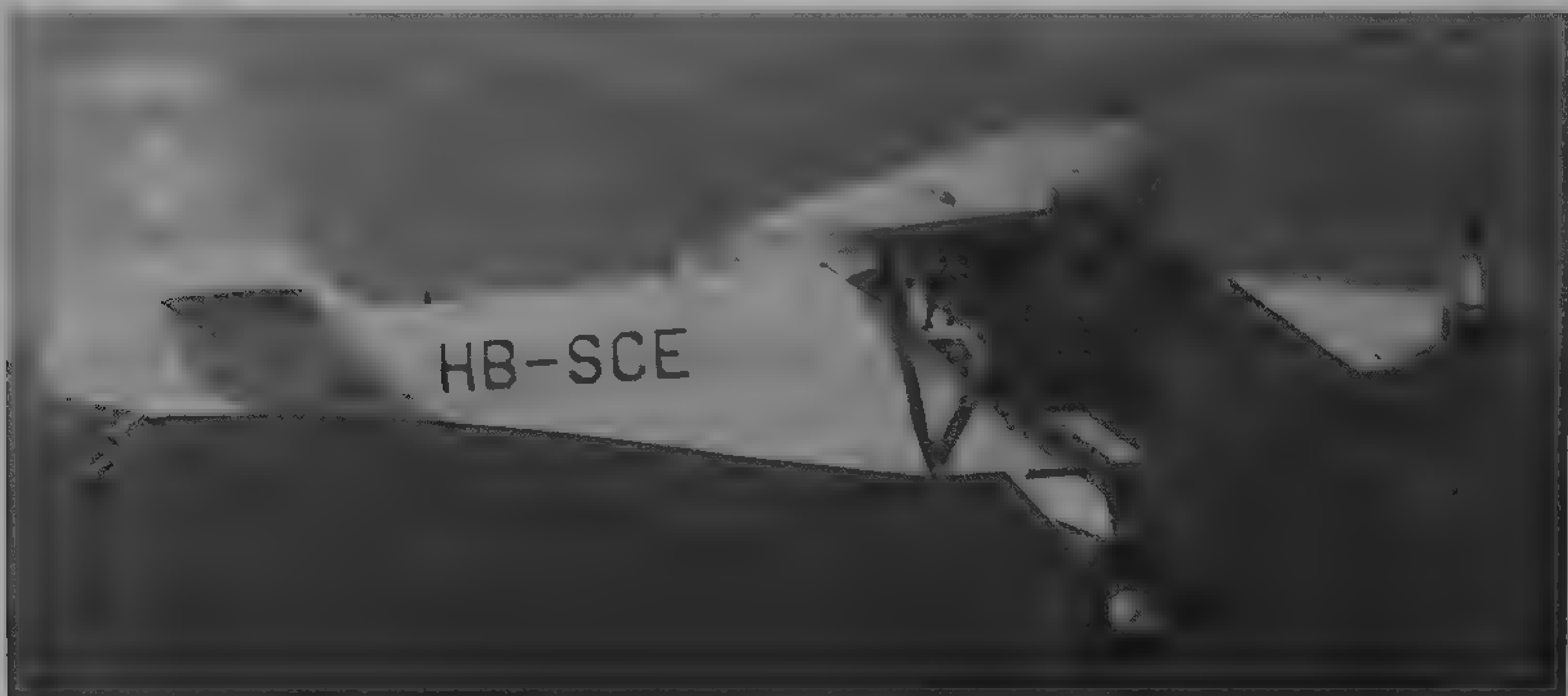
UPDATED

SKYFOX

SKYFOX AVIATION

PO Box 930, Caloundra, Queensland 4551
Telephone: 61 (74) 91 5355
Fax: 61 (74) 91 8237
MANAGING DIRECTOR: Graham Day
GENERAL MANAGER: David Anning

Skyfox Aviation is part of Hedaro International Pty Ltd
UPDATED



First exported Skyfox, a CA-25 for a Swiss customer
1994

SKYFOX CA-22 and CA-25

TYPE: Two-seat cabin lightplanes.

PROGRAMME: First flight 6 September 1989 as modified version of Denney (now SkyStar; which see in US section) Kitfox, with reported 38 changes. First flight of production CA-22 made on 22 June 1990; CAO 101 55 certification of CA-22 followed by development of JAR VLA version as CA 25, in June 1993 this became first Australian aircraft to be certificated under JAR-VLA (Normal category), although ultralight certification available as option. Production of both types continues in parallel, with increasing emphasis on CA-25. Nosewheel version, CA-25N Gazelle, prototype (VH-CAL) flew 17 December 1994.

CURRENT VERSIONS: **CA-22**: ARV version, certificated to CAO 101 55

CA-25: JAR-VLA version

CA 25N Gazelle: Nosewheel version

Following description applies to all versions except where indicated.

CUSTOMERS: About 100 CA-22s and CA-25s sold by March 1995; most current production is for commercial flying training organisations, replacing Cessna 150s and Piper Cherokees. First export (CA 25 to Swiss customer) August 1993; dealer in Thailand appointed to market CA-25 in a number of Asian countries. Thai government has two, with four in prospect, for forestry patrols, pilot training and police support.

DESIGN FEATURES: Fixed-gear, high-wing cabin monoplane; wings can be folded without disconnecting fuel or control lines.

FLYING CONTROLS: Primary surfaces include all-flying ailerons as standard.

STRUCTURE: Wing comprises two extruded aluminium spars with I-beam plywood ribs and (except for metal skinned ailerons) fabric covering, fuselage, tail surfaces and mainwheel legs of welded 4130 chromoly steel tube, covered with Stits Polyfiber fabric.

POWER PLANT: One 60.4 kW (81 hp) Rotax 912 flat-four engine, with 2.273 1 reduction gear. Fuel capacity (usable) 51.75 litres (13.7 US gallons, 11.4 Imp gallons). Oil capacity 3 litres (0.8 US gallon, 0.7 Imp gallon).

ACCOMMODATION: Two seats side by side with full dual controls including dual toe brakes. Cabin doors (one each side) open upwards and clip against wing undersurface, or can be removed completely without imposing any operational restrictions. Small compartment aft of seats, with access via separate door, for up to 10 kg (22 lb) of baggage.

DIMENSIONS, EXTERNAL:

Wing span	9.52 m (31 ft 3 in)
Wing aspect ratio	7.82
Width, wings folded	2.40 m (7 ft 10½ in)
Length overall	5.60 m (18 ft 4½ in)
Height overall, tail down (except CA-25N)	1.87 m (6 ft 1½ in)
Propeller diameter	1.73 m (5 ft 8 in)

AREAS (all):

Wings, gross	11.60 m² (124.9 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped: CA-22	274 kg (604 lb)
CA-25	300 kg (661 lb)
Max T-O weight: CA 22	450 kg (992 lb)
CA 25	520 kg (1,146 lb)
Max wing loading: CA-22	38.79 kg/m² (7.94 lb/sq ft)
CA-25	44.82 kg/m² (9.18 lb/sq ft)
Max power loading: CA-22	7.45 kg/kW (12.25 lb/hp)
CA 25	8.61 kg/kW (14.15 lb/hp)

PERFORMANCE (at max T-O weight):

Max level speed at S/L	
CA 22	85 kts (157 km/h, 98 mph)
CA-25	95 kts (176 km/h, 109 mph)
Max cruising speed (75% power)	
CA-22	75 kts (139 km/h, 86 mph)
CA 25	85 kts (157 km/h, 98 mph)
Econ cruising speed (70% power)	
CA-22	70 kts (130 km/h, 81 mph)
CA-25	80 kts (149 km/h, 92 mph)
Stalling speed: CA-22	40 kts (75 km/h, 46 mph)
CA-25	43 kts (80 km/h, 50 mph)
Max rate of climb at S/L: CA-22	274 m (900 ft)/min
CA-25	244 m (800 ft)/min
Service ceiling: CA-22	3,050 m (10,000 ft)
CA-25	4,115 m (13,500 ft)
T-O and landing run: CA-22, CA-25	122 m (400 ft)
T-O to 15 m (50 ft): CA-25	421 m (1,382 ft)
Landing from 15 m (50 ft): CA-25	395 m (1,296 ft)
Range: CA-22	280 n miles (518 km, 322 miles)
Max endurance	
CA-25 at 50 kts (92 km/h, 57 mph)	[illegible]

UPDATED

Skyfox CA-25N Gazelle with tricycle undercarriage

1995

VEETOL

VEETOL HELICOPTERS PTY LTD

PO Box 5195C, Newcastle West, NSW 2302
Telephone: 61 (49) 43 5348
Fax: 61 (49) 62 3806
CHAIRMAN: Duan A Phillips

Formed 1991 to carry former VTOL Aircraft Pty Ltd Phillicopter programme into production stage.

UPDATED

VEETOL PHILLICOPTER Mk 1

TYPE: Two-seat light helicopter

PROGRAMME: Details of prototype (first flight 1971) last given in 1989-90 *Jane's*. Development and flight testing of modified preproduction model (VH-DXV, produced 1989) continuing, performance flight tests with this have provided information for production model modifications, transmission improvements and upgrading of power supply expected to enhance performance considerably. Design frozen by early 1995; investors being sought to finance production.

COSTS: A$170,000

UPDATED

Veetol Phillicopter during a flight test sortie

1995

AUSTRIA

HOAC

HOAC AUSTRIA FLUGZEUGWERK WIENER NEUSTADT GmbH

N. A. Otto-Strasse 5, A-2700 Wiener Neustadt
Telephone: 43 (2622) 26700
Fax: 43 (2622) 26780
PRESIDENT: Christian Dries
MANAGING DIRECTOR: Wolfgang Grumeth
CHIEF DESIGNER: Martin Volck
SALES DIRECTOR: Michael Feinig

Company formed 1981 in Carinthia, southern Austria, as Hoffmann Flugzeugbau-Friesach GmbH, re-formed after August 1984 bankruptcy as Hoffmann Aircraft Ltd, relocated to new facility at Wiener Neustadt 1987, present name adopted 1990 after Spring 1989 management buyout. Production of H 36 Dimona and improved Dimona Mk II motor gliders between 1981 and 1989 totalled approximately 400.

Factory has 2,500 m² (26,910 sq ft) of floor space; workforce 60 in early 1994. Current products are DV 20 Katana and HK 36R Super Dimona. Subsidiary Dimona Aircraft Industries recently formed at London, Ontario, to produce DA 20 and projected four-seat DA 40 in Canada. Agency for Eurospace F 15F Excalibur (see Addenda, International section).

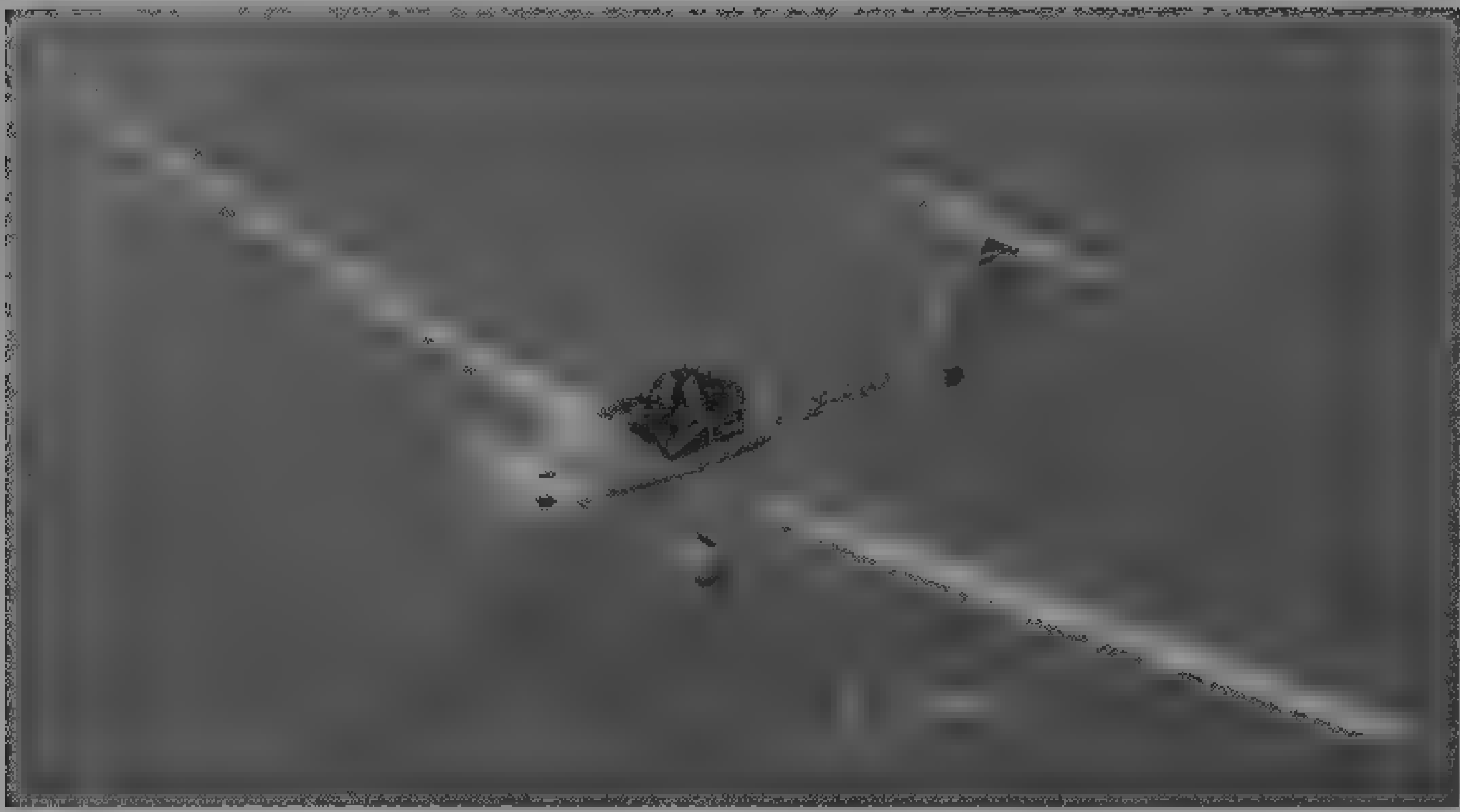
UPDATED

HOAC HK 36R SUPER DIMONA

TYPE: Two-seat, limited aerobatic motor glider

PROGRAMME: Original H-36 Dimona (Diamond) was designed by Austrian-German team, first flight by first of three prototypes taking place in Germany 9 October 1980; production, in Austria, started May 1981 and more than 270 built before introduction of improved Dimona Mk II May 1985 (smaller wingtip fairings, modified cowling, better propeller pitch control, stronger main gear, sprung steerable tailwheel); over 100 Mk IIs built by 1989.

Development of Super Dimona started March 1987, first flight, with 67.1 kW (90 hp) Limbach L 2400 engine, October 1989, and one or two more completed with Limbach engines, but Rotax 912 adopted as standard power plant. Production began April 1990 and Austrian certification to JAR 22 awarded 15 May 1990. 'Short-wing' LF 2000 was proof-of-concept for Katana (which see); TS glider-towing version introduced 1995.



HOAC HK-36R Super Dimona two-seat motor glider

1994

CUSTOMERS: Total of 120 sold by early 1995
COSTS: $96,000 (1994)
DESIGN FEATURES: Generally similar appearance to Dimona but considerably redesigned by Dieter Kohler (K in designation); low mid-wing has carbonfibre main spar, modified inboard leading-edge, sweptback wingtips and Schempp-Hirth (instead of DFS) type airbrakes, better access to engine and control system via completely removable cowlings, improved spin characteristics, stronger main landing gear and improved tailwheel springing, larger canopy with new mechanism, wingroot fairings and rear fuselage redesigned.
Wortmann wing sections FX-63-137 at root, FX-71 at tip fairings. Wings can be detached and folded back alongside fuselage for transportation and storage.
FLYING CONTROLS: Primary surfaces mechanical, longitudinal stability improved over original Dimona by increasing elevator chord and adding trim tab, airbrakes in wing upper surface.
STRUCTURE: Mainly of GFRP, carbonfibre wing spar and main bulkhead. GFRP mainwheel legs and fairings.
LANDING GEAR: Non-retractable tailwheel type. Cantilever main legs with 6 in wheels, sprung, steerable tailwheel. Removable fairings on main legs and wheels.
POWER PLANT: One 59.7 kW (80 hp) Rotax 912A-3 flat-four engine, with 2.27:1 reduction drive to a Hoffmann HO-V62/170 composite, two-blade, three-position constant speed propeller. Fuel tank in fuselage, capacity 55 litres (14.5 US gallons, 12.1 Imp gallons) standard, 80 litres (21.1 US gallons, 17.5 Imp gallons) optional.
ACCOMMODATION: Two seats side by side. Cockpit canopy hinged at rear to open upward. Baggage space aft of seats.
DIMENSIONS, EXTERNAL:
Wing span: 16.20 m (53 ft 1¾ in)
Wing aspect ratio: 17.15
Length overall: 7.10 m (23 ft 3½ in)
wings folded: 9.50 m (31 ft 2 in)
Width, wings folded: 2.20 m (7 ft 2½ in)
Height over tail: 2.40 m (7 ft 10½ in)
AREAS:
Wings, gross: 15.30 m² (164.7 sq ft)
WEIGHTS AND LOADINGS:
Weight empty: 545 kg (1,201 lb)
Max T-O weight: 770 kg (1,698 lb)
Max wing loading: 50.33 kg/m² (10.31 lb/sq ft)
Max power loading: 12.91 kg/kW (21.22 lb/hp)
PERFORMANCE, POWERED (at max T-O weight, ISA):
Never-exceed speed (VNE): 141 kts (261 km/h; 163 mph)
Max level speed: 116 kts (215 km/h; 133 mph)
Cruising speed:
75% power: 108 kts (200 km/h; 124 mph)
65% power: 97 kts (180 km/h; 112 mph)
Max rate of climb at S/L: 252 m (827 ft)/min
Service ceiling: above 5,000 m (16,400 ft)
T-O run, hard runway: 175 m (575 ft)
T-O to 15 m (50 ft), hard runway: 280 m (919 ft)
Range with max fuel:
at 94 kts (175 km/h; 109 mph), continuous power: 496 n miles (920 km; 572 miles)
at average 57 kts (105 km/h; 65 mph), saw-tooth climb and glide: 1,242 n miles (2,300 km; 1,429 miles)
g limits: +5.3/−2.65
PERFORMANCE, UNPOWERED:
Best glide ratio at 56 kts (105 km/h; 65 mph): 28
Min sink rate at 52 kts (95 km/h; 59 mph): 1.14 m (3.74 ft)/s
Stalling speed, airbrakes in: 40 kts (74 km/h; 46 mph)

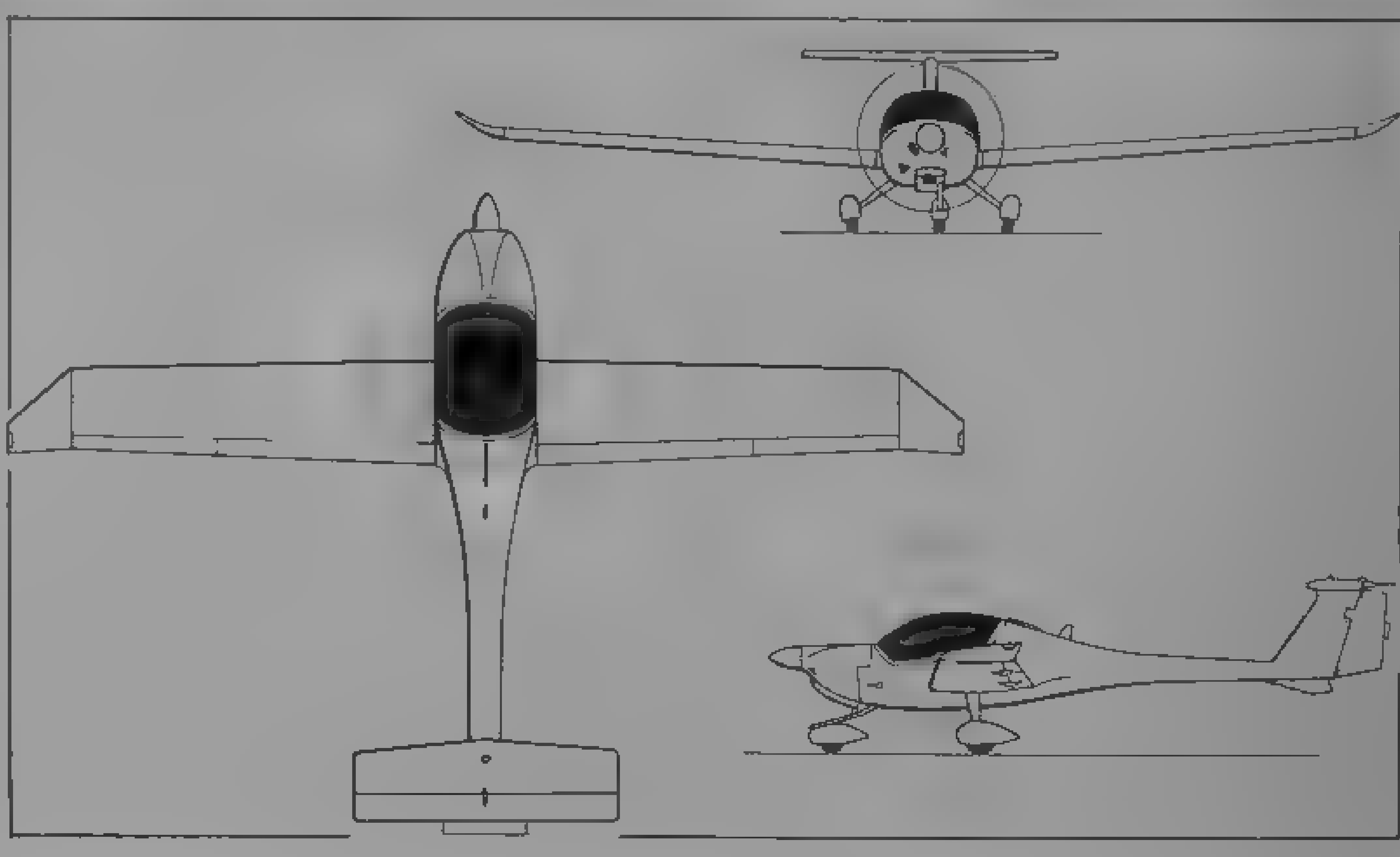
UPDATED

HOAC DV 20 KATANA (SAMURAI SWORD)

TYPE: Two-seat, non-aerobatic private and primary training aircraft.
PROGRAMME: Revealed following first flight on 16 March 1991 of proof-of-concept LF 2000 (OE-VPX), illustrated in Addenda to 1991-92 *Jane's*; followed by LF 2 Katana predecessor (OE-CPU, first flight December 1991); DV 20 prototype (OE-AKL, first flight 17 December 1992) developed from this by Dries and Volck and representative of production aircraft; Austrian and German certification 26 April 1993, JAR-VLA certification received later in 1993, now certificated also by UK and USA (FAA); output six per month by early 1994. HOAC acquired site in Canada for North American production line under name Dimona Aircraft Industries in 1994. First Canadian built DV 20A1 (C-FSQN) flew 29 June 1994 at London, Ontario; plans to sell Canadian Katanas in Europe and elsewhere from 1995.
CURRENT VERSIONS: **DV 20**: European production.
DV 20A1: Canadian production from June 1994.
CUSTOMERS: Nearly 300 ordered; 100th European built Katana (OE-COG) delivered February 1995, 10 built in Canada during 1994, Canadian production increasing to one per day.
COSTS: $96,400 (1994).
DESIGN FEATURES: Designed to JAR VLA criteria; general configuration similar to Super Dimona except for shorter wings, turned-up wingtips and tricycle landing gear. Low-wing design with T tail and side by side seats. Wing section modified Wortmann FX-63-137; sweepback 1° on leading edges, dihedral 4°. Wing folding optional.
FLYING CONTROLS: Mechanically actuated primary surfaces, with trim tab in elevator; electrically actuated flaps. Ventral strake on production aircraft.
STRUCTURE: Entirely of fibre composites, generally similar to that of Super Dimona.
LANDING GEAR: Non-retractable tricycle type, with cantilever self sprung steel leg on each unit. Hydraulic single-disc brakes on mainwheels, parking brake. Optional streamline speed fairings on all three wheels.
POWER PLANT: One 59.7 kW (80 hp) Rotax 912A-3 flat-four engine; 2.27 reduction gear to two-blade constant speed Hoffmann HO-V72F-M/S propeller with composite blades. Fixed-pitch propeller optional. Fuel capacity 79 litres (20.9 US gallons, 17.4 Imp gallons), normal, 55 litres (14.5 US gallons, 12.1 Imp gallons), optional. Fuel grades 100LL or mogas (95 octane leaded/unleaded).
ACCOMMODATION: Two seats side by side, with baggage space to rear; leather seats optional. Canopy hinged at rear to open upward. Maximum internal noise level 55.6 dB.
AVIONICS: Becker or Bendix/King com/nav package to customer's choice.
Flight: Optional GPS nav.
Instrumentation: VSI, turn co-ordinator, turn and slip indicator, directional gyro and horizon optional.
EQUIPMENT: Options include fire extinguisher, first aid kit, baggage harness and landing/position lights.

HOAC DV 20 Katana two-seat light aircraft *(Heinz Zeggl)*

1995



HOAC DV 20 Katana (one Rotax 912A-3 flat four) *(Jane's/James Goulding)*

1995

DIMENSIONS, EXTERNAL:
Wing span 10.80 m (35 ft 5¼ in)
Wing chord: at root 1.252 m (4 ft 1¼ in)
at tip 0.90 m (2 ft 11½ in)
Wing aspect ratio 10.06
Length overall 7.10 m (23 ft 3½ in)
Height overall 2.10 m (6 ft 10¾ in)
Tailplane span 2.40 m (7 ft 10½ in)
Wheel track 1.90 m (6 ft 2¾ in)
Wheelbase 1.72 m (5 ft 7¾ in)
AREAS:
Wings, gross 11.60 m² (124.9 sq ft)
Vertical tail surfaces (total) 1.066 m² (11.47 sq ft)
Horizontal tail surfaces (total) 1.536 m² (16.53 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 495 kg (1,091 lb)
Max usable fuel 60 kg (132 lb)
Max T-O weight 730 kg (1,609 lb)
Max wing loading 62.93 kg/m² (12.89 lb/sq ft)
Max power loading 12.24 kg/kW (20.12 lb/hp)
PERFORMANCE (at max T-O weight):
Never-exceed speed (VNE) 157 kts (291 km/h, 181 mph)
Max operating speed 125 kts (231 km/h, 144 mph)
Max cruising speed, 75% power 122 kts (226 km/h, 140 mph)
Stalling speed: flaps up 51 kts (94 km/h, 58 mph)
flaps down 44 kts (81 km/h, 51 mph)
Max rate of climb at S/L 240 m (787 ft)/min
Best glide ratio at 70 kts (130 km/h, 81 mph), power off 14
Service ceiling 5,030 m (16,500 ft)
T-O run 205 m (673 ft)
T-O to 15 m (50 ft) 490 m (1,608 ft)
Range with max optional fuel, no reserves:
at 128 kts (237 km/h, 147 mph) 491 n miles (910 km, 565 miles)
at 118 kts (218 km/h, 135 mph) 561 n miles (1,040 km, 646 miles)
g limits +4.4/−2.2

UPDATED

BELGIUM

EPERVIER

EPERVIER AVIATION SA

Chaussée de Fleurus 179, B-6041 Gosselies
Telephone: 32 (71) 37 23 76
Fax: 32 (71) 37 28 57
MANAGING DIRECTOR: Yves Kinard

EPERVIER AVIATION EPERVIER

TYPE: Side by side two-seat cabin aircraft; conforms to JAR-VLA.

PROGRAMME: Construction of prototype began September 1989; first flight September 1990, first marketed in microlight form; production 1993. Epervier also proposed for observation, with equipment on request.

Following details refer to ARV version:

COSTS: BFr1.5 mil on assembled.

DESIGN FEATURES: Wing section NACA 23012. Baggage area behind seats.

FLYING CONTROLS: Conventional mechanical control, with ailerons, flaps, elevators and rudder.

STRUCTURE: Strut braced wings with CFRP/epoxy spars, PVC foam/CFRP/epoxy ribs and GFRP/epoxy skin. Fuselage of GFRP/CFRP/epoxy.

LANDING GEAR: Non-retractable tricycle type, with brakes, optional floats or skis.

POWER PLANT: One 56 kW (75 hp) Limbach L 2000 flat-four engine, driving a Hoffmann two-blade fixed-pitch aluminium propeller. Total fuel capacity in two tanks 60 litres (15.9 US gallons; 13.2 Imp gallons).

Epervier two-seat cabin monoplane *(Geoffrey P. Jones)* *1993*

DIMENSIONS, EXTERNAL:
Wing span 11.15 m (36 ft 7 in)
Wing aspect ratio 7.10
Length overall 6.82 m (22 ft 4½ in)
Height overall 2.55 m (8 ft 4½ in)
AREAS:
Wings, gross 17.52 m² (188.58 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 450 kg (992 lb)
Baggage capacity 70 kg (154 lb)
Max T-O weight 750 kg (1,653 lb)
Max wing loading 42.81 kg/m² (8.77 lb/sq ft)
Max power loading 13.39 kg/kW (22.04 lb/hp)
PERFORMANCE (estimated):
Cruising speed 98 kts (181 km/h, 112 mph)
Stalling speed 35 kts (65 km/h, 41 mph)
Max rate of climb at 49 kts (90 km/h, 56 mph) 150 m (492 ft)/min
T-O run 70-120 m (230-394 ft)
Landing run 50-100 m (164-329 ft)
g limits +3.8/−1.9

VERIFIED

PROMAVIA

PROMAVIA SA

Chaussée de Fleurus 181, B-6041 Gosselies-Aéroport
Telephone: 32 (71) 35 08 29
Fax: 32 (71) 35 79 54
CHAIRMAN AND CEO: André L. Delhamende
DEPUTY CHAIRMAN: Philippe Delhamende
MARKETING MANAGER: Joseph Bernas

Promavia formed at Charleroi-Gosselies Airport in 1984 by industrialists, investment companies and a bank, to initiate Jet Squalus programme following 1983 completion of a market survey. Financial backing from Belgian government in 1985 contributed towards prototype research and development. Creation of PIC (Promavia International Corporation) in Canada (see 1993-94 and earlier *Jane's*) abandoned late 1992 and all Promavia activities transferred back to Belgium. ATTA 3000 tandem-seat version was under joint development with MiG of Russia until association dissolved in 1994 and project reverted to Promavia. Both programmes in abeyance by early 1995 because of funding shortage.

UPDATED

Promavia Jet Squalus *1995*

PROMAVIA JET SQUALUS F1300

TYPE: Two-seat primary and basic jet trainer.

PROGRAMME: Dott Ing Stelio Frati of Italy commissioned to undertake design and prototype construction; prototype made first flight 30 April 1987 and had completed approximately 650 hours' flying by end of 1993, demonstrated to Canadian Forces April/May 1991; plans to refit in 1993 with 7.12 kN (1,600 lb st) TFE109-3 superseded, and now to be fitted with 8.45 kN (1,900 lb st) Williams-Rolls FJ44; second prototype (OO-JET, not yet flown at time of going to press) being modified to airline pilot training configuration; third prototype to have pressurised cockpit.

CURRENT VERSIONS: **Prototypes:** Two built, of which one flown (see Programme). *Description applies to first prototype.*

AWS versions: Four 'air ward system' proposed production variants announced 1990 (details in 1991-92 *Jane's*); no subsequent information received.

ATTA 3000: Tandem-seat derivative; described separately.

DESIGN FEATURES: Jet Squalus (Latin for 'shark') designed to cover all stages of flying training, from elementary to part of advanced syllabus; side by side seating; underwing hardpoints for weapon training/light tactical missions; non-swept wings/tailplane, sweptback fin/rudder.

Wings of supercritical section (thickness/chord ratio 13 per cent constant); incidence 1° at root, −1° 45′ at tip; dihedral 6° from roots.

FLYING CONTROLS: Primary control surfaces (Frise differential ailerons, elevators and rudder) actuated mechanically; hydraulic actuation for wing trailing-edge flaps and two-piece underfuselage airbrake; ailerons each have servo tab, starboard elevator electrically operated trim tab, fixed incidence tailplane.

STRUCTURE: Composites for fairings and some non-structural components, otherwise basically metal throughout (semi-monocoque/flush riveted stressed skin); large quick-disconnect panel in lower rear fuselage for rapid engine access/removal.

LANDING GEAR: Retractable tricycle type, with single wheel and oleo-pneumatic shock absorber on each unit. Mainwheels retract inward, nosewheel rearward. Hydraulic actuation, with built-in emergency system. Main gear of trailing-arm type. Nosewheel steerable ±18°. Mainwheels and tyres size 6.00-6, nosewheel 5.00-5.

POWER PLANT: One AlliedSignal TFE109-1 turbofan originally, in rear fuselage, rated initially at 5.92 kN (1,330 lb st); alternative 8.45 kN (1,900 lb st) Williams Rolls FJ44 under consideration since 1994. Semi-integral metal fuel tank in centre-fuselage, maximum usable capacity 720 litres (190 US gallons, 158 Imp gallons). Single gravity refuelling point on top of fuselage, aft of canopy. Electric fuel pump for engine starting and emergency.

ACCOMMODATION: Two persons side by side in air conditioned cockpit, on Martin-Baker Mk 11 lightweight ejection seats operable at altitudes up to 12,200 m (40,000 ft) and at any speed between 60 and 400 knots (111 and 741 km/h, 69 and 461 mph), including ejection through canopy. One-piece canopy is hinged at rear and opens upward.

SYSTEMS: Environmental control system for cockpit air conditioning. Hydraulic system (operating pressure 117 bars; 1,700 lb/sq in) for actuation of airbrake, landing gear and flaps. System incorporates electrically driven oil pump, with two air/oil accumulators (one for normal and one for emergency operation), separate standby system for emergency lowering of landing gear. Electrical system is 28 V DC, using an engine driven starter/generator and Ni/Cd or lead-acid battery. Negretti Aviation oxygen system

AVIONICS: Include dual Collins Pro Line II EFIS

ARMAMENT: Four underwing attachment points, each of 150 kg (331 lb) capacity, capable of carrying a variety of weapons or auxiliary fuel tanks

DIMENSIONS, EXTERNAL:

Wing span	9.04 m (29 ft 8 in)
Wing chord: at root	1.90 m (6 ft 2¾ in)
at tip	1.00 m (3 ft 3¼ in)
mean aerodynamic	1.575 m (5 ft 2 in)
Wing aspect ratio	6.02
Length of fuselage	9.36 m (30 ft 8½ in)
Height overall	3.60 m (11 ft 9¾ in)
Tailplane span	3.80 m (12 ft 5½ in)
Wheel track	3.59 m (11 ft 9¼ in)
Wheelbase	3.58 m (11 ft 9 in)

AREAS:

Wings, gross	13.58 m² (146.17 sq ft)
Ailerons (total)	1.122 m² (12.08 sq ft)
Trailing-edge flaps (total)	1.784 m² (19.20 sq ft)
Fin	1.256 m² (13.52 sq ft)
Rudder	0.782 m² (8.42 sq ft)
Tailplane	2.04 m² (22.00 sq ft)
Elevators (total, incl tab)	1.61 m² (17.33 sq ft)

WEIGHTS AND LOADINGS (TFE109-1 engine):

Weight empty	1,300 kg (2,866 lb)
Max external stores load	600 kg (1,323 lb)
Max T-O weight: Aerobatic	2,000 kg (4,409 lb)
Normal	2,400 kg (5,291 lb)
Max wing loading:	
Aerobatic	147.27 kg/m² (30.18 lb/sq ft)
Normal	176.73 kg/m² (36.21 lb/sq ft)
Max power loading:	
Aerobatic	337.84 kg/kN (3.31 lb/lb st)
Normal	405.40 kg/kN (3.98 lb/lb st)

PERFORMANCE (at max T-O weight, TFE109-1 engine):

Never-exceed speed (VNE)	Mach 0.70 (345 kts; 638 km/h, 397 mph)
Max level speed at 4,265 m (14,000 ft)	280 kts (519 km/h, 322 mph)
Normal operating speed	260 kts (482 km/h, 299 mph)
Max speed for landing gear extension	150 kts (278 km/h, 173 mph)
Max speed for flap extension (landing position)	130 kts (241 km/h, 150 mph)
Stalling speed, flaps down	67 kts (124 km/h, 77 mph)
Max rate of climb at S/L	762 m (2,500 ft)/min
Service ceiling	11,275 m (37,000 ft)
Max operating ceiling	7,620 m (25,000 ft)
T-O run	366 m (1,200 ft)
T-O to 15 m (50 ft)	656 m (2,150 ft)
Landing from 15 m (50 ft)	671 m (2,200 ft)
Landing run	335 m (1,100 ft)
Ferry range at 6,100 m (20,000 ft), max internal fuel	1,000 n miles (1,852 km, 1,151 miles)
g limits	+2.8 sustained, at 3,050 m (10,000 ft)
	+7/−3.5 Aerobatic

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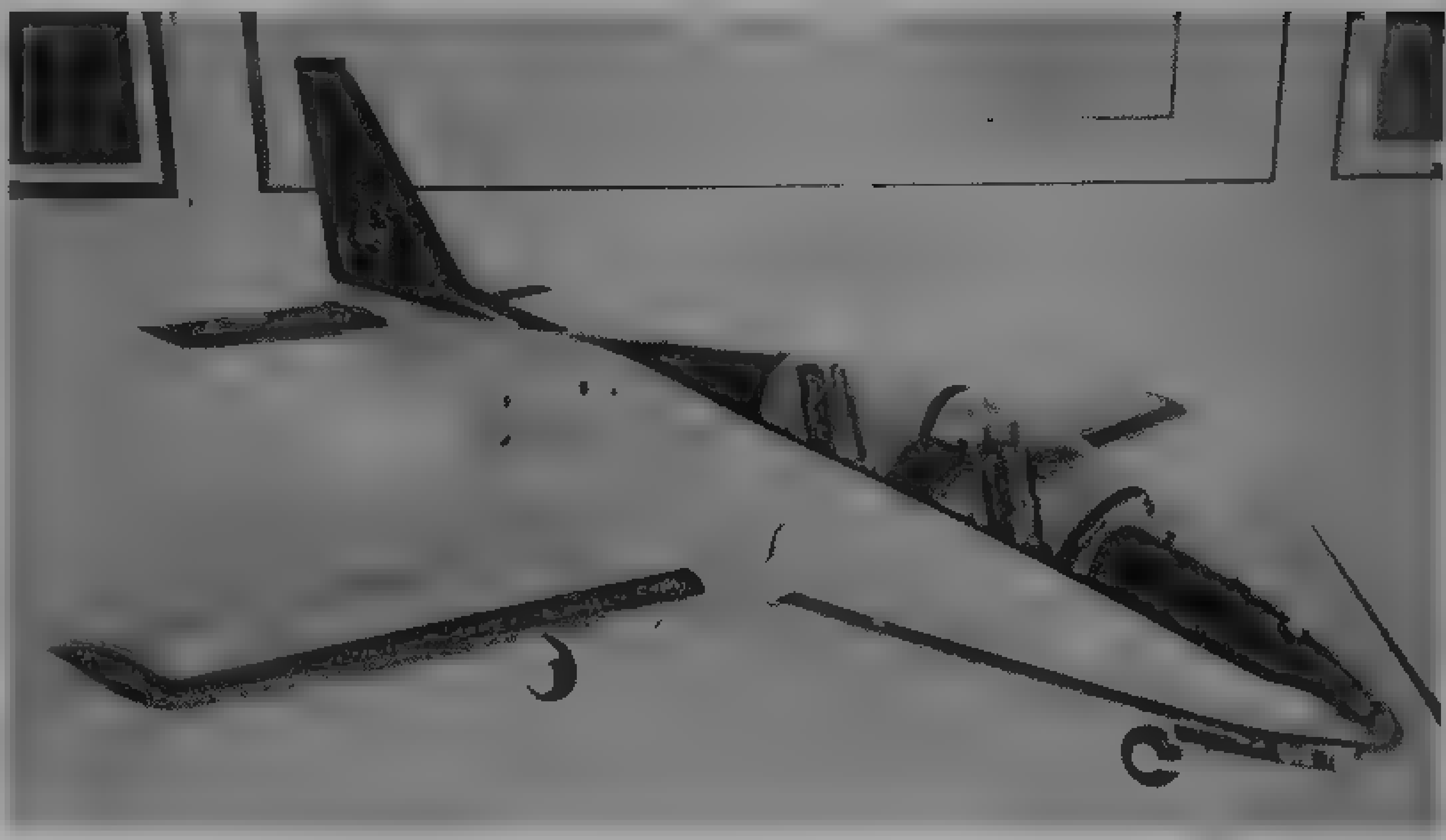


Model of the Promavia ATTA 3000 tandem-seat trainer project

1995

PROMAVIA ATTA 3000

TYPE: Projected tandem-seat derivative of Jet Squalus, for advanced training and/or light attack

PROGRAMME: Announced by Promavia 1989; being promoted internationally together with Jet Squalus, as military training package offering complete primary/basic/advanced capability to take pupils through to combat types such as F-16, F/A-18 and Tornado.

Agreement signed 18 July 1992 between Promavia SA and A I Mikoyan Aviation Scientific Production Complex (MiG) for design, development, construction and flight testing of two prototypes. Power plant, ejection seats, many systems and avionics to be supplied mainly by US manufacturers. Alliance with MiG in abeyance by 1995 and programme awaiting additional funds. Specification in 1994-95 and previous *Jane's*.

UPDATED

PROMAVIA ARA 3600

TYPE: Projected single-seat light attack/reconnaissance aircraft

PROGRAMME: Announced 1989; programme overtaken by ATTA 3000 work and now on indefinite hold

UPDATED

SABCA

SOCIETE ANONYME BELGE DE CONSTRUCTIONS AERONAUTIQUES

Details of the SABCA Mirage System Improvement Programme (MIRSIP or Elkan) will now be found in *Jane's Aircraft Upgrades*

UPDATED

SONACA

SOCIETE NATIONALE DE CONSTRUCTION AEROSPATIALE SA

Activities of Sonaca are now restricted to subcontracting for the aerospace industry, as detailed in the 1994-95 *Jane's*.

UPDATED

BRAZIL

AEROMOT

AEROMOT INDÚSTRIA MECANICO-METALURGICA LTDA

Caixa Postal 8031, 90201-970 Porto Alegre, RS
Telephone: 55 (51) 337 1344
Fax: 55 (51) 343 3655
Telex: 515026 AEMT BR
PRESIDENT: Claudio B Viana
MANAGING DIRECTOR: Nestor Rancich
TECHNICAL DIRECTOR: Luiz V Castilho
SALES DIRECTOR: Vitor J P Neves

Aeromot Indústria is part of Aeromot Group with Aeromot Aeronaves e Motores SA (parent company, founded 1967) and Aeroeletrônica Indústria de Componentes Aviônicos SA (established 1981); former sells aircraft and spares and provides maintenance; latter certificates and manufactures avionic equipment for civil and military aircraft, including 11 items for Embraer Tucano and 13 for Italian Brazilian AMX.

Aeromot Indústria initially designed, certificated and built seats for aircraft built by Embraer; it later produced several structural parts for Embraer aircraft and designed and certificated seats for Airbus, Boeing, Fokker and McDonnell Douglas commercial transports. In 1985 it purchased assets of Fournier motor glider factory in France, including sole manufacturing rights in RF-10; has since incorporated several improvements to basic model, as described in this entry.

Factory has shop floor area of 3,100 m² (33,375 sq ft) and 1994 workforce of 123. Future plans include eventual manufacture under licence of high-performance foreign sailplanes and of all-composites four-seat light aircraft.

UPDATED

AEROMOT AMT-100 XIMANGO and AMT-200 SUPER XIMANGO

TYPE: Two-seat training and sporting motor glider

PROGRAMME: Brazilian production version of French Aérostructure (Fournier) RF-10, first flight (French prototype) 6 March 1981; see Sailplanes section of 1990-91 *Jane's* for French production history. All production rights sold to Aeromot July 1985. Brazilian CTA certification of AMT-100 granted 5 June 1986 and French (DGAC) 10 October 1990. AMT-200, developed by Aeromot, made first flight July 1992, was certificated 3 February 1993 in Brazil and 29 December 1993 in USA (to FAR Pt 22)

CURRENT VERSIONS: **AMT-100:** Standard Limbach powered civil version, *detailed description applies to this version except where indicated*

AMT 100P and -100R: Military/police (100P) and observation (100R) versions. Two side windows below canopy; underfuselage pod for 100 kg (220 lb) of weapons and avionics or surveillance equipment. In service with Brazilian military police and other law enforcement agencies.

AMT 200: Generally similar to AMT 100 except for Rotax power plant.

CUSTOMERS: Initial order for 100 from Brazilian Civil Aeronautical Department; also produced for military/paramilitary roles such as observation, patrol and counter-insurgency. Production, for customers in Argentina, Brazil, France, Portugal, UK and USA totalled 81 by December 1994 (78 AMT 100s and three AMT 200s).

COSTS: $89,000 for AMT 100, $98,000 for AMT-200 (1994).

DESIGN FEATURES: Non-swept low-wing monoplane with fixed incidence T tail. NACA 64_3-618 section wings, with 2° 30' dihedral from roots, are detachable for transportation and storage; outer panels can be folded inward without disconnecting aileron controls.

FLYING CONTROLS: Mechanical actuation of primary surfaces. Schempp-Hirth airbrakes in wing upper surface.

STRUCTURE: All GFRP except for carbonfibre main spar and light alloy airbrakes.

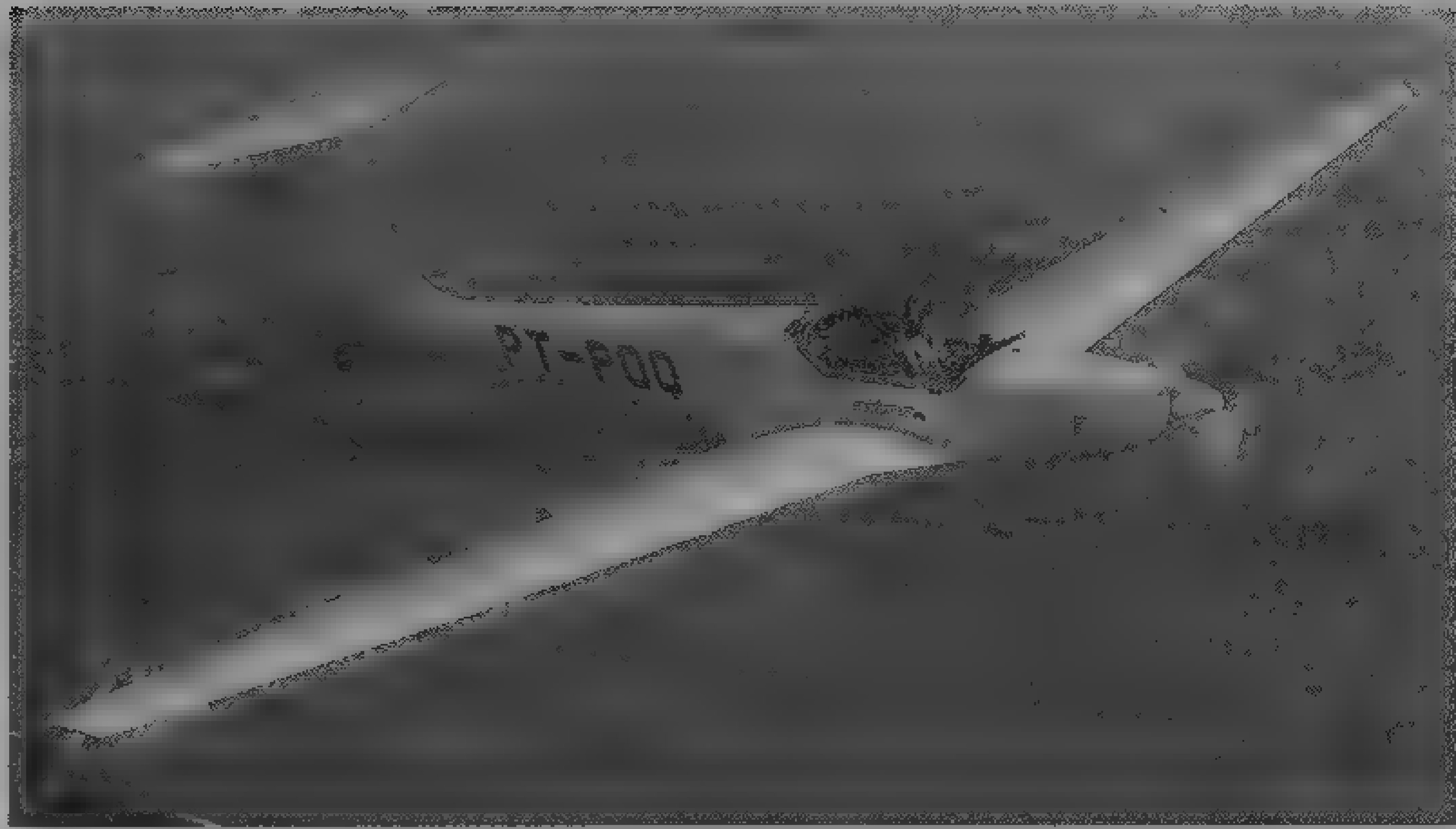
LANDING GEAR: Mechanically retractable mainwheels (tyre size 330 × 130 mm), with hydraulic suspension and JPX hydraulic disc brakes, steerable tailwheel with size 210 × 65 mm tyre.

POWER PLANT: One 59.7 kW (80 hp) Limbach L 2000 EO1 flat-four engine in AMT-100, driving a Hoffman two-blade three-position variable-pitch propeller. AMT-200 has a 59.7 kW (80 hp) Rotax 912A flat-four with a larger diameter Hoffmann HO-V62R/170FA propeller. Fuel in two main tanks in wings, combined capacity 90 litres (23.8 US gallons, 19.75 Imp gallons).

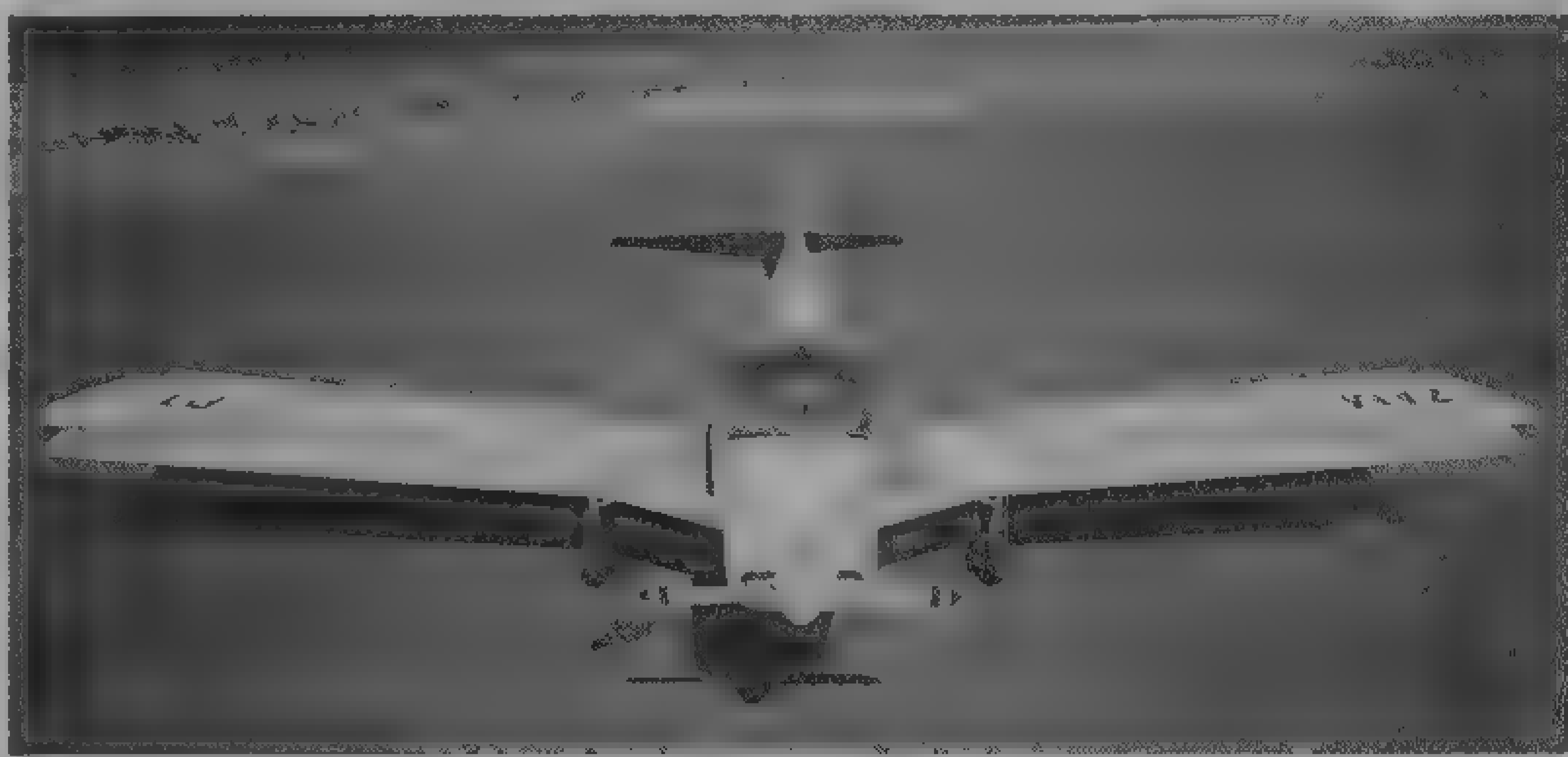
ACCOMMODATION: Two seats side by side. One-piece canopy hinged at rear to open upward. Dual controls standard.

SYSTEMS: Electric starter and 12 V 30 A alternator.

DIMENSIONS, EXTERNAL:	
Wing span	17.47 m (57 ft 3¾ in)
Wing aspect ratio	16.32
Width, wings folded	10.15 m (33 ft 3½ in)
Length overall: 100	7.89 m (25 ft 10¾ in)
200	8.05 m (26 ft 5 in)
Height overall	1.93 m (6 ft 4 in)
Propeller diameter: 100	1.60 m (5 ft 3 in)
200	1.70 m (5 ft 7 in)
AREAS:	
Wings, gross	18.70 m² (201.3 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: 100	600 kg (1,323 lb)
200	605 kg (1,334 lb)
Max T-O weight: 100	800 kg (1,764 lb)
200	850 kg (1,874 lb)
Max wing loading: 100	42.78 kg/m² (8.77 lb/sq ft)
200	45.45 kg/m² (9.31 lb/sq ft)
Max power loading: 100	13.42 kg/kW (22.05 lb/hp)
200	14.26 kg/kW (23.42 lb/hp)
PERFORMANCE, POWERED (at max T-O weight):	
Never-exceed speed (VNE):	
100, 200	133 kts (245 km/h; 153 mph)
Max cruising speed: 100	102 kts (190 km/h; 118 mph)
200	110 kts (205 km/h; 127 mph)
Econ cruising speed: 100	97 kts (180 km/h; 112 mph)
Stalling speed: 100	38 kts (70 km/h; 44 mph)
200	39 kts (72 km/h; 45 mph)
Max rate of climb at S/L: 100	132 m (433 ft)/min
200	180 m (590 ft)/min



Aeromot AMT-200 Super Ximango two-seat motor glider *1995*



AMT-100 with outboard wing panels folded *1995*

Service ceiling: 100, 200	5,000 m (16,400 ft)
T-O run, hard runway: 100	220 m (722 ft)
200	226 m (742 ft)
T-O to 15 m (50 ft), hard runway:	
100	405 m (1,329 ft)
200	323 m (1,060 ft)
Range with max fuel, continuous power:	
100 at 100 kts (185 km/h; 115 mph)	745 n miles (1,380 km; 857 miles)
200 at 110 kts (205 km/h; 127 mph)	675 n miles (1,250 km; 777 miles)
Max endurance: 100	7 h 0 min
200	6 h 30 min
g limits: 100, 200	+5.3/−2.65

PERFORMANCE, UNPOWERED (at max T-O weight):	
Best glide ratio:	
100 at 56 kts (104 km/h; 65 mph)	31
200 at 58 kts (107 km/h; 66 mph)	30
Min rate of sink:	
100 at 51 kts (94 km/h; 58 mph)	0.90 m (2.95 ft)/s
200 at 52 kts (97 km/h; 60 mph)	0.96 m (3.15 ft)/s
Sink rate at 81 kts (150 km/h; 93 mph):	
100	2.3 m (7.54 ft)/s
200	2.2 m (7.22 ft)/s
Stalling speed: 100	38 kts (70 km/h; 44 mph)
200	39 kts (72 km/h; 45 mph)

UPDATED

EMBRAER

EMPRESA BRASILEIRA DE AERONÁUTICA SA

Caixa Postal 343, 12227-901 São José dos Campos, SP
Telephone: 55 (123) 21 8842, 25 1000 or 25 1529
Fax: 55 (123) 21 5339 or 21 8446
Telex: 1233589 EBAE BR

CHAIRMAN: Jefferson Esteves Xavier
PRESIDENT AND CEO: Juarez de Siqueira Britto Wanderley
SENIOR VICE-PRESIDENT, COMMERCIAL (MARKETING AND SALES): Frederico Pinheiro Fleury Curado
SENIOR VICE-PRESIDENT, ADMINISTRATION: Antonio Pires Monteiro
SENIOR VICE-PRESIDENT, ENGINEERING: Luis Carlos Affonso
SENIOR VICE-PRESIDENT, PRODUCTION: Artur Aparecido Valério Coutinho
SENIOR VICE-PRESIDENT, FINANCE: Mrs Izilda de Fátima Victor
SENIOR VICE-PRESIDENT, EMBRAER PROGRAMMES: Satoshi Yokota
SENIOR VICE-PRESIDENT, SPECIAL PROGRAMMES (EMB-120EW/SR): Walter Bartels

Created 19 August 1969, Embraer began operating on 2 January 1970. It has a 250,000 m² (2,690,975 sq ft) factory area, and had built and delivered 4,810 aircraft by 1 January 1995, when workforce was 5,600. The 4,500th aircraft to be delivered (Brasília c/n 120204) was handed over on 27 October 1992. Neiva (which see) became a subsidiary March 1980.

Privatisation of Embraer was undertaken on 7 December 1994 with the auction of 55.4 per cent of voting stock. A consortium led by Bozano Simonsen bank acquired 45.44 per cent of auctioned stock, assumed a controlling interest in the company, and additionally provided extra $36 million in capitalisation. A further 10 per cent of voting stock was offered to the public within 60 days, with Embraer employees and the Brazilian government retaining 10 per cent and 18.4 per cent respectively.

Principal current own-design manufacturing programmes are EMB-120 Brasília commuter transport, AMX tactical fighter (jointly with Alenia and Aermacchi of Italy) and EMB-312 Tucano turboprop military trainer; under development is EMB 145 regional transport. CBA 123 Vector commuter transport (joint development with FMA of Argentina) abandoned in 1994. Subsidiary Neiva manufactures EMB 202 Ipanema agricultural aircraft and, under licence from Piper Aircraft Corporation, PA-32-301 Saratoga (as EMB-720D Minuano) and PA-34-220T (as EMB-810D Seneca IV).

In subcontract field, Embraer delivered 100th shipset of MD-11 outboard flaps to McDonnell Douglas in 1993, and received confirmation for third block (40 shipsets) against order placed 1987 for 200 sets, plus further 100 on option. First deliveries made in 1994 of wingtips and vertical fin fairings for Boeing 777 under 1991 contract.

Aircraft deliveries during 1994 totalled 65 (seven Brasílias, six Tucanos, one AMX and 51 assorted light aircraft).

UPDATED

EMBRAER EMB-312 TUCANO (TOUCAN)

Brazilian Air Force designation: T-27
Venezuelan Air Force designations: A-27/T-27

TYPE: Two-seat turboprop trainer.

PROGRAMME: Design started January 1978, Ministry of Aeronautics contract received 6 December that year for two flying prototypes and two static/fatigue test airframes, first prototype (Brazilian Air Force serial number 1300) made first flight 16 August 1980, second (1301) on 10 December 1980; third to fly (PP-ZDK, on 16 August 1982) was to production standard.

Deliveries to FAB began September 1983. In same month Egypt placed order for itself (40) and Iraq (80), with options on 60 more (including 20 for Iraq), first 10 of these built by Embraer and delivered from October 1984, remaining 110 (plus further 14 ordered early 1989) delivered to AOI in Egypt (see 1994-95 *Jane's*) as CKD kits for local assembly; selected for RAF by UK government March 1985 (see Shorts in UK section, 1994-95 and previous editions of *Jane's*), last of 118 on original Brazilian Air Force order delivered September 1986, FAB ordered further 10 in January 1990, all of which delivered during that year. French government commitment for up to 80 confirmed in July 1990, came into effect October 1991, with deliveries to take place 1993-97 (see Current Versions); five more ordered by Brazilian Air Force 1992, 14 for Colombian Air Force delivered December 1992.

CURRENT VERSIONS: **EMB-312**: Standard Embraer built version. *Detailed description applies to this model.*

Seven of the 14 Tucano trainers delivered to the Colombian Air Force

1993

EMB-312F. Version for French Armée de l'Air, replacing Fouga Magister at Groupement d'Instruction 312/Ecole de l'Air, Salon de Provence. Modifications include increased fatigue life airframe (10,000 hours), ventral airbrake, AoA indicator, propeller and canopy de-icing, repositioned refuelling and jacking points, and French-supplied (TEAM, Sextant, Thomson-CSF/CNI, Rockwell Collins France and SFIM) avionics suite incorporating latest com/nav electronics with LCDs. Two pre-series aircraft (funded in 1991) made first flights 7 and 8 April 1993 (PP-ZVD/439 and PP-ZVC/438 respectively), one delivered to CEV at Brétigny and one to CEAM at Mont-de-Marsan July 1993; second also later to Mont-de-Marsan where both underwent one-year evaluation. No 438 delivered to GI 312 on 6 July 1994. First batch of 20 (Nos 456-465) funded in 1992 for delivery July 1994-July 1995, but received from late 1994, second batch of 28 funded 1994 and to follow July 1995-July 1996. Requirement outstanding for final 30 to be delivered by May 1998.

EMB-312H Super Tucano: Stretched version, described separately.

S312. Modified version, with British equipment and more powerful 820 kW (1,100 shp) AlliedSignal TPE331 engine, built by Shorts for Royal Air Force. Difference in span due to redesigned wingtip fairings.

CUSTOMERS: See table. Total firm orders 653, of which more than 600 delivered, options held for further 96 (Brazil 35, Egypt 26, Iraq 20, UK 15). Delivery total includes kits for 25 of those ordered by UK.

EMBRAER TUCANO ORDERS

Country	Qty	First aircraft	First delivery
Argentina	30	E-101	May 1987
Brazil	133	1300	September 1983
Colombia	14	2250	December 1992
Egypt	54†	—	October 1984
France	80	438	June 1993
Honduras	12	250	May 1984
Iran	25	—	1989
Iraq	80†	—	1984
Kenya	12*	811	June 1990
Kuwait	16*	101	— (not yet delivered)
Paraguay	6	1051	1988
Peru	30	—	April 1987
UK	130*	ZF135	June 1987
Venezuela	31	0040	July 1986
Total	**653**		

*Shorts S312 produced in UK
†124 Egyptian/Iraqi aircraft assembled by AOI in Egypt
Excludes demonstrators (see Super Tucano) and one Shorts S312 destroyed on test flight

DESIGN FEATURES: Meets requirements of FAR Pt 23 Appendix A, and MIL and CAA Section K specifications. Low-mounted wings, stepped cockpits in tandem, fully aerobatic. NACA wing sections (63_2A-415 at root, 63A-212 at tip); incidence 1° 25′, geometric twist 2° 13′, dihedral 5° 30′ at 30 per cent chord, sweepback 0° 43′ 26″ at quarter-chord. Small fillet forward of tailplane root each side.

FLYING CONTROLS: Primary surfaces internally balanced and actuated mechanically; electrically actuated trim tab in, and small geared tab on, each Frise aileron, electromechanically actuated spring tab in rudder and port elevator. Electrically actuated single-slotted Fowler flaps on wing trailing-edges. Fixed incidence tailplane. Ventral airbrake on aircraft for France.

STRUCTURE: Conventional all-metal construction from 2024 series aluminium alloys; continuous three-spar wing box forms integral fuel tankage. Steel flap tracks. French aircraft strengthened to increase airframe life to 10,000 hours.

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel and Piper oleo-pneumatic shock-absorber on each unit. Accumulator for emergency extension in the event of hydraulic system failure. Shimmy damper on nose unit. Rearward-retracting steerable nose unit; main units retract inward into wings. Parker Hannifin 40-130 mainwheels, Oldi-DI-1 555-02-OL nosewheel. Tyre sizes 6.50-10 (Type III, 8 ply rating) on mainwheels, 5.00-5 (Type III, 6 ply rating) on nosewheel. Tyre pressures (±0.21 bar, 3 lb/sq in in each case) are 5.17 bars (75 lb/sq in) on mainwheels, 4.48 bars (65 lb/sq in) on nosewheel. Parker Hannifin 30-95A hydraulic mainwheel brakes.

POWER PLANT: One 559 kW (750 shp) Pratt & Whitney Canada PT6A-25C turboprop, driving a Hartzell HC-B3TN-3C/T10178-8R three-blade constant-speed fully feathering reversible-pitch propeller. Single-lever combined control for engine throttling and propeller pitch adjustment. Two integral fuel tanks in each wing, total capacity 694 litres (183.3 US gallons; 152.7 Imp gallons). Fuel tanks lined with anti-detonation plastics foam. Gravity refuelling point in each wing upper surface. Fuel system allows nominally for up to 30 seconds of inverted flight. (Aircraft has been test flown inverted for up to 10 minutes.) Provision for two underwing ferry fuel tanks, total capacity 660 litres (174.4 US gallons; 145 Imp gallons).

ACCOMMODATION: Instructor and pupil in tandem, on Martin-Baker BR8LC lightweight ejection seats, in air conditioned cockpit. One-piece fully transparent vacuum formed canopy, opening sideways to starboard, with internal and external jettison provisions. Rear seat elevated 25 cm (9.9 in). Dual controls standard. Baggage compartment in rear fuselage, with access via door on port side. Cockpit heating and canopy demisting by engine bleed air.

SYSTEMS: Freon cycle air conditioning system, with engine-driven compressor. Single hydraulic system, consisting basically of (a) control unit, including reservoir with usable capacity of 1.9 litres (0.5 US gallon, 0.42 Imp gallon), (b) an engine-driven pump with nominal pressure of 131 bars (1,900 lb/sq in) and nominal flow rate of 4.6 litres (1.22 US gallons; 1.01 Imp gallons)/min at 3,800 rpm, (c) landing gear and gear door actuators; (d) filter, (e) shutoff valve; and (f) hydraulic fluid to MIL-H-5606. Under normal operation, hydraulic system actuates landing gear extension/retraction and control of gear doors. Landing gear extension can be performed under emergency operation, emergency retraction also possible during landing and T-O with engine running. Reservoir and system are suitable for aerobatics. No pneumatic system. 28 V DC electrical power provided by a 6 kW starter/generator, 26 Ah battery and, for 115 V and 26 V AC power at 400 Hz, a 250 VA inverter. Diluter-demand oxygen system conforms to MIL-C-5887 and is supplied individually to each occupant by six MS 21227 D2 type cylinders (total capacity approx 1,200 litres, 317 US gallons; 264 Imp gallons) at a pressure of 31 bars (450 lb/sq in).

AVIONICS: *Comms:* Standard Collins avionics include dual VHF-20A transceivers; TDR-90 ATC transponder and dual 387C-4 audio systems; Embraer radio transferring system, Telephonics audio control panel.

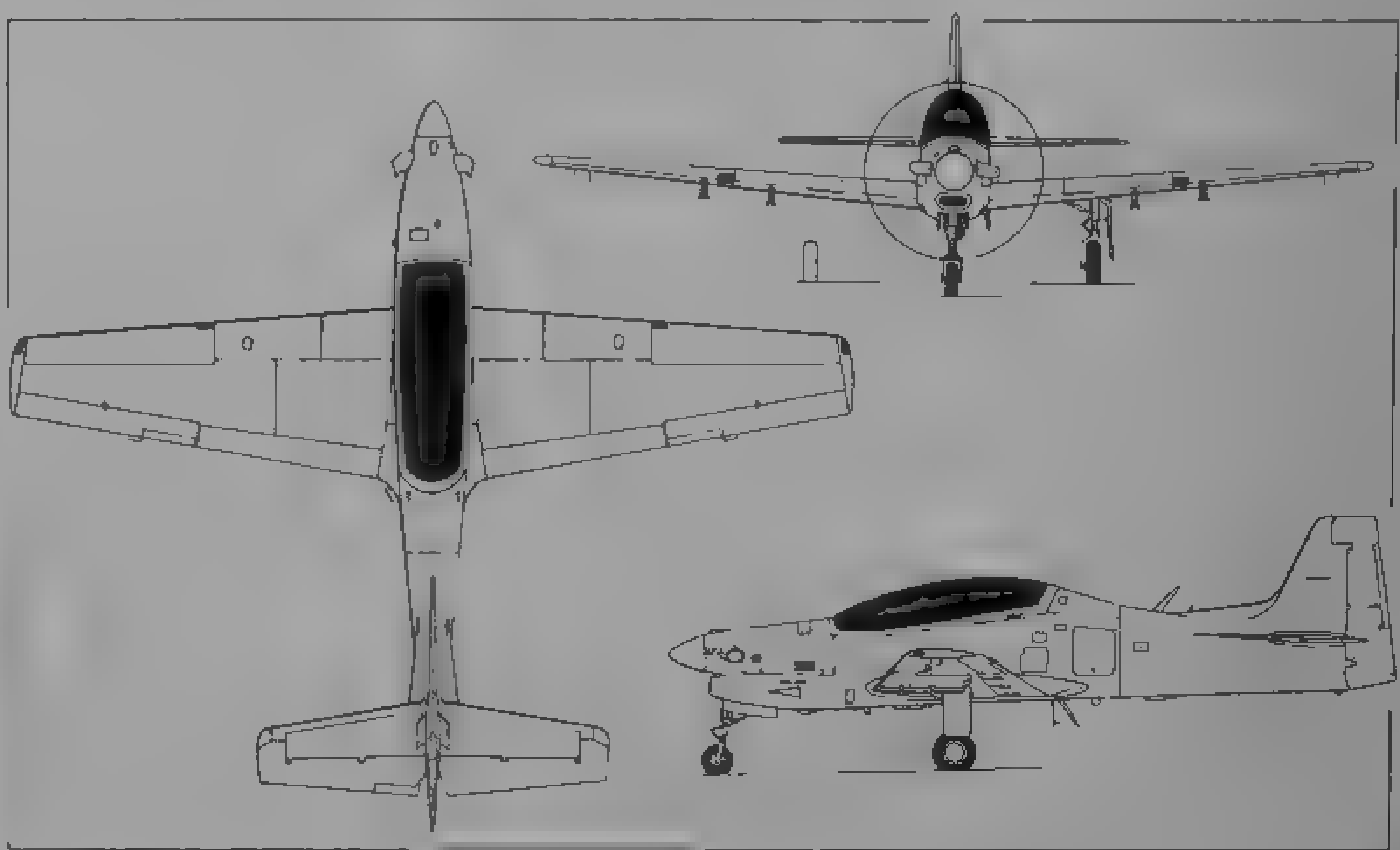
Flight: VIR-31A VOR/ILS/marker beacon receiver; DME-40; PN-101 gyromagnetic compass and ADF-60A. TEAM (Télécommunications Electroniques, Aéronautiques et Maritimes) responsible for Sextant/Thomson-CSF/Rockwell Collins France/SFIM package for French Air Force Tucanos. See 1993-94 *Jane's* for Shorts S312 avionics.

EQUIPMENT: Landing light in each wing leading-edge, taxying lights on nosewheel unit.

ARMAMENT: Two hardpoints under each wing, each stressed for a maximum load of 250 kg (551 lb). Typical loads, on GB100-20-36B pylons, include two 0.30 in C2 machine gun pods, each with 500 rds, four 25 lb Mk 76 practice bombs, four 250 lb Mk 81 general purpose bombs; or four LM 37/7A or LM-70/7 launchers, each with seven rockets (Avibras SBAT-37 and SBAT-70 respectively). Fixed reflex-type gunsight.

DIMENSIONS, EXTERNAL:

Wing span	11.14 m (36 ft 6½ in)
Wing chord: at root	2.30 m (7 ft 6½ in)
at tip	1.07 m (3 ft 6¼ in)
Wing aspect ratio	6.40
Length overall	9.86 m (32 ft 4¼ in)
Fuselage: Length (excl rudder)	8.53 m (27 ft 11⅞ in)
Max width	1.00 m (3 ft 3¼ in)
Max depth	1.55 m (5 ft 1 in)
Height overall (static)	3.40 m (11 ft 1¾ in)
Tailplane span	4.66 m (15 ft 3½ in)
Wheel track	3.76 m (12 ft 4 in)
Wheelbase	3.16 m (10 ft 4½ in)
Propeller diameter	2.36 m (7 ft 9 in)



Embraer EMB-312 Tucano basic trainer *(Jane's/Dennis Punnett)*

1983

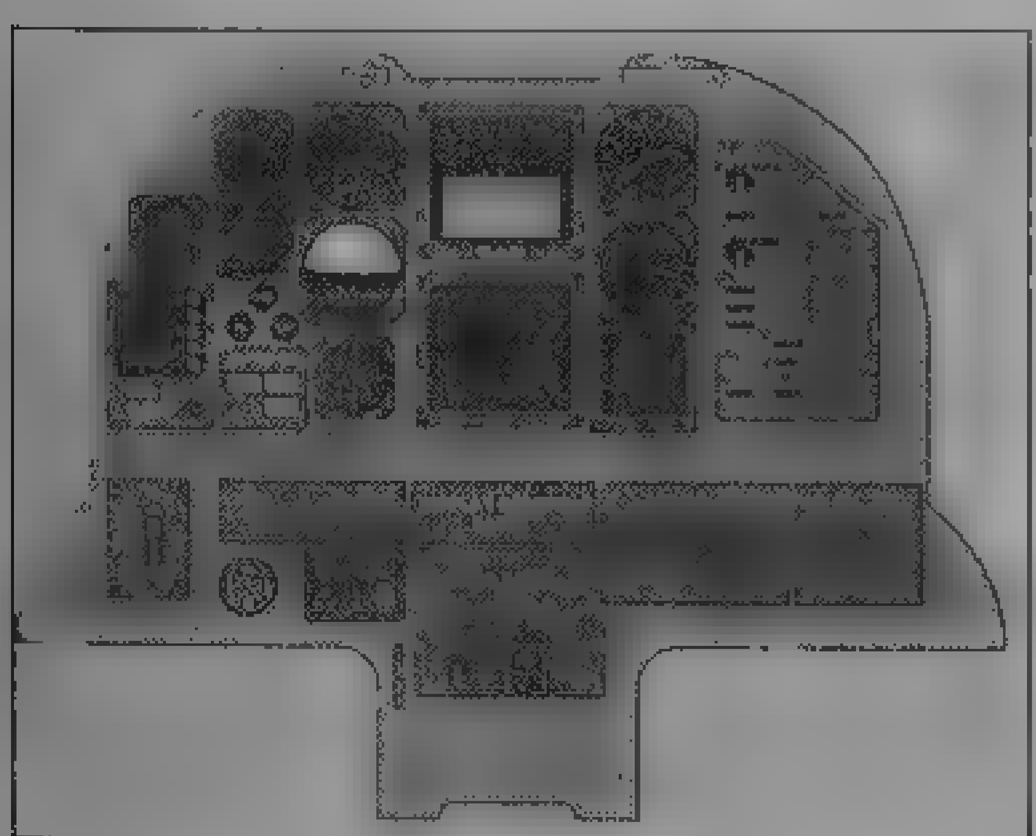
EMB-312 Tucano tandem-seat trainer of the Brazilian Air Force

1994

Propeller ground clearance (static)	0.33 m (1 ft 1 in)
Baggage compartment door:	
Height	0.60 m (1 ft 11½ in)
Width	0.54 m (1 ft 9¼ in)
Height to sill	1.25 m (4 ft 1¼ in)
DIMENSIONS, INTERNAL	
Cockpits: Combined length	2.90 m (9 ft 6¼ in)
Max height	1.55 m (5 ft 1 in)
Max width	0.85 m (2 ft 9½ in)
Baggage compartment volume	0.17 m³ (6.0 cu ft)
AREAS	
Wings, gross	19.40 m² (208.82 sq ft)
Ailerons (total)	1.97 m² (21.20 sq ft)
Trailing-edge flaps (total)	2.58 m² (27.77 sq ft)
Fin, incl dorsal fin	2.29 m² (24.65 sq ft)
Rudder, incl tab	1.38 m² (14.85 sq ft)
Tailplane, incl fillets	4.77 m² (51.34 sq ft)
Elevators, incl tab	2.00 m² (2[illegible].53 sq ft)
WEIGHTS AND LOADINGS	
Basic weight empty	1,870 kg (4,123 lb)
Max internal fuel load (usable)	529 kg (1,166 lb)
Max external stores load	1,000 kg (2,205 lb)
Max T-O weight: clean	2,550 kg (5,622 lb)
with external stores	3,175 kg (7,000 lb)
Max ramp weight	3,195 kg (7,044 lb)
Max landing weight: clean	2,550 kg (5,622 lb)
with external stores	2,800 kg (6,173 lb)
Max zero-fuel weight	2,050 kg (4,519 lb)
Max wing loading: clean	131.4 kg/m² (26.92 lb/sq ft)
with external stores	163.7 kg/m² (33.52 lb/sq ft)
Max power loading: clean	4.56 kg/kW (7.50 lb/shp)
with external stores	5.68 kg/kW (9.33 lb/shp)

PERFORMANCE (at max clean T-O weight except where indicated):

Never-exceed speed (VNE)	280 kts (519 km/h, 322 mph) EAS
Max level speed at 3,050 m (10,000 ft)	242 kts (448 km/h, 278 mph)
Max cruising speed at 3,050 m (10,000 ft)	222 kts (411 km/h, 255 mph)
Econ cruising speed at 3,050 m (10,000 ft)	172 kts (319 km/h, 198 mph)
Stalling speed, power off:	
flaps and landing gear up	72 kts (133 km/h, 83 mph) EAS
flaps and landing gear down	67 kts (124 km/h, 77 mph) EAS
Max rate of climb at S/L	680 m (2,231 ft)/min
Service ceiling	9,150 m (30,000 ft)
T-O run	380 m (1,250 ft)
T-O to 15 m (50 ft)	710 m (2,330 ft)
Landing from 15 m (50 ft)	605 m (1,985 ft)
Landing run	370 m (1,214 ft)
Range at 6,100 m (20,000 ft) with max fuel, 30 min reserves	995 n miles (1,843 km; 1,145 miles)
Ferry range at 6,100 m (20,000 ft) with underwing tanks	1,798 n miles (3,330 km; 2,069 miles)
Endurance on internal fuel at econ cruising speed at 6,100 m (20,000 ft), 30 min reserves	approx 5 h



Instrument panel of Embraer AL-X

1995

g limits: fully Aerobatic category, at max clean T-O weight	+6/−3
at max T-O weight with external stores	+4.4/−2.2

UPDATED

EMBRAER EMB-312H SUPER TUCANO

TYPE: Stretched version of EMB-312.

PROGRAMME: Development began January 1991, EMB-312H announced at Paris Air Show June 1991, Embraer development aircraft PT-ZTW (c/n 312161, previously used as prototype for TPE331 powered Tucano adopted by Royal Air Force) modified as Tucano H proof-of-concept (POC) prototype, making first flight in this form 9 September 1991. This aircraft toured US Air Force/Navy bases August and September 1992 as preliminary to Super Tucano entry in JPATS competition, Embraer teamed with Northrop May 1992 to bid Super Tucano for JPATS (see USAF entry in US section). Provisional Brazilian type certification granted August 1994 after 500 hour, 396-sortie test and certification programme.

CURRENT VERSIONS: **EMB-312H**: Two prototypes (PT-ZTV, c/n 312454, first flight 15 May 1993, and PP-ZTF, c/n 312455, first flight 14 October 1993) tailored to US JPATS requirements as **EMB-312HJ**.

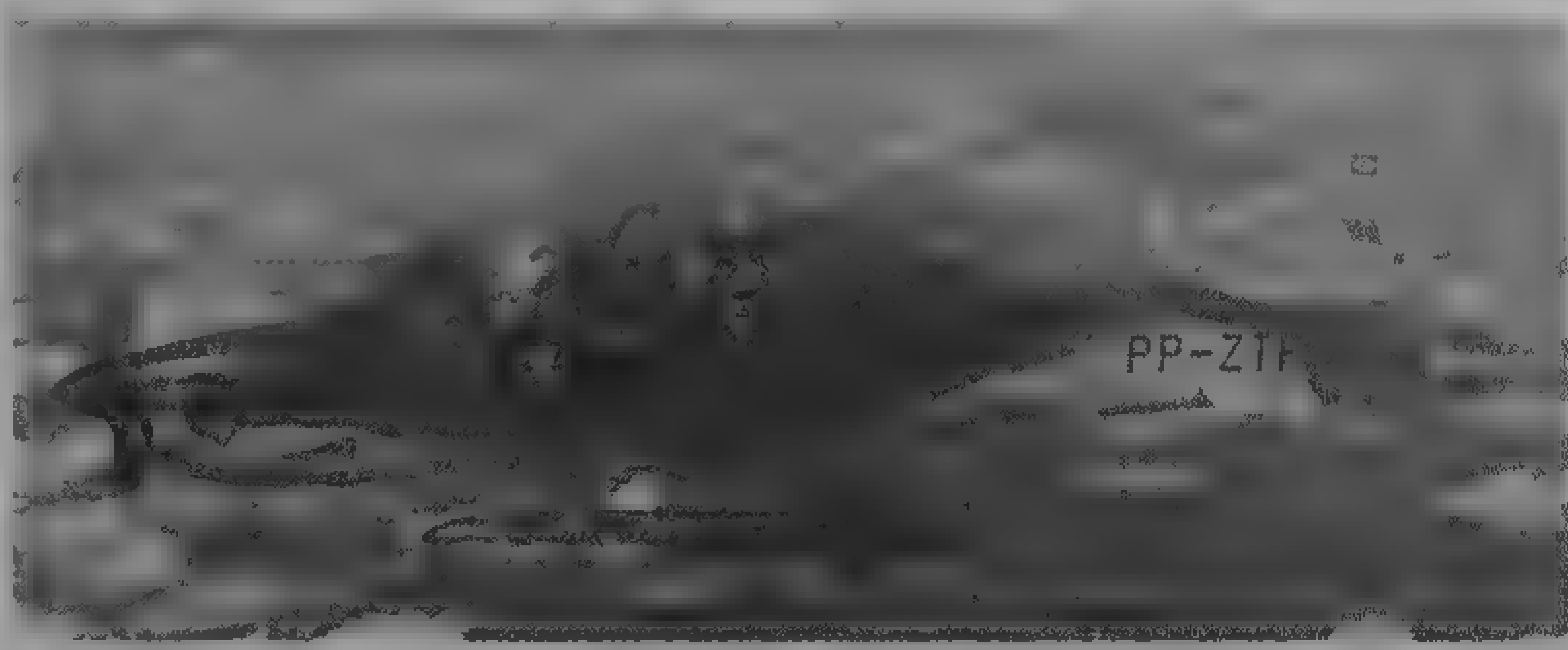
AL-X: Brazilian Air Force (FAB) version, for border patrol missions under its SIPAM (SIstema de Proteção da AMazonia) programme. FAB finalised specification in early 1994; trials to validate projected flight characteristics, using POC aircraft and both Super Tucano prototypes, completed 1994. Contract anticipated July 1995 for two prototypes (including one single-seat) and production of 100 (of which 30 to 40 for training).

DESIGN FEATURES: Differs from standard EMB-312 mainly in having more powerful engine and plugs of 0.37 m (1 ft 2 in) forward and 1.00 m (3 ft 3¼ in) aft of cockpit to accommodate longer engine and retain CG and stability. Other changes include strengthened airframe for higher *g* loads and longer fatigue life; cockpit pressurisation, new, reprofiled, electrically actuated clamshell canopy, zero/zero ejection seats, air cycle air conditioning and crew anti-g system, onboard oxygen generating system (OBOGS), single-point pressure refuelling/defuelling, canopy and propeller de-icing, ventral airbrake, hydraulic steering 'all glass' avionics including GPS navigation and TCAS. Able to cover whole primary and half of advanced pilot training syllabus, and fly precision weapons delivery and target towing missions.

POWER PLANT: *AL-X*: One 932 kW (1,250 shp) Pratt & Whitney Canada PT6A-68-1 turboprop, driving a Hartzell five-blade constant-speed fully feathering reversible-pitch propeller (PT6A-67R of 1,193 kW, 1,600 shp in POC prototype). *EMB-312HJ*: One 969 kW (1,300 shp) PT6A-68A. Total fuel capacity (all versions) 694 litres (183 US gallons, 153 Imp gallons).

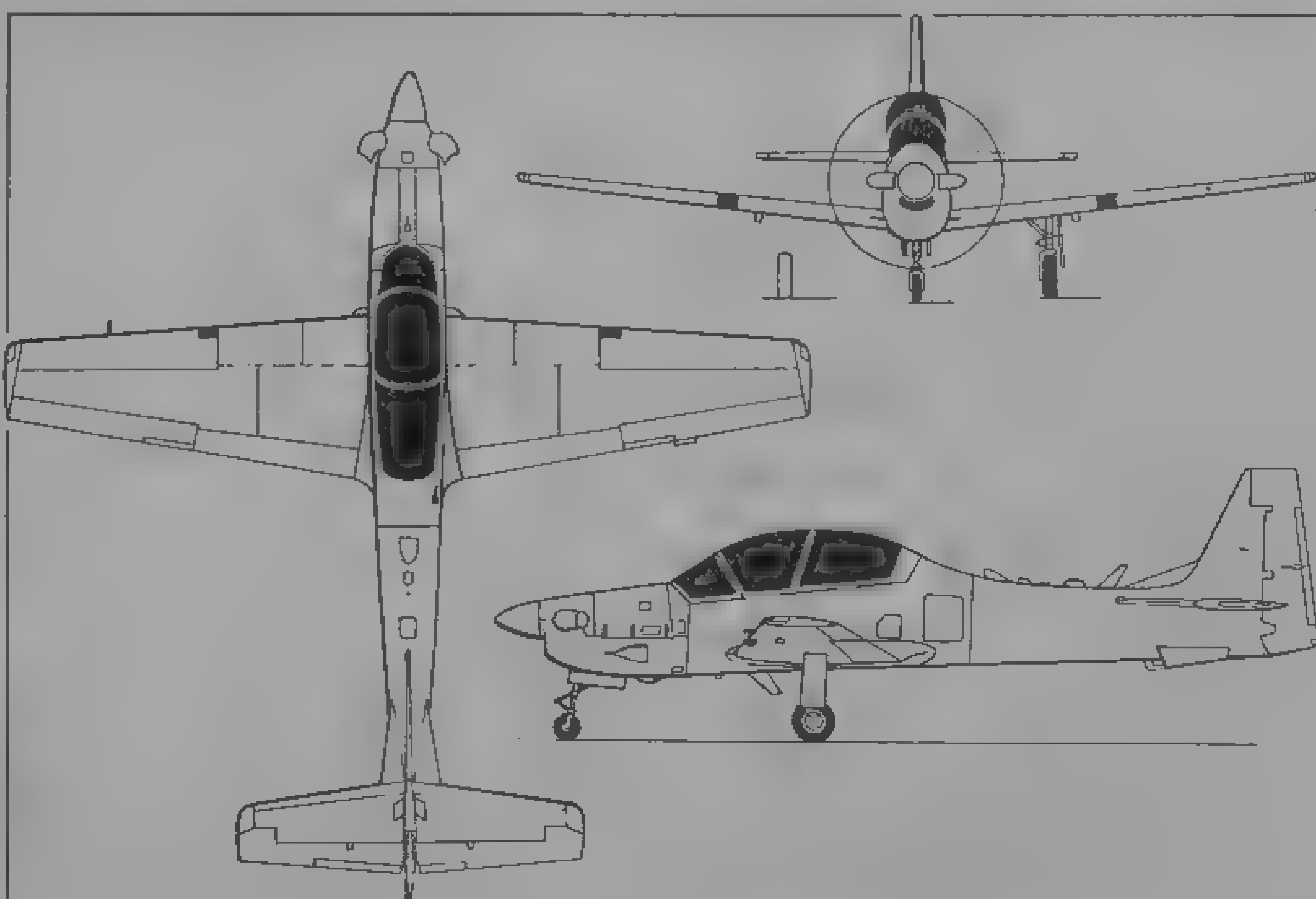
DIMENSIONS, EXTERNAL: As EMB-312 except:

Length overall	11.42 m (37 ft 5¾ in)
Fuselage: Length (excl rudder)	10.53 m (34 ft 6½ in)
Max depth	1.86 m (6 ft 1¼ in)
Height overall (static)	3.90 m (12 ft 9½ in)
Wheelbase	3.36 m (11 ft 0¼ in)
Propeller diameter	2.39 m (7 ft 10 in)
Propeller ground clearance (static)	0.345 m (1 ft 1½ in)
WEIGHTS AND LOADINGS (clean):	
Basic weight empty	2,420 kg (5,335 lb)
Max internal fuel load (usable)	538 kg (1,186 lb)
Max T-O and landing weight	3,190 kg (7,033 lb)



EMB-312H Super Tucano second prototype *(Embraer/Mario Vinagre)*

1995



AL-X internal security version of Embraer Super Tucano *(Jane's/James Goulding)*

1995

EMB 120 Brasilia operated as a VC-97 VIP transport by Grupo de Transporte Especial (GTE) of the Brazilian Air Force

1993

Max ramp weight 3,210 kg (7,077 lb)
Max zero-fuel weight 2,670 kg (5,886 lb)
Max wing loading 164 4 kg/m² (33 68 lb/sq ft)
Max power loading 3 42 kg/kW (5 63 lb/shp)

PERFORMANCE (at max clean T-O weight except where indicated):
Max level speed at 6,100 m (20,000 ft)
301 kts (557 km/h, 346 mph)
Max cruising speed at 6,100 m (20,000 ft)
286 kts (530 km/h, 329 mph)
Econ cruising speed at 6,100 m (20,000 ft)
228 kts (422 km/h, 262 mph)
Stalling speed, power off
flaps and landing gear up
85 kts (157 km/h, 98 mph) EAS
flaps and landing gear down
78 kts (145 km/h, 90 mph) EAS
Max rate of climb at S/L 895 m (2,925 ft)/min
Service ceiling 10,670 m (35,000 ft)
T-O run 350 m (1,148 ft)
T-O to 15 m (50 ft) 550 m (1 805 ft)
Landing from 15 m (50 ft) 860 m (2,820 ft)
Landing run 550 m (1,805 ft)
Range at 9,150 m (30,000 ft) with max fuel, 30 min reserves 847 n miles (1,568 km, 974 miles)
Ferry range at 7,620 m (25,000 ft) with underwing tanks and 30 min reserves
1,495 n miles (2,768 km; 1,720 miles)
Endurance on internal fuel at econ cruising speed at 7,620 m (25,000 ft), 30 min reserves 6 h 30 min
g limits, fully Aerobatic category at 2,770 kg (6,107 lb) +7/−3.5
at 2,770 kg (6,107 lb) with external stores +4/−2 2

UPDATED

EMBRAER EMB-120 BRASILIA

Brazilian Air Force designation: VC-97

TYPE: Twin-turboprop passenger and cargo transport

PROGRAMME: Design began September 1979; three flying prototypes, two static/fatigue test aircraft and one preseries demonstrator built (first flight, by PT-ZBA, 27 July 1983); Brazilian CTA certification with original PW115 engines on 10 May 1985 followed by FAA (FAR Pt 25) type approval 9 July 1985, British/French/German approval 1986 and Australian in April 1990, deliveries began June 1985 (to Atlantic Southeast Airlines, USA, entering service that October), first order for corporate version (United Technologies Corporation, USA) received August 1986, delivered following month, from October 1986 (c/n 120028), all Brasilias delivered incorporate composite materials equivalent to 10 per cent of aircraft basic empty weight, also since late 1986 has been available in hot and high version (certificated 26 August 1986) with PW118A engines which maintain maximum output up to ISA + 15°C at S/L (first customer Skywest of USA); on 4 January 1989, first prototype began flight trials with AlliedSignal TPE331-12B turboprop on port side of rear fuselage, as testbed for engine installation of now cancelled Embraer/FMA CBA-123, 200th Brasilia delivered 20 August 1990; one million flying hours completed January 1991

Extended-range EMB 120ER (now standard version) announced June 1991, certificated by CTA February 1992, 3 29 million flying hours (3 6 million cycles) completed and 72 million passengers carried by January 1995

CURRENT VERSIONS: **EMB-120**: Initial production version, with 1,118 5 kW (1,500 shp) PW115 engines and Hamilton Standard 14RF four-blade propellers (replaced at early stage by higher output PW115s of 1,193 kW, 1,600 shp).

EMB-120RT (Reduced Take-off): Standard production version until 1993, 1,342 kW (1,800 shp) PW118 engines for better field performance; most early aircraft now retrofitted to RT standard. Also, from late 1986, in hot/high version with PW118As which maintain maximum output up to ISA + 15°C at S/L.

EMB-120 Cargo: All-cargo version of ER with 4,000 kg (8,818 lb) payload capacity; floor and sidewall protection, fire detection system, smoke curtain between flight deck and cargo cabin, and cargo restraint net

EMB-120 Combi: Mixed configuration version of ER with quick-release seats, 9*g* movable rear bulkhead and cargo restraint net, retains toilet and galley, typical capacity 30 passengers and 700 kg (1,543 lb) of cargo or 19 passengers and 1,100 kg (2,425 lb) cargo

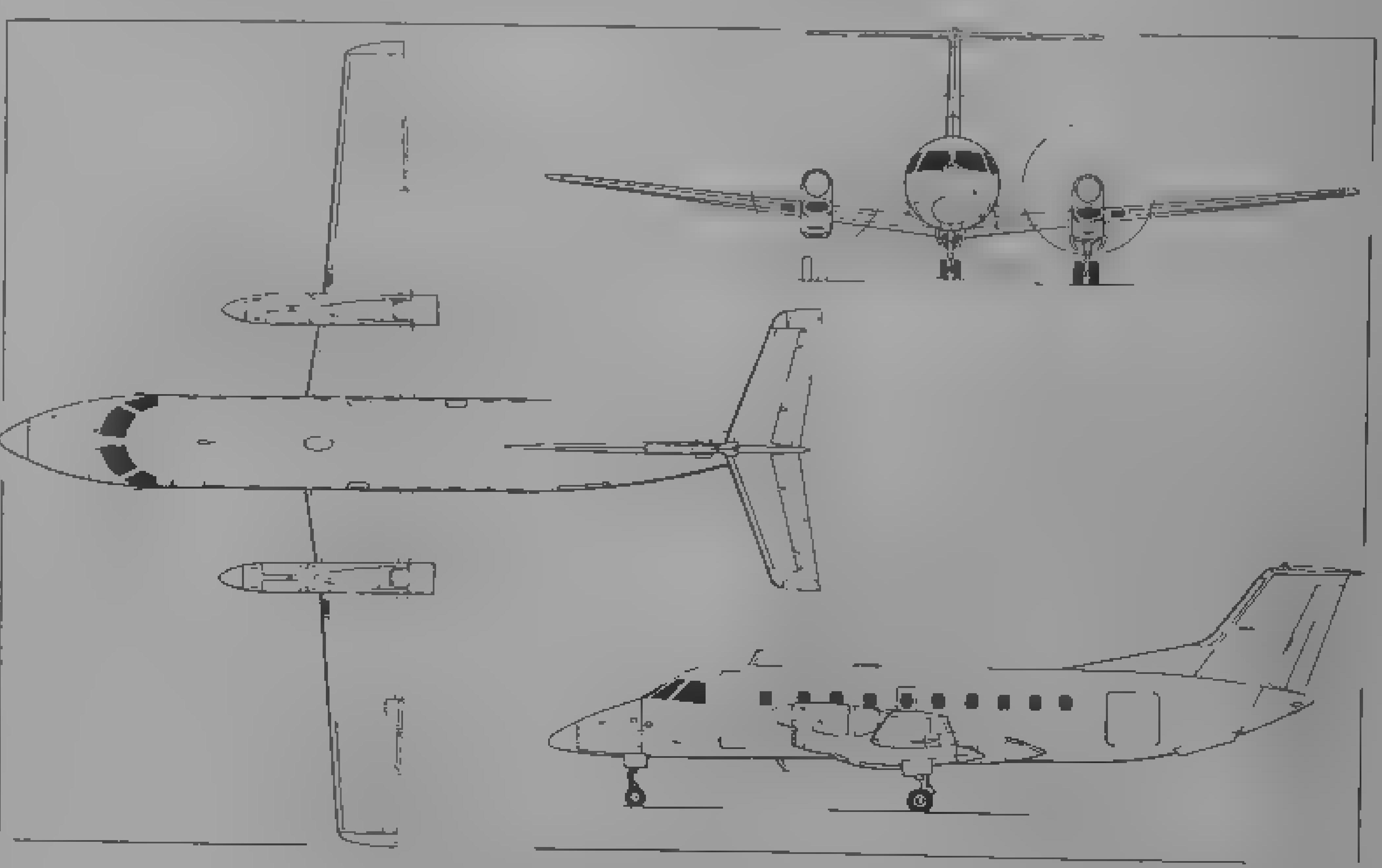
EMB-120QC (Quick-Change): Convertible in 40 minutes from 30-passenger layout to 3,500 kg (7,716 lb) all-cargo configuration with floor and sidewall protection, fire detection system, smoke curtain aft of flight deck, 9 *g* movable rear bulkhead and cargo restraint net, conversion from cargo to passenger interior takes 50 minutes. First customer (14 May 1993 delivery), Total Linhas Aereas of Brazil

EMB-120ER Brasilia Advanced Standard production version from 1994, previously referred to as EMB-120X or Improved Brasilia. Additional range obtained by increasing maximum T-O weight without major structural change, this also allows for increased standard passenger-plus-baggage weight (97 5 kg, 215 lb per person instead of 91 kg; 200 lb) and obligatory fitting of TCAS and flight data recorder Incorporates several modifications and some redesign aimed at maximising both passenger comfort and dispatchability while reducing operational and maintenance costs. These include redesigned, interchangeable leading-edges for all flying surfaces, deletion of the fin de-icing boot, improved door seals and redesigned interior panel joints to reduce passenger cabin noise, more comfortable pilot seats; redesigned flight deck door; and new-design overhead bins with wider doors and increased capacity Other features include new passenger cabin lighting, redesigned flight deck and cabin ventilation systems, new windscreen frame fairings to improve resistance to condensation; new flight deck sun visors; improved flap system, and an increase in baggage/cargo compartment capacity to 700 kg (1,543 lb)

Existing Brasilias can be retrofitted to ER standard (first two customers for retrofit Delta Air Transport and Luxair), initial production deliveries (two) to Great Lakes Aviation in USA, December 1994 *Detailed description applies to EMB-120ER except where indicated*

EMB-120EW Airborne early warning and remote sensing version, announced September 1994, under development for Brazilian government's Sistema de Vigilancia da AMazonia (SIVAM) programme. EMB-120EW (initial order for five, for delivery to Brazilian Air Force by 1997) will have internal structural changes to accommodate mission systems, maximum T-O weight increased to 14,000 kg (30,865 lb), engines uprated to 1,491 kW (2,000 shp), additional fuel tank in rear fuselage to increase mission endurance to 11 hours, more powerful Sundstrand APS-1000 APU; new avionics including dual ring laser gyro INS, GPS, new flight management system; secure, real-time VHF data downlink, and modified electrical and environmental control systems Mission systems comprise civil version of Ericsson Erieye side-looking airborne radar with antenna housed in long overfuselage fairing, optimised for lower speed targets typically encountered in border incursions. Radar is pulse Doppler type, operating in S-band, offering coverage from very low level up to about 25,000 m (82,000 ft) and at ranges exceeding 162 n miles (300 km, 186 miles). Accommodation for up to seven flight crew of two, relief flight crew and up to three multifunction operator stations for missions system specialists, including tactical co-ordinator

EMB-120SR. Remote sensing version, of which three ordered for FAB's SIVAM programme Same airframe/engine modifications as EMB 120EW, but different mission systems for primary roles in natural resources exploitation, environmental and river pollution control, economic activities, ground occupation monitoring and illegal activities surveillance Main sensor is version of Canadian MacDonald Dettwiler IRIS (Integrated Radar Imaging System) synthetic aperture radar, installed in underfuselage bulge with auxiliary antennae beneath



Embraer EMB-120 Brasilia twin turboprop transport *(Jane's/Dennis Punnett)*

1993

Embraer EMB-120 Brasilia in the insignia of Brazilian airline Pantanal

1994

wingroots, operating in P-band interferometric mode. Other main sensors include Versatron SA 144 Skyball high-sensitivity TV/FLIR, and ultra-violet/visible/infra-red linescanner.

Both special mission versions have 'communications/non-communications exploitation system' to track VHF/UHF illegal communications traffic.

VC-97: VIP transport model for Brazilian Air Force's 6° Esquadrao de Transporte Aérea and Grupo de Transporte Especial, both at Brasilia.

CUSTOMERS: Total of 318 ordered, of which 285 delivered (including four VC-97s) by 8 December 1994, further 147 then on option. Operators include airlines in Angola (Ematec), Aruba (Air Aruba), Australia (Flight West), Belgium (Delta Air Transport), Bophuthatswana (Bop Air), Brazil (Interbrasil STAR, Nordeste, Pantanal, Total and Rio-Sul), Canada (Ontario Express), Cape Verde (TA de Cabo Verde), France (Air Exel and Air Littoral), Luxembourg (Luxair), Norway (Norsk Air), Panama (Tatais), the UK (CSE Aviation and Esquel) and the USA (ACA, ASA, Air Midwest, Comair, Great Lakes, Mesa, Midway, SkyWest, Texas Air/Britt Airways and WestAir).

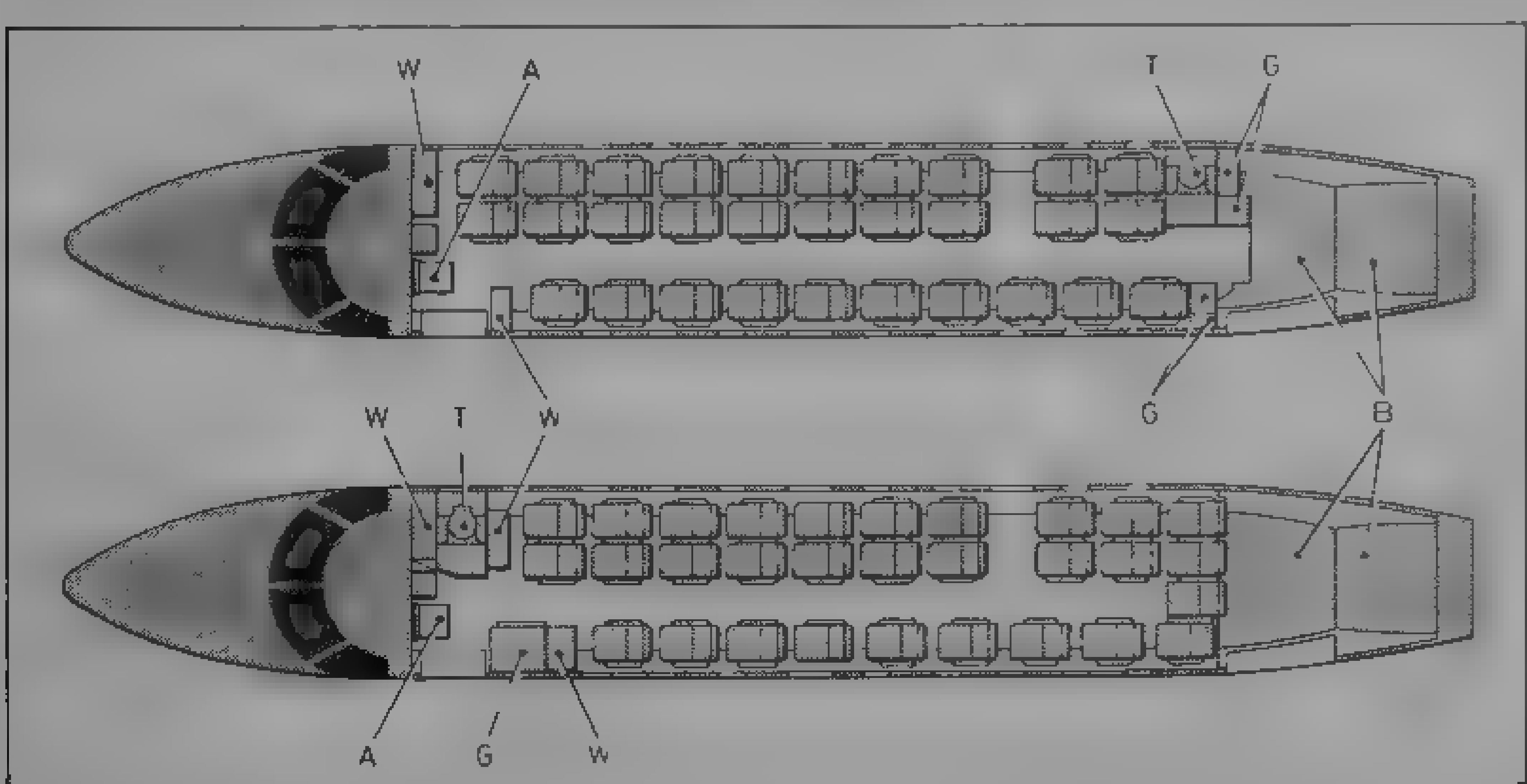
DESIGN FEATURES: Low mounted unswept wings, circular-section pressurised fuselage, all sweptback T tail unit. Wing section NACA 23018 (modified) at root, NACA 23012 at tip, incidence 2°, at 66 per cent chord, wings have 6° 30′ dihedral. Fixed incidence tailplane.

FLYING CONTROLS: Internally balanced ailerons, and horn balanced elevators, actuated mechanically (ailerons by dual irreversible actuators); serially hinged two-segment rudder actuated hydraulically by Bertea CSD unit, trim tabs in ailerons (one port, two starboard) and each elevator. Hydraulically actuated, electrically controlled, double-slotted Fowler trailing-edge flap inboard and outboard of each engine nacelle, with small plain flap beneath each nacelle, no slats, slots, spoilers or airbrakes. Small fence on each outer wing between outer flap and aileron, twin ventral strakes under rear fuselage.

STRUCTURE: Kevlar reinforced glassfibre for wing and tailplane leading-edges and tips, wingroot fairings, dorsal fin, fuselage nosecone and (when no APU fitted) tailcone, Fowler flaps of carbonfibre. Remainder conventional semi-monocoque/stressed skin structure of 2024/7050/7475 aluminium alloys with chemically milled skins. Fuselage pressurised between flat bulkhead forward of flight deck and hemispherical bulkhead aft of baggage compartment, and meets damage tolerance requirements of FAR Pt 25 (Transport category) up to Amendment 25-54. Wing is single continuous three-spar fail-safe structure, attached to underfuselage frames, tail surfaces also three-spar.

LANDING GEAR: Retractable tricycle type, with Goodrich twin wheels and oleo-pneumatic shock-absorber on each unit (main units 12 in, nose unit 8 in). Hydraulic actuation, all units retract forward (main units into engine nacelles). Hydraulically powered nosewheel steering. Goodyear tyres, size 24 × 7.25 in (main), 18 × 5.5 in (nose); pressure 6.90 to 7.58 bars (100 to 110 lb/sq in) on main units, 4.14 to 4.83 bars (60 to 70 lb/sq in) on nose unit. Goodrich carbon brakes standard (steel optional). Hydro Aire anti-skid system standard, autobrake optional. Minimum ground turning radius 15.76 m (51 ft 8½ in). Nosewheel guard optional for operation from unpaved surfaces.

POWER PLANT: Two Pratt & Whitney Canada PW118 or PW118A turboprops, each rated at 1,342 kW (1,800 shp) for T-O and maximum continuous power, and driving a Hamilton Standard 14RF-9 four-blade constant-speed reversible-pitch autofeathering propeller with glassfibre blades containing aluminium spars. Fuel in two-cell 1,670 litre (441 US gallon, 367.2 Imp gallon) integral tank in each wing, total capacity 3,340 litres (882 US gallons, 734.4 Imp gallons), of which 3,308 litres (874 US gallons, 728 Imp gallons) are usable. Single-point pressure refuelling (beneath outer starboard wing), plus gravity point in upper surface of each wing. Oil capacity 9 litres (2.4 US gallons, 2 Imp gallons).



Alternative 30-passenger layouts in the EMB-120 Brasilia (*Jane's/Mike Keep*)
A: attendant's seat, B: baggage, G: galley, T: toilet, W: wardrobe

1994

ACCOMMODATION: Two-pilot flight deck. Main cabin accommodates cabin attendant and 30 passengers in three-abreast seating at 79 cm (31 in) pitch, with overhead lockable baggage racks, in pressurised and air conditioned environment. Passenger seats of carbonfibre and Kevlar, floor and partitions of carbonfibre and Nomex sandwich, side panels and ceiling of glassfibre/Kevlar/Nomex/carbonfibre sandwich. Provisions for wardrobe, galley and toilet. Quick change interior available optionally (first customer, Total Linhas Aéreas in 1993), for 30 passengers or 3,500 kg (7,716 lb) of cargo. Downward-opening main passenger door, with airstairs, forward of wing on port side. Type II emergency exit on starboard side at rear. Overwing Type III emergency exit on each side. Pressurised baggage compartment aft of passenger cabin, with large door on port side. Also available with all-cargo interior, executive or military transport interior, or in mixed traffic version with 24 or 26 passengers (toilet omitted in latter case), and 900 kg (1,984 lb) of cargo in enlarged rear baggage compartment.

SYSTEMS: AiResearch air conditioning/pressurisation system (differential 0.48 bar; 7 lb/sq in), with dual packs of recirculation equipment. Duplicated hydraulic systems (pressure 207 bars; 3,000 lb/sq in), each powered by an engine driven pump, for landing gear, flap, rudder and brake actuation, and nosewheel steering. Emergency standby electric pumps on each system, plus single standby hand pump for landing gear extension. Main electrical power supplied by two 28 V 400 A DC starter/generators, two 28 V 100 A DC auxiliary brushless generators for secondary and/or emergency power, one 24 V 40 Ah Ni/Cd battery for assisted starting and emergency power. Main and standby 450 VA static inverters for 26/115 V AC power at 400 Hz. Single high-pressure (127.5 bars; 1,850 lb/sq in) oxygen cylinder for crew, individual chemical oxygen generators for passengers. Pneumatic de-icing for wing and tail leading-edges, and engine air intakes; electrically heated windscreens, propellers and pitot tubes; bleed air de-icing of engine air intakes. Optional AlliedSignal GTCP36-150(A) APU in tailcone, for electrical and pneumatic power supply.

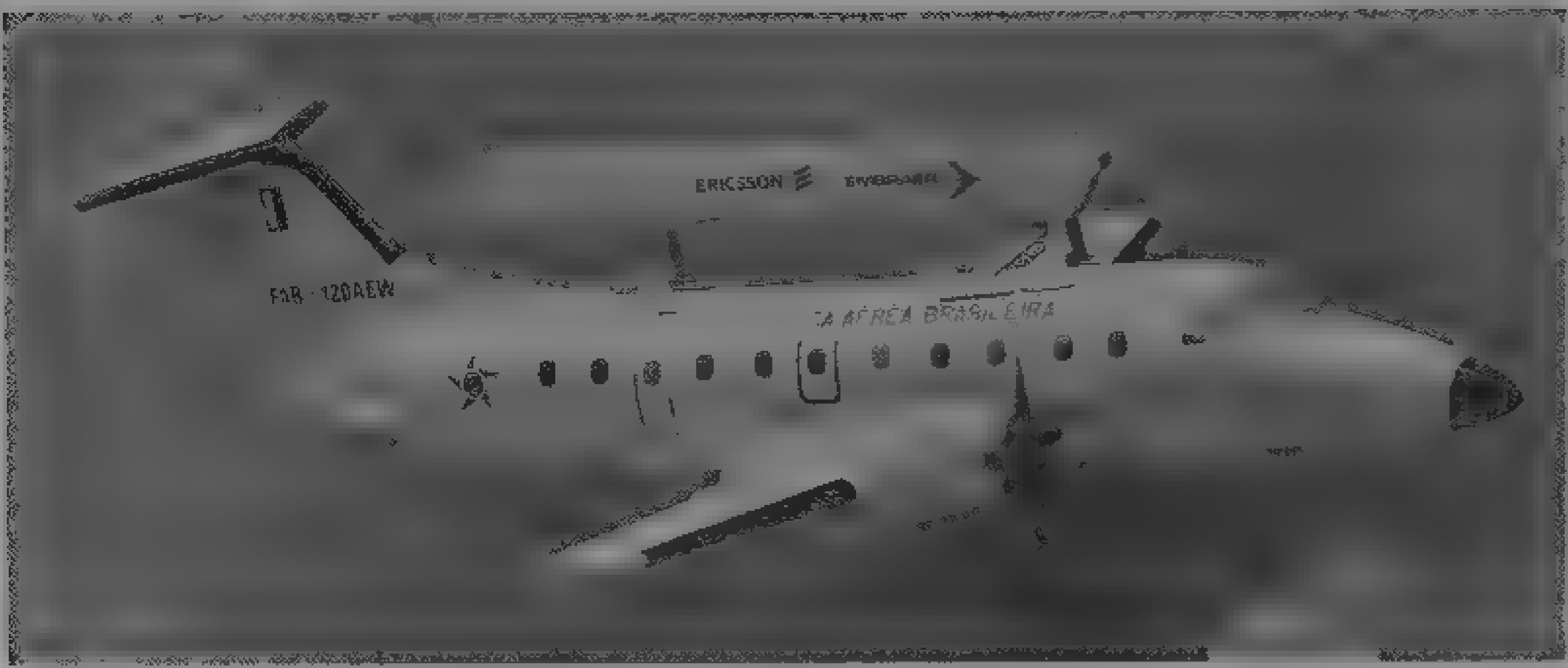
AVIONICS: Collins Pro Line II digital package as core system.

Comms: Dual VHF-22 com transceivers, one TDR 90 transponder, Dorne & Margolin DMELT 81 emergency locator transmitter, Fairchild voice recorder, dual Avtech audio/interphones and Avtech PA and cabin interphone all standard. Third VHF com, second transponder, Motorola Selcal and flight entertainment music all optional. Alternative Bendix/King avionics package optional.

Radar: Collins WXR 270 weather radar standard. WXR-300 optional.

Flight: Dual VIR 32 VHF nav receivers, one ADF 60A, DME 41 and CLT 22/32/62/92 control heads. Optional single/dual JET RNS-8000 3D or Racal Avionics RN 5000 nav and second DME. Optional equipment includes APS 65 digital autopilot, single/dual FCS 65 digital flight director, single/dual Canadian Marconi CMA-771 Alpha VLF/Omega, MLS, GPWS, flight recorder.

Instrumentation: Dual AHRS-85 digital strapdown AHRS, dual ADI-84, dual EHSI-74, dual RMI 36 and JET standby altitude indicator standard. Optional equipment



Model of Brazilian Air Force EMB-120EW with dorsal housing for Ericsson Erieye SLAR
1995

includes dual EFIS 86 electronic flight instrumentation systems, MFD-85 multifunction display, dual ALT 55 radio altimeters and altitude alerter/preselect

Mission: Other avionics, for special versions, described under EMB 120EW and EMB 120SR

DIMENSIONS, EXTERNAL:
Wing span 19.78 m (64 ft 10¾ in)
Wing chord: at root 2.81 m (9 ft 2¾ in)
at tip 1.40 m (4 ft 7 in)
Wing aspect ratio 9.92
Length overall: 120 20.00 m (65 ft 7½ in)
120ER 20.07 m (65 ft 10¼ in)
Fuselage: Length 18.73 m (61 ft 5½ in)
Max diameter 2.28 m (7 ft 5¾ in)
Height overall 6.35 m (20 ft 10 in)
Elevator span 6.94 m (22 ft 9¼ in)
Wheel track (c/l of shock-struts) 6.58 m (21 ft 7 in)
Wheelbase 6.97 m (22 ft 10½ in)
Propeller diameter 3.20 m (10 ft 6 in)
Propeller ground clearance (min) 0.52 m (1 ft 8½ in)
Passenger door (fwd, port): Height 1.70 m (5 ft 7 in)
Width 0.774 m (2 ft 6½ in)
Height to sill 1.47 m (4 ft 10 in)
Cargo door (rear, port): Height 1.36 m (4 ft 5½ in)
Width 1.30 m (4 ft 3¼ in)
Height to sill 1.67 m (5 ft 5¾ in)
Emergency exit (rear, stbd): Height 1.37 m (4 ft 6 in)
Width 0.51 m (1 ft 8 in)
Height to sill 1.56 m (5 ft 1½ in)
Emergency exits (overwing, each):
Height 0.91 m (3 ft 0 in)
Width 0.51 m (1 ft 8 in)
Emergency exits (flight deck side windows, each):
Min height 0.48 m (1 ft 7 in)
Min width 0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:
Cabin, excl flight deck and baggage compartment:
Length 9.38 m (30 ft 9¼ in)
Max width 2.10 m (6 ft 10¾ in)
Max height 1.76 m (5 ft 9¼ in)
Floor area 14.97 m² (161.14 sq ft)
Volume 27.40 m³ (967.6 cu ft)
Rear baggage compartment volume:
30-passenger version 6.40 m³ (226 cu ft)
all-cargo version 2.70 m³ (95 cu ft)
passenger/cargo version 11.00 m³ (388 cu ft)
Cabin, incl flight deck and baggage compartment:
total volume approx 41.8 m³ (1,476 cu ft)
Max available cabin volume (all-cargo version)
31.10 m³ (1,098 cu ft)

AREAS:
Wings, gross 39.43 m² (424.42 sq ft)
Ailerons (total) 2.88 m² (31.00 sq ft)
Trailing-edge flaps (total) 3.23 m² (34.77 sq ft)
Fin, incl dorsal fin 5.74 m² (61.78 sq ft)
Rudder 2.59 m² (27.88 sq ft)
Tailplane 6.10 m² (65.66 sq ft)
Elevator, incl tabs 3.90 m² (41.98 sq ft)

WEIGHTS AND LOADINGS:
* Weight empty, equipped: 120 7,140 kg (15,741 lb)
120ER 7,150 kg (15,763 lb)
Operating weight empty: 120 7,550 kg (16,645 lb)
120ER 7,560 kg (16,667 lb)
Max usable fuel: 120, 120ER 2,660 kg (5,864 lb)
* Max payload: 120 (passenger) 2,950 kg (6,504 lb)
120 (cargo) 3,402 kg (7,500 lb)
120ER 3,340 kg (7,363 lb)
Max T-O weight: 120 11,500 kg (25,353 lb)
120ER 11,990 kg (26,433 lb)
Max ramp weight: 120 11,580 kg (25,529 lb)
120ER 12,080 kg (26,632 lb)
Max landing weight: 120 11,250 kg (24,802 lb)
120ER 11,700 kg (25,794 lb)
Max zero-fuel weight: 120 10,500 kg (23,148 lb)
120ER 10,900 kg (24,030 lb)
Max wing loading: 120 292 kg/m² (59.81 lb/sq ft)
120ER 304.1 kg/m² (62.28 lb/sq ft)
Max power loading: 120 4.29 kg/kW (7.04 lb/shp)
120ER 4.47 kg/kW (7.34 lb/shp)

* *4 kg (8.8 lb) payload decrease/empty weight increase with PW118A engines*

PERFORMANCE (at max T-O weight, ISA, except where indicated):
Max operating speed:
120, 120ER 272 kts (504 km/h; 313 mph) EAS
Max level speed at 6,100 m (20,000 ft):
120 328 kts (608 km/h; 378 mph)
120ER 327 kts (606 km/h; 377 mph)
Max cruising speed at 7,620 m (25,000 ft):
120, 120ER (PW118) 300 kts (555 km/h; 345 mph)
120 (PW118A) 310 kts (574 km/h; 357 mph)
120ER (PW118A) 313 kts (580 km/h; 360 mph)
Long-range cruising speed at 7,620 m (25,000 ft):
120 260 kts (482 km/h; 299 mph)
120ER 270 kts (500 km/h; 311 mph)
Stalling speed, power off:
flaps up: 120 117 kts (217 km/h; 135 mph) CAS
120ER 120 kts (223 km/h; 138 mph) CAS
flaps down: 120 87 kts (162 km/h; 100 mph) CAS
120ER 89 kts (165 km/h; 103 mph) CAS
Max rate of climb at S/L: 120 646 m (2,120 ft)/min
120ER 762 m (2,500 ft)/min
Rate of climb at S/L, OEI: 120 206 m (675 ft)/min
120ER 168 m (550 ft)/min
Service ceiling: 120 (PW118) 9,150 m (30,000 ft)
120ER (PW118) 8,840 m (29,000 ft)
120, 120ER (PW118A) 9,750 m (32,000 ft)
Service ceiling, OEI, AUW of 11,200 kg (24,690 lb):
120 (PW118) 5,240 m (17,200 ft)
120ER (PW118 or PW118A) 4,600 m (15,100 ft)
120 (PW118A) 5,790 m (19,000 ft)
FAR Pt 25 T-O field length: 120 1,420 m (4,660 ft)
120ER 1,550 m (5,085 ft)
FAR Pt 135 landing field length, max landing weight at S/L: 120 1,370 m (4,495 ft)
120ER 1,390 m (4,560 ft)
Range at 9,150 m (30,000 ft), reserves for 100 n mile (185 km; 115 mile) diversion and 45 min hold:
with max (30 passenger) payload (2,721 kg; 6,000 lb):
120 (PW118) 500 n miles (926 km; 575 miles)
120 (PW118A) 460 n miles (852 km; 529 miles)
120ER (PW118)
850 n miles (1,575 km; 979 miles)
120ER (PW118A)
800 n miles (1,482 km; 921 miles)
with max fuel:
120 (PW118), 14 passengers (1,305 kg; 2,877 lb payload) 1,720 n miles (3,185 km; 1,979 miles)
120 (PW118A), 14 passengers (1,305 kg; 2,877 lb payload) 1,649 n miles (3,054 km; 1,897 miles)
120ER (PW118), 20 passengers (1,785 kg; 3,935 lb payload) 1,629 n miles (3,017 km; 1,874 miles)
120ER (PW118A), 20 passengers (1,785 kg; 3,935 lb payload) 1,570 n miles (2,908 km; 1,806 miles)

OPERATIONAL NOISE LEVELS (120 and 120ER, FAR Pt 36, BCAR-N and ICAO Annex 16):
T-O 81.2 EPNdB
Approach 92.3 EPNdB
Sideline 83.5 EPNdB

UPDATED

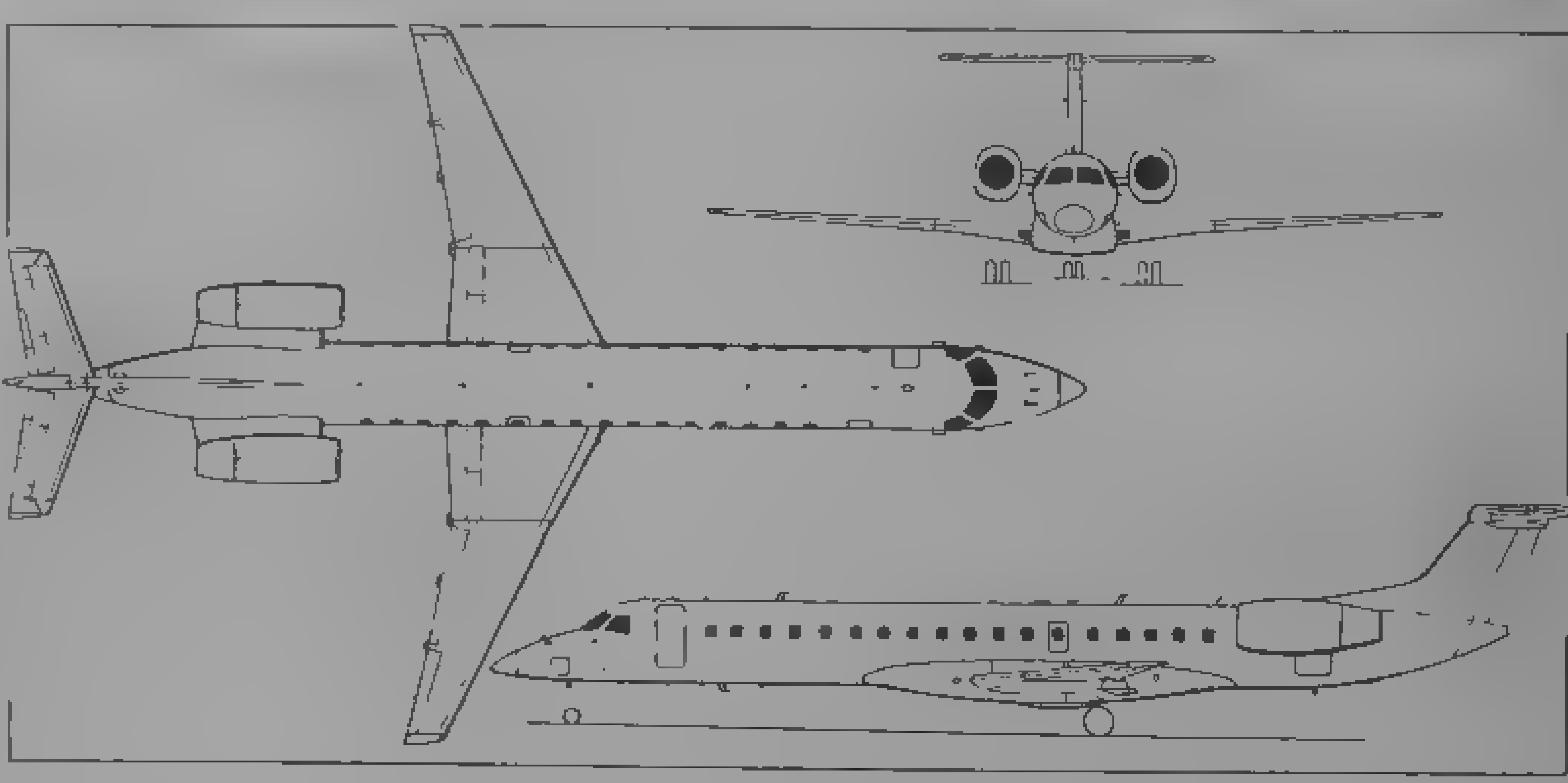
EMBRAER EMB-145

TYPE: Twin-turbofan regional airliner.

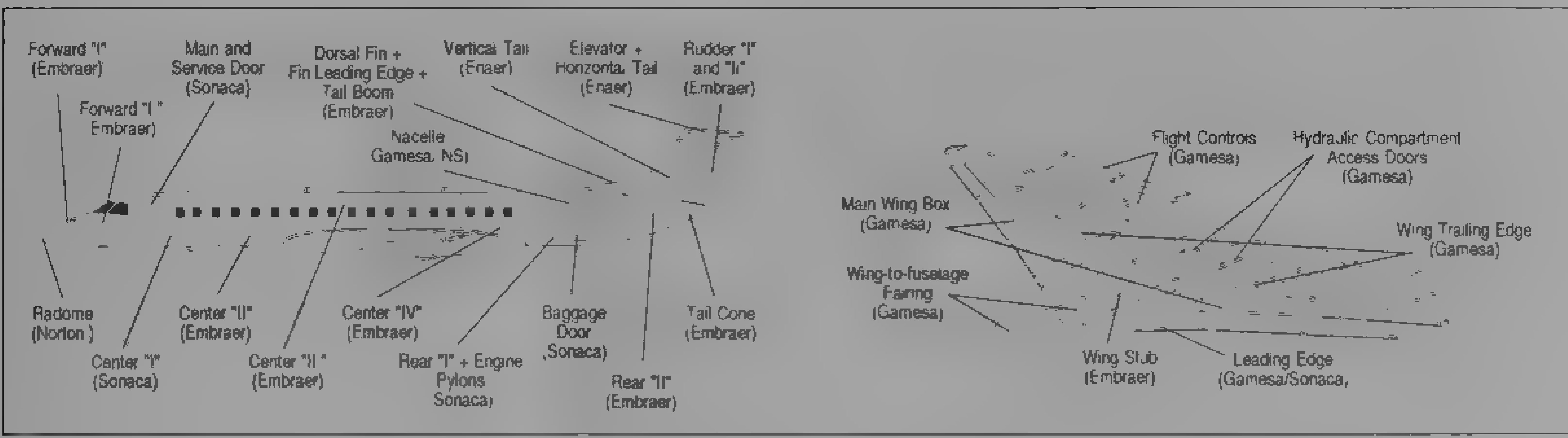
PROGRAMME: Original development plans revealed 12 June 1989, aimed at first flight late 1991 and first deliveries mid-1993, following FAR/JAR Pt 25 and FAR Pt 36 (ICAO Annex 16) international certification, programme delayed by company cutbacks initiated in Autumn 1990.

Complete redesign of wing, engine installation and landing gear completed March 1991, new wind tunnel

Model of the EMB-145 in the colours of TransBrasil, which has signed a letter of intent for eight
1995



EMB-145 rear-engined twin-turbofan regional airliner *(Jane's/Mike Keep)*
1995



Fuselage side and exploded wing views of EMB-145 showing subcontract sources

1995

models being tested at CTA and Boeing in following month, first flight then planned for late 1992 and certification for mid/late 1993 Further redesign announced October 1991 in which engines moved from underwing to rear of fuselage: subsonic/transonic wind tunnel tests of eventual configuration (frozen July 1992) confirmed or bettered predicted performance

First metal cut for prototype (parts common to EMB 120 and CBA 123), and tooling fabrication, began in second quarter 1993; first metal for dedicated EMB-145 parts cut September 1993 Wind tunnel tests late 1993 revealed better than expected runway performance, including significant hot/high decrease in T-O run, 210 m (689 ft) reduction in landing distance, and no need for nacelle/pylon trailing-edge fences, which were deleted. As a result, weight restrictions decreased or eliminated for such airports as Reno, Brasilia and Porto Alegre Initial 'flights' in EMB-120 simulator in late 1993 being expanded to explore full flight envelope

Assembly of prototype began October 1994; fuselage sections mated January 1995, planned roll out 18 August 1995, certification (to FAR/JAR 25, FAR 36, ICAO Annex 16 and FAR 121) late 1996. Single prototype will be joined by three preseries aircraft for 1,100 hour, 13 month development flight testing and certification programme, CTA and FAA type approval expected first quarter 1996, with simultaneous European JAA certification, preseries aircraft will later be refurbished for sale. Deliveries to begin in second half of 1996, production forecast of 25 aircraft in 1996, capacity increasing to four per month in 1997

CURRENT VERSIONS **EMB-145**: Initial version, *to which following description applies*

EMB-145ER (Extended Range). Under simultaneous development for full passenger payload range of 1,180 n miles (2,185 km; 1,358 miles); maximum T-O weight increased to 20,600 kg (45,415 lb), but payload and other maximum operating and landing weights unchanged, maximum cruising speed at 95 per cent of MTOW reduced to 416 knots (771 km/h; 479 mph), FAR T-O field length at MTOW 1,760 m (5,775 ft), FAR landing field length at typical landing weight 1,500 m (4,922 ft)

CUSTOMERS Thirteen orders, eight purchase options and 127 letters of intent from 18 airlines in nine countries by February 1995, covering 148 EMB-145s. Launch customer Flight West Australia (two), European launch customer Regional Airlines France (three, plus two options)

COSTS Estimated development costs $300 million, target sale price $13 million (1995)

DESIGN FEATURES Stretched EMB 120 Brasilia fuselage (with tailcone adapted for rear-mounted engine installation), allied to new-design wing with Embraer supercritical section, CBA 123 nose and cabin, T tailplane Wing sweepback 22° 43' 48" at quarter-chord

FLYING CONTROLS: Ailerons and rudder hydraulically actuated, elevator with automatic and spring tab In-flight and ground spoilers, two pairs of double-slotted flaps

STRUCTURE Fuselage as for Brasilia, two-spar wing with integral fuel tanks, plus auxiliary third spar supporting landing gear; T tail unit with aluminium main boxes; wing and tailplane leading-edges aluminium, fin leading edge composites sandwich GAMESA (Spain) to build wings, wing/body fairings, main landing gear doors and engine nacelles, rear fuselage section 1, including engine pylons and passenger/service/baggage doors, plus centre-fuselage section 1, including doors, by Sonaca (Belgium), fin, tailplane and elevators by ENAER (Chile); nose radome by Norton, passenger cabin and baggage compartment interiors by C & D Interiors (USA)

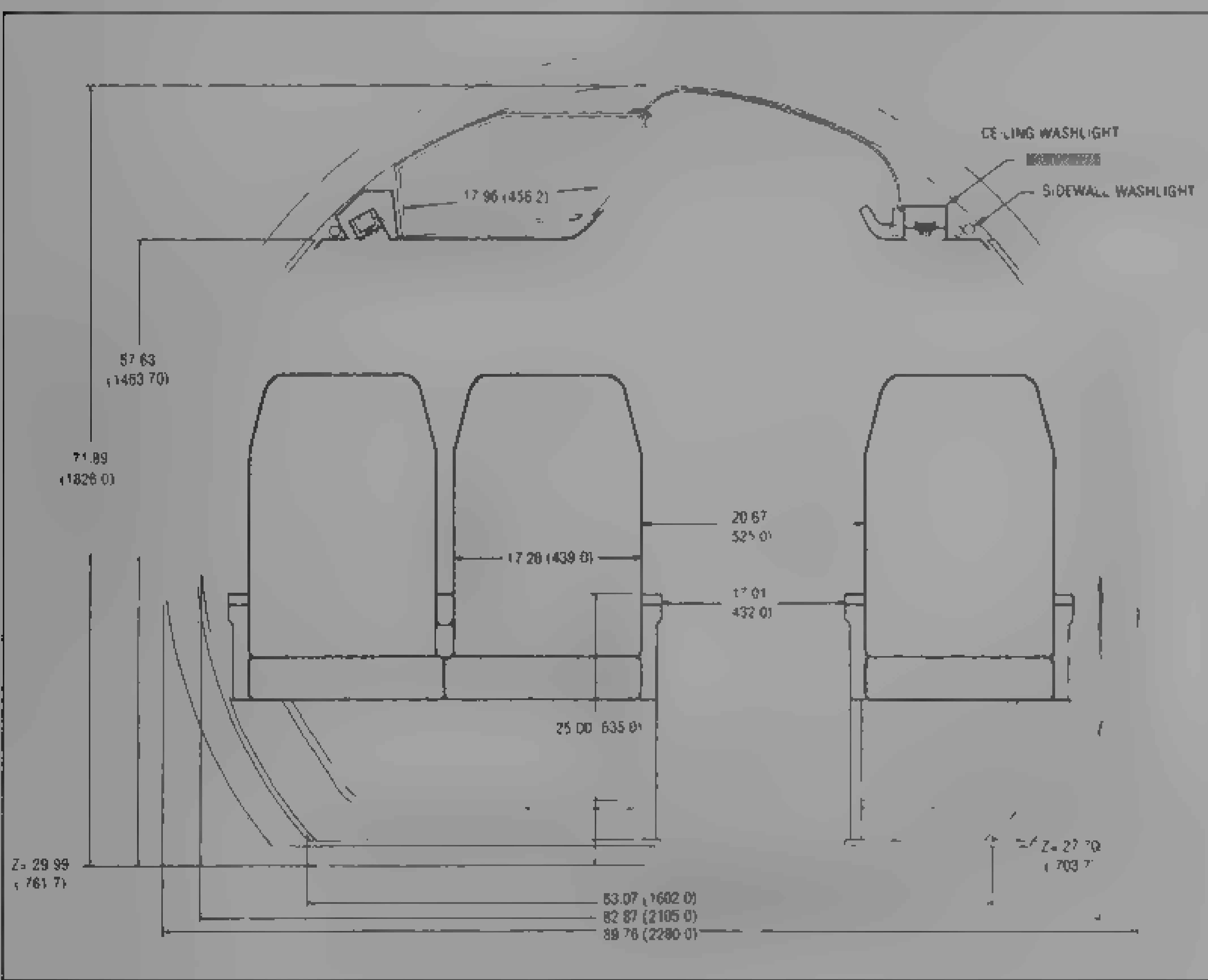
LANDING GEAR Twin-wheel main legs retract inward into wing/fuselage fairings, twin-wheel nose unit retracts forward EDE/Liebherr landing gear system, with EDE responsible for whole system and Liebherr for development and production of nose unit. Goodrich wheels and brakes. Tyre sizes 30 × 9 5-14 (main), 19 5 × 6 75-8 (nose), tyre pressure 8 6-9 0 bars (125-130 lb/sq in) Minimum ground turning radius at nosewheel 12 51 m (41 ft 0 in

POWER PLANT Two 31 32 kN (7,040 lb st), FADEC-equipped Allison AE 3007A turbofans, pylon mounted on rear cone of fuselage. For fuel, see Weights and Loadings Parker Hannifin fuel system

ACCOMMODATION: Two pilots, flight observer and cabin attendant Standard accommodation for 50 passengers three-abreast at seat pitch of 79 cm (31 in) Carry-on baggage cabinet and galley at front of cabin; toilet and main baggage compartment at rear of cabin. Cabinet plus overhead bins carry-on baggage capacity 358 kg (789 lb), underseat capacity 450 kg (992 lb); main baggage compartment capacity 1,000 kg (2,204 lb) Additional baggage cabinet or galley capacity can be provided by removing one or two single forward passenger seats Outward-opening plug-type door, incorporating airstair, identical to that of EMB-120, upward-sliding baggage door at rear on port side, sideways-opening service door at front on starboard side, inward-opening emergency exit above wing on each side. Entire accommodation, including baggage compartments, pressurised and air conditioned

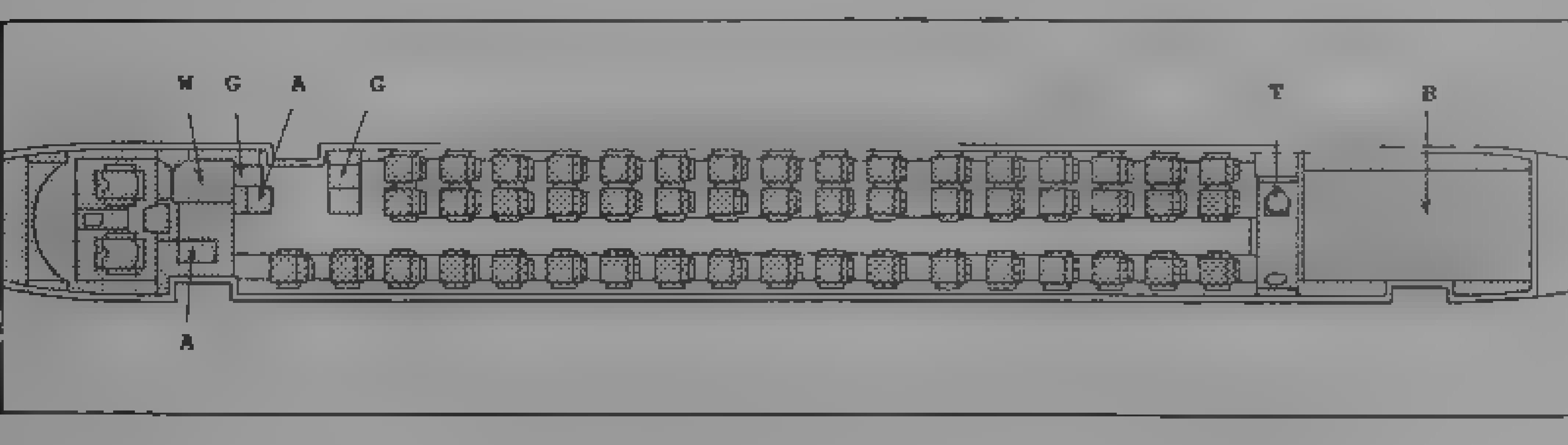
SYSTEMS. ABG SEMCA pressurisation system (maximum differential 0.54 bar, 7 8 lb/sq in) Hamilton Standard air conditioning and bleed air systems (wing and tailplane leading-edges anti-iced by engine bleed air) Lucas electrical power generation system. APIC 18 6 kW (25 shp) APS-500 APU Garrett air turbine starter Parker Hannifin flight control and steering systems. Hydro-Aire brake-by-wire control system EROS oxygen system

AVIONICS Honeywell Primus 1000 digital avionics suite.



EMB-145 fuselage cross-section. Dimensions in inches (millimetres)

1995



Standard 50-passenger layout in EMB-145 ***(Jane's/James Goulding)***
A. attendant's seat, B baggage, G. galley, T toilet, W. wardrobe

1995

DIMENSIONS, EXTERNAL

Wing span	20 04 m (65 ft 9 in)
Wing chord at root	4 09 m (13 ft 5 in)
at tip	1 04 m (3 ft 5 in)
Wing aspect ratio	7 86
Length overall	29 87 m (98 ft 0 in)
Fuselage Length	27 93 m (91 ft 7½ in)
Max diameter	2 28 m (7 ft 5¾ in)
Height overall	6.71 m (22 ft 0¼ in)
Elevator span	7 40 m (24 ft 3¼ in)
Wheel track (c/l of shock-struts)	4 10 m (13 ft 5½ in)
Wheelbase	14.45 m (47 ft 5 in)
Passenger door (fwd, port) Height	1 70 m (5 ft 7 in)
Width	0 71 m (2 ft 4 in)
Height to sill (max)	1 62 m (5 ft 3¾ in)
Baggage door (rear, port) Height	1 10 m (3 ft 7¼ in)
Width	1 00 m (3 ft 3¼ in)
Height to sill (max)	1 76 m (5 ft 9¼ in)

Fuselage of the EMB 145 prototype after components mated, January 1995

Service door (rear, stbd): Height 1.42 m (4 ft 8 ...)

sill 1.59 m (5 ft 2½ in)

Height 0.92 m (3 ft 0¼ in)

Width 0.51 m (1 ft 8 in)

Volume

overhead bins 1.50 m³ (52.97 cu ft)

underseat 2.20 m³ (77.69 cu ft)

Wings, gross

UPDATED

EMBRAER EMB-202 IPANEMA

CURRENT VERSIONS: EMB-202: C... generally similar to EMB-201A e... seat, larger hopper and choice of ...

... shock-absorber. Mainwheels and tyres size 8.50-10. Tailwheel diameter 250 mm (10 in). Tyre pressures: main, 2.07 to 2.41 bars (30 to 35 lb/sq in); tail... Hydraulic disc brakes on ...

... 224 kW (300 hp) Textron Lycoming ... driving a Hartzell two-... -speed metal pro-... Continental 224 kW ...

... horizontally/vertically adjustable ... cabin with bottom-hinged, triple-... window door on each side and two ... Ventilation airscoop at top of ... leading-edge ... inertial shoulder ...

... supplied by two Crai... EN 2400.74 28 V 35 A alter-... for external battery (AN-2552-3A ...

... VFR avionics include ... KY 96A transceiver (Bendix/King ...

... PS optional ...

... ons) liquid or 750 kg ... below centre of fuselage ... of or above wing ... sure generator for use with liquid spray systems; improved ... AU 5000 rotary atomisers, and trapezoidal spreader with adjustable inlet to improve application of dry chemicals.

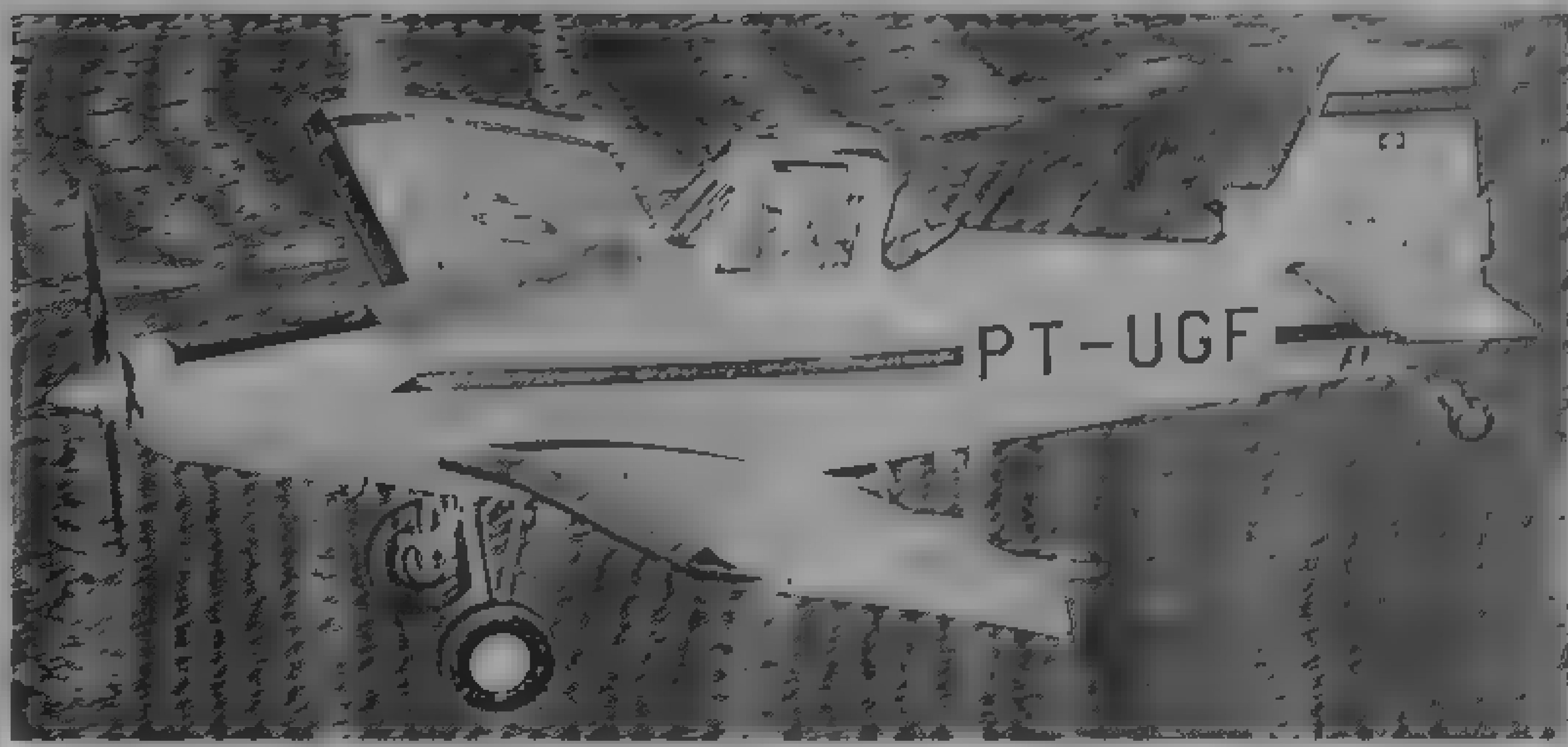
... 18.49 lb/sq ft

... 11.39 lb/hp

... 13.23 lb/hp

Embraer EMB-202 Ipanema (one Textron Lycoming IO-540) (*Jane's/Dennis Punnett*)

Max level speed at S/L	
N	124 kts (230 km/h; 143 mph)
R	121 kts (225 km/h, 140 mph)
Max cruising speed (75% power) at 1,830 m (6,000 ft)	
N	113 kts (209 km/h; 130 mph)
R	111 kts (206 km/h, 128 mph)
Stalling speed, power off (N)	
flaps up	56 kts (103 km/h, 64 mph)
8° flap	54 kts (100 km/h, 62 mph)
30° flap	50 kts (92 km/h, 57 mph)
Stalling speed, power off (R)	
flaps up	60 kts (110 km/h, 68 mph)
8° flap	58 kts (107 km/h, 66 mph)
30° flap	53 kts (99 km/h, 61 mph)
Max rate of climb at S/L, 8° flap	
N	283 m (930 ft)/min
R	201 m (660 ft)/min
Service ceiling, 8° flap R	3,470 m (11,385 ft)
T-O run at S/L, 8° flap, asphalt runway	
N	200 m (656 ft)
R	354 m (1,160 ft)
T-O to 15 m (50 ft), conditions as above	
N	332 m (1,090 ft)
R	564 m (1,850 ft)
Landing from 15 m (50 ft) at S/L, 30° flap, asphalt runway	
N	412 m (1,352 ft)
R	476 m (1,562 ft)
Landing run, conditions as above N	153 m (502 ft)
R	170 m (558 ft)



Embraer EMB 202 Ipanema single-seat agricultural aircraft

1995

Range at 1,830 m (6,000 ft), no reserves	
N	506 n miles (938 km, 583 miles)
R	474 n miles (878 km, 545 miles)

UPDATED

OTHER AIRCRAFT

Refer to International section for **AMX**. Details of **Piper aircraft** built under licence by Embraer can be found in the US section of this and earlier editions of *Jane's*.

NEW ENTRY

HELIBRAS

HELICÓPTEROS DO BRASIL SA

(Subsidiary of Eurocopter France)

Caixa Postal 184, 37500-000 Itajubá, MG
Telephone: 55 (35) 623 2000
Fax: 55 (35) 623 2001
Telex: 35 4268 HL BR
SUPERINTENDENT: Gérald Négrel
COMMERCIAL MANAGER: Patrick de la Revelière
COMMUNICATIONS: Luis Henrique Testa

Formed 1978, owned jointly by Grupo Bueninvest (30 per cent), MGI Participações (25 per cent) and Eurocopter France (45 per cent). First assembly hall inaugurated 28 March 1980; facility occupies 12,000 m² (129,175 sq ft), 1995 workforce 263.

Assembly, marketing and overhaul, under Eurocopter licence, of single- and twin-engined Ecureuil/Fennec helicopters and twin-engined Dauphin/Panther; markets and overhauls civil twin-engined Eurocopter/Kawasaki BK 117C-1 (see International section) in Brazil. Gavião (licence SA 315B Lama, see 1993-94 and earlier *Jane's*; seven built) no longer produced.

Total of 263 helicopters sold by December 1994 to more than 80 customers, including over 110 to Brazilian Army, Navy and Air Force; nearly 10 per cent of overall total exported.

UPDATED

Left to right: Helibras AS 565 Panther, AS 350 Esquilo and AS 365 Dauphin

1994

HELIBRAS (EUROCOPTER) ESQUILO and FENNEC

TYPE: Single- and twin-engined Brazilian assembled versions of Eurocopter France Ecureuil and Fennec (see International section).

PROGRAMME: Deliveries began 1979; aeromedical version launched February 1989. Production totalled 215 by December 1994.

CURRENT VERSIONS: **Esquilo.** Civil versions of single-engined AS 350BA and AS 350B2 and twin-engined AS 355F2 and AS 355N (Arrius) Ecureuil.

Fennec: Military versions of single-engined AS 550U2 and AS 550A2 and twin-engined AS 555U2 and AS 555A2. Brazilian Air Force designations **CH-50** (AS 550U2), **CH-55** (AS 555U2), **TH-50** (AS 550U2) and **VH-55** (VIP AS 550U2). Brazilian Navy designations **UH-12** (AS 550U2) and **UH-12B** (AS 555U2). Brazilian Army designation **HA-1** (AS 550A2). Army HA-1s equipped for tactical support and reconnaissance, serve with 1st Aviation Battalion at Taubaté, São Paulo. Navy UH-12/12Bs equip 1º Esquadrão de Helicópteros de Emprego Geral (squadron of general purpose helicopters).

CUSTOMERS: Total of 215 delivered by December 1994 (124 civil/79 military single-engined, nine civil/three military twin-engined).

Military orders totalling 105 from Brazilian Army (46 HA-1), Navy (11 UH-12, nine UH-12B) and Air Force (30 CH/TH-50, 11 CH-55, two VH-55) and Paraguay (Air Force four AS 350B, Navy two).

Total 133 to Brazilian state police forces (São Paulo, Rio de Janeiro and Minas Gerais), state governments, offshore transport companies and aeromedical agencies; exports of single-engined civil Esquilos to Argentina (three), Bolivia (one) and Venezuela (three).

ACCOMMODATION (Aeromedical version): Doctor, nurse and two stretcher patients in addition to pilot.

EQUIPMENT (Aeromedical version): Electrocardiograph, respirator, pacemaker, stretchers, battery operated incubator, oxygen/compressed air cylinders, first aid kit, and four-way socket for 115 V AC (60 Hz) and 12 V DC power.

ARMAMENT (HA-1): Can include a 20 mm gun and 2.75 in unguided rockets, or anti-tank missiles and HeliTOW.

ARMAMENT (UH-12/12B): Two Avibrás LM-70/7 pods each containing seven SBAT 70 mm rockets, or two FN Herstal twin 7.62 mm MAG machine gun pods and a door-mounted MAG pedestal.

UPDATED

Helibras assembly line for the Dauphin and Panther

1995

HELIBRAS (EUROCOPTER) DAUPHIN and PANTHER

TYPE: Brazilian assembled Eurocopter Dauphin and Panther (see International section).

PROGRAMME: Helibras programme began with assembling final 10 of Brazilian Army order for 36 from French built CKD kits, now also producing civil Dauphin.

CURRENT VERSIONS: **Dauphin:** Civil AS 365N2.

Panther: Military AS 565. Brazilian Army designation **HM-1**.

CUSTOMERS: Brazilian Army 36 HM-1s delivered (26 by Aerospatiale 1989-90, 10 assembled locally).

UPDATED

NEIVA

INDÚSTRIA AERONÁUTICA NEIVA SA (Subsidiary of Embraer)

Rua Nossa Senhora de Fátima 360, Caixa Postal 10, 18608 900 Botucatu, SP
Telephone 55 (149) 21 2122
Fax 55 (149) 22 1285
Telex 142 736 SOAN BR
PRESIDENT: Eng Paulo Cury
CEO: Paulo Urbanavicius
MANAGERS
Eng Tennysson de Mello Cesar Jr (Engineering and Production)
José Armando Pescatori (Finance and Administration)
Hélio Fortes (Commercial)

Formed 1954, became wholly owned Embraer subsidiary 10 March 1980; factory area 20,580 m² (221,525 sq ft), work force 375. Substantial participation in Embraer general aviation programmes, including complete production of EMB 720D Minuano and EMB-810D Seneca IV (licence built Piper models); also responsible since 1981 for total production of EMB-202 and now discontinued -201A Ipanema. Marketing agency for PZL-104 Wilga, PZL-106 Kruk and PZL-111 Koliber under MoU between Embraer and PZL Warszawa Okecie, June 1995.

UPDATED

Neiva production of Piper-designed aircraft for Embraer includes the EMB-810D Seneca IV *1995*

CANADA

AIRTECH

AIRTECH CANADA

Details of Airtech Canada's re-engining programmes for the DHC-2 Beaver and DHC-3 Otter were given in 1994-95 *Jane's*, now transferred to *Jane's Aircraft Upgrades*.

UPDATED

BELL

BELL HELICOPTER TEXTRON CANADA (a Division of Textron Canada Ltd)

12800 rue de l'Avenir, Mirabel, Quebec J7J 1R4
Telephone 1 (514) 437 3400
Fax 1 (514) 437 6010
Telex 05-25827
PRESIDENT: Dell Young

Memorandum of understanding to start helicopter industry in Canada signed 7 October 1983; 38,900 m² (418,725 sq ft) factory opened late 1985 and employs 1,300 people. US civil production of 206B JetRanger transferred to Canada in 1986, 206L LongRanger by early 1987, then 212 in 1988 and 412 in 1989. The 230 was introduced and certificated in Canada in 1992. Over 1,000 (all models) delivered by 1995; about half of each helicopter made in Canada (dynamic systems supplied by Bell Fort Worth). Production rate from 15 to 25 per month.

UPDATED

Bell 206B-3 JetRanger III of Fort Worth (Texas) Police Force *1995*

BELL 206B-3 JETRANGER III

US Army designation TH-67 Creek

TYPE: Five-seat turbine-powered light helicopter.

PROGRAMME: Delivery of current 206B-3 JetRanger III began Summer 1977, transferred to Mirabel, Canada, 1986.

CURRENT VERSIONS: **206B-3 JetRanger III**: Current civil production version. *Subject of description below.*

TH-67 Creek (Bell designation TH-206): Selected March 1993 as US Army NTH choice to replace UH-1 at pilot training school (223 Aviation Regiment) at Fort Rucker, Alabama. Instructor and one pupil in front seats; second pupil observing from rear seat sees flight instruments by closed circuit TV screen mounted on back of right-hand front seat. Powered by Allison 250-C20JN engine. First batch included nine cockpit procedures trainers outfitted by Frasca International; three configurations VFR, IFR, and VFR with IFR provision.

TH-67 features also include dual controls, crashworthy seats, five-point seat restraints, heavy duty battery, particle separator, bleed air heater, heavy-duty skid shoes and enlarged instrument panel. IFR version additionally possesses force trim system, auxiliary electrical system and is FAA certified for dual pilot operation.

CUSTOMERS: TH-206 (TH-67 Creek) declared winner of US Army NTH (New Training Helicopter) competition March 1993, initial 102 ordered in IFR configuration, second batch of 35 VFR helicopters ordered February 1994; deliveries began 15 October 1993 with N67001 and N67014 (all TH-67s have civilian registrations), 45 aircraft (and six procedures trainers) delivered in time for first training course to open 5 May 1994; 92 delivered by 6 December 1994, total orders 137 TH-67s and nine cockpit procedures trainers; option for procurement of three more procedures trainers and 20 more TH-67s. Two 206B-3s ordered for Slovenian Territorial Forces in June 1994, for training.

Well over 7,000 JetRangers produced by Bell and licensees by January 1994, including 4,200 Bell 206Bs and 2,200 military OH-58 series; 370 completed at Mirabel by January 1994, combined civil sales of JetRanger/LongRanger 178 in 1991, 144 in 1992, 115 in 1993 and 143 in 1994.

COSTS: US Army initial NTH contract $84.9 million.

DESIGN FEATURES: Two-blade teetering main rotor with preconed and underslung bearings, blades retained by grip, pitch change bearing and torsion-tension strap assembly; two-blade tail rotor; main rotor rpm 374 to 394.

FLYING CONTROLS: Hydraulic fully powered cyclic and collective controls and foot powered tail rotor control, tailplane with highly cambered inverted aerofoil section and stall strip produces appropriate nose-up and nose-down attitude during climb and descent, optional autostabiliser, autopilot and IFR systems.

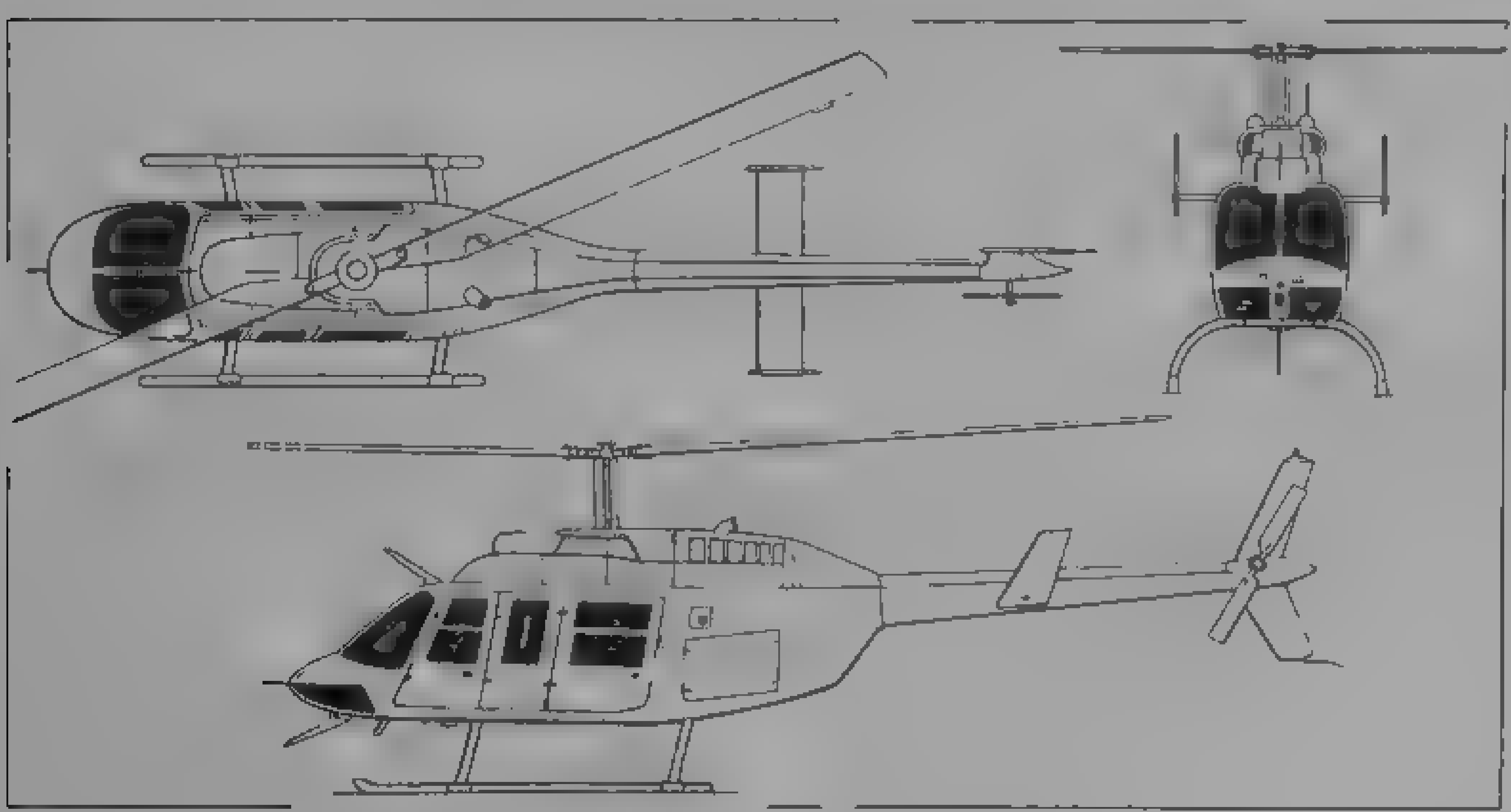
STRUCTURE: Conventional light alloy structure with two floor beams and bonded honeycomb sandwich floor; transmission mounted on two beams and deck joined to floor by three fuselage frames, main rotor blades have extruded aluminium D-section leading-edge with honeycomb core behind, covered by bonded skin, tail rotor blades have bonded skin without honeycomb core.

LANDING GEAR: Aluminium alloy tubular skids bolted to extruded cross-tubes. Tubular steel skid on ventral fin to protect tail rotor in tail-down landing. Special high skid gear (0.25 m, 10 in greater ground clearance) available for use in areas with high brush. Pontoons or stowed floats, capable of in-flight inflation, available as optional kits.

POWER PLANT: One 313 kW (420 shp) Allison 250-C20J turboshaft, flat rated at 236 kW (317 shp). Transmission rating 236 kW (317 shp) for T-O; 201 kW (270 shp) continuous. Rupture resistant fuel tank below and behind rear passenger seat, capacity 344 litres (91 US gallons, 75.75 Imp gallons). Refuelling point on starboard side of

Bell 206L 4 LongRanger IV

1995



Bell 206L-4 LongRanger IV general purpose light helicopter (*Jane's/Dennis Punnett*)

1994

fuselage, aft of cabin Oil capacity 5 2 litres (1.38 US gallons; 1 13 Imp gallons)

ACCOMMODATION Two seats side by side in front and three-seat rear bench Dual controls optional Two forward-hinged doors on each side, made of formed aluminium alloy with transparent panels (bulged on rear pair). Baggage compartment aft of rear seats, capacity 113 kg (250 lb), with external door on port side

SYSTEMS Hydraulic system, pressure 41 5 bars (600 lb/sq in), for cyclic collective and directional controls. Maximum flow rate 7 57 litres (2 US gallons, 1 65 Imp gallons)/min Open reservoir Electrical supply from 150 A starter/generator One 28 V 13 Ah (optionally 17 Ah) Ni/Cd battery Optional ECS

AVIONICS *Comms* VHF communications, intercom and speaker system

Flight. VOR, ADF, DME and R/Nav optional

EQUIPMENT Standard equipment includes cabin fire extinguisher, first aid kit, door locks, night lighting, and dynamic flapping restraints Optional items include clock, engine hour meter, turn and slip indicator, custom seating, internal stretcher kit, rescue hoist, cabin heater, camera access door, high intensity night lights, engine fire detection system, and external cargo hook of 680 kg (1,500 lb) capacity

DIMENSIONS, EXTERNAL

Main rotor diameter	10 16 m (33 ft 4 in)
Tail rotor diameter	1 65 m (5 ft 5 in)
Main rotor blade chord	0 33 m (1 ft 1 in)
Tail rotor blade chord	0 122 m (4¾ in)
Distance between rotor centres	5 96 m (19 ft 6½ in)
Length overall, rotors turning	11.82 m (38 ft 9½ in)
fuselage, incl tailskid	9 50 m (31 ft 2 in)
Height over tailfin	2 54 m (8 ft 4 in)
to top of rotor head	2 91 m (9 ft 6½ in)
Stabiliser span	1 97 m (6 ft 5¾ in)
Width over skids	1 92 m (6 ft 3½ in)
Forward cabin doors (each) Height	1 02 m (3 ft 4 in)
Width	0 61 m (2 ft 0 in)
Rear cabin doors (each) Height	1 02 m (3 ft 4 in)
Width	0.91 m (3 ft 0 in)

DIMENSIONS, INTERNAL

Cabin Length of seating area	2 13 m (7 ft 0 in)
Max width	1 27 m (4 ft 2 in)
Max height	1 28 m (4 ft 3 in)
Volume	1 13 m³ (40 cu ft)
Baggage compartment volume	approx 0.45 m³ (16 cu ft)

AREAS

Main rotor blades (each)	1 68 m² (18 05 sq ft)
Tail rotor blades (each)	0 11 m² (1.18 sq ft)
Main rotor disc	81 07 m² (872.7 sq ft)
Tail rotor disc	2 14 m² (23 04 sq ft)
Stabiliser	0 90 m² (9 65 sq ft)

WEIGHTS AND LOADINGS

Weight empty standard civil	737 kg (1,625 lb)
TH 67: VFR	852 kg (1 879 lb)
IFR	911 kg (2,009 lb)
Operating weight, TH-67. VFR	1,369 kg (3,019 lb)
IFR	1,428 kg (3,149 lb)
Max payload internal	635 kg (1,400 lb)
external	680 kg (1,500 lb)
Max T-O weight internal load	1,451 kg (3,200 lb)
external load	1,519 kg (3,350 lb)
Max disc loading	
internal load	17 92 kg/m² (3.67 lb/sq ft)
external load	18 74 kg/m² (3 84 lb/sq ft)
Max power loading	
internal load	6 15 kg/kW (10 09 lb/shp)
external load	6.43 kg/kW (10 57 lb/shp)

PERFORMANCE (at internal load max T-O weight, ISA):

Never exceed speed (VNE) at S/L	122 kts (225 km/h, 140 mph)
Max cruising speed at S/L	115 kts (214 km/h, 133 mph)
Max rate of climb at S/L	390 m (1,280 ft)/min
Vertical rate of climb at S/L	91 m (300 ft)/min
Service ceiling	4,115 m (13,500 ft)
Hovering ceiling IGE	3,900 m (12,800 ft)
OGE	2,680 m (8 800) ft
Range with max fuel, no reserves	
at S/L	365 n miles (676 km, 420 miles)
at 1 525 m (5,000 ft)	395 n miles (732 km, 455 miles)
Range TH-67 VFR with normal 314 l (83 US gallons, 69 Imp gallons) fuel	327 n miles (605 km, 376 miles)

UPDATED

BELL 206L-4 LONGRANGER IV

TYPE Seven-seat single-turbine general purpose light helicopter (stretched JetRanger)

PROGRAMME Announced 25 September 1973, production in Canada began January 1987 MoU early 1993 for Aymet Aerospace Industries (Turkey) to assemble 14 of 24 ordered for Turkish armed forces

CURRENT VERSIONS. **LongRanger III** Major version from 1978-92, Canadian production began January 1987, details in 1992-93 and earlier *Jane's*. Now superseded by LongRanger IV

LongRanger IV Announced March 1992 as new current standard model, transmission uprated to absorb 365 kW (490 shp) instead of 324 kW (435 shp) from same engine; gross weight raised from 1,882 kg (4,150 lb) to 2,018 kg (4,450 lb), certificated late 1992, delivered from December

TwinRanger: Twin-engined version, described separately

Gemini ST: Twin-engined rebuild of LongRanger III/IV developed by Tridair and Soloy in USA and described under Tridair heading in *Jane's Aircraft Upgrades*

CUSTOMERS More than 1 500 LongRangers produced by January 1994, total Canadian deliveries 503 by January 1995, including 43 in 1994, see JetRanger entry for civil sales

DESIGN FEATURES Cabin length increased to make room for club seating and extra window; Bell Noda Matic transmission to reduce vibration, improvements introduced on LongRanger II include new freewheel unit, modified shafting and increased-thrust tail rotor; main rotor rpm 394 rotor brake optional

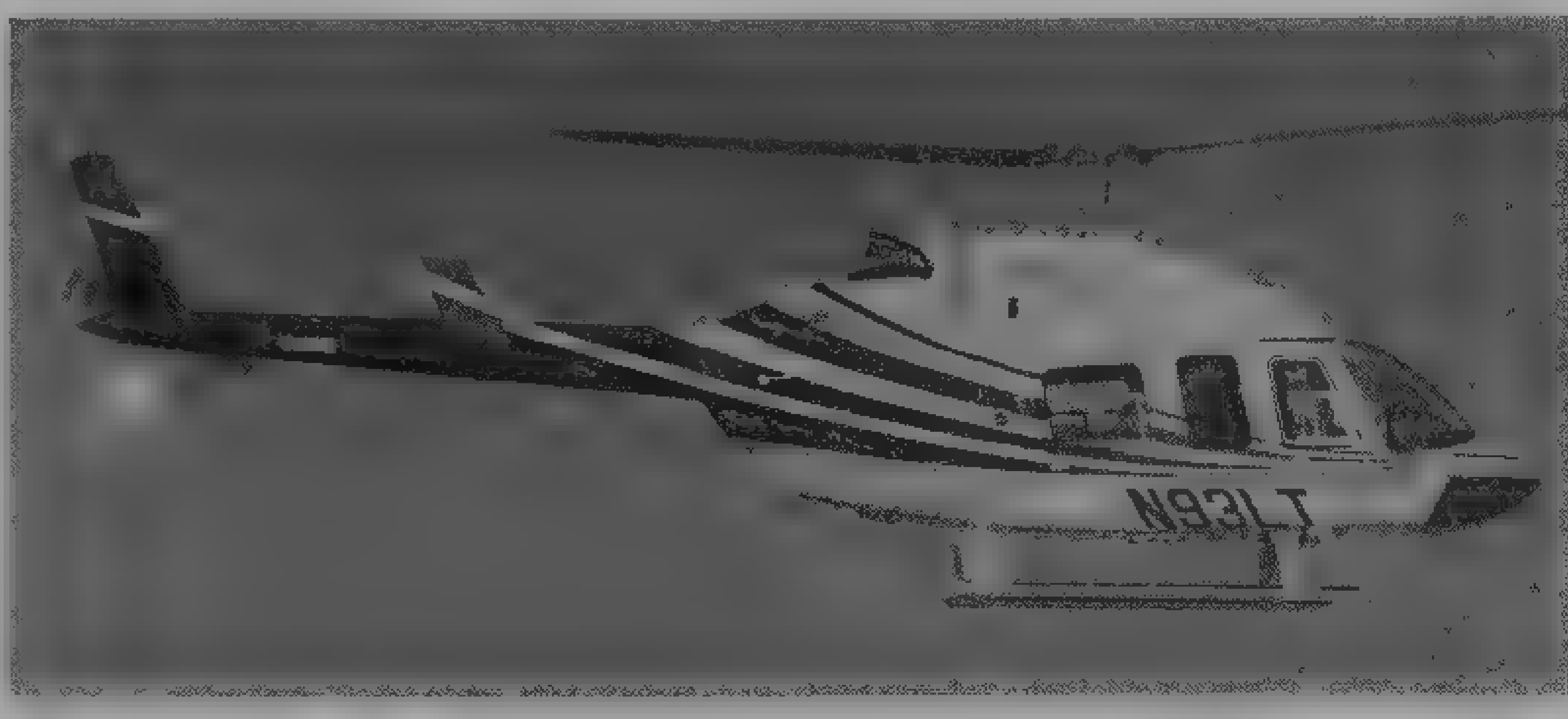
FLYING CONTROLS. As JetRanger, but with endplate fins on tailplane, single-pilot IFR with Collins AP-107H autopilot, optional SFENA autopilot with stabilisation and holds for heading, height and approach

STRUCTURE As JetRanger

LANDING GEAR. As JetRanger

POWER PLANT. One 485 kW (650 shp) Allison 250-C30P turboshaft (maximum continuous rating 415 kW, 557 shp) Transmission rated at 365 kW (490 shp) for take-off, with a continuous rating of 276 kW (370 shp), 340 kW (456 shp) transmission optional Rupture resistant fuel system, capacity 419 litres (110 7 US gallons, 92 2 Imp gallons)

ACCOMMODATION Redesigned rear cabin, more spacious than JetRanger With a crew of two, standard cabin layout accommodates five passengers in two canted rearward-facing seats and three forward-facing seats. An optional executive cabin layout has four individual passenger seats Port forward passenger seat has folding back to a low



Bell's 206LT TwinRanger, a twin-engined version of the LongRanger

1995

loading of a 2.44 × 0.91 × 0.30 m (8 × 3 × 1 ft) container, making possible carriage of such items as survey equipment, skis and other long components. Double doors on port side of cabin provide opening 1.54 m (5 ft 1 in) wide, for straight-in loading of stretcher patients or utility cargo. In ambulance or rescue role two stretcher patients and two ambulatory patients/attendants may be carried. Dual controls optional.

SYSTEMS: Hydraulic system, 28 V DC electrical power from 180 A starter/generator and 17 Ah battery. Engine bleed air ECS.

AVIONICS: *Comms:* Standard Collins MicroLine suite includes dual nav/com and transponder.

Flight: ADF, DME and marker beacon receiver. Bendix/King R/Nav, radio altimeter and encoding altimeter optional.

EQUIPMENT: Optional kits include emergency flotation gear, 907 kg (2,000 lb) cargo hook, rescue hoist, Nightsun searchlight (requires high skid gear).

DIMENSIONS, EXTERNAL:	
Main rotor diameter	11.28 m (37 ft 0 in)
Tail rotor diameter	1.65 m (5 ft 5 in)
Main rotor blade chord	0.33 m (1 ft 1 in)
Tail rotor blade chord	[illegible]
Length: overall, rotors turning	13.02 m (42 ft 8 [illegible] in)
fuselage, incl tailskid	9.81 m (32 ft [illegible] in)
Height: over tailfin	3.12 m (10 ft 2 [illegible] in)
to top of rotor head	3.14 m (10 ft 3¾ in)
Fuselage: Max width	1.32 m (4 ft 4 in)
Stabiliser span	1.98 m (6 ft 6 in)
Width over skids	2.34 m (7 ft 8 in)
Forward cabin doors (each): Height	1.02 m (3 ft 4 in)
Width	0.61 m (2 ft 0 in)
Centre cabin door (port): Height	1.02 m (3 ft 4 in)
Width	0.63 m (2 ft 1 in)
Rear cabin doors (each): Height	1.02 m (3 ft 4 in)
Width	0.91 m (3 ft 0 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	2.74 m (9 ft 0 in)
Max width and height	as JetRanger
Volume	2.35 m³ (83 cu ft)
AREAS:	
Main rotor disc	99.89 m² (1,075.2 sq ft)
Tail rotor disc	2.13 m² (22.97 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, standard	1,031 kg (2,274 lb)
Max external load	907 kg (2,000 lb)
Max T-O weight: normal	2,018 kg (4,450 lb)
external load	2,064 kg (4,550 lb)
Max disc loading: normal	20.66 kg/m² (4.23 lb/sq ft)
external load	19.29 kg/m² (3.95 lb/sq ft)
Max power loading: transmission for T-O, normal	5.52 kg/kW (9.08 lb/shp)
transmission for T-O, external load	5.65 kg/kW (9.29 lb/shp)
PERFORMANCE (at max normal T-O weight, ISA):	
Never-exceed speed (VNE): at S/L	130 kts (241 km/h; 150 mph)
at 1,525 m (5,000 ft)	133 kts (246 km/h; 153 mph)
Max cruising speed: at S/L	110 kts (203 km/h; 126 mph)
at 1,525 m (5,000 ft)	111 kts (206 km/h; 128 mph)
Max rate of climb at S/L	408 m (1,340 ft)/min
Service ceiling at max cruise power	3,050 m (10,000 ft)
Hovering ceiling: IGE	3,050 m (10,000 ft)
OGE	1,980 m (6,500 ft)
Range with max fuel, no reserves: at S/L	321 n miles (595 km; 369 miles)
at 1,525 m (5,000 ft)	357 n miles (661 km; 411 miles)

UPDATED

BELL 206LT TWINRANGER

TYPE: Seven-seat twin turboshaft light helicopter (twin-engined LongRanger derivative).

PROGRAMME: New build production counterpart of Tridair Gemini ST (see *Jane's Aircraft Upgrades*); first deliveries January 1994.

CUSTOMERS: Total 10 delivered during 1994.

DESIGN FEATURES: Same airframe as LongRanger except for modified cowling contours for twin engine installation.

POWER PLANT: Two Allison 250-C20R turboshafts, each rated at 335.5 kW (450 shp) for 5 minutes for T-O and 283 kW (380 shp) maximum continuous; OEI maximum continuous rating 335.5 kW (450 shp). Transmission rating as for LongRanger. Fuel capacity (usable) 427 litres (112.7 US gallons; 93.8 Imp gallons).

ACCOMMODATION: As for LongRanger.

SYSTEMS: Generally as for LongRanger except electrical system uses two 150 A starter/generators and 28 Ah Ni/Cd battery.

AVIONICS: Similar to those of LongRanger.

DIMENSIONS, EXTERNAL: As LongRanger IV

DIMENSIONS, INTERNAL: As LongRanger IV

AREAS: As LongRanger IV

WEIGHTS AND LOADINGS: As LongRanger IV except:

Weight empty, standard	1,246 kg (2,748 lb)

PERFORMANCE (estimated, at max normal T-O weight, ISA except where indicated):

Max cruising speed at S/L	106 kts (196 km/h; 122 mph)
Econ cruising speed at S/L, average gross weight	108 kts (200 km/h; 124 mph)

Bell 212 of Colombian National Police with 'shark's fin' above cockpit

1995

Service ceiling	3,050 m (10,000 ft)
Service ceiling, OEI, 30 min power: ISA	3,050 m (10,000 ft)
ISA + 20°C	2,350 m (7,700 ft)
Hovering ceiling: IGE	3,050 m (10,000 ft)
OGE	2,100 m (6,900 ft)
Range at S/L with max fuel, long-range cruising speed, no reserves	250 n miles (463 km; 288 miles)

UPDATED

BELL 212 TWIN TWO-TWELVE

US military designation: UH-1N

Canadian Forces designation: CH-135

Israel Defence Force name: Anafa (Heron)

TYPE: Twin turbine utility helicopter.

PROGRAMME: Canadian government approval to develop twin-engined UH-1 with P&WC PT6T-3 Twin-Pac announced 1 May 1968; more powerful PT6T-3B introduced June 1980; manufacture transferred to Canada August 1988; production averaged one a month in 1994.

CURRENT VERSIONS: **CH-135**: Canadian version, originally CUH-1N.

UH-1N: US Air Force, Navy and Marines version.

Twin Two-Twelve: Civil version. FAA certification October 1970; FAA Category A transport certification 30 June 1971; IFR certification granted by FAA, UK's CAA, Norwegian DCA and Canadian DoT; first-ever single-pilot IFR certification with fixed floats granted June 1977.

Description applies to this version.

CUSTOMERS: Canadian Forces received 50 CH-135s (originally CUH-1Ns) in 1971-72; delivery of 109 UH-1Ns to US Air Force began 1970 for Special Operations Force counter-insurgency, psychological warfare plus SAR, and unconventional warfare plus SAR; delivery of 40 UH-1Ns to US Navy and 22 to Marines began 1971; further 149 delivered to US Navy and Marines 1973 to 1978.

Other deliveries include Austria (24), Brunei (11), Israel (61), Singapore (16), Sri Lanka (15), and 56 to 19 other countries including Australia, China, Japan and Saudi Arabia. Recent civil sales, 18 in 1991, seven in 1992, six in 1993 and 17 in 1994. Further production by Agusta in Italy (see 1990-91 *Jane's*).

DESIGN FEATURES: All-metal two-blade semi-rigid teetering main rotor with interchangeable blades, underslung feathering axis head; rotor brake optional.

FLYING CONTROLS: Fully powered hydraulic controls; gyroscopic stabiliser bar above main rotor; automatic variable incidence tailplane; IFR versions have large fin above cabin to improve roll-yaw responses during manual instrument flying.

STRUCTURE: Metal main rotor blades have extruded aluminium nose sections and laminates, glassfibre safety straps provide redundant load path; fuselage conventional light metal.

LANDING GEAR: Tubular skid type. Lock-on ground handling wheels, high skid gear, fixed floats and emergency pop-out nylon float bags optional.

POWER PLANT: Pratt & Whitney Canada PT6T-3B Turbo Twin-Pac, comprising two PT6 turboshafts coupled to combining gearbox with single output shaft. Engine rating 1,342 kW (1,800 shp) for T-O, 1,193 kW (1,600 shp) maximum continuous, OEI rating 764 kW (1,025 shp) for 2½ minutes, 723 kW (970 shp) for 30 minutes. Transmission rating 962 kW (1,290 shp) for T-O, 846 kW (1,134 shp) maximum continuous and 764 kW (1,025 shp) OEI. Five interconnected rubber fuel cells, total usable capacity 818 litres (216 US gallons; 180 Imp gallons). Two 76 or 341 litre (20 or 90 US gallon; 16.7 or 75 Imp gallon) auxiliary fuel tanks optional, to provide maximum possible capacity of 1,499 litres (396 US gallons; 330 Imp gallons). Single-point refuelling on starboard side of cabin. Oil capacity 11.5 litres (3 US gallons; 2.5 Imp gallons) for engines, 8.5 litres (2.25 US gallons; 1.87 Imp gallons) for transmission.

ACCOMMODATION: Pilot and up to 14 passengers. Dual controls optional. In cargo configuration, has total internal volume of 7.02 m³ (248 cu ft), including baggage space in tailboom, capacity 181 kg (400 lb). Forward-opening crew door each side of fuselage. Two doors each side of cabin, forward (jettisonable) door hinged to open forward, rear door sliding aft. Accommodation heated and ventilated.

SYSTEMS: Dual hydraulic systems, pressure 69 bars (1,000 lb/sq in) each, maximum flow rate 22.7 litres (6 US gallons; 5 Imp gallons)/min. Open reservoir. 28 V DC electrical system supplied by two completely independent 30 V 200 A (derated to 150 A) starter/generators. Secondary AC power supplied by two independent 250 VA single-phase solid-state inverters. A third inverter can acquire automatically the load of a failed inverter. 40 Ah Ni/Cd battery. AiResearch air cycle environmental control unit optional.

AVIONICS: *Comms:* Optional IFR avionics include dual Bendix/King KTR 908 720-channel VHF com transceivers.

Radar: Weather radar optional.

Flight: Dual KNR 660A VOR/LOC RMI receivers, KDF 800 ADF, KMD 700A DME, KXP 750A transponder and KGM 690 marker beacon/glide slope receiver. Dual Honeywell Tarsyn-444 three-axis gyro units, stability augmentation system, automatic flight control system. Flight director optional.

EQUIPMENT: Optional equipment includes a stretcher kit, cargo hook, cargo sling and rescue hoist.

DIMENSIONS, EXTERNAL:	
Main rotor diameter	14.69 m (48 ft 2¼ in)
Tail rotor diameter	2.59 m (8 ft 6 in)
Main rotor blade chord	0.59 m (1 ft 11¼ in)
Tail rotor blade chord	0.292 m (11½ in)
Length: overall (main rotor fore and aft)	17.46 m (57 ft 3¼ in)
fuselage	12.92 m (42 ft 4¾ in)
Height: to top of rotor head	3.92 m (12 ft 10¼ in)
overall	4.53 m (14 ft 10¼ in)
Width: over skids	2.64 m (8 ft 8 in)
overall (main rotor fore and aft)	2.81 m (9 ft 2½ in)
Elevator span	2.86 m (9 ft 4½ in)
Rear sliding doors (each): Height	1.24 m (4 ft 1 in)
Width	1.88 m (6 ft 2 in)
Height to sill	0.76 m (2 ft 6 in)
Baggage compartment door: Height	0.53 m (1 ft 9 in)
Width	1.71 m (2 ft 4 in)
Emergency exits (centre cabin windows, each): Height	0.76 m (2 ft 6 in)
Width	0.97 m (3 ft 2 in)
DIMENSIONS, INTERNAL:	
Cabin, excl flight deck: Length	2.34 m (7 ft 8 in)
Max width	2.44 m (8 ft 0 in)
Max height	1.24 m (4 ft 1 in)
Floor area	4.74 m² (51.0 sq ft)
Volume	6.23 m³ (220 cu ft)
Baggage compartment volume	0.78 m³ (28 cu ft)
AREAS:	
Main rotor disc	168.11 m² (1,809.6 sq ft)
Tail rotor disc	5.27 m² (56.74 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, standard configuration: VFR	2,765 kg (6,097 lb)
IFR	2,847 kg (6,277 lb)
Max external load	2,268 kg (5,000 lb)
Max T-O weight, internal or external load	5,080 kg (11,200 lb)
Max disc loading	30.22 kg/m² (6.19 lb/sq ft)
Max power loading	5.28 kg/kW (8.68 lb/shp)

PERFORMANCE (at max T-O weight, ISA):
Never-exceed speed (VNE) and max cruising speed at S/L
111 kts (206 km/h; 128 mph)
Max cruising speed at 1,525 m (5,000 ft) at max cruise power 102 kts (189 km/h; 117 mph)
Long-range cruising speed at 1,525 m (5,000 ft)
104 kts (193 km/h; 120 mph)
Max rate of climb at S/L 402 m (1,320 ft)/min
Service ceiling 3,960 m (13,000 ft)
Max altitude for T-O and landing 1,430 m (4,700 ft)
Hovering ceiling, IGE 1,450 m (4,750 ft)
Max range with standard fuel at 1,525 m (5,000 ft), long-range cruising speed, no reserves
243 n miles (450 km; 280 miles)

UPDATED

BELL 412HP

TYPE: Four-blade, twin-engined utility helicopter.

PROGRAMME: Original 412 announced 8 September 1978 (see earlier editions of *Jane's*); FAR Pt 29 VFR approval received 9 January 1981, IFR 13 February 1981; production (SP version) transferred to Canada February 1989; first delivery (civil) 18 January 1981. Production licences obtained by IPTN of Indonesia and Agusta of Italy (which see).

CURRENT VERSIONS: **412SP**: Special Performance version with increased maximum T-O weight, new seating options and 55 per cent greater standard fuel capacity. Superseded by 412HP early 1991. Details in 1991-92 *Jane's*.

Military 412: Announced by Bell June 1986; fitted with Lucas Aerospace chin turret and Honeywell Head Tracker helmet sight similar to that in AH-1S; turret carries 875 rounds, weighs 188 kg (414 lb) and can be removed in under 30 minutes; firing arcs ±110° in azimuth, +15° and −45° in elevation; other armament includes twin dual FN Herstal 7.62 mm gun pods, single FN Herstal 0.50 in pod, pods of seven or nineteen 2.75 in rockets, M240E1 pintle-mounted door guns, FN Herstal four-round 70 mm rocket launcher and a 0.50 in gun or two Giat M621 20 mm cannon pods.

412HP: Improved transmission giving better OGE hover; FAR Pt 29 certification 5 February 1991, first delivery (c/n 36020) later that month.

412EP (Enhanced Performance): PT6T-3D engine; dual digital automatic flight control system (DDAFCS) three-axis in basic aircraft but customer option for four-axis and EFIS. Also customer option for SAR fit. Now standard current model, *to which detailed description applies*.

Griffon: Bell developed military version of 412EP, described separately.

NBell-412: Indonesia's IPTN (which see) has licence to produce up to 100 Model 412SPs.

CUSTOMERS: Total 270 Bell 412 and 97 412SP delivered January 1994; civil sales 18 in 1991, 18 in 1992, 19 in 1993 and 24 in 1994.

Military deliveries include Venezuelan Air Force (two), Botswana Defence Force (three), Public Security Flying Wing of Bahrain Defence Force (two), Sri Lankan armed forces (four), Nigerian Police Air Wing (two), Mexican government (two VIP transports), South Korean Coast Guard (one), Honduras (10), Royal Norwegian Air Force (19, of which 18 assembled by Helikopter Service, Stavanger, to replace UH-1Bs of 339 Squadron at Bardufoss and 720 Squadron at Rygge). Three 412EPs ordered in June 1994 for Slovenian Territorial Forces, for border patrol and rescue details; delivery scheduled for completion 6 April 1995.

DESIGN FEATURES: Four-blade main rotor with blades retained within central metal star fitting by single elastomeric bearings, shorter rotor mast than 212, blades can be folded; rotor brake standard; two-blade tail rotor; main rotor rpm 314.

FLYING CONTROLS: As 212 with automatic tailplane incidence control.

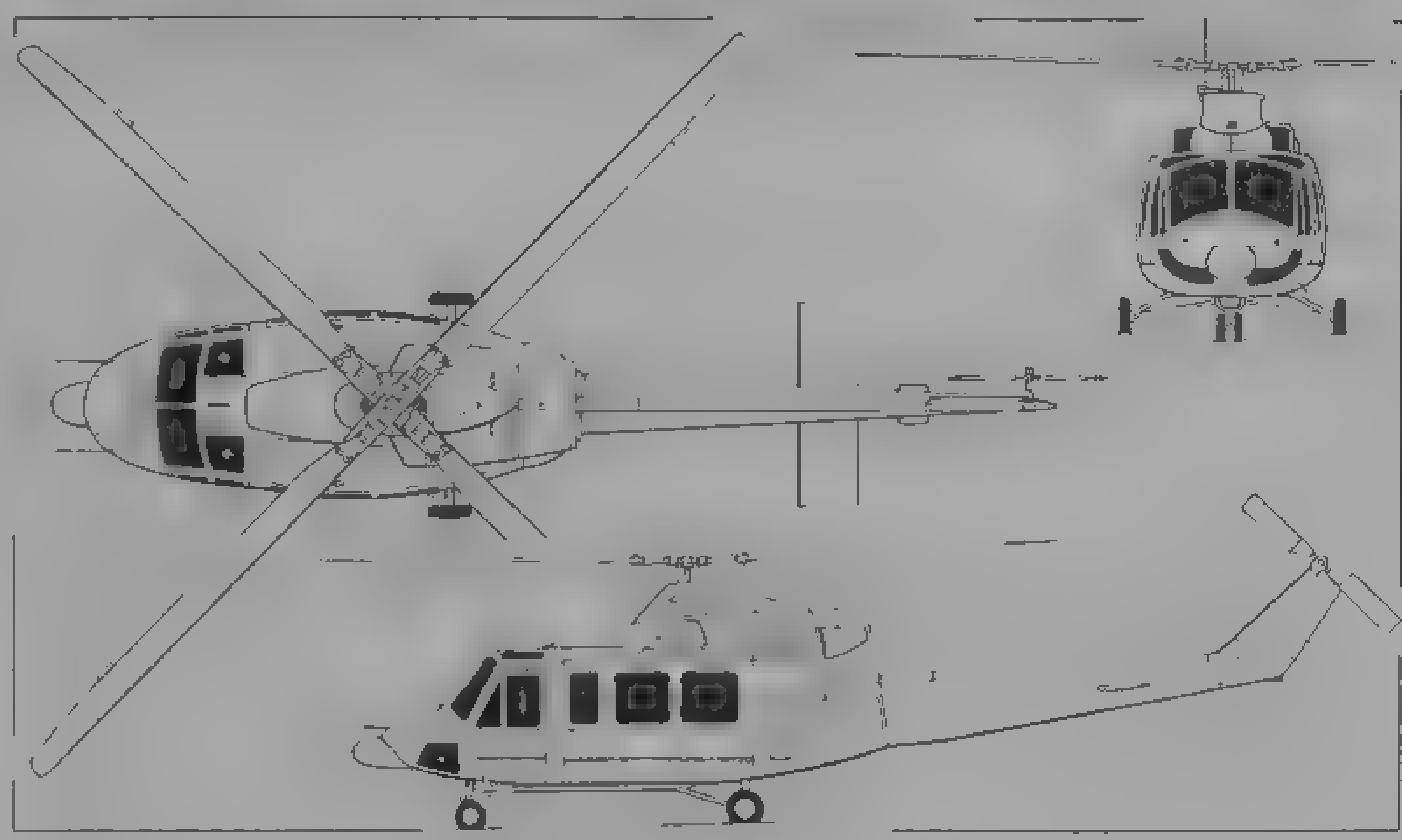
STRUCTURE: Main rotor blade spar unidirectional glassfibre with 45° wound torque casing of glassfibre cloth, Nomex rear section core with trailing-edge of unidirectional glassfibre, leading-edge protected by titanium abrasion strip and replaceable stainless steel cap at tip; lightning protection mesh embedded; provision for electric de-icing heater elements; main rotor hub of steel and light alloy; all metal tail rotor.

LANDING GEAR: High skid; emergency pop-out float or non-retractable tricycle gear optional.

POWER PLANT: Pratt & Whitney Canada PT6T-3D Turbo Twin-Pac, rated at 1,424 kW (1,910 shp) for T-O and maximum continuous. In event of engine failure, remaining engine can deliver up to 850 kW (1,140 shp) for 2½ minutes, or 723 kW (970 shp) for 30 minutes. Transmission rating 1,022 kW (1,370 shp) for T-O, 828 kW (1,110 shp) maximum continuous; OEI rating 764 kW (1,025 shp). Optional 30 kW (40 shp) for accessory drives from main gearbox. Seven interconnected rupture resistant fuel cells, with automatic shut-off valves (breakaway fittings), have a combined capacity of 1,249 litres (330 US gallons; 275 Imp gallons). Two 76 or 310 litre (20 or 82 US gallon; 16.7 or 68.3 Imp gallon) auxiliary fuel tanks, in any combination, can increase maximum total capacity to 1,870 litres (494 US gallons; 411 Imp gallons). Single-point refuelling on starboard side of cabin.

Bell 412EP of the Washington Park Police

1995



Bell 412EP twin-turboshaft utility helicopter (*Jane's/Dennis Punnett*)

1994

ACCOMMODATION: Generally as for Bell 212.

SYSTEMS: As Bell 212 except inverters are 450 VA.

AVIONICS: Generally as for Bell 212. Optional IFR avionics include Bendix/King Gold Crown III and dual Honeywell AFCS.

EQUIPMENT: Optional equipment includes cargo sling and rescue hoist.

DIMENSIONS, EXTERNAL:
Main rotor diameter 14.02 m (46 ft 0 in)
Tail rotor diameter 2.62 m (8 ft 7 in)
Main rotor blade chord: at root 0.40 m (1 ft 4 in)
at tip 0.22 m (8½ in)
Tail rotor blade chord 0.29 m (11½ in)
Length: overall, rotors turning 17.12 m (56 ft 2 in)
fuselage, excl rotors 12.92 m (42 ft 4¾ in)
Height: to top of rotor head 3.48 m (11 ft 5 in)
overall, tail rotor turning 4.57 m (15 ft 0 in)
Stabiliser span 2.87 m (9 ft 5 in)
Width over skids 2.84 m (9 ft 4 in)
Door sizes as Bell 212

AREAS:
Main rotor disc 154.40 m² (1,661.9 sq ft)
Tail rotor disc 5.38 m² (57.86 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, standard equipped:
VFR 3,018 kg (6,654 lb)
IFR 3,066 kg (6,759 lb)
Max external hook load 2,041 kg (4,500 lb)
Max T-O and landing weight, internal or external load
5,397 kg (11,900 lb)
Max disc loading 34.96 kg/m² (7.16 lb/sq ft)
Max power loading 4.02 kg/kW (6.61 lb/shp)

PERFORMANCE (at max T-O weight, ISA):
Max cruising speed: at S/L 122 kts (226 km/h; 140 mph)
at 1,525 m (5,000 ft) 124 kts (230 km/h; 143 mph)
Long-range cruising speed at 1,525 m (5,000 ft)
130 kts (241 km/h; 150 mph)
Service ceiling, OEI, 30 min power rating
2,070 m (6,800 ft)
Hovering ceiling: IGE 3,110 m (10,200 ft)
OGE 1,585 m (5,200 ft)
Range at 1,525 m (5,000 ft), long-range cruising speed, standard fuel, no reserves
402 n miles (745 km; 463 miles)

UPDATED

BELL 412CF

Canadian Forces designation: CH-146 Griffon

TYPE: Twin turboshaft tactical and utility transport helicopter.

PROGRAMME: Canadian Forces contract for 100 CH-146s (modified Bell 412EP) placed in 1992, to replace current Bell 205s (CH-118/UH-1H), 206s (CH-136/COH-58A) and 212s (CH-135/CUH-1N); duties include armed support, troop/cargo transport, medevac, ASW, SAR and patrol; deliveries began October 1994 and continuing at approximately three per month, completion of order due early 1998.

CUSTOMERS: Canadian Forces 100, of which 10 for search and rescue with 417 Squadron at CFB Cold Lake and 439 Squadron at Bagotville. Remaining 90 allocated as follows for duties in support of ground forces: 24 to 408 Sqdn at Edmonton; 16 each to 403 Sqdn (Gagetown), 427 Sqdn (Petawawa) and 430 Sqdn (Valcartier), and six each to 400/411 Sqdns (Toronto), 401/438 Sqdns (Montreal) and 460 Sqdn (Montreal).

DESIGN FEATURES: Generally as commercial Bell 412EP except for avionics and mission equipment.

STRUCTURE: Generally as for Bell 412EP except for crash-resistant, self sealing fuel cells.

LANDING GEAR: Optional ski gear.

AVIONICS: Fully integrated cockpit, designed and manufactured by Canadian Marconi.

Comms: Dual Collins AN/ARC-210 VHF/UHF, Collins AN/ARC-217 HF and Magnavox VHF/AM radios. Bendix/King AN/APX-100 IFF transponder. Provisions for secure voice com. VHF/FM.

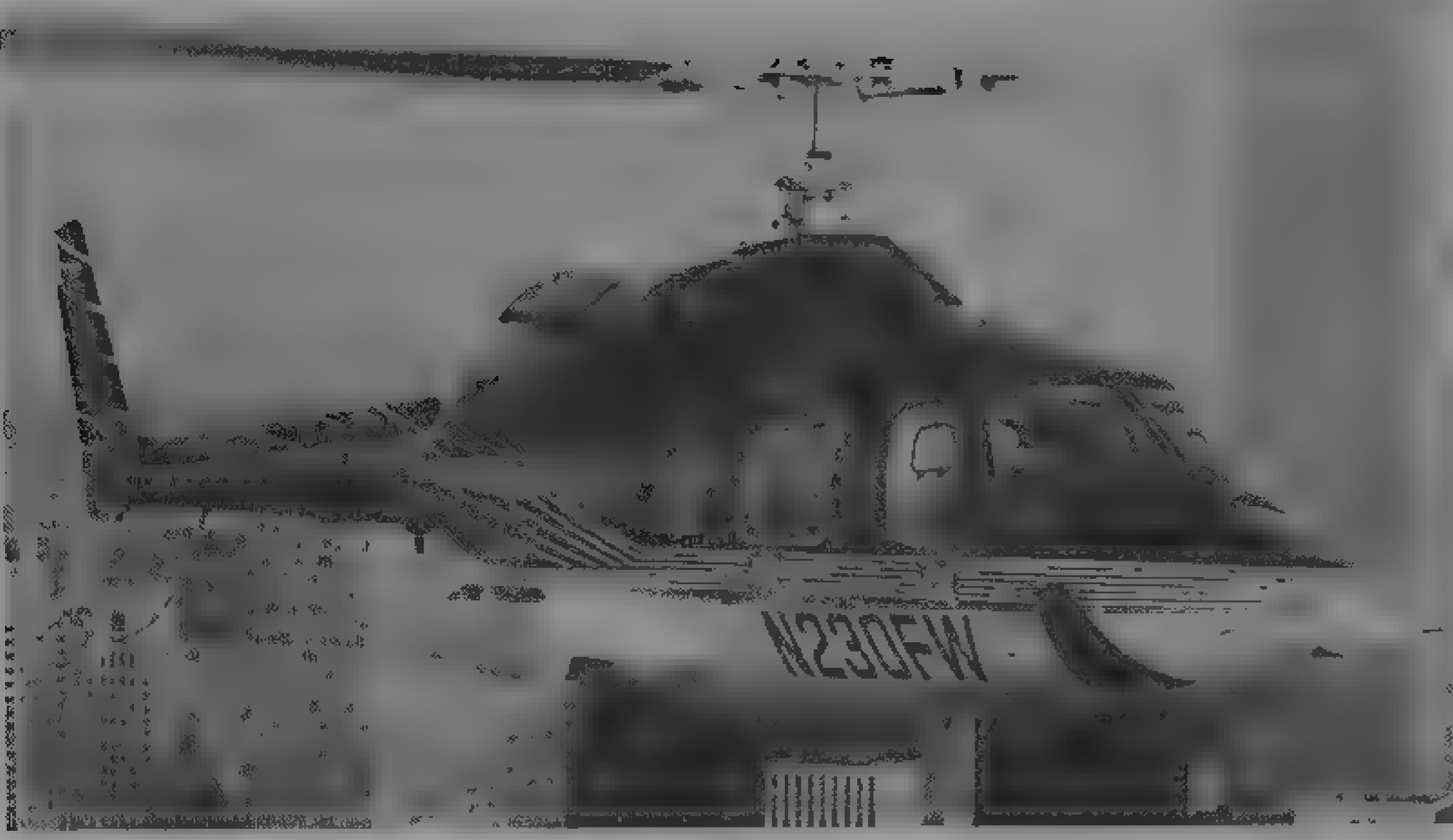
Flight: AN/ARN-147 VOR/ILS and marker beacon receiver, Collins AN/ARN-149 ADF, DM-442 DME and MAGR GPS, Canadian Marconi CMA2012B Doppler.

Instrumentation: Cockpit lighting compatible with NVGs. Provision for nav/map display, encoding altimeter, radar altimeter and FLIR.

Self-Defence: Some aircraft include Litton AN/APR-39A(V)2 RWR, Loral AN/AAR-47 MAWS and Loral AN/ALE-39 chaff/flare dispenser.

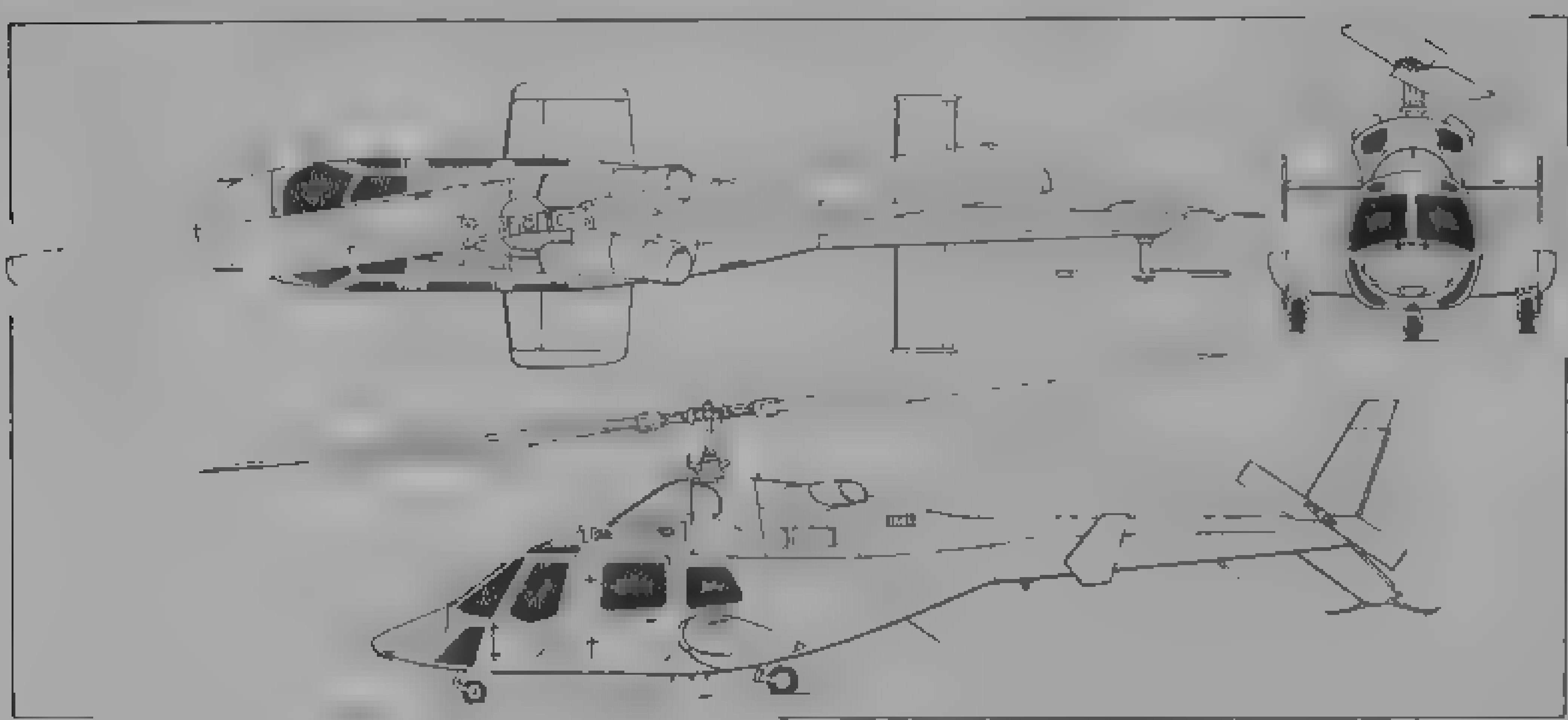
EQUIPMENT: Provisions for armoured floor, energy-absorbing crew seats, observers' bubble window, Nightsun searchlight, cargo hook, external rescue hoist, wire strike protection system and heavy-duty heater, depending upon mission.

NEW ENTRY



Bell 230 (twin Allison 250-C30G2 turboshafts)

1995



Bell 230 twin-turboshaft helicopter *(Jane's/Dennis Punnett)*

1994

BELL 230

TYPE: Twin-turboshaft commercial helicopter.

PROGRAMME: Announced at 1989 NBAA Convention, two Bell 222s converted at Mirabel 1990-91, first flights 12 August (C-GEXP) and 3 October (C-GBLL) 1991; Transport Canada type approval 12 March 1992, production aircraft first flight (C-GAHJ) 23 May 1992, deliveries began (c/n 230002 for Mitsui) 16 November 1992.

CURRENT VERSIONS: **Utility** and **Executive** models, similar to corresponding versions of Bell 222. **EMS** (Emergency Medical Service) versions also available. *Details are for initial production aircraft with Allison engines.*

CUSTOMERS: Launch customer Mitsui & Co (distributor) with order for 20. Total 14 delivered in 1994. Demonstrator (N230CN) leased for six months by Chilean Navy 1993-94, equipped for shipboard evaluation with Indal ASIST deck recovery system, auxiliary fuel tanks, Breeze Eastern BL 1600 rescue hoist, Bendix/King RDR 1500B radar, Teledyne AN/APX-101 transponder, Bendix/King KHF-950 SSB transceiver, Magnavox AN/ARC-164 UHF, Rockwell AN/ARC-186 VHF, Spectrolab SX 5 Starburst searchlight, Agema thermal imager in Heli-Dyne turret, Honeywell EDZ-705 EFIS with SPZ 7000 AFCS, Trimble TNL 7880 GPS/Omega and Flight Visions FV 2000 HUD.

COSTS: Canadian government provided C$14 million as repayable development loan.

DESIGN FEATURES: Replaced Bell 222 (see US section of 1990-91 *Jane's*), AlliedSignal LTS 101 turboshafts of Bell 222 replaced by Allison 250-C30G2s in first 50 aircraft; main and tail rotors substantially same as Bell 222, former having Wortmann 090 blade section with 8 per cent thickness/chord ratio and swept tips. Independent (hydraulic) rotor brake. Short span sponson each side of fuselage houses mainwheel units and fuel tanks, and serves as work platform.

FLYING CONTROLS: Fully powered hydraulic, with elastomeric pitch change and flapping bearings; fixed tailplane with leading-edge slats and endplate fins, strakes under sponsons, single-pilot IFR system without autostabilisation.

STRUCTURE: Substantially as Bell 222. Two-blade main rotor with stainless steel spars and leading-edges, Nomex honeycomb trailing-edge with glassfibre skin, and glassfibre safety straps; tail rotor blades stainless steel. Aluminium alloy fuselage with integral tailboom and some honeycomb panels.

LANDING GEAR: Tubular skid type on Utility version. Executive version to have hydraulically retractable tricycle gear, single mainwheels retracting forward into sponsons, forward-retracting nosewheel fully castoring and self-centring, hydraulic disc brakes on main units.

POWER PLANT: First 50 aircraft each to be powered by two Allison 250-C30G2 turboshafts, each rated at 522 kW (700 shp) for 5 minutes for T-O, 464 kW (622 shp) maximum continuous, 581 kW (779 shp) OEI for 2½ minutes and 553 kW (742 shp) OEI for 30 minutes. Main transmission rated at 690 kW (925 shp) for T-O, 652.5 kW (875 shp) maximum continuous and 548 kW (735 shp) for single-engined operation. Usable fuel capacity 935 litres (247 US gallons, 206 Imp gallons) in skid gear version, 710 litres (187.5 US gallons, 156 Imp gallons) in wheeled version. Optional 182 litres (48 US gallons; 40 Imp gallons) of auxiliary fuel for both versions.

ACCOMMODATION: Standard layout has forward-facing seats for nine persons (2-2-2-3) including pilot(s). Options include eight-seat executive (rear six in club layout), six-seat executive (rear four in club layout with console between each pair), or 10-seat utility (2-2-3-3, all forward-facing). Customised Emergency Medical Service (EMS) versions also available, configured for pilot-only operation plus one or two pivotable stretchers and four or three medical attendants/sitting casualties respectively. Two forward-opening doors each side. Entire interior ram air ventilated and soundproofed. Dual controls optional.

SYSTEMS: Dual hydraulic system (dual for main rotor collective and cyclic, single for tail rotor). Dual 28 V DC electrical system, powered by two 30 V 200 A engine-mounted starter/generators (derated to 180 A) and a 24 V 28 Ah Ni/Cd battery. ECS optional.

AVIONICS: *Comms:* Bendix/King Gold Crown III KTR 908 VHF com radio and KMA 24H-71 ICS standard.

Flight: Honeywell attitude indicator; Bendix/King KPI 552B HSI with glideslope; KCS 305 compass.

Instrumentation: Bendix/King EFIS and AFCS optional.

EQUIPMENT: Standard equipment includes rotor and cargo tie-downs, ground handling wheels for skid version, retractable 450 W search/landing light. Options include dual controls, auxiliary fuel tankage, force/feel trim system, more comprehensive nav/com avionics, 136 kg (300 lb) capacity rescue hoist, 1,270 kg (2,800 lb) capacity cargo hook, emergency flotation gear, heated windscreen, particle separator and snow baffles.

DIMENSIONS, EXTERNAL:

Main rotor diameter	12.80 m (42 ft 0 in)
Tail rotor diameter	2.10 m (6 ft 10½ in)
Main rotor blade chord	0.66 m (2 ft 2 in)
Tail rotor blade chord	0.25 m (10 in)
Length, incl tailskid: overall, rotors turning (skid gear)	15.23 m (49 ft 11½ in)
overall, rotors turning (wheel gear)	15.29 m (50 ft 2 in)
fuselage (skid gear)	12.81 m (42 ft 0½ in)
fuselage (wheel gear)	12.87 m (42 ft 2¾ in)
Height over tailfin: skid gear	3.33 m (10 ft 11 in)
wheel gear	3.39 m (11 ft 1½ in)
Height overall: skid gear	3.70 m (12 ft 1½ in)
Width over endplate fins	3.12 m (10 ft 3 in)
Width over sponsons: skid gear	3.62 m (11 ft 10½ in)
wheel gear	3.45 m (11 ft 4 in)
Width over skids	2.39 m (7 ft 10 in)
Wheel track	2.78 m (9 ft 1½ in)
Passenger doors (each): Height	1.24 m (4 ft 1 in)
Width	0.91 m (3 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin (excl flight deck and rear baggage compartment):	
Length	2.16 m (7 ft 1 in)
Max width	1.47 m (4 ft 10 in)
Max height	1.45 m (4 ft 9 in)
Volume	3.67 m³ (129.5 cu ft)
Flight deck volume	1.87 m³ (65.9 cu ft)
Baggage compartment volume:	
aft of cabin	1.05 m³ (37.2 cu ft)
nose	0.40 m³ (14.2 cu ft)

AREAS:

Main rotor disc	128.7 m² (1,385.4 sq ft)
Tail rotor disc	3.45 m² (37.12 sq ft)

WEIGHTS AND LOADINGS:

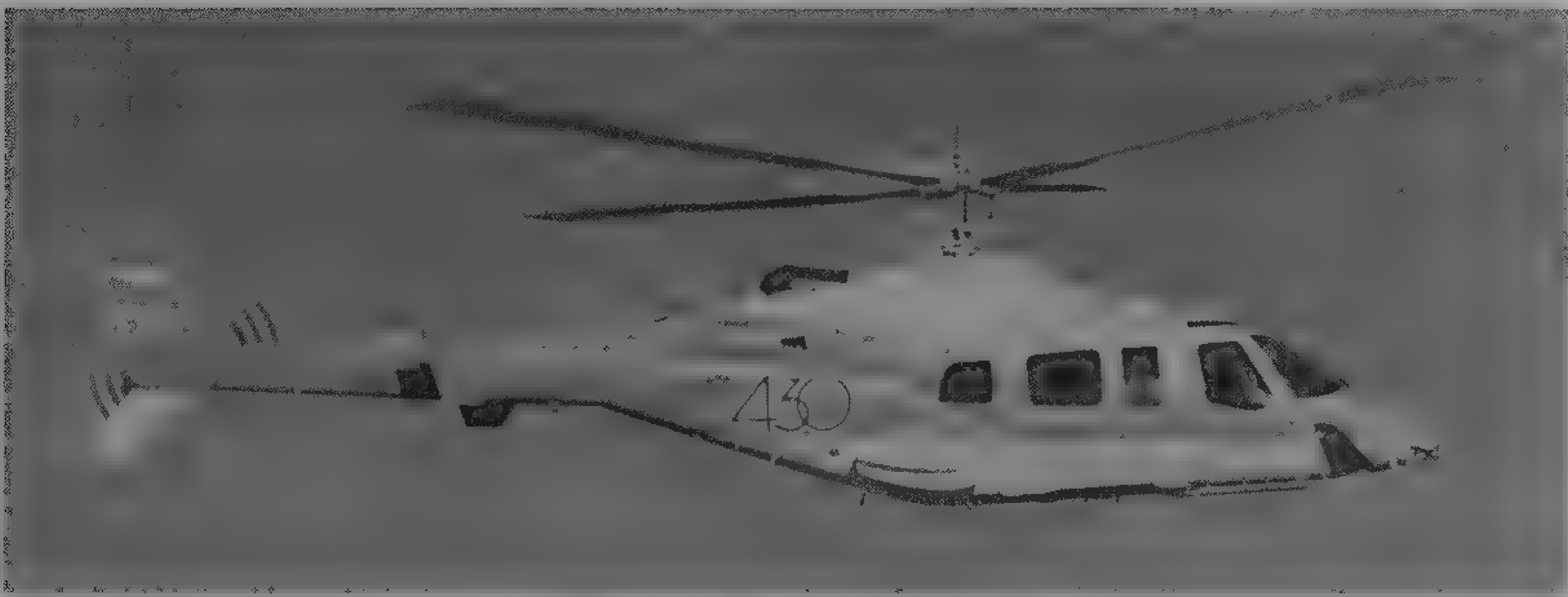
Weight empty, standard:	
skid gear	2,268 kg (5,000 lb)
wheel gear	2,312 kg (5,097 lb)
Max external sling load	1,270 kg (2,800 lb)
Max T-O weight, internal or external load	3,810 kg (8,400 lb)
Max disc loading	29.6 kg/m² (6.06 lb/sq ft)
Max power loading	5.53 kg/kW (9.08 lb/shp)

PERFORMANCE (at max T-O weight, ISA, except where indicated):

Max cruising speed at S/L:	
skid gear	137 kts (254 km/h, 158 mph)
wheel gear, standard fuel	141 kts (261 km/h, 162 mph)
wheel gear, auxiliary fuel	137 kts (254 km/h, 158 mph)
Econ cruising speed at S/L at average gross weight:	
skid gear, standard fuel	134 kts (248 km/h, 154 mph)
wheel gear	138 kts (256 km/h, 159 mph)
Service ceiling at max cruise power:	
both	4,725 m (15,500 ft)
Service ceiling, OEI, 30 min power rating:	
both	2,350 m (7,700 ft)
Hovering ceiling IGE (both): ISA	3,780 m (12,400 ft)
ISA + 20°C	2,895 m (9,500 ft)
Hovering ceiling OGE (both): ISA	2,225 m (7,300 ft)
ISA + 20°C	1,220 m (4,000 ft)
Range at S/L at econ cruising speed, standard fuel, no reserves: skid gear	385 n miles (713 km; 443 miles)
wheel gear	301 n miles (558 km, 346 miles)

Bell 230 demonstrator N230CN after service with Chilean Navy *(Paul Jackson)*

1995



Prototype Bell 430 twin turboshaft helicopter

1995

Range at S/L at econ cruising speed, auxiliary fuel, no reserves, wheel gear 379 n miles (702 km, 436 miles)

UPDATED

BELL 430

TYPE: Four-blade rotor, higher powered and stretched (nine seat) variant of Bell 230

PROGRAMME: Proposed 1992, two prototypes, modified from Bell 230 airframes; first prototype (C-GBLL; wheel-equipped) flown 25 October 1994, second prototype (skid-equipped, with complete avionics suite) flown 19 December 1994; first flight of production 430 scheduled for October 1995; deliveries to begin early 1996 after Canadian type approval, planned for November 1995. Intended production totals, 24 in 1996, 36 in 1997 and up to 55 each year thereafter

CUSTOMERS: Nine orders held at end of 1994

COSTS: Programme $18 million, 35 per cent financed by Canadian Defence Industry Productivity Program (DIPP) and repayable as royalty on each sale. Unit cost $3.675 million basically equipped

DESIGN FEATURES: Bell 230 fuselage lengthened by 0.46 m (1 ft 6 in) plug. Bell 680 all-composites four-blade bearingless main rotor; approximately 10 per cent power increase over Bell 230

POWER PLANT: Two Allison 250-C40 turboshafts, each rated at 584 kW (783 shp) for T-O and 521 kW (699 shp) maximum continuous. Chandler Evans FADEC. New transmission rated at 779 kW (1,045 shp).

AVIONICS: *Comms*: Bendix/King Gold Crown III

Flight: Bendix/King KFC 500 AFCS. GPS optional

Instrumentation: Rogerson-Kratos LCD integrated instrument display system (IIDS) comprising two active matrix LCDs displaying engine and system parameters, optional Rogerson-Kratos EFIS.

DIMENSIONS, EXTERNAL:

Main rotor diameter	13.79 m (45 ft 3 in)

WEIGHTS AND LOADINGS:

Max external load	1,270 kg (2,800 lb)
Max payload	1,549 kg (3,415 lb)

PERFORMANCE: Refer to Addenda for additional data

UPDATED

Bell 430 cockpit test rig, showing Rogerson-Kratos IIDS display in centre

1995

BELL 442

TYPE: Twin turboshaft medium weight helicopter

PROGRAMME: In design definition stage from Spring 1993; same weight class as Bell 412, four-blade main rotor; intended as Bell 412 successor, international partner(s) being sought

LANDING GEAR: Hydraulically retractable tricycle gear

POWER PLANT: Two Allison/AlliedSignal CTS800 or MTU/Turbomeca/Rolls-Royce MTR 390 turboshafts

UPDATED

Artist's impression of Bell 442 twin-turboshaft, medium weight helicopter

1995

BELL 407 and 407T

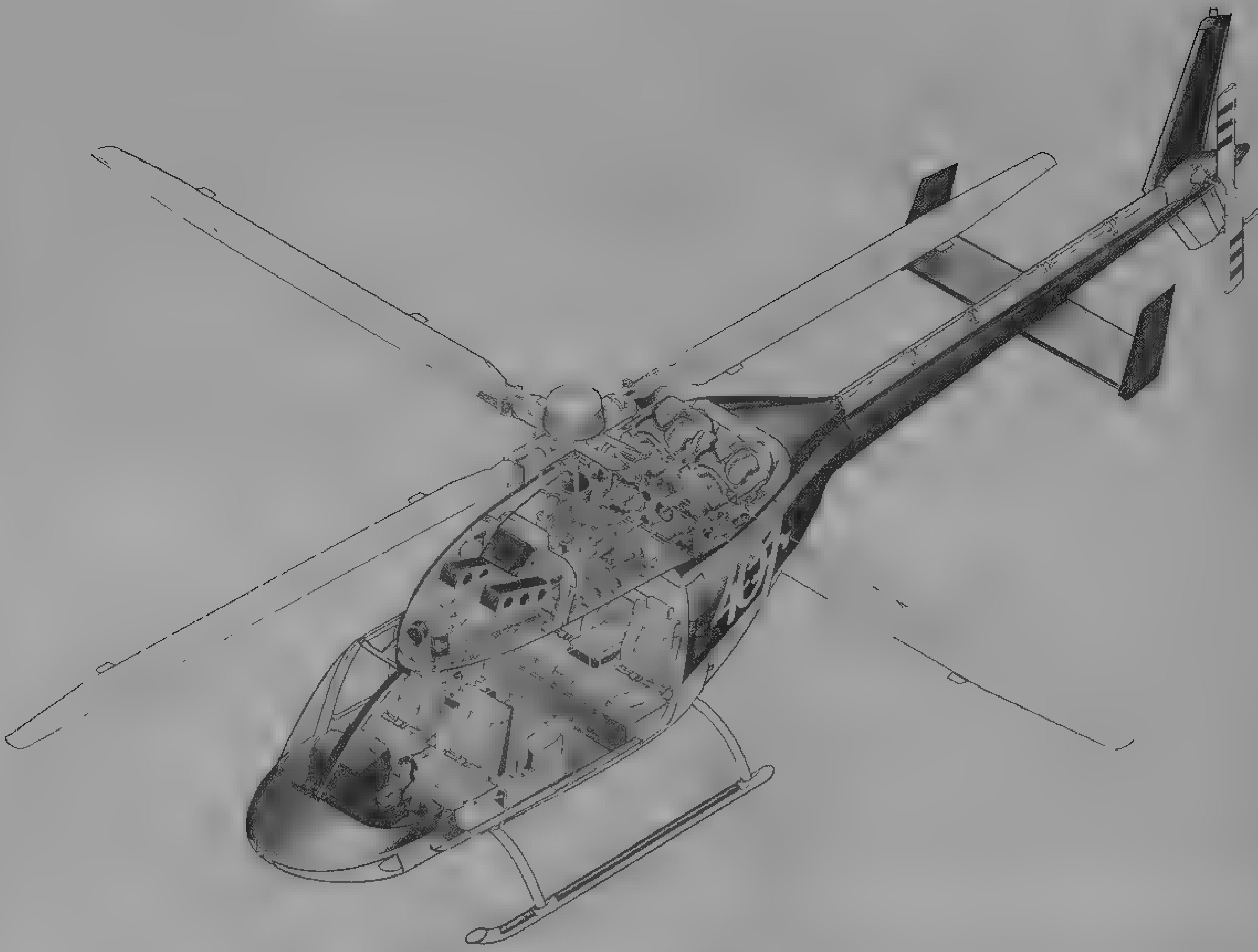
TYPE: Single- and twin-turboshaft, seven-seat light helicopters.

PROGRAMME: Design definition under way since 1993 as Bell Light Helicopter, to replace JetRanger, LongRanger and TwinRanger; concept demonstrator (N407LR) first flown 21 April 1994 (standard Bell 206L-4 modified with tailboom and dynamic system of military OH-58D, plus sidewall fairings to simulate broader fuselage); public debut and launch at Heli Expo '95, Las Vegas, January 1995. Two definitive 407s then under construction, first due to fly in mid-June 1995, certification 407 late 1995, 407T in early 1997, deliveries 407 early 1996, 407T early 1997, initial production, seven and a half 407s per month

CUSTOMERS: More than 60 orders for 407 by January 1995, launch customers Niagara Helicopters and Greenland Air

COSTS: 407 $1.15 million, 407T $1.795 million (1995)

DESIGN FEATURES: Based on Bell 206L LongRanger fuselage with cabin widened by 17.8 cm (7 in); larger cabin windows; Litton LCD cockpit displays; all-composites four-blade main rotor based on that of OH-58D, with soft mounted pylon isolation system; 407 has single Allison 250-C47 turboshaft rated at 590 kW (791 shp) for T-O, 525 kW (704 shp) maximum continuous, transmission rating 503 kW (674 shp), 407T has two Allison 250-C22B turboshafts, each rated at 364 kW (489 shp) for T-O, 318 kW (427 shp) maximum continuous, with Soloy combining gearbox, FADEC standard on both versions;



Cutaway drawing of twin-turbine Bell 407T *1995*

testing of 'ring-fin' shrouded rotor continuing early 1995 as possible future option

WEIGHTS AND LOADINGS (407)

Max payload (internal)	1,093 kg (2,411 lb)
Max external load	1,200 kg (2,645 lb)
Max T-O weight: internal load	2,268 kg (5,000 lb)
external load	2,495 kg (5,500 lb)

PERFORMANCE: Refer to Addenda for additional data

UPDATED

Concept demonstrator for Bell 407 turbine-powered seven-seat helicopter *1995*

BOMBARDIER

BOMBARDIER AEROSPACE GROUP, NORTH AMERICA

PRESIDENT: Robert E. Brown
EXECUTIVE VICE PRESIDENT, MANUFACTURING: Roland Gagnon
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VICE-PRESIDENT, STRATEGIC PLANNING AND BUSINESS DEVELOPMENT: Robert D. Gillespie
GROUP VICE-PRESIDENT, PROCUREMENT: Rene Brasseur
DIRECTOR, PUBLIC RELATIONS: Catherine Chase
MEMBER COMPANIES:
Canadair: see this section
de Havilland: see this section
Learjet: see US section

Created 1992 with combined workforce of nearly 15,000 (Canadair 8,000, de Havilland 3,150, Learjet 3,750). Current products and programmes comprise Canadair Challenger 601-3R and 604, Regional Jet, Global Express and CL-215T/415; de Havilland Dash 8 Series 100, 200, 300 and 400; and Learjet 31A, 35A, 45 and 60. Canadair designs and manufactures components for Aerospatiale, Boeing and McDonnell Douglas, provides aircraft systems support for Canadian Forces CF-18 and flying training, and is responsible for CL-227 Sentinel and CL-289 UAVs. De Havilland, as subcontractor, builds fuselage and tail section of Shorts C-23A+ Sherpa.

UPDATED

Two of the Bombardier family of aircraft: the Canadair Regional Jet (nearest camera) and the de Havilland Dash 8 (Series 200). Other Bombardier aircraft include the Canadair Challenger and Global Express, and Learjets *1994*

BRISTOL AEROSPACE

BRISTOL AEROSPACE LTD

Details of Bristol Aerospace's Northrop F-5 upgrade programmes were given in 1994-95 *Jane's*, now transferred to *Jane's Aircraft Upgrades*

UPDATED

CANADAIR

CANADAIR, BOMBARDIER INC

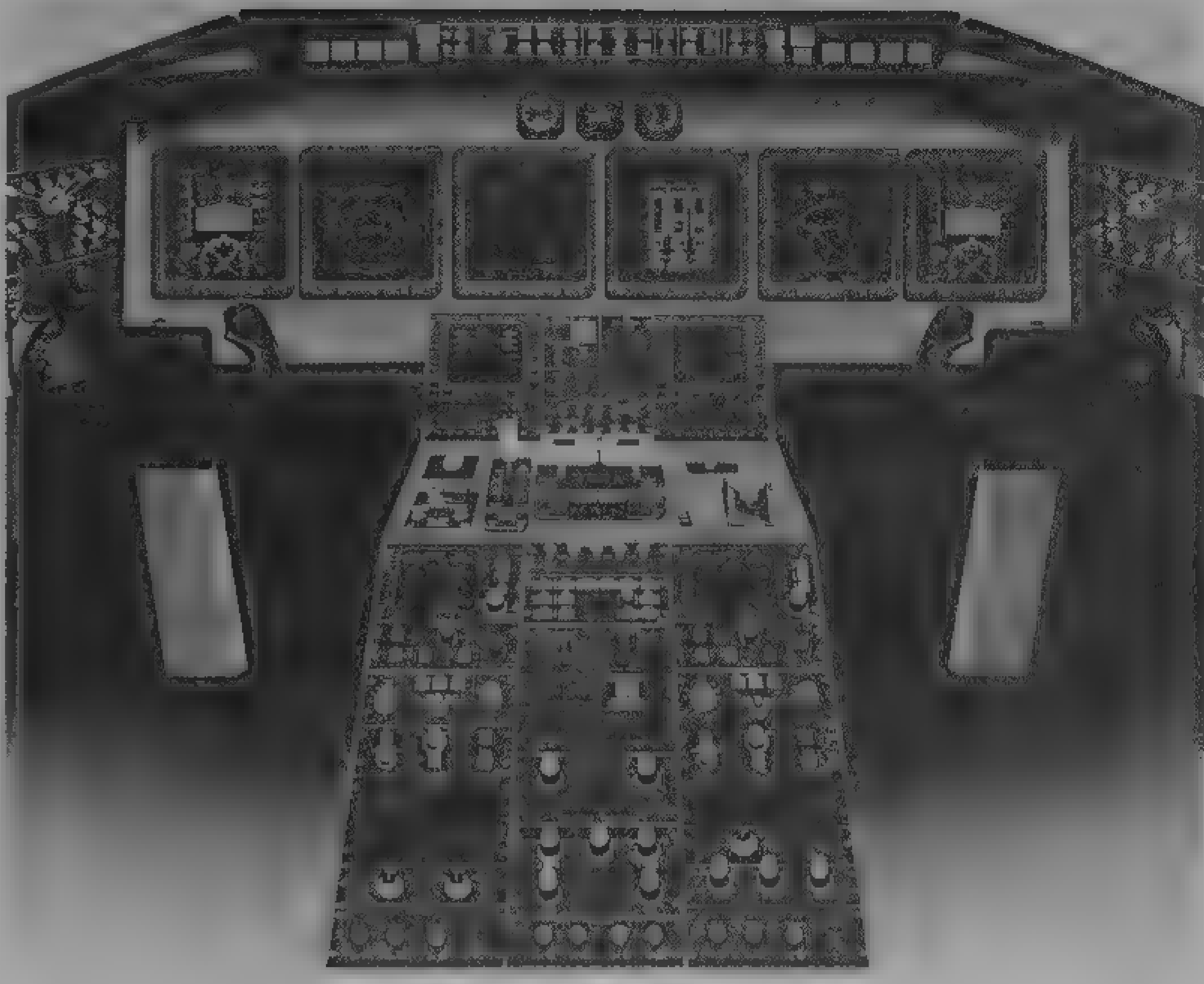
400 Chemin de la Cote-Vertu, Dorval, Quebec H4S 1Y9
POSTAL ADDRESS: PO Box 6087, Station Centreville, Montreal, Quebec H3C 3G9
Telephone: 1 (514) 855 5000
Fax: 1 (514) 855 7903
Telex: 05 826747
PRESIDENT: Robert E. Brown
PRESIDENT, BOMBARDIER BUSINESS AIRCRAFT DIVISION: Bryan T. Moss
PRESIDENT, BOMBARDIER REGIONAL AIRCRAFT DIVISION: Pierre Lortie
PRESIDENT, CANADAIR AMPHIBIOUS AIRCRAFT DIVISION: James C. Cherry
PRESIDENT, DEFENCE SYSTEMS DIVISION: David Huddlestone
VICE-PRESIDENT/GENERAL MANAGER: Roland Gagnon (Manufacturing Division)
PUBLIC RELATIONS: Catherine Chase

By early 1995 Canadair had manufactured some 4,260 aircraft since 1944, acquired by Bombardier Inc 23 December 1986, merged with parent company as Canadair Group of Bombardier Inc 5 August 1988, has four divisions, Business Aircraft, Amphibious Aircraft, Manufacturing, and Defence Systems.

Administrative centre is adjacent Montreal International Airport (Dorval). Three plants in St Laurent complex at Cartierville Airport, facility at Montreal (Dorval) expanded for Challenger, Regional Jet and CL-415 assembly, new facilities at Montreal (Mirabel) for CF-18 work and other military work. Total covered floor area (1994) 362,310 m² (3,899,875 sq ft); workforce about 8,000 in December 1994.

Main subcontracts include nose barrel units for McDonnell Douglas F/A-18, six major fuselage subassemblies for 600 Airbus A330/340s for Aerospatiale, Airbus inboard wing leading-edge assemblies for BAe and rear fuselage sections for Boeing 767. Prime contractor for engineering support for CF-18 (with CAE Electronics and NWI); also repairs, overhauls and produces spares for other aircraft.

UPDATED



Canadair Challenger 604 flight deck with Collins Pro Line IV integrated avionics

1995

CANADAIR CHALLENGER

Canadian Forces designations: CC-144 and CE-144A

TYPE: Twin-turbofan business, cargo and regional transport.

PROGRAMME: First flight of first of three prototypes (C-GCGR-X) 8 November 1978; first flight production Challenger 600 with AlliedSignal ALF 502L-2 turbofans 21 September 1979, first customer delivery 30 December 1980; first flight Challenger 601 with GE CF34s 10 April 1982, first 601-1A delivered 6 May 1983, first 601-3A 6 May 1987 and first 601-3A/ER 19 May 1989, first 601-3R July 1993.

CURRENT VERSIONS: **Challenger 600**: Total 83 built after certification in 1980 (76 since retrofitted with winglets); 12 delivered to Canadian Department of National Defence as CC-144 (three) and CE-144A (three) (see 1989-90 and earlier *Jane's*), plus three for coastal patrol, two for general transport and one test aircraft. Production completed.

Challenger 601-1A: First production version to have CF34 engines (see 1990-91 *Jane's*); first flight 17 September 1982. Production (66 built) completed.

Challenger 601-3A: Version with 'glass' cockpit and upgraded CF34s, first flight 28 September 1986. Canadian and US certification 21 and 30 April 1987, also certificated for Cat. II and in 22 other countries; improvements include CF34-3A engines flat rated to 21°C, and fully integrated digital flight guidance and flight management systems. Production (134 built) completed.

Challenger 601-3R: Extended range option available on new 601-3As since 1989 and as retrofit to 601-1As and 601-3As, range increased to 3,585 n miles (6,639 km; 4,125 miles) with NBAA IFR reserves; first flight 8 November 1988, Canadian certification 16 March 1989; tail fairing replaced with conformal tailcone fuel tank which extends fuselage length by 46 cm (1 ft 6 in) and adds 118 kg (260 lb) to operating weight empty; maximum ramp weight increased by 680 kg (1,500 lb). Optional gross weight increase of 227 kg (500 lb). Total of 37 delivered by February 1995, production rate of two per month. *Detailed description applies to 3R version except where indicated.*

Challenger 604: Has range of 4,000 n miles (7,408 km; 4,603 miles) at Mach 0.74 and is powered by General Electric CF34-3B engines each rated at 38.8 kN (8,730 lb st) T-O power at ISA + 15°C, first flight 18 September 1994. Exploits systems developed in Regional Jet programme. Rockwell Collins Pro Line IV EFIS, extra 1,242 litres (328 US gallons, 273 Imp gallons) of fuel in aft equipment bay, forward fuselage tank and tail tank. Automatic aft-CG control to reduce trim drag for longer range. New landing gear and anti-skid system, strengthened tail unit, new wing-to-fuselage and underbelly fairings. Maximum T-O weight 21,863 kg (48,200 lb). Transport Canada certification scheduled for October 1995, FAA certification November 1995, first customer deliveries early 1996.

CUSTOMERS: Total 84 Challenger 600 and 66 601-1A delivered, total 134 Challenger 601-3A delivered between 19 May 1987 and July 1993, total 37 601-3R delivered by February 1995, total 321 Challengers of all versions delivered by February 1995; recent customers include South Korea's Ministry of Transport (one for flight inspection, July 1995 delivery).

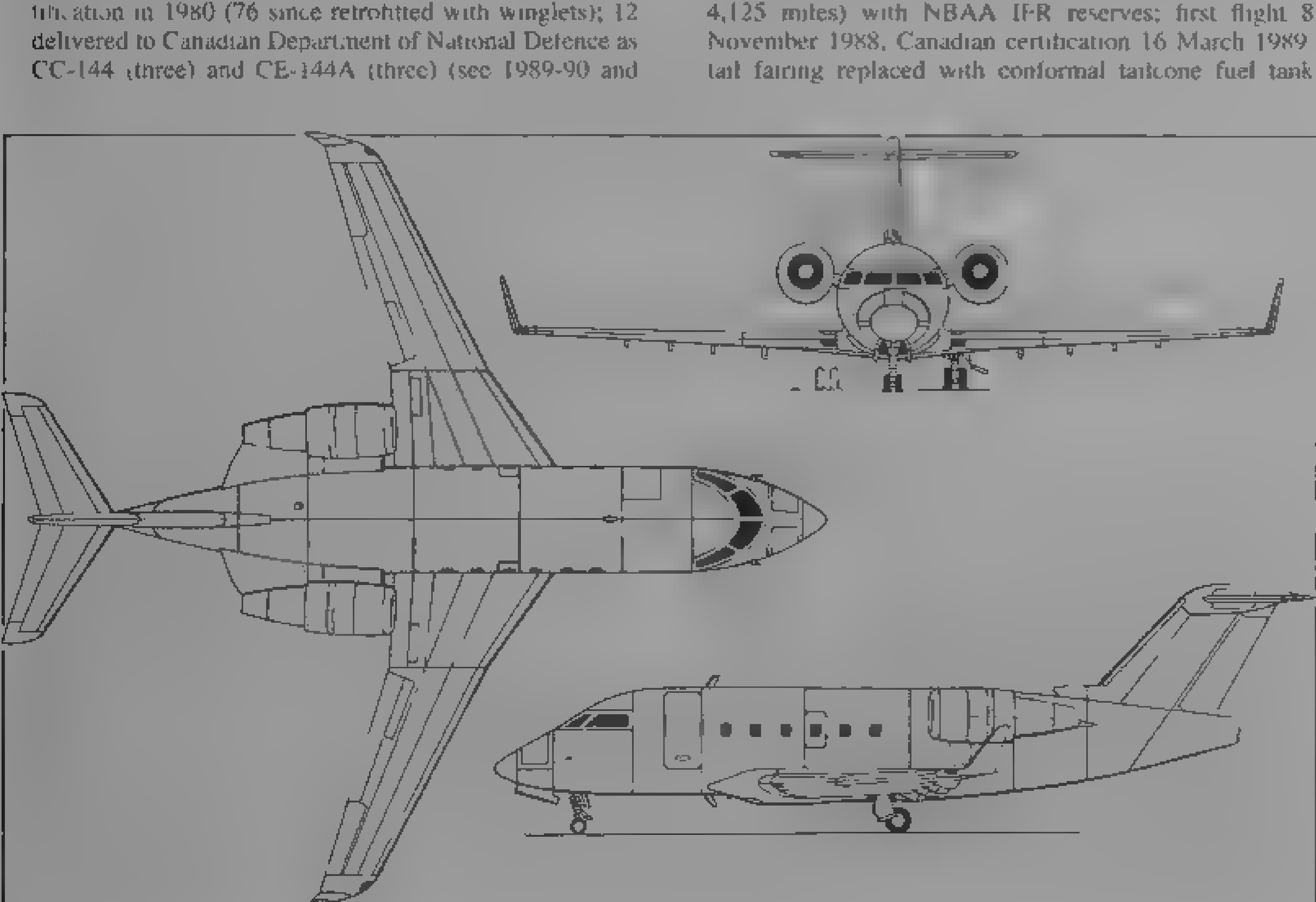
COSTS: Unit cost (604), $17.95 million 'green', $20 million outfitted.

DESIGN FEATURES: Advanced wing section, quarter-chord sweep 25°, thickness/chord ratio 14 per cent at root, 12 per cent at leading-edge sweep break and 10 per cent at tip; dihedral 2° 33′, incidence at root 3° 30′, fuselage circular cross-section, pressurised.

FLYING CONTROLS: Fully powered hydraulic controls, electrically actuated variable incidence tailplane, two-segment spoilers (outboard airbrake panels, inboard lift dumpers), two-segment double-slotted flaps.

STRUCTURE: Two-spar wing torsion box, chemically milled fuselage skin panels with riveted frames and stringers form damage-tolerant structure; multispar fin and tailplane.

LANDING GEAR: Hydraulically retractable tricycle type, with twin wheels and Dowty oleo-pneumatic shock absorber on each unit. Mainwheels retract inward into wing centre-section, nose unit forward. Nose unit steerable and self-centring. Mainwheels have Goodyear 25.75 × 6.75 tyres, pressure 14.20 bars (206 lb/sq in); nosewheels have B. F. Goodrich 18 × 4.4 tyres, pressure 10.41 bars (151 lb/sq in).



Canadair Challenger 601-3R (two General Electric CF34-3A1 turbofans) ***(Jane's/Mike Keep)***

1995

Canadair Challenger 601-3R twin-turbofan business aircraft

1995

ABS (Aircraft Braking Systems) hydraulically operated multiple-disc carbon brakes with fully modulated anti-skid system. Minimum ground turning radius 12.19 m (40 ft 0 in)

POWER PLANT: Two General Electric CF34-3A1 turbofans each rated at 41.0 kN (9,220 lb st) with automatic power reserve, or 38.8 kN (8,730 lb st) without APR, pylon mounted on rear fuselage and fitted with cascade type fan air thrust reversers. Nacelles and thrust reversers by Vought Aircraft. Integral fuel tank in centre-section, capacity 2,839 litres (750 US gallons; 624 Imp gallons), one in each wing (each 2,725 litres, 720 US gallons, 600 Imp gallons) and auxiliary tanks (combined capacity 984 litres, 260 US gallons, 216.5 Imp gallons) beneath cabin floor. Tank in tailcone, capacity 696.5 litres (184 US gallons, 153 Imp gallons). Total fuel capacity 9,975 litres (2,635 US gallons, 2,194 Imp gallons). Pressure and gravity fuelling and defuelling. Oil capacity 13.6 litres (3.6 US gallons, 3 Imp gallons)

ACCOMMODATION: Two-pilot flight deck with dual controls. Blind flying instrumentation standard. Cabin interiors to customer's specifications; maximum of 19 passenger seats and three crew approved. Typical installations include toilet, buffet, bar and wardrobe. Medevac version can carry up to seven stretcher patients, infant incubator, full complement of medical staff and comprehensive intensive care equipment. Baggage compartment, with own loading door, accessible in flight. Downward opening, power assisted door on port side, forward of wing. Overwing emergency exit on starboard side. Entire accommodation heated, pressurised and air conditioned

SYSTEMS: AiResearch pressurisation and air conditioning systems, maximum pressure differential 0.61 bar (8.8 lb/sq in). Three independent hydraulic systems, each of 207 bars (3,000 lb/sq in). No. 1 system powers flight controls (via servo-actuators positioned by cables and pushrods), No. 2 system for flight controls and brakes; No. 3 system for flight controls, landing gear extension/retraction, brakes and nosewheel steering. Nos. 1 and 2 systems each powered by an engine-driven pump, supplemented by an AC electric pump, No. 3 system by two AC pumps. Two 30 kVA engine-driven generators supply primary 115/200 V three-phase AC electric power at 400 Hz. Four transformer rectifiers to convert AC power to 28 V DC, one 43 Ah Ni/Cd battery. Alternative primary power provided by APU and/or an air-driven generator, latter deployed automatically in flight if engine-driven generators and APU are inoperative. Stall warning system, with stick shakers and stick pusher. AlliedSignal GTCP 100E gas turbine APU for engine start, ground air conditioning and other services. Electric anti-icing of windscreen, flight deck side windows and pitot heads, Sundstrand bleed air anti-icing of wing leading-edges, engine intake cowls and guide vanes. Gaseous oxygen system, pressure 127.5 bars (1,850 lb/sq in). Continuous-element fire detectors in each engine nacelle, APU and main landing gear bays, two-shot extinguishing system for engines, single-shot system for APU

AVIONICS: Collins Pro Line II nav/com.

Comms: Dual VHF, dual ATC transponders, dual HF, cockpit voice recorder.

Radar: Honeywell Primus 870 four-colour digital weather radar with turbulence detection.

Flight: Dual VHF nav; dual DME, dual ADF; dual Honeywell laser inertial reference systems (LIRS) with full provision for third, dual flight management system, Lasertrack navigation display unit; digital automatic flight control system, with dual-channel fail-operational autopilot and flight director, Mach trim and auto trim; dual digital air data system. Space provisions for flight data recorder, ELT, VLF/Omega, GPWS, AHS.

Instrumentation: Honeywell digital avionics include SPZ-8000 five-tube EFIS including a single multifunction display (MFD), standby instruments (artificial horizon, airspeed indicator, compass and altimeter). Systems certified for Cat. II operations

EQUIPMENT (Medevac version): Includes cardio-pulmonary resuscitation unit, physio control lifepack comprising heart

Interior of a Challenger 601 3R

1995

defibrillator, ECG and cardioscope, ophthalmoscope; respirators and resuscitators, infant monitor; X-ray viewer, cardiostimulator, foetal heart monitor, and anti shock suit.

DIMENSIONS, EXTERNAL:
- Wing span over winglets: 19.61 m (64 ft 4 in)
- Wing chord: at fuselage c/l: 4.89 m (16 ft 0½ in)
  - at tip: 1.27 m (4 ft 2 in)
- Wing aspect ratio (excl winglets): 7.96
- Length overall: 20.85 m (68 ft 5 in)
- Fuselage: Max diameter: 2.69 m (8 ft 10 in)
- Height overall: 6.30 m (20 ft 8 in)
- Tailplane span: 6.20 m (20 ft 4 in)
- Wheel track (c/l of shock struts): 3.18 m (10 ft 5 in)
- Wheelbase: 7.99 m (26 ft 2¼ in)
- Passenger door (port, fwd): Height: 1.78 m (5 ft 10 in)
  - Width: 0.91 m (3 ft 0 in)
  - Height to sill: 1.61 m (5 ft 3¼ in)
- Baggage door (port, rear): Height: 0.84 m (2 ft 9 in)
  - Width: 0.71 m (2 ft 4 in)
  - Height to sill: 1.61 m (5 ft 3¼ in)
- Overwing emergency exit (stbd):
  - Height: 0.91 m (3 ft 0 in)
  - Width: 0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:
- Cabin: Length, incl galley, toilet and baggage area, excl flight deck: 8.61 m (28 ft 3 in)
  - Max width: 2.49 m (8 ft 2 in)
  - Width at floor level: 2.18 m (7 ft 2 in)
  - Max height: 1.85 m (6 ft 1 in)
  - Floor area: 18.77 m² (202 sq ft)
  - Volume: 32.6 m³ (1,150 cu ft)

AREAS:
- Wings, gross (excl winglets): 48.31 m² (520.0 sq ft)
- Ailerons (total): 1.39 m² (15.0 sq ft)
- Trailing-edge flaps (total): 7.80 m² (84.0 sq ft)
- Fin: 9.18 m² (98.8 sq ft)
- Rudder: 2.03 m² (21.9 sq ft)
- Tailplane: 6.45 m² (69.4 sq ft)
- Elevators (total): 2.15 m² (23.1 sq ft)

WEIGHTS AND LOADINGS (601-3R):
- Manufacturer's weight empty: 9,405 kg (20,735 lb)
- Operating weight empty: 11,684 kg (25,760 lb)
- Max fuel: 8,119 kg (17,900 lb)
- Max payload: 2,377 kg (5,240 lb)
- Payload with max fuel: 721 kg (1,590 lb)
- Max T-O weight: 20,457 kg (45,100 lb)
- Max ramp weight: 20,525 kg (45,250 lb)
- Max landing weight: 16,329 kg (36,000 lb)
- Max zero-fuel weight: 14,062 kg (31,000 lb)
- Max wing loading: 489.3 kg/m² (100.2 lb/sq ft)
- Max power loading (without APR): 263.42 kg/kN (2.58 lb/lb st)

PERFORMANCE (601-3R at max T-O weight, except where indicated):
- Max cruising speed: 476 kts (882 km/h, 548 mph)
- Normal cruising speed: 459 kts (851 km/h, 529 mph)
- Long-range cruising speed: 425 kts (787 km/h; 489 mph)
- Time to initial cruise altitude: 24 min
- Max operating altitude: 12,500 m (41,000 ft)
- Service ceiling, OEI: 5,550 m (18,200 ft)
- Balanced T-O field length (ISA at S/L): 1,844 m (6,050 ft)
- Landing distance at S/L at max landing weight: 1,006 m (3,300 ft)
- Range with max fuel and five passengers, NBAA IFR reserves (200 n miles, 370 km; 230 mile alternate) at long-range cruising speed: 3,585 n miles (6,639 km; 4,125 miles)
- Design g limit: +2.6

OPERATIONAL NOISE LEVELS (601-3R, FAR Pt 36):
- T-O: 79.7 EPNdB
- Sideline: 85.7 EPNdB
- Approach: 90.8 EPNdB

UPDATED

CANADAIR REGIONAL JET

TYPE: Twin-turbofan regional transport

PROGRAMME: Design studies began Autumn 1987; basic configuration frozen June 1988, formal programme go-ahead given 31 March 1989, extended range 100ER announced September 1990. Three development aircraft built (c/n 7001-7003), plus static test airframe (c/n 7991) and forward fuselage test article (7992); first flight of 7001 (C-FCRJ) 10 May 1991; 7002 (C-FNRJ) first flew 2 August 1991 and 7003 on 17 November 1991, all three in 1,400 hour flight test programme in Wichita, USA. CF34-3A1 engine obtained its US type certificate 24 July 1991. Transport Canada type approval (100 and 100ER) 31 July 1992, first flight of first delivery aircraft (c/n 7004) 4 July 1992 first delivery (to Lufthansa CityLine of Germany as D-ARJA) 29 October 1992, European JAA and US FAA certification 14 and 21 January 1993 respectively. Production rate increased from two to three per month during 1994 and to five per month in October 1995

CURRENT VERSIONS: **Series 100**: Standard aircraft; designed to carry 50 passengers over 980 n mile (1,816 km; 1,128 mile) range; maximum T-O weight 21,523 kg (47,450 lb).

Series 100ER: Extended range capability with optional increase in maximum T-O weight to 23,133 kg (51,000 lb) and optional additional fuel capacity, for range of 1,620 n miles (3,000 km, 1,864 miles).

Series 100LR: Announced March 1994 as longer range version of ER (more than 1,970 n miles, 3,648 km 2,267 miles), maximum T-O weight increased by 907 kg (2,000 lb) to 24,040 kg (53,000 lb); launch customer Lauda Air of Austria (six firm orders plus six on option) Transport Canada certification 29 April 1994, available as retrofit to 100ER

CRJ-X: Described separately

Corporate Jetliner: Company shuttle version with more spacious cabin accommodation for 18 to 30 passengers. One delivered June 1993 to Xerox Corporation

CUSTOMERS: Total 116 firm orders by 12 June 1995, of which 67 delivered (see table)

REGIONAL JET PRODUCTION
(at 12 June 1995)

Customer	Orders	Delivered	Backlog
Air Canada	24	9	15
Air Littoral	6	4	2
Brit air	6		6
COMAIR	35	22	13
Lauda Air	7	7	
Lufthansa	23	16	7
SkyWest	10	8	2
Xerox	1	1	
Undisclosed	4		4
Totals	**116**	**67**	**49**

COSTS: Programme development costs C$275 million

DESIGN FEATURES: Evolved from Challenger (which see), designed expressly for regional airline operating environment. Advanced transonic wing design, with winglets for high-speed operations; fuel-efficient GE turbofans options include higher design weights, additional fuel capacity, more comprehensive avionics and maximum certificated altitude raised to 12,500 m (41,000 ft)

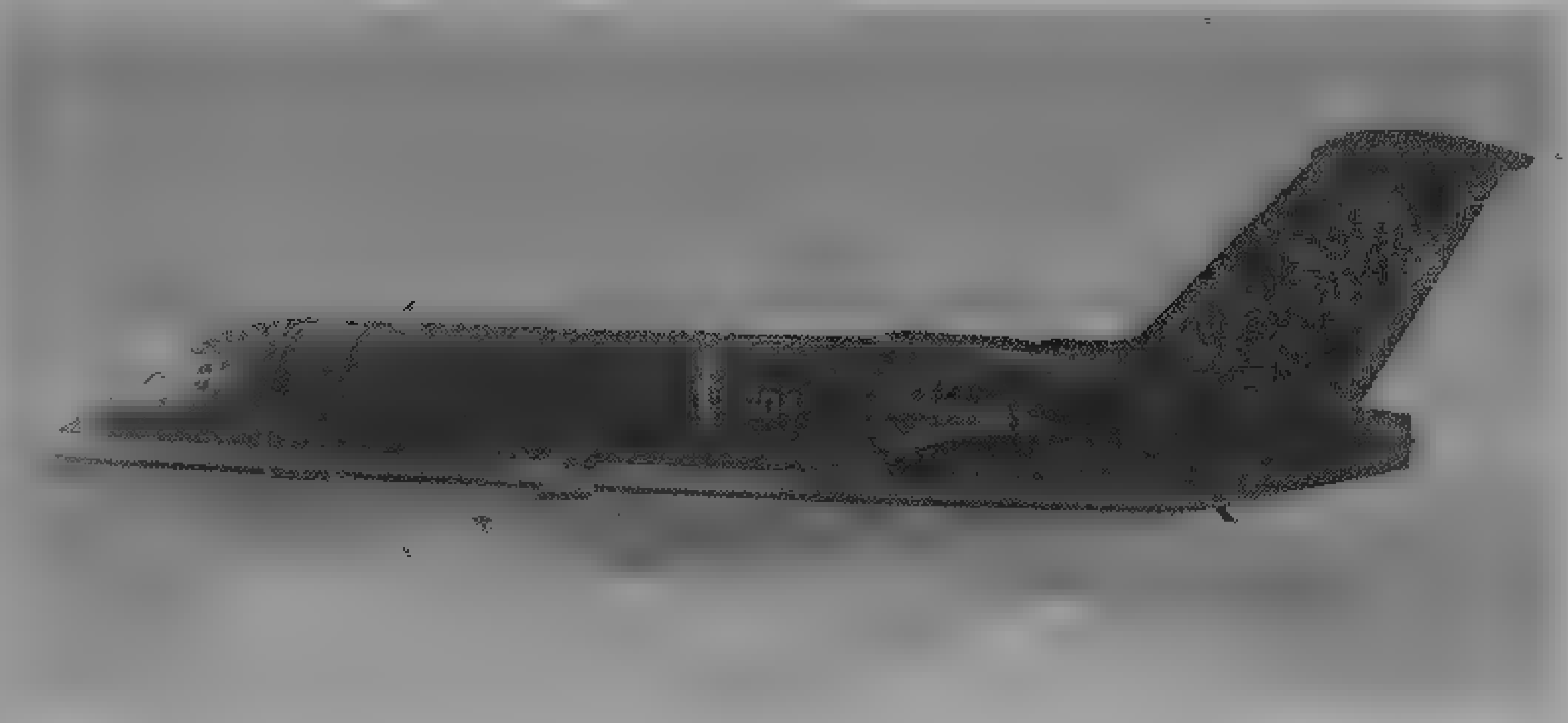
Wings, designed with computational fluid dynamics (CFD), have 13.2 per cent (root) and 10 per cent (tip) thickness/chord ratios. 2° 20′ dihedral. 3° 25′ root incidence and 24° 45′ quarter-chord sweepback

FLYING CONTROLS: Conventional three-axis primary controls with cables and push/pull rods for multiple redundancy, hydraulically actuated ailerons, elevators and rudder with at least two hydraulic power control unit actuators per surface (three on rudder and elevator), ailerons and elevators fitted with flutter dampers (dual on elevators), rudder with dual-channel control yaw damping, artificial feel and electric trim for roll and yaw; electronically controlled, variable incidence T tailplane for pitch trim and electronically controlled artificial pitch feel. Double-slotted electromechanical flaps with electronically controlled Datron electric motors. GEC-Marconi Avionics fly-by-wire spoiler and spoileron system, four spoilers each side, with inner two functioning as ground spoilers, outer two comprising one flight spoiler and one spoileron, both also providing lift dumping on touchdown. Avionics suite includes engine indication and crew alerting system (EICAS)

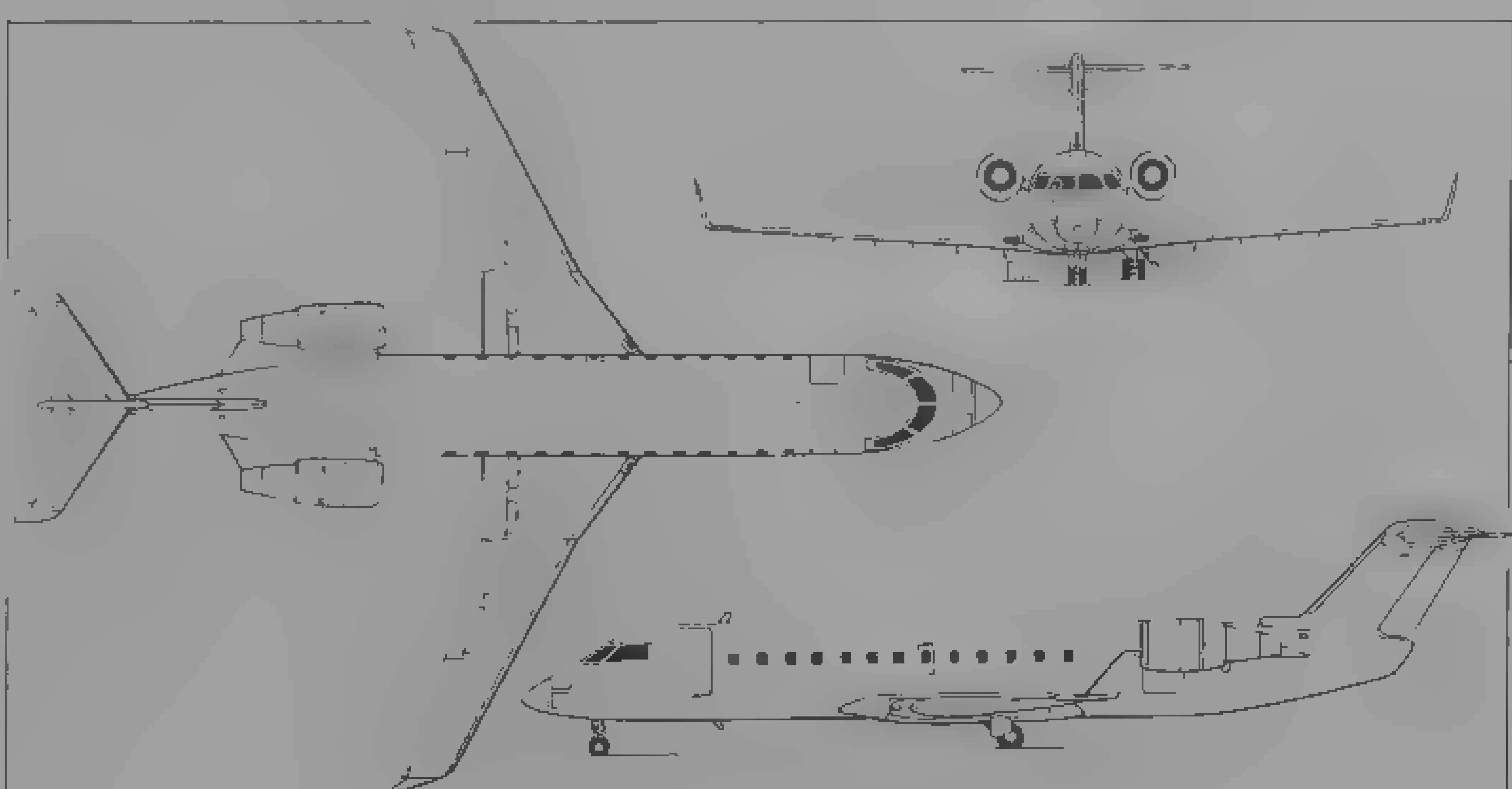
STRUCTURE: Semi-monocoque fuselage is damage tolerant FAR/JAR Pt 25 certificated airframe with chemically milled skins, flat pressure bulkheads forward of flight deck and aft of baggage compartment, extensive use of advanced composites in secondary structures (passenger compartment floor, wing/fuselage fairings, nacelle doors, wing access door covers, winglets, tailcone, avionics access doors and landing gear doors), comprehensive anti corrosion treatment and drainage. Wing is one-piece unit mounted to underside of fuselage, two-spar box joined by ribs, covered top and bottom with integrally stiffened skin panels (three upper and three lower each side) for smooth flow, machined or built-up spars and shearweb type ribs. Short Brothers (UK) manufactures fuselage central section, fore and aft fuselage plugs, wing flaps, ailerons, spoilerons and inboard spoilers

LANDING GEAR: Hydraulically retractable tricycle type, manufactured by Dowty. Inward-retracting main units each have 15 in Aircraft Braking System (ABS) wheels with 29 × 9-15 Goodyear H tubeless tyres, pressure 11.17 bars (162 lb/sq in) unladen. Nose unit has Dowty Canada steer by-wire steering and unladen tyre pressure of 8.62 bars (125 lb/sq in). Aircraft Braking System steel multidisc brakes and fully modulated Hydro Aire Mk III anti-skid system. Minimum taxiway width for 180° turn (with 3.35 m, 11 ft 0 in safety margin) is 22.86 m (75 ft 0 in)

POWER PLANT: Two General Electric CF34-3A1 turbofans, each rated at 41.0 kN (9,220 lb st) with APR and 38.8 kN (8,729 lb st) without, GE CF34-3B1 engines optional from early 1996. Nacelles produced by Short Brothers. Pneumatically actuated thrust reversers. Fuel in two integral wing tanks, combined capacity 5,300 litres (1,400 US gallons, 1,166 Imp gallons); increasable to 8,080 litres (2,135 US gallons; 1,778 Imp gallons) with optional centre-wing tank. Pressure refuelling point in starboard leading-edge wingroot, transfer rate 474 litres (125 US gallons; 104 Imp



Canadair Challenger 604, the latest long-range version of this business/regional transport aircraft *1995*



Canadair Regional Jet transport (two General Electric CF34-3A1 turbofans) *(Jane's/Dennis Punnett)* *1988*

Cutaway drawing of the Canadair Regional Jet

1994

Canadair Regional Jet of Air Canada

1995

gallons)/min at 3.45 bars (50 lb/sq in); two gravity points on starboard wing (one for centre tank) and one on port wing

ACCOMMODATION: Two-pilot flight deck, one or two cabin attendants. Main cabin seats up to 50 passengers in standard configuration, four-abreast at 79 cm (31 in) pitch, with centre aisle; maximum capacity 52 seats. Various configurations, from 15 to 50 seats, available for corporate version. Downward-opening front passenger door with integral airstairs on port side, plug type forward emergency exit/service door opposite on starboard side. Inward-opening baggage door on port side at rear. Overwing Type III emergency exit each side. Entire accommodation pressurised, including rear baggage compartment

SYSTEMS: Cabin pressurisation and air conditioning system (maximum differential 0.57 bar; 8.3 lb/sq in). Primary flight control systems powered by hydraulic servo-actuators with distinct, alternate paths cable and pushrod systems. Electric trim and dual yaw dampers. Three fully independent 207 bar (3,000 lb/sq in) hydraulic systems. Three-phase 115 V AC electrical primary power at 400 Hz supplied by two 30 kVA engine-driven generators, alternative power provided by APU and air-driven generator. Conversion to 28 V DC by five transformer rectifier units. Main (Ni/Cd) battery 17 Ah, APU battery 43 Ah. AlliedSignal GTCP 36-150 (RJ) APU and two-pack air conditioning system in rear of fuselage. Wing leading-edges and engine intake cowls anti-iced by engine bleed air. Electric anti-icing of windscreen and cockpit side windows, pitot heads, air data vanes, static sources and sensors. Ice detection system standard

AVIONICS: *Comms*: Dual VHF nav/com radios. Options include HF radio, single Selcal and MLS provisions

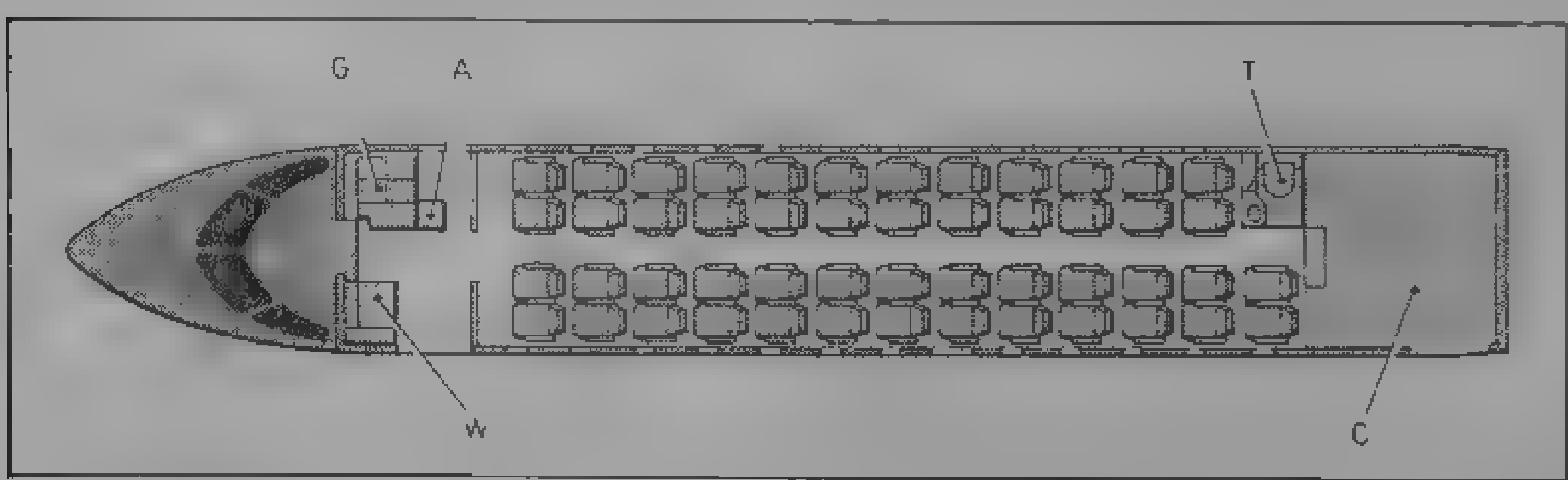
Radar: Digital weather radar system; split-scan weather radar and radar with turbulence mode optional

Flight: Dual flight management systems optional. GPWS, windshear detection system and TCAS. Loral Fairchild flight data recorder

Instrumentation: Collins Pro Line IV integrated all-digital suite, including dual primary flight displays, dual multifunction displays, dual EICAS, dual AFCS, dual AHRS, dual air data system and Cat. II capability with Cat. IIIa optional using head-up guidance system. Dual inertial reference system optional in lieu of AHRS

DIMENSIONS, EXTERNAL: As for Challenger 601-3R except:

Wing span over winglets	21.21 m (69 ft 7 in)
Wing chord: at fuselage c/l	5.13 m (16 ft 10 in)
at tip	1.27 m (4 ft 2 in)
Wing aspect ratio (excl winglets)	8.85
Length: overall	26.77 m (87 ft 10 in)
fuselage	24.38 m (80 ft 0 in)
Height overall	6.22 m (20 ft 5 in)



Canadair Regional Jet standard 79 cm (31 in) pitch 50-seat layout (*Jane's/Mike Keep*)
A: attendant's seat, C: cargo, G: galley, T: toilet, W: wardrobe

1994

Computer-generated impression of Canadair CRJ-X

1995

Wheelbase 11.39 m (37 ft 4½ in)
Service door (stbd, fwd): Height 1.22 m (4 ft 0 in)
Width 0.61 m (2 ft 0 in)
Height to sill (all doors) 1.63 m (5 ft 4 in)
Baggage door (port, rear): Width 1.09 m (3 ft 7 in)

DIMENSIONS, INTERNAL: As for Challenger 601-3R except:
Cabin (incl baggage compartment, excl flight deck):
Length 14.76 m (48 ft 5 in)
Max height 1.87 m (6 ft 1½ in)
Floor area 32.14 m² (346.0 sq ft)
Volume 57.06 m³ (2,015 cu ft)
Stowage volume: main (rear) baggage compartment 8.89 m³ (314.0 cu ft)
wardrobes/bins/underseat (total) 5.15 m³ (182.0 cu ft)

AREAS:
Wings, gross (excl winglets) 54.54 m² (587.1 sq ft)
net 48.35 m² (520.4 sq ft)
Ailerons (total) 1.93 m² (20.8 sq ft)
Trailing-edge flaps (total) 10.60 m² (114.1 sq ft)
Spoilers (total) 2.26 m² (24.3 sq ft)
Winglets (total) 1.38 m² (14.9 sq ft)
Fin 9.18 m² (98.8 sq ft)
Rudder 2.03 m² (21.9 sq ft)
Tailplane 9.44 m² (101.6 sq ft)
Elevators (total) 2.84 m² (30.52 sq ft)

WEIGHTS AND LOADINGS:
Manufacturer's weight empty:
100, 100ER 13,236 kg (29,180 lb)
Corporate Jetliner 11,703 kg (25,800 lb)
Operating weight empty: 100 13,653 kg (30,100 lb)
100ER 13,663 kg (30,122 lb)
Corporate Jetliner 14,424 kg (31,800 lb)
Max payload (structural): 100 5,488 kg (12,100 lb)
100ER 6,295 kg (13,878 lb)
Max fuel: 100 4,254 kg (9,380 lb)
100ER, Corporate Jetliner 6,489 kg (14,305 lb)
Payload with max fuel: 100 3,728 kg (8,220 lb)
Max baggage hold capacity 1,542 kg (3,400 lb)
100ER 3,095 kg (6,823 lb)
Corporate Jetliner 2,334 kg (5,145 lb)
Max T-O weight: 100 21,523 kg (47,450 lb)
100ER, Corporate Jetliner 23,133 kg (51,000 lb)
100LR, Corporate Jetliner (optional) 24,040 kg (53,000 lb)
Max ramp weight: 100 21,636 kg (47,700 lb)
100ER 23,246 kg (51,250 lb)
Max zero-fuel weight: 100 19,141 kg (42,200 lb)
100ER 19,958 kg (44,000 lb)
Max landing weight: 100 20,275 kg (44,700 lb)
100ER, Corporate Jetliner 21,319 kg (47,000 lb)
Max wing loading: 100 394.6 kg/m² (80.82 lb/sq ft)
100ER 424.14 kg/m² (86.87 lb/sq ft)
Max power loading (APR rating):
100 262.48 kg/kN (2.57 lb/lb st)
100ER 282.1 kg/kN (2.77 lb/lb st)

PERFORMANCE (at max T-O weight except where indicated):
Max operating speed:
above 9,570 m (31,400 ft) Mach 0.85
below 7,740 m (25,400 ft) 335 kts (621 km/h; 386 mph)
High-speed cruising speed at 11,275 m (37,000 ft) Mach 0.80 or 459 kts (851 km/h; 529 mph)
Normal cruising speed at 11,275 m (37,000 ft) Mach 0.74 or 424 kts (786 km/h; 488 mph)
Approach speed, 45° flap, ALW of 19,504 kg (43,000 lb) 137 kts (254 km/h; 158 mph)
Max rate of climb at 457 m (1,500 ft), 250 kts CAS/Mach 0.74 climb schedule: 100 1,128 m (3,700 ft)/min
100ER 1,036 m (3,400 ft)/min
Max operating altitude 12,500 m (41,000 ft)
FAR T-O field length at S/L, ISA: 100 1,605 m (5,265 ft)
Corporate Jetliner 1,856 m (6,090 ft)
FAR landing field length at S/L, ISA, at max landing weight: 100 1,440 m (4,725 ft)
Corporate Jetliner 898 m (2,945 ft)
Range with max payload at long-range cruising speed, FAR Pt 121 reserves:
100 980 n miles (1,815 km; 1,128 miles)
100ER 1,620 n miles (3,000 km; 1,864 miles)
100LR more than 1,900 n miles (3,519 km; 2,186 miles)
Corporate (30 seats), NBAA IFR reserves 2,017 n miles (3,735 km; 2,321 miles)

OPERATIONAL NOISE LEVELS:
T-O 78.6 EPNdB
Approach 92.1 EPNdB
Sideline 82.2 EPNdB

UPDATED

CANADAIR CRJ-X

TYPE: Stretched derivative of Regional Jet.

PROGRAMME: Design and market evaluation proceeding late 1994 in consultation with 15-member CRJ-X Advisory Panel of airline operators. GE CF34-8C1 engines selected February 1995; low-speed wind tunnel testing began early 1995 at Institute of Aeronautical Research, Ottawa.

DESIGN FEATURES: Fuselage stretched 5.94 m (19 ft 6 in) by plugs fore and aft of centre-section to seat 72 (European configuration) or 74 (North American configuration) passengers; wing span increased by 1.83 m (6 ft 0 in) by wing root plug; wing leading-edge extended and equipped with high-lift devices; larger horizontal tail surfaces; main landing gear lengthened; new wheels, tyres, brakes; air conditioning and anti-icing systems upgraded; new engines.

POWER PLANT: Two 58.14 kN (13,070 lb st) General Electric CF34-8C1 turbofans with dual-channel FADEC.

Following data are provisional:

DIMENSIONS, INTERNAL:
Baggage compartment volume:
72 seats 12.71 m³ (449 cu ft)
74 seats 14.41 m³ (509 cu ft)

PERFORMANCE:
High-speed cruising speed Mach 0.86
T-O field length, ISA 1,704 m (5,590 ft)
Range: with 72 passengers 1,271 n miles (2,354 km; 1,463 miles)
with 74 passengers 1,529 n miles (2,832 km; 1,759 miles)

UPDATED

CANADAIR GLOBAL EXPRESS

TYPE: Long-range high-speed corporate transport.

PROGRAMME: Announced 28 October 1991 at NBAA Convention; design started early 1993. Programme launched 20 December 1993; high-speed configuration frozen June 1994, low-speed configuration established August 1994. Mitsubishi Heavy Industries (MHI) of Tokyo to supply wings and centre-fuselage sections, Short Brothers of Belfast will design and manufacture engine nacelles and some fuselage components. First flight scheduled for Autumn 1996, delivery of first 'green' airframes in late 1997, certification and service entry 1998. Honeywell Primus 2000 XP avionics, Dowty Aerospace landing gear; Sextant flight control system; Parker Bertea Aerospace fuel system, Lucas Aerospace electrical systems, ABG-Semca air management system, AlliedSignal APU, Abex NWL hydraulic system.

CUSTOMERS: 40 orders and options by September 1994.

COSTS: $29.5 million for 'green' aircraft.

DESIGN FEATURES: Wide-body fuselage with approximately same cabin length as Regional Jet; all-new 35° supercritical swept wings with winglets, rear-mounted engines, sweptback T tail. Three-compartment passenger configuration, plus crew rest area, large galley and baggage compartment; modern flight deck may include six flat panel displays, head-up guidance system, sidestick controllers and electronic library.

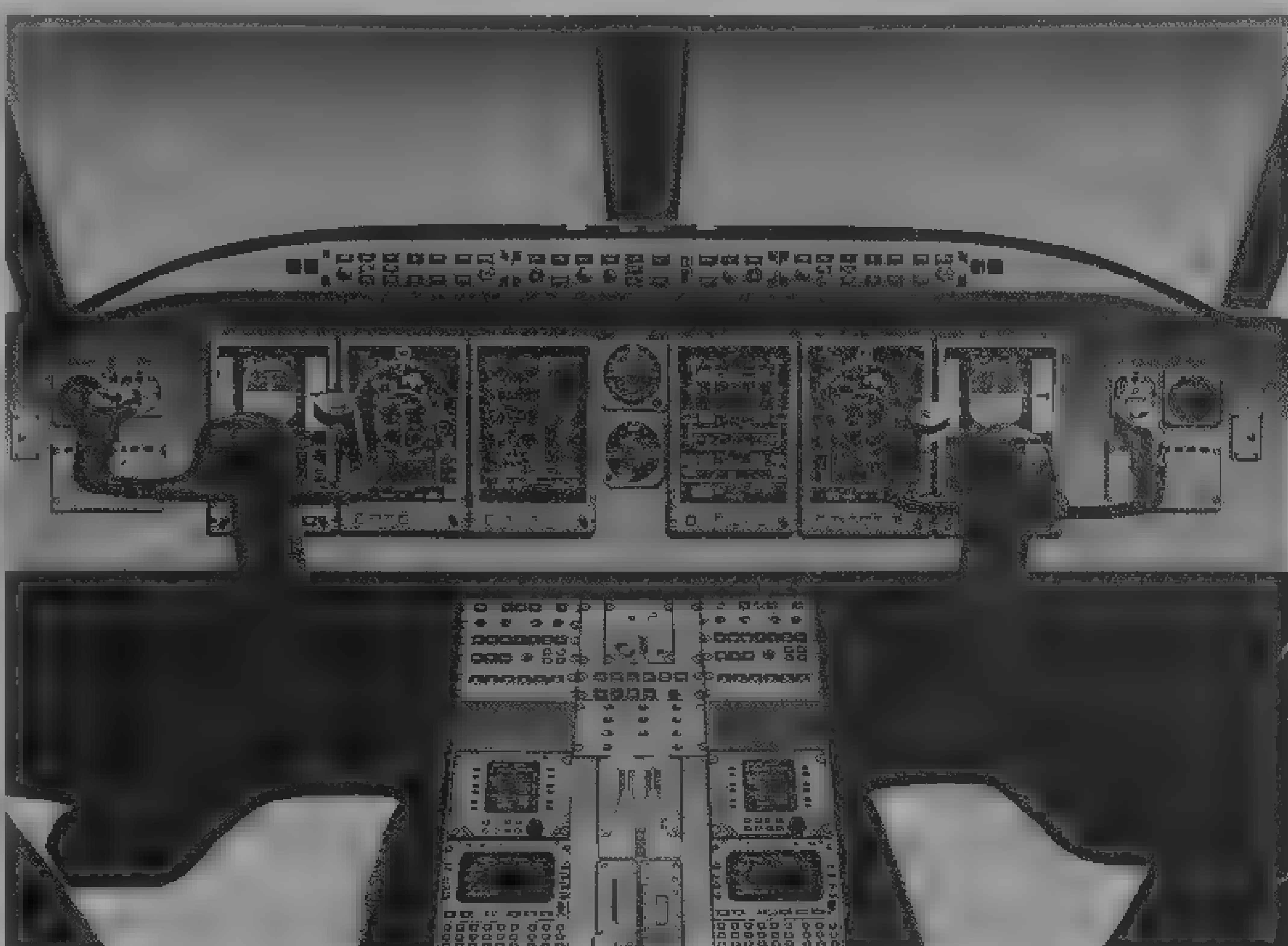
POWER PLANT: Two rear-mounted 65.3 kN (14,690 lb st) BMW Rolls-Royce BR710-48-C2 turbofans, flat rated to ISA + 20°C.

ACCOMMODATION: Crew of three (including cabin attendant) and 8 to 19 passengers depending on interior fit.

Following data are provisional:

DIMENSIONS, EXTERNAL:
Wing span over winglets 28.50 m (93 ft 6 in)
Length overall 30.30 m (99 ft 5 in)
Height overall 7.47 m (24 ft 6 in)

DIMENSIONS, INTERNAL:
Cabin (excl flight deck): Length 14.63 m (48 ft 0 in)
Width at floor 2.11 m (6 ft 11 in)
Max width 2.49 m (8 ft 2 in)
Max height 1.90 m (6 ft 3 in)



Artist's impression of Global Express flight deck

1995

Floor area	31.12 m² (335.0 sq ft)
Volume	58.81 m³ (2,077 cu ft)
WEIGHTS AND LOADINGS:	
Max fuel weight	18,665 kg (41,150 lb)
Max T-O weight	41,277 kg (91,000 lb)
Max landing weight	35,652 kg (78,600 lb)
PERFORMANCE (design target):	
Max cruising speed	Mach 0.88
Normal cruising speed	Mach 0.85
Long-range cruising speed	Mach 0.80
Initial cruising altitude	13,100 m (43,000 ft)
Max operating altitude	15,545 m (51,000 ft)
T-O field length at max T-O weight	1,689 m (5,540 ft)
Range with two crew and eight passengers:	
at Mach 0.80	6,500 n miles (12,038 km; 7,480 miles)
at Mach 0.85	6,330 n miles (11,723 km; 7,284 miles)
at Mach 0.88	5,000 n miles (9,260 km; 5,754 miles)

UPDATED

CANADAIR CL-415

TYPE: Twin-turboprop amphibian.

PROGRAMME: Introduced as product follow-on to piston-engined CL-215, given new designation CL-415 in 1991 to distinguish new production turboprop model from CL-215T retrofit; launched officially 16 October 1991 with firm orders from France and (August 1992) Quebec; first flight (C-GSCT) 6 December 1993, although preceded by initial CL-215T conversion (C-FASE), flown on 8 June 1989. Canadian certification 24 June 1994 in Restricted and Utility categories, FAA approval 14 October 1994 in Restricted category. First delivery, to France in December 1994 (C-FBFT).

CURRENT VERSIONS: Standard **CL-415** and first production units are in **firefighting** configuration; **CL-415M** being developed for **maritime, SAR and special missions**.

CUSTOMERS: Governments of France (12 Mk 6B11) and Quebec (eight); Societa Italiana Servizi Aerei Mediterranei of Italy (four). Seven delivered by June 1995.

COSTS: C$155 million (Quebec order).

DESIGN FEATURES: Retains well proven basic airframe of piston-engined CL-215 (thick wing with zero dihedral, row of vortex generators on each wing outboard of fence, long stall strip inboard of starboard fence, leading-edge strakes and fences beside engine nacelles, water scoops behind planing step, anti-spray channels in planing bottom chine) but incorporates upgrading modifications and improvements including higher operating weights for increased firefighting productivity; pressure refuelling; wing endplates for lateral stability, finlets and tailplane/fin bullet to recover longitudinal and directional stability affected by relocated thrust line; increased power and new propellers; powered rudder, ailerons and elevators; new electrical system; new 'glass' cockpit with air conditioning; enlarged four-tank firefighting drop system.

FLYING CONTROLS: Hydraulically actuated ailerons, and mass balanced elevators and rudder standard; manual reversion in event of hydraulic failure; geared tab in each aileron, spring tab in rudder and each elevator, plus trim tab in port aileron and port elevator. Hydraulically operated single slotted flaps, each supported by four external hinges.

STRUCTURE: No-dihedral, no-twist high wing of constant chord, set at 2° incidence; one-piece structure with two conventional spars, extruded spanwise stringers and inter spar ribs and aluminium alloy skins. All-metal, fail-safe single-step boat-hull fuselage with numerous watertight compartments. Tail surfaces of aluminium alloy sheet and extrusions, with honeycomb panels on control surfaces.

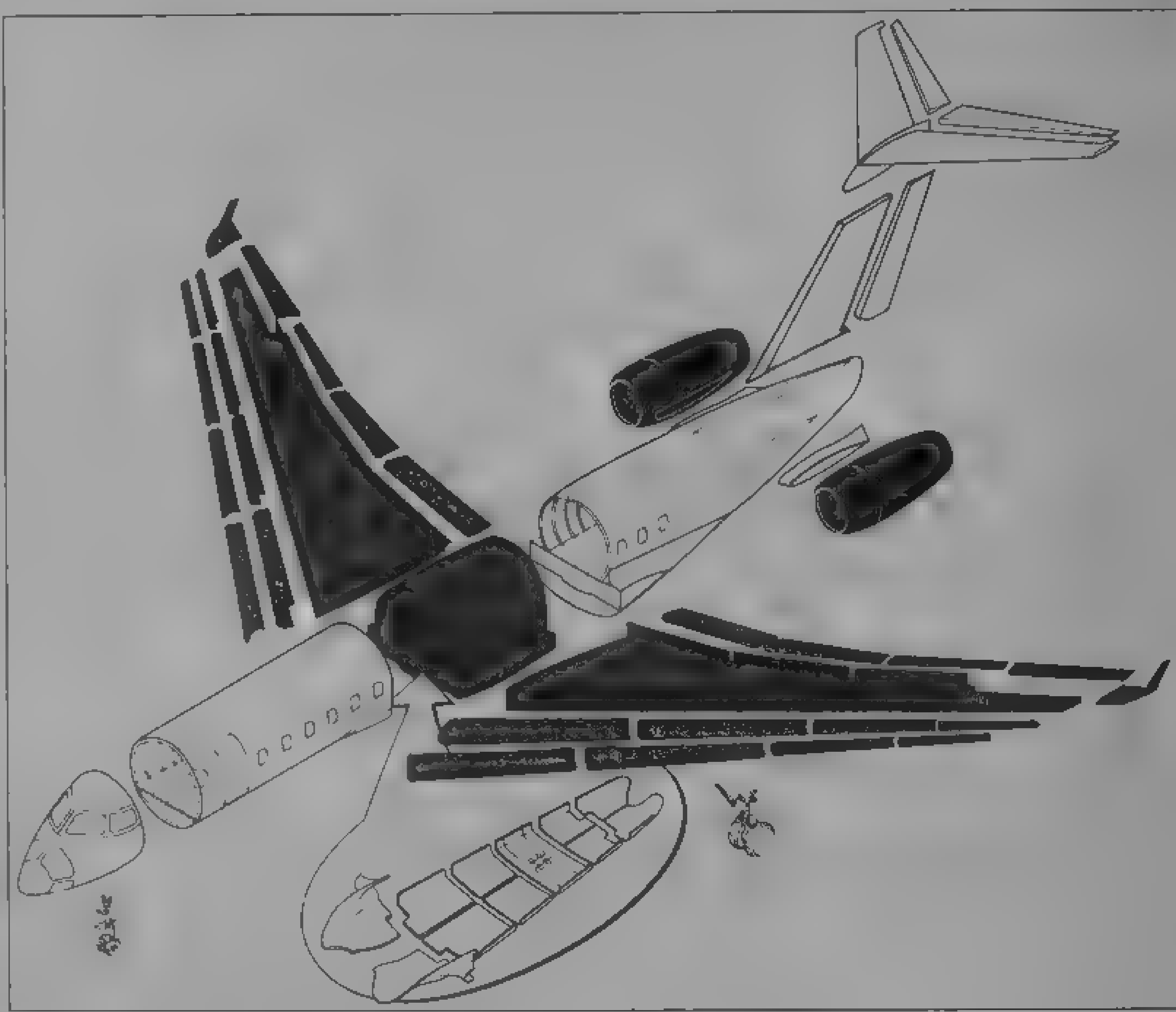
LANDING GEAR: Hydraulically retractable tricycle type. Self-centring twin-wheel nose unit retracts rearward into hull and is fully enclosed by conformal doors. Nosewheel steering standard. Main gear support structures retract into wells in sides of hull. Plate mounted on each main gear assembly encloses bottom of wheel well. Mainwheel tyre pressure 5.31 bars (77 lb/sq in); nosewheel tyre pressure 6.55 bars (95 lb/sq in). Hydraulic disc brakes. Non-retractable stabilising floats, each carried near wingtip on pylon cantilevered from wing box structure, with breakaway provision.

POWER PLANT: Two 1,775 kW (2,380 shp) Pratt & Whitney Canada PW123AF turboprops, on damage-tolerant mounts capable of withstanding a breach of the compressor/turbine casing, each driving a Hamilton Standard 14SF-19 four-blade constant-speed fully feathering reversible-pitch propeller. Two fuel tanks, each of eight identical flexible cells, in wing spar box, with total usable capacity of 5,796 litres (1,531 US gallons; 1,275 Imp gallons). Single-point pressure refuelling (rear fuselage, starboard side), plus gravity points in wing upper surface.

ACCOMMODATION: Normal crew of two side by side on flight deck, with dual controls. Additional stations in maritime patrol/SAR versions for third cockpit member, mission specialist and two observers. For water bomber cabin installation, see Equipment paragraph. With above-floor water tanks removed, transport configurations can include layout for 30 passengers plus toilet, galley and baggage area, with seat pitch of 79 cm (31 in). Combi layout offers cargo at front, full firefighting capability, plus 11 seats at rear. Other quick change interiors available for utility/paratroop (up to 14 troop-type folding canvas seats in cabin) or other special missions according to customer's

Artist's impression of Canadair Global Express

1995



Construction details of Canadair Global Express; detailed cutaway drawing appears in the Addenda

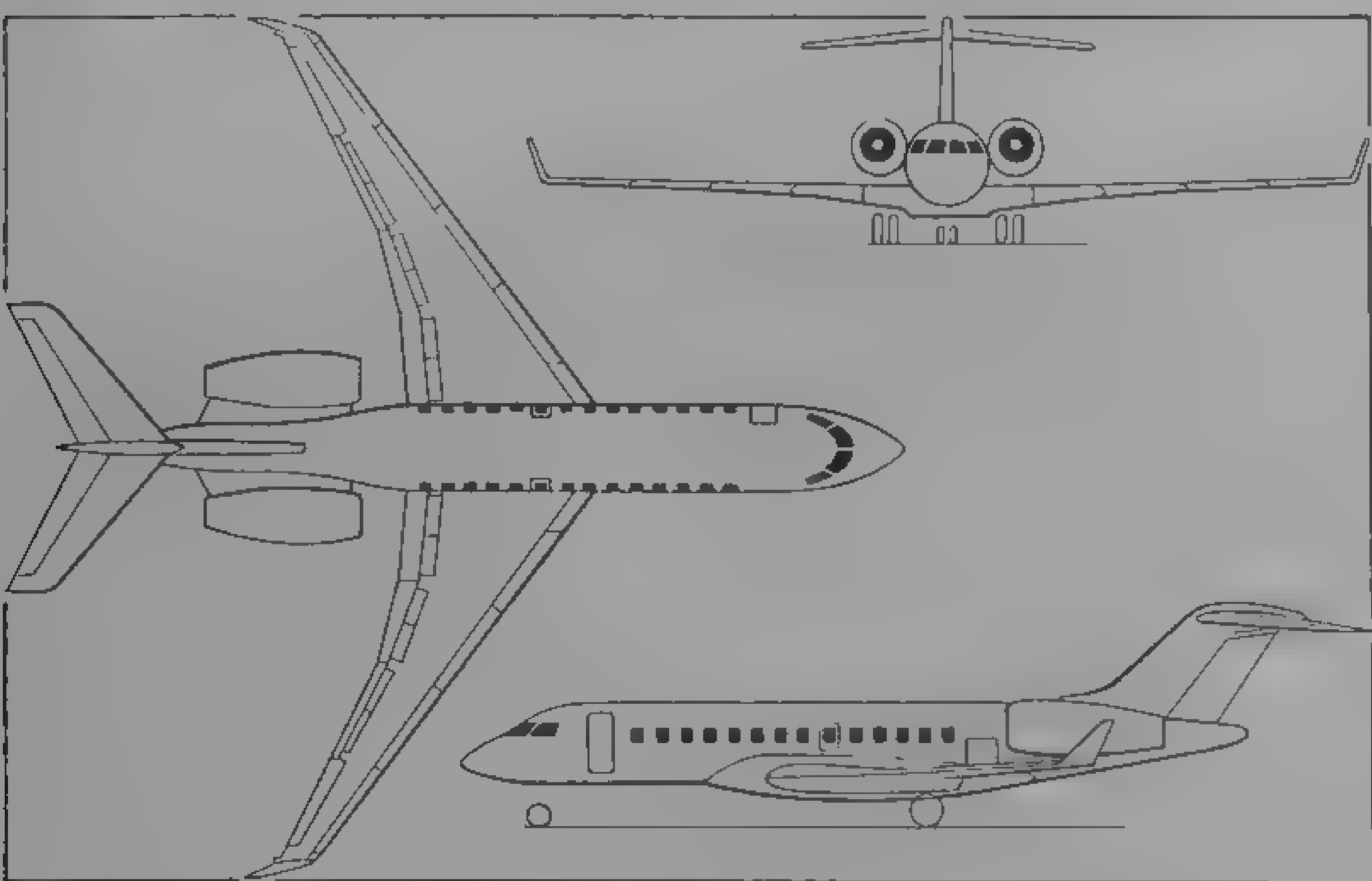
1995

Alternative Global Express cabin layouts, 12 to 18 passengers (top) and 9 to 17 passengers
B: baggage, E: entertainment system, G: galley, T: toilet, W: wardrobe

1995

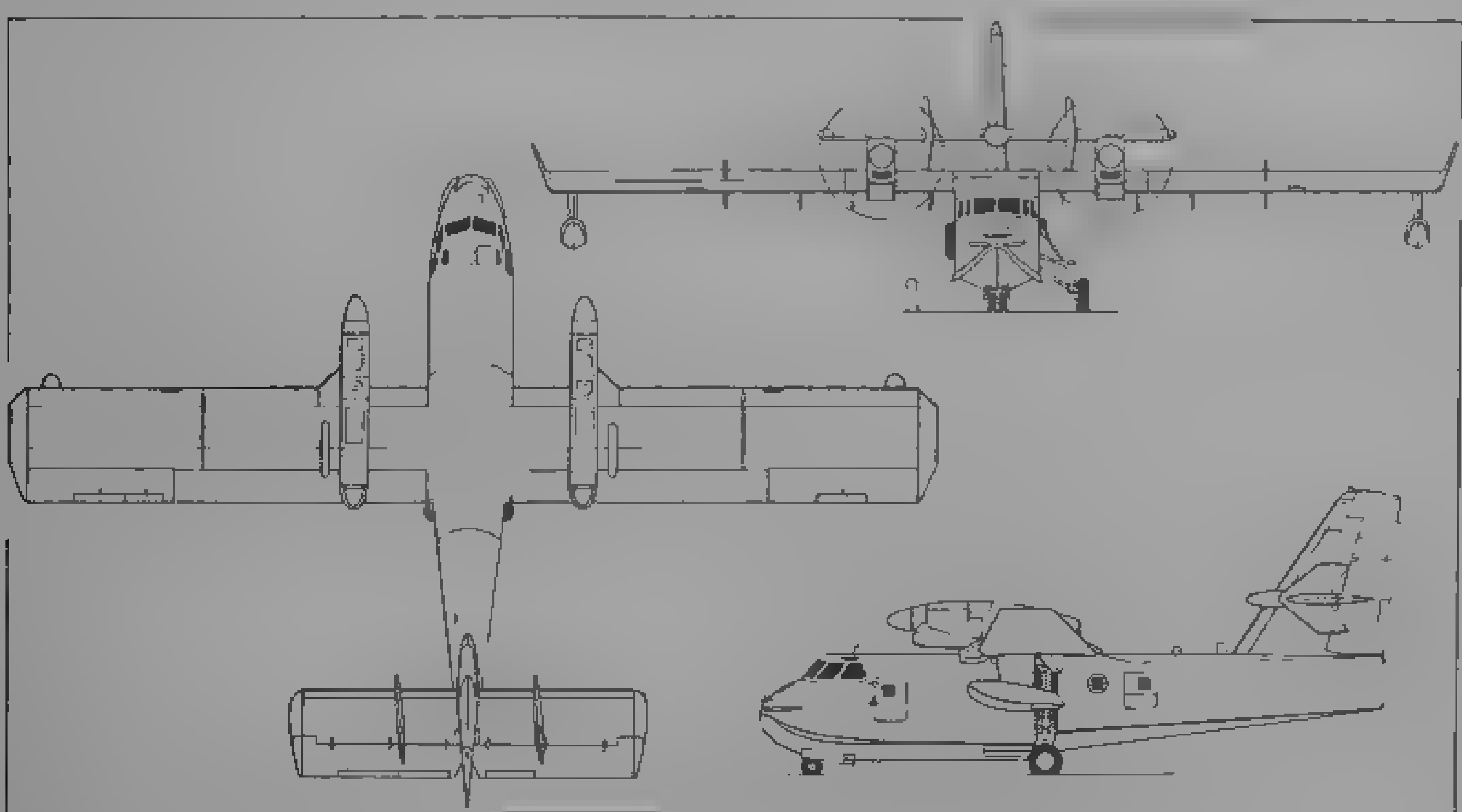
Global Express executive workstation

1995



Preliminary three-view drawing of the Global Express *(Jane's/James Goulding)*

1995



Canadair CL-415 twin-turboprop general purpose amphibian *(Jane's/Dennis Punnett)*

1992

requirements. Flush doors to main cabin on port side of fuselage forward and aft of wings. Emergency exit on starboard side aft of wing trailing-edge. Crew emergency hatch in flight deck roof on starboard side. Mooring hatch in upper surface of nose. Provision for additional cabin windows

SYSTEMS: Vapour cycle air conditioning system and combustion heater. Hydraulic system, pressure 207 bars (3,000 lb/sq in), utilises two engine-driven pumps (maximum flow rate 45.5 litres, 12 US gallons; 10 Imp gallons/min) to actuate nosewheel steering, landing gear, flaps, water drop doors, pickup probes, flight controls, main gear unlocking and wheel brakes. Hydraulic fluid (MIL-H-83282) in air/oil reservoir slightly pressurised by engine bleed air. Electrically driven third pump provides hydraulic power for emergency actuation of landing gear and brakes and closure of water doors. Electrical system includes two 800 VA 115 V 400 Hz static inverters, two 28 V 400 A DC engine-driven starter/generators and two 40 Ah Ni/Cd batteries. Pneumatic/electric intake de-icing system, airframe ice protection system optional

AVIONICS: Dual Honeywell Primus 2 digital integrated nav/com.

Comms: Global VHF/UHF/AM/FM and Collins HF radios with central control heads, ELT and dual transponders.

Radar: Search/weather radar optional.

Flight: Dual ADF, VOR/ILS, marker beacon receivers and single DME.

Instrumentation: Honeywell EDZ-605 EFIS with four-tube display for EADI and EHSI, dual Honeywell AHRS, dual air data computers, Honeywell radio altimeter

EQUIPMENT (firefighter): Four integral water tanks in main fuselage compartment, near CG (combined capacity 6,140 litres, 1,622 US gallons, 1,351 Imp gallons), plus eight inward-facing seats in forward cabin. Tanks filled by two hydraulically actuated scoops aft of hull step, fillable also on ground by hose adaptor on each side of fuselage. Four independently openable water doors in hull bottom. Onboard foam concentrate reservoirs (capacity 680 kg, 1,500 lb) and mixing system. Improved drop pattern and drop door sequencing compared with CL-215. Optional spray kit can be coupled with firefighting tanks for large-scale spraying of oil dispersants and insecticides. In a typical firefighting mission, with a fire 85 n miles (157 km, 98 miles) from airbase, and a water source 10 n miles (18.5 km; 11.5 miles) from the fire, aircraft could make 25 water scoop and drop circuits before having to return to base to refuel. Water tanks can be scoop-filled completely (ISA at S/L, zero wind) in an on-water distance of only 381 m (1,250 ft); partial water loads can be scooped on smaller bodies of water. Minimum safe water depth for scooping is only 1.40 m (4 ft 7 in)

EQUIPMENT (other versions): Stretcher kits, passenger or troop seats, cargo tiedowns, searchlight and other equipment according to mission and customer requirements. Provision for underwing pylon attachment points for variety of stores. CL-415M will be equipped with maritime surveillance radar and electro-optical sensors, precision navigation and communications equipment and autopilot

DIMENSIONS, EXTERNAL:

Wing span	28.63 m (93 ft 11 in)
Wing chord, constant	3.54 m (11 ft 7½ in)
Wing aspect ratio	8.17
Length overall	19.82 m (65 ft 0½ in)
Beam (max)	2.59 m (8 ft 6 in)
Length/beam ratio	7.5
Height overall: on land	8.98 m (29 ft 5½ in)
on water	6.88 m (22 ft 7 in)
Draught: wheels up	1.12 m (3 ft 8 in)
wheels down	2.03 m (6 ft 8 in)
Tailplane span	10.97 m (36 ft 0 in)
Wheel track	5.28 m (17 ft 4 in)
Wheelbase	7.23 m (23 ft 9 in)
Propeller diameter	3.97 m (13 ft 0¼ in)
Propeller fuselage clearance	0.59 m (1 ft 11¼ in)
Propeller water clearance	1.30 m (4 ft 3¼ in)
Propeller ground clearance	2.77 m (9 ft 1 in)
Forward door: Height*	1.37 m (4 ft 6 in)
Width	1.03 m (3 ft 4 in)
Height to sill	1.68 m (5 ft 6 in)
Rear door: Height	1.12 m (3 ft 8 in)
Width	1.03 m (3 ft 4 in)
Height to sill	1.83 m (6 ft 0 in)
Water drop door: Length	1.60 m (5 ft 3 in)
Width	0.81 m (2 ft 8 in)
Emergency exit: Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

* *incl 25 cm (10 in) removable sill*

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	9.38 m (30 ft 9½ in)
Max width	2.39 m (7 ft 10 in)
Max height	1.90 m (6 ft 3 in)
Floor area	19.69 m² (212.0 sq ft)
Volume	35.59 m³ (1,257.0 cu ft)

AREAS:

Wings, gross	100.33 m² (1,080.0 sq ft)
Ailerons (total)	8.05 m² (86.6 sq ft)
Flaps (total)	22.39 m² (241.0 sq ft)
Fin	11.22 m² (120.75 sq ft)
Rudder, incl tabs	6.02 m² (64.75 sq ft)

Tailplane 20.55 m² (221.2 sq ft)
Elevators (total, incl tabs) 7.88 m² (84.8 sq ft)

WEIGHTS AND LOADINGS (A: firefighter, B: utility, land or water based):

Typical operating weight empty:
- A 12,861 kg (28,353 lb)
- B 12,712 kg (28,025 lb)

Max internal fuel weight: A, B 4,649 kg (10,250 lb)
Max payload: A (disposable) 6,123 kg (13,500 lb)
- B 3,799 kg (8,375 lb)

Max ramp weight: A (land) [illegible]
- A (water), B 17,236 kg (38,000 lb)

Max T-O weight: A (land) 19,890 kg (43,850 lb)
- A (water), B (land and water) 17,168 kg (37,850 lb)

Max touchdown weight for water scooping:
- A 16,420 kg (36,200 lb)

Max flying weight after water scooping:
- A 20,865 kg (46,000 lb)

Max landing weight:
- A, B (land and water) 16,783 kg (37,000 lb)

Max zero-fuel weight: A 19,051 kg (42,000 lb)
- B 16,511 kg (36,400 lb)

Max wing loading:
- A (after scoop) 207.9 kg/m² (42.59 lb/sq ft)
- A (land) 198.2 kg/m² (40.60 lb/sq ft)
- B (land and water) 171.1 kg/m² (35.05 lb/sq ft)

Max power loading:
- A (after scoop) 5.88 kg/kW (9.66 lb/shp)
- A (land) 5.60 kg/kW (9.21 lb/shp)
- B (land and water) 4.84 kg/kW (7.95 lb/shp)

PERFORMANCE (estimated at weights shown):

Max cruising speed at 3,050 m (10,000 ft), AUW of 14,741 kg (32,500 lb) 203 kts (376 km/h; 234 mph)
Long-range cruising speed at 3,050 m (10,000 ft), AUW of 14,741 kg (32,500 lb) 145 kts (269 km/h; 167 mph)
Patrol speed at S/L, AUW of 14,741 kg (32,500 lb) 130 kts (241 km/h; 150 mph)
Stalling speed: 15° flap, AUW of 20,865 kg (46,000 lb) 79 kts (147 km/h; 91 mph)
- 25° flap, AUW of 16,783 kg (37,000 lb) 68 kts (126 km/h; 79 mph)

Max rate of climb at S/L, AUW of 20,865 kg (46,000 lb) 419 m (1,375 ft)/min

T-O distance at S/L, ISA:
- land, AUW of 19,890 kg (43,850 lb) 844 m (2,770 ft)
- water, AUW of 17,168 kg (37,850 lb) 814 m (2,670 ft)

Landing distance at S/L, ISA:
- land, AUW of 16,783 kg (37,000 lb) 674 m (2,210 ft)
- water, AUW of 16,783 kg (37,000 lb) 665 m (2,180 ft)

Scooping distance at S/L, ISA (incl safe clearance heights) 1,293 m (4,240 ft)
Ferry range with 499 kg (1,100 lb) payload 1,310 n miles (2,426 km; 1,507 miles)
Design g limits (15° flap) +3.25/−1

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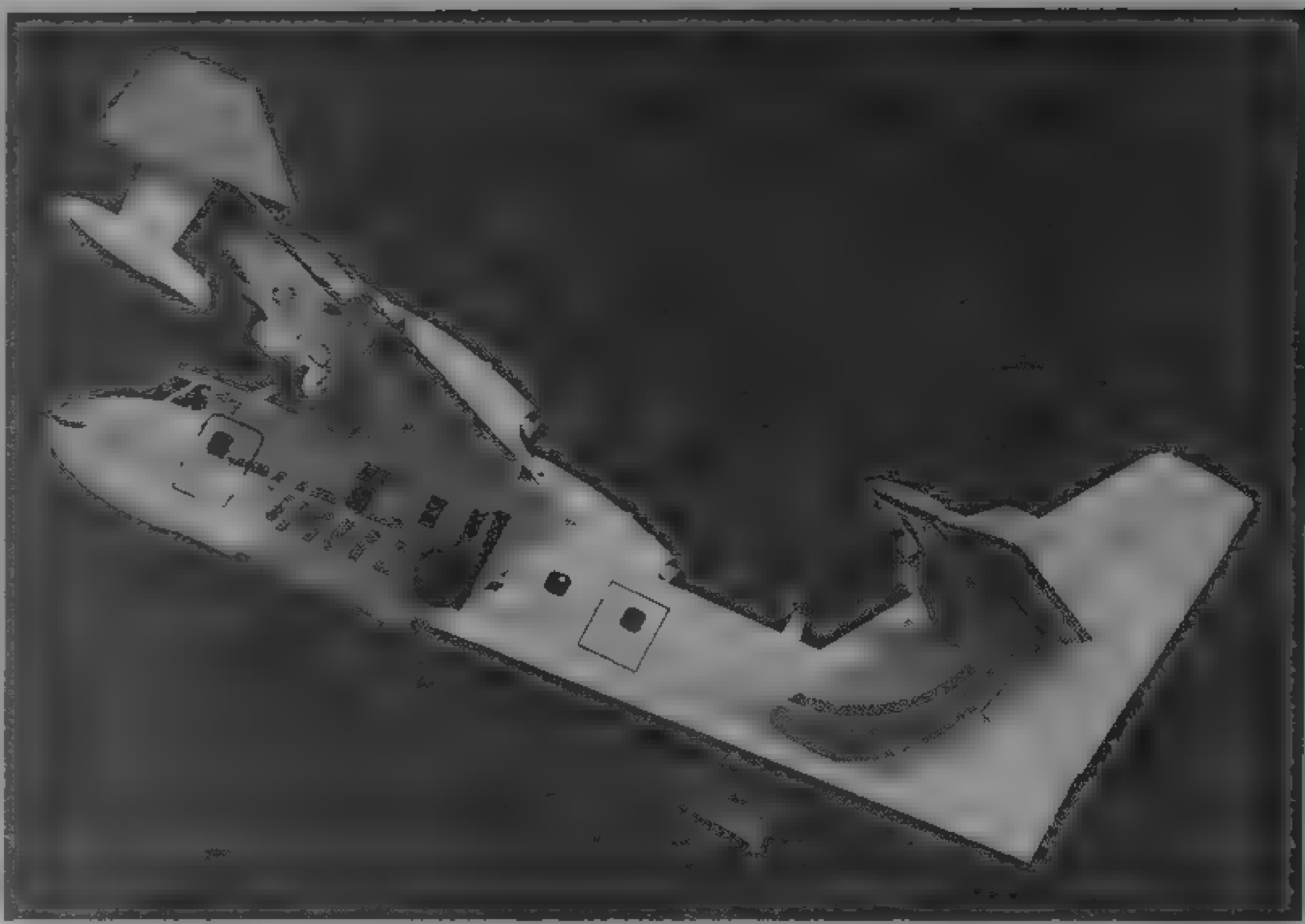
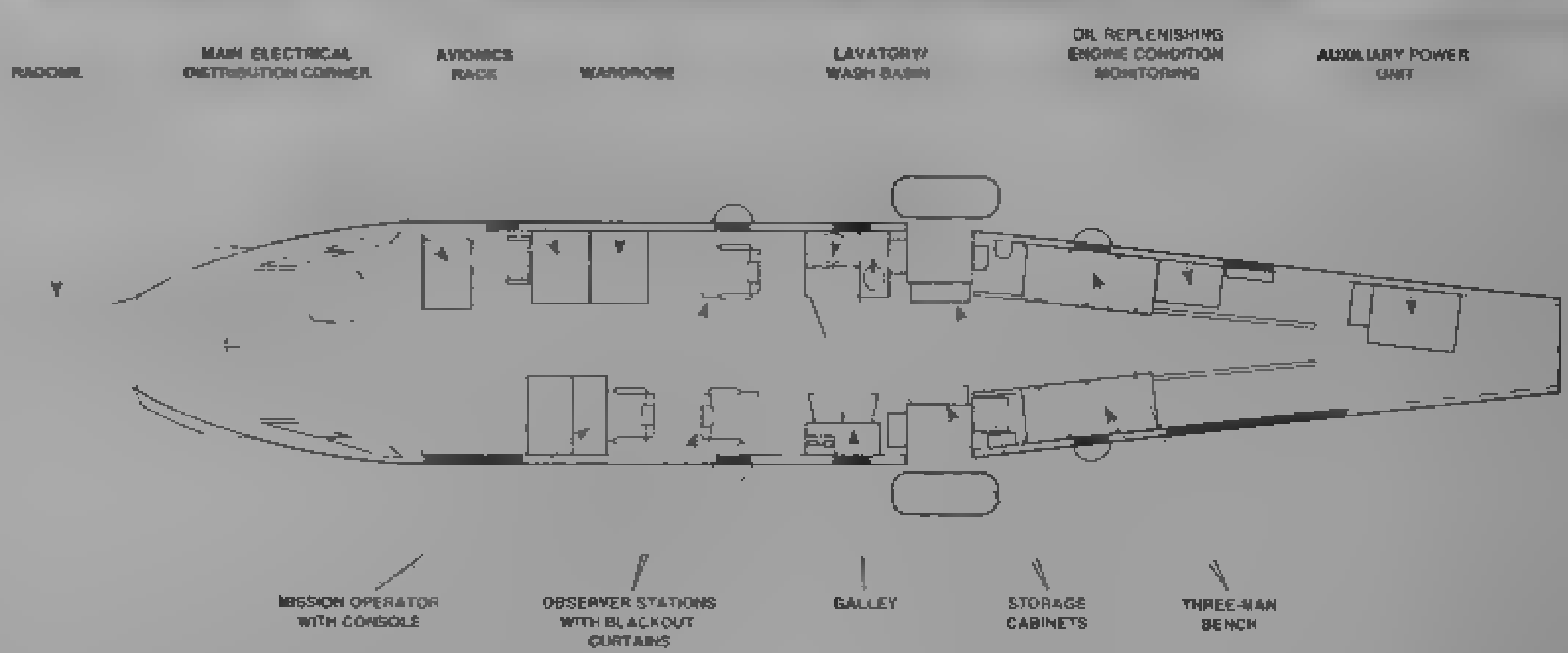


Canadair CL-415 (first production aircraft) of France's Securite Civile

1995

Canadair CL-415 flight deck with Honeywell and Kratos systems

1995



Internal layout of Canadair CL-415M multimission amphibian

1995

CONAIR

CONAIR AVIATION LTD

Details of Conair's Firecat, Turbo Firecat, F27 Firefighter and Helitanker fire control aircraft were given in 1994-95 *Jane's*, now transferred to *Jane's Aircraft Upgrades*

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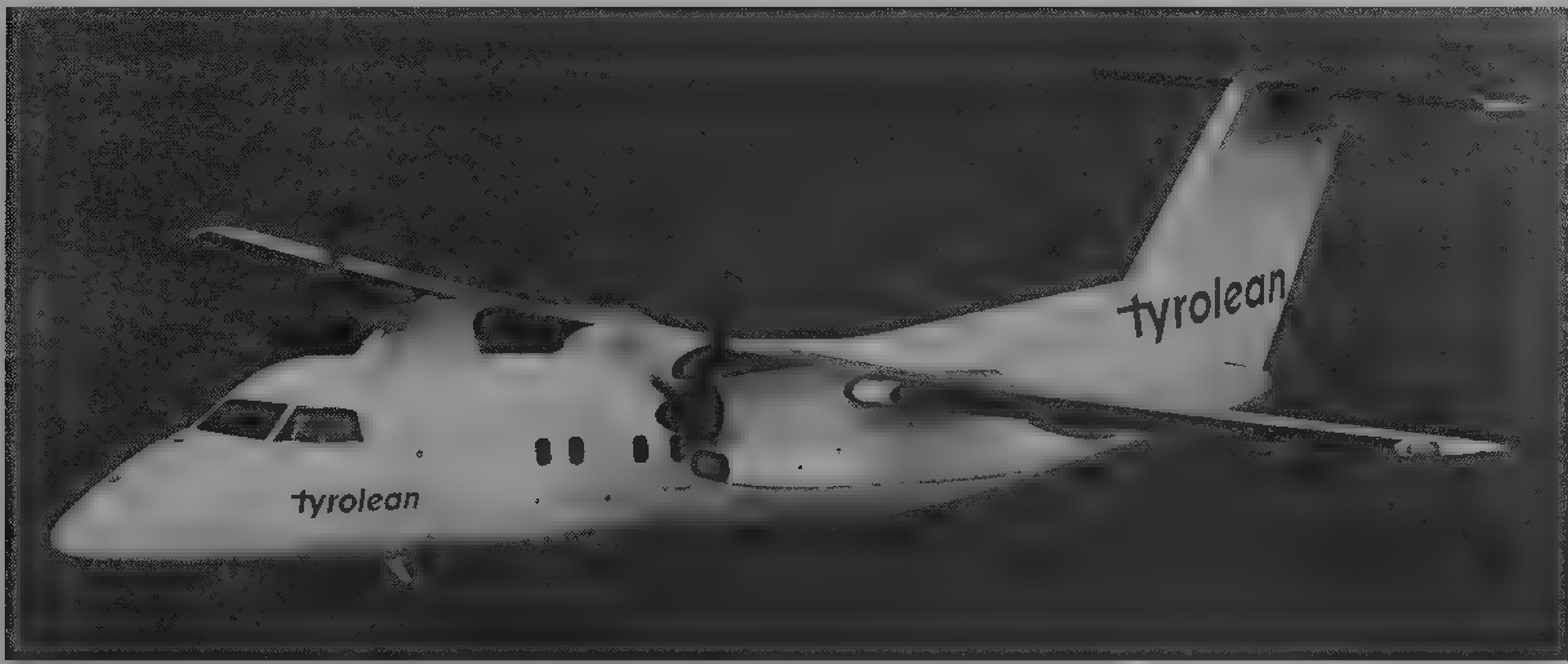

Dash 8 Series 100B in the colours of the Austrian carrier Tyrolean

1995

DE HAVILLAND

DE HAVILLAND INC

Garratt Boulevard, Downsview, Ontario M3K 1Y5
Telephone: 1 (416) 633 7310
Fax: 1 (416) 375 4546
Telex: 0622128
PRESIDENT: Kenneth G Laver
VICE-PRESIDENT OPERATIONS: Serge Perron
VICE-PRESIDENT ENGINEERING: Carl Gerard
MARKETING AND SALES:
See Bombardier Regional Aircraft Division
MANAGER, PUBLIC RELATIONS: Colin S. Fisher

Established 1928 as The de Havilland Aircraft of Canada Ltd, subsidiary of The de Havilland Aircraft Company Ltd both absorbed 1961 by Hawker Siddeley Group, ownership transferred to Canadian government 26 June 1974, purchased by Boeing Company 31 January 1986 and made a division of Boeing of Canada Ltd, Boeing intention to sell announced July 1990.

Sale to Bombardier Inc (51 per cent) and government of Ontario (49 per cent), signed 22 January 1992, supported by help from Ontario and federal governments, with Canadian Export Development Corporation to provide sales financing for Dash 8, all government support conditionally repayable. Workforce (5,000 in 1991) reduced to 3,350 by September 1992. Dash 8 production rate raised to three per month by mid-1995.

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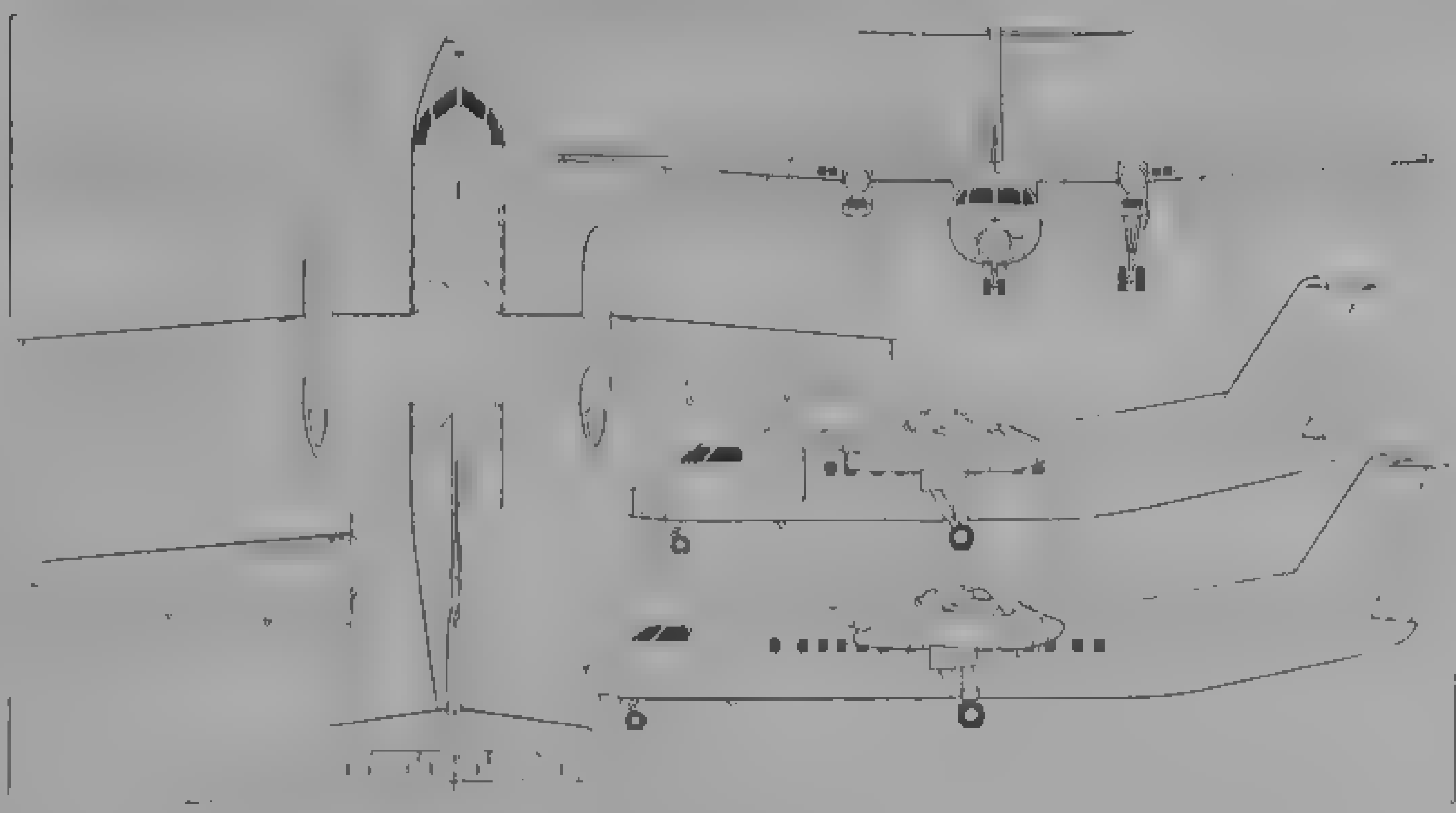

DHC-8 Dash 8 Series 100, with additional side view (bottom) and wingtip of Series 300 *(Jane's/Dennis Punnett)*

1995

DHC-8 DASH 8 SERIES 100 and 200

TYPE: Twin-turboprop short-range transport.

PROGRAMME: Launched 1980, first flight first prototype (C-GDNK) 20 June 1983, second prototype (C-GGMP) 26 October 1983, third prototype November 1983, fourth aircraft, first with production P&WC PW120 engines, flying by early 1984, certificated to Canadian DoT, FAR Pts 25 and 36 and SFAR No. 27 on 28 September 1984, followed by FAA type approval, also certificated Australia, Austria, Brazil, China, Germany, Ireland, Italy, Netherlands, New Zealand, Norway, Papua New Guinea, South Africa, Taiwan and UK, first delivery (NorOntair) 23 October 1984. New B model standard introduced 1992 offers reduced vibration and noise damping, improved crosswind capability, higher operating weights, Cat IIIa weather operation available as option, can be retrofitted to the A model.

CURRENT VERSIONS: **Series 100**: Initial version with choice of PW120A or PW121 engines, described in 1992-93 and earlier editions.

Series 100A: Introduced 1990; PW120A (or optional PW121) engines and restyled interior with 6.35 cm (2.5 in) more headroom in aisle, first delivery to Pennsylvania Airlines July 1990. *Detailed description applies to this version except where indicated.*

Series 100B: Improved version from 1992; PW121 engines enhance airfield and climb performance.

Series 200A: Increased speed/payload version of Series 100A, launched 16 March 1992, increased OEI capability and greater commonality with Series 300. Same airframe as 100A/B, but PW123C engines give 30 knot (56 km/h; 35 mph) increase in cruising speed, allowing airlines to increase frequencies or operational radius. Transport Canada certification March 1995. Launch customers National Jet Systems (three to be equipped as maritime patrol aircraft for coastwatch contract with Australian customs service), BPX Colombia (one, corporate), Archana Airways India (two) and Mesa Airlines (25, plus 25 options). Deliveries from April 1995.

Series 200B: As 200A but with PW123D engines for full power at higher ambient temperatures.

Dash 8M and Series 300 and 400: described separately.

CUSTOMERS: Total 325 firm orders for civil and military (Dash 8M) Series 100/100A/100B and 200A/B by June 1995, of which 293 delivered. Recent customers include the Norwegian Civil Aviation Administration, which has taken delivery of one Series 100A for navaid calibration duties.

COSTS: Unit cost approximately $10 million.

DESIGN FEATURES: Wing has constant chord inboard section and tapered outer panels, thickness/chord ratio 18 per cent at root, 13 per cent at tip; dihedral 2° 30′ on outer panels, inboard leading-edges drooped; 3° washout at wingtips. T tail, swept fin with large dorsal fin.

FLYING CONTROLS: Fixed tailplane, horn balanced elevator with four tabs, mechanically actuated horn balanced ailerons with inset tabs, hydraulically actuated roll spoilers/lift dumpers forward of each outer flap; two-segment serially hinged rudder, hydraulically actuated, yaw damper; stall strips on leading-edges outboard of engines, two-section slotted Fowler flaps. Digital AFCS.

STRUCTURE: Fuselage near-circular section, flush riveted and pressurised; adhesive bonded stringers and cutout reinforcements, wing leading-edge, radome, nose bay, wing/fuselage and wingtip fairings, dorsal fin, fin leading-edge, fin/tailplane fairings, tailplane leading-edges, elevator tips, flap shrouds, flap trailing-edges and other components of Kevlar and Nomex, wing has tip-to-tip torsion box. Wheel doors of Kevlar and other composites.

LANDING GEAR: Retractable tricycle type, by Dowty Aerospace, with twin wheels on each unit. Steer by wire nose unit retracts forward, main units rearward into engine nacelles. Goodrich mainwheels and brakes; Hydro-Aire Mk 3 anti-skid system. Standard tyre pressures: main 9.03 bars (131 lb/sq in), nose 5.52 bars (80 lb/sq in). Low pressure tyres optional, pressure 5.31 bars (77 lb/sq in) on main units, 3.31 bars (48 lb/sq in) on nose unit.

POWER PLANT: Two 1,491 kW (2,000 shp) Pratt & Whitney Canada PW120A turboprops in Series 100A, each driving a Hamilton Standard 14SF-7 four-blade constant-speed fully feathering aluminium/glassfibre propeller with reversible pitch. Series 100B has 1,603 kW (2,150 shp) PW121A engines, 1,603 kW (2,150 shp) PW123Cs in Series 200A are flat rated for full power at up to 26°C. PW123Ds in Series 200B maintain same power at up to 45°C. Propeller blades have Beta control. Standard usable fuel capacity (in-wing tanks) 3,160 litres (835 US gallons; 695 Imp gallons), optional auxiliary tank system increases this to 5,700 litres (1,506 US gallons; 1,254 Imp gallons). Pressure refuelling point in rear of starboard engine nacelle; overwing gravity point in each outer wing panel. Oil capacity 21 litres (5.5 US gallons; 4.6 Imp gallons) per engine.

ACCOMMODATION: Crew of two on flight deck, plus cabin attendant. Dual controls standard. Standard commuter layout provides four-abreast seating, with central aisle, for 37 passengers at 79 cm (31 in) pitch, plus buffet, toilet and large rear baggage compartment. Wardrobe at front of passenger cabin, in addition to overhead lockers and underseat stowage, provides additional carry-on baggage capacity. Alternative 39-passenger, passenger/cargo or corporate layouts available at customer's option. Movable bulkhead to facilitate conversion to mixed traffic. Port side airstair door at front for crew and passengers, large inward-opening port side door aft of wing for cargo loading. Emergency exit each side, in line with wing leading-edge, and opposite passenger door on starboard side. Entire accommodation pressurised and air conditioned.

SYSTEMS: Pressurisation system with maximum differential 0.38 bar (5.5 lb/sq in). Normal hydraulic installation comprises two independent systems, each having an engine-driven variable displacement pump and an electrically driven standby pump; accumulator and hand pump for emergency use. Electrical system DC power provided by two starter/generators, two transformer rectifier units, and

Dash 8 Series 200, which entered service in 1995

1995

Dash 8M-100 in E-9A configuration as a USAF missile range control aircraft

1993

two Ni/Cd batteries. Variable frequency AC power provided by two engine-driven AC generators and three static inverters. Ground power receptacles in port side of nose (DC) and rear of starboard nacelle (AC). Rubber boot de-icing of wing, tailplane and fin leading-edges and nacelle intake by pneumatic system, electric de-icing of propeller blades, pitot static ports, stall warning transducer, engine intake adapter and elevator horn leading-edge. APU standard in corporate version. Simmonds fuel monitoring system.

AVIONICS: Bendix/King Gold Crown III comm/nav. Collins equipment alternative option.

Comms: KTR 908 VHF com and KXP 756 transponder. Avtech audio integrating system. Telephonics PA system.

Radar: Primus 800 colour weather radar.

Flight: KNR 806 ADF. KDM 706A DME. Honeywell SPZ-800 dual-channel digital AFCS with integrated flight operational flight director/autopilot system, dual digital air data system. Optional FMS and GPS.

Instrumentation: Honeywell EFIS. Hughes/Flight Dynamics HGS 2000 head-up guidance system for Cat IIIa operation optional.

DIMENSIONS, EXTERNAL:

Wing span	25.91 m (85 ft 0 in)
Wing aspect ratio	12.35
Length overall	22.25 m (73 ft 0 in)
Fuselage: Max diameter	2.69 m (8 ft 10 in)
Height overall	7.49 m (24 ft 7 in)
Elevator span	7.92 m (26 ft 0 in)
Wheel track (c/l of shock struts)	7.87 m (25 ft 10 in)
Wheelbase	7.95 m (26 ft 1 in)
Propeller diameter	3.96 m (13 ft 0 in)
Propeller ground clearance	0.94 m (3 ft 1 in)
Propeller fuselage clearance	0.76 m (2 ft 6 in)
Passenger/crew door (fwd, port):	
Height	1.65 m (5 ft 5 in)
Width	0.76 m (2 ft 6 in)
Height to sill	1.09 m (3 ft 7 in)
B[illegible] door (rear, port): Height	1.52 m (5 ft 0 in)
Width	1.27 m (4 ft 2 in)
Height to sill	1.09 m (3 ft 7 in)

DIMENSIONS, INTERNAL:

Cabin (excl flight deck): Length	9.17 m (30 ft 1 in)
Max width	2.49 m (8 ft 2 in)
Width at floor	2.03 m (6 ft 8 in)
Max height	1.94 m (6 ft 4½ in)
Volume	39.36 m³ (1,390 cu ft)
Baggage compartment volume	8.5 m³ (300 cu ft)

AREAS:

Wings, gross	54.35 m² (585.0 sq ft)
Ailerons (total)	1.12 m² (12.1 sq ft)
Fin	9.81 m² (105.6 sq ft)
Rudder	4.31 m² (46.4 sq ft)
Tailplane	8.97 m² (96.5 sq ft)
Elevators (total)	4.97 m² (53.5 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty: 100A	10,251 kg (22,600 lb)
100B	10,273 kg (22,648 lb)
200A, 200B	10,338 kg (22,791 lb)
Max usable fuel, standard (all)	2,576 kg (5,678 lb)
optional 100A	4,646 kg (10,244 lb)
optional 100B, 200A, 200B	3,402 kg (7,500 lb)
Max payload: passengers: 100A	3,810 kg (8,400 lb)
100B	4,242 kg (9,352 lb)
200A, 200B	4,134 kg (9,114 lb)
Max T-O weight: 100A	15,650 kg (34,500 lb)
100B, 200A, 200B	16,465 kg (36,300 lb)
Max landing weight: all	15,375 kg (33,900 lb)
Max zero-fuel weight: 100A	14,060 kg (31,000 lb)
100B, 200A, 200B	14,515 kg (32,000 lb)
Max wing loading: 100A	287.95 kg/m² (58.97 lb/sq ft)
100B, 200A, 200B	302.96 kg/m² (62.05 lb/sq ft)
Max power loading: 100A	5.25 kg/kW (8.62 lb/shp)
100B, 200A, 200B	5.14 kg/kW (8.44 lb/shp)

PERFORMANCE (at 95% standard MTOW except where indicated):

Max cruising speed: 100A	265 kts (491 km/h, 305 mph)
100B	270 kts (500 km/h, 311 mph)
200A, 200B	300 kts (556 km/h, 345 mph)
Stalling speed, flaps down	72 kts (134 km/h, 83 mph)
Max rate of climb at S/L	450 m (1,475 ft)/min
Rate of climb at S/L, OEI	137 m (450 ft)/min
Certificated ceiling	7,620 m (25,000 ft)
Service ceiling, OEI	4,905 m (16,100 ft)
FAR Pt 25 T-O field length, max T-O weight, 15° flap:	
100A (S/L, ISA)	942 m (3,090 ft)
100B, 200A, 200B (S/L, ISA)	960 m (3,150 ft)
200B (at 1,525 m; 5,000 ft, ISA + 30°C, 0° flap)	2,195 m (7,200 ft)
FAR Pt 25 landing field length at max landing weight: all	780 m (2,560 ft)
Range with standard fuel, IFR reserves:	
full passenger load	835 n miles (1,546 km, 960 miles)
2,721 kg (6,000 lb) payload	1,100 n miles (2,037 km, 1,266 miles)

OPERATIONAL NOISE LEVELS (FAR Pt 36 Stage 3 and ICAO Annex 16):

T-O	81.1 EPNdB
Sideline	86.1 EPNdB
Approach	95 EPNdB

UPDATED

DHC-8 DASH 8M

Canadian Forces designations: CC-142 and CT-142

US Air Force designation: E-9A

TYPE: Multimission medium utility aircraft.

CURRENT VERSIONS: **CC-142 and CT-142**: Passenger/cargo transport and navigation trainer versions of Dash 8M-100 respectively, both have long-range fuel tanks, low-pressure tyres, high-strength floors and mission avionics. Canadian Department of National Defence operates two CC-142s and four CT-142s, latter with mapping radar in extended nose.

E-9A: US Air Force Dash 8-100 as missile range control aircraft, relays telemetry, voice and drone and fighter control data and simultaneously observes range with radar; avionics include large electronically steered phased-array radar in fuselage side and AN/APS-128D surveillance radar in ventral dome.

CUSTOMERS: Canadian Department of Transport (two Dash 8M-100), Canadian Forces (two CC-142, four CT-142), USAF (two E-9A with 82nd ATS/475th WEG at Tyndall AFB Florida); all 10 included in Series 100/100A delivery total.

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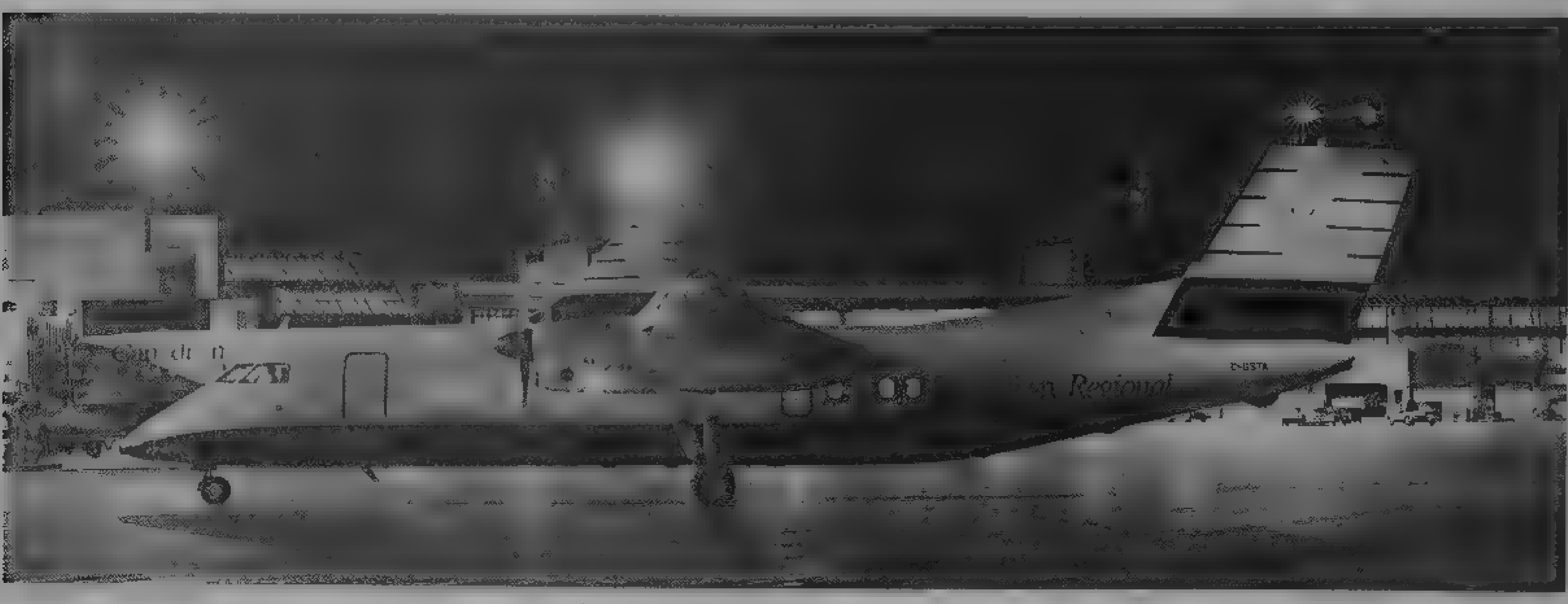


Dash 8 Series 300B of Canadian Regional

1995

DHC-8 DASH 8 SERIES 300

TYPE: Stretched twin turboprop regional transport.

PROGRAMME: Announced mid 1985, launched March 1986, first flight (modified Series 100 prototype C-GDNK) 15 May 1987, Canadian DoT certification 14 February 1989, first delivery (Time Air) 27 February 1989, FAA type approval 8 June 1989; now also certificated in Austria, Brazil, China, Germany, Ireland, Italy, Netherlands, South Africa and Taiwan.

CURRENT VERSIONS: **Series 300**: Initial version differs from Series 100A in having extended wingtips; 3.43 m (11 ft 3 in) two-plug fuselage extension giving standard seating for 50 at 81 cm (32 in) pitch or 56 at 74 cm (29 in) pitch, plus second cabin attendant, also larger galley, galley service door, additional wardrobe, larger lavatory, dual air conditioning packs and optional Turbomach T-40 APU, powered by 1,775 kW (2,380 shp) P&WC PW123s driving Hamilton Standard 14SF-23 four-blade propellers, fuel capacity as Series 100A, tyre pressures increased (mainwheels 6.69 bars, 97 lb/sq in, nosewheels 4.14 bars, 60 lb/sq in).

Series 300A: Introduced 1990; 1,775 kW (2,380 shp) PW123A engines standard (PW123B optional) and improved payload/range; same interior improvements as Series 100A; higher gross weight optional, first delivery to German Contact Air on 24 August 1990. First 300A/PW123B delivered to Tyrolean Airways 1991, this version now Series 300B.

Series 300B: Introduced 1992; generally as for 300A, but payload/range and airfield performance improved by 1,864 kW (2,500 shp) PW123B engines; optional high gross weight of 300A is standard on 300B.

Series 300E: Introduced 1994, generally as for 300A but hot and high performance improved by 5 per cent increase in thermodynamic power of 1,775 kW (2,380 shp) PW123E engines up to 40°C (96°F).

CUSTOMERS: Firm orders for 118 by June 1995, of which 108 then delivered.

DIMENSIONS, EXTERNAL: As for Series 100A except

Wing span	27.43 m (90 ft 0 in)
Wing aspect ratio	13.39
Length overall	25.68 m (84 ft 3 in)
Wheelbase	10.01 m (32 ft 10 in)

DIMENSIONS, INTERNAL: As for Series 100A except

Cabin (excl flight deck): Length	12.65 m (41 ft 6 in)
Volume	50.12 m³ (1,770 cu ft)
Baggage compartment volume:	
with 50 passengers	9.06 m³ (320 cu ft)
with 56 passengers	7.93 m³ (280 cu ft)

AREAS:

Wings, gross	56.21 m² (605.0 sq ft)
Ailerons and tail surfaces	as for Series 100A/200A

WEIGHTS AND LOADINGS:

Operating weight empty:	
300A, 300E	11,666 kg (25,720 lb)
300B	11,677 kg (25,743 lb)
Max usable fuel, 300A, 300B:	
standard	2,576 kg (5,679 lb)
optional	4,646 kg (10,243 lb)
Max payload: 300A, 300E	5,207 kg (11,480 lb)
300B	6,240 kg (13,757 lb)
Max T-O weight: 300A, 300E	18,642 kg (41,100 lb)
300A (optional), 300B	19,504 kg (43,000 lb)
Max landing weight: 300A, 300E	18,144 kg (40,000 lb)
300B	19,050 kg (42,000 lb)
Max zero-fuel weight: 300A, 300E	16,873 kg (37,200 lb)
300B	17,917 kg (39,500 lb)
Max wing loading:	
300A, 300E	331.65 kg/m² (67.93 lb/sq ft)
300B	346.99 kg/m² (71.07 lb/sq ft)
Max power loading:	
300A, 300E	5.25 kg/kW (8.63 lb/shp)
300B	5.49 kg/kW (9.03 lb/shp)

PERFORMANCE (at max T-O weight except where indicated):

Max cruising speed at 95% of MTOW:	
300A, 300E	287 kts (532 km/h, 330 mph)
300B	285 kts (528 km/h, 328 mph)
Stalling speed, flaps down	77 kts (141 km/h, 88 mph)
Max rate of climb at S/L	549 m (1,800 ft)/min
Rate of climb at S/L, OEI	137 m (450 ft)/min
Certificated ceiling	7,620 m (25,000 ft)
Service ceiling, OEI	4,115 m (13,500 ft)
FAR Pt 25 T-O field length at S/L, ISA, 15° flap:	
300A	1,085 m (3,560 ft)
300B	1,177 m (3,862 ft)
FAR Pt 25 landing field length at max landing weight:	
300A	1,006 m (3,305 ft)
300B	1,040 m (3,415 ft)

Range with standard fuel, IFR reserves:
full passenger load 830 n miles (1,537 km, 955 miles)
2,721 kg (6,000 lb) payload, 4,646 kg (10,243 lb) fuel
1,850 n miles (3,426 km, 2,128 miles)

UPDATED

Artist's impression of the Dash 8 Series 400

1995

DHC-8 DASH 8 SERIES 400

TYPE: Further stretch of Dash 8.

PROGRAMME: Launched June 1995, first flight scheduled for third quarter 1997; certification and initial deliveries 1998.

DESIGN FEATURES: Fuselage stretched 5.76 m (18 ft 11 in) to seat up to 78, new engines, new tapered inboard wing section and new wing/fuselage fairings; revised ailerons and flaps, new fin cap fairing, new baggage/service doors.

POWER PLANT: Two Pratt & Whitney Canada PW150 turboprops with FADEC, driving six-blade propellers to give 15 per cent reduction in T-O rpm and 6 to 9 per cent reduction in cruise rpm over Series 100/300.

ACCOMMODATION: Variety of cabin configurations providing four-abreast seating, with central aisle, for 70 passengers at 79 cm (31 in) pitch, 78 passengers at 76 cm (30 in) pitch or two-class layout for 10 business class passengers at 86 cm (34 in) pitch and 58 economy class passengers at 79 cm (31 in) pitch.

DIMENSIONS, EXTERNAL: As for Series 300 except

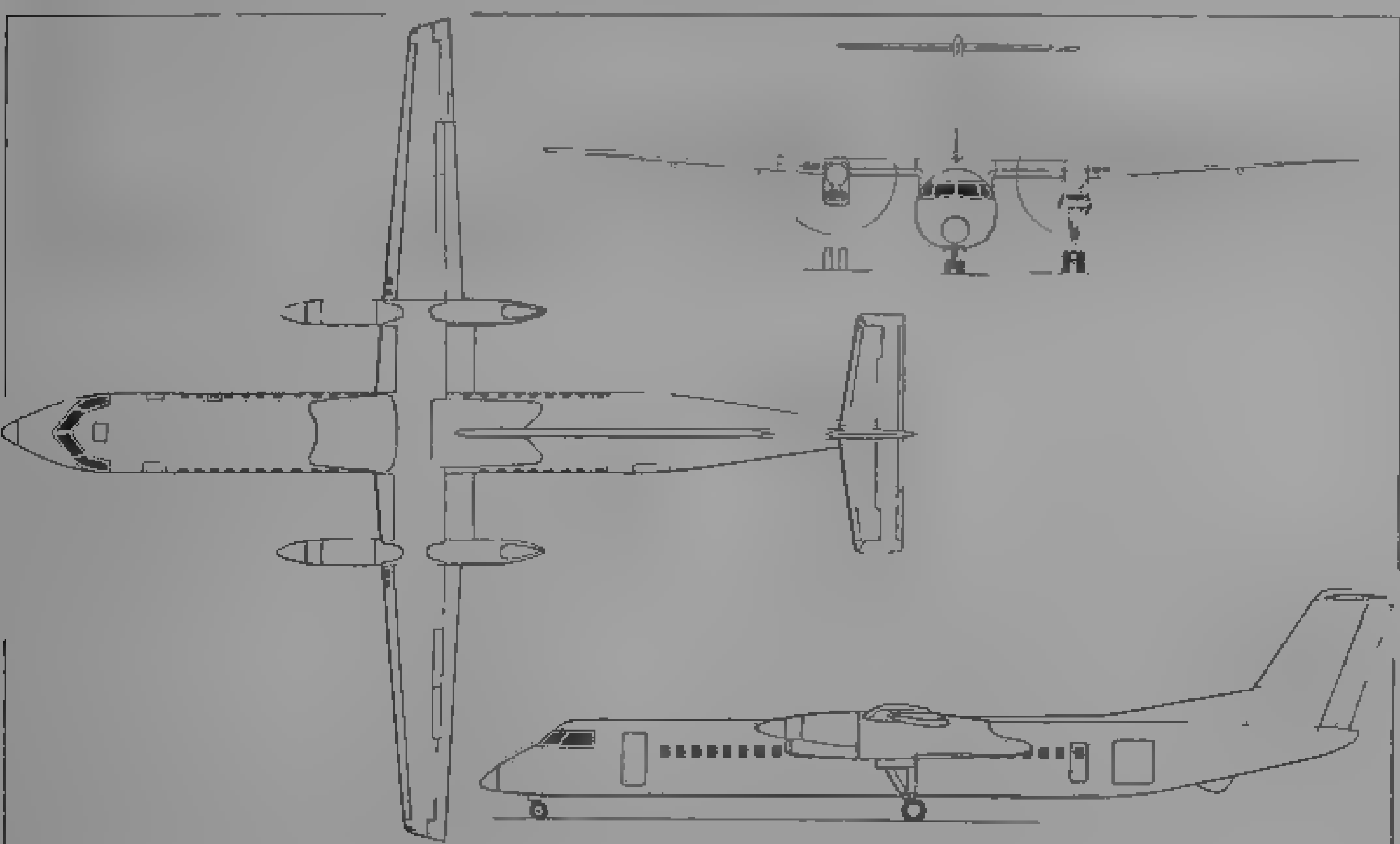
Wing span	28.12 m (92 ft 3 in)
Wing aspect ratio	12.74
Length overall	31.60 m (103 ft 8 in)
Height overall	8.10 m (26 ft 7 in)
Wheelbase	8.48 m (27 ft 10 in)
Baggage compartment door:	
Height to sill	1.55 m (5 ft 1 in)

DIMENSIONS, INTERNAL:

Cabin: Length	17.75 m (58 ft 3 in)
Max height	1.94 m (6 ft 4½ in)
Baggage compartment volume:	
front	2.29 m³ (81.0 cu ft)
rear	11.50 m³ (406.0 cu ft)

AREAS: As for Series 300 except

Wings, gross	62.05 m² (668.0 sq ft)


General arrangement of the Dash 8 Series 400 *(Jane's/Dennis Punnett)*

1994

DASH 8 PRODUCTION
(at 12 June 1995)

Customer	Orders	Delivered	Backlog
AGES/Worldwide	6	6	
Air Atlantic	15	15	
AirBC	18	18	
Air Creebec	1	1	
Air Dolomiti	3	3	
Air Manitoba	1	1	
Air Nova	6	6	
Air Ontario	36	36	
Air Wisconsin	12	12	
Alberta Government	1	1	
ALM	2	2	
America West	12	12	
Ansett New Zealand	2	2	
Archana Airways	2		2
Australian Airlines	4	4	
Aviaco/Furlong	4	4	
Avline	4	4	
BPX Colombia	1	1	
Bahamasair	3	3	
Brymon Airways	2	2	
CCAir	2	2	
City Express	4	4	
Contact Air	6	6	
DND Canada	6	6	
Eastern Metro Express	8	8	
Eveden Investments	4	4	
Fairways Corp	1	1	
GPA Jetprop	30	30	
Great China Airlines	14	10	4
Hamburg Airlines	4	4	
Horizon Air	2	2	
Interot	3	3	
Liat	5	5	
MarkAir	2	2	
Mesa Air	25		25
Mobil Oil	1	1	
National Jet	5	2	3
Norfolk Airlines	1	1	
norOntair	2	2	
Northwest Airlines	25	25	
Norwegian CAA	1	1	
Rheintalflug	3	3	
Schreiner Airways	3	3	
SA Express	12	12	
Talair	2	2	
Time Air	14	14	
Transport Canada	2	2	
Tyrolean	19	17	2
USAF/Sierra	2	2	
USAir Express*	56	56	
Wideroe	15	13	5
Zhejiang Airlines	2	2	
Undisclosed	8	4	4
Totals	**443**	**401**	**42**

Notes: Operators with leased Dash 8 aircraft include, but are not necessarily restricted to, the following: Air Alliance, Bangkok Airways, ERA, Lloyd Aviation, Lufthansa CityLine, Sabena, TABA.

* USAir Express operators include Piedmont Airlines and Allegheny Commuter.

Delivery and backlog by series is

Series 100	292	2
Series 200	1	30
Series 300	108	10

WEIGHTS AND LOADINGS
Operating weight empty 15,558 kg (34,300 lb)
Max usable fuel 5,352 kg (11,800 lb)
Max payload (standard passenger aircraft) 7,484 kg (16,500 lb)
Max T-O weight, standard 25,855 kg (57,000 lb)
optional 27,215 kg (60,000 lb)
Max landing weight 25,628 kg (56,500 lb)
Max zero-fuel weight 23,042 kg (50,800 lb)
Max wing loading 438.6 kg/m² (89.8 lb/sq ft)

PERFORMANCE (estimated)
Max cruising speed at 95% of max T-O weight, ISA 350 kts (648 km/h, 403 mph)
Service ceiling, OEI, at 95% of max T-O weight, ISA 6,220 m (20,400 ft)
FAR T-O field length at S/L, ISA 1,128 m (3,700 ft)
FAR landing field length at S/L, max landing weight 1,247 m (4,090 ft)
Max range with 70 passengers 1,375 n miles (2,546 km, 1,582 miles)
Range at max cruising speed with 70 passengers and baggage, IFR reserves 925 n miles (1,713 km; 1,064 miles)

UPDATED

DIAMOND

DIAMOND AIRCRAFT

Diamond Aircraft is trading name of Dimona Aircraft Industries established June 1994 at London, Ontario, to build DV 20 Katana light aircraft, described under HOAC in Austrian section, Canadian designation DA 20A1; initial aircraft (C-FSQN) first flight 29 June 1994, five early DA 20s built for demonstration; 11 produced by February 1995, 145 to be built in 1995, with production rate stabilising at 22 per month by November 1995, cost $98,500; 121 on order by March 1995, many by US flight schools (of which Missouri State University first recipient, March 1995)

NEW ENTRY

ELMWOOD

ELMWOOD AVIATION

RR 4 Elmwood Drive, Belleville, Ontario K8N 4Z4
Telephone: 1 (613) 967 1853
DESIGNER/PROPRIETOR: Ronald B. Mason

VERIFIED

ELMWOOD CA-05 CHRISTAVIA Mk I

TYPE: Tandem two-seat homebuilt.
PROGRAMME: First flight of Christavia Mk I (C-GENC) 3 October 1981, plans offered, aircraft considered suitable for flying such as missionary work, 570 sets of plans sold and about 300 Mk Is flying, several built for mission field.
COSTS: Plans $200 (1995), information kit $10. Average construction cost suggested at about $11,000.
DESIGN FEATURES: Computer designed wing section.
FLYING CONTROLS: Include Frise ailerons.
STRUCTURE: Braced two-spar wing of Sitka spruce, with truss ribs and Dacron covering. Aluminium can be used alternatively to fabricate spars and ribs. Wooden ailerons have Dacron covering. Fuselage of welded 4130 and 1025 steel tube, Dacron covered. Wire braced tail of steel tube, with mild steel plate ribs, Dacron covered.
LANDING GEAR: Non-retractable tailwheel type, optional floats or skis.
POWER PLANT: Prototype has a 48.5 kW (65 hp) Teledyne Continental A65. Engines of 37.25 to 112 kW (50 to 150 hp) can be fitted. Main fuel tank, capacity 57 litres (15 US gallons, 12.5 Imp gallons), in fuselage aft of firewall; auxiliary tank capacity 23 litres (6 US gallons, 5 Imp gallons), in each wing.

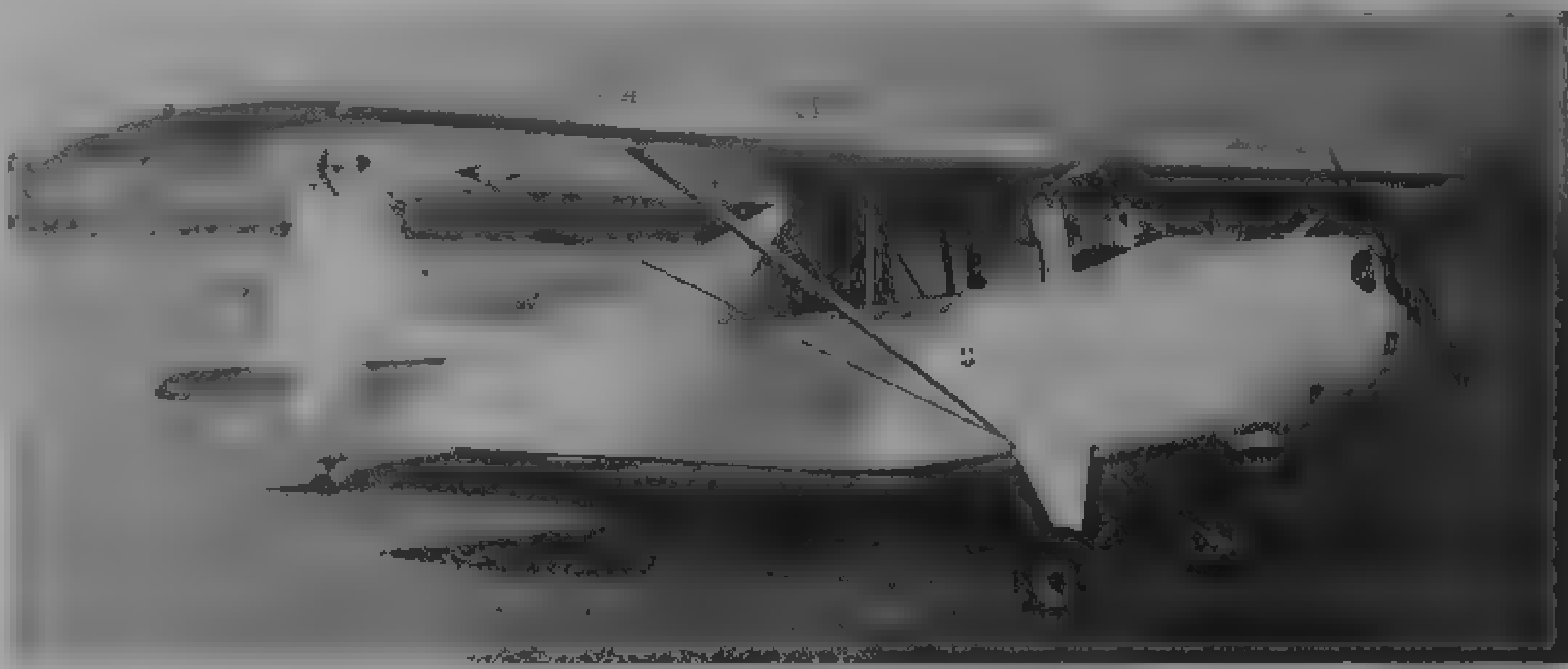
DIMENSIONS, EXTERNAL:
Wing span 9.91 m (32 ft 6 in)
Wing aspect ratio 7.22
Length overall 6.30 m (20 ft 8 in)
Height overall 2.13 m (7 ft 0 in)
Propeller diameter 1.83 m (6 ft 0 in)

AREAS:
Wings, gross 13.59 m² (146.25 sq ft)

WEIGHTS AND LOADINGS (48.5 kW, 65 hp engine, 15 US gallons fuel):
Weight empty 338 kg (745 lb)
Max T-O weight 590 kg (1,300 lb)
Max wing loading 43.41 kg/m² (8.89 lb/sq ft)
Max power loading 12.16 kg/kW (20.00 lb/hp)

PERFORMANCE (at max T-O weight, engine and fuel as above):
Max level speed at S/L 104 kts (193 km/h, 120 mph)
Cruising speed at 610 m (2,000 ft), 45% power 74 kts (137 km/h, 85 mph)
Stalling speed: power off 37 kts (68 km/h, 42 mph)
power on 31 kts (57 km/h, 35 mph)
Max rate of climb at S/L 259 m (850 ft)/min
Service ceiling 3,960 m (13,000 ft)
T-O run 107 m (350 ft)
Landing from 15 m (50 ft) 198 m (650 ft)
Range with standard fuel, 45% power 382 n miles (708 km, 440 miles)
g limits +4.5/−2.8

UPDATED


Elmwood CA-05 Christavia Mk I

1995

ELMWOOD CH-8 CHRISTAVIA Mk 4

TYPE: Four-seat homebuilt cabin monoplane.
PROGRAMME: Four-seat development of Christavia Mk I; first flight 3 January 1986. Plans and information kit available; 270 sets of plans sold, about 100 flying.
COSTS: Plans $200 (1995), information kit $10. Average construction cost $10,000.
DESIGN FEATURES: Similar to Christavia Mk I.
POWER PLANT: One 112 kW (150 hp) Textron Lycoming O-320 flat-four or converted motorcar engine. Fuel capacity 136.4 litres (36 US gallons, 30 Imp gallons).

DIMENSIONS, EXTERNAL:
Wing span 10.67 m (35 ft 0 in)
Wing aspect ratio 7.00
Length overall 7.01 m (23 ft 0 in)
Height overall 1.98 m (6 ft 6 in)
Propeller diameter 1.78 m (5 ft 10 in)

AREAS:
Wings, gross 16.26 m² (175.0 sq ft)

WEIGHTS AND LOADINGS (112 kW, 150 hp engine):
Weight empty 522 kg (1,150 lb)
Max T-O weight 1,043 kg (2,300 lb)
Max wing loading 64.15 kg/m² (13.14 lb/sq ft)
Max power loading 9.31 kg/kW (15.33 lb/hp)

PERFORMANCE:
Max level speed at 610 m (2,000 ft) 111 kts (206 km/h, 128 mph)
Econ cruising speed, 65% power 102 kts (188 km/h, 117 mph)
Stalling speed: flaps up 35 kts (65 km/h; 40 mph)
12° flap 31 kts (57 km/h, 35 mph)
Max rate of climb at S/L 244 m (800 ft)/min
Service ceiling 5,485 m (18,000 ft)
T-O run 91 m (300 ft)
Landing run 152 m (500 ft)
Range with max fuel 548 n miles (1,017 km, 632 miles)

UPDATED

Elmwood CH-8 Christavia Mk 4

1995

EUROCOPTER CANADA

EUROCOPTER CANADA LTD
(Subsidiary of Eurocopter SA)

HEAD OFFICE: PO Box 250, 1100 Gilmore Road, Fort Erie, Ontario L2A 5M9
Telephone: 1 (905) 871 7772
Fax: 1 (905) 871 3320
PRESIDENT AND CEO: Willy Heidbüche
VICE-PRESIDENT AND COO: Michael D. Lavoy

Started as MBB Helicopter Canada April 1984 following MBB agreement with Canadian federal and provincial governments; Fort Erie factory covering 7,900 m² (85,000 sq ft) opened mid-1986. Company holds world product mandate and design authority for high powered BO 105 LS sells and completes standard BO 105 CBS and Eurocopter/Kawasaki BK 117s in Canada and is partner in new EC 135. First product BO 105 LS A-3. Workforce about 80. Distribution and support centers at Montreal and Edmonton, supporting a fleet of Eurocopter aircraft in Canada of over 200.

UPDATED

EUROCOPTER BO 105 LS

TYPE: Version of BO 105 CBS utility twin-engined helicopter (which see under Eurocopter in International section) with more power.
PROGRAMME: First flight 23 October 1981, German LBA certification July 1984, extended for landing and take-off at 6,100 m (20,000 ft) April 1985, extended again 7 July 1986 to cover BO 105 LS A-3. FAA and Canadian DoT certification followed.
COSTS: C$1.86 million.
CURRENT VERSIONS: **BO 105 LS A-3**: Production version, first delivery February 1987. *Details as for BO 105 CBS (see under Eurocopter in International section) except where indicated.*

BO 105 LS B-1: One-off testbed C-FMCL, powered by two 307 kW (412 shp) P&WC PW 205B turboshafts, made first flight 13 October 1988; further details in 1989-90 *Jane's*.

CUSTOMERS: Peruvian Air Force and police, Chile, South Africa, Nigeria, Japan, Mexico and USA. Total 50 built by February 1995, German built BO 105s being supplied to US customers (two in 1994).

DESIGN FEATURES: Uprated transmission and Allison 250-C28C engines produce exceptional hot and high performance.

POWER PLANT: Two Allison 250-C28C turboshafts, each rated at 410 kW (550 shp) for 2½ minutes, and with 5 minute T-O and maximum continuous power ratings of 373 kW (500 shp) and 368 kW (493 shp) respectively. Main transmission, type ZF-FS 112, rated for independent restricted input of 310 kW (416 shp) per engine at T-O power or 294 kW (394 shp) per engine for maximum continuous operation, or single-engine restricted input of 368 kW (493 shp) at maximum continuous power, or 410 kW (550 shp) for 2½ minutes at T-O power. Fuel capacity as for CB/CBS. Oil capacity 4.5 litres (1.2 US gallons; 1.0 Imp gallons) per engine.

ACCOMMODATION: Pilot, and co-pilot or passenger, on two front seats, three or four passengers in main cabin. Cargo space behind rear seats, plus additional 20 kg (44 lb) in baggage compartment. Crew door and passengers' sliding door each side; clamshell rear cargo doors, removable for carriage of long cargo. Cabin heating and air conditioning available optionally.

SYSTEMS: As for BO 105 CBS, except stability augmentation system is standard, bleed air anti-icing optional. Options for hoist, firefighting kit, weapon fittings, mast mounted sight and floats.

DIMENSIONS: As for BO 105 CBS except slightly smaller cabin volume 3.1 m³ (109 cu ft), cargo area 1.27 m³ (45 cu ft), total 4.37 m³ (154 cu ft).

WEIGHTS AND LOADINGS:

Weight empty, basic	1,372 kg (3,152 lb)
Fuel weight	456 kg (1,005 lb)
Max internal payload	637 kg (1,404 lb)
Max T-O weight	2,600 kg (5,732 lb)
Max disc loading	34.19 kg/m² (7.00 lb/sq ft)
Max power loading (transmission restricted)	4.19 kg/kW (6.89 lb/shp)

PERFORMANCE (at T-O weight of 2,400 kg; 5,291 lb, ISA):

Never-exceed speed (VNE) at S/L	145 kts (270 km/h; 167 mph)
Max cruising speed at S/L	131 kts (243 km/h; 151 mph)
Max forward rate of climb at S/L	551 m (1,810 ft)/min
Max vertical rate of climb at S/L	427 m (1,400 ft)/min
Max operating altitude	6,100 m (20,000 ft)
Service ceiling, OEI	1,798 m (5,900 ft)
Hovering ceiling: IGE	2,987 m (9,800 ft)
OGE	2,551 m (8,370 ft)
Range at S/L, standard fuel, max internal payload, no reserves	278 n miles (515 km; 320 miles)
with overload fuel	475 n miles (880 km; 547 miles)

UPDATED

Searchlight equipped Eurocopter Canada BO 105 LS in service with Virginia State Police

1995

IMP

IMP AEROSPACE LTD

Details of the IMP upgrade of Sikorsky Sea Kings to CH-124B standard appear in *Jane's Aircraft Upgrades*.

UPDATED

KFC

KELOWNA FLIGHTCRAFT GROUP

A stretched conversion of Convair 580 is offered by KFC as the CV5800; details in *Jane's Aircraft Upgrades* and previous editions of this volume.

UPDATED

MURPHY

MURPHY AVIATION LTD

Unit 1, 8155 Aitken Road, Chilliwack, British Columbia V2R 4H5
Telephone: 1 (604) 792 5855
Fax: 1 (604) 792 7006
PRESIDENT: Darryl Murphy
SALES MANAGER: Dave Walker

In addition to Renegade II and Renegade Spirit, Murphy has developed three-seat Rebel. This can be built as a homebuilt or ARV, or as a microlight in some countries.

UPDATED

MURPHY RENEGADE II

TYPE: Two-seat dual-control ARV and homebuilt biplane; also conforms to microlight regulations in Canada and some European countries.

PROGRAMME: Prototype Renegade II made first flight May 1985. Ready assembled aircraft, plans and kits are available, latter in four standards ranging from partial parts kit to 300/400 working hour quick build kit with all parts premanufactured plus partly assembled fuselage, wings and engine mounting.

CUSTOMERS: By early 1995, at least 16 assembled aircraft, 114 kits and 109 sets of plans had been sold, with 67 kit built and 37 plans built Renegades then flying.

COSTS: Quick build kit C$13,100; complete parts kit C$12,128, full materials kit C$9,100; partial parts kit C$3,650, plans C$335.

DESIGN FEATURES: Strut and wire braced biplane with NACA 23012 wing section; optional extended wings and rounded tips, optional floats, skis, agricultural spraygear and parachute.

FLYING CONTROLS: Conventional, Frise ailerons (upper and lower wings or lower only).

STRUCTURE: Fabric covered metal.

LANDING GEAR: Non-retractable tailwheel type.

POWER PLANT: One 35.8 kW (48 hp) Rotax 503 standard, 39.5 kW (53 hp) twin-carburettor Rotax 503 2V optional. Alternative engines include Rotax 532 and Teledyne Continental O-65, O-75 and O-85. Fuel in two 29.5 litre (7.8 US gallon; 6.5 Imp gallon) tanks.

DIMENSIONS, EXTERNAL:

Wing span: upper	6.48 m (21 ft 3 in)
lower	6.05 m (19 ft 10 in)
Length overall	5.61 m (18 ft 5 in)
Height overall	2.08 m (6 ft 10 in)
Propeller diameter	1.73 m (5 ft 8 in)

AREAS:

Wings, gross	14.29 or 15.61 m² (153.8 or 168.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	163-181 kg (360-400 lb)
Max T-O weight	386 kg (850 lb)

PERFORMANCE (Rotax 503 engine and two crew, unless stated otherwise):

Max level speed at 305 m (1,000 ft)	69 kts (129 km/h; 80 mph)
Econ cruising speed	61 kts (113 km/h; 70 mph)
Stalling speed, power off	33 kts (62 km/h; 38 mph)
Max rate of climb at S/L	183 m (600 ft)/min
Service ceiling	3,660 m (12,000 ft)
T-O and landing run	61 m (200 ft)
Range with max payload	195 n miles (362 km; 225 miles)
Endurance	4 h 30 min
g limits: pilot only	+6.6/-4
dual	+5.5/-3

UPDATED

MURPHY RENEGADE SPIRIT

TYPE: Variant of Renegade II.

PROGRAMME: First flight (C-IJLW) 6 May 1987.

DESIGN FEATURES: Alternative power plants; internal and external refinements.

CUSTOMERS: By early 1995, at least 33 assembled aircraft, 341 kits and 229 sets of plans had been sold; 172 had flown by then (kit built).

COSTS: Quick-build kit C$13,985, complete parts kit C$12,995, full materials kit C$9,945, partial parts kit C$3,895, plans C$335.

POWER PLANT: One 47.7 kW (64 hp) Rotax 532 engine standard, in radial type cowling. Rotax 912 flat four or Alvis rotary engine optional.

DIMENSIONS, EXTERNAL, AND WEIGHTS: As for Renegade II.

PERFORMANCE (two crew):

Max level speed	78-82 kts (145-153 km/h; 90-95 mph)
Econ cruising speed	65 kts (120 km/h; 75 mph)
Stalling speed, power off	33 kts (62 km/h; 38 mph)
Max rate of climb at S/L	274 m (900 ft)/min
Service ceiling	3,660 m (12,000 ft)
T-O run	53 m (175 ft)
Landing run	61 m (200 ft)
Range with max payload	195 n miles (362 km; 225 miles)
Endurance	4 h 30 min
g limits: pilot only	+6.6/-4
dual	+5.5/-3

UPDATED

MURPHY REBEL AND MAVERICK

TYPE: Three-seat dual-control homebuilt, ARV and microlight.

Murphy Renegade Spirit two-seat biplane

1995

Murphy Maverick with Rotax 582 power plant option

1995

Murphy Rebel three-seat cabin monoplane fitted with floats

1995

PROGRAMME: Construction of prototype started October 1989, first flight 1990; building of production aircraft/kits began in October 1990. Estimated assembly time is 300-400 hours

CURRENT VERSIONS: **Rebel**: Standard version, *as described below*

Maverick: Developed version with 'considerable' detail design changes

CUSTOMERS: At least 137 aircraft or kits ordered by early 1995

COSTS: Rebel kit C$13,985, or available as subkit. Maverick kit US$14,395

DESIGN FEATURES: High-wing cabin monoplane for recreational, training, cross-country, border patrol and other roles, designed to conform to FAR Pt 23 and JAR (Utility category); STOL performance

FLYING CONTROLS: Conventional mechanical primary surfaces, full-span flaperons

STRUCTURE: Strut braced high-wing monoplane, with aluminium alloy frame and skins. Modified NACA 4415 wing section

LANDING GEAR: Non-retractable tailwheel with brakes. Wheeled floats available

POWER PLANT: One 59.7 kW (80 hp) Rotax 912, 48.5 kW (65 hp) Rotax 582, or 86.5 kW (116 hp) Textron Lycoming O-235 engine, 2.27:1 reduction gear with Rotax engines and direct drive with O-235. Ground adjustable wooden two-blade propeller. Standard fuel capacity 38 litres (10 US gallons; 8.3 Imp gallons), 152 litres (40 US gallons; 33.2 Imp gallons) in auxiliary tanks

ACCOMMODATION: Pilot and two passengers

DIMENSIONS, EXTERNAL:

Wing span	9.14 m (30 ft 0 in)
Wing aspect ratio	6.00
Length overall	6.55 m (21 ft 6 in)
Height overall	1.98 m (6 ft 6 in)
Propeller diameter	1.78 m (5 ft 10 in)

AREAS:

Wings, gross	13.94 m^2 (150.0 sq ft)

WEIGHTS AND LOADINGS (A: Rotax 912, B: O-235):

Weight empty: A	295 kg (650 lb)
B	329 kg (725 lb)
Baggage capacity	45.5-68 kg (100-150 lb)
Max T-O weight: A, B	658 kg (1,450 lb)

PERFORMANCE (A: Rotax 912, B: O-235):

Max level speed: A	91 kts (169 km/h; 105 mph)
B	104 kts (193 km/h; 120 mph)
Cruising speed, 75% power:	
A	78 kts (145 km/h; 90 mph)
B	91 kts (169 km/h; 105 mph)
Stalling speed, flaps down:	
A, B, with power off and 20° flap	32 kts (58 km/h; 36 mph)
A, B, with power on and 20° flap	26 kts (49 km/h; 30 mph)
Max rate of climb at S/L: A	244 m (800 ft)/min
B	427 m (1,400 ft)/min

Service ceiling B	3,960 m (13,000 ft)
T-O run: A	61 m (200 ft)
B	77 m (250 ft)
Landing run: A	77 m (250 ft)
B	92 m (300 ft)
Range: B	442 n miles (820 km, 510 miles)
Endurance: B	6 h 45 min
g limits	+3.8/−2.5

UPDATED

MURPHY SUPER REBEL

TYPE: Four-seat development of Rebel.

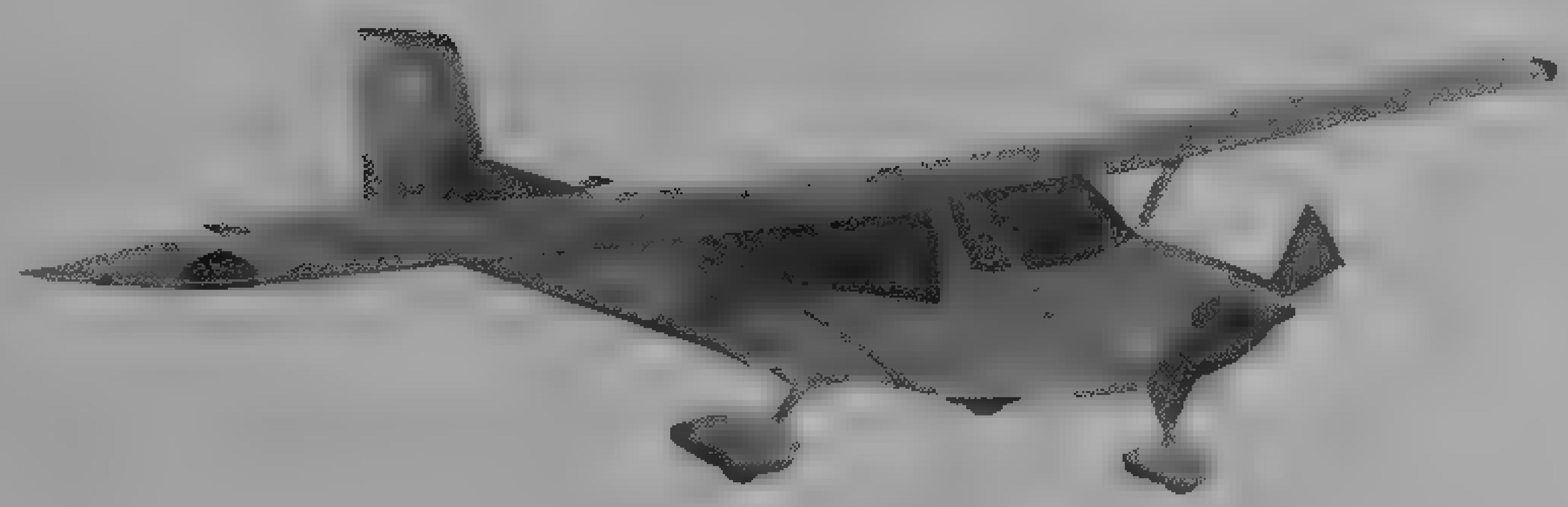
PROGRAMME: First flight 1995.

COSTS: Basic kit $26,500 (1995).

LANDING GEAR: Non-retractable tricycle gear standard; tailwheel or wheeled float gear optional.

POWER PLANT: Choice of engines from 112 to 156.5 kW (150 to 210 hp), 210 hp in prototype. Fuel capacity 175 litres (46.2 US gallons; 38.5 Imp gallons) standard; 272.5 litres (72 US gallons; 60 Imp gallons) option for two-seat variant.

ACCOMMODATION: Seats for four persons and space for 160 kg (353 lb) of baggage; baggage capacity increases to 210 kg (463 lb) with only two occupants.



Artist's impression of Murphy Super Rebel four-seat lightplane *1995*

WEIGHTS AND LOADINGS:

Max T-O weight	1,134 kg (2,500 lb)

NEW ENTRY

NWI

NORTHWEST INDUSTRIES LIMITED (a Division of CAE Industries Ltd)

Aircraft modification programmes of NWI are detailed in *Jane's Aircraft Upgrades*.

UPDATED

ZENAIR

ZENAIR LTD

Huronia Airport, Midland, Ontario L4R 4K8
Telephone: 1 (705) 526 2871
Fax: 1 (705) 526 8022
PRESIDENT AND DESIGNER: Christophe Heintz
MANAGER: Bruce Barker
PRODUCTION MANAGER: Mathieu Heintz
SALES MANAGER: Bob Elliot

Founded in 1974, Zenair designs, develops and manufactures light aircraft. Christophe Heintz was formerly chief engineer of Avions Pierre Robin in France. In 1992 Zénith Aircraft Company was formed to manufacture and market Zenair aircraft in USA (which see).

Manufacture of kits for the CH 200, 250 and 300 (see 1994-95 *Jane's*) were discontinued in January 1995. In addition to light aircraft, company constructs metal floats and amphibious floats.

Zenair has licensed representatives in Africa, South America, France, Italy, Japan, Spain and the UK.

UPDATED

ZENAIR ZODIAC CH 601HD

TYPE: Side by side two-seat, dual-control homebuilt or ultralight aircraft.

PROGRAMME: Available as kit and as 85 per cent preassembled kit requiring only 120 working hours to complete. Initials HD mean 'Heavy duty'.

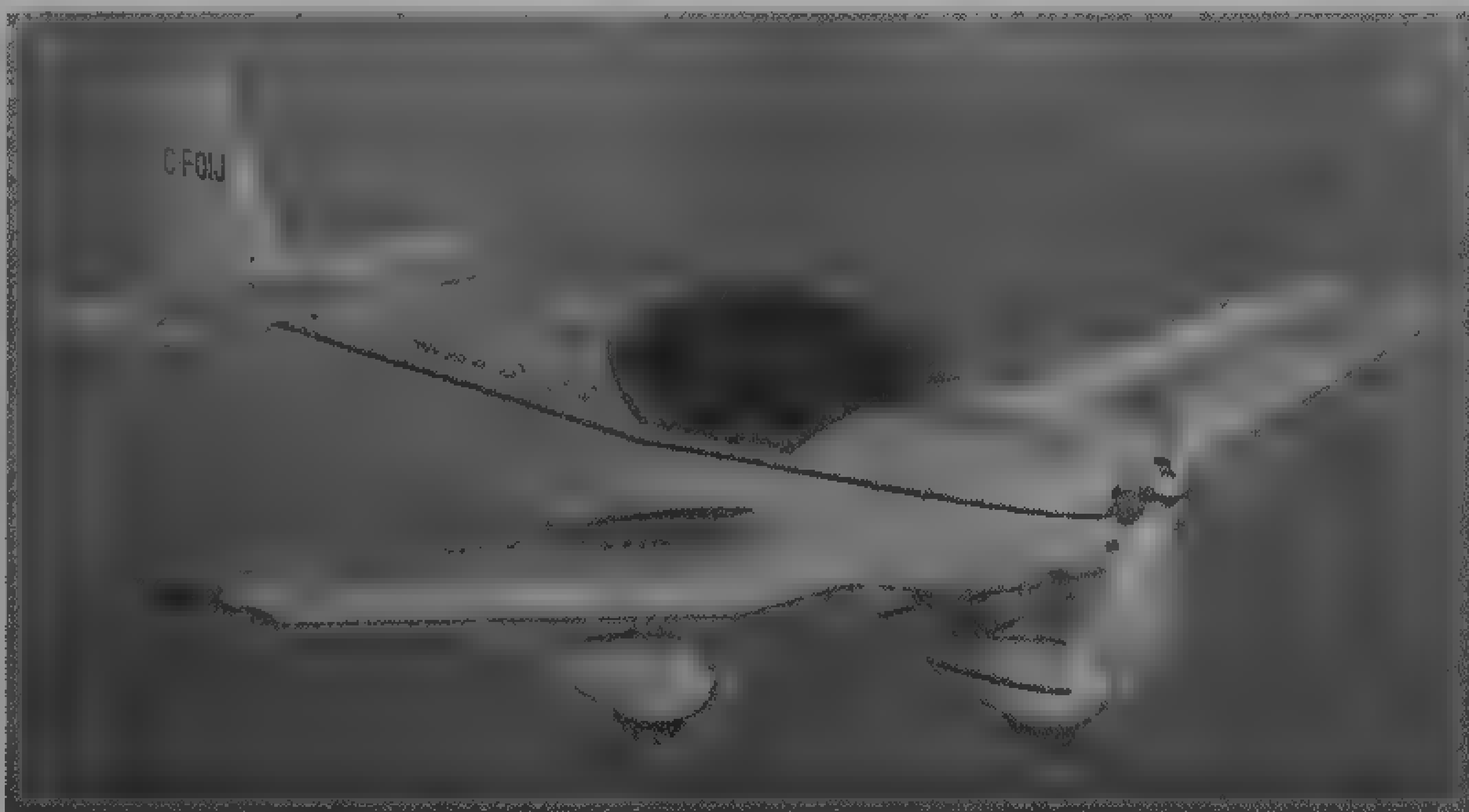
COSTS: Plans, C$320. Kit, C$12,620. Information pack C$20. Materials and component parts are available.

DESIGN FEATURES: Wider cabin than CH 601 (1994-95 *Jane's*). No fixed fin. Wing section NACA 65018.

STRUCTURE: All metal.

LANDING GEAR: Non-retractable tricycle or tailwheel type. Skis and floats optional.

POWER PLANT: One engine of 48.5 to 85.75 kW (65 to 115 hp) including 59.7 kW (80 hp) Rotax 912, with reduction gear, 47.7 kW (64 hp) Rotax 532, 48.5 to 74.5 kW (65 to 100 hp) Teledyne Continental, 37.3 kW (50 hp) Volkswagen without electric starting or 52 kW (70 hp) Volkswagen. Fuel capacity 60 litres (16 US gallons; 13.3 Imp gallons).



Zenair Super Zodiac CH 601HDS two-seat monoplane *1995*

DIMENSIONS, EXTERNAL: As CH 601 except:

Height overall	1.90 m (6 ft 2¾ in)
Propeller diameter	1.52 m (5 ft 0 in)

WEIGHTS AND LOADINGS (Rotax 912 for power loading):

Weight empty, equipped	268 kg (590 lb)
Max T-O weight	544 kg (1,200 lb)
Max wing loading	45.07 kg/m² (9.23 lb/sq ft)
Max power loading	9.11 kg/kW (15.00 lb/hp)

PERFORMANCE (Rotax 912, at max T-O weight):

Max level speed at S/L	117 kts (217 km/h; 135 mph)
Econ cruising speed	104 kts (193 km/h; 120 mph)
Stalling speed	41 kts (76 km/h; 47 mph)
Max rate of climb at S/L	351 m (1,150 ft)/min
Service ceiling	4,875 m (16,000 ft)
T-O run	131 m (430 ft)
Landing run	138 m (450 ft)
Range with max fuel	380 n miles (704 km; 437 miles)
Endurance	4 h
g limits	±4.3

UPDATED

Two Zenair Zodiac CH 601s showing nosewheel and tailwheel landing gear configurations *1995*

ZENAIR SUPER ZODIAC CH 601HDS

TYPE: Side by side two-seat monoplane, pending Recreational category certification in Canada.

PROGRAMME: Latest member of CH 601 series, conceived to offer higher performance and true cross-country capability. Prototype first flight August 1991. Apart from recreational flying, is suitable for surveillance, patrol and training. Military version designated **CH 601HDS-M**.

COSTS: Plans C$340. Kit C$13,640.

DESIGN FEATURES: Shorter span and tapered 'speed' wing.

STRUCTURE: All metal.

LANDING GEAR: Non-retractable tricycle or tailwheel type, with disc brakes. Optional skis and floats.

POWER PLANT: One 59.7 kW (80 hp) Rotax 912, with 2.53:1 reduction gear. Optional engines include converted motorcar types, Textron Lycoming O-235 and Teledyne Continental O-200. Fuel capacity 60 litres (16 US gallons; 13.3 Imp gallons). Two 28.4 litre (7.5 US gallon; 6.25 Imp gallon) wing tanks optional.

DIMENSIONS, EXTERNAL: As CH 601 except:

Wing span	7.01 m (23 ft 0 in)
Wing aspect ratio	5.40
Height overall	1.57 m (5 ft 2 in)
Propeller diameter	1.73 m (5 ft 8 in)

AREAS:

Wings, gross	9.10 m² (98.0 sq ft)

WEIGHTS AND LOADINGS

Weight empty	258 kg (570 lb)
Max T-O weight	544 kg (1,200 lb)
Max wing loading	59.78 kg/m² (12.24 lb/sq ft)
Max power loading	9.11 kg/kW (15.00 lb/hp)

PERFORMANCE

Max level speed at S/L	130 kts (241 km/h; 150 mph)
Econ cruising speed at S/L, 60% power	113 kts (209 km/h; 130 mph)
Stalling speed, engine idling	46 kts (86 km/h; 53 mph)
Max rate of climb at S/L	314 m (1,030 ft)/min
Service ceiling	4,875 m (16,000 ft)
T-O run	168 m (550 ft)
Landing run	183 m (600 ft)
Range	
with standard fuel	440 n miles (815 km; 506 miles)
with wing tanks	825 n miles (1,528 km; 950 miles)
Endurance	7 h
g limits	±4

UPDATED

ZENAIR STOL CH 701

TYPE: Two-seat advanced ultralight or Experimental homebuilt.

PROGRAMME: Experimental category prototype made first flight Summer 1986. Plans, 49 or 85 per cent kits, or fully assembled aircraft available. Meets TP 10141 standards for advanced ultralight trainers.

COSTS: Plans C$320. Kit C$11,670 with engine. Information pack C$20. Materials and component parts available.

DESIGN FEATURES: Strut braced high-wing cabin monoplane with foldable wings and fixed leading-edge slats. In most countries, CH 701s can be registered either as advanced ultralights (AULs) or as Experimental homebuilts.

FLYING CONTROLS: Full span leading-edge flaps for STOL performance.

LANDING GEAR: Can be completed with tricycle or tailwheel gear, with floats, amphibious and ski gears as options.

POWER PLANT: One 37.3 kW (50 hp) Rotax 503 engine in prototype, but 59.7 kW (80 hp) Rotax 912, 48.5 kW (65 hp) Rotax 582, 44.7 to 52 kW (60 to 70 hp) VW or 48.5 to 67 kW (65 to 90 hp) Teledyne Continental engine optional; standard fuel capacity 60 litres (16 US gallons; 13.3 Imp gallons); optional 114 litres (30 US gallons; 25 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span	8.23 m (27 ft 0 in)
Wing aspect ratio	5.98
Length overall	6.10 m (20 ft 0 in)
Propeller diameter	1.73 m (5 ft 8 in)

AREAS:

Wings, gross	11.33 m² (122.0 sq ft)

WEIGHTS AND LOADINGS (48.5 kW, 65 hp engine for power loading):

Weight empty	208 kg (460 lb)
Max T-O weight	435 kg (960 lb)
Max wing loading	38.42 kg/m² (7.87 lb/sq ft)
Max power loading	8.97 kg/kW (14.77 lb/hp)

PERFORMANCE (48.5 kW, 65 hp engine, at max T-O weight):

Max level speed at S/L	74 kts (137 km/h; 85 mph)
Max cruising speed	65 kts (121 km/h; 75 mph)
Stalling speed	25 kts (45 km/h; 28 mph)
Max rate of climb at S/L	366 m (1,200 ft)/min
Service ceiling	4,875 m (16,000 ft)
T-O run	28 m (90 ft)
Landing run	39 m (125 ft)
Range: standard fuel	250 n miles (463 km; 287 miles)
with wing tanks	450 n miles (834 km; 5[illegible]8 miles)
Endurance	1 h 40 min
g limits	+4/−2

VERIFIED

ZENAIR STOL CH 701-AG

TYPE: Agricultural version of CH 701.

PROGRAMME: Operated extensively in South America. Micro Ag spraying/dusting system. Aircraft are assembled by Zenair's Colombian subsidiary, Agricopteros Ltda (which see).

CUSTOMERS: 55 sold by Spring 1995.

COST: Approximately $35,000, depending on equipment fit.

UPDATED

Ninth factory-built Zenair Zenith CH 2000, used as demonstrator *1995*

ZENAIR ZENITH CH 2000 TRAINER

TYPE: Two-seat multipurpose trainer.

PROGRAMME: Prototype C-FQCU completed June 1993. US and Canadian certification March 1994, first two production models (C-FRSK and C-FRSV) delivered April 1994. US and Canadian certification January 1995.

CUSTOMERS: 27 sold, four options by Spring 1995.

COSTS: Introductory price C$59,900 (with basic equipment).

DESIGN FEATURES: Side by side two-seat and smaller span derivative of Tri-Z CH 300. Designed to conform to FAR Pt 23 (JAR VLA equivalent level of safety) and aimed at primary training market. Wing section LS (1) 0417 (mod).

FLYING CONTROLS: Mechanical, except for electrically actuated flaps. Dual controls/dual rudder pedals.

STRUCTURE: Aluminium alloy, with stressed skins.

LANDING GEAR: Non-retractable tricycle type; optional floats and skis.

POWER PLANT: One 86.5 kW (116 hp) Textron Lycoming O-235, driving metal Sensenich CKS 6-0-54 propeller. Fuel capacity 90 litres (24 US gallons; 20 Imp gallons) standard, 180 litres (48 US gallons; 40 Imp gallons) optional.

AVIONICS: *Instrumentation*: Standard VFR. IFR will be available.

DIMENSIONS, EXTERNAL:

Wing span	7.60 m (24 ft 11 in)
Wing aspect ratio	5.36
Length overall	6.81 m (22 ft 4 in)
Height overall	2.34 m (7 ft 8 in)
Propeller diameter	1.83 m (6 ft 0 in)

AREAS:

Wings, gross	10.78 m² (116.0 sq ft)

WEIGHTS AND LOADINGS:

Max payload: with max fuel	180 kg (396 lb)
with standard fuel and baggage	220 kg (485 lb)
Max T-O weight	726 kg (1,600 lb)
Max wing loading	67.34 kg/m² (13.79 lb/sq ft)
Max power loading	8.39 kg/kW (13.79 lb/hp)

PERFORMANCE (estimated):

Max level speed	128 kts (236 km/h; 147 mph)
Econ cruising speed	104 kts (193 km/h; 120 mph)
Stalling speed	45 kts (82 km/h; 51 mph)
Max rate of climb at S/L	28[illegible] m (920 ft)/min
Service ceiling	3,660 m (12,000 ft)
T-O run	213 m (700 ft)
Landing run	183 m (600 ft)
Range: with max standard and optional fuel	851 n miles (1,577 km; 980 miles)
with max payload and standard fuel	425 n miles (788 km; 490 miles)
g limits	+3[illegible]/-1.5

UPDATED

Zenair STOL CH 701 *1994*

CHILE

ENAER

EMPRESA NACIONAL DE AERONÁUTICA DE CHILE

Avenida José Miguel Carrera 11087, P. 36 ½, Santiago
Telephone: 56 (2) 5282599, 5282735 and 5282823
Fax: 56 (2) 5282699
Telex: 645157 ENAER CT
CHAIRMAN: General Ramón V. Hidalgo (Ret'd)
COMMERCIAL DIRECTOR: Alejandro Vargas

State owned company, formed 1984 from IndAer industrial organisation set up 1980 by Chilean Air Force (FACh), workforce approximately 1,700; aircraft manufacture started 1979 with assembly of 27 Piper PA-28 Dakota lightplanes for Chilean Air Force and flying clubs; current or recent activities include design and production of aircraft and EW equipment, and upgrade programmes for Chilean Air Force.

Present main programmes are Pantera upgrade of FACh Mirage 50s, Tigre upgrade of FACh F-5Es, co-production (due to end in 1995) of CASA C-101 as A-36 Halcón, fin/tailplane manufacture of EMB-145 as Embraer risk-sharing partner, and subcontract manufacture of part of tail unit of Airtech CN-235. Own-design programmes comprise T-35DT Turbo Pillán military trainer and Ñamcu light aircraft.

UPDATED

ENAER T-35DT TURBO PILLÁN

TYPE: Two-seat turboprop military trainer (converted T-35D).

PROGRAMME: Original **T-35TX Aucán** turboprop prototype (CC-PZC; see 1988-89 *Jane's*) made first flight February 1986, flight trials suspended 1987 after some 500 flight

hours; subsequently modified to have new one-piece canopy opening sideways to starboard, oxygen system, and partial avionics upgrade. Soloy (see US Engines section) awarded 1990 contract to develop production-ready modification kit for existing T-35s, based on Allison 250-B17D engine; marketing effort began early 1991. First flight of this **T 35DT** 'prototype' (CC-PZG) March 1991; evaluation continued in 1994, but no orders yet announced.

COSTS: Approximately $950,000 (1994).

DESIGN FEATURES: As T-35 Pillán (see 1992-93 and earlier editions) except for adaptation to turboprop power plant. Wing section NACA 65_2-415 on constant chord inboard panels, NACA 65_2-415 (modified) at tips; incidence 2° at root, –0° 30′ at tip; dihedral 7° from roots.

FLYING CONTROLS: Manual/mechanical actuation of primary control surfaces (ailerons slotted, elevator/rudder mass balanced); single-slotted wing flaps, aileron trim tab (port) and rudder/tailplane/elevator trim all electrically actuated; variable incidence tailplane; one-piece elevator.

STRUCTURE: Main structure of aluminium alloy and steel, with riveted skins, except for glassfibre engine cowling, wing tips and tailplane tips. Single-spar fail-safe wings, with components mainly from PA-28-236 Dakota (leading-edges) and PA-32R-301 Saratoga (trailing-edges), modified for shorter span; vertical tail virtually identical with Dakota; tailplane uses some standard components from Dakota and PA-31 (Navajo/Cheyenne); tailcone from Cherokee components, modified for narrower fuselage.

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel on each unit, nosewheel steerable ±25°. Main units retract inward, nosewheel rearward. Piper oleo-pneumatic shock-absorber in each unit. Emergency free-fall extension. Cleveland mainwheels and McCreary tyres size 6.00-6 (8 ply), nosewheel and tyre size 5.00-5 (6 ply). Tyre pressures: 2.62 bars (38 lb/sq in) on mainwheels, 2.41 bars (35 lb/sq in) on nosewheel. Single-disc air-cooled hydraulic brake on each mainwheel. Parking brake. Minimum ground turning radius 6.20 m (20 ft 4 in).

POWER PLANT: One 313 kW (420 shp) Allison 250-B17D turboprop in Soloy inverted installation with Soloy reduction gearbox; Hartzell HC B3TF-7A/T9212K-2B three-blade constant-speed reversible-pitch propeller. Total usable fuel 277.8 litres (73.4 US gallons; 61.1 Imp gallons), in two integral wing tanks and one central tank. Inverted-flight fuel feed system.

ENAER A-36 Halcón in Fuerza Aérea de Chile insignia *(Denis Hughes)*

1992

ACCOMMODATION: Two vertically adjustable seats, with seat belts and shoulder harnesses, in tandem beneath one-piece transparent jettisonable canopy which opens sideways to starboard. One-piece acrylic windscreen, and one-piece window in glassfibre fairing aft of canopy. Rear (instructor's) seat 22 cm (8.7 in) higher. Dual controls standard. Baggage compartment aft of rear cockpit, with external access on port side. Cockpits ventilated; cockpit heating and canopy demisting by engine bleed air.

SYSTEMS: Electrically operated hydraulic system, at 124 bars (1,800 lb/sq in) pressure for landing gear retraction and 44.8 bars (650 lb/sq in) for gear extension; separate system at 20.7 bars (300 lb/sq in) for wheel brakes. Electrical system is 28 V DC, powered by 28 V 80 A engine-driven starter/generator and 24 V 20 Ah lead acid battery, with inverter for AC power at 400 Hz to operate RMIs and attitude indicators. External power socket. Oxygen system.

AVIONICS: *Comms:* Dual VHF/VOR transceivers and audio selector panels, ATC transponder.

Flight: DME with dual indicators, dual HSI, ADF, dual RMI, marker beacon receiver, dual magnetic compasses, dual directional gyros and slave meter.

Instrumentation: Blind-flying instrumentation standard.

DIMENSIONS, EXTERNAL:

Wing span	8.84 m (29 ft 0 in)
Wing chord: at root	1.88 m (6 ft 2 in)
constant portion	1.60 m (5 ft 3 in)
at tip	1.26 m (4 ft 1½ in)
Wing aspect ratio	5.71
Length overall	8.41 m (27 ft 7 in)
Height overall	2.64 m (8 ft 8 in)
Tailplane span	3.05 m (10 ft 0 in)
Wheel track	3.01 m (9 ft 10½ in)
Wheelbase	2.00 m (6 ft 6¾ in)
Propeller diameter	1.93 m (6 ft 4 in)

DIMENSIONS, INTERNAL:

Cockpit: Length	3.24 m (10 ft 7½ in)
Max width	1.04 m (3 ft 5 in)
Max height	1.48 m (4 ft 10¼ in)

AREAS:

Wings, gross	13.69 m² (147.36 sq ft)
Ailerons (total)	1.14 m² (12.27 sq ft)
Trailing-edge flaps (total)	1.36 m² (14.64 sq ft)
Fin	0.69 m² (7.43 sq ft)
Rudder	0.38 m² (4.09 sq ft)
Tailplane	1.57 m² (16.90 sq ft)
Elevator	0.77 m² (8.29 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	943 kg (2,080 lb)
Fuel weight: usable	224 kg (494 lb)
max	238 kg (524 lb)
T-O and landing weight: Aerobatic	1,315 kg (2,900 lb)
max	1,338 kg (2,950 lb)
Max wing loading	97.73 kg/m² (20.03 lb/sq ft)
Max power loading	4.27 kg/kW (7.02 lb/shp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (V_{NE}) 241 kts (446 km/h; 277 mph) IAS

Max manoeuvring speed (V_A) 183 kts (339 km/h; 211 mph) IAS

Max level speed at S/L 230 kts (426 km/h; 264 mph)

Cruising speed: 75% power at 2,320 m (7,616 ft) 182 kts (337 km/h; 209 mph)

65% power at 3,450 m (11,320 ft) 176 kts (326 km/h; 203 mph)

55% power at 4,630 m (15,190 ft) 169 kts (313 km/h; 194 mph)

Max speed with flaps extended 118 kts (218 km/h; 135 mph)

Max speed with landing gear extended 138 kts (255 km/h; 158 mph)

Landing speed 90 kts (166 km/h; 103 mph)

Stalling speed, power off:

flaps and landing gear up 66 kts (123 km/h; 76 mph)

flaps and landing gear down 62 kts (115 km/h; 71 mph)

Max rate of climb at S/L	670 m (2,200 ft)/min
Service ceiling	7,620 m (25,000 ft)
Absolute ceiling	8,075 m (26,500 ft)
Time to 2,000 m (6,560 ft)	3 min 30 s
Time to 3,000 m (9,850 ft)	5 min 30 s
T-O run	195 m (640 ft)
T-O to 15 m (50 ft)	357 m (1,175 ft)
Landing from 15 m (50 ft)	555 m (1,820 ft)
Landing run	128 m (420 ft)

Range, 45 min reserves:

75% power at 2,500 m (8,200 ft) 350 n miles (648 km; 403 miles)

55% power at 4,000 m (13,125 ft) 410 n miles (759 km; 472 miles)

Range, no reserves: 65% power at 5,485 m (18,000 ft) 579 n miles (1,072 km; 666 miles)

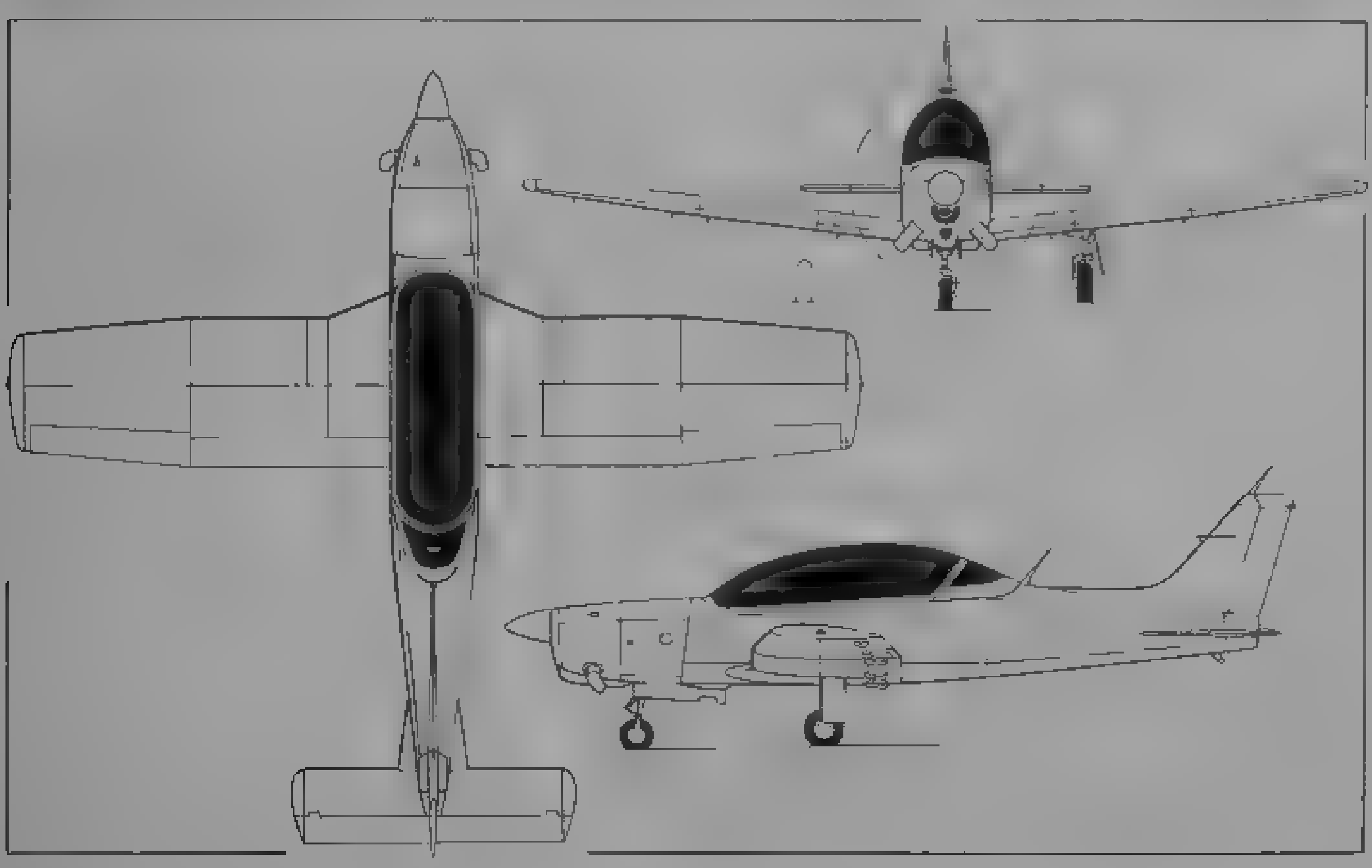
Endurance: 55% power at 3,660 m (12,000 ft) 3 h 30 min

g limits +6/–3

UPDATED

Prototype T-35DT Turbo Pillán, converted by Soloy *(Paul Jackson)*

1995



ENAER T 35DT Turbo Pillán tandem-seat turboprop trainer *(Jane's/Dennis Punnett)*

1993

ENAER T-36 and A-36 HALCÓN (HAWK)

TYPE: Licence-built CASA C-101 (see under Spain).

PROGRAMME: Chilean Air Force (FACh) contract 1980 included licence for progressive increase from CKD kit assembly to local manufacture of part of airframe. A-36 made first flight November 1983; ENAER began phase 3B

(manufacture of hydraulic and electrical systems, and small subassemblies) third quarter 1989 with aircraft s/n 417, final phase 4 involves manufacture of forward fuselages, tail units and flying control surfaces

CURRENT VERSIONS: **T-36**: Trainer version (CASA C-101BB-02), with 16.46 kN (3,700 lb st) AlliedSignal TFE731-3 turbofan, entered service with Escuela de Aviación Capitan Avalos at El Bosque AB, Santiago, in 1982. Four built in Spain, 10 assembled by ENAER. T-36s upgraded to **A-36BB** standard 1986 and reissued to Grupo 1 of Ala 4/I Brigada Aérea at Los Condores, northern Chile, to provide Curso Tactico Basico basic training courses. Production complete.

A-36CC: Attack version (CASA C-101CC-02), with 19.13 kN (4,300 lb st) TFE731-5 turbofan (increasable to 20.91 kN; 4,700 lb st with military power reserve); in service with Grupo 12 of Ala 3/IV Brigada Aérea at Carlos Ibánez AB in extreme south of Chile, providing Curso Tactico Avanzado advanced training courses. Four built in Spain (s/n 413 complete, plus 414-416 as kits for Chilean assembly) further 19 being co-produced by ENAER, latter programme due for completion by mid-1995

AVIONICS: *Radar*: Ranging radar (both versions)

ARMAMENT: Provision for SCAR-81 pod containing 30 mm DEFA 553 cannon

CUSTOMERS: Chilean Air Force (14 A-36BBs and 23 A-36CCs)

UPDATED

ENAER ÑAMCU (EAGLET)

TYPE: Two-seat light aircraft

PROGRAMME: Launched June 1986 under project name Avión Liviano (light aircraft), prototype construction started February 1987 (three to be built), first flight (CC-PZI) April 1989; first flight of second prototype (CC-PZJ) early March 1990; second prototype since lost. ENAER planning to sell in both factory built and kit form, first prototype flew demonstrations in USA early 1994, fourth (third flying) prototype (CC-PZL) then being readied to undertake certification programme

DESIGN FEATURES: First ENAER aircraft of all-Chilean design intended as small, inexpensive club aircraft, initially for domestic market and later for export, fully aerobatic training capability, conforms to FAR Pt 23 (Utility category)

Wing section NACA 63_2-415, incidence 3° at root, 0 30' at tip, dihedral 5° from roots

FLYING CONTROLS: Conventional primary surfaces (plain ailerons, balanced elevators and rudder), mechanically actuated; trim tab in starboard elevator, plain flaps on wing trailing-edges

STRUCTURE: All-composites (glassfibre/foam sandwich), including movable surfaces, glassfibre/carbonfibre type C main spar with carbonfibre spar caps

LANDING GEAR: Non-retractable tricycle type. Cantilever spring steel main units, steerable and self-centring nose unit with oleo-pneumatic shock-absorber and shimmy damper. Cleveland wheel and Goodyear 6 ply tyre on each unit, all three tyres size 5.00-5. Cleveland hydraulic main wheel disc brakes

Prototype ENAER Ñamcu two-seat light aircraft (*Jane's/Charles Bickers*)

1993

POWER PLANT: One Textron Lycoming O-235-N2C flat-four engine (86.5 kW; 116 hp at 2,800 rpm), driving an MT 178 R115-2C two-blade fixed-pitch wooden propeller. Integral fuel tank in each wing leading-edge, combined capacity 100 litres (26.4 US gallons, 22 Imp gallons); overwing gravity fuelling point for each tank

ACCOMMODATION: Two seats side by side in fully enclosed cockpit, with adjustable headrests and four piece safety harnesses. Dual controls. Two independent gull wing window/doors, hinged on centreline to open upward. Space for 10 kg (22 lb) of baggage aft of seats. Cockpit heated and ventilated. Electric defrosting of windscreen

SYSTEMS: Hydraulic system for brakes only. Electrical power supplied by Prestolite 12 V 70 A alternator and 12 V 35 Ah lead-acid battery

AVIONICS: *Comms*: Walter Dittel FSG 71M 760-channel VHF transceiver and intercom standard

Instrumentation: VFR flight and engine instrumentation standard; IFR optional

DIMENSIONS, EXTERNAL:	
Wing span	8.31 m (27 ft 3¼ in)
Wing chord: at root	1.53 m (5 ft 0¼ in)
at tip	0.84 m (2 ft 9 in)
Wing aspect ratio	6.90
Length overall	7.05 m (23 ft 1½ in)
Height overall	2.42 m (7 ft 11¼ in)
Tailplane span	3.00 m (9 ft 10 in)
Wheel track	2.54 m (8 ft 4 in)
Wheelbase	1.50 m (4 ft 11 in)
Propeller diameter	1.78 m (5 ft 10 in)
DIMENSIONS, INTERNAL:	
Cockpit: Max width	1.22 m (4 ft 0 in)
AREAS:	
Wings, gross	10.01 m² (107.75 sq ft)
Ailerons (total)	0.44 m² (4.74 sq ft)
Trailing-edge flaps (total)	0.92 m² (9.90 sq ft)
Fin	0.88 m² (9.47 sq ft)
Rudder	0.34 m² (3.66 sq ft)
Tailplane	2.08 m² (22.39 sq ft)
Elevators (total)	0.76 m² (8.18 sq ft)
WEIGHTS AND LOADINGS:	
Basic weight empty	546 kg (1,204 lb)
Max fuel	72 kg (159 lb)
Max T-O and landing weight	800 kg (1,763 lb)
Max wing loading	79.92 kg/m² (16.38 lb/sq ft)
Max power loading	9.25 kg/kW (15.20 lb/hp)
PERFORMANCE (at max T-O weight except where indicated):	
Never-exceed speed (VNE)	177 kts (328 km/h, 204 mph)
Max level speed at S/L	127 kts (235 km/h; 146 mph)
Max cruising speed, 75% power at 2,440 m (8,000 ft)	103 kts (191 km/h; 119 mph)
Stalling speed, power off:	
flaps up	56 kts (104 km/h, 65 mph)
flaps down	50 kts (93 km/h, 58 mph)
Max rate of climb at S/L	295 m (968 ft)/min
Service ceiling	4,270 m (14,000 ft)
T-O run	304 m (998 ft)
T-O to 15 m (50 ft)	412 m (1,352 ft)
Landing from 15 m (50 ft)	364 m (1,195 ft)
Landing run	177 m (581 ft)
Range at 75% power at 2,440 m (8,000 ft) with max fuel, 10% reserves	495 n miles (917 km, 570 miles)
Endurance, conditions as above	3 h 40 min
g limits	+4.4/−2.2

UPDATED

OTHER AIRCRAFT

Refer to 1994-95 and earlier editions for **T-35 Pillán**, and to *Jane's Aircraft Upgrades* for **Pantera 50C** conversion of Dassault Mirage 50

NEW ENTRY

CHINA, PEOPLE'S REPUBLIC

AVIC

AVIATION INDUSTRIES OF CHINA

67 Jiao Nan Street (PO Box 33), Beijing 100712
Telephone: 86 (10) 4019360
Fax: 86 (10) 4013648
PRESIDENT: Zhu Yuli
VICE-PRESIDENTS:
Wang Ang
Zhang Hongbiao
Zhang Yanzhong
GENERAL MANAGER: Mao Dehua
CHIEF ENGINEER: Yan Huif
INTERNATIONAL MARKETING:

CATIC (China National Aero-Technology Import and Export Corporation)
CATIC Plaza, 8 Beichen East Street, Chaoyang District, Beijing 100101
Telephone: 86 (10) 4940370 and 4941090
Fax: 86 (10) 4941088 and 4940658
Telex: 22318 AEROT CN
PRESIDENT: Liu Guomin
EXECUTIVE VICE-PRESIDENT: Tang Xiaoping
DIRECTOR, PUBLIC RELATIONS: Bi Jianía

Former Ministry of Aero-Space Industry abolished 1993 and AVIC created on 26 June 1993 as economic entity to develop market economy and expand international collaboration in aviation programmes. CATIC Group formed 26 August 1993, with CATIC (founded January 1979) as its core company, to be responsible for import and export of aero and non-aero products, subcontract work and joint ventures.

There are design and development centres at Shenyang, Beijing, Harbin and elsewhere. Over 13,000 aircraft and 50,000 aero-engines produced since 1949, of which more than 700 exported, approximately 10 per cent of exported aircraft are civil types. Xian, Chengdu, Shanghai, Shenyang, Harbin and other factories also carry out subcontract work on Airbus A300/A310/A320, ATR 42, BAe 146 and Jetstream 61; Boeing 737/747/757; de Havilland Dash 8, Canadair CL-215, McDonnell Douglas MD-80 series and Shorts 360.

Total workforce of aerospace industry approximately 560,000 in 1994, although most factories also have wide range of non-aerospace products. Transition from military to civil aerospace products being accelerated. Discussing co-development with South Korea and Germany of 100-seat regional airliner (see KCAD/AVIC/DASA entry in International section)

UPDATED

CAC

CHENGDU AIRCRAFT INDUSTRIAL CORPORATION

PO Box 800, Chengdu, Sichuan 610092
Telephone: 86 (28) 669629
Fax: 86 (28) 6698.6
Telex: 60132 CCDAC CN
PRESIDENT: Yang Baoshu
GENERAL MANAGER: Hou Jianwu
DEPUTY GENERAL MANAGER: Li Shaoming
DIRECTOR, INTERNATIONAL CO-OPERATION DIVISION:
Wang Yinggong

Major centre for fighter development and production, founded 1958, has since built over 2,000 fighters of more than 10 models or variants; current facility occupies site area of 462 ha (1.142 acres) and had 1994 workforce of nearly 20,000. Production includes J-7/F-7 fighter series (several models), limited batch production of JJ-5/FT-5 fighter trainer (see 1994-95 and earlier editions) may now have ended. New fighter currently under development (see 'XJ-10' entry which follows). Subcontract work includes July 1988 contract for 100 nosecones for McDonnell Douglas MD-80/90 series, both for Shanghai MD-82/83 programme (see SAMF entry in this section; first one delivered 13 December 1991) and for US production line. Output also includes various non-aerospace products

UPDATED

CAC (MIKOYAN) J-7

Chinese name: Jianjiji-7 (Fighter aircraft 7) or Jian-7
Westernised designation: F-7

TYPE: Single-seat fighter and close support aircraft.

PROGRAMME: Soviet licence to manufacture MiG-21F-13 and its R-11F-300 engine granted to Chinese government 1961, when some pattern aircraft and CKD (component

knocked down) kits delivered, but necessary technical documentation not completed; assembly of first J-7 using Chinese made components began early 1964, original plan in 1964-65 was for Chengdu and Guizhou factories to become main airframe/engine production centres for J-7 backed up by Shenyang until these were fully productive, but plans affected by onset of cultural revolution. Static testing completed November 1965, first flight of Shenyang built J-7, 17 January 1966; Chengdu production of J-7 I began June 1967, development of J-7 II began 1975, followed by first flight 30 December 1978 and production approval September 1979, development of F-7M and J-7 III started 1981, J-7 III first flight 26 April 1984, F-7M revealed publicly October 1984, production go-ahead December 1984, named Airguard early 1986; first F-7P deliveries to Pakistan 1988, first F-7MPs to Pakistan mid 1989.

CURRENT VERSIONS: **J-7**: Initial licence version using Chinese made components; built at Shenyang, few only.

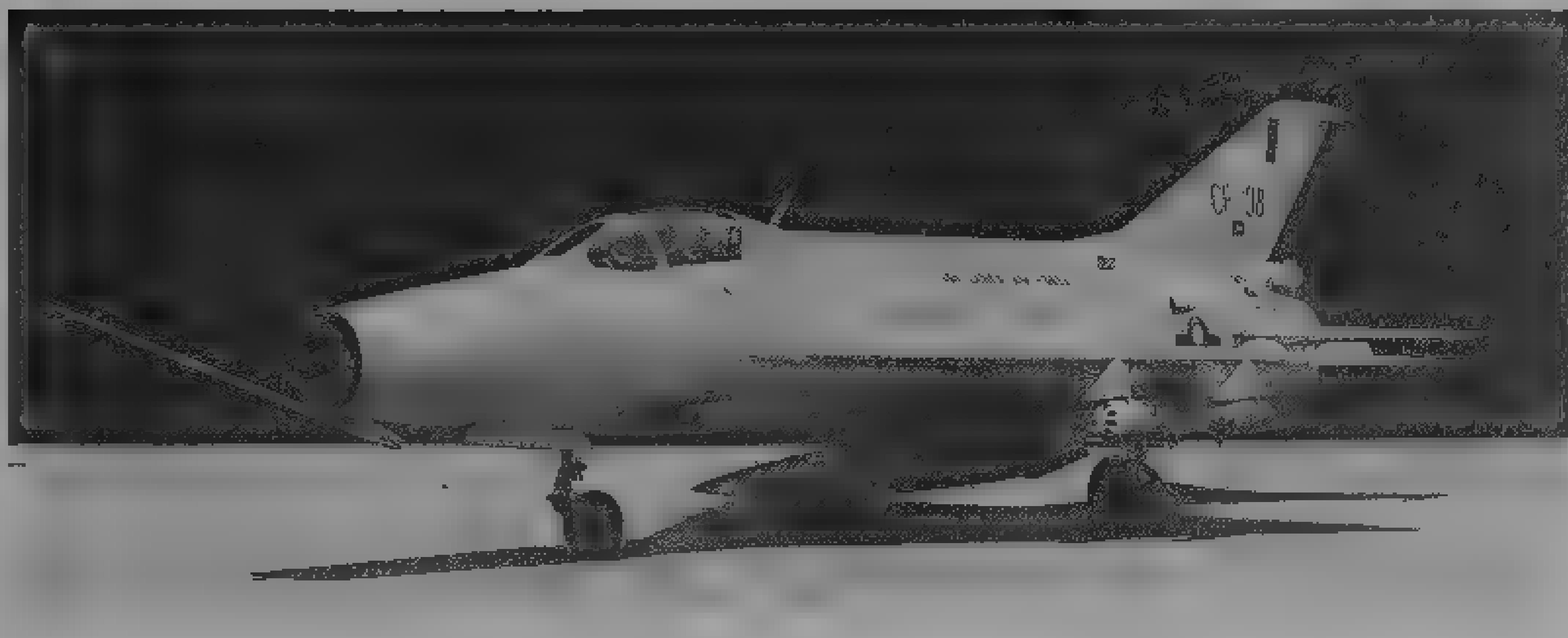
J-7 I: Initial Chengdu version for PLA Air Force (1967) with variable intake shock cone and second 30 mm gun, not accepted in large numbers, due mainly to unsatisfactory escape system (front-hinged canopy, to which ejection seat was attached).

F-7A: Export counterpart of J-7 I, supplied to Albania and Tanzania.

J-7 II: Modified and improved development of J-7 I, with WP7B turbojet of increased thrust (43.15 kN, 9,700 lb st dry, 59.82 kN, 13,448 lb st with afterburning), 720 litre (190.2 US gallon, 158.4 Imp gallon) centreline drop tank for increased range, brake-chute relocated at base of rudder to improve landing performance and shorten run, rear hinged canopy, jettisoned before ejection seat deploys; new Chengdu Type II seat offering ejection at zero height and speeds down to 135 knots (250 km/h, 155 mph), and new Lanzhou compass system. Small batch production (eg 14 in 1989) may still continue, notwithstanding advent of J-7 III.

F-7B: Export version of J-7 II, with R550 Magic missile capability, supplied to Egypt and Iraq in 1982-83.

F-7BS: Hybrid version supplied to Sri Lanka 1991; has F-7B fuselage/tail and Chinese avionics (no HUD and so on), combined with four pylon wings of F-7M. Equips No. 5 Squadron.



CAC F-7BS of No. 5 Squadron, Sri Lanka Air Force *(Denis Hughes)*

1995

F-7M Airguard: Upgraded export version, developed from J-7 II, new avionics imported from May 1979 included GEC Marconi Avionics HUDWAC (head-up display and weapon aiming computer), new ranging radar, air data computer, radar altimeter and IFF; more secure com radio; improved electrical power generation system for the new avionics, two additional underwing stores points, improved WP7B(BM) engine, birdproof windscreen, strengthened landing gear; ability to carry PL-7 air-to-air missiles, nose probe relocated from beneath intake to top lip of intake, offset to starboard. Exported to Bangladesh, Iran (18) and Zimbabwe. In production. *Description applies to this version except where indicated.*

F-7MG and F-7PG: New designations mentioned in 1995 CATIC brochure, no details known.

F-7P Airguard: Variant of F-7M (briefly called Skybolt), embodying 24 modifications to meet specific requirements of Pakistan Air Force, including ability to carry four air-to-air missiles (Sidewinders) instead of two and fitment of Martin-Baker Mk 10L ejection seat. Delivered 1988-91.

F-7MP: Further modified variant of F-7P, improved cockpit layout and navigation system incorporating Collins AN/ARN-147 VOR/ILS receiver, AN/ARN-149 ADF and Pro Line II digital DME-42. Avionics (contract for up to 100 sets) delivered to China from early 1989. FIAR Grifo 7 fire control radars (range of more than 30 n miles, 55 km, 34 miles) for F-7P and MP ordered 1993, to replace GMAv Skyranger, to be delivered 1994-95.

J-7 III: Chinese equivalent of MiG-21MF, much redesigned from J-7 II with blown flaps and all-weather, day/night capability. Main improvements are more powerful WP13 engine, additional fuel in deeper dorsal spine, JL-7 (J-band) interception radar, with correspondingly larger nose intake and centrebody radome, sideways opening (to starboard) canopy, with centrally located rearview mirror, improved HTY-4 low-speed/zero height ejection seat, more advanced fire control system, twin-barrel 23 mm gun under fuselage (with HK-03D optical gunsight); broader chord vertical tail surfaces, incorporating antennae for LJ-2 omnidirectional RWR in hemispherical fairing each side at base of rudder; increased weapon/stores capability (four underwing stations), similar to that of F-7M, and new or additional avionics (which see). Joint development by Chengdu and Guizhou (GAIC); thought to have entered PLA Air Force and Navy service from 1992.

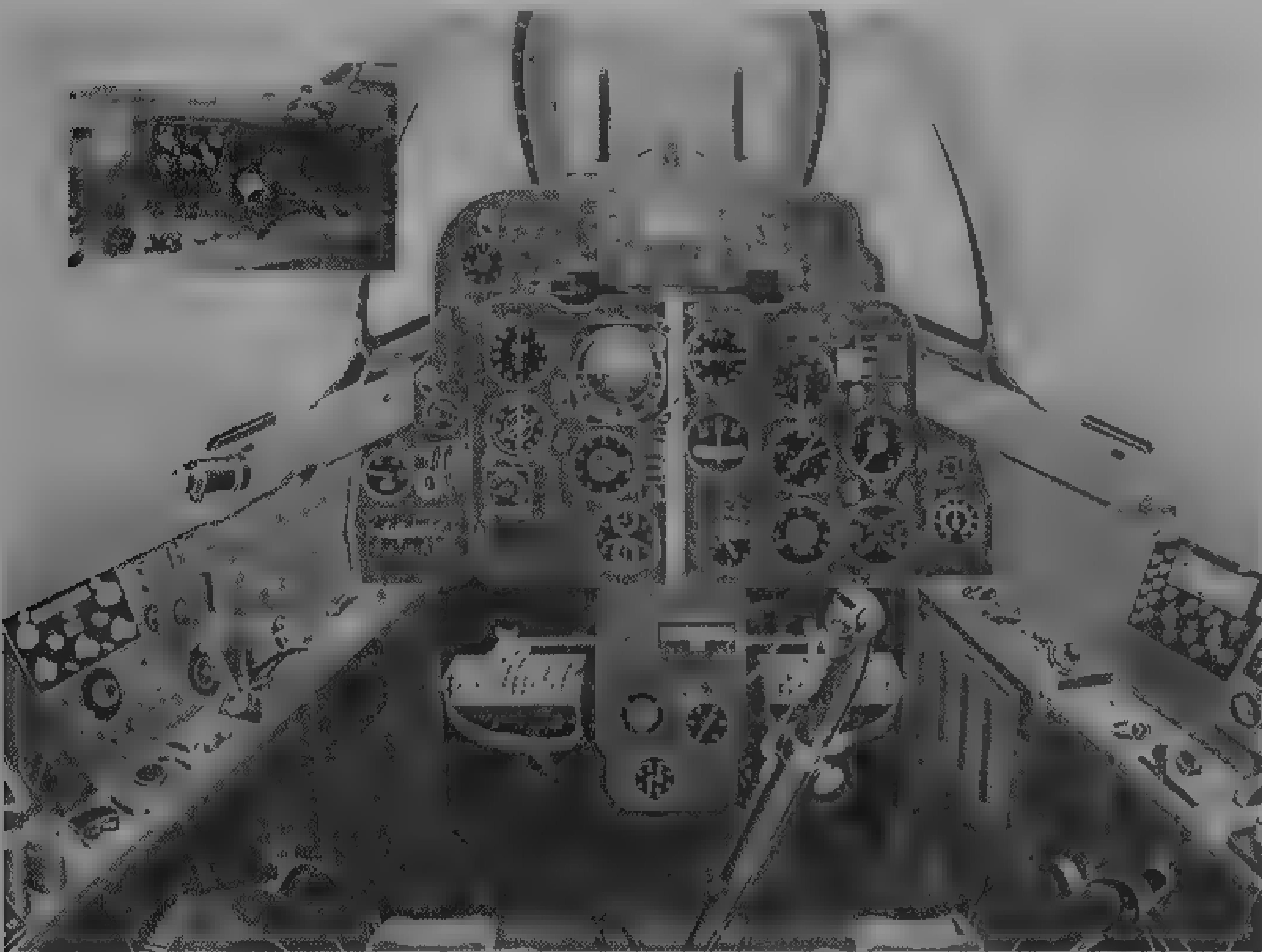
F-7 3: Export designation of J-7 III.

J-7E: Upgraded version of J-7 II with modified wing (see drawing), retaining existing leading-edge sweep angle of 57° inboard but reduced sweep of only 42° outboard, span increased by 1.17 m (3 ft 10 in) and area by 1.88 m² (20.2 sq ft), giving 8.17 per cent more wing area; four underwing stations instead of two, outer pair each plumbed for 480 litre (127 US gallon, 105.6 Imp gallon) drop tank; new WP7F version of WP7 engine, rated at 44.13 kN (9,921 lb st) dry and 63.74 kN (14,330 lb st) with afterburning; armament generally as listed for F-7M, but capability extended to include PL-8 air-to-air missiles, g limits of 8 (up to Mach 0.8) and 6.5 (above Mach 0.8); avionics include head-up display and air data computer. No firm evidence of production or service entry, despite reportedly having been due to fly in April 1990; could be the type stated by CAC President in January 1994 as finalised in design May 1993 followed by delivery of "a number" to PLA Air Force by end of that year.

Super-7: Proposed development of F-7M, described separately.

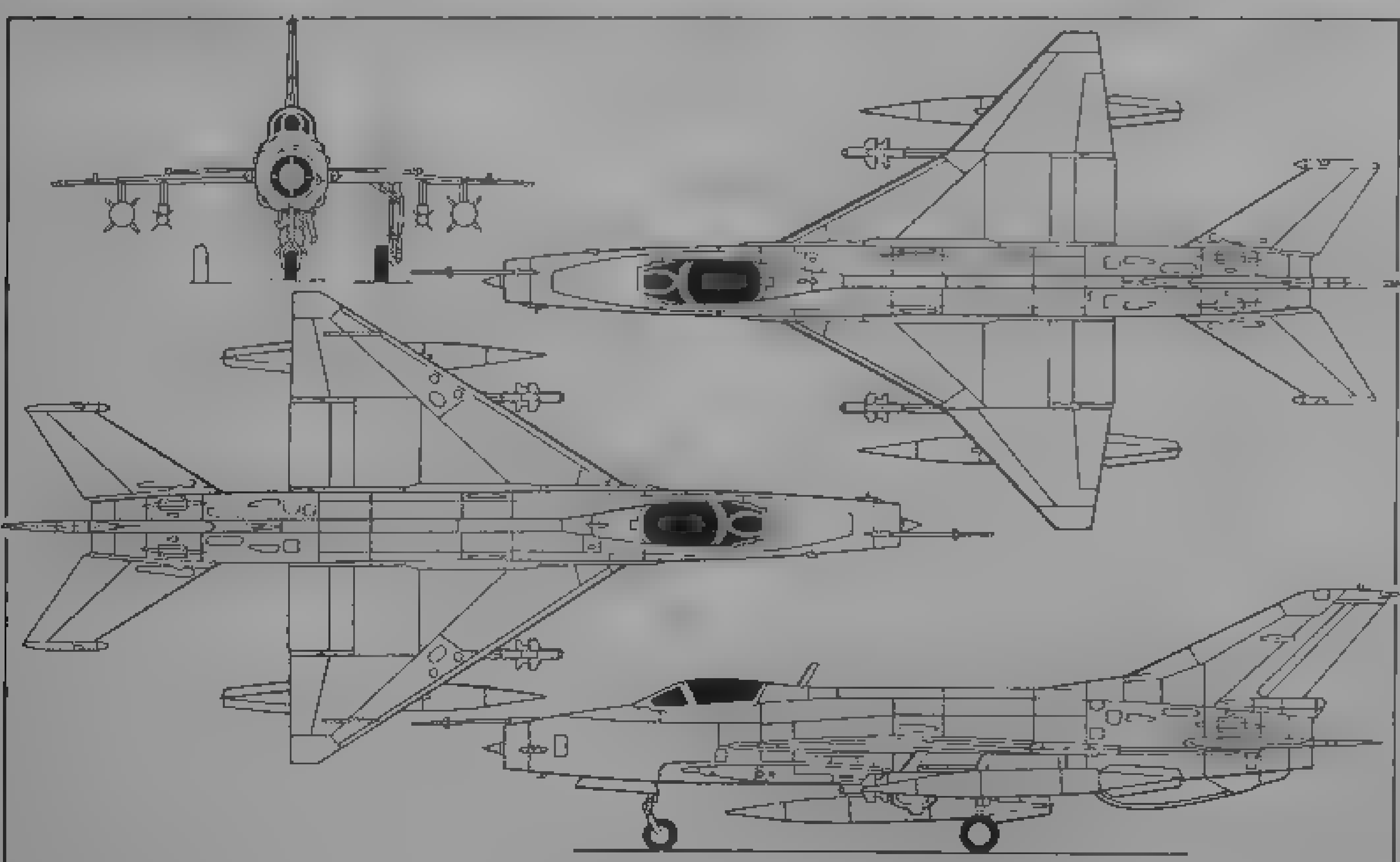
JJ-7/FT-7: Tandem two-seat operational trainer, based on J-7 II and MiG-21US, developed at Guizhou and described under GAIC entry.

CUSTOMERS: Several hundred built for Chinese air forces; over 400 exported to Albania (12 F-7A), Bangladesh (16 F-7M), Egypt (approximately 80 F-7B?), Iran (F-7M), Iraq (approximately 90 F-7B?), Myanmar (36 F-7M), Pakistan (20 F-7P and 60 F-7MP, all designated F-7P by PAF, more F-7MP reportedly on order), Sri Lanka (four F-7BS), Tanzania (16 F-7A) and Zimbabwe (22 F-7M). Pakistan Air



Cockpit layout of the F-7M Airguard

1993



CAC F-7M Airguard single-seat fighter and close support aircraft; upper plan view shows modified outer wings of J-7E *(Jane's/Mike Keep)*

1993

Force squadrons are No. 2 at Masroor, Nos. 18 and 20 at Rafiqui and No. 25 at Mianwali, F-7BSs serve with Sri Lanka's No. 5 Squadron.

DESIGN FEATURES: Diminutive tailed delta with clipped tips to mid-mounted wings, circular-section fuselage with dorsal spine, nose intake with conical centrebody; swept tail, with large vertical surfaces and ventral fin.

Wing anhedral 2° from roots; incidence 0°, thickness/chord ratio approximately 5 per cent at root, 4.2 per cent at tip; quarter-chord sweepback 49° 6′ 36″, no wing leading-edge camber.

FLYING CONTROLS: Manual operation, with autostabilisation in pitch and roll, hydraulically boosted inset ailerons, plain trailing-edge flaps, actuated hydraulically, forward hinged door type airbrake each side of underfuselage below wing leading-edge, third, forward-hinged airbrake under fuselage forward of ventral fin, airbrakes actuated hydraulically, hydraulically boosted rudder and all-moving, trimmable tailplane.

STRUCTURE: All-metal, wings have two primary spars and auxiliary spar, semi-monocoque fuselage, with spine housing control pushrods, avionics, single point refuelling cap and fuel tank, blister fairings on fuselage above and below each wing to accommodate retracted mainwheels.

LANDING GEAR: Inward-retracting mainwheels, with 600 × 200 mm tyres (pressure 11.5 bars, 166.8 lb/sq in) and LS-16 disc brakes, forward-retracting nosewheel, with 500 × 180 mm tyre (pressure 7.0 bars, 101.5 lb/sq in) and LS-15 double-acting brake. Nosewheel steerable ±47°. Minimum ground turning radius 7.04 m (23 ft 1¼ in). Tail braking parachute at base of vertical tail.

POWER PLANT: One Chengdu WP7B(BM) turbojet (43.15 kN; 9,700 lb st dry, 59.82 kN; 13,448 lb st with afterburning) in F-7M, WP13 turbojet (40.21 kN; 9,039 lb st dry, 64.72 kN; 14,550 lb st with afterburning) in J-7 III/F7-3. Total internal fuel capacity 2,385 litres (630 US gallons; 524.5 Imp gallons), contained in six flexible tanks in fuselage and two integral tanks in each wing. Provision for carrying a 500 or 800 litre (132 or 211.3 US gallon; 110 or 176 Imp gallon) centreline drop tank, and/or a 500 litre drop tank on each outboard underwing pylon. Maximum internal/external fuel capacity 4,185 litres (1,105.3 US gallons; 920.5 Imp gallons).

ACCOMMODATION: Pilot only, on CAC zero-height/low-speed ejection seat operable between 70 and 459 knots (130 and 850 km/h; 81 and 528 mph) IAS. Martin-Baker Mk 10L seat in F-7P/MP. One-piece canopy, hinged at rear to open upward. J-7 III/F7-3 canopy opens sideways to starboard.

SYSTEMS: Improved electrical system in F-7M, using three static inverters, to cater for additional avionics. Jianghuai YX-3 oxygen system.

AVIONICS: *Comms:* GMAv AD 3400 UHF/VHF multifunction com. Chinese Type 602 IFF transponder, Type 605A ('Odd Rods' type) IFF in J-7 III.

Radar: GMAv Type 226 Skyranger ranging radar in F-7M. FIAR Grifo 7 in F-7P/MP. Chinese JL-7 fire control radar in J-7 III.

Flight: Navigation function of HUDWAC includes approach mode. WL-7 radio compass, XS-6A marker beacon receiver, Type 0101 HR A/2 radar altimeter and GMAv air data computer in F-7M. Beijing Aeronautical Instruments Factory KJ-11 twin-channel autopilot and HJ-1 flight data recorder in J-7 III.

Instrumentation: GMAv Type 956 HUDWAC (head-up display and weapon aiming computer) in F-7M provides pilot with displays for instrument flying, with air-to-air and air-to-ground weapon aiming symbols integrated with flight-instrument symbology. It can store 32 weapon parameter functions, allowing for both current and future weapon variants. In air-to-air combat its four modes (missiles, conventional gunnery, snapshoot gunnery, dogfight and standby aiming reticle) allow for all eventualities.

Self-defence: Skyranger ECCM in F-7M. Chinese Type 930-2 RWR and GT-4 ECM jammer in J-7 III.

ARMAMENT (F-7M): Two 30 mm Type 30-1 belt-fed cannon, with 60 rds/gun, in fairings under front fuselage just forward of wingroot leading-edges. Two hardpoints under each wing, of which outer ones are wet for carriage of drop tanks. Centreline pylon used for drop tank only. Each inboard pylon capable of carrying a PL-2, -2A, -5B or -7 missile or, at customer's option, an R550 Magic, one 18-tube pod of Type 57-2 (57 mm) air-to-air and air-to-ground rockets; one Type 90-1 (90 mm) seven-tube pod of air-to-ground rockets, or a 50, 150, 250 or 500 kg bomb. Each outboard pylon can carry one of above rocket pods, a 50 or 150 kg bomb, or a 500 litre drop tank.

CAC F-7P fighters of the Pakistan Air Force (*Peter Steinemann*)

1993

ARMAMENT (J-7 III): One 23 mm Type 23-3 twin-barrel gun in ventral pack. Five external stores stations can carry two to four PL-2 or PL-5B air-launched missiles; two or four Qingan HF-16B 12-round launchers for Type 57-2 or seven-round pods of Type 90-1 rockets, or two 500 kg, four 250 kg or ten 100 kg bombs, in various combinations with 500 litre (one centreline and/or one under each wing) or 800 litre (underfuselage station only) drop tanks.

DIMENSIONS, EXTERNAL:
- Wing span: except J-7E — 7.154 m (23 ft 5⅝ in)
  - J-7E — 8.32 m (27 ft 3½ in)
- Wing chord: at root — 5.508 m (18 ft 0¾ in)
  - at tip (except J-7E) — 0.462 m (1 ft 6¼ in)
- Wing aspect ratio: except J-7E — 2.22
  - J-7E — 2.78
- Length overall: excl nose probe — 13.945 m (45 ft 9 in)
  - incl nose probe — 14.885 m (48 ft 10 in)
- Fuselage: Length — 12.177 m (39 ft 11½ in)
  - Max diameter — 1.341 m (4 ft 4 in)
- Height overall — 4.103 m (13 ft 5 in)
- Tailplane span — 3.74 m (12 ft 3¼ in)
- Wheel track — 2.692 m (8 ft 10 in)
- Wheelbase — 4.807 m (15 ft 9¼ in)

AREAS:
- Wings, gross: except J-7E — 23.00 m² (247.6 sq ft)
  - J-7E — 24.88 m² (267.8 sq ft)
- Ailerons (total): except J-7E — 1.18 m² (12.70 sq ft)
- Trailing-edge flaps (total) — 1.87 m² (20.13 sq ft)
- Fin — 3.48 m² (37.46 sq ft)
- Rudder — 0.97 m² (10.44 sq ft)
- Tailplane — 3.94 m² (42.41 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty — 5,275 kg (11,629 lb)
- Normal max T-O weight with two PL-2 or PL-7 air-to-air missiles: F-7M — 7,531 kg (16,603 lb)
  - J-7 III — 8,150 kg (17,967 lb)
- Wing loading at normal max T-O weight:
  - F-7M — 327.43 kg/m² (67.10 lb/sq ft)
  - J-7 III — 354.35 kg/m² (72.58 lb/sq ft)
- Power loading at normal max T-O weight:
  - F-7M — 125.5 kg/kN (1.230 lb/lb st)
  - J-7 III — 125.9 kg/kN (1.234 lb/lb st)

PERFORMANCE (F-7M at normal max T-O weight with two PL-2 or PL-7 air-to-air missiles, except where indicated):
- Never exceed speed (V_{NE}) above 12,500 m (41,010 ft) — Mach 2.35 (1,346 kts; 2,495 km/h; 1,550 mph)
- Max level speed between 12,500 and 18,500 m (41,010-60,700 ft) — Mach 2.05 (1,175 kts; 2,175 km/h; 1,350 mph)
- Unstick speed — 167-178 kts (310-330 km/h; 193-205 mph)
- Touchdown speed — 162-173 kts (300-320 km/h; 186-199 mph)
- Max rate of climb at S/L — 10,800 m (35,435 ft)/min
- Acceleration from Mach 0.9 to 1.2 at 5,000 m (16,400 ft) — 35 s
- Max sustained turn rate: Mach 0.7 at S/L — 14.7°/s
  - Mach 0.8 at 5,000 m (16,400 ft) — 9.5°/s
- Service ceiling — 18,200 m (59,710 ft)
- Absolute ceiling — 18,700 m (61,350 ft)
- T-O run — 700-950 m (2,297-3,117 ft)
- Landing run with brake-chute — 600-900 m (1,969-2,953 ft)
- Typical mission profiles:
  - combat air patrol at 11,000 m (36,000 ft) with two air-to-air missiles and three 500 litre drop tanks, incl 5 min combat — 45 min
  - long-range interception at 11,000 m (36,000 ft) at 351 n miles (650 km; 404 miles) from base, incl Mach 1.5 dash and 5 min combat, stores as above
  - hi-lo-hi interdiction radius, out and back at 11,000 m (36,000 ft), with three 500 litre drop tanks and two 150 kg bombs — 324 n miles (600 km; 373 miles)
  - lo-lo-lo close air support radius with four rocket pods, no external tanks — 200 n miles (370 km; 230 miles)
- Range: two PL-7 missiles and three 500 litre drop tanks — 939 n miles (1,740 km; 1,081 miles)
  - self-ferry with one 800 litre and two 500 litre drop tanks, no missiles — 1,203 n miles (2,230 km; 1,385 miles)
- g limit — +8

PERFORMANCE (J-7 III at normal max T-O weight):
- Max operating Mach number — 2.1
- Unstick speed (with afterburning) — 173 kts (320 km/h; 199 mph)
- Touchdown speed (with flap blowing) — 146 kts (270 km/h; 168 mph)
- Min level flight speed — 140 kts (260 km/h; 162 mph)
- Max rate of climb at S/L — 9,000 m (29,525 ft)/min
- Service ceiling — 18,000 m (59,050 ft)
- Acceleration from Mach 1.2 to 1.9 at 13,000 m (42,650 ft) — 3 min 27 s
- Air turning radius at 5,000 m (16,400 ft) at Mach 1.2 — 5,093 m (16,710 ft)
- T-O run (with afterburning) — 800 m (2,625 ft)
- Landing run (with flap blowing, drag-chute and brakes deployed) — 550 m (1,805 ft)
- Range: on internal fuel — 518 n miles (960 km; 596 miles)
  - with 800 litre belly tank — 701 n miles (1,300 km; 807 miles)
  - with 800 litre belly tank and two 500 litre underwing tanks — 1,025 n miles (1,900 km; 1,180 miles)
- g limits: up to Mach 0.8 — +8.5
  - above Mach 0.8 — +7

UPDATED

CAC J-7 III of the Chinese PLA Air Force touching down after a mission

1995

CAC SUPER-7

TYPE: Development of F-7M Airguard.

PROGRAMME: Agreement between CATIC and Grumman (USA) for joint preliminary design signed 21 October 1988, but Grumman participation suspended by US government mid-1989. Preliminary design and wind tunnel testing completed. CATIC now co-operating with PAC (Pakistan) to continue programme. First flight planned for 1996.

DESIGN FEATURES: Lateral air intakes for more powerful engine; 'solid' ogival nosecone for modern fire control radar, wings of enlarged span and area, with leading-edge slats and additional stations at wingtips for air-to-air missiles; enlarged dorsal spine housing additional fuel, single-point pressure refuelling; easier access engine compartment, arrester hook, modified ventral fin, strengthened main landing gear with larger tyres, new straight-leg, steerable nosewheel unit, belly mounted twin-barrel 23 mm gun instead of two internal 30 mm; new cockpit, incorporating HUD and new ejection seat, revised ECS for avionics cooling.

CUSTOMERS: Pakistan regarded as main market.

POWER PLANT: Original Western candidates (GE F404 and Turbo-Union RB199) discarded in favour of Russian

alternatives: *China Aviation News* reported February 1994 that Klimov RD-33 selected as power plant, other sources have suggested that first flight might be made with Saturn (Lyulka) AL-31F turbofan

DIMENSIONS, EXTERNAL:

Wing span	8.98 m (29 ft 5½ in)
Length overall	15.30 m (50 ft 2½ in)
Height overall	4.13 m (13 ft 6½ in)
Wheel track	2.79 m (9 ft 1¾ in)
Wheelbase	5.59 m (18 ft 4 in)

AREAS:

Wings, gross	approx 24.62 m² (265.0 sq ft)

WEIGHTS AND LOADINGS (estimated):

Internal fuel	2,327 kg (5,130 lb)
Design gross weight	9,100 kg (20,062 lb)
Max T-O weight	11,295 kg (24,900 lb)

PERFORMANCE (estimated):

Max level speed	above Mach 1.8
Service ceiling	16,765 m (55,000 ft)
T-O distance	555 m (1,821 ft)
Landing distance	860 m (2,822 ft)
Mission radius:	
air-to-air (hi-hi-hi)	475 n miles (880 km, 547 miles)
air-to-ground (hi-lo-hi)	329 n miles (610 km, 379 miles)
g limit (max)	+8.5

UPDATED

Model of the Super-7 advanced development of the F-7M (*Jane's/Kenneth Munson*) 1994

CAC 'XJ-10'

As reported in recent editions of *Jane's* under CAC J-9 heading, Chengdu believed to have been developing new-generation multirole fighter to replace J-7 family and NAMC Q-5. Prototype of J-9 reported, apparently erroneously, to have made first flight on 5 September 1991; allegedly 10 to 15 tonne (22,045 to 33,070 lb) sweptwing design with close-coupled canards and fly-by-wire control system. No firm evidence of this fighter's existence forthcoming, however since October 1994 reports have emerged from sources in China and Israel of collaborative venture between CAC and IAI, said to bear some resemblance to cancelled IAI Lavi and incorporating 'some technology' from that aircraft – most probably avionics similar to those in current IAI F-5 Plus upgrade package. Existence of programme (reported provisional designation XJ-10) confirmed by some US and Israeli defence officials, denied by official Chinese sources. Prototype expected to fly early 1996, possibly with Saturn/Lyulka AL-31F turbofan, production version to have Chinese engine and enter service early next century.

NEW ENTRY

CHAIC

CHANGHE AIRCRAFT INDUSTRIES CORPORATION

PO Box 109, Jingdezhen, Jiangxi 333002
Telephone: 442019
Telex: 95027 CHAF CN
GENERAL MANAGER: Yuan Yaohui

CHAIC (formerly Changhe Aircraft Factory), built on a 234 ha (578 acre) site at Jingdezhen, began producing coaches and commercial road vehicles in 1974. These and other automotive products still account for most of output but after being placed under MAS jurisdiction it batch-produced helicopters and is one of three members (with Harbin Aircraft Manufacturing Corporation and China Helicopter Design and Research Institute) of China Helicopter Industry Corporation. CHAIC's 1994 workforce of 6,800 included more than 2,000 engineers and technicians.

UPDATED

Second prototype CAF Z-8 three-turboshaft helicopter 1993

CHAIC Z-8

Chinese name: Zhishengji-8 (Vertical take-off aircraft 8) or Zhi-8

TYPE: Multirole military and civil helicopter.

PROGRAMME: Design work begun 1976, but suspended from 1979 to mid-1984; initial flights of first prototype 11 December 1985, second prototype October 1987; domestic type approval awarded 8 April 1989; first Z-8 handed over to PLA Naval Air Force for service trials 5 August 1989; initial production approved; final design approval granted 12 November 1994. Applications expected to include troop transport, ASW/ASV, search and rescue, minelaying/sweeping, aerial survey and firefighting.

CURRENT VERSIONS: Standard version, *as described*.

CUSTOMERS: Seven delivered to Chinese PLA Navy by end of 1994.

DESIGN FEATURES: Chinese equivalent of Aerospatiale Super Frelon (see 1982-83 *Jane's*). Six-blade main rotor and five-blade tail rotor; boat-hull fuselage with watertight compartments inside planing bottom; stabilising float at rear each side, attached to small stub-wing; small, strut braced fixed horizontal stabiliser on starboard side of tail rotor pylon.

FLYING CONTROLS: Pitch control fitting at root of each main rotor blade, drag and flapping hinges for each blade mounted on rotor head starplates, each main blade also has a hydraulic drag damper. Fully redundant flight control system, with Dong Fang KJ 8 autopilot.

STRUCTURE: Stressed skin metal fuselage, with riveted watertight compartments; gearboxes manufactured by Zhongnan Transmission Machinery Factory.

LANDING GEAR: Non-retractable tricycle type, with twin wheels and low-pressure oleo-pneumatic shock-absorber on each unit. Small tripod tailskid under rear of tailboom. Boat hull and side floats permit emergency water landings and take-offs.

POWER PLANT: Three Changzhou (CLXMW) WZ6 turboshafts, each with maximum emergency rating of 1,156 kW (1,550 shp) and 20 per cent power reserve at S/L, ISA. Two engines side by side in front of main rotor shaft and one aft of shaft. Transmission rated at 3,072 kW (4,120 shp). Standard internal fuel capacity 3,900 litres (1,030 US gallons; 858 Imp gallons), in flexible tanks under floor of centre fuselage. Auxiliary fuel tanks can be carried inside cabin for extended range or self ferry missions, increasing total capacity to 5,800 litres (1,532 US gallons; 1,276 Imp gallons).

ACCOMMODATION: Crew of two or three on flight deck. Accommodation in main cabin for up to 27 fully armed troops, or 39 without equipment, up to 15 stretchers and a medical attendant in ambulance configuration, a BJ-212 jeep and its crew; or other configurations according to mission. Entire accommodation heated, ventilated, soundproofed and vibration-proofed. Forward-opening crew door on each side of flight deck. Rearward-sliding door at front of cabin on starboard side. Hydraulically actuated rear-loading ramp/door.

EQUIPMENT: Equipment for SAR role can include 275 kg (606 lb) capacity hydraulic rescue hoist and two five-person liferafts. Can also be equipped with sonar, sonobuoys, search radar, or equipment for oceanography, geological survey and forest firefighting.

ARMAMENT: Can be equipped with torpedoes, anti-shipping missiles, or gear for minelaying (eight 250 kg mines) or minesweeping.

DIMENSIONS, EXTERNAL:

Main rotor diameter	18.90 m (62 ft 0 in)
Tail rotor diameter	4.00 m (13 ft 1½ in)
Length overall, rotors turning	23.035 m (75 ft 7 in)
Height overall, rotors turning	6.66 m (21 ft 10¼ in)
Width over main gear sponsons	5.20 m (17 ft 0¾ in)

AREAS:

Main rotor blades (each)	5.10 m² (54.90 sq ft)
Tail rotor blades (each)	0.56 m² (6.03 sq ft)
Main rotor disc	280.48 m² (3,019.1 sq ft)
Tail rotor disc	12.57 m² (135.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	7,550 kg (16,645 lb)
Max cargo payload: internal	4,000 kg (8,818 lb)
on external sling	5,000 kg (11,023 lb)
Max hovering weight OGE at S/L	12,480 kg (27,513 lb)
Max T-O weight: standard fuel	10,592 kg (23,351 lb)
with auxiliary fuel	12,074 kg (26,618 lb)
Max disc loading:	
standard fuel	37.76 kg/m² (7.73 lb/sq ft)
auxiliary fuel	43.05 kg/m² (8.82 lb/sq ft)
Max power loading:	
standard fuel	3.45 kg/kW (5.67 lb/shp)
auxiliary fuel	3.93 kg/kW (6.46 lb/shp)

PERFORMANCE (A at T-O weight of 9,000 kg, 19,841 lb, B at 11,000 kg, 24,251 lb, C at 13,000 kg, 28,660 lb):

Never-exceed speed (V_{NE}):	
A	170 kts (315 km/h, 195 mph)
B	159 kts (296 km/h; 183 mph)
C	148 kts (275 km/h, 170 mph)
Max cruising speed: A	143 kts (266 km/h, 165 mph)
B	140 kts (260 km/h, 161 mph)
C	134 kts (248 km/h, 154 mph)
Econ cruising speed: A	137 kts (255 km/h, 158 mph)
B	132 kts (246 km/h; 153 mph)
C	125 kts (232 km/h, 144 mph)
Rate of climb at S/L (15° 30′ collective pitch, OEI):	
A	690 m (2,263 ft)/min
B	552 m (1,811 ft)/min
C	396 m (1,299 ft)/min
Service ceiling: A	6,000 m (19,685 ft)
B	4,900 m (16,075 ft)
C	3,050 m (10,000 ft)
Hovering ceiling IGE: A	5,500 m (18,045 ft)
B	3,600 m (11,810 ft)
C	1,900 m (6,235 ft)
Hovering ceiling OGE: A	4,400 m (14,435 ft)
B	2,300 m (7,545 ft)
Range with max standard fuel, OEI, no reserves:	
A	232 n miles (430 km; 267 miles)
B	442 n miles (820 km; 509 miles)
C	431 n miles (800 km, 497 miles)

Ferry range with auxiliary fuel tanks, OEI, no reserves
C 755 n miles (1,400 km, 870 miles)
Endurance with max standard fuel, OEI, no reserves
A [illegible]
B [illegible]
C [illegible]

UPDATED

CHAIC Z-11

Chinese name: Zhishengji-11 (Vertical take-off aircraft 11) or Zhi-11

TYPE: Light helicopter

PROGRAMME: Under development in 1994 [illegible] class, suitable for pilot training, police security patrol, reconnaissance, coastguard, geological survey, [illegible] forestry protection. No other details known at time of going to press.

NEW ENTRY

Z-8 multirole utility helicopter with rear-loading ramp lowered

GAIC

GUIZHOU AVIATION INDUSTRIAL CORPORATION

PO Box 38, Anshun, Guizhou 561000
Telephone: 86 (851) 551027, or 86 (412) 22228
Fax: 86 (853) 25528
Telex: 66018 AIMGA CN

GENERAL MANAGER: Sun Rusheng

GAIC incorporates many enterprises, factories and institutes engaged in various aerospace and non-aerospace activities; aerospace workforce is about 6,000. Aviation programmes include JJ-7/FT-7 fighter trainer, two-shaft turbojets, air-to-air missiles and rocket launchers, plus participation in Chengdu (CAC, which see) production of single-seat J-7/F-7.

UPDATED

GAIC FT-7 two-seat trainer of the Sri Lanka Air Force *(Denis Hughes)*

1995

GAIC JJ-7

Chinese name: Jianjiji Jiaolianji-7 (Fighter training aircraft 7) or Jianjiao-7

Westernised designation: FT-7

TYPE: Tandem two-seat fighter trainer

PROGRAMME: Launched October 1982; first metal cut April 1985, first flight 5 July 1985, series production began February 1986, production FT-7 first flight December 1987. FT-7P first flight 9 November 1990 and received MAS production approval 13 May 1992. Stretched version with internal 30 mm cannon and increased avionics volume reportedly under development in 1994.

CURRENT VERSIONS: **JJ-7**: Basic version, based on single-seat J-7 II and MiG-21US.

FT-7: Export version of JJ-7.

FT-7P: Version of FT-7 for Pakistan; imported fire control system, HUD and air data computer, improved instrument layout, two underwing pylons each side, increased fuel load, 25 per cent increase in operational range.

[illegible] Bangladesh Air Force (four FT-7), Myanma AF [illegible], Pakistan AF (15 FT-7P), Sri Lanka AF (one FT-7), Zimbabwe AF (two FT-7).

[illegible]RES: Generally as J-7/F-7 and MiG-21US except for twin canopies opening sideways to starboard (rear one [illegible]ctable periscope), twin ventral strakes of modi[illegible] and removable saddleback fuel tank aft of second cockpit. Can provide full training syllabus for all [illegible]ons, plus most of that necessary for Shenyang J-[illegible]

[illegible]s: As J-7/F-7

[illegible] As J-7/F-7

[illegible] As J-7/F-7

[illegible]LANT: As F-7M. Internal fuel tank arrangement as for [illegible] fuselage and wing total capacities are 1,880 and [illegible] respectively (496.6 and 148 US gallons; 413.5 [illegible] Imp gallons), giving total capacity of 2,440 litres [illegible] US gallons; 536.7 Imp gallons). External drop tanks [illegible]

ACCOMMODATION: Second cockpit in tandem, with dual controls. Canopies open sideways to starboard.

SYSTEMS: Cockpits pressurised and air conditioned (maximum differential 0.3 bar; 4.35 lb/sq in). Hydraulic system pressure 207 bars (3,000 lb/sq in), flow rates 36 litres (9.51 US gallons; 7.92 Imp gallons)/min in main system, 4 litres (1.06 US gallons; 0.88 Imp gallon)/min in standby system. Pneumatic system pressure 49 bars (710.6 lb/sq in). Electrical power provided by QF-12C 12 kW engine-driven starter/generator, with 400 A static inverters for 28.5 V DC power. YX-1 oxygen system for crew. De-icing/anti-icing standard.

AVIONICS: *Comms:* Include CT-3M VHF com transceiver. Other (unidentified) Chinese nav/com avionics designated Type 222, Type 262, JT-2A and J7L.

Flight: WL-7 radio compass and XS-6A marker beacon receiver. FJ-1 flight data recorder.

ARMAMENT: Single underwing pylon each side (two on FT-7P) for such stores as a PL-2B air-to-air missile, an

Front (left) and rear cockpits of the GAIC FT-7

1995

HF-5A 18-round launcher for 57 mm rockets, or a bomb of up to 250 kg size, can also be fitted with Type 23-3 twin-barrel 23 mm gun in underbelly pack and HK-03E optical gunsight.

DIMENSIONS, EXTERNAL: As F-7M except

Length overall, incl probe	14.874 m (48 ft 9½ in)

WEIGHTS AND LOADINGS:

Weight empty, equipped, FT-7	5,519 kg (12,167 lb)
FT-7P	5,330 kg (11,750 lb)
Max fuel weight, internal	1,891 kg (4,169 lb)
external	558 kg (1,230 lb)
Max external stores load, FT-7	1,187 kg (2,617 lb)
Normal T-O weight with two PL-2 air-to-air missiles, FT-7P	7,590 kg (16,733 lb)
Max T-O weight, FT-7	8,555 kg (18,860 lb)
FT-7P	8,600 kg (18,960 lb)
Max landing weight, FT-7	6,096 kg (13,439 lb)
Max zero-fuel weight: FT-7	7,300 kg (16,094 lb)
Max wing loading: FT-7	371.96 kg/m² (76.18 lb/sq ft)
FT-7P	373.91 kg/m² (76.58 lb/sq ft)
Max power loading: FT-7	315.28 kg/kN (3.09 lb/lb st)
FT-7P	316.94 kg/kN (3.11 lb/lb st)

PERFORMANCE (FT-7 at max T-O weight):

Never-exceed speed (VNE) above 12,500 m (41,010 ft)	Mach 2.35 (1,346 kts; 2,495 km/h; 1,550 mph)
Max level speed above 12,500 m (41,010 ft)	Mach 2.05 (1,175 kts; 2,175 km/h; 1,350 mph)
Max cruising speed at 11,000 m (36,100 ft)	545 kts (1,010 km/h; 627 mph)
Econ cruising speed at 11,000 m (36,100 ft)	516 kts (956 km/h; 594 mph)
Unstick speed	170-181 kts (315-335 km/h; 196-208 mph)
Touchdown speed	165-175 kts (305-325 km/h; 189-202 mph)
Stalling speed, flaps down	135 kts (250 km/h; 156 mph)
Max rate of climb at S/L	9,300 m (30,510 ft)/min
Service ceiling	17,300 m (56,760 ft)
Absolute ceiling	17,700 m (58,070 ft)
T-O run	827 m (2,714 ft)
T-O to 15 m (50 ft)	1,331 m (4,355 ft)
Landing from 15 m (50 ft)	1,368 m (4,489 ft)
Landing run	1,060 m (3,478 ft)
Range at 11,000 m (36,000 ft): max internal fuel (clean)	545 n miles (1,010 km; 627 miles)
max internal and external fuel	788 n miles (1,459 km; 906 miles)
max external stores	708 n miles (1,313 km; 816 miles)
g limit with two PL-2B missiles	+7

UPDATED

HAMC

HARBIN AIRCRAFT MANUFACTURING CORPORATION

15 Youxie Street, PO Box 201, Harbin, Heilongjiang 150066
Telephone: 86 (451) 8602122
Fax: 86 (451) 8602061
Telex: 87082 HAF CN
PRESIDENT: Yang Shouwen
VICE-PRESIDENT: Shao Huitian
DIRECTOR, AIRCRAFT SALES: Xu Zhanbin

HAMC established 1952, subsequently producing H-5 light bomber (Soviet designed Il-28) and Z-5 helicopter (Soviet designed Mi-4) in large numbers, as well as smaller numbers of Chinese designed SH-5 flying boat and Y-11 agricultural light twin (see earlier editions of *Jane's* for details). Occupies 514 ha (1,270 acre) site, including 350,000 m² (3,767,375 sq ft) of workshop space. Workforce in 1994 numbered approximately 17 000.

Currently producing own-design Y-12 (II) utility light twin and licence manufacturing Eurocopter France Dauphin 2 as Z-9A-100. Subcontract work includes doors for BAe 146 and Dauphin doors for Eurocopter France.

UPDATED

HAMC SH-5

Chinese name: Shuishang Hongzhaji 5 (Maritime bomber 5) or Shuihong-5

Westernised designation: PS-5

TYPE: Maritime patrol and anti-submarine bomber, surveillance and SAR flying-boat.

PROGRAMME: Joint design by HAMC and Seaplane Design Institute, but development a victim of cultural revolution, detail design started February 1970; static testing of first complete airframe August 1974, first flight 3 April 1976, six more SH-5s completed and flown 1984-85, four of these handed over 3 September 1986 to PLA Naval Air Force for service at Tuandao naval air station, Qingdao. No further examples built. See 1994-95 and earlier editions for description and illustrations.

UPDATED

HAMC (EUROCOPTER) Z-9A HAITUN (DOLPHIN)

Chinese name: Zhishengji-9A (Vertical take-off aircraft 9A) or Zhi-9A

TYPE: Licence-built Eurocopter France AS 365N Dauphin 2 (which see in International section).

PROGRAMME: Licence agreement (Aerospatiale/CATIC) signed 2 July 1980; first (French built) example made initial acceptance flight in China 6 February 1982, Chinese parts manufacture began 1986; initial agreed batch of 50, last of which delivered January 1992. Production continuing as Z-9A-100 under May 1988 domestic contract, with much increased local manufacture (72.2 per cent of airframe and 91 per cent of engine).

CURRENT VERSIONS: **Z-9**: Initial Chinese licence version, equivalent to French AS 365N. Details in 1994-95 and earlier *Jane's*.

Z-9A: Later aircraft in initial 50, to AS 365N₁ standard and with increased proportion of locally manufactured components.

Z-9A-100: Current production version, with much increased local manufacture (see Programme). First flight 16 January 1992; flight test programme completed 20 November 1992 after almost 200 flight hours (408 flights). Chinese type approval received 30 December 1992. Weight and performance details as for Z-9A.

CUSTOMERS: Serve with CAAC and all three Chinese armed services. Entered service with two PLA group armies January and February 1988 (Beijing and Shenyang Military Regions respectively); first anti-tank version (Norinco 'Red Arrow 8' missiles) first flew late 1988 or early 1989. PLA Naval Air Force believed to use the type for commando transport as well as shipboard communications role.

Civil models used for various duties including offshore oil rig support and air ambulance (four stretchers/two seats or two stretchers/five seats). Operators in 1994 included Flying Dragon Aviation (three).

STRUCTURE: Transmission manufactured by Dongan Engine Manufacturing Co at Harbin, hubs and tail rotor blades by Baoding Propeller Factory.

POWER PLANT: Arriel 1C and 1C1 turboshafts produced by SMPMC at Zhuzhou as WZ8 and WZ8A, fuel capacity 1,140 litres (301 US gallons; 251 Imp gallons).

WEIGHTS AND LOADINGS:

Weight empty, equipped	2,050 kg (4,519 lb)
Max payload	2,038 kg (4,493 lb)
Max load on cargo sling	1,600 kg (3,527 lb)
Max T-O weight, internal or external load	4,100 kg (9,039 lb)

PERFORMANCE (at max T-O weight):

Max cruising speed at S/L	154 kts (285 km/h; 177 mph)
Max vertical rate of climb at S/L	246 m (805 ft)/min
Max forward rate of climb at S/L	456 m (1,496 ft)/min
Service ceiling	6,000 m (19,685 ft)
Hovering ceiling: IGE	2,600 m (8,530 ft)
OGE	1,600 m (5,250 ft)
Max range at 140 kts (260 km/h; 161 mph) normal cruising speed, no reserves: standard tanks	464 n miles (860 km; 534 miles)
with 180 litre (47.5 US gallon; 39.6 Imp gallon) auxiliary tank	539 n miles (1,000 km; 621 miles)

UPDATED

HAMC Y-11B (I)

Chinese name: Yunshuji-11B (I) (Transport aircraft 11B) or Yun-11B

TYPE: Agricultural and general purpose aircraft.

PROGRAMME: Initiated November 1988 to find new power plant for Y-11 able to confer required single-engine performance at 1 500 m (4 920 ft) at normal maximum T-O weight; two flying prototypes (first flight 25 December 1990), plus two for static test; domestic certification obtained late 1991; one delivered 1992, no further deliveries up to beginning of 1995.

CURRENT VERSIONS: **Y-11**: Original production version, with 213 kW (285 hp) SMPMC (Zhuzhou) HS6A radial engines, more than 40 built, described in 1986-87 and earlier *Jane's*, operators listed in 1994-95 edition.

Y-11B (I): Upgraded current version, with turbocharged US flat-six engines, improved avionics and minor airframe changes. *Details apply to this version.* To be available in **passenger** (pilot plus seven or eight), **passenger/cargo** (optional four collapsible double seats) and **agricultural** (sowing/spraying gear and higher operating weights) configurations.

CUSTOMERS: One delivered to Flying Dragon Aviation 1992.

DESIGN FEATURES: Constant chord high wings, braced at mid-span to small stub-wings at cabin floor level which also support mainwheel units, rectangular section fuselage, upswept at rear; non-swept tail surfaces, with dorsal fin. Wing section NACA 4412, dihedral 1° 30', incidence 3°. Conforms to FAR Pt 23 and BCAR.

FLYING CONTROLS: Mechanical (rods/cables) for drooping ailerons, horn balanced rudder and elevators, all except port aileron having inset trim tab, electrically actuated two-segment double-slotted flaps on trailing-edges.

STRUCTURE: Conventional aluminium alloy stressed skin, two-spar wing.

LANDING GEAR: Non-retractable tricycle type, with oleo-pneumatic shock-absorber in each unit. Twin-wheel main units, attached to underside of stub-wings. Single self-centring, non-steerable nosewheel. Tyre sizes 500 × 200 mm on mainwheels, 400 × 150 mm on nosewheel; pressure 3.0 bars (43.51 lb/sq in) on all units. Hydraulic mainwheel disc brakes. Small bumper under tailcone.

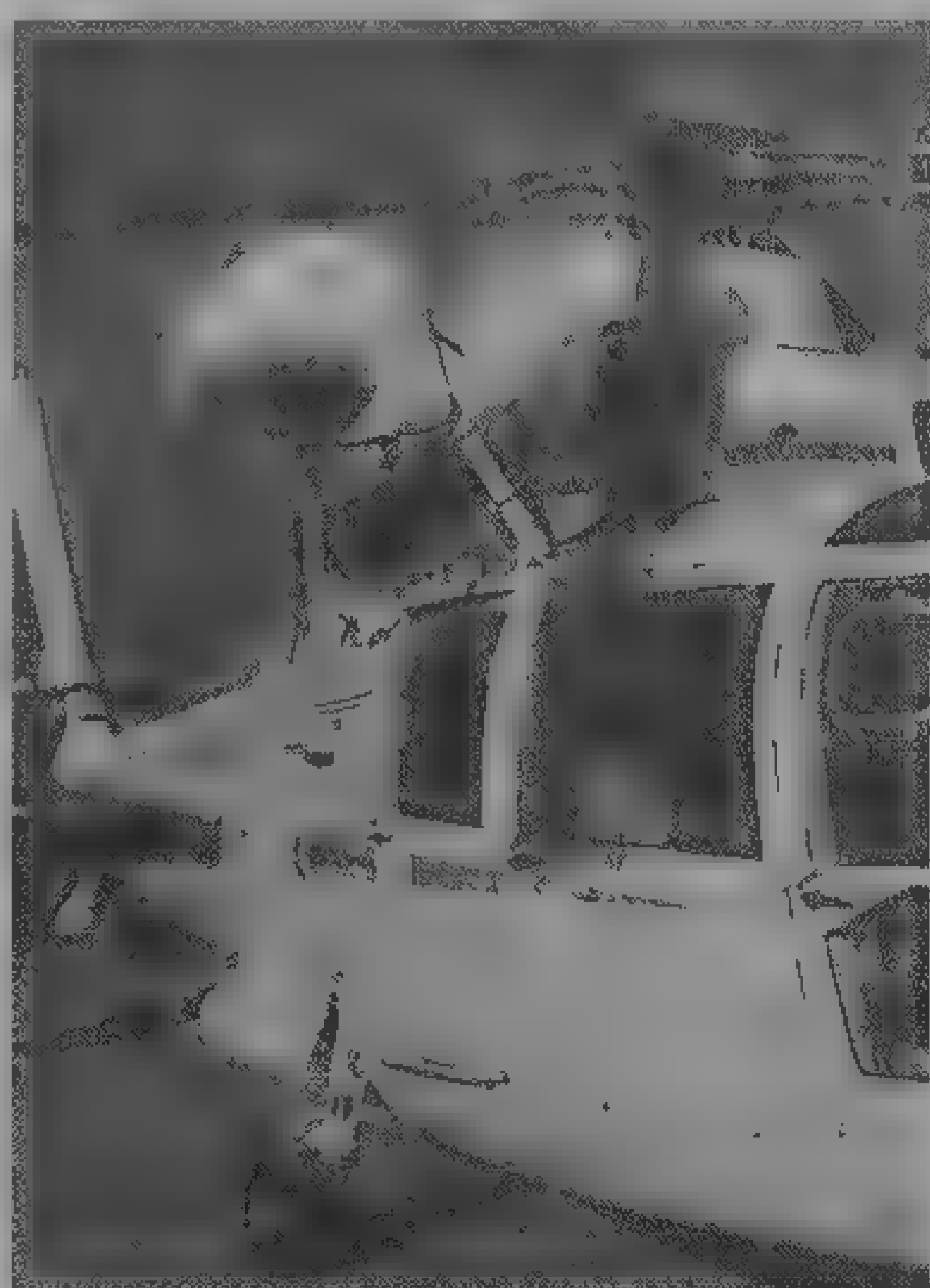
POWER PLANT: Two 261 kW (350 hp) Teledyne Continental TSIO-550-B flat six engines, each driving a Hartzell PHC-C3YF-2KUF/FC8468K-6R three-blade variable-pitch propeller. Fuel in two integral wing tanks, combined capacity 624 litres (164.8 US gallons; 137.3 Imp gallons); gravity refuelling point in top of each wing. Oil capacity 11.4 litres (3 US gallons, 2.5 Imp gallons).

ACCOMMODATION: Flight crew of one (VFR) or two (IFR). Seats aft of flight deck for seven passengers (three left, four right), with baggage compartment to rear. Forward opening crew door on port side, forward of wing, with main cabin door on same side aft of wing, emergency exit below wing on starboard side.

SYSTEMS: Hydraulic system (operating pressure 85 bars, 1,233 lb/sq in) for mainwheel brakes. Two 3 kW generators and a 28 Ah battery for electrical power.

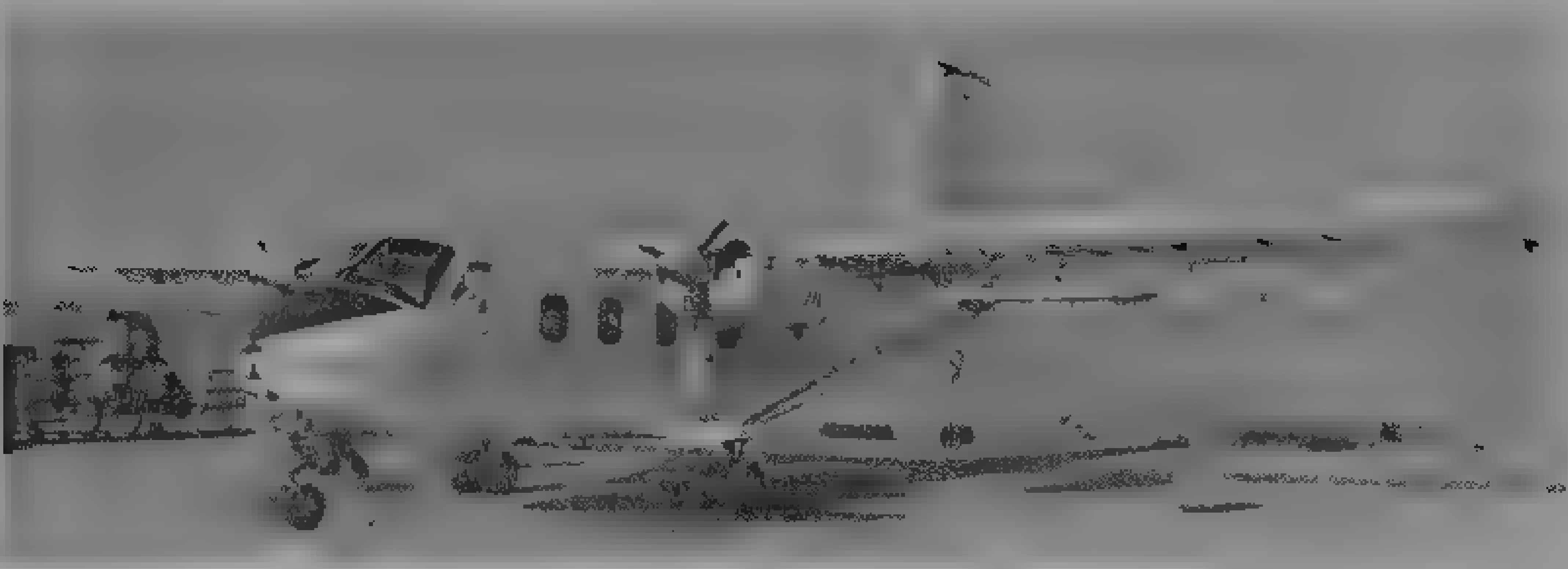
HAMC Z-9A Haitun twin-turbine light helicopter in PLA Air Force insignia

1995



Z-9A with external rescue hoist

1995



Prototype HAMC Y-11B (I) (two TCM TSIO-550-B flat-six engines) 1992

AVIONICS: *Comms:* Bendix/King KY 196A VHF (dual), KHF 950 HF (single), and KMA 24H-70 audio control system. *Flight:* Dual Bendix/King KR 87 and KR 21 ADF.

DIMENSIONS, EXTERNAL:

Wing span	17.08 m (56 ft 0½ in)
Wing chord, constant	2.00 m (6 ft 6¾ in)
Wing aspect ratio	8.54
Length overall	12.12 m (39 ft 9¼ in)
Height overall	5.186 m (17 ft 0¼ in)
Wheel track (c/l of shock struts)	3.10 m (10 ft 2 in)
Wheelbase	3.697 m (12 ft 1 [illegible] in)
Propeller diameter	2.03 m (6 ft 8 in)
Passenger door: Height	1.23 m (4 ft [illegible] in)
Width	0.988 m (3 ft 3 in)
Baggage compartment door: Height	1.115 m (3 ft 8 in)
Width	0.45 m (1 ft 5 [illegible] in)
Height to sill	0.215 m (8 [illegible] in)
Emergency exit: Height	0.67 m (2 ft [illegible] in)
Width	0.49 m (1 ft 7¼ in)
Height to sill	0.40 m (1 ft 3¾ in)

DIMENSIONS, INTERNAL:

Cabin: Length	3.58 m (11 ft 9 in)
Max width	1.27 m (4 ft 2 in)
Max height	1.48 m (4 ft 10¼ in)
Floor area	4.55 m² (48.98 sq ft)
Volume	6.73 m³ (237.7 cu ft)
Baggage compartment volume	0.48 m³ (16.95 cu ft)

AREAS:

Wings, gross	34.16 m² (367.7 sq ft)
Ailerons (total, incl tab)	2.674 m² (28.78 sq ft)
Trailing-edge flaps (total)	6.288 m² (67.68 sq ft)
Fin	[illegible] m² (56.42 sq ft)
Rudder, incl tab	[illegible] m² (30.84 sq ft)
[illegible]	6.973 m² (75.06 sq ft)
Elevators (total, incl tabs)	4.06 m² (43.70 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	2,504 kg (5,520 lb)
Max fuel weight	450 kg (992 lb)
Max payload: Normal	830 kg (1,830 lb)
Restricted	1,200 kg (2,645 lb)
Max T-O and landing weight:	
Normal	3,500 kg (7,716 lb)
Restricted	3,900 kg (8,598 lb)
Max wing loading: Normal	102.5 kg/m² (20.98 lb/sq ft)
Restricted	114.2 kg/m² (23.38 lb/sq ft)
Max power loading: Normal	6.70 kg/kW (11.02 lb/hp)
Restricted	7.47 kg/kW (12.28 lb/hp)

PERFORMANCE (at Normal category max T-O weight):

Max level speed at 3,000 m (9,840 ft)	143 kts (265 km/h; 165 mph)
[illegible] speed	135 kts (250 km/h; 155 mph)
Max cruising speed at 3,000 m (9,840 ft)	127 kts (235 km/h; 146 mph)
Econ cruising speed at 3,000 m (9,840 ft)	108 kts (200 km/h; 124 mph)
Stalling speed, 30° flap	57 kts (104 km/h; 65 mph)
Max rate of climb at S/L	336 m (1,100 ft)/min
Rate of climb at S/L, OEI	33 m (108 ft)/min
Service ceiling	6,000 m (19,685 ft)
Service ceiling, OEI	2,100 m (6,890 ft)
T-O run	200 m (657 ft)
T-O to 15 m (50 ft)	435 m (1,428 ft)
Landing from 15 m (50 ft)	530 m (1,739 ft)
Landing run	275 m (903 ft)
Range at 3,000 m (9,840 ft) at optimum cruising speed:	
with max payload	162 n miles (300 km; 186 miles)
with max fuel	582 n miles (1,080 km; 671 miles)

UPDATED

HAMC Y-12 (II)

Chinese name: Yunshuji-12 (II) (Transport aircraft 12) or Yun-12 (II)

TYPE: Twin-turboprop STOL general purpose transport.

PROGRAMME: Initiated as uprated version of Y-12 (I) (1987-88 and earlier *Jane's*); first flight 16 August 1984; domestic certification December 1985; UK (BCAR Section K) certification received 20 June 1990; FAA type approval of Y-12 (IV) received 26 March 1995.

CURRENT VERSIONS: **Y-12 (I)**: Initial version (first flight 14 July 1982), with PT6A-11 engines; three prototypes and approximately 30 production examples built, described in 1987-88 *Jane's*.

Y-12 (II): Current production version, *to which detailed description applies*; higher rated engines, no leading-edge slats and smaller ventral fin.

Y-12 (IV): Improved version (first flight 30 August 1993). Modifications to wingtips, control surface actuation, main gear and brakes, redesigned seating for 18 to 19 passengers; starboard side rear baggage door; maximum T-O weight increased to 5,670 kg (12,500 lb) and maximum payload to 1,984 kg (4,374 lb). Domestic certification received 3 July 1994.

Future versions: Plans under consideration include stretched version and one with pressurised cabin.

CUSTOMERS: Total of 80 delivered by January 1995; see table. Total of approximately 90 export orders at that date.

DESIGN FEATURES: Designed to standards of FAR Pts 23 and 135 Appendix A and developed to improve upon modest payload/range of original piston-engined Y-11. Constant chord high braced wings, with small stub-wings at cabin floor level supporting mainwheel units; basically rectangular section fuselage, upswept at rear; non-swept tail surfaces, large dorsal fin, ventral fin under tailcone.

Wing section LS(1)-0417, thickness/chord ratio 17 per cent; dihedral 1° 41'; incidence 4°.

FLYING CONTROLS: Drooping ailerons, horn balanced elevators and rudder, all mechanically actuated; trim tab in starboard aileron, rudder and each elevator; electrically actuated two-segment double-slotted flaps on each wing trailing-edge.

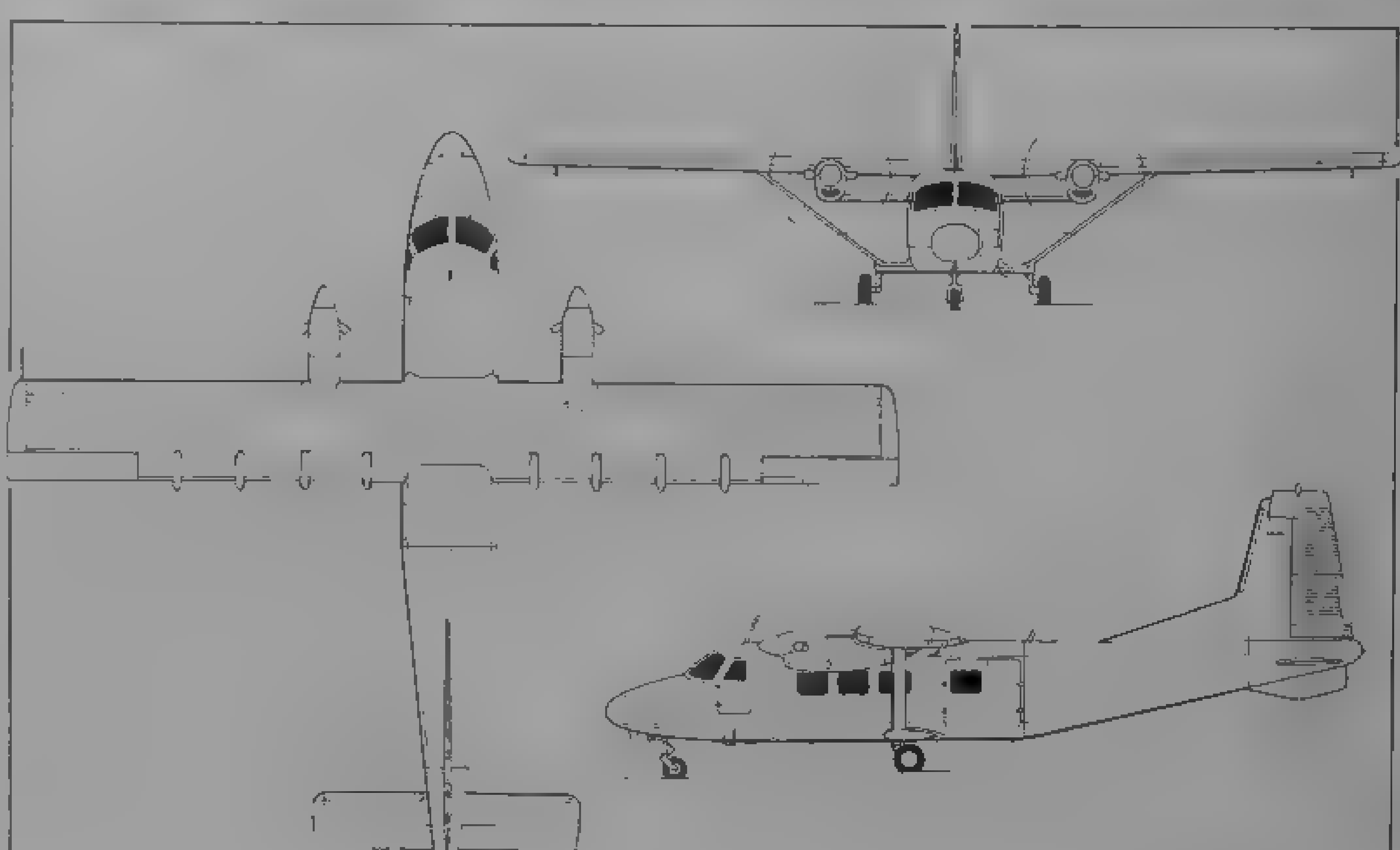
STRUCTURE: Conventional all-metal structure with two-spar fail-safe wings and stressed skin fuselage; Ziqiang-2 resin bonding on 70 per cent of wing structure and 40 per cent of fuselage; integral fuel tankage in wing spar box; bracing strut from each stub-wing out to approximately one-third span.

LANDING GEAR: Non-retractable tricycle type, with oleo-pneumatic shock-absorber in each unit. Single-wheel main units, attached to underside of stub-wings. Single

Y-12 (II) DELIVERIES
(at 1 January 1995)

Country	Operator	Quantity
Cambodia	Air Force	2
China	AVIC No 630 Institute	1
	China General Aviation Corporation	5
	China Southwest Airlines	4
	Flying Dragon Aviation	9
	Guizhou Aviation Corporation	1
Eritrea	Air Force	3
Fiji	Fiji Air	1
Laos	Lao Aviation	7
Malaysia	Berjaya Air Charter	2
Middle East	Unidentified	7
Mongolia	Mongolian Airlines	6
Nepal	Nepal Airlines	5
Pakistan	Unidentified	1
Peru	Air Force	6
	Ministry of Internal Affairs	3
Philippines	Island Holding Corporation	3
Sri Lanka	Air Force	9
Tanzania	Ministry of Defence	2
Zambia	Ministry of Defence	2
Zimbabwe	Zimbabwe Airlines	1
Total		**80**

Civil Y-12 (II) of Lao Aviation, Laos 1995



HAMC Y-12 (II) twin-turboprop STOL general purpose transport (*Jane's/Dennis Punnett*) 1988

HAMC Y-12 (II), one of nine for the Sri Lanka Air Force (*Denis Hughes*)

1995

non-steerable nosewheel. Mainwheel tyres size 640 × 230 mm, pressure 5.5 bars (80 lb/sq in), nosewheel tyre size 480 × 200 mm, pressure 3.5 bars (51 lb/sq in). Hydraulic brakes. Minimum ground turning radius 16.75 m (54 ft 11½ in).

POWER PLANT: Two Pratt & Whitney Canada PT6A-27 turboprops, each flat rated at 462 kW (620 shp) and driving a Hartzell HC-B3TN-3B/T10173B-3 three-blade constant-speed reversible-pitch propeller. All fuel in tanks in wing spar box, total capacity 1,616 litres (427 US gallons, 355.5 Imp gallons), with overwing gravity filling point each side. Domestic WJ9 turboprop (442 to 520 kW; 593 to 697 shp) under development for Y-12 and other aircraft.

ACCOMMODATION: Crew of two on flight deck, with access via forward-opening door on port side. Four-way adjustable crew seats. Dual controls. Main cabin can accommodate up to 17 passengers in commuter configuration, in three-abreast layout (with aisle), at seat pitch of 75 cm (29½ in). Alternative layouts for up to 15 parachutists, or all-cargo configuration with 11 tiedown rings. Passenger/cargo double door on port side at rear, rear half of which opens outward and forward half inward; foldout steps in passenger entrance. Emergency exits on each side at front of cabin and opposite passenger door on starboard side at rear. Baggage compartments in nose and at rear of passenger cabin for 100 kg (220 lb) and 260 kg (573 lb) respectively.

SYSTEMS: Hamilton Standard R70-3WG environmental control system. Hydraulic system (operating pressure 118 to 147 bars; 1,711 to 2,132 lb/sq in) for mainwheel brakes. Two 6 kW DC starter/generators, two 600 VA 400 Hz single-phase static inverters and one 43 Ah Ni/Cd battery for electrical power. Goodrich Type 29S-7D 5178 anti-icing system optional for wing, tailplane and fin leading-edges.

AVIONICS: *Comms:* VHF-251 and HF-230 radio, AUD-251A intercom and TDR 950 transponder.

Radar: Bendix/King 1400C, RDS-81 or RDS-82 weather radar.

Instrumentation: 20025-11324 airspeed indicator, 510-8D10 horizon, 101420-11934 encoding altimeter, 30230-11101 vertical speed indicator, 9551-BN541 bank indicator, LC-2 magnetic compass, ZWH-1 outside air temperature indicator, and ZEY 1 flap position indicator, dual engine torquemeters, interturbine temperature indicators, gas generator tachometers, oil temperature and pressure indicators, fuel pressure and quantity indicators, 309W clock, and XDH 10B warning light box.

Flight: ALT-50 radio altimeter, DME-451, ADF-650A, MKR-350 marker beacon receiver, VIR-351 VOR, GLS-350 glide slope receiver and PN 101 pictorial display. Doppler navigation with satellite responder optional (eg in mineral detection role).

EQUIPMENT: Hopper for 1,200 litres (317 US gallons; 264 Imp gallons) of dry or liquid chemical in agricultural version. Appropriate specialised equipment for firefighting, geophysical survey (eg long, kinked sensor tailboom) and other missions.

DIMENSIONS, EXTERNAL:

Wing span	17.235 m (56 ft 6½ in)
Wing chord, constant	2.00 m (6 ft 6¾ in)
Wing aspect ratio	8.67
Length overall	14.86 m (48 ft 9 in)
Height overall	5.575 m (18 ft 3½ in)
Elevator span	5.365 m (17 ft 7¼ in)
Wheel track	3.60 m (11 ft 9¾ in)
Wheelbase	4.698 m (15 ft 5 in)
Propeller diameter	2.49 m (8 ft 2 in)
Propeller ground clearance	1.325 m (4 ft 4¼ in)
Distance between propeller centres	4.94 m (16 ft 2½ in)
Fuselage ground clearance	0.65 m (2 ft 1½ in)
Crew door: Height	1.12 m (3 ft 8 in)
Width	0.65 m (2 ft 1½ in)
Passenger/cargo door: Height	1.38 m (4 ft 6¼ in)
Width (passenger door only)	0.65 m (2 ft 1½ in)
Width (double door)	1.45 m (4 ft 9 in)
Emergency exits (three, each):	
Height	0.68 m (2 ft 2¾ in)
Width	0.68 m (2 ft 2¾ in)
Baggage door (nose, port):	
Max height	0.56 m (1 ft 10 in)
Width	0.75 m (2 ft 5½ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck and rear baggage compartment:	
Length	4.82 m (15 ft 9¾ in)
Max width	1.46 m (4 ft 9½ in)
Max height	1.70 m (5 ft 7 in)
Floor area	7.04 m² (75.78 sq ft)
Volume	12.9 m³ (455.5 cu ft)
Baggage compartment volume:	
nose	0.77 m³ (27.20 cu ft)
rear	1.89 m³ (66.75 cu ft)

AREAS:

Wings, gross	34.27 m² (368.88 sq ft)
Ailerons (total, incl tab)	2.88 m² (31.00 sq ft)
Trailing-edge flaps (total)	6.00 m² (64.58 sq ft)
Fin, incl dorsal fin	2.236 m² (24.07 sq ft)
Rudder, incl tab	3.339 m² (35.94 sq ft)
Tailplane	3.10 m² (33.37 sq ft)
Elevators (total, incl tabs)	4.06 m² (43.70 sq ft)

WEIGHTS AND LOADINGS:

Max fuel load	1,230 kg (2,712 lb)
Max payload	1,700 kg (3,748 lb)
Max T-O and landing weight	5,300 kg (11,684 lb)
Max ramp weight	5,330 kg (11,750 lb)
Max zero-fuel weight	4,900 kg (10,803 lb)
Max cabin floor loading (cargo)	750 kg/m² (153.7 lb/sq ft)
Max wing loading	145.9 kg/m² (29.90 lb/sq ft)
Max power loading	5.74 kg/kW (9.42 lb/shp)

PERFORMANCE (at max T-O weight, ISA):

Max operating speed (VMO) at 3,000 m (9,840 ft)	177 kts (328 km/h; 204 mph)
Max cruising speed at 3,000 m (9,840 ft)	157 kts (292 km/h; 181 mph)
Econ cruising speed at 3,000 m (9,840 ft)	135 kts (250 km/h; 155 mph)
Max rate of climb at S/L	486 m (1,594 ft)/min
Rate of climb at S/L, OEI	84 m (275 ft)/min
Service ceiling	7,000 m (22,960 ft)
Service ceiling, OEI, 15 m (50 ft)/min rate of climb, max continuous power	3,000 m (9,840 ft)
T-O run, 15° flap	340 m (1,116 ft)
T-O to 15 m (50 ft), 15° flap	425 m (1,395 ft)
Landing from 15 m (50 ft): with braking and propeller reversal	480 m (1,575 ft)
with brakes only	620 m (2,035 ft)
Landing run: with braking and propeller reversal	200 m (656 ft)
with brakes only	340 m (1,116 ft)
Range at 135 kts (250 km/h; 155 mph) at 3,000 m (9,840 ft) with max fuel, 45 min reserves	723 n miles (1,340 km; 832 miles)
Endurance, conditions as above	5 h 12 min

UPDATED

OTHER AIRCRAFT

HAMC partnered with Eurocopter and Singapore Aerospace in **Europter EC 120** light helicopter programme. See International section for details.

NEW ENTRY

The 19-seat Y-12 (IV), granted FAA type approval in March 1995

1995

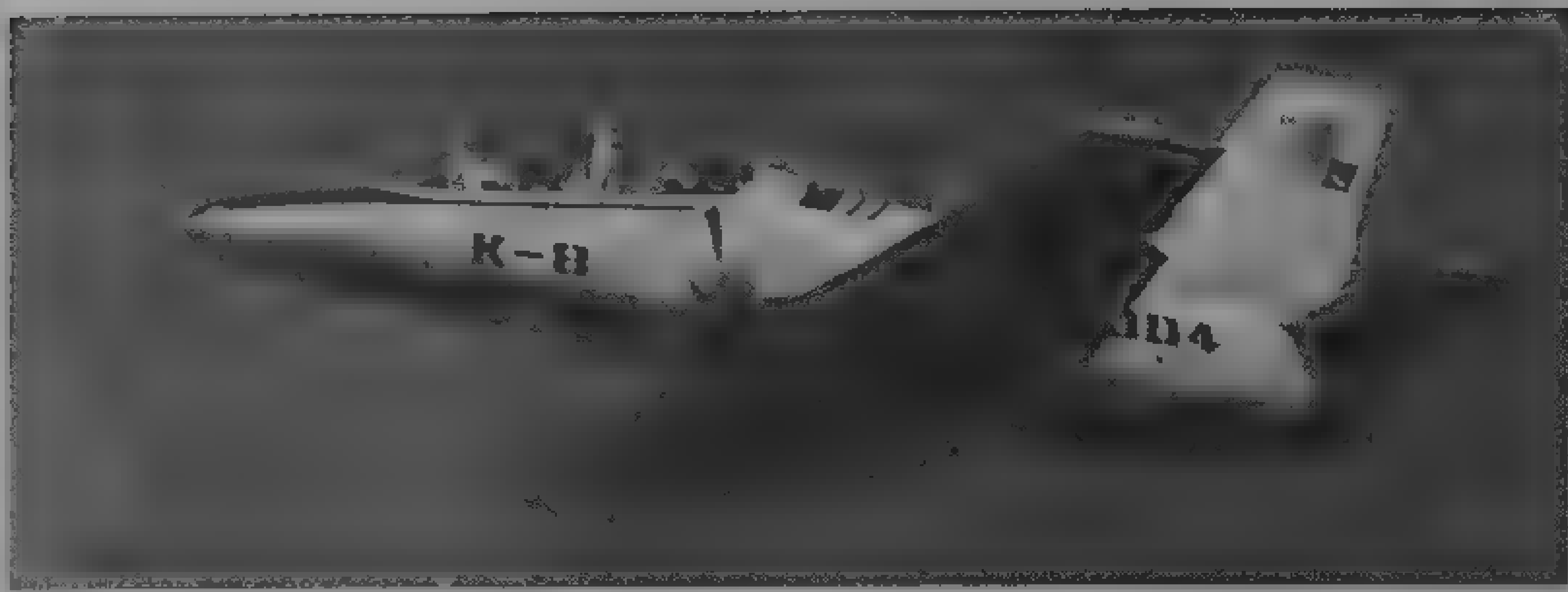
NAMC

NANCHANG AIRCRAFT MANUFACTURING COMPANY

PO Box 5001-506, Nanchang, Jiangxi 330024
Telephone 86 (791) 251833
Fax: 86 (791) 25149.
Telex 95068 NAMC CN
GENERAL MANAGER. Wu Mingwang
INFORMATION Feng Jinghua

NAMC created 1951, built 379 CJ-5s (licence Soviet Yak 18s) between 1954 and 1958, and in 1960s shared in large production programme for J-6 fighter (Chinese development of MiG-19), also built (1957 68) 727 Y 5 (Chinese An-2) biplanes (see under SAMC in this section and under NAMC in 1991 92 *Jane's*) Current programmes are CJ-6A development of CJ 5, Q-5/A-5 attack derivative of J 6 and its upgraded A-5M version, K-8 jet trainer and N 5A dedicated agricultural aircraft. NAMC occupies a 500 ha (1,235 acre) site, with 10,000 m² (107 639 sq ft) of covered space, and had 1991 workforce of over 20 000; delivered its 4,000th aircraft in 1993 About 80 per cent of its activities are non-aerospace

UPDATED



K-8 004, the third flying prototype of the Karakorum trainer

1995

NAMC K 8 KARAKORUM 8

TYPE Tandem-seat jet basic trainer and light ground attack aircraft

PROGRAMME: Launched publicly (as L 8) by NAMC at 1987 Paris Air Show as proposed export aircraft to be developed jointly with international partner Subsequently proposed to be co-developed with Pakistan as partner (25 per cent share), aircraft then redesignated K 8 and named after mountain range forming part of China/Pakistan border Manufacture of four prototypes started January 1989, three flying prototypes 001 (first flight 21 November 1990), 003 (first flight 18 October 1991) and 004, nearly 800 hours flown by November 1994, 002 is static and fatigue test aircraft Pakistan decided 1994 against own assembly line

CUSTOMERS Total of 21 completed by September 1994. Original joint venture agreement reportedly involved up to 75 for Pakistan Air Force Initial PAF batch of six (ordered 9 April 1994) handed over in China on 21 September and delivered to Pakistan November 1994. China reported interest at that time from Bangladesh, Eritrea, Laos Myanma, Sri Lanka and Zambia

DESIGN FEATURES Tapered, non-swept low wings, with NACA 64A-114 root and NACA 64A-412 tip sections, 2 incidence at root, 3° dihedral from roots; sweptback vertical, non-swept horizontal tail surfaces, intended for full basic flying training plus parts of primary and advanced syllabi, but capable also of light ground attack missions

FLYING CONTROLS: Mechanically actuated primary control surfaces variable incidence tailplane; trim tab in rudder and port elevator; two-position Fowler flaps, and split air brake under each side of rear fuselage, hydraulically actuated, ailerons have hydraulic boost

STRUCTURE. All-metal damage-tolerant main structure; ailerons of honeycomb, fin and rudder of composites. PAC share (initially only tailplane and elevators) increasing to 25 per cent with fin, rudder, rear fuselage and engine cowling access panels

LANDING GEAR. Retractable tricycle type, with single wheel and oleo-pneumatic shock-absorber on each unit Main units retract inward into underside of fuselage, nosewheel, which has hydraulic steering, retracts forward Mainwheel tyres size 561 × 169 mm, pressure 6 9 bars (100 lb/sq in) Chinese hydraulic disc brakes. Anti-skid units

POWER PLANT: One 16 01 kN (3,600 lb st) AlliedSignal TFE731-2A-2A turbofan, with Lucas Aerospace FADEC mounted in rear fuselage, intake and splitter plate on each side of fuselage, initial supply of 55 engines ordered from US manufacturer, later planned to be licence-built in China by SMPMC (Zhuzhou) Fuel in two flexible tanks in fuselage and one integral tank in wing centre-section, combined capacity 1,000 litres (264 US gallons, 220 Imp gallons) single refuelling point in fuselage. Provision for carrying one 250 litre (66 US gallon, 55 Imp gallon) drop tank on outboard pylon under each wing

ACCOMMODATION Instructor and pupil in tandem, on Martin-Baker CN10LW zero/zero ejection seats, rear seat elevated 28 cm (11 in) One-piece wraparound windscreen; canopy opens sideways to starboard Cockpits pressurised and air conditioned

SYSTEMS AiResearch ECS 51833 air conditioning and pressurisation system, with maximum differential of 0.27 bar (3 91 lb/sq in) Hydraulic system, pressure 207 bars (3,000 lb/sq in), for operation of landing gear extension/retraction, wing flaps, airbrakes, aileron boost, nosewheel steering and wheel brakes Flow rate 15 litres (3 96 US gallons; 3.30 Imp gallons)/min, with air pressurised reservoir, plus emergency back-up hydraulic system Abex AP09V 8 01 pump. Electrical systems 28.5 V DC (primary) and 24 V DC (auxiliary), with 115/26 V single-phase AC and 36 V three-phase AC available from Ni/Cd battery and static inverter, both at 400 Hz Liquid oxygen system for occupants Demisting of cockpit transparencies

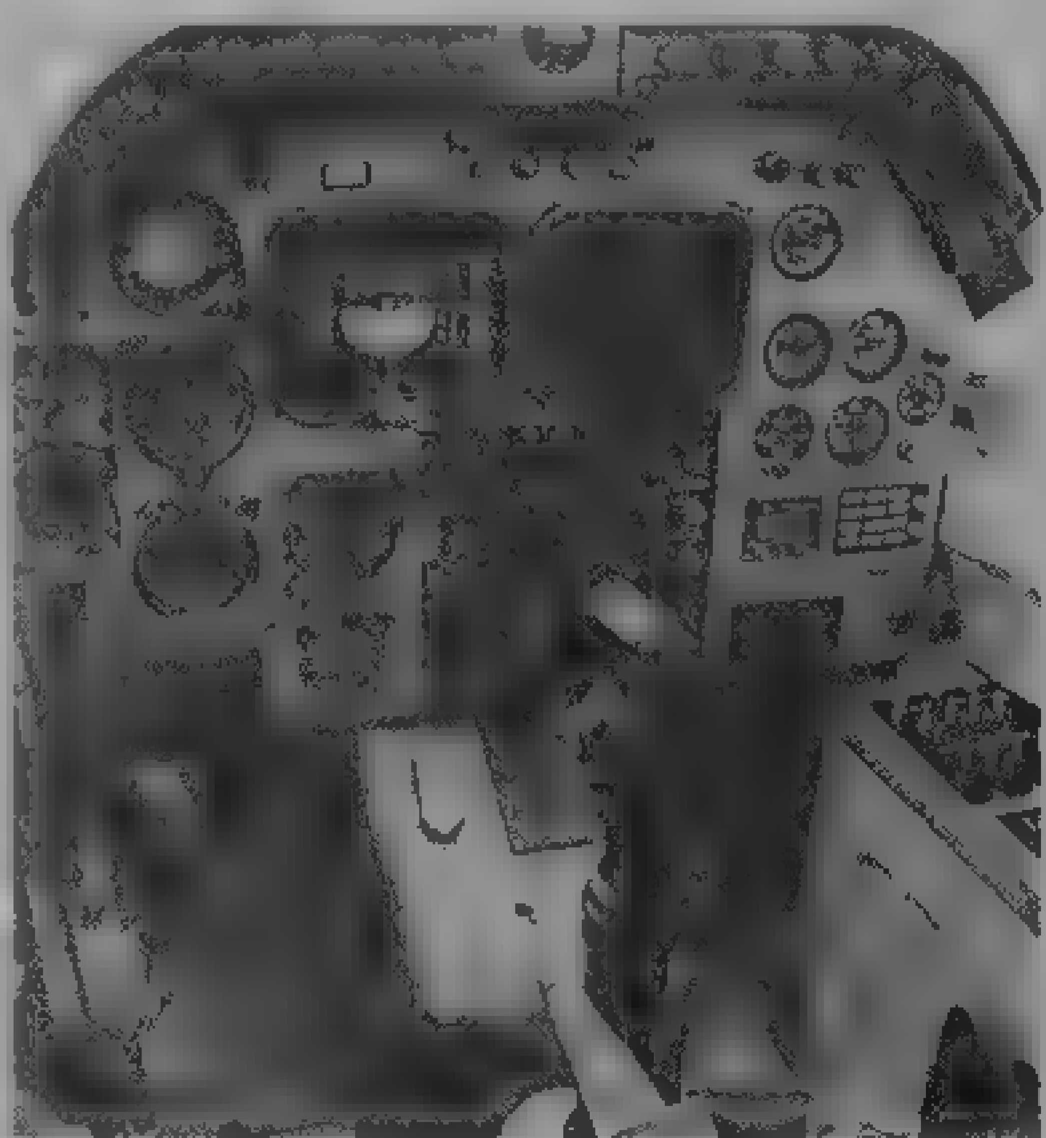
AVIONICS *Comms:* Bendix/King VHF and Collins EFIS-86 system selected for first 100 aircraft, incorporating CRT primary flight and navigation displays for each crew member plus dual display processing units and selector panels for tandem operation. Magnavox AN/ARC 164 UHF radios

Flight Bendix/King KNR 634A VOR/ILS with marker beacon receiver, ADF, Type 265 radio altimeter, AHRS and air data computer and KTU-709 Tacan; WL-7 radio compass

Instrumentation Collins EFIS-86T Blind-flying instrumentation standard. Standby flight instruments include ASI, rate of climb indicator, barometric altimeter, emergency horizon and standby compass

ARMAMENT (optional): One 23 mm gun pod under centre-fuselage, self-computing optical gunsight in cockpit, plus gun camera. Two external stores points under each wing Twin ejector racks on inboard stations can carry total of four 6, 11 5 or 50 kg practice bombs, single-store outboard stations can each carry a PL-7 air-to-air missile, a 12-round pod of 57 mm rockets, a 200 kg, 250 kg or BL755 bomb, or a drop fuel tank

DIMENSIONS, EXTERNAL
Wing span 9 63 m (31 ft 7¼ in)
Wing aspect ratio 5 45
Length overall, incl nose pitot 11.60 m (38 ft 0¾ in)
Height overall 4 21 m (13 ft 9¾ in)
Elevator span 4 20 m (13 ft 9½ in)
Wheel track 2 54 m (8 ft 4 in)
Wheelbase 4 313 m (14 ft 1¾ in)



K-8 front cockpit

1995

AREAS
Wings, gross 17 021 m² (183 2 sq ft)
Ailerons (total incl tab) 1 096 m² (11 80 sq ft)
Trailing-edge flaps (total) 2 652 m² (28.55 sq ft)
Fin 1 976 m² (21 27 sq ft)
Rudder, incl tab 1 117 m² (12.02 sq ft)
Tailplane 3.037 m² (32 69 sq ft)
Elevators (total, incl tab) 1 32 m² (14.21 sq ft)

WEIGHTS AND LOADINGS
Weight empty, equipped 2,687 kg (5,924 lb)
Max fuel internal 780 kg (1,720 lb)
external (two drop tanks) 388 kg (855 lb)
Max external stores load 943 kg (2,080 lb)
T-O weight clean 3,630 kg (8,003 lb)
Max T-O weight with external stores 4,330 kg (9,546 lb)
Max wing loading 254.4 kg/m² (52.11 lb/sq ft)
Max power loading 270.4 kg/kN (2.65 lb/lb st)

PERFORMANCE (at clean T-O weight)
Never-exceed speed (VNE)
512 kts (950 km/h, 590 mph) IAS
Max level speed at S/L 435 kts (807 km/h, 501 mph)
Approach speed 108 kts (200 km/h; 124 mph)
Unstick speed 100 kts (185 km/h, 115 mph)
Touchdown speed, 35° flap
89 kts (165 km/h, 103 mph)
Stalling speed, 35° flap 81 kts (150 km/h, 94 mph)
Max rate of climb at S/L 1,620 m (5,315 ft)/min
Service ceiling 13,000 m (42,650 ft)
T-O run 424 m (1,392 ft)
T-O to 15 m (50 ft) 600 m (1,969 ft)
Landing from 15 m (50 ft) 518 m (1,700 ft)
Landing run 500 m (1,641 ft)
Range:
max internal fuel 755 n miles (1,400 km, 870 miles)
max internal/external fuel
1,189 n miles (2,202 km, 1,368 miles)
Endurance: max internal fuel 3 h
max internal external fuel 4 h 25 min
g limits +7 33/−3

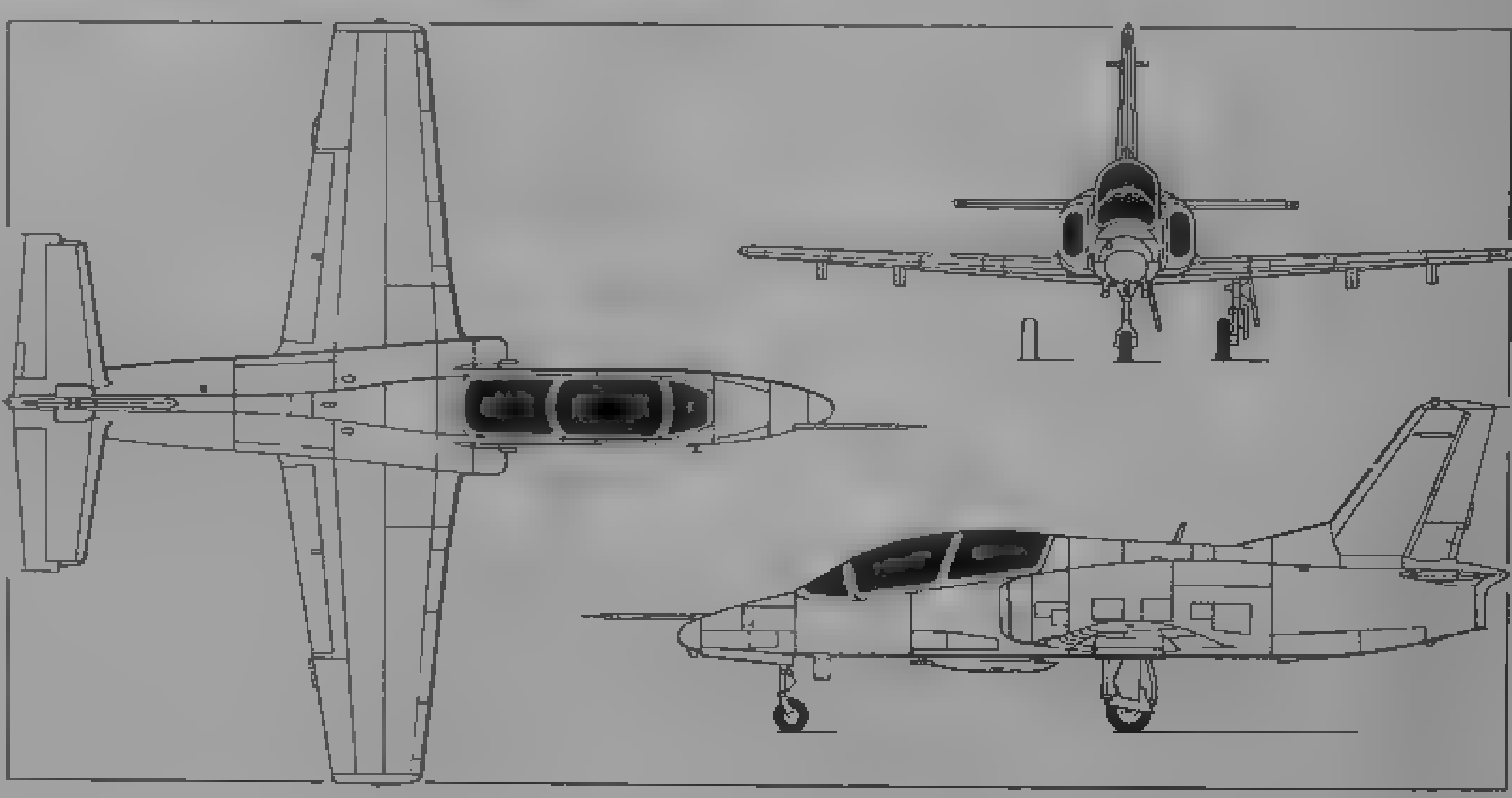
UPDATED

NAMC Q-5

Chinese name: Qiangjiji-5 (Attack aircraft 5) or Qiang-5
Westernised designation: A-5
NATO reporting name: Fantan

TYPE Single-seat close air support and ground attack aircraft, with air-to-air combat capability

PROGRAMME: Derivative of J-6 fighter (see 1989-90 and earlier *Jane's* for details of changes), originating August 1958 as Shenyang design proposal, responsibility assigned to Nanchang prototype programme cancelled 1961, but kept alive by small team and resumed officially 1963, first flight



NAMC K-8 Karakorum 8 jet trainer and light attack aircraft (*Jane's/Mike Keep*)

1992

NAMC A-5Cs of the Bangladesh Air Force *(Peter Steinemann)*

1993

4 June 1965, preliminary design certificate awarded and preproduction batch authorised late 1965, but further modifications (to fuel, armament, hydraulic and other systems) found necessary, leading to flight test of two much modified prototypes from October 1969; series production approved at end of 1969, deliveries beginning 1970.

Improved Q-5 I proposed 1976, flight tested late 1980 and certificated for production 20 October 1981, by which time (April 1981) Pakistan had placed order for A-5C modified export version; first A-5C deliveries January 1983, completed January 1984, domestic Q-5 IA, incorporating many of A-5C improvements, certificated January 1985; design study by Flight Refuelling Ltd of UK completed in mid-1980s for receiver version (with Xian H-6 as tanker), but no go-ahead for conversion given; upgrade programmes involving Western avionics started in 1986 with France (Q-5K Kong Yun) and Italy (A-5M, which see), but Kong Yun programme terminated 1990 (details in 1990-91 *Jane's*). Batch production of latest versions may continue.

CURRENT VERSIONS: **Q-5**: Initial production version, with internal fuselage bay approximately 4.00 m (13 ft 1½ in) long for two 250 kg or 500 kg bombs, two underfuselage attachments adjacent bay for two similar bombs, and two stores pylons beneath each wing. Series 6 WP6 turbojets, brake-chute in tailcone, between upper and lower pen-nib fairings. Some adapted for nuclear weapon delivery tests in early 1970s.

Q-5 I: Extended payload/range version, with internal bomb bay blanked off and space used to enlarge main fuselage fuel tank and add a flexible tank, underfuselage stores points increased to four; improved series WP6 engines, modified landing gear, brake-chute relocated under base of rudder; improved Type I rocket ejection seat, HF/SSB transceiver added. Some aircraft, adapted for PLA Naval Air Force to carry two underfuselage torpedoes, reportedly have Doppler type nose radar and 20 m (66 ft) sea-skimming capability with C-801 anti-shipping missiles.

Q-5 IA: Improved Q-5 I, with additional underwing hardpoint each side (increasing stores load by 500 kg, 1,102 lb), new gun/bomb sighting systems, pressure refuelling, and added warning/countermeasures systems.

Q-5 II: As Q-5 IA, but fitted (or retrofitted) with radar warning receiver.

A-5C: Export version for Pakistan Air Force (and later customers), involving 32 modifications from Q-5 I, notably upgraded avionics, Martin-Baker PKD10 zero/zero seats, and adaptation of hardpoints for 356 mm (14 in) lugs compatible with Sidewinder missiles and other PAF weapons, three prototypes preceded production programme, in service with Nos 7, 16 and 26 Squadrons of PAF. Ordered also by Bangladesh and Myanma. *Description applies to Q-5 IA and A-5C except where indicated.*

A-5M: Upgraded version of Q-5 II, described separately.

CUSTOMERS: Nearly 1,000 (all versions) built to date, including over 100 for export to Asian and African countries including Bangladesh (20 A-5C), North Korea (40 Q-5 IA), Myanma (24 A-5C) and Pakistan (52 A-5C).

DESIGN FEATURES: Mid mounted sweptback wings with deep full chord fence on each upper surface at mid-span, air intake on each side of fuselage abreast of cockpit; twin jetpipes side by side at rear with upper and lower pen-nib fairings aft of nozzles; fuselage has area ruled 'waist', rear fuselage detachable aft of wing trailing-edge for engine access, dorsal spine fairing, shallow ventral strake under each jetpipe, all-swept tail surfaces.

Wings have 52° 30′ sweep at quarter-chord, 0° incidence and 4° anhedral from roots, tailplane has 6° 30′ anhedral.

FLYING CONTROLS: Internally balanced ailerons and fully powered slab tailplane; mechanically actuated mass balanced rudder; hydraulically actuated Gouge flaps on inboard trailing-edges; electrically operated trim tab in port aileron and rudder; forward-hinged, hydraulically actuated door type airbrake under centre of fuselage, forward of bomb attachment points, anti flutter weight on each tailplane tip. Aileron deflection 18° 30′ up/down, tailplane leading-edge 12° 30′ up/30° down, rudder 25° left/right.

STRUCTURE: Conventional all-metal stressed skin structure. Multispar wings have three-point attachment to fuselage, fuselage built in forward and rear portions.

LANDING GEAR: Hydraulically retractable wide-track tricycle type, with single wheel and oleo-pneumatic shock-absorber on each unit. Main units retract inward into wings, non-steerable nosewheel forward into fuselage, rotating through 87° to lie flat in gear bay. Mainwheels have size 830 × 205 mm tubeless tyres and disc brakes, nosewheel tyre size 595 × 230 mm. Tail braking parachute, deployed when aircraft is 1 m (3.3 ft) above the ground, in bullet fairing beneath rudder.

POWER PLANT: Two Shenyang WP6 turbojets, each rated at 25.50 kN (5,732 lb st) dry and 31.87 kN (7,165 lb st) with afterburning, mounted side by side in rear of fuselage. Improved WP6A engines (see A-5M entry for details) available optionally. Lateral air intake, with small splitter plate, for each engine. Hydraulically actuated nozzles. Internal fuel in three forward and two rear fuselage tanks with combined capacity of 3 648 litres (964 US gallons, 802.5 Imp gallons). Provision for carrying a 760 litre (201 US gallon, 167 Imp gallon) drop tank on each centre underwing pylon, to give maximum internal/external fuel capacity of 5,168 litres (1,366 US gallons, 1,136.5 Imp gallons). When centre wing stations are occupied by bombs, a 400 litre (105.7 US gallon, 88 Imp gallon) drop tank can be carried instead on each outboard underwing pylon.

ACCOMMODATION: Pilot only, under one-piece jettisonable canopy which is hinged at rear and opens upward. Downward view over nose, in level flight, is 13° 30′. Low-speed seat allows for safe ejection within speed range of 135 to 458 knots (250 to 850 km/h, 155 to 528 mph) at zero height or above. Aircraft in Pakistan service have Martin-Baker PKD10 zero/zero seats. Armour plating in some areas of cockpit to protect pilot from anti-aircraft gunfire. Cockpit pressurised and air conditioned.

SYSTEMS: Dual air conditioning systems, one for cockpit environment and one for avionics cooling. Two independent hydraulic systems, each operating at pressure of 207 bars (3,000 lb/sq in). Primary system actuates landing gear extension and retraction, flaps, airbrake and afterburner nozzles; auxiliary system supplies power for aileron and all-moving tailplane boosters. Emergency system, operating pressure 108 bars (1,570 lb/sq in), for actuation of main landing gear. Electrical system (28 V DC) powered by two 6 kW engine-driven starter/generators, with two inverters for 115 V single-phase and 36 V three-phase AC power at 400 Hz.

AVIONICS: *Comms*: CT-3 VHF transceiver, YD-3 IFF ('Odd Rods' type aerials under nose on Q-5s, replaced on A-5C by single blade antenna).

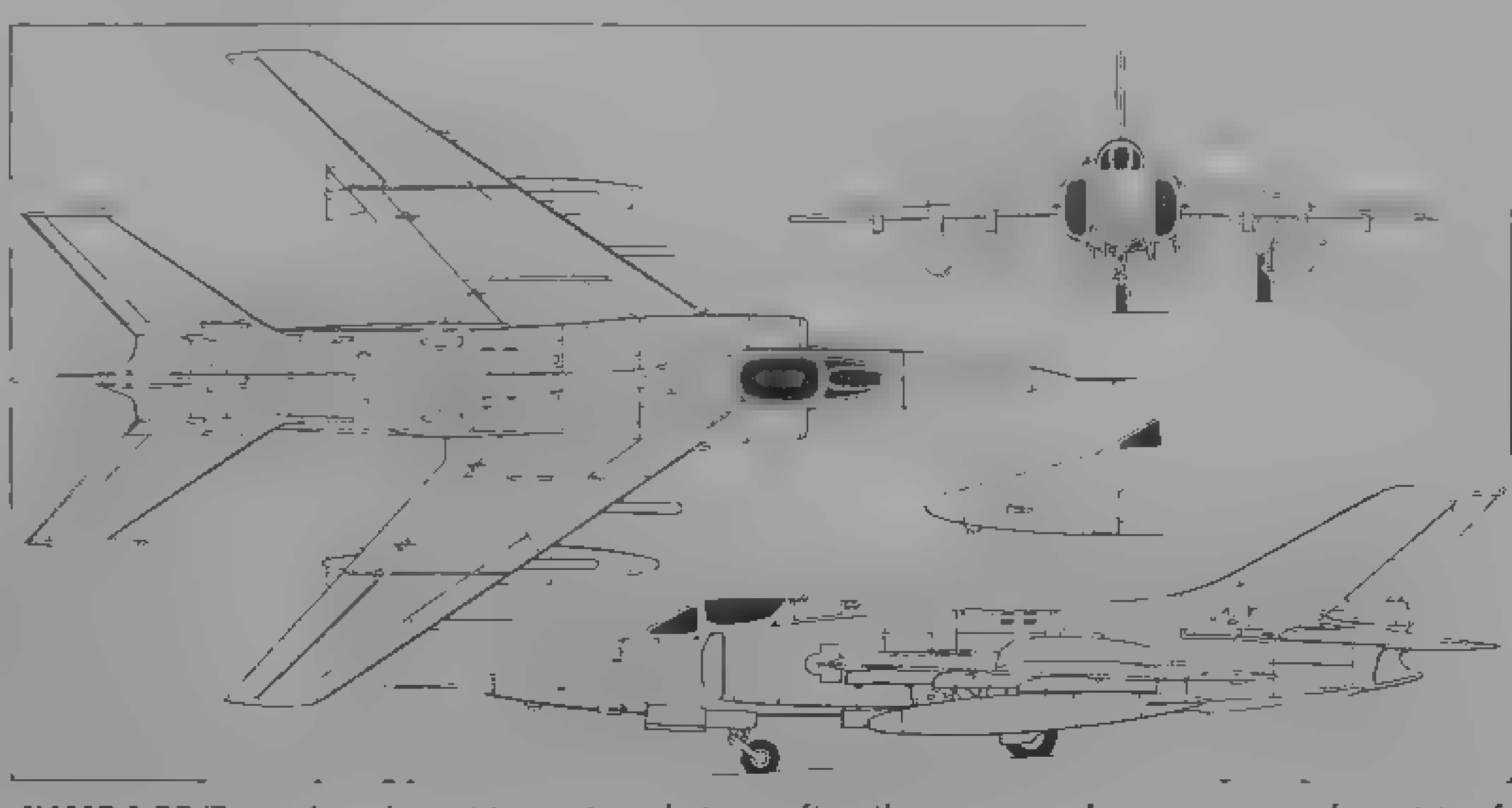
Flight: WL-7 radio compass, WG-4 low-altitude radio altimeter; LTC-2 horizon gyro; XS-6 marker beacon receiver.

Self-defence: Type 930 RWR (antenna in fin-tip).

Space provision in nose and centre-fuselage for additional or updated avionics.

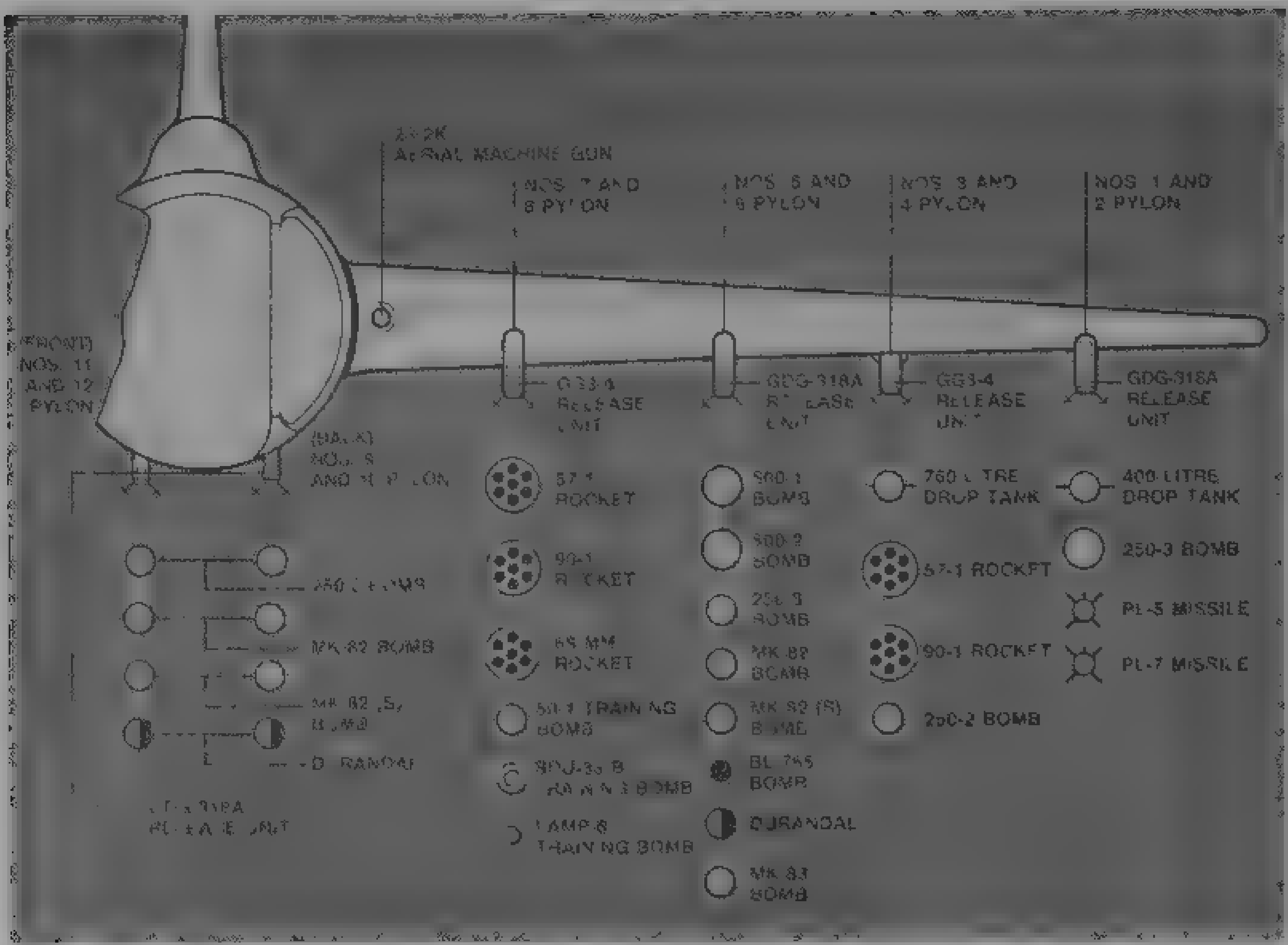
EQUIPMENT: Combat camera in small teardrop fairing on starboard side of nose (not on export models). Landing light under fuselage, forward of nosewheel bay and offset to port. Taxying light on nosewheel leg.

ARMAMENT: Internal armament consists of one 23 mm cannon (Norinco Type 23-2K), with 100 rds, in each wingroot. Ten attachment points normally for external stores: two pairs in tandem under centre of fuselage, and three under each wing (one inboard and two outboard of mainwheel leg). Fuselage stations can each carry a 250 kg bomb (Chinese 250-2 or 250-3, US Mk 82 or Snakeye, French Durandal, or similar). Inboard wing stations can carry 6 kg or 25 lb



NAMC A-5C 'Fantan' single-seat twin-jet combat aircraft, with scrap view showing nose configuration of A-5M *(Jane's/Dennis Punnett)*

1991



Weapon options of the export A-5M

1995

practice bombs, or a pod containing eight Chinese 57-2 (57 mm), seven 68 mm, or seven Norinco 90-1 (90 mm) or four 130-1 (130 mm) rockets. Centre wing stations can carry a 500 kg or 750 lb bomb, a BL755 600 lb cluster bomb, a Chinese 250-2 or -3 bomb, US Mk 82 or Snakeye, French Durandal, or similar, or a Chinese C-801 anti-shipping missile. Normal bomb carrying capacity is 1,000 kg (2,205 lb), maximum capacity 2,000 kg (4,410 lb). Instead of bombs, centre wing stations can each carry a 760 litre drop tank (see Power Plant paragraph) or ECM pod. Outboard wing stations can each be occupied by a 400 litre drop tank (when the larger tank is not carried on the centre wing station) or by air-to-air missiles such as PL-2, PL-2B, PL-7, AIM-9 Sidewinder and R550 Magic. With an overall maximum T-O weight, all stores mentioned can be carried provided that CG shift remains within allowable operating range of 31 to 39 per cent of mean aerodynamic chord; more than 22 external stores configurations possible. Aircraft carries SH-1J or ABS1A optical sight for level and dive bombing, or for air-to-ground rocket launching. Some early aircraft in Chinese service modified to carry a single 5-20 kT nuclear bomb.

DIMENSIONS, EXTERNAL:
- Wing span: Q-5 IA — 9.68 m (31 ft 9 in)
  - A-5C — 9.70 m (31 ft 10 in)
- Wing chord (mean aerodynamic) — 3.097 m (10 ft 2 in)
- Wing aspect ratio — 3.37
- Length overall:
  - incl nose probe: Q-5 IA — 15.65 m (51 ft 4¼ in)
    - A-5C — 16.772 m (55 ft 0¼ in)
  - excl nose probe: A-5C — 15.695 m (51 ft 6 in)
- Height overall: Q-5 IA — 4.333 m (14 ft 2¼ in)
  - A-5C — 4.515 m (14 ft 9¾ in)
- Wheel track — 4.40 m (14 ft 5¼ in)
- Wheelbase — 4.01 m (13 ft 2 in)

AREAS (Q-5 IA and A-5C):
- Wings, gross — 27.95 m² (300.85 sq ft)
- Ailerons (total) — 3.30 m² (35.52 sq ft)
- Airbrake — 1.773 m² (19.08 sq ft)
- Vertical tail surfaces (total) — 4.64 m² (49.94 sq ft)
- Horizontal tail surfaces:
  - movable — 5.00 m² (53.82 sq ft)
  - total, incl projected fuselage area — 8.62 m² (92.78 sq ft)
- Ventral strakes (total) — 1.60 m² (17.22 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty: Q-5 IA — 6,375 kg (14,054 lb)
  - A-5C — 6,398 kg (14,105 lb)
- Fuel: max internal — 2,827 kg (6,232 lb)
  - two 400 l drop tanks — 62[illegible] kg ([illegible]367 lb)
  - two 760 l drop tanks — [illegible]178 kg ([illegible] lb)
  - max internal/external — 4,005 kg (8,829 lb)
- Max external stores load — 2,000 kg (4,410 lb)
- Max T-O weight:
  - clean: Q-5 IA — 9,486 kg (20,913 lb)
    - A-5C — 9,495 kg (20,932 lb)
  - with max external stores:
    - Q-5 IA — 11,830 kg (26,080 lb)
    - A-5C — 12,000 kg (26,455 lb)
- Max wing loading:
  - clean: Q-5 IA — 339.4 kg/m² (69.5 lb/sq ft)
    - A-5C — 341.0 kg/m² (69.9 lb/sq ft)
  - with max external stores:
    - Q-5 IA — 423.3 kg/m² (86.7 lb/sq ft)
    - A-5C — 429.3 kg/m² (87.9 lb/sq ft)
- Max power loading:
  - clean: Q-5 IA — 148.8 kg/kN (1.46 lb/lb st)
    - A-5C — 149.5 kg/kN (1.47 lb/lb st)
  - with max external stores:
    - Q-5 IA — 185.6 kg/kN (1.82 lb/lb st)
    - A-5C — 188.3 kg/kN (1.85 lb/lb st)

PERFORMANCE (A-5C at max clean T-O weight, with afterburning, except where indicated):
- Max limiting Mach number — 1.5
- Max level speed: at 11,000 m (36,000 ft) — Mach 1.12 (643 kts, 1,190 km/h, 740 mph)
  - at S/L — 658 kts (1,220 km/h; 758 mph)
- T-O speed: clean, 15° flap — 162 kts (300 km/h; 186 mph)
  - with max external stores, 25° flap — 178 kts (330 km/h; 205 mph)
- * Landing speed: 25° flap, brake-chute deployed — 150-165 kts (278-307 km/h, 172-191 mph)
- * Max rate of climb at 5,000 m (16,400 ft) — 4,980-6,180 m (16,340-20,275 ft)/min
- Service ceiling — 15,850 m (52,000 ft)
- T-O run:
  - *clean, 15° flap — 700-750 m (2,300-2,460 ft)
  - with max external stores, 25° flap — 1,250 m (4,100 ft)
- Landing run:
  - 25° flap, brake-chute deployed — 1,060 m (3,480 ft)
- Combat radius with max external stores, afterburners off:
  - lo-lo-lo (500 m, 1,640 ft) — 216 n miles (400 km, 248 miles)
  - hi-lo-hi (8,000/500/8,000 m, 26,250/1,640/26,250 ft) — 324 n miles (600 km; 373 miles)
- Range at 11,000 m (36,000 ft) with max internal and external fuel, afterburners off — nearly 1,080 n miles (2,000 km, 1,243 miles)
- *g* limits:
  - with full load of bombs and/or drop tanks — +5
  - with drop tanks empty — +6.5
  - clean — +7.5

* *depending upon airfield elevation and temperature*

UPDATED

NAMC A-5M

TYPE: Upgraded export version of Q-5 II.

PROGRAMME: Begun 1 August 1986 by Alenia (Italy) and CATIC to upgrade nav/attack capability; two Q-5 IIs converted as prototypes, first one (first flight 30 August 1988) lost in crash 17 October same year; first flight of second prototype 8 March 1989, replacement for first aircraft completed subsequently; successful completion of development and flight testing announced 19 February 1991; plans reported mid-1992 for further improvements including Martin Baker zero/zero seat, new Alenia ECM pod and WP6A III engines (same ratings, but TBO increased from 150 to 300 hours). According to chief A-5M designer Yong Zhengqiu in early 1993, ongoing upgrade programme will also include wider use of radar-absorbent composites to reduce radar signature, addition of in-flight refuelling probe, installation of IR night vision equipment (helmet mounted NVGs and electronic displays) and laser rangefinder; more powerful active jammer pod, and ability to carry laser-guided bombs and anti-radiation missiles.

Cockpit of NAMC A-5C

1995

DESIGN FEATURES: New all-weather nav/attack system similar to that used in AMX; uprated engines; two additional underwing stores stations.

POWER PLANT: Improved WP6A turbojets with dry and afterburning ratings of 29.42 kN (6,614 lb st) and 36.78 kN (8,267 lb st) respectively. Underwing drop tanks can be of 1,140 litre (301 US gallon, 251 Imp gallon) capacity.

AVIONICS: *Comms:* AR 3201 VHF radio; IFF.

Radar: Pointer 2500 ranging radar.

Flight: Litton LN-39A INS; radio altimeter; radio compass, marker beacon receiver, air data computer, three-axis gyro package, HSI.

Instrumentation: Alenia HUD-35, AG-5 attitude indicator.

Mission: All-weather nav/attack system designed around two Singer central digital computers and dual-redundant MIL-STD-1553B databus, interfaced to com/nav and armament systems.

Self-defence: RW-30 RWR. Chaff/flare dispenser.

ARMAMENT: External stores stations increased to 12 by adding fourth pylon beneath each outer wing, with some redistribution of weapons on each wing station. PL-5B added to range of air-to-air missiles; larger underwing drop tanks optional (see Power Plant). External stores configurations otherwise generally as for Q-5 IA/A-5C.

DIMENSIONS, EXTERNAL: As for Q-5 IA/A-5C except:
- Length overall — 15.366 m (50 ft 5 in)
- Height overall — 4.53 m (14 ft 10¼ in)

WEIGHTS AND LOADINGS:
- Weight empty — 6,728 kg (14,833 lb)
- * Max external stores load — 2,000 kg (4,410 lb)
- Max T-O weight: clean — 9,769 kg (21,537 lb)
  - with max external stores — 12,200 kg (26,869 lb)
- Max wing loading: clean — 349.5 kg/m² (71.58 lb/sq ft)
  - with max external stores — 436.5 kg/m² (89.40 lb/sq ft)
- Max power loading: clean — 132.8 kg/kN (1.30 lb/lb st)
  - with max external stores — 165.8 kg/kN (1.63 lb/lb st)

* *Reportedly to be increased to 3,000 kg (6,614 lb)*

Prototype A-5M improved-capability attack aircraft, with new nav/attack system and digital avionics

1990

PERFORMANCE (estimated)
- Max level speed at S/L at clean T-O weight: 658 kts (1,220 km/h, 758 mph)
- Max level flight Mach number at 11,000 m (36,000 ft) at clean T-O weight: 1.205
- Unstick speed, with afterburning
  - no external stores, 15° flap: 162 kts (300 km/h, 187 mph)
  - full external stores, 25° flap: 174 kts (322 km/h, 200 mph)
- Landing speed, 25° flap, brakes on and brake-chute deployed (depending upon AUW): 150-166 kts (278-307 km/h, 173-191 mph)
- Max vertical rate of climb at 5,000 m (16,400 ft) at clean T-O weight, with afterburning: 6,900 m (22,638 ft)/min
- Service ceiling at clean T-O weight: 16,000 m (52,500 ft)
- T-O run, with afterburning
  - no external stores, 15° flap: 911 m (2,989 ft)
  - full external stores, 25° flap: 1,250 m (4,101 ft)
- Landing run, 25° flap, brakes on and brake-chute deployed: 1,060 m (3,478 ft)
- Combat radius with full external stores
  - out at 8,000 m (26,250 ft), combat at 500 m (1,640 ft) and back at 11,000 m (36,000 ft): 280 n miles (518 km, 322 miles)
  - out, combat and back all at 500 m (1,640 ft): 174 n miles (322 km, 200 miles)
- Range at 11,000 m (36,000 ft) with two 760 litre (200 US gallon, 167 Imp gallon) drop tanks: 1,080 n miles (2,000 km, 1,243 miles)

UPDATED

NAMC CJ-6A

Chinese name: Chuji Jiaolianji-6A (Basic training aircraft 6A) or Chujiao-6A

Westernised designation: PT-6A

TYPE: Primary trainer

PROGRAMME: Design initiated at Shenyang Autumn 1956 as Chinese engineered successor to CJ-5 (licence Yak-18; see 1991-92 and earlier *Jane's*); first flight of first prototype (108 kW; 145 hp Mikulin M-11ER engine) 27 August 1958, but trials disappointing; modified version with 194 kW (260 hp) Ivchenko AI-14R made first flight 18 July 1960. Responsibility subsequently transferred to Nanchang; further redesign preceding first flight of production-standard prototype 15 October 1961; production go-ahead for aircraft January 1962, for HS6 engine (Chinese AI-14R) June 1962.

CURRENT VERSIONS: **CJ-6A**: Standard version since December 1965, with uprated HS6A engine.

CJ-6B: Armed version; 10 built 1964-66.

Haiyan A: Prototype of civil agricultural version, described in 1991-92 and earlier *Jane's*. Programme superseded by N-5A (which see).

CUSTOMERS: Total of 1,796 (all versions) built by end of 1986; more than 2,000 now built for PLA Air Force and approximately 200 for foreign customers. Exported to Albania, Bangladesh, Cambodia, North Korea, Tanzania and Zambia, plus civilian owners in Australia (from 1991), USA and elsewhere.

DESIGN FEATURES: Low-mounted wings with dihedral on outer panels, tandem seats in framed 'glasshouse' cockpit.

STRUCTURE: All-metal, with two-spar wings, outer panels of which are detachable.

LANDING GEAR: Retractable tricycle type with low-pressure mainwheel tyres, suitable for operation from grass strips.

POWER PLANT: One 213 kW (285 hp) Zhuzhou (SMPMC) HS6A nine-cylinder air-cooled radial engine, driving a Baoding J9-G1 two-blade constant-speed propeller. Fuel capacity (two tanks) 100 litres (26.4 US gallons, 22 Imp gallons).

DIMENSIONS, EXTERNAL:
- Wing span: 10.22 m (33 ft 6½ in)
- Length overall: 8.46 m (27 ft 9 in)
- Height overall: 3.25 m (10 ft 8 in)

WEIGHTS AND LOADINGS:
- Weight empty: 1,095 kg (2,414 lb)
- Max fuel: 110 kg (243 lb)
- Max T-O weight: 1,400 kg (3,086 lb)

PERFORMANCE:
- Max permissible diving speed: 199 kts (370 km/h, 230 mph)
- Max level speed: 160 kts (297 km/h, 185 mph)
- Landing speed: 62 kts (115 km/h, 72 mph)
- Max rate of climb at S/L: 380 m (1,248 ft)/min
- Service ceiling: 6,250 m (20,500 ft)
- T-O run: 280 m (920 ft)
- Landing run: 350 m (1,150 ft)
- Range with max fuel: 372 n miles (690 km, 428 miles)
- Endurance: 3 h 36 min

UPDATED

NAMC N-5A

Chinese name: Nongye Feiji 5 (Agricultural aircraft 5) or Nong-5

TYPE: Single/two-seat agricultural aircraft

PROGRAMME: Design began November 1987, first details being revealed at Farnborough air show September 1988; first of three prototypes (B-501L) made first flight 26 December 1989; CAAC type certificate awarded 12 August 1992, batch production then initiated in anticipation of manufacturing approval.

CURRENT VERSIONS: **N-5A**: Standard version, *as described*.

CUSTOMERS: At least seven ordered by Chinese agricultural agencies or farms by end of 1993, others leased by NAMC during that year. Estimated domestic market for more than 300 as Y-5 replacement, also expected to be offered for export.

DESIGN FEATURES: Designed to meet Chinese (CCAR) and US (FAR Pt 23) Normal category requirements, for specialised farming and forestry applications; crash-resistant forward fuselage with quickly removable side panels; cable cutter on windscreen, with deflector cable from this to tip of fin. Wings mainly constant chord, of LS(1)-0417 Mod section (17 per cent thickness/chord ratio), but swept forward 18 at root; dihedral 4° 30' from roots, incidence 2°. Tailplane has inverted aerofoil section.

FLYING CONTROLS: [illegible] with ailerons operable differentially; ground adjustable tab on rudder and each aileron; electrically actuated trim tab in [illegible] trailing-edge flaps [illegible]

STRUCTURE: All-metal, with two-spar thin-wall wings, two-spar fin and tailplane, welded alloy steel tube forward fuselage and riveted duralumin rear fuselage; lower fuselage skin panels are of stainless steel and non-removable. Entire structure anodised before assembly and finished in polyurethane enamel paint.

LANDING GEAR: Non-retractable tricycle type, with single wheel and oleo-pneumatic shock-absorber on each unit. Nose unit has a telescopic strut, a size 400 × 150 mm tyre (pressure 2.5 bars; 36.3 lb/sq in), and is fitted with a shimmy damper and wire cutter. Main gear legs are of trailing-link type, with tyres size 500 × 200 mm, pressure 3.0 bars (43.5 lb/sq in). Hydraulic mainwheel disc brakes and parking brake.

POWER PLANT: One 298 kW (400 hp) Textron Lycoming IO-720-D1B flat-eight engine, driving a Hartzell HC-C3YR-1RF/F8475R three-blade variable-pitch metal propeller. All fuel in wing tanks with combined capacity of 315 litres (83.2 US gallons; 69.3 Imp gallons). Gravity fuelling point in upper surface of each wing at root.

ACCOMMODATION: Tandem seats and inertia reel safety harnesses for pilot and, when required, a loader/mechanic, under hard-top framed canopy with all round field of view. Downward opening window/door on each side. Cockpit semi-sealed with ram air ventilation, slightly pressurised to prevent chemical ingress. Cockpit heating optional. Windscreen washer, wiper and demister standard. Deflector cable from top of windscreen cable cutter to tip of fin.

SYSTEMS: Hydraulic system for brakes only. No pneumatic system. Electrical system powered by Prestolite 28 V 100 A AC generator and 30 Ah battery.

AVIONICS: *Comms*: Bendix/King KY 96A VHF com transceiver standard. KHF 950 HF/SSB com transceiver optional.

Flight: Options include Type 263 radio altimeter; LC-2 magnetic compass, WL-7A radio compass, and XS-6B marker beacon receiver. Stall warning system.

EQUIPMENT: Glassfibre honeycomb hopper, for liquid or dry chemicals, forward of cockpit, with quick-dump system permitting release of all contents within 5 seconds. Solid or spray dispersal system, as appropriate. Dispersal of liquids, powered by fan-driven pump, is via Y-type filter and 60-nozzle spraybars and is suitable for high, medium or low volume application. Wire cutters on main landing gear and in front of cockpit canopy.

DIMENSIONS, EXTERNAL:
- Wing span: 13.418 m (44 ft 0¼ in)
- Wing chord: at root: 2.319 m (7 ft 7¼ in)
  - constant portion: 1.877 m (6 ft 2 in)
- Wing aspect ratio: 6.80
- Length overall: 10.487 m (34 ft 4¾ in)
- Height overall: 3.733 m (12 ft 3 in)
- Fuselage: Max width: 1.01 m (3 ft 3¾ in)
  - Max depth: 1.735 m (5 ft 8¼ in)
- Tailplane span: 4.59 m (15 ft 0¾ in)
- Wheel track: 3.528 m (11 ft 7 in)
- Wheelbase: 2.713 m (8 ft 10¾ in)
- Propeller diameter: 2.184 m (7 ft 2 in)

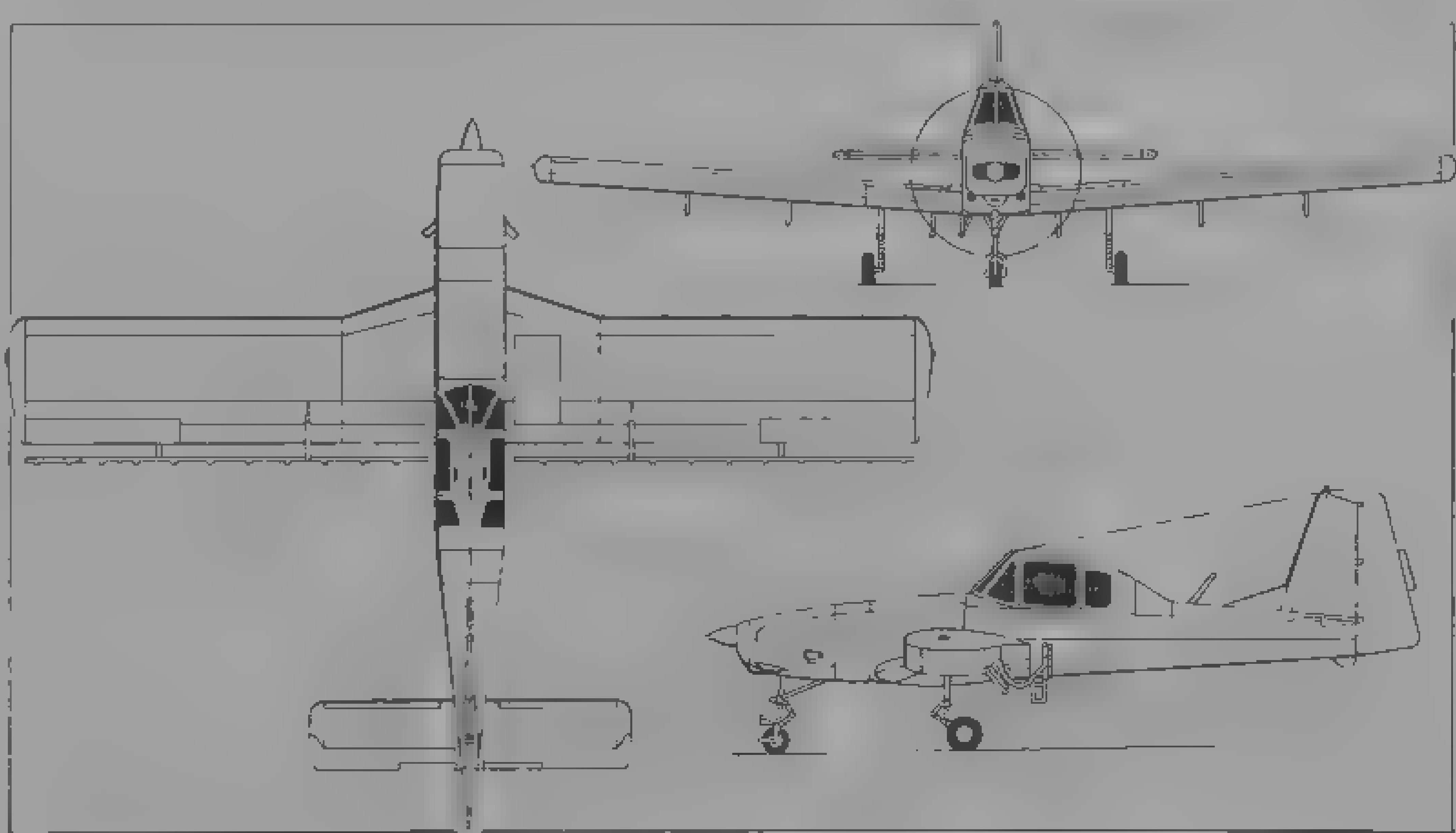
DIMENSIONS, INTERNAL:
- Cockpit: Length: 2.29 m (7 ft 6¼ in)
  - Max width: 1.00 m (3 ft 3¼ in)
  - Max height: 1.26 m (4 ft 1½ in)
- Hopper volume: 1.20 m³ (42.38 cu ft)

AREAS:
- Wings, gross: 26.0 m² (279.86 sq ft)
- Ailerons (total): 2.08 m² (22.39 sq ft)
- Trailing-edge flaps (total): 4.06 m² (43.70 sq ft)
- Fin: 2.28 m² (24.54 sq ft)
- Rudder, incl tab: 1.57 m² (16.90 sq ft)
- Tailplane: 4.68 m² (50.38 sq ft)
- Elevators (total, incl tabs): 2.20 m² (23.68 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty: 1,328 kg (2,928 lb)
- Fuel weight: normal: 85 kg (187 lb)
  - max: 233 kg (513 lb)

NAMC PT-6A primary trainers of the Bangladesh Air Force *(Peter Steinemann)*

1993



NAMC N-5A agricultural monoplane *(Jane's/Mike Keep)*

1990

Payload normal	705 kg (1,554 lb)
max	905 kg (1,995 lb)
Max T-O weight: normal	2,250 kg (4,960 lb)
overload	2,450 kg (5,401 lb)
Max wing loading: normal	86.54 kg/m² (17.72 lb/sq ft)
overload	94.23 kg/m² (19.30 lb/sq ft)
Max power loading: normal	7.55 kg/kW (12.40 lb/hp)
overload	8.22 kg/kW (13.50 lb/hp)

PERFORMANCE (A: with, B: without dispersal equipment)

Max level speed: A	111 kts (205 km/h, 127 mph)
B	118 kts (220 km/h, 136 mph)
Normal operating speed:	
A, B	92 kts (170 km/h, 105 mph)
Stalling speed:	
A, B, flaps up	57 kts (105 km/h, 66 mph)
A, B, flaps down	47 kts (86 km/h, 54 mph)
Max rate of climb at S/L: A	257 m (845 ft)/min
B	281 m (922 ft)/min
Service ceiling: A	3,750 m (12,[illegible] ft)
B	4,280 m (14,[illegible] ft)
T-O run: A	303 m (995 ft)
B	296 m (971 ft)
T-O to 15 m (50 ft): A	569 m (1,867 ft)
B	553 m (1,814 ft)
Landing from 15 m (50 ft): A	373 m (1,225 ft)
B	379 m (1,243 ft)
Landing run: A	246 m (807 ft)
B	252 m (827 ft)
Min banking turn radius: A	145 m (476 ft)
B	140 m (459 ft)
Normal range with max payload, 45 min reserves:	
A	135 n miles (250 km, 155 miles)
B	152 n miles (282 km, 175 miles)
Ferry range with max fuel:	
A	528 n miles (979 km, 608 miles)
Endurance with max payload, 45 min reserves:	
A	1 h 48 min
B	1 h 56 min
Endurance (self-ferry) with max fuel	5 h 45 min

First prototype NAMC N-5A (Textron Lycoming IO-720 flat-eight engine) *1991*

UPDATED

SAC

SHAANXI AIRCRAFT COMPANY

PO Box 34, Chenggu, Shaanxi 723213
Telephone: 86 (916) 2 6301
Fax: 86 (916) 216302
PRESIDENT: Wang Wenfeng
MARKETING MANAGER: Li Yousen

Founded early 1970s; currently occupies a 204 ha (504 acre) site and had 1994 workforce of about 10,000; covered workspace includes largest final assembly building in China. Main aircraft programme is Y-8 transport; non-aerospace products include 36-seat coaches and small trucks.

VERIFIED

SAC Y-8

Chinese name: Yunshuji-8 (Transport aircraft 8) or Yun-8

TYPE: Four-turboprop medium-range transport.

PROGRAMME: Redesign, as Chinese development of Antonov An-12B, started at Xian March 1969; first flight of first prototype 25 December 1974, followed by second (first built by SAC) 29 December 1975; production go-ahead given January 1980; type approval of Y-8X awarded September 1984, Y-8F 26 January 1994. First Y-8B delivered 1986, first Y-8A and Y-8D 1987, first Y-8E 1989, first Y-8F early 1990. Pressurised Y-8C made first flight 17 December 1990; Y-8C domestic certification 1993, followed by initial batch production.

CURRENT VERSIONS: **Y-8**: Prototype.

Y-8A: Helicopter carrier. Main cabin height increased by 120 mm (4.72 in) by deleting internal gantry; downward-opening rear ramp/door. In service. *Detailed description applies to this version unless otherwise indicated.*

Y-8B: Civil transport. Military equipment deleted, weight reduced by 1,720 kg (3,792 lb), some avionics differ. In service.

Y-8C: Fully pressurised version for civil and military applications, developed with Lockheed collaboration. Pressurised volume increased from 31 m³ (1,095 cu ft) to 212 m³ (7,487 cu ft); effective length of cargo hold extended by 2.00 m (6 ft 6¾ in); other changes include redesigned cargo loading door and main landing gear, improved air conditioning and oxygen systems, additional emergency exits. Five delivered by January 1994.

Y-8D: Export version, with main avionics by Collins and Litton. Ten orderd by January 1995.

Y-8E: Drone carrier version. Forward pressure cabin accommodates drone controller's console; carrier/launch trapeze for one drone under each outer wing panel. In service.

Y-8F: Livestock carrier, with cages to hold up to 500 sheep or goats. In service.

Y-8H: Aerial survey version.

Y-8X: Maritime patrol version, with Western com/nav, radar, surveillance and search equipment; larger chin radome. May be used for both ASW patrol and civilian offshore duties such as fishery patrol, pollution monitoring and oil exploration support, but not yet in production.

CUSTOMERS: Total of 50 delivered by December 1994, including 10 exported. In service in China with commercial operators and PLA Air Force; exports (Y-8D) to air forces of Myanma (four), Sri Lanka (four) and Sudan (two). First two Sri Lankan aircraft modified locally for use as bombers (one since lost).

DESIGN FEATURES: More pointed nose transparencies than An-12; high-mounted wing, circular-section fuselage (forward section and tail turret pressurised), upswept at rear, angular tail surfaces with large dorsal fin.

Wing sections C-5-18 at root, C-3-16 at rib 15 and C-3-14 at tip, final two digits indicating thickness/chord ratio; incidence 4°; 1° dihedral on intermediate panels, 4° anhedral on outboard panels; 6° 50′ sweepback at quarter-chord; fixed incidence tailplane.

FLYING CONTROLS: Mechanical actuation of aerodynamically balanced differential ailerons, elevators and rudder, each of which has inset trim tab; two-segment, hydraulically actuated double-slotted Fowler flaps on each wing trailing-edge; comb-shaped spoilers forward of flaps.

STRUCTURE: All-metal (aluminium alloy) conventional semi-monocoque/stressed skin; wings, tailplane and fin are two-spar box structures; landing gear and all hydraulic components manufactured by Shaanxi Aero-Hydraulic Component Factory (SAHCF).

LANDING GEAR: Hydraulically retractable tricycle type, with Shaanxi (SAHCF) nitrogen/oil shock-struts on all units. Four-wheel main bogie on each side retracts inward and upward into blister on side of fuselage. Twin-wheel nose unit, hydraulically steerable to ±35°, retracts rearward. Mainwheel tyres size 1,050 × 300 mm, pressure 28.4 bars (412 lb/sq in); nosewheel tyres size 900 × 300 mm, pressure 16.7 bars (242 lb/sq in). Hydraulic disc brakes and Xingping inertial anti-skid sensor. Minimum ground turning radius 13.75 m (45 ft 1¼ in).

POWER PLANT: Four 3,177 kW (4,260 ehp) Zhuzhou (SMPMC) WJ6 turboprops, each driving a Baoding four-blade J17-G13 constant-speed propeller. Alternative power plants under consideration include GE CT7. All fuel in two integral tanks and 29 bag-type tanks in wings (20,102 litres; 5,310.5 US gallons; 4,422 Imp gallons) and fuselage (10,075 litres; 2,661.5 US gallons; 2,216 Imp gallons), giving total capacity of 30,177 litres (7,972 US gallons; 6,638 Imp gallons). Refuelling points in starboard side of fuselage (between frames 14 and 15), mainwheel fairing, and in wing upper surface.

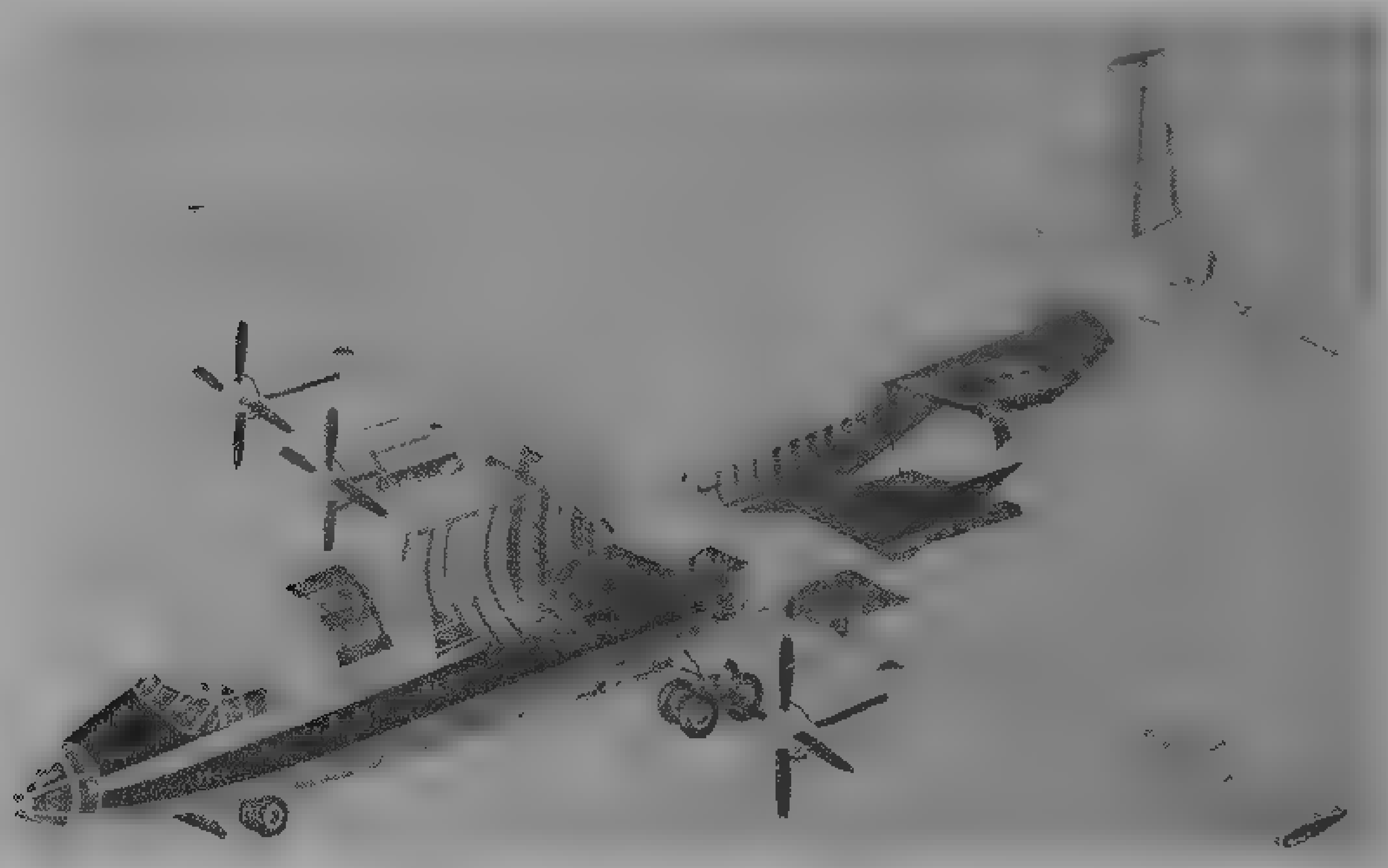
ACCOMMODATION: Flight crew of five (pilot, co-pilot, navigator, engineer and radio operator). Forward portion of fuselage (up to frame 13) is pressurised, and can accommodate up to 14 passengers in addition to crew. Cargo compartment (between frames 13 and 43) is unpressurised. Maximum accommodation for up to 96 troops, or 82 paratroops; or up to 83 casualties with three medical attendants, or two 'Liberation' army trucks. Crew door and two emergency exits in forward fuselage. Three additional emergency exits in cargo compartment, access to which is via a large rear loading ramp/door in underside of rear fuselage. Individual cargo items of up to 7,400 kg (16,314 lb) can be air-dropped. Entire accommodation heated and ventilated.

SYSTEMS: Forward fuselage pressurised to maintain a differential of 0.20 bar (2.84 lb/sq in) at altitudes above 4,300 m (14,100 ft). Two independent hydraulic systems, with operating pressures of 152 bars (2,200 lb/sq in) (port) and 147 bars (2,130 lb/sq in) (starboard), plus hand and electrical standby pumps, for actuation of landing gear extension/retraction, nosewheel steering, flaps, brakes and rear ramp/door. Electrical DC power (28.5 V) supplied by eight 12 kW generators, an 18 kW (24 hp) Xian Aero Engine Co APU (mainly for engine starting) and four 28 Ah batteries. Four 12 kVA alternators provide 115 V AC power at 400 Hz. Gaseous oxygen system for crew. Electric de-icing of windscreen, propellers and fin/tailplane leading edges; hot air de-icing for wing leading-edges.

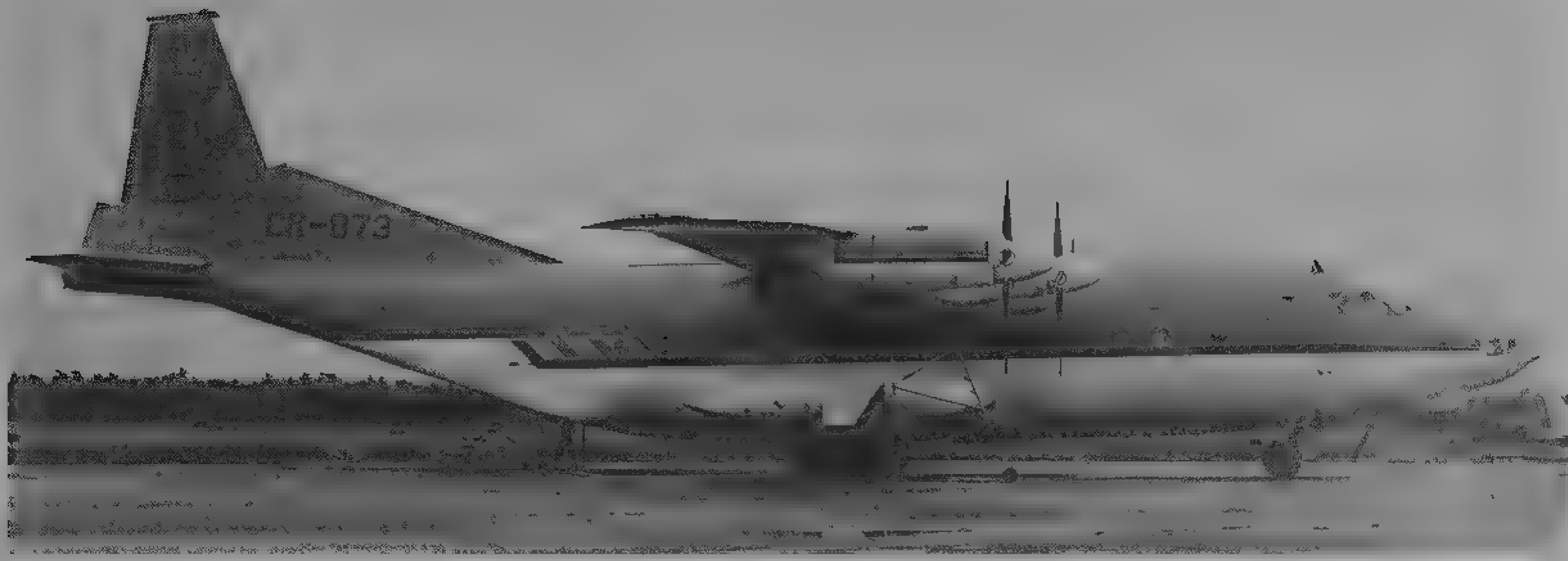
AVIONICS (Y-8C): *Comms:* Collins UHF and Bendix/King HF com radios and ATC transponder; Sundstrand CVR.

Radar: Honeywell colour weather radar.

Flight: Litton Omega/VLF nav system; Collins flight director, air data computer, ILS and comparator warning



Cutaway drawing of the pressurised Y-8C *1994*



SAC Y-8D four-turboprop medium-range transport of the Sri Lanka Air Force *(Denis Hughes)*

1995

system; Honeywell magnetic heading reference system and vertical gyro, Sundstrand flight data recorder

AVIONICS (Y-8X) *Comms* Collins VHF, dual HF (DF-2 and DS-3) and HF/SSB radios, IFF; TDR-90 ATC transponder

Radar: Litton Canada AN/APS 504(V)3 search radar

Flight: Litton Canada LTN-72 INS and LTN-211 Omega navigation system, autopilot, Collins ADF, DME-42, VOR-32, HSI 85, ADI-85A and 520-3337 RMI

Mission. Optical and infra-red cameras, IR submarine detection system, sonobuoys

DIMENSIONS, EXTERNAL

Wing span	38.00 m (124 ft 8 in)
Wing chord, at root	4.73 m (15 ft 6¼ in)
at tip	1.69 m (5 ft 6½ in)
mean aerodynamic	3.451 m (11 ft 3⅞ in)
Wing aspect ratio	11.85
Length overall	34.022 m (111 ft 7½ in)
Fuselage	
Max diameter of circular section	4.10 m (13 ft 5½ in)
Height overall	11.16 m (36 ft 7½ in)
Tailplane span	12.196 m (40 ft 0¼ in)
Wheel track (c/l of shock struts)	4.92 m (16 ft 1¾ in)
Wheelbase (c/l of main bogie)	9.576 m (31 ft 5 in)
Propeller diameter	4.50 m (14 ft 9¼ in)
Propeller ground clearance	1.89 m (6 ft 2½ in)
Crew door: Height	1.455 m (4 ft 9¼ in)
Width	0.80 m (2 ft 7½ in)
Rear-loading hatch: Length	7.67 m (25 ft 2 in)
Width: min	2.65 m (8 ft 8¼ in)
max	3.10 m (10 ft 2 in)
Emergency exits (each): Height	0.55 m (1 ft 9¾ in)
Width	0.60 m (1 ft 11 in)

DIMENSIONS, INTERNAL

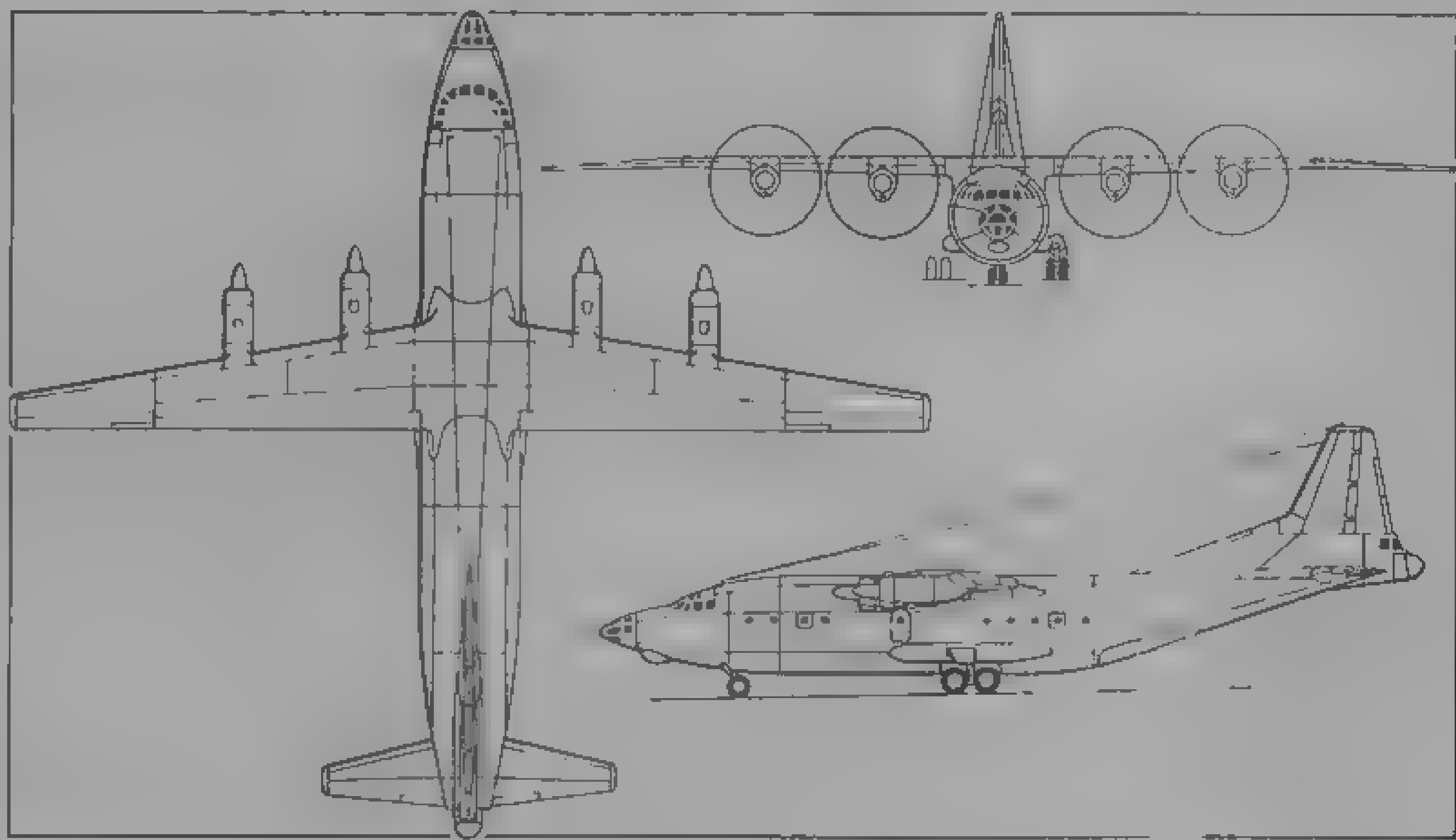
Cabin (incl flight deck, galley and toilet)	
Length	13.50 m (44 ft 3½ in)
Width: min	3.00 m (9 ft 10 in)
max	3.50 m (11 ft 5¾ in)
Height: min	2.40 m (7 ft 10½ in)
max	2.60 m (8 ft 6½ in)
Floor area	55.0 m² (592.0 sq ft)
Volume	123.3 m³ (4,354.3 cu ft)

AREAS

Wings, gross	121.86 m² (1,311.7 sq ft)
Ailerons (total)	7.84 m² (84.39 sq ft)
Trailing-edge flaps (total)	26.91 m² (289.66 sq ft)
Rudder	6.537 m² (70.36 sq ft)
Tailplane	27.05 m² (291.16 sq ft)
Elevators (total)	7.101 m² (76.43 sq ft)

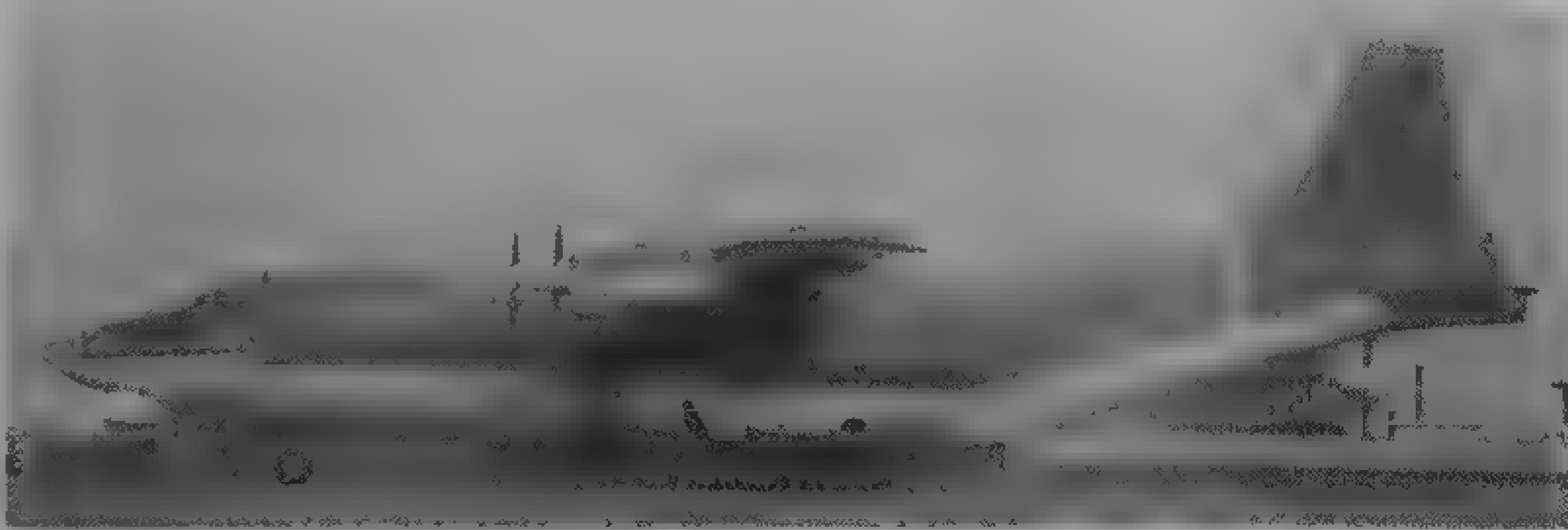
WEIGHTS AND LOADINGS

Weight empty, equipped	35,500 kg (78,264 lb)
Max fuel load	22,900 kg (50,485 lb)
Max payload: containerised	16,000 kg (35,275 lb)
bulk cargo	20,000 kg (44,090 lb)
Max air droppable cargo	13,200 kg (29,100 lb)
Max T-O weight	61,000 kg (134,480 lb)
Max taxi weight	61,500 kg (135,585 lb)
Max landing weight	58,000 kg (127,870 lb)
Max zero-fuel weight	36,266 kg (79,955 lb)
Max wing loading	500.6 kg/m² (102.5 lb/sq ft)
Max power loading	4.80 kg/kW (7.89 lb/ehp)



SAC Y-8 four-turboprop multipurpose transport *(Jane's/Mike Kee...)*

1994



The sole example so far completed of the maritime Y-8X

1994

PERFORMANCE (at max T-O weight except where indicated):

Max level speed at 7,000 m (22,965 ft)	370 kts (685 km/h, 425 mph)
Max cruising speed at 8,000 m (26,250 ft)	297 kts (550 km/h, 342 mph)
Econ cruising speed at 8,000 m (26,250 ft)	286 kts (530 km/h, 329 mph)
Unstick speed	129 kts (238 km/h, 148 mph)
Landing speed at MLW	130 kts (240 km/h, 150 mph)
Max rate of climb at S/L	473 m (1,552 ft)/min
Rate of climb at S/L, OEI	231 m (758 ft)/min
Service ceiling, AUW of 51,000 kg (112,435 lb)	10,400 m (34,120 ft)
Service ceiling, OEI, AUW of 51,000 kg (112,435 lb)	8,100 m (26,575 ft)
T-O run	1,270 m (4,167 ft)
T-O to 15 m (50 ft)	3,007 m (9,866 ft)
Landing from 15 m (50 ft) at MLW	2,174 m (7,133 ft)
Landing run at MLW	1,050 m (3,445 ft)
Range:	
with max payload	687 n miles (1,273 km; 791 miles)
with max fuel	3,032 n miles (5,615 km, 3,489 miles)
Max endurance	11 h 7 min

UPDATED

SAGC

SHENYANG AIRCRAFT GROUP INDUSTRY CORPORATION LTD

PO Box 328, Shenyang, Liaoning 110034
Telephone: 86 (24) 6896680
Fax: 86 (24) 6896689
Telex: 80018 SAMC CN
PRESIDENT: Tang Qiansan
VICE-PRESIDENT: Xu Guosheng

Pioneer Chinese fighter design centre (formerly Shenyang Aircraft Corporation, see 1994-95 and earlier *Jane's*); built 767 examples of J-5 (licence MiG-17F) from 1956-59 and from 1963 was major producer of J-6 series (reverse engineered MiG-19), including 634 JJ-6 tandem-seat fighter trainers; initiated development and production of J-7 (see under CAC). Now occupies site area of more than 800 ha (1,976 acres) and has workforce of 30,000, only some 30 per cent of current activities are in aerospace.

Principal recent programme has been J-8 II fighter. On 29 June 1994, SAGC became core enterprise in newly formed

SAGC J-8 II single-seat multirole fighter

1995

Shenyang Aircraft Industry Group (SAIG). Primary current output of SAGC is non-aerospace (automobiles), but according to *China Aero Information* in July 1994 SAIG "will mainly develop and build attackers" and will also produce commercial aircraft.

Aerospace subcontract manufacture includes cargo doors for Boeing 757 and baggage/service/emergency exit doors for de Havilland Dash 8 (100th Dash 8 door delivered 12 June 1992), rudders for BAe Jetstream 61, wing ribs and emergency exits for Airbus A320, tailcone/landing gear door/pylon components for Lockheed C-130, and other machined parts for BAe, Boeing, Daimler-Benz Aerospace Airbus and Saab.

UPDATED

SAGC J-8

Chinese name: Jianjiji-8 (Fighter aircraft 8) or Jian-8
Westernised designation: F-8
NATO reporting name: Finback

TYPE: Single-seat twin-engined air superiority fighter, with secondary capability for ground attack.

PROGRAMME: Development started 1964, first flight of first of two prototypes 5 July 1969; flight trials (but no other J-8 activity) permitted to continue during 1966-76 cultural revolution, totalling 663 hours in 1,025 flights by prototypes; initial production authorised July 1979; three prototypes of J-8 I then built (one lost before flight testing), first flight 24 April 1981 by second aircraft, production go-ahead for this version given July 1985. This preceded 12 June 1984 by first flight of first of four prototypes of much redesigned J-8 II; J-8/J-8 I production ended 1987; Peace Pearl programme (see 1990-91 *Jane's*), to upgrade J-8 II with Western avionics, embargoed by US government mid-1989 and cancelled by China 1990; two prototypes supplied to Grumman for Peace Pearl returned to China 1993, plans for F-8 II upgrade apparently continuing.

CURRENT VERSIONS: **J-8** ('Finback-A'): Initial clear-weather day fighter, powered by two Liyang (LMC) WP7B turbojets (each 43.15 kN, 9,700 lb st dry and 59.82 kN, 13,448 lb st with afterburning) and armed with two single-barrel 30 mm cannon and four wing-mounted PL-2B air-to-air missiles; single intake in nose, with conical centrebody housing ranging radar only. Built in small numbers only, production ended 1987.

J-8 I ('Finback-A'): Improved all-weather version of J-8, with same power plant but fitted from outset with Sichuan SR-4 fire control radar in intake centrebody, single twin-barrel 23 mm cannon. More than 100 now in service (including upgraded J-8s), but gradually being supplanted by J-8 II. Described in 1985-86 *Jane's*.

J-8 II ('Finback-B'): All-weather dual-role version (high-altitude interceptor and ground attack), embodying some 70 per cent redesign compared with J-8 I. Main configuration change is to 'solid' nose and twin lateral air intakes, providing more nose space for fire control radar and other avionics, plus increased air flow for more powerful WP13A II turbojets. In production and service, with at least 24 built by 1993, but being manufactured in small economic batches rather than continuous production. *Detailed description applies to this version.*

F-8 IIM: Proposed export version: WP13B engines (uprated by 4 per cent to 68.65 kN, 15,432 lb st with afterburning), pulse Doppler lookdown radar, digital avionics (including HUD and two HDDs) with 1553B databus, leading-edge flaps, in-flight refuelling, seven stations for 4,500 kg (9,921 lb) stores load, maximum speed Mach 2.2. Roll-out 'before long' announced by SAGC in February 1994, but no further news by early 1995.

CUSTOMERS: China (PLA Air Force and Naval Air Force).

DESIGN FEATURES: Thin-section, mid-mounted delta wings and all-sweptback tail surfaces; fuselage has area rule 'waisting', detachable rear portion for engine access, and dorsal spine fairing; large ventral fin under rear fuselage, main portion of which folds sideways to starboard during take-off and landing, provides additional directional stability; small fence on each wing upper surface near tip; small airscoops at foot of fin leading-edge and at top of fuselage each side, above tailplane. Sweepback 60° on wing and tailplane leading-edges; wings have slight anhedral.

FLYING CONTROLS: Hydraulically boosted ailerons, rudder and low-set all-moving tailplane; two-segment single-slotted flaps on each wing trailing-edge, inboard of aileron; four door type underfuselage airbrakes, one under each engine air intake trunk and one immediately aft of each mainwheel well.

STRUCTURE: Conventional aluminium alloy semi-monocoque, stressed skin construction, with high tensile steel for high load bearing areas of wings and fuselage and titanium in high temperature fuselage areas; ailerons, rudder and rear portion of tailplane are of aluminium honeycomb with sheet aluminium skin; dielectric skins on nosecone, tip of main fin, and on non-folding portion of ventral fin leading-edge.

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel and oleo-pneumatic shock absorber on each unit. Steerable nose unit retracts forward, main units inward into centre fuselage; mainwheels turn to stow vertically inside fuselage, resulting in slight overwing bulge. Brake-chute in bullet fairing at base of rudder.

POWER PLANT: Two Liyang (Guizhou Engine Co) WP13A II turbojets, each rated at 42.7 kN (9,590 lb st) dry and 65.9 kN (14,815 lb st) with afterburning, mounted side by side in rear fuselage with pen-nib fairing above and between exhaust nozzles. Lateral, non-swept air intakes, with automatically regulated ramp angle and large splitter plates similar in shape to those of MiG-23. Internal fuel capacity (four integral wing tanks plus fuselage tanks) approximately 5,400 litres (1,426 US gallons; 1,188 Imp gallons). Single-point pressure refuelling. Provision for auxiliary fuel tanks on fuselage centreline and each outboard underwing pylon.

ACCOMMODATION: Pilot only, on ejection seat under one-piece canopy hinged at rear and opening upward. Cockpit pressurised, heated and air conditioned. Heated windscreen.

SYSTEMS: Two simple air-cycle environmental control systems, one for cockpit heating and air conditioning and one for radar cooling, cooling air bled from engine compressor. Two 207 bar (3,000 lb/sq in) independent hydraulic systems (main utility system plus one for flight control surfaces boost), powered by engine-driven pumps. Primary electrical power (28.5 V DC) from two 12 kW engine-driven starter/generators, with two 6 kVA alternators for 115/200 V three-phase AC at 400 Hz. Pneumatic bottles for emergency landing gear extension. Pop-out ram air emergency turbine under fuselage.

AVIONICS: *Comms*: VHF/UHF and HF/SSB radios; 'Odd Rods' type IFF.

Radar: Monopulse radar in nose.

Flight: ILS, Tacan, marker beacon receiver, radio compass, radar altimeter, autopilot.

Mission: Gyro gunsight and gun camera.

Self-Defence: RWR (antenna in fin-tip); chaff/flare dispensers in tailcone.

Enlarged avionics bays in nose and fuselage provide room for modernised fire control system and other upgraded avionics.

ARMAMENT: One 23 mm Type 23-3 twin-barrel cannon, with 200 rds, in underfuselage pack immediately aft of nosewheel doors. Seven external stations (one under fuselage and three under each wing) for a variety of stores which can include PL-2B infra-red air-to-air missiles, PL-7 medium-range semi-active radar homing air-to-air missiles, Qingan HF-16B 12-round pods of 57 mm Type 57-2 unguided air-to-air rockets, launchers for 90 mm air-to-surface rockets, bombs, or (centreline and outboard underwing stations only) auxiliary fuel tanks.

DIMENSIONS, EXTERNAL:

Wing span	9.344 m (30 ft 7⅞ in)
Wing aspect ratio	2.07
Length overall, incl nose probe	21.59 m (70 ft 10 in)
Height overall	5.41 m (17 ft 9 in)
Wheel track	3.741 m (12 ft 3.4 in)
Wheelbase	7.337 m (24 ft 0¾ in)

AREAS:

Wings, gross	42.2 m² (454.2 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	9,820 kg (21,649 lb)
Normal T-O weight	14,300 kg (31,526 lb)
Max T-O weight	17,800 kg (39,242 lb)
Wing loading:	
at normal T-O weight	338.9 kg/m² (69.4 lb/sq ft)
at max T-O weight	421.8 kg/m² (86.4 lb/sq ft)
Power loading:	
at normal T-O weight	110.5 kg/kN (1.08 lb/lb st)
at max T-O weight	137.5 kg/kN (1.35 lb/lb st)

PERFORMANCE:

Design max operating Mach number	2.2
Design max level speed	701 kts (1,300 km/h; 808 mph) IAS
Unstick speed	175 kts (325 km/h; 202 mph)
Landing speed	156 kts (290 km/h; 180 mph)
Max rate of climb at S/L	12,000 m (39,370 ft)/min
Acceleration from Mach 0.6 to 1.25 at 5,000 m (16,400 ft)	54 s
Service ceiling	20,200 m (66,275 ft)
T-O run, with afterburning	670 m (2,198 ft)
Landing run, brake-chute deployed	1,000 m (3,280 ft)
Combat radius	432 n miles (800 km; 497 miles)
Ferry range	1,188 n miles (2,200 km; 1,367 miles)
g limit in sustained turn at Mach 0.9 at 5,000 m (16,400 ft)	+4.83

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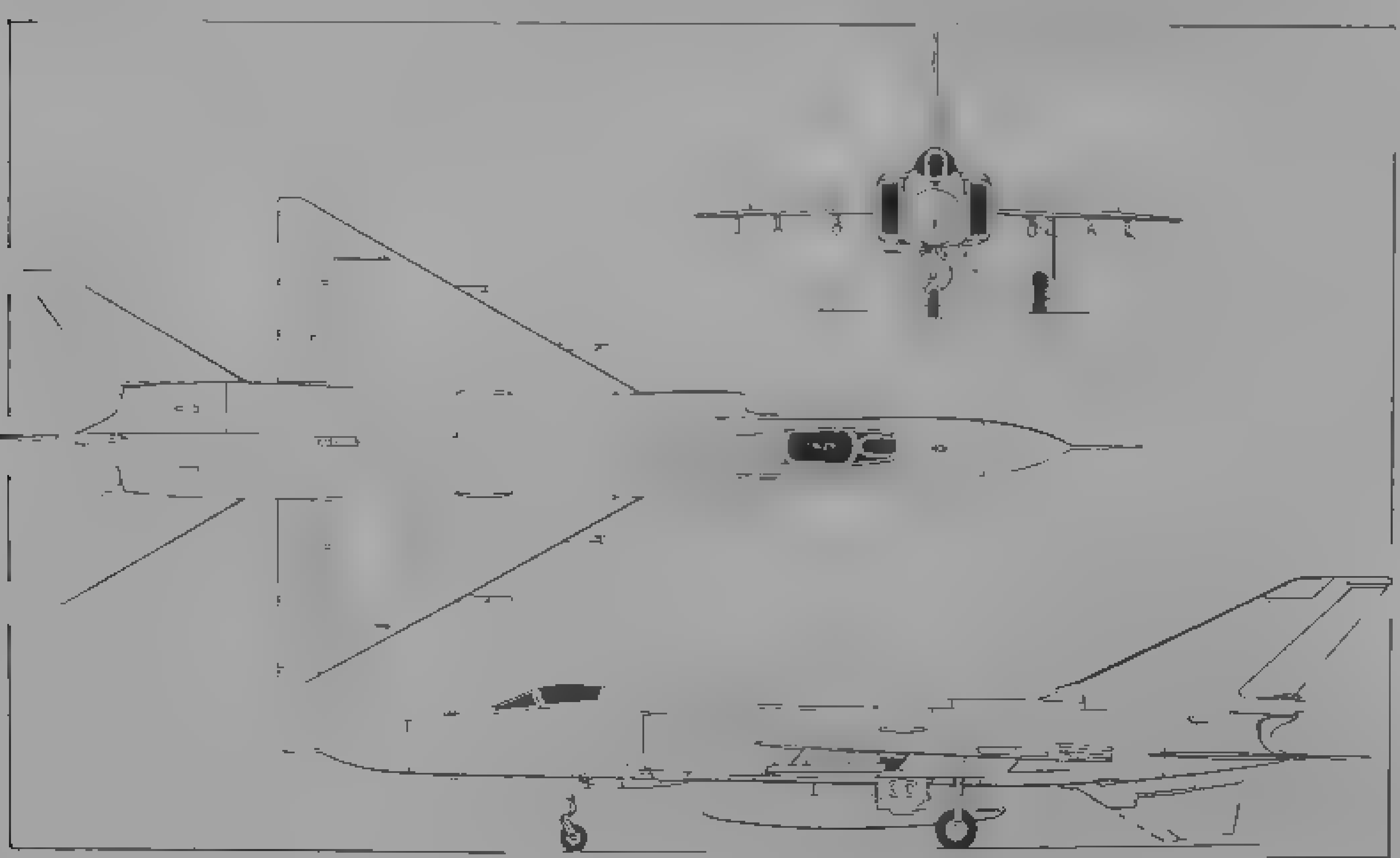

J-8 II version of the 'Finback' twin-jet fighter ***(Jane's/Dennis Punnett)***

1986

SAMC

SHIJIAZHUANG AIRCRAFT MANUFACTURING CORPORATION

PO Box 164, Shijiazhuang, Hebei 050062
Telephone: 86 (311) 744251
Telex: 26236 HBJXC CN
DIRECTOR: Yue Dongsheng
CHIEF ENGINEER: Zhang Zengshou

SAMC has produced more than 225 An-2 general purpose biplanes since 1970, concentrating now on Y-5B and C customised agricultural and tourist versions; other products include W-5 and W-6 microlight series (see 1992-93 and earlier *Jane's*). Occupies 460,000 m² (4,951,394 sq ft) site, including over 100,000 m² (1,076,390 sq ft) of covered space. Workforce of nearly 4,000 in 1994 included some 650 engineers and technicians. Became part of Xian Aircraft Industrial Group July 1992.

UPDATED

SAMC Y-5B

Chinese name: Yunshuji-5 (Transport aircraft 5) or Yun-5

TYPE: Agricultural biplane.

PROGRAMME: Antonov An-2 (see under PZL Mielec in Polish section) built under licence in China since 1957, chiefly at Nanchang and latterly by SAMC; Y-5B dedicated agricultural and forestry version made first flight 2 June 1989; certificated to Chinese equivalent of FAR Pt 23, now in batch production, first nine produced in 1990; more than 35 Y-5B/Cs produced by end of 1994.

CURRENT VERSIONS: **Y-5N**: Standard Chinese civil transport and general purpose version.

Y-5B: Dedicated agricultural and forestry variant, *following description applies to this version.*

Y-5C: Passenger version, first flown 1993.

Y-5D: Projected future civil version; no details yet known.

CUSTOMERS: Current operators of Y-5B include Xinjiang Airlines (eight) and Jiangnan General Aviation, 12 ordered by CASC (China Aviation Supplies Corporation) in December 1992 for delivery 1993, further 12 (six each for China Eastern and China Northern Airlines) ordered 25 December 1993.

STRUCTURE: As standard An-2/Y-5N, but specially treated to resist corrosion, cabin doors sealed against chemical ingress.

POWER PLANT: One 735.5 kW (986 hp) PZL Kalisz ASz-621R-16 or SMPMC (Zhuzhou) HS5 nine-cylinder radial engine, respectively driving an AW-2 or Baoding J12-G15 four-blade propeller.

ACCOMMODATION: Flight crew of one or two; cabin heating and ventilation improved by new ECS.

AVIONICS: *Comms:* Bendix/King KHF 950 HF and KY 196 VHF radios and KMA 24 audio control panel, some electrical and other instrument installations also improved.

EQUIPMENT: Large hopper/tank with emergency jettison of contents, high flow rate, wind-driven pump; sprayers with various nozzle sizes, depending upon spray volume required.

DIMENSIONS, EXTERNAL:
Propeller diameter: AW-2 — 3.60 m (11 ft 9¾ in)
J12-G15 — 3.40 m (11 ft 2 in)

WEIGHTS AND LOADINGS (A: with dry chemical spreader, B: with liquid spray system):
Max payload: A, B — 1,367 kg (3,013 lb)
Max T-O weight: A, B — 5,250 kg (11,574 lb)

PERFORMANCE (A and B as for Weights):
Max level speed at S/L:
A — 110 kts (205 km/h, 127 mph)
B — 108 kts (200 km/h, 124 mph)
Max level speed at 1,700 m (5,575 ft):
A — 119 kts (220 km/h, 137 mph)
B — 116 kts (215 km/h, 133 mph)
Operating speed: A, B — 86 kts (160 km/h, 99 mph)
Stalling speed: A, B — 52 kts (95 km/h, 59 mph)
Max rate of climb at S/L: A — 120 m (394 ft)/min
B — 114 m (374 ft)/min
Rate of climb at 1,600 m (5,250 ft):
A — 133 m (436 ft)/min
B — 123 m (404 ft)/min
Service ceiling: A — 3,460 m (11,350 ft)
B — 3,250 m (10,660 ft)
Air turning radius: A, B — 350 m (1,150 ft)
T-O run: A — 170 m (558 ft)
B — 180 m (591 ft)
Landing run: A — 160 m (525 ft)
B — 157 m (515 ft)
Range at S/L with fuel load of 670 litres (177 US gallons, 147 Imp gallons):
A, B — 456 n miles (845 km, 525 miles)
Endurance, conditions as above: A, B — 5 h 39 min
Swath width — 20-50 m (66-165 ft)

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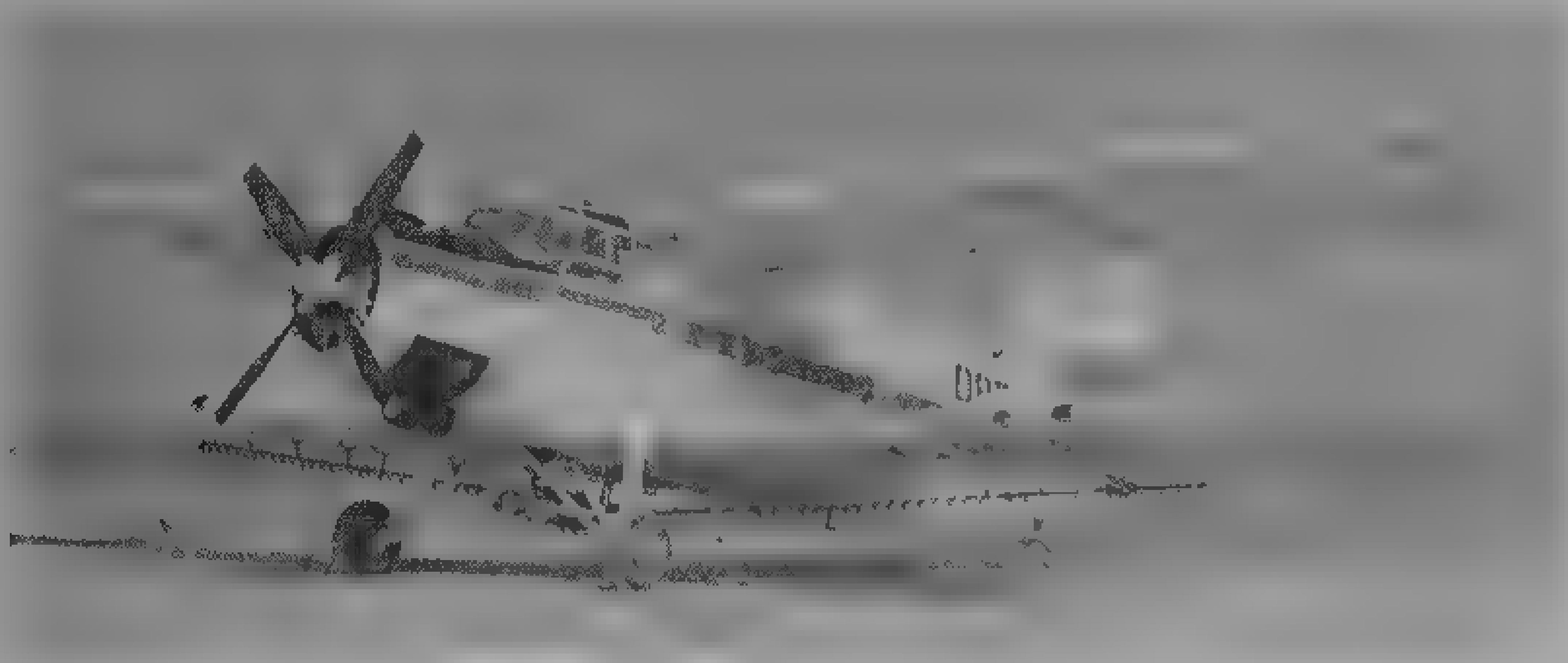

Y-5B agricultural biplane produced by Shijiazhuang

1991

SAMF

SHANGHAI AIRCRAFT MANUFACTURING FACTORY (Subsidiary of Shanghai Aviation Industrial Corporation)

PO Box 232-007, Shanghai 200232
Telephone: 86 (21) 4383310
Fax: 86 (21) 6658103
Telex: 33136 SHAIR CN
PRESIDENT: Wu Zuoquan

Created 1951, occupies site area of 135 ha (333.5 acres), total workforce approximately 7,000, of whom about 3,000 engaged in present MD-80/90 programme. Has produced main and landing gear doors for McDonnell Douglas MD-80 series since 1979, now also produces cargo and service doors, avionics bay doors and tailplanes.

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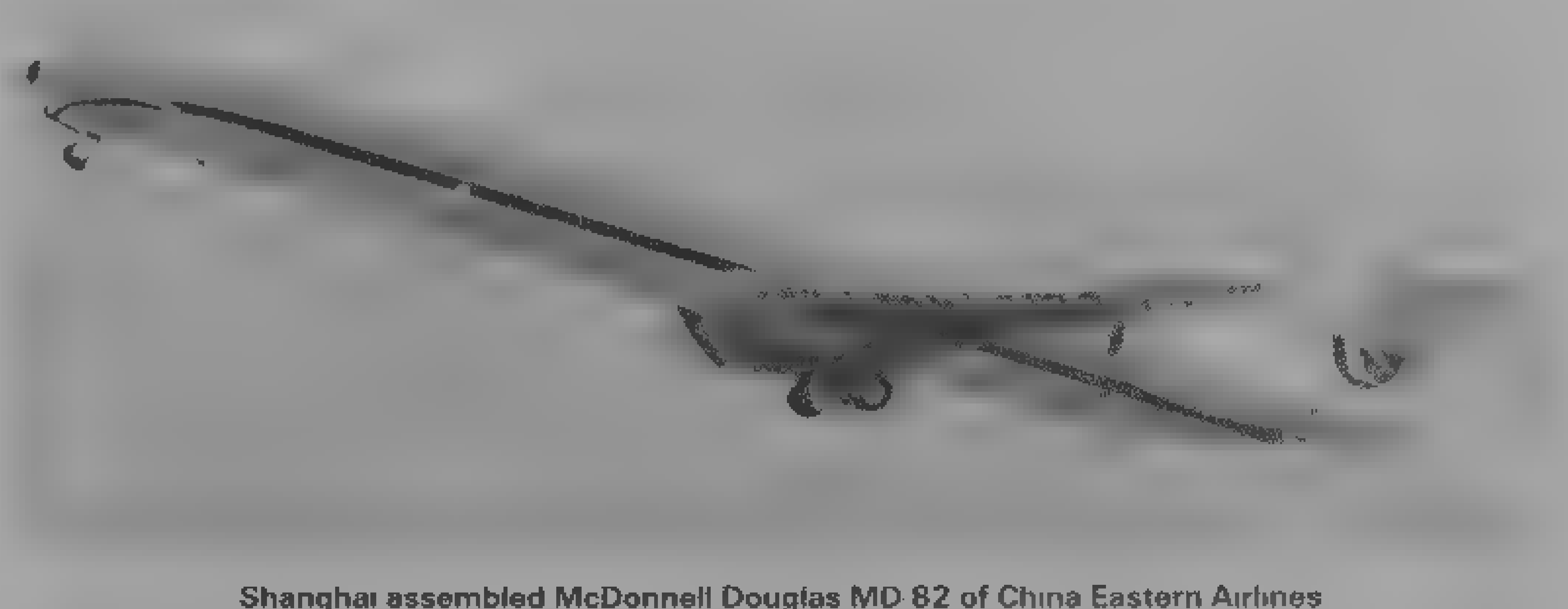

Shanghai assembled McDonnell Douglas MD-82 of China Eastern Airlines

1993

SAMF (McDONNELL DOUGLAS) MD-82 and MD-83

TYPE: Commercial airliners (see US section for description).

PROGRAMME: Letter of intent (SAMF/McDonnell Douglas) for MD-82 co-production announced 11 January 1984, programme details confirmed April 1985 with announcement of sale of 26 MD-82s to China, of which one Douglas built (delivered September 1985) and 25 (all for Chinese airlines) to be assembled in China. Shanghai programme began April 1986 using major Douglas subassemblies for first three MD-82s, next 22 having gradually increasing share of Chinese manufactured components (see 1991-92 and earlier *Jane's*). First Chinese assembled MD-82 rolled out 8 June 1987 and first flight 2 July 1987, delivered (to Shenyang branch of CAAC) 31 July and entered service (with China Northern Airlines) 4 August 1987, 25th SAMF aircraft delivered 12 October 1991. Programme extended April 1990 by agreement for 10 more aircraft (five each MD-82 and MD-83, of which latter for resale to McDonnell Douglas), MD-83 work started 14 August 1991, first follow-on MD-82 delivered 30 December 1991, first MD-83 made first flight 26 June 1992, delivered to McDonnell Douglas 14 July, all five delivered by end of 1992. Last follow-on MD-82 (B-2145) delivered to China Northern Airlines 18 October 1994.

CUSTOMERS: China Eastern Airlines (14) and China Northern Airlines (21) shared the 35 MD-82s.

UPDATED

SAMF (McDONNELL DOUGLAS) MD-90-30T

TYPE: Commercial airliner (see US section for description).

PROGRAMME: Selected June 1992, after many years' deliberation, to fulfil Chinese **Trunkliner** requirement, with manufacturing contributions by Chengdu (nose section), Shenyang (rear fuselage and vertical tail) and Xian (wings and forward/mid fuselage) and final assembly at Shanghai, similar offset deal for co-production of V2500 engines; production to increase towards target of 93 per cent of airframe (by weight) being produced in China; follow-on orders expected later. Contract announced 29 June 1992 with order for 20 each MD-82/82T (3 + 17) and MD-90-30T (see 1994-95 *Jane's*), but first 20 abandoned in revised agreement signed 4 November 1994. Start-up of Chinese production due in 1996, first delivery scheduled for April 1998. First shipment of materials for Shanghai MD-90 programme despatched by Douglas 3 March 1995.

UPDATED

SGAC

SHENZHEN GENERAL AVIATION COMPANY LTD

Announced 1992 as Shenzhen government development project to set up new, non-governmental production centre to manufacture light aircraft in four- to 10-seat range, of Chinese and/or foreign design, intended to have eventual output capability of up to 180 aircraft per year. Pilatus Britten-Norman (see UK section) reported 'very firm interest' by SGAC, during discussions in 1993-94, in possibility of producing that company's Islander and/or Trislander.

UPDATED

SLAC

SHENYANG LIGHT AIRCRAFT COMPANY

Shenyang, Liaoning

New company located in suburbs of Shenyang, factory construction completed April 1994. First product is four-seat light aircraft with empty and gross weights of 600 and 1,400 kg (1,323 and 3,086 lb); speed range of 65 to 108 knots (120 to 200 km/h, 74 to 124 mph); and ceiling of more than 3,000 m (9,840 ft). Initial example planned for roll-out July 1994, applications include tourism, forest fire patrol and cropspraying

NEW ENTRY

SSF

SHENYANG SAILPLANE FACTORY

17 Shen Liao East Road, Shenyang, Liaoning 110021
Telex 804007
GENERAL MANAGER: Zhu R. Xie
CHIEF ENGINEER: Li Ji Jang

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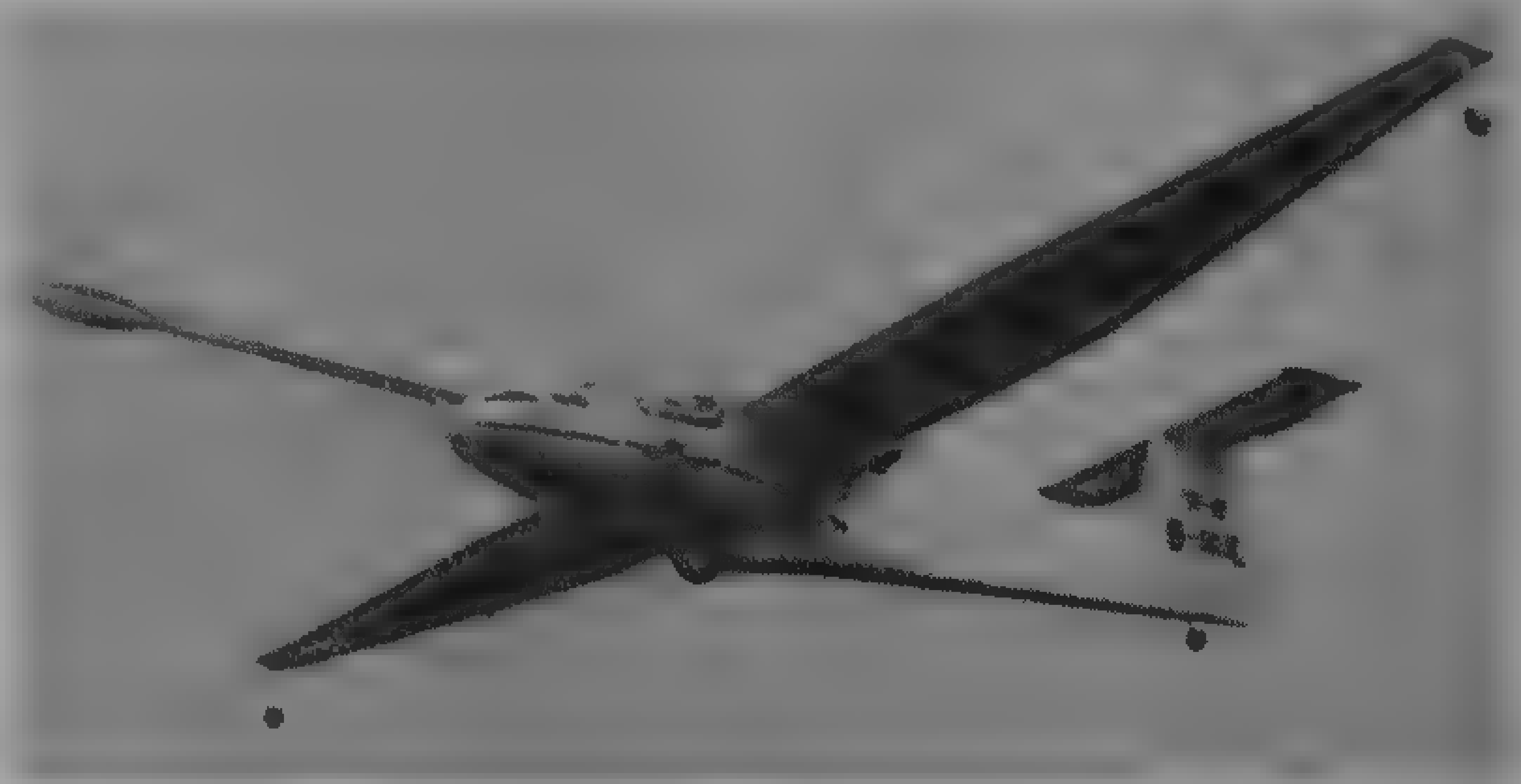


Shenyang HU-1 Seagull motor glider carrying aerial survey equipment

1994

SHENYANG HU-1 SEAGULL

TYPE: Two-seat motor glider

PROGRAMME: Received Chinese certification July 1988; developments include training version

COSTS: 75,000 renminbi (yuan) (1992)

DESIGN FEATURES: Non-swept shoulder wing and T tail. Eppler E603 wing section, dihedral 1°; incidence 2°. Intended primarily for aerial survey/photography and forest patrol work (camera hatch beneath one seat)

FLYING CONTROLS: Primary surfaces mechanical, wing flaps

STRUCTURE: Mainly aluminium alloy stressed skin, some non-load-bearing structures in GFRP and wood, elevators and rudder fabric covered. Single-spar wing

LANDING GEAR: Non-retractable monowheel, with 480 × 200 mm low-pressure tyre; wheels at wingtips on short outriggers. Steerable 200 × 80 mm tailwheel

POWER PLANT: One 86.5 kW (116 hp) Textron Lycoming O-235 N2A flat-four engine, mounted above wing and driving a pusher propeller

ACCOMMODATION: Two seats side by side; starboard seat can [illegible] to make room for equipment when used for [illegible], industrial or other purposes. Canopy hinged at [illegible] and opens upward

DIMENSIONS, EXTERNAL:

Wing span	17.00 m (55 ft 9¼ in)
Wing aspect ratio	16.35
Length overall	7.62 m (25 ft 0 in)
Height over tail	1.73 m (5 ft 8 in)
Propeller diameter	1.76 m (5 ft 9¼ in)

AREAS:

Wings, gross	17.68 m² (190.3 sq ft)

WEIGHTS AND LOADINGS (U: Utility category, N: Normal):

Weight empty: U, N	600 kg (1,323 lb)
Max T-O weight: U	900 kg (1,984 lb)
N	1,050 kg (2,315 lb)
Max wing loading: U	50.90 kg/m² (10.43 lb/sq ft)
N	59.39 kg/m² (12.16 lb/sq ft)
Max power loading: U	10.23 kg/kW (16.81 lb/hp)
N	11.93 kg/kW (19.62 lb/hp)

PERFORMANCE, POWERED (at Utility max T-O weight):

Never-exceed speed (V_{NE})	121 kts (225 km/h, 140 mph)
Cruising speed	86 kts (160 km/h, 99 mph)
Stalling speed, flaps up	46 kts (85 km/h, 53 mph)
Max rate of climb at S/L	240 m (787 ft)/min
Service ceiling	4,500 m (14,765 ft)
T-O run	173 m (568 ft)
Range	485 n miles (900 km, 559 miles)
Endurance	5 h
g limits	+3.8/−1.9

PERFORMANCE, UNPOWERED:

Min rate of sink at 43 kts (80 km/h; 50 mph)	1.50 m (4.92 ft)/s
Best glide ratio	20

UPDATED

Shenyang HU-2 Petrel 650B two/three-seat light aircraft

1994

SHENYANG HU-2 PETREL 650B

TYPE: Two/three-seat light aircraft

PROGRAMME: Preceded by two-seat Petrel 550 and three-seat Petrel 650, first flight 1985, Chinese CAAC certification in late 1980s and in production since 1990

COSTS: 30,000 renminbi (yuan) (1992)

DESIGN FEATURES: Strut braced high-wing cabin monoplane, Göttingen 535 section wooden wing. Improved version of Petrel 650

LANDING GEAR: Cantilever self-sprung mainwheel legs, tailwheel

POWER PLANT: One 59.7 kW (80 hp) Limbach L 2000 EO1 flat-four engine; two-blade propeller

ACCOMMODATION: Fully enclosed two/three-seat cabin with side window/doors

DIMENSIONS, EXTERNAL:

Wing span	14.92 m (48 ft 11½ in)
Wing aspect ratio	11.34
Length overall	7.02 m (23 ft 0½ in)
Height overall	2.14 m (7 ft 0¼ in)

AREAS:

Wings, gross	19.63 m² (211.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	485 kg (1,069 lb)
Max T-O weight	750 kg (1,653 lb)
Max wing loading	38.20 kg/m² (7.82 lb/sq ft)
Max power loading	12.58 kg/kW (20.67 lb/hp)

PERFORMANCE (at max T-O weight):

Max level speed	73 kts (135 km/h, 84 mph)
Cruising speed	54 kts (100 km/h, 62 mph)
Stalling speed	33 kts (60 km/h, 38 mph)
Max rate of climb at S/L	144 m (472 ft)/min
Service ceiling	3,850 m (12, 625 ft)
Max range	323 n miles (600 km; 372 miles)
Endurance	6 h

UPDATED

WHC

WUHAN HELICOPTER CORPORATION

Established August 1993 to co-produce Enstrom F28F, 280FX, TH-28 and 480 helicopters (see US section), assembled first two (280FX and TH-28) from CKD kits October 1993, delivered to Wuhan Public Security Bureau and PLA respectively. New factory construction due to start October 1994 on 150 ha (370.7 acre) site and be completed mid-1995, will have capability for building up to 100 helicopters per year

NEW ENTRY

XAC

XIAN AIRCRAFT COMPANY

PO Box 140-84, Xian, Shaanxi 710000
Telephone: 86 (29) 7214959, 7214960 and 7216929
Fax: 86 (29) 6203707
Telex: 70101 XAC CN
PRESIDENT: Wang Qinping
AIRCRAFT MARKETING MANAGER: Wang Zhigang

Aircraft factory established at Xian 1958, current XAC has covered area of some 300 ha (741.3 acres) and 1993 workforce of 19,730, of whom about 90 per cent are engaged in aircraft production. Earlier programmes have included licence production of Tu-16 twin-jet bomber (as H-6: see 1991-92 and earlier *Jane's*); major current programmes concern JH-7 attack aircraft and Y-7 transport series of An-24/26 derivatives. Subcontract work includes glassfibre header tanks, water float pylons, ailerons and various doors for Canadair CL-215/415 amphibians, fins and tailplanes for Boeing 737 (300th set delivered 17 December 1993), and various components for Airbus, Boeing 747 and ATR 42. To produce Boeing 737 rear fuselages from 1995

UPDATED

XAC JH-7

Chinese name: Jianjiji Hongzhaji-7 (Fighter-bomber aircraft 7) or Jian Hong 7

Westernised designation: B-7

TYPE: All-weather interdictor and attack aircraft, secondary air-to-air capability.

PROGRAMME: First revealed publicly September 1988 as model at Farnborough International air show, first of two prototypes having been rolled out during previous month, first flight late 1988 or early 1989, service entry originally scheduled for 1992-93, but seems to have been delayed.

CURRENT VERSIONS: **JH-7**: Initial version, *as described*.

CUSTOMERS: PLA Air Force and, in maritime attack form, PLA Naval Air Force.

DESIGN FEATURES: In same role and configuration class as Russian Sukhoi Su-24 'Fencer'. High mounted wings with compound sweepback, dog tooth leading edges and marked anhedral; twin turbofans, with lateral air intakes, all-swept tail surfaces, comprising large main fin, single small ventral fin and low-set all moving tailplane, small overwing fence at approximately two-thirds span. Quarter chord sweep angles approximately 45° on wings and fin, 55° on tailplane.

STRUCTURE: Assumed conventional all-metal except for dielectric panels.

LANDING GEAR: Retractable tricycle type, with twin wheels on each unit. Main units retract inward, nose unit forward.

POWER PLANT: Prototypes said in 1988 to be powered by two Xian WS9 turbofans (Rolls-Royce Spey Mk 202, each 91.2 kN; 20,515 lb st with afterburning). One Chinese source has suggested that US engines are or were envisaged but later embargoed; eventual intention believed to be to power production JH-7 with LEMC (Liming) turbofans of 71.3 kN (16,027 lb st) dry rating (138.3 kN; 31,085 lb st with afterburning).

ACCOMMODATION: Crew of two in tandem (rear seat elevated). HTY-4 ejection seats, operable at speeds from zero to 540 knots (1,000 km/h; 621 mph) and altitudes from S/L to 20,000 m (65,600 ft).

AVIONICS: Terrain-following radar and other avionics on prototypes said to be of Chinese origin.

ARMAMENT: Twin-barrel 23 mm gun in nose; two stores pylons under each wing, plus rail for close range air-to-air missile at each wingtip. Typical underwing load for maritime attack, two C-801 sea-skimming anti-ship missiles (inboard) and two drop tanks (outboard).

DIMENSIONS, EXTERNAL:

Wing span	12.80 m (42 ft 0 in)
Wing aspect ratio	3.13
Length overall, excl probe	21.00 m (68 ft 10¾ in)
Height overall	6.22 m (20 ft 4⅞ in)
Wheel track	3.06 m (10 ft 0½ in)
Wheelbase	7.80 m (25 ft 7 in)

AREAS:

Wings, gross	52.3 m² (562.95 sq ft)

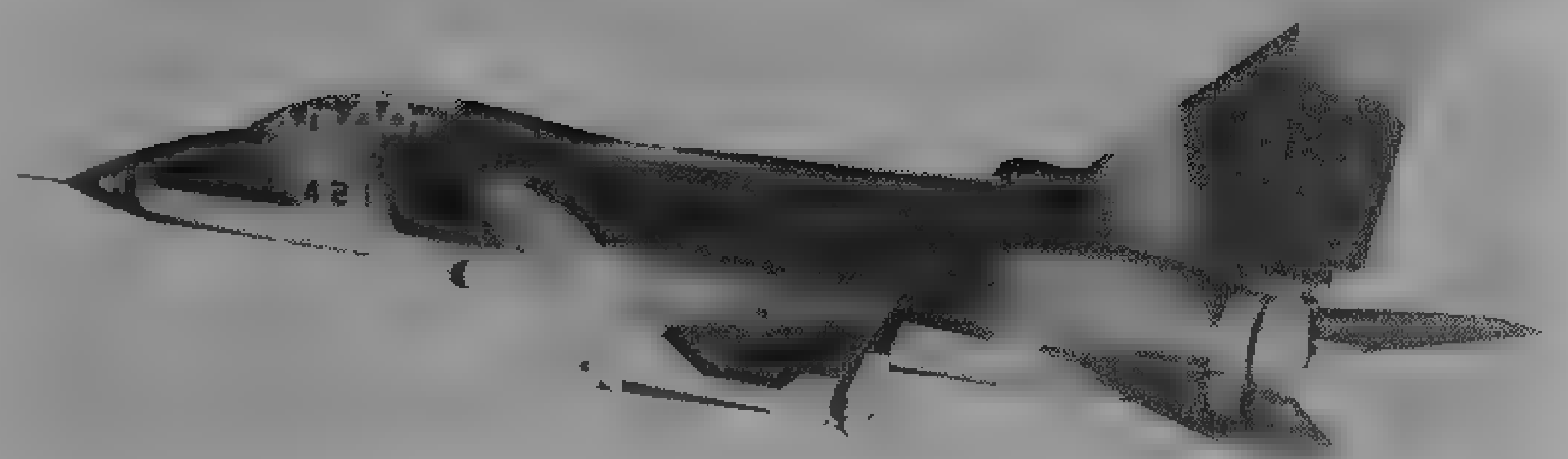
WEIGHTS AND LOADINGS:

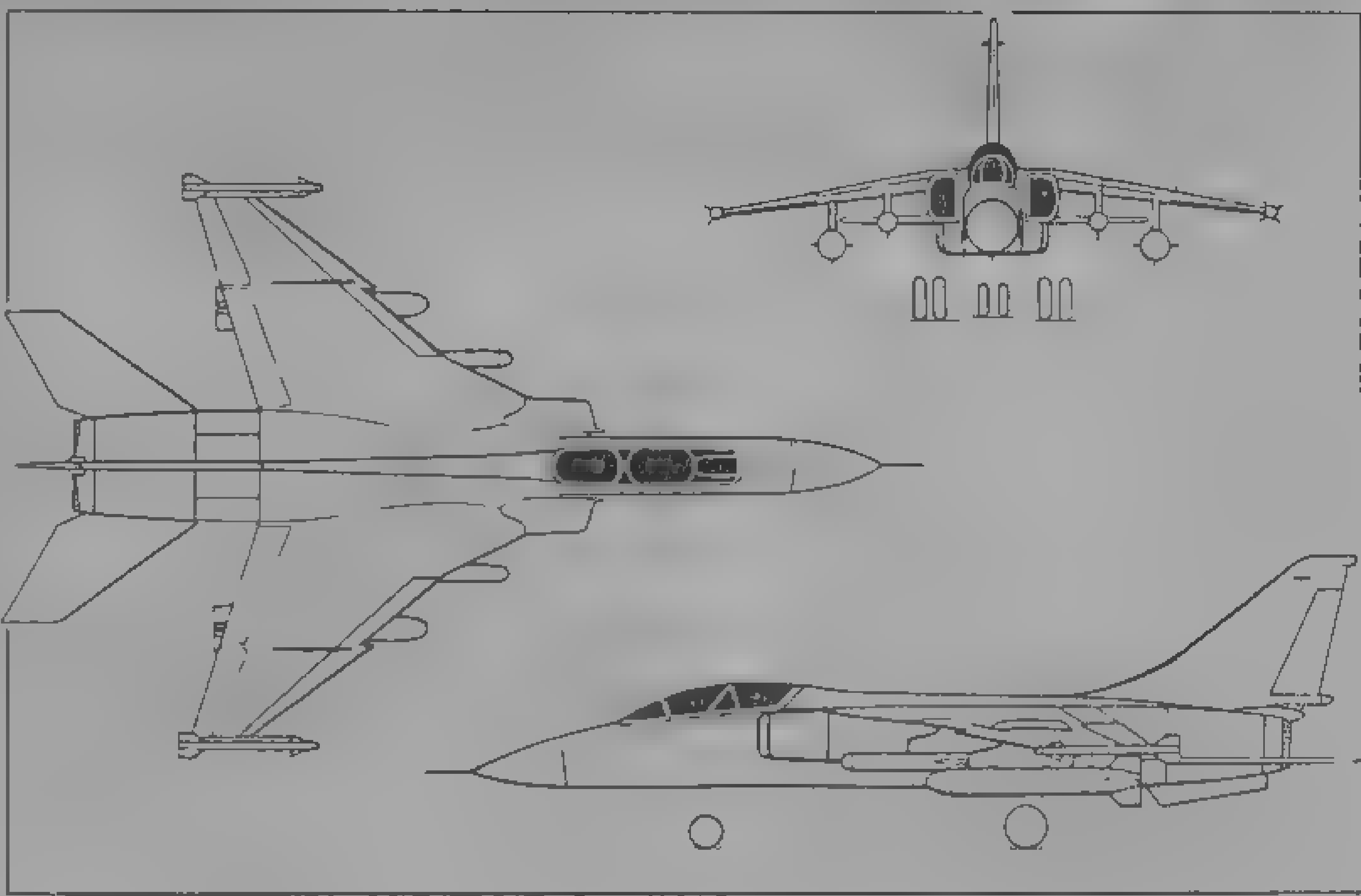
Max weapon load	5,000 kg (11,023 lb)
Max T-O weight	27,415 kg (60,439 lb)
Max landing weight	21,130 kg (46,583 lb)
Max wing loading	524.2 kg/m² (107.4 lb/sq ft)
Max power loading (prototypes)	150.3 kg/kN (1.47 lb/lb st)

PERFORMANCE:

Max level speed at 11,000 m (36,000 ft)	Mach 1.6-1.7 (917-975 kts, 1,699-1,808 km/h; 1,056-1,122 mph)
Cruising speed	Mach 0.80-0.85 (459-487 kts, 850-903 km/h; 528-561 mph)
Service ceiling (clean)	15,500 m (50,850 ft)
T-O run	920 m (3,019 ft)
Landing run	1,050 m (3,445 ft)
Combat radius	486 n miles (900 km; 559 miles)
Ferry range	1,673 n miles (3,100 km; 1,926 miles)

UPDATED





Provisional three-view (*Jane's/James Goulding*) and model of the XAC JH-7 in maritime attack form

1995

XAC Y-7

Chinese name: Yunshuji-7 (Transport aircraft 7) or Yun-7

TYPE: Twin-turboprop short/medium-range transport.

PROGRAMME: Reverse engineering of Soviet 48/52 passenger Antonov An-24 began in mid-1970s, three prototypes (first flight 25 December 1970) and two static test airframes completed. Chinese C of A awarded 1980; preproduction Y-7 made public debut 17 April 1982; small batch production began 1984, first scheduled services with CAAC, 29 April 1986. Y7-100 prototype conversion by HAECO 1985 (first flight of production Y7-100 late 1985), followed by domestic certification 23 January 1986; first flight of Y7-200B (B-528L) 23 November 1990, first flight of Y7-200A made 26 December 1993.

CURRENT VERSIONS: **Y-7**: Initial production version, full description in 1988-89 *Jane's*. Being retrofitted with winglet modification of Y7-100. In production.

Y-7 Freighter: Civil cargo version of Y-7, first flown late 1989; five delivered to domestic operators in 1992 (first one on 24 June).

Y7-100: Improved version, meeting BCAR standards. Changes include winglets, new three-crew (instead of five) flight deck, all-new cabin interior with 52 reclining seats, windscreen de-icing, new HF/VHF com, new nav equipment, addition of oxygen/air data/environmental control systems. One Y-7 (B-3499) converted as prototype 1985 by Hong Kong Aircraft Engineering Company (HAECO). In production. Subvariants **Y7-100C1/C2/C3** have five-person crew and are available with avionics and equipment to customer's requirements. *Detailed description applies to standard Y7-100, except where indicated.*

Y7-200A: Improved Y7-100, with 2,051 kW (2,750 shp) Pratt & Whitney Canada PW127 turboprops, Hamilton Standard 247F-3 four-blade propellers and Collins EFIS 85/86 avionics; AlliedSignal GTCP-150CY APU; empty weight reduced, fuselage lengthened to accommodate 56 (standard) or a maximum of 60 passengers (seat pitch 78 cm, 31 in and 72 cm, 28 in respectively); two-crew flight deck (plus observer's seat) with improved field of view. Three prototypes built; first flight 26 December 1993; Chinese type and production certificates to be obtained by end of 1995 and FAA type approval by end of 1996.

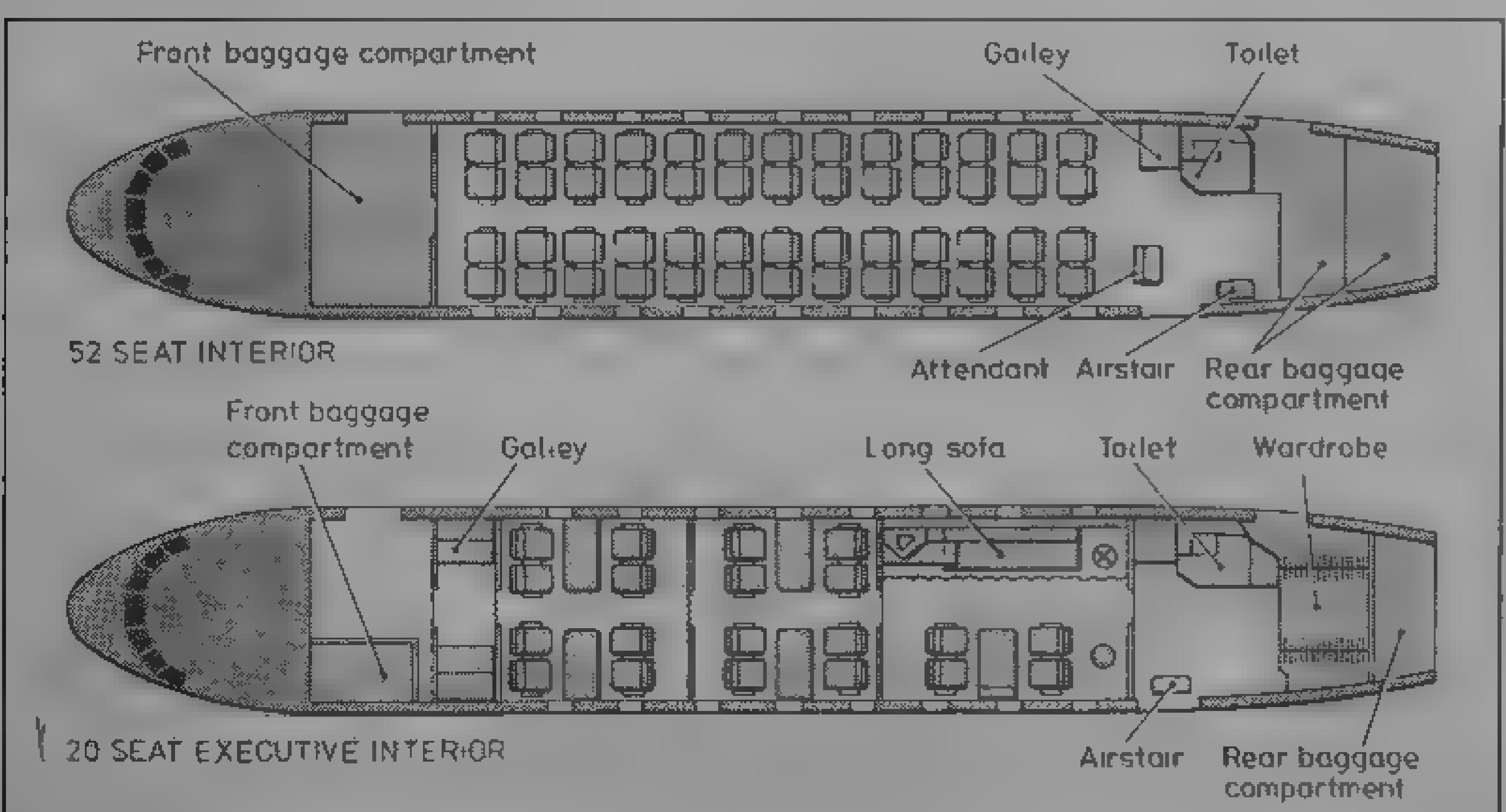
Y7-200B: Improved Y7-100 for domestic market, with Dongan WJ5A IG improved turboprops, new four-blade propellers, Collins EFIS 85B14 avionics, modified wing leading-edge, higher maximum lift coefficient, ground spoilers added, improved stall characteristics, lower fuel consumption, winglets deleted, overall length increased by 0.74 m (2 ft 5¼ in) and tailplane span by 1 per cent, empty weight reduced by 500 kg (1,102 lb), Cat. II automatic landing capability, 49 hours flown by January 1993 (latest information supplied).

Y-7E: Hot/high version with different (more powerful?) APU, first flight 5 July 1994.

Y7H and Y7H-500: Military and civil cargo versions, derived from Antonov An-26, described separately.

CUSTOMERS: Delivered to 14 Chinese domestic airlines and armed services, including two or more Y-7s for PLA Naval Air Force. Chinese Y-7 operators at September 1994 included Changan Airlines (three), Fujian Airlines (three), Guizhou Airlines (three), Wuhan Airlines (four) and Zhong Yuan Airlines (two); operators of Y7-100 included Air China (seven), China Great Wall (three), China Eastern (nine), China General Aviation (three), China Northern (11), China Northwest (seven), China Southern (five), China Southwest (three), Nanjing Aviation (one) and Sichuan Airlines (five).

Export customers include Laos Airlines (three Y7-100C). Total of 62 Y-7s and 54 or more Y7-100s sold by May 1993, 95 delivered by February 1994.



Standard 52-passenger layout of the Y7-100 (top), and a typical 20-seat executive transport configuration (*Jane's/Mike Keep*)

1994

Xian Aircraft Company Y7-100 twin-turboprop transport of China Northern Airlines

1993

COSTS: Y-7 $5 million, Y7-100 $6 million (September 1990).

DESIGN FEATURES: Non-swept high-mounted wings, with 2° 12′ 12″ anhedral on tapered outer panels, wingtip winglets standard on Y7-100, being retrofitted on Y-7; basically circular section fuselage, sweptback fin and rudder; 9° dihedral on tailplane; ventral fin under tailcone. Wing sweepback 6° 50′ at quarter-chord of outer panels, incidence 3°.

FLYING CONTROLS: Primary surfaces mechanical/manual (ailerons mass balanced), servo tab and trim tab in each aileron, balance tab in each elevator, trim tab and spring tab in rudder. Hydraulically operated Fowler flaps on wing trailing edges, single-slotted inboard of nacelles, double-slotted outboard.

STRUCTURE: Conventional all-metal, with two-spar wing box and bonded/welded fuselage, glassfibre aileron trim tabs. CFRP fin and tailplane tips on Y7-200B.

LANDING GEAR: Retractable tricycle type with twin wheels on all units. Hydraulic actuation, with emergency gravity extension. All units retract forward. Mainwheels are size 900 × 300 mm, tyre pressure 5.39 to 5.88 bars (78.2 to 85.3 lb/sq in); nosewheels size 700 × 250 mm, tyre pressure 3.92 bars (56.8 lb/sq in). (Mainwheel tyre pressures variable to cater for different types of runway.) Disc brakes on mainwheels, hydraulically steerable (±45°) and castoring nosewheel unit.

POWER PLANT: Two Dongan (DEMC) WJ5A I turboprops, each rated at 2,080 kW (2,790 shp) for T-O and 1,976 kW (2,650 shp) at ISA + 23°C, Baoding J16-G10A four-blade constant-speed fully feathering propellers. Fuel in integral wing tanks immediately outboard of nacelles, and four bag-type tanks in centre-section, total capacity 5,550 litres (1,466 US gallons; 1,220 Imp gallons). Provision for four additional tanks in centre-section. Pressure refuelling point in starboard engine nacelle, gravity fuelling point above each tank. One 8.83 kN (1,984 lb st) RU 19A-300 auxiliary turbojet in starboard engine nacelle for engine starting, to improve take-off and in-flight performance, and to reduce stability and handling problems if one turboprop fails in flight.

ACCOMMODATION: Crew of three on flight deck (five in Y7-100C1/C2/C3), plus one or two cabin attendants. Standard layout has four-abreast seating, with centre aisle, for 52 passengers in air conditioned, soundproofed (by Tracor) and pressurised cabin. Galley (by Lermer) and toilet at rear on starboard side. Baggage compartments forward and aft of passenger cabin, plus overhead stowage bins in cabin. Alternative layouts available for 48 or 50 passengers, or 20-passenger executive interior. Passenger airstair door on port side at rear of cabin. Emergency exit each side at front of cabin. Doors to forward and rear baggage compartments on starboard side. All doors open inward.

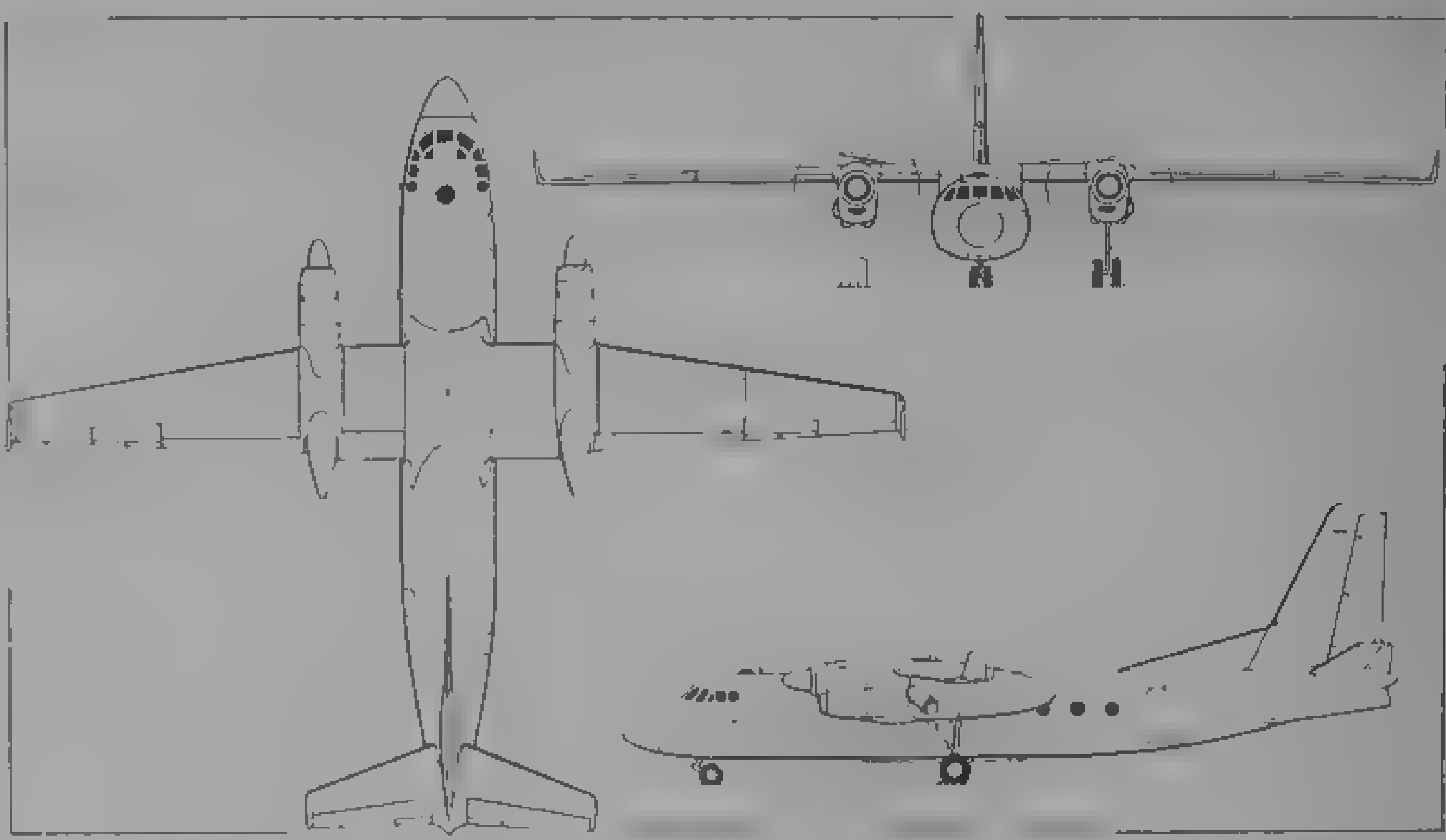
SYSTEMS: Hamilton Standard environmental control system (cabin pressure differential in An-24RV is 0.29 bar, 4.27 lb/sq in). Puritan Bennett passenger oxygen system optional. Main and emergency hydraulic systems, pressure 152 bars (2,200 lb/sq in), for landing gear actuation, nosewheel steering and braking, flaps, brakes, windscreen wipers and propeller feathering. Electrical system (28.5 V DC) powered by two 18 kW QF-18 starter/generators and two 24 V 28 Ah 12HK-28 batteries; AC power (115 V at 400 Hz) supplied by two JF-30A 16 kVA generators, with two 3 kVA static inverters for secondary AC power (115/26 V at 400 Hz). Electric windscreen de-icing.

AVIONICS: *Comms*: Dual Collins 618M-3 VHF, single Collins 628T-3 HF, Becker audio selection and intercom, Collins 621A-6A ATC transponder; Sundstrand AV-557C cockpit voice recorder.

Radar: Honeywell Primus 90 colour weather radar.

Flight: Beijing KJ-6A autopilot, Collins FGS-65 flight guidance system, dual ADI-84A, dual EHSI-74 electronic HSI, dual RMI-36, dual DF-206 ADF and single 860F-4 radio altimeter; Litton LTN 211 VLF/Omega navigation system, Honeywell MHRS dual compass system and VG-311 dual attitude reference; dual Collins 51RV-4B VOR/ILS and DME-42, Collins 51Z-4 marker beacon receiver, SFENA H321 AKM emergency horizon, Chinese IIDC air data system and XLG-2A stall warning system with stick shaker, Sundstrand 980-4100-FWXS flight data recorder.

Instrumentation: Collins CWS-80 instrument warning system, Gables control units.



XAC Y7-100 current production version of the Y-7 twin-turboprop transport *(Jane's/Dennis Punnett)*

1986

DIMENSIONS, EXTERNAL (Y7-100):

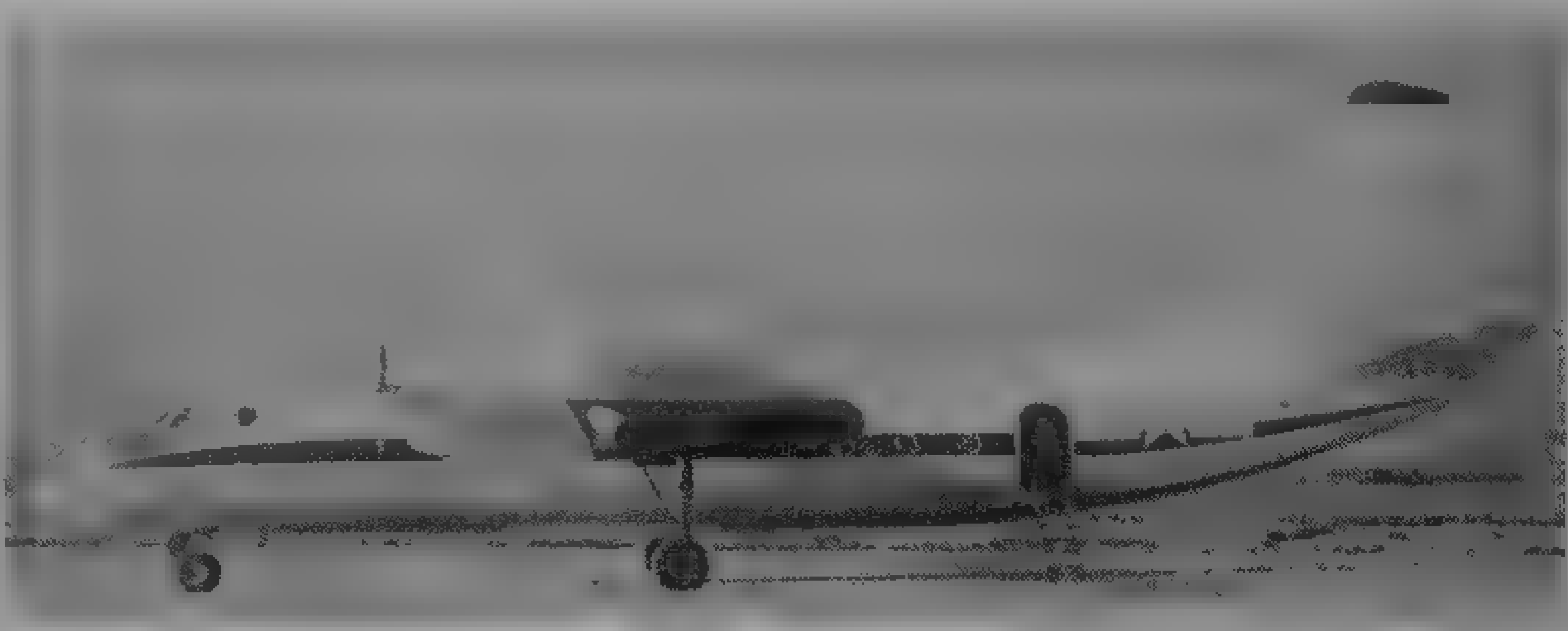
Wing span (over winglets)	29.666 m (97 ft 4 in)
Wing chord: at root	3.50 m (11 ft 5¾ in)
at tip	1.095 m (3 ft 7 in)
Wing aspect ratio	11.69
Length overall	24.218 m (79 ft 5½ in)
Height overall	8.553 m (28 ft 0¾ in)
Fuselage: Max width	2.90 m (9 ft 6¼ in)
Max depth	2.50 m (8 ft 2½ in)
Tailplane span	9.08 m (29 ft 9½ in)
Wheel track (c/l of shock-struts)	7.90 m (25 ft 11 in)
Wheelbase	7.90 m (25 ft 11 in)
Propeller diameter	3.90 m (12 ft 9½ in)
Propeller fuselage clearance	0.72 m (2 ft 4¼ in)
Propeller ground clearance	1.145 m (3 ft 9 in)
Passenger door (port, rear):	
Height	1.40 m (4 ft 7 in)
Width	0.75 m (2 ft 5½ in)
Height to sill	1.40 m (4 ft 7 in)
Baggage compartment door (starboard, fwd):	
Height	1.10 m (3 ft 7¼ in)
Width	1.20 m (3 ft 11¼ in)
Height to sill	1.30 m (4 ft 3 in)
Baggage compartment door (starboard, rear):	
Height	1.41 m (4 ft 7½ in)
Width	0.75 m (2 ft 5½ in)
Emergency exits (two, each):	
Height	0.927 m (3 ft 0½ in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, EXTERNAL (Y7-200A): As Y7-100 except:

Wing span	29.20 m (95 ft 9½ in)
Length overall	24.708 m (81 ft 0¾ in)
Height overall	8.548 m (28 ft 0½ in)
Tailplane span	9.996 m (32 ft 9¾ in)
Wheelbase	8.598 m (28 ft 2½ in)
Propeller diameter	3.96 m (13 ft 0 in)
Propeller fuselage clearance	0.692 m (2 ft 3¼ in)
Baggage compartment door (starboard, fwd):	
Height	1.22 m (4 ft 0 in)
Width	1.19 m (3 ft 10¾ in)

DIMENSIONS, INTERNAL (Y7-100):

Cabin: Length, incl flight deck	10.50 m (34 ft 5⅜ in)

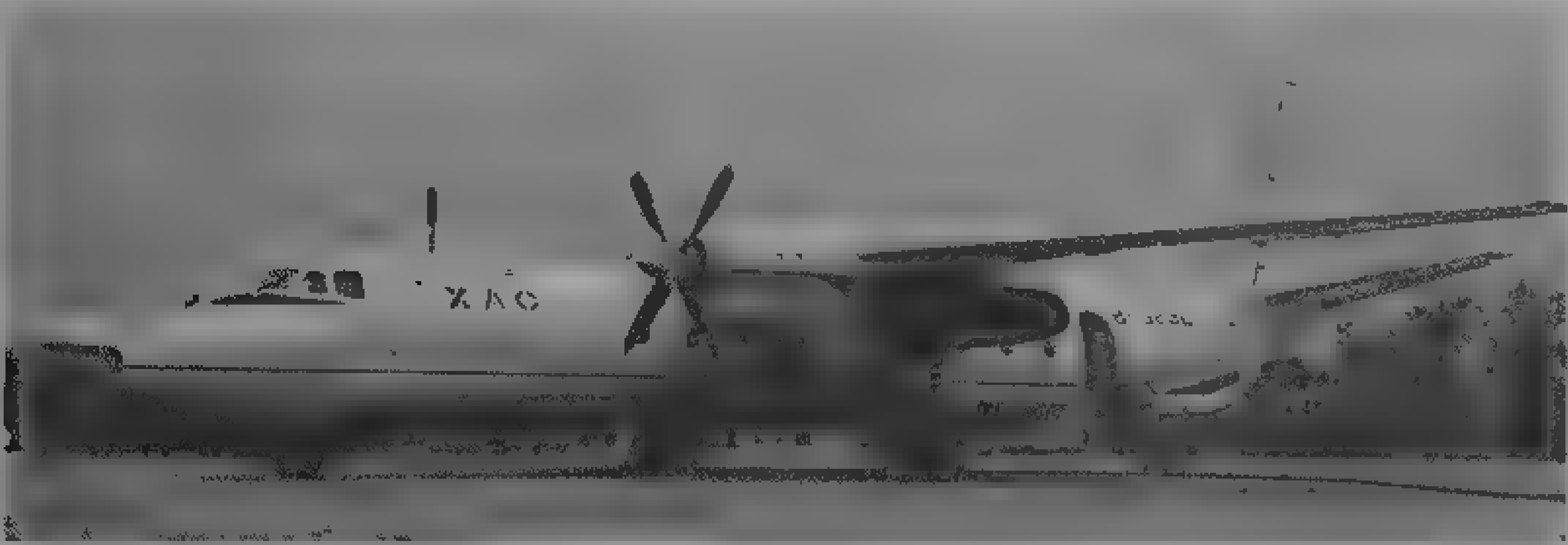


XAC Y-7 in PLA Air Force insignia

1993

Instrument panel of Y7-100

1995



Prototype of the improved XAC Y7-200B for the Chinese domestic market

1992

Max width 2.76 m (9 ft 0¾ in)
Max height 1.90 m (6 ft 2¾ in)
Volume 56.0 m³ (1,978 cu ft)
Baggage compartment volume
fwd 4.50 m³ (159 cu ft)
rear 6.70 m³ (237 cu ft)

DIMENSIONS, INTERNAL (Y7-200A): As Y7-100 except
Cabin: Length, incl flight deck 10.575 m (34 ft 8¼ in)
Volume not stated

AREAS (Y7-100)
Wings, gross 75.26 m² (810.1 sq ft)
Ailerons (total, incl tabs) 5.48 m² (58.99 sq ft)
Trailing-edge flaps (total) 14.81 m² (159.41 sq ft)
Fin 13.38 m² (144.02 sq ft)
Dorsal fin 2.88 m² (31.00 sq ft)
Rudder, incl tabs 5.103 m² (54.93 sq ft)
Tailplane 17.30 m² (186.22 sq ft)
Elevators (total, incl tabs) 5.14 m² (55.33 sq ft)

WEIGHTS AND LOADINGS (Y7-100)
Operating weight empty 14,988 kg (33,042 lb)
Max fuel 4,790 kg (10,560 lb)
Max payload 5,500 kg (12,125 lb)
Max T-O and landing weight 21,800 kg (48,060 lb)
Max zero-fuel weight 19,655 kg (43,332 lb)
Max wing loading 289.7 kg/m² (59.34 lb/sq ft)
Max power loading 5.24 kg/kW (8.61 lb/shp)

WEIGHTS AND LOADINGS (Y7-200A)
Operating weight empty 14,000 kg (30,865 lb)
Max fuel 4,000 kg (8,818 lb)
Max payload 5,200 kg (11,464 lb)
Max T-O weight 21,800 kg (48,060 lb)
Max landing weight 21,200 kg (46,738 lb)
Max zero-fuel weight 19,500 kg (42,990 lb)
Max power loading 5.32 kg/kW (8.74 lb/shp)

PERFORMANCE (Y7-100, at max T-O weight except where indicated)
Max level speed 271 kts (503 km/h, 313 mph)
Max cruising speed at 6,000 m (19,685 ft)
257 kts (476 km/h, 296 mph)
Econ cruising speed at 6,000 m (19,685 ft)
228 kts (423 km/h, 263 mph)
Max rate of climb at S/L, AUW of 21,000 kg (46,297 lb)
458 m (1,504 ft)/min
Service ceiling, AUW of 21,000 kg (46,297 lb)
8,750 m (28,700 ft)
Service ceiling, OEI, AUW of 19,000 kg (41,887 lb)
3,850 m (12,630 ft)
T-O run at max T-O weight 640 m (2,100 ft)
T-O run at S/L, FAR Pt 25, AUW of 21,000 kg (46,297 lb):
ISA 546 m (1,792 ft)
ISA + 20°C 1,398 m (4,590 ft)
Landing run, AUW of 21,000 kg (46,297 lb)
620 m (2,035 ft)
Landing run at max T-O weight 645 m (2,117 ft)
Range: max (52 passenger) payload
491 n miles (910 km, 565 miles)
max standard fuel
1,070 n miles (1,982 km, 1,[illegible] miles)
standard and auxiliary fuel
1,296 n miles (2,400 km, 1,491 miles)

PERFORMANCE (Y7-200A)
Econ cruising speed at 6,000 m (19,685 ft)
248 kts (460 km/h, 286 mph)
Service ceiling 8,870 m (29,100 ft)
Service ceiling, OEI 4,2[illegible] m (14,065 ft)
T-O to 15 m (50 ft) 1,157 m (3,796 ft)
Landing from 15 m (50 ft) 510 m (1,674 ft)
Range
with max payload 594 n miles (1,100 km; 683 miles)
with max fuel 1,430 n miles (2,650 km; 1,646 miles)

UPDATED

XAC Y7H

TYPE: Military (Y7H) and civil cargo (Y7H-500) transport

PROGRAMME: First flight of prototype late 1988 (originally known as Y-14-100); Y7H-500 first flight 24 March 1992, domestic civil type certificate 30 December 1993, followed by series production certificate 15 June 1994. Three prototypes built by January 1995.

CURRENT VERSIONS: **Y7H**: Military transport.

Y7H-500: Civil cargo version, *detailed description applies to this model except where indicated.*

DESIGN FEATURES: Chinese derivative of Antonov An-26 (see Ukraine section), with winglet modification of Y7-100, rear-loading underfuselage ramp/door, WJ5A I engines and rough-field landing gear.

FLYING CONTROLS: Generally as for An-26/Y7-100.

STRUCTURE: Generally as for An-26/Y7-100; commonality with latter includes wings and forward fuselage, flight deck windows enlarged compared with An-26.

LANDING GEAR: Mainwheel tyres size 1,050 × 400 mm, nosewheel tyre size as for Y7-100. Tyre pressures 3.92 bars (56.9 lb/sq in) (main), 3.43 bars (49.8 lb/sq in) (nose).

POWER PLANT: Two 2,081 kW (2,790 shp) Dongan (DEMC) WJ5E turboprops, each driving a Baoding J16-G10A four-blade constant-speed metal propeller. RU 19A-300 turbojet APU (maximum thrust 8.83 kN, 1,984 lb) for take-off assistance in hot and high conditions. Fuel in 10 flexible and two integral wing tanks. Oil capacity 90 kg (198 lb).

ACCOMMODATION: Flight crew of three (pilot, co-pilot and flight engineer) in Y7H-500, or five (navigator and radio operator added) in Y7H. Up to 38 fully equipped troops or 39 paratroops in Y7H, or 24 stretcher cases and one medical attendant in medevac role.

AVIONICS: *Comms*: Generally as for Y7-100 except Bendix/King KHF 950 HF/SSB.

Radar: As for Y7-100.

Flight: Generally as for Y7-100 except Collins AL-101 radio altimeter and FJ-30 flight data recorder.

EQUIPMENT: DJC 2 electric winch (capacity 2,000 kg, 4,409 lb) and KSY-1 hydraulic conveyor for cargo loading/unloading, can be controlled automatically or manually. Up to 2,000 kg (4,409 lb) of external airdrop stores, such as supply containers or weapons, on fuselage attachments.

DIMENSIONS, EXTERNAL
Wing span 29.20 m (95 ft 9½ in)
Length overall 24.31 m (79 ft 9 in)
Height overall 8.89 m (29 ft 2 in)
Tailplane span 10.01 m (32 ft 10 in)
Wheel track (c/l of shock-struts) 7.90 m (25 ft 11 in)
Wheelbase 8.356 m (27 ft 5 in)
Propeller diameter 3.90 m (12 ft 9½ in)
Propeller fuselage clearance 0.72 m (2 ft 4¼ in)
Propeller ground clearance 1.43 m (4 ft 8¼ in)
Crew door: Height 1.02 m (3 ft 4¼ in)
Width 0.70 m (2 ft 3½ in)
Rear ramp/door: Max width 2.40 m (7 ft 10½ in)
Max length 3.05 m (10 ft 0 in)
Height to sill 1.74 m (5 ft 8½ in)
Emergency exits (two, each):
Height 0.50 m (1 ft 7¾ in)
Width 0.60 m (1 ft 11½ in)

DIMENSIONS, INTERNAL
Cargo hold: Length 11.43 m (34 ft 2½ in)
Max width 2.78 m (9 ft 1½ in)
Max height 1.91 m (6 ft 3¼ in)
Volume 60.0 m³ (2,119 cu ft)

AREAS: As for Y7-100 except
Wings, gross 74.98 m² (807.08 sq ft)
Rudder, incl tabs 5.00 m² (53.82 sq ft)
Tailplane 19.83 m² (213.45 sq ft)
Elevators (total, incl tabs) 5.15 m² (55.43 sq ft)

WEIGHTS AND LOADINGS
Operating weight empty 15,773 kg (34,773 lb)
Max fuel weight 5,500 kg (12,125 lb)
Max payload 5,500 kg (12,125 lb)
Max ramp weight 24,230 kg (53,420 lb)

Rear-loading ramp/door of the Y7H-500

1993

Max T-O and landing weight	24,000 kg (52,910 lb)
Max wing loading	320.08 kg/m² (65.56 lb/sq ft)
Max power loading	5.55 kg/kW (9.12 lb/shp)

PERFORMANCE (at max T-O weight except where indicated):

Max level speed at 6,000 m (19,685 ft) at AUW of 22,500 kg (49,600 lb)	255 kts (473 km/h; 294 mph)
Max cruising speed at 6,000 m (19,685 ft)	237 kts (440 km/h; 273 mph)
Econ cruising speed at 6,000 m (19,685 ft)	229 kts (424 km/h; 263 mph)
Max rate of climb at S/L	512 m (1,680 ft)/min
Rate of climb at S/L, OEI	176 m (577 ft)/min
Service ceiling	8,200 m (26,900 ft)
Service ceiling, OEI	3,800 m (12,465 ft)
T-O to 15 m (50 ft)	660 m (2,166 ft)
Landing from 15 m (50 ft)	670 m (2,199 ft)

Range at 236 kts (438 km/h; 272 mph) at 6,000 m (19,685 ft):

with max payload	560 n miles (1,038 km; 645 miles)
with 3,300 kg (7,275 lb) payload	1,187 n miles (2,200 km; 1,367 miles)
Max endurance	5 h 23 min

UPDATED

XAC Y7H-500 medium-range civil cargo transport *1992*

XAC Y-7 DERIVATIVE

TYPE: Design study for 60/64-seat regional transport.

PROGRAMME: In concept design phase late 1991 (latest information received); alternative configurations then under study included high-wing twin resembling Y-7 and low-wing/dihedral type similar to Saab 340.

DESIGN FEATURES: General parameters include twin turboprops, empty weight of approximately 21,200 kg (46,740 lb), range 700 n miles (1,300 km; 808 miles) or 863 n miles (1,600 km; 994 miles) with 60 and 56 passengers respectively; would conform to FAR Pt 25 and have Western power plant and avionics.

POWER PLANT: Pratt & Whitney Canada PW120 series and General Electric CT7-11 under consideration.

UPDATED

ZLAC

ZHONGMENG LIGHT AIRCRAFT CORPORATION

Wenquan, Hainan

Construction of airfield and light aircraft manufacturing facility began Spring 1992 and planned for completion by 1995. Initial product stated to be AD-200, a development of Nanjing Aeronautical Institute (now NUAA: Nanjing University of Aeronautics and Astronautics) AD-100 described in 1987-88 *Jane's*; of advanced all-composites construction, planned development into series including an AD-300 and AD-600. Also to produce latest (Mifeng-11) in BUAA-designed microlight range. Intention is to export 90 per cent of output.

UPDATED

Single-seat AD-100 (foreground) and two-seat AD-200 *1995*

COLOMBIA

AVIONES DE COLOMBIA

AVIONES DE COLOMBIA SA

The last known Agtrainer conversion of Cessna 188 Ag Truck was produced in 1990. Full description in 1993-94 *Jane's*; abbreviated data in 1994-95 edition. No known sales of AC-05 Pijao, last described in the 1994-95 *Jane's*.

UPDATED

GAVILÁN

EL GAVILÁN SA

Carrera 3a No. 56-19, Apartado Aéreo 6781, Santa Fé de Bogotá

Telephone: 57 (1) 211 8100

Fax: 57 (1) 212 8952, 676 0650

Telex: 44 581 LAVE CO

GENERAL MANAGER: Eric C. Leaver

Formerly Aero Mercantil (see 1991-92 and earlier *Jane's*), associated with Piper Aircraft Corporation as dealer and then distributor since 1952, sold its shares in AICSA (which see) and in 1991 formed new Gavilán (Sparrowhawk) company to pursue development and manufacture of own-design EL-1 utility aircraft.

VERIFIED

GAVILÁN 358

TYPE: Seven-passenger utility light transport.

PROGRAMME: Launched March 1986, construction began May 1987, first flight (HK-3500-Z) 27 April 1990; after 50 hours' flying, fuselage stretched 0.305 m (1 ft 0 in) immediately forward of main spar and gross weight increased by 136 kg (300 lb); new first flight 7 November 1990; wing incidence increased 1991 to improve cruising speed, and passenger windows reshaped; damage from emergency landing in USA in February 1992 delayed progress and company decided to obtain FAA (FAR Pt 23) certification from outset, this to be gained by second prototype being built by General Aviation Technical Services of Lock Haven, Pennsylvania, USA, funding arranged December 1994 for FAA certification. Second aircraft to fly April 1996, FAA certification predicted July 1996, with deliveries starting two months later.

COSTS: Standard aircraft, VFR equipped $320,000 (1995).

DESIGN FEATURES: Constant chord, unswept braced wing of NACA 4412 section, dihedral 2°, incidence 5° 30'.

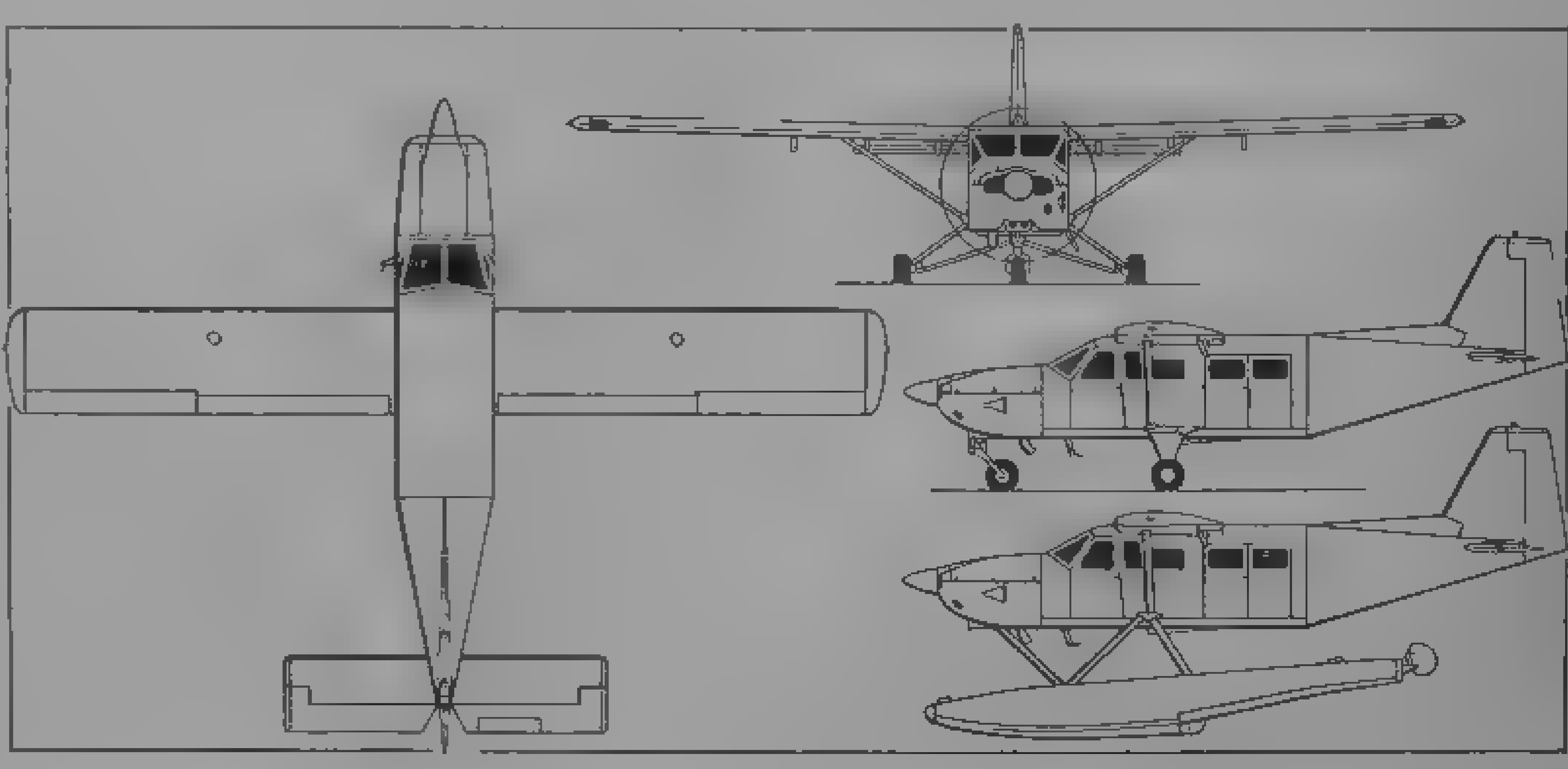
FLYING CONTROLS: All-mechanical (cables), with fixed tailplane; mass balanced ailerons, elevators and rudder horn balanced; spring bias on rudder; trim tab with dual actuators in starboard elevator; single-slotted flaps on offset hinges. Autopilot planned.

STRUCTURE: All metal, mainly of 2024-T3 aluminium alloy sheet; fuselage frame of 4130N steel tube skinned with 2024-T3; two-spar wing with single strut each side; two-spar fin.

LANDING GEAR: Non-retractable tricycle type, with elastomeric shock-absorption and single wheel on each unit. Nosewheel steerable ±40°. Tyre sizes 700 × 6-6 (main) and 600 × 6-6 (nose); pressures 2.76 bars (40 lb/sq in) and 3.03 bars (44 lb/sq in) respectively. Cleve and hydraulic mainwheel brakes. Float/ski options to be offered later.

POWER PLANT: One Textron Lycoming TIO-540-W2A flat-six engine (261 kW; 350 hp at 2,700 rpm), driving a three-blade constant-speed Hartzell propeller. Fuel tank in each wing, combined capacity 454.2 litres (120 US gallons; 99.9 Imp gallons). Refuelling point in top of each tank. Oil capacity 11.4 litres (3 US gallons; 2.5 Imp gallons).

ACCOMMODATION: Pilot and co-pilot or one passenger at front



Gavilán 358 seven-passenger utility transport, with additional side view of future twin-float version *(Jane's/Mike Keep)* *1993*

Two rows of three seats to rear of pilots, facing each other Door at front on each side, plus larger double door at rear on port side.

SYSTEMS: Engine mounted vacuum pump for gyro instruments, driven at 0 37 bar (5.5 lb/sq in) 24 V 70 Ah battery Hydraulic system for brakes only Gaseous oxygen system optional.

AVIONICS: *Comms:* Bendix/King KX 155 VHF nav/com radio

Flight: Bendix/King KR 87 ADF

DIMENSIONS, EXTERNAL:

Wing span	12 80 m (42 ft 0 in)
Wing chord, constant	1 55 m (5 ft 1 in)
Wing aspect ratio	7 84
Length overall	9.53 m (31 ft 3 in)
Fuselage: Max width	1 42 m (4 ft 8 in)
Height overall	3 35 m (11 ft 0 in)
Tailplane span	3 10 m (10 ft 2 in)
Wheel track	3.35 m (11 ft 0 in)
Wheelbase	3 35 m (11 ft 0 in)
Propeller diameter	2 13 m (7 ft 0 in)
Propeller ground clearance	0.36 m (1 ft 2 in)
Pilot's door: Height	1 17 m (3 ft 10 in)
Max width	0.86 m (2 ft 10 in)
Height to sill	1 02 m (3 ft 4 in)
Co-pilot's door: Height	1 17 m (3 ft 10 in)
Max width	0 66 m (2 ft 2 in)
Height to sill	1 02 m (3 ft 4 in)
Passenger door: Height	1 17 m (3 ft 10 in)
Width	1 24 m (4 ft 1 in)
Height to sill	1 02 m (3 ft 4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	3 40 m (11 ft 2 in)
Max width	1 37 m (4 ft 6 in)
Max height	1 37 m (4 ft 6 in)
Floor area	4 09 m² (44 0 sq ft)
Volume	5 38 m³ (190 0 cu ft)

AREAS:

Wings, gross	18 95 m² (204 0 sq ft)
Ailerons (total)	0 97 m² (10 4 sq ft)
Trailing-edge flaps (total)	1 12 m² (12 0 sq ft)
Fin	1 48 m² (15 91 sq ft)
Rudder	0 91 m² (9 81 sq ft)

Gavilán 358 prototype

1995

Tailplane	1 51 m² (16 3 sq ft)
Elevators (total, incl tab)	0 90 m² (9 7 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	1,270 kg (2 800 lb)
Max fuel	326 kg (720 lb)
Max payload with 30 min fuel at 75% power	716 kg (1,580 lb)
Max T-O and landing weight	2,041 kg (4,500 lb)
Max wing loading	107.65 kg/m² (22 06 lb/sq ft)
Max power loading	7 82 kg/kW (12 86 lb/hp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (VNE)	204 kts (378 km/h, 235 mph)
Max level speed at 4,575 m (15,000 ft)	140 kts (259 km/h, 161 mph)
Max cruising speed at 4,575 m (15,000 ft)	135 kts (250 km/h, 155 mph)
Econ cruising speed at 4,575 m (15,000 ft)	128 kts (237 km/h, 147 mph)
Stalling speed, engine idling:	
flaps up	69 kts (128 km/h, 80 mph)
40° flap	58 kts (108 km/h, 67 mph)
Max rate of climb at S/L	274 m (900 ft)/min
Service ceiling	7,010 m (23,000 ft)
T-O run	275 m (900 ft)
T-O to 15 m (50 ft)	457 m (1,500 ft)
Landing from 15 m (50 ft)	366 m (1,200 ft)
Landing run	183 m (600 ft)
Range, no reserves:	
with max payload	550 n miles (1 019 km 633 miles)
with max fuel	800 n miles (1,482 km, 921 miles)

UPDATED

CZECH REPUBLIC

AERO

AERO HOLDING AS

Beranovych 130, CR-199 04 Prague 9-Letňany
Telephone: 42 (2) 884065 and 882747
Fax: 42 (2) 886581, 884065 and 882747
Telex: 121893 VZLU C

DIRECTOR GENERAL: Ing Zdeněk Pernica

EXECUTIVE DIRECTORS:
Ing Vladimír Plšek (Commercial Affairs)
Ing Jan Bartoň (Technical Strategy)
Ing František Petrášek (Finance)

MARKETING COMMUNICATIONS AND PUBLIC RELATIONS:
Zdeněk Burian

This joint stockholding management organisation replaced state owned Aero Concern of Czechoslovak Aerospace Industry on 1 December 1990; airframe, engine and equipment factories and research centres became limited companies on 1 January 1991. Joint stock company was partly privatised in 1992, basically changing current role of Aero Holding from an operational holding to a financial one (100 per cent ownership of 10 subsidiaries), full privatisation of Aero Holding approved by Czech government June 1993. Activities accordingly now comprise organisation, co-ordination and financing of research, development, production and sale of aircraft and other aviation products. Total Aero group work force in late 1994 was more than 9 000.

Shareholdings in wholly owned subsidiaries being decreased since September 1993 by sales to various foreign and domestic partners. Čenkovské Strojírny subsidiary liquidated, Moravan (Zlín) sold in July 1994 to Investiční Poštovní Banka, 31.5 per cent of Aero Holding shares in Aero Vodochody, Letov, Technometra and VZLU now handed over to new state bank Konsolidační Banka, plus 14 per cent of each holding to Investiční Postovní Banka and 10 per cent to Obchodní Banka. Current subsidiaries and investments at early 1995 thus as follows

Aero Trade Prague	34 0 per cent
Aero Vodochody	44 5 per cent
Let Kunovice	100.0 per cent
Letov Prague	44 5 per cent
Walter (Motorlet) Prague	100 0 per cent
Technometra Radotin	44.5 per cent
Teset Semily	100.0 per cent
VZLU (ARTI) Prague	44.5 per cent

ASSOCIATED COMPANIES:

Aero Trade AS (address as previously)
Telephone: 42 (2) 882509 and 8590813
Fax: 42 (2) 8590116
Telex: 121893 VZLU C

Formed April 1993, responsibilities include sale and ..., ing, and sale of spare parts, for all aircraft and other aeronautical products manufactured by the Czech aeronautical industry.

Omnipol AS, Nekázanka 11, CR-1 . 2 2, Prague 1
Telephone: 42 (2) 24011111
Fax: 42 (2) 24012241
Telex: 121299 OMPO C

Trading company specialising in export and import of all kinds of goods including aircraft, aeronautical products and defence equipment. No capital connection with Aero Holding AS.

UPDATED

AERO

AERO VODOCHODY

CR 250 70 Odolena Voda
Telephone: 42 (2) 843641
Fax: 42 (2) 823172
Telex: 121169 AERO C

PRESIDENT: Zdeněk Chalupník

VICE-PRESIDENTS:
Adam Straňák (Engineering)
Jan Spára (Production)
Jiří Kraus (Finance)
Viktor Kučera (Research & Development)
Zdeněk Prokop (Sales)

MARKETING DIRECTOR: Ing Miloš Vališ

Factory established 1 July 1953; produced (with Let) 3,568 L-29 Delfin jet trainers between 1963 and 1974. Current workforce about 2,350.

UPDATED

AERO L-39 and L-139 ALBATROS

TYPE: Two-seat jet trainer with armed and combat variants.

PROGRAMME: First flight 4 November 1968, 10 preproduction aircraft from 1971, selected 1972 to succeed L-29 as standard trainer for USSR, Czechoslovakia and East Germany and production started same year, service trials in USSR and Czechoslovakia 1973, entered service with Czechoslovak Air Force 1974.

CURRENT VERSIONS: **L-39 C**: Initial pilot trainer, with two underwing stations; production completed. Details in 1994-95 and earlier *Jane's*.

L-39 V: Target towing version for Czech and East German use, eight only.

L-39 ZO (Z = Zbrojní: armed). Reinforced wings with four underwing stations; first flight (X-09) 25 August 1975. Production completed; weight, performance and other data in 1991-92 and earlier *Jane's*.

L-39 ZA: Ground attack and reconnaissance version of ZO; four underwing stations and centreline gun pod, reinforced wings and landing gear; prototypes (X-10 and X-11) flown 29 September 1976 and 16 May 1977, in production. Export demonstrator completed with Western avionics (HUD, mission computer, Bendix/King avionics and navigation equipment) as **L-39 ZA/MP** (for multipurpose). Version for Thailand has Elbit avionics and is designated **ZA/ART**, deliveries to RTAF began January 1994 and were completed that year. *Detailed description applies to ZA version except where indicated.*

L-39 MS: Development aircraft for L-59, five delivered to Czech Air Force 1991-92.

L-59: New advanced training version with more powerful engine and improved avionics, described separately.

L-139 Albatros 2000: Trainer, powered by 18.15 kN (4,080 lb st) AlliedSignal TFE731-4-1T turbofan under preliminary Aero/AlliedSignal agreement signed June 1991, Flight Visions HUD and Bendix/King avionics, VS-2A zero/zero seats. First flight (5501) 8 May 1993.

CUSTOMERS: Total of 2,828 built (excluding five prototypes) by 1 January 1995, see table for details. In production for Bangladesh (eight) in mid-1995.

DESIGN FEATURES: Tandem two-seater with ejection seats and pressurisation, fixed tip tanks also contain navigation/landing lights, rear fuselage and tail, attached by five bolts, allow easy removal for access to engine; tapered wing has NACA 64A012 Mod 5 section; quarter-chord sweepback 1° 45′, dihedral 2° 30′ from roots; incidence 2°.

FLYING CONTROLS: Mechanical by pushrods, fixed incidence tailplane; electrically actuated trim tab in each elevator; balance tab in rudder; mass balanced ailerons with balance

L 39 PRODUCTION

	Afghanistan	Algeria	Bulgaria	Cuba	Czech	Ethiopia	Germany(E)	Iraq	Libya	Nigeria	Romania	Syria	Thailand	USSR	Vietnam	Total	Cum Total
1971					5 C											5	5
1972					10 C											10	15
1973					5 C									14 C		19	34
1974														55 C		55	89
1975					10 C			22 ZO						60 C		92	181
1976					8 V, 1 ZA			28 ZO						73 C		110	291
1977	12 C						21 ZO	1 ZO						82 C		116	407
1978							27 ZO		36 ZO					57 C		120	527
1979									37 ZO					94 C		131	658
1980					5 ZA							41 ZO		77 C	12 C	135	793
1981								10 ZO	21 ZO		8 ZA	6 ZO		89 C	12 C	146	939
1982				30 C	12 ZA		4 ZO		44 ZO		4 ZA	8 ZO		58 C		160	1,099
1983						10 C			43 ZO		8 ZA	16 ZA		91 C		168	1,267
1984								10 ZO			8 ZA	20 ZA		156 C		194	1,461
1985								10 ZO			4 ZA	7 ZA		184 C		205	1,666
1986			12 ZA		3 ZA					12 ZA		1 ZA		193 C		221	1,887
1987		10 ZA	6 ZA							12 ZA				207 C		235	2,122
1988		10 ZA			5 C	10 C								227 C		252	2,374
1989					1 C, 6 ZA									246 C		253	2,627
1990		12 ZA	18 ZA		4 ZA									131 C		165	2,792
1991					3 MS											3	2,795
1992					2 MS											2	2,797
1993													8 ZA			8	2,805
1994													28 ZA			28	2,833
Sub-totals																	
C	**12**			**30**	**36**	**20**								**2,094**	**24**	**2,216**	
MS					**5**											**5**	
V					**8**											**8**	
ZO							**52**	**81**	**181**[2]			**55**				**369**	
ZA		**32**	**36**		**31**					**24**[3]	**32**	**44**	**36**			**235**	
Totals	**12**	**32**	**36**	**30**	**80**	**20**	**52**	**81**	**181**	**24**	**32**	**99**	**36**	**2,094**	**24**	**2,833**	

Notes

[1] Two transferred to East Germany [2] Ten transferred to Egypt [3] Reported 1992 order for further 27 not delivered

tabs (port tab actuated electrically for trimming); two airbrake panels under fuselage just below wing leading-edge, operated by single hydraulic jack, extend automatically as speed approaches Mach 0.8, double-slotted flaps extended by rods from single hydraulic jack, retracting automatically as airspeed reaches 167 knots (310 km/h, 193 mph)

STRUCTURE: One-piece all-metal stressed skin wing with main and auxiliary spars, four-point wing attachment, fuselage ahead of engine bay has three sections, nose containing avionics/battery/antennae/air and oxygen bottles/nosewheel unit, next section forming pressurised cockpit, third section containing air intakes/fuel tanks/engine bay

LANDING GEAR: Retractable tricycle type, with single wheel and oleo-pneumatic shock-absorber on each unit, designed for touchdown sink rate of 3.4 m (11.15 ft)/s at AUW of 4,600 kg (10,141 lb). Retraction and extension operated hydraulically, with electrical control. All wheel well doors close automatically after wheels are lowered, to prevent ingress of dirt and debris. Mainwheels retract inward into wings (with automatic braking during retraction), nosewheel forward into fuselage. K28 mainwheels with 610 × 215 mm tyres and K27 nosewheel with 450 × 165 mm tyre. Hydraulic disc brakes and anti-skid units on mainwheels, shimmy damper on nosewheel leg. Minimum ground turning radius (about nosewheel) 2.50 m (8 ft 2 in). L-39 ZA can operate from grass strips with bearing strength of 6 kg/cm^2 (85 lb/sq in)

POWER PLANT: One 16.87 kN (3,792 lb st) Progress AI-25 TL turbofan in rear fuselage, with semi-circular lateral air intake, with splitter plate, on each side of fuselage above wing centre-section. Fuel in five rubber main bag tanks aft of cockpits, with combined capacity of 1,055 litres (279 US gallons; 232 Imp gallons), and two 100 litre (26.5 US gallon; 22 Imp gallon) non-jettisonable wingtip tanks. Total internal fuel capacity 1,255 litres (332 US gallons; 276 Imp gallons). Gravity refuelling points on top of fuselage and on each tip tank. Provision for two 150 or 350 litre (39.6 or 92.5 US gallon, 33 or 77 Imp gallon) drop tanks on inboard underwing pylons, increasing total overall fuel capacity to a maximum of 1,955 litres (517 US gallons, 430 Imp gallons). Fuel system permits up to 20 seconds of inverted flight

ACCOMMODATION: Crew of two in tandem, on Czech VS-1 BRI rocket-assisted ejection seats, operable at zero height and at speeds down to 81 knots (150 km/h, 94 mph), individual canopies hinge sideways to starboard and are jettisonable. Rear seat elevated. One-piece windscreen hinges forward for access to front instrument panel. Internal transparency between cockpits. Dual controls standard

SYSTEMS: Cabin pressurised (standard differential 0.227 bar; 3.29 lb/sq in, maximum overpressure 0.29 bar; 4.20 lb/sq in) and air conditioned, using engine bleed air and cooling unit. Air conditioning system provides automatic temperature control from 10 to 25°C at ambient air temperatures from −55 to +45°C

Main and standby interconnected hydraulic systems, main system having variable flow pump with operating pressure of 147 bars (2,133 lb/sq in) for actuation of landing gear, flaps, airbrakes, ram air turbine and (at 34.3 bars, 500 lb/sq in pressure) wheel brakes. Emergency system for all of above except airbrakes, incorporates three accumulators. Pneumatic canopy seals supplied by a 2 litre (0.07 cu ft) compressed air bottle in nose (pressure 147 bars, 2,133 lb/sq in)

Electrical system (27 V DC) powered by 7.5 kVA engine-driven generator; if primary generator fails, V 910 ram air turbine extends automatically into airstream and generates up to 3 kVA emergency power for essential services. 12 V 28 Ah SAM 28 lead-acid battery for standby power and APU starting. Two 800 VA static inverters (first for radio equipment, ice warning lights, engine vibration measurement and air conditioning, second for navigation and landing systems, IFF and air-to-air missiles) provide 115 V single-phase AC power at 400 Hz. Second circuit incorporates 500 VA rotary inverter and 40 VA static inverter for 36 V three-phase AC power, also at 400 Hz

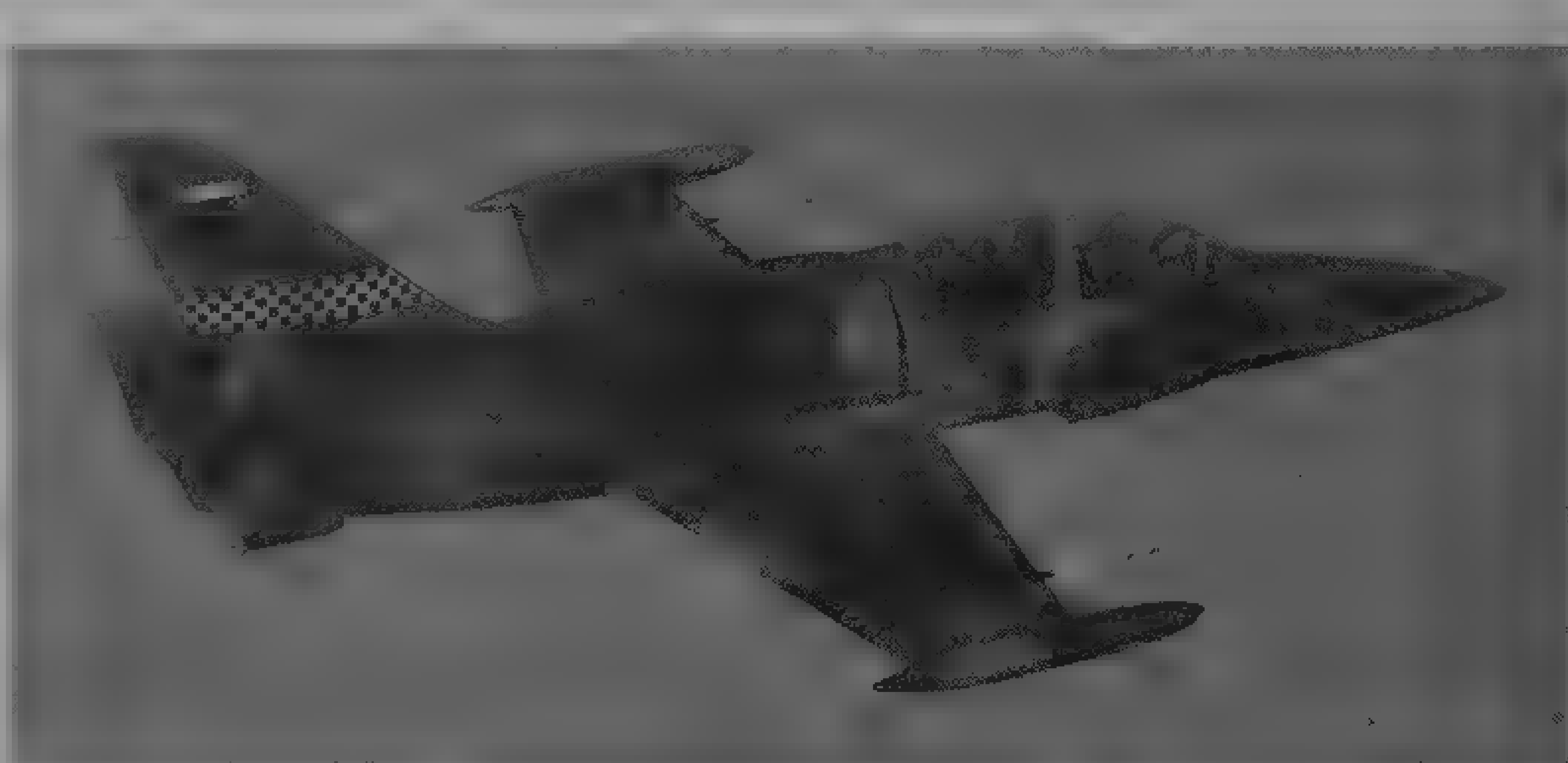
Saphir 5 APU and SV-25 turbine for engine starting. Air intakes and windscreen anti-iced by engine bleed air, anti-icing normally sensor-activated automatically, but manual standby system also provided. Six-bottle oxygen system for crew, pressure 147 bars (2,133 lb/sq in)

AVIONICS (L-39 ZA/ART): *Comms:* ARC-186 VHF (30 to 78 MHz/FM and 108 to 151.75 MHz/AM) and ARC-164 VHF (220 to 399.975 MHz) radios, KXP 756 transponder, Orbit crew intercom

Flight: KNR 634A VOR, KTV 709 Tacan; RB 5 radar altimeter

Instrumentation: Elbit WDNS with HUD and video camera in front cockpit and monitor in rear cockpit

ARMAMENT (L-39 ZA/ART): Underfuselage pod below front cockpit, housing a single 23 mm GSh-23 two-barrel gun, ammunition (maximum 150 rds) housed in fuselage above gun pod. Gun/rocket/missile firing and weapon release controls in front cockpit only. Four underwing hardpoints, inboard pair each stressed for up to 500 kg (1,102 lb) and outer pair for up to 250 kg (551 lb) each, maximum underwing stores load 1,000 kg (2,205 lb). Non-jettisonable pylons, each comprising an MD3-57D stores rack. Typical underwing stores can include various combinations of bombs (two of up to 500 kg or four of up to 250 kg), four rocket launchers for 2.75 in FFAR or CRV7 rockets, AIM-9 air-to-air missiles (outboard stations only), two 150 or 350 litre drop tanks (see under Power Plant) (inboard stations only); or two training dispensers. See 1993-94 and earlier editions for L-39 ZA armament



Aero L-39 ZA/ART of the Royal Thai Air Force

DIMENSIONS, EXTERNAL
Wing span, incl tip tanks 9.46 m (31 ft 0½ in)
Wing chord (mean) 2.15 m (7 ft 0½ in)
Wing aspect ratio: geometric 4.4
incl tip tanks 5.2
Length overall 12.13 m (39 ft 9½ in)
Height overall 4.77 m (15 ft 7¾ in)
Tailplane span 4.40 m (14 ft 5 in)
Wheel track 2.44 m (8 ft 0 in)
Wheelbase 4.39 m (14 ft 4¾ in)

AREAS
Wings, gross 18.80 m² (202.36 sq ft)
Ailerons (total) 1.23 m² (13.26 sq ft)
Trailing-edge flaps (total) 2.68 m² (28.89 sq ft)
Airbrakes (total) 0.50 m² (5.38 sq ft)
Fin 2.60 m² (27.99 sq ft)
Rudder, incl tab 0.91 m² (9.80 sq ft)
Tailplane 3.93 m² (42.30 sq ft)
Elevators, incl tabs 1.14 m² (12.27 sq ft)

WEIGHTS AND LOADINGS (L-39 ZA):
Weight empty, equipped 3,565 kg (7,859 lb)
Fuel load: fuselage tanks 824 kg (1,816 lb)
wingtip tanks 156 kg (344 lb)
Max external stores load 1,290 kg (2,844 lb)
T-O weight clean 4,635 kg (10,218 lb)
Max T-O weight 5,600 kg (12,346 lb)
Max wing loading 297.9 kg/m² (61.01 lb/sq ft)
Max power loading 332.0 kg/kN (3.25 lb/lb st)

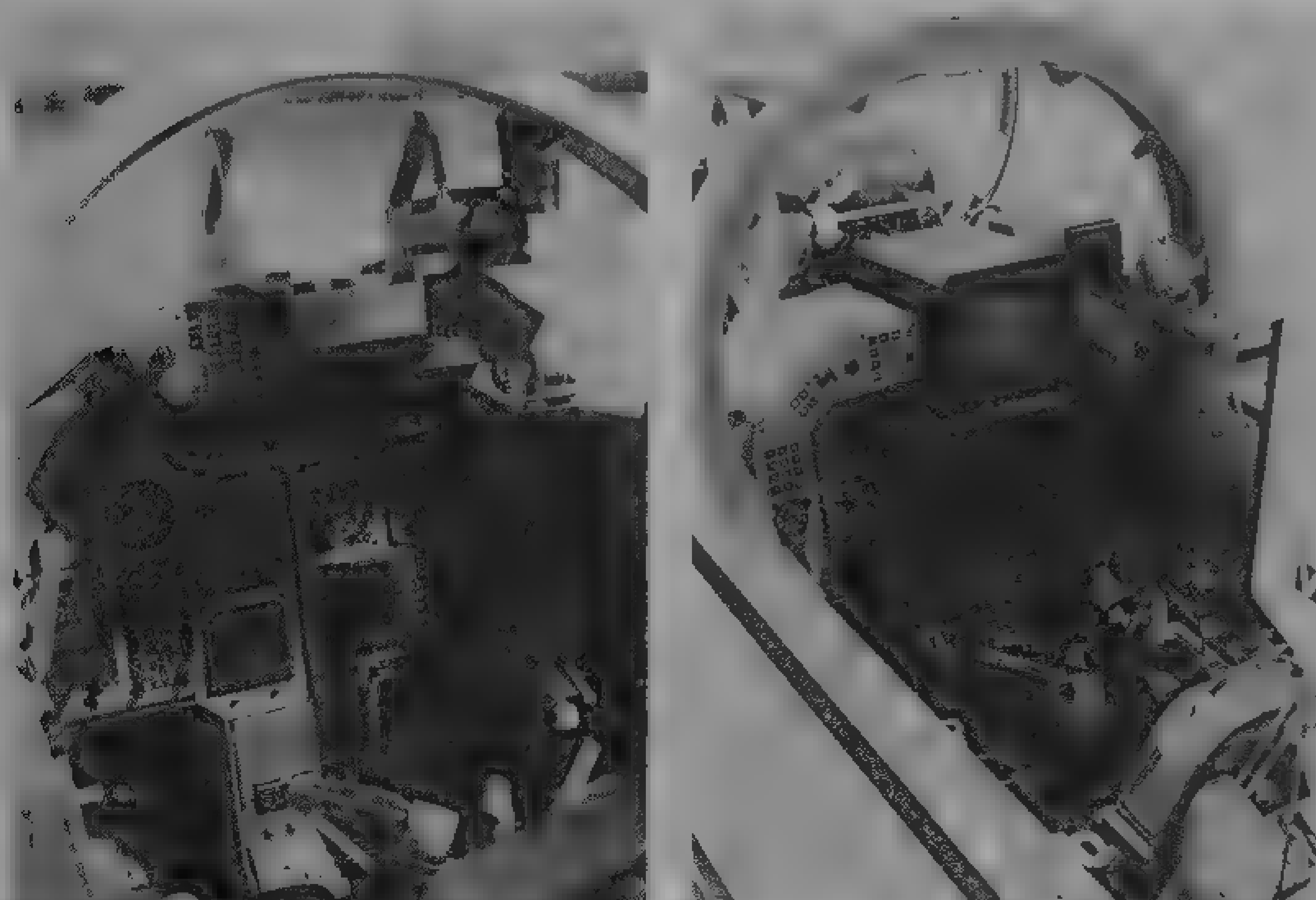
WEIGHTS AND LOADINGS (L-139):
Basic weight empty 3,458 kg (7,623 lb)
Fuel weights (fuselage and wingtip tanks)
as for L-39 ZA
Max external fuel (4 x 350 l tanks) 1,088 kg (2,398 lb)
Max underwing stores 1,500 kg (3,307 lb)
Max ramp weight:
with external stores 6,000 kg (13,227 lb)
clean 4,600 kg (10,141 lb)
T-O weight clean 4,548 kg (10,026 lb)
Max landing weight 4,800 kg (10,582 lb)
Wing loading at clean T-O weight
241.9 kg/m² (49.55 lb/sq ft)
Power loading at clean T-O weight
250.8 kg/kN (2.46 lb/lb st)

PERFORMANCE (L-39 ZA at max T-O weight, except where indicated):
Max limiting Mach number 0.80
Max level speed at S/L 329 kts (610 km/h; 379 mph)
Max level speed at 5,000 m (16,400 ft)
340 kts (630 km/h; 391 mph)
Stalling speed 103 kts (190 km/h; 118 mph)
Max rate of climb at S/L 810 m (2,657 ft)/min
Time to 5,000 m (16,400 ft) 10 min
Service ceiling 7,500 m (24,600 ft)
T-O run (concrete) 970 m (3,182 ft)
Landing run (concrete) 800 m (2,625 ft)
g limits:
operational: at 4,200 kg (9,259 lb) AUW +8/–4
at 5,500 kg (12,125 lb) AUW +5.2/–2.6
ultimate, at 4,200 kg (9,259 lb) AUW +12

PERFORMANCE (L-139 at clean T-O weight):
Max level speed at 6,100 m (20,000 ft)
410 kts (760 km/h; 472 mph)
Touchdown speed 99 kts (183 km/h; 114 mph)
Stalling speed, flaps down 90 kts (167 km/h; 104 mph)
Max rate of climb at S/L 1,278 m (4,193 ft)/min
Service ceiling 11,800 m (38,715 ft)

Aero Vodochody's L-139 demonstrator, with AlliedSignal engine and Bendix/King avionics *1995*

T-O run 500 m (1,641 ft)
Landing run 610 m (2,002 ft)
Range on internal fuel
870 n miles (1,611 km; 1,001 miles)
Endurance 3 h 32 min



Front (left) and rear cockpits of the L-139 *1995*

UPDATED

AERO L-59 and L-159

TYPE: Developed versions of L-39 jet trainer.

PROGRAMME: Early development under designation L-39 MS; first flight in definitive configuration (X-22 prototype OK-184) 30 September 1986; two more prototypes (X-24, X-25) flown 26 June and 6 October 1987; first flight of production L-59, 1 October 1989; first flight of first L-59 E made on 22 April 1992; deliveries of L-59 E (two aircraft) began 29 January 1993 and were completed in early 1994.

CURRENT VERSIONS: **L-59 E**: Production two-seat version for Egyptian Air Force. *Detailed description applies to this version except where indicated.*

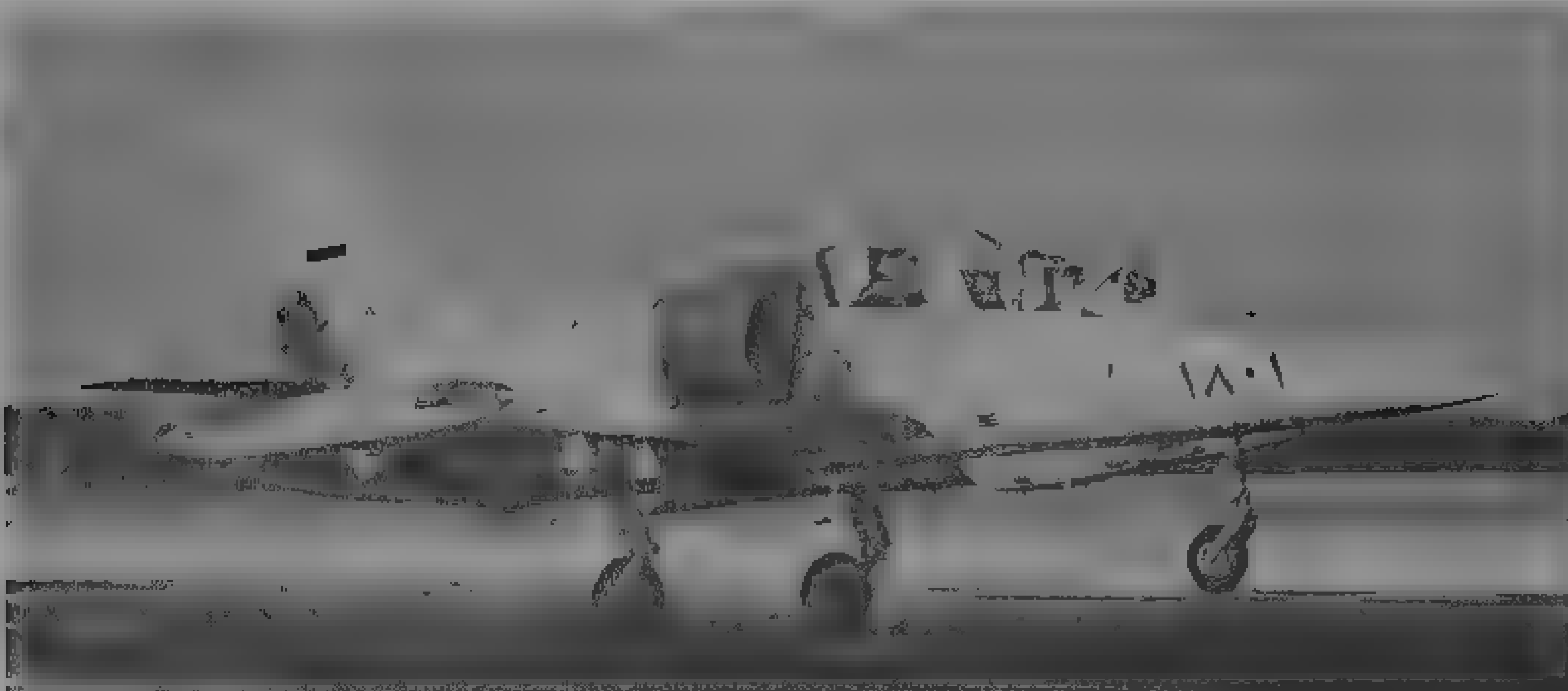
L-159: Light ground attack single-seat version of L-59 to be developed for Czech Air Force. AlliedSignal F124 turbofan (28.02 kN; 6,300 lb st) selected as power plant in mid-1994. Other major differences include single-seat cockpit, additional 297 kg (655 lb) of internal fuel, and Western radar and other avionics. Rival avionics bids by Elbit, Rockwell Collins and Bendix/King. First flight planned for 1996. Further data and illustrations in Addenda.

CUSTOMERS: Egyptian Air Force (48 L-59 Es); Tunisian Air Force (12 ordered). Total of 53 L-59s built by January 1995.

COSTS: Egyptian order reportedly worth $204 million.

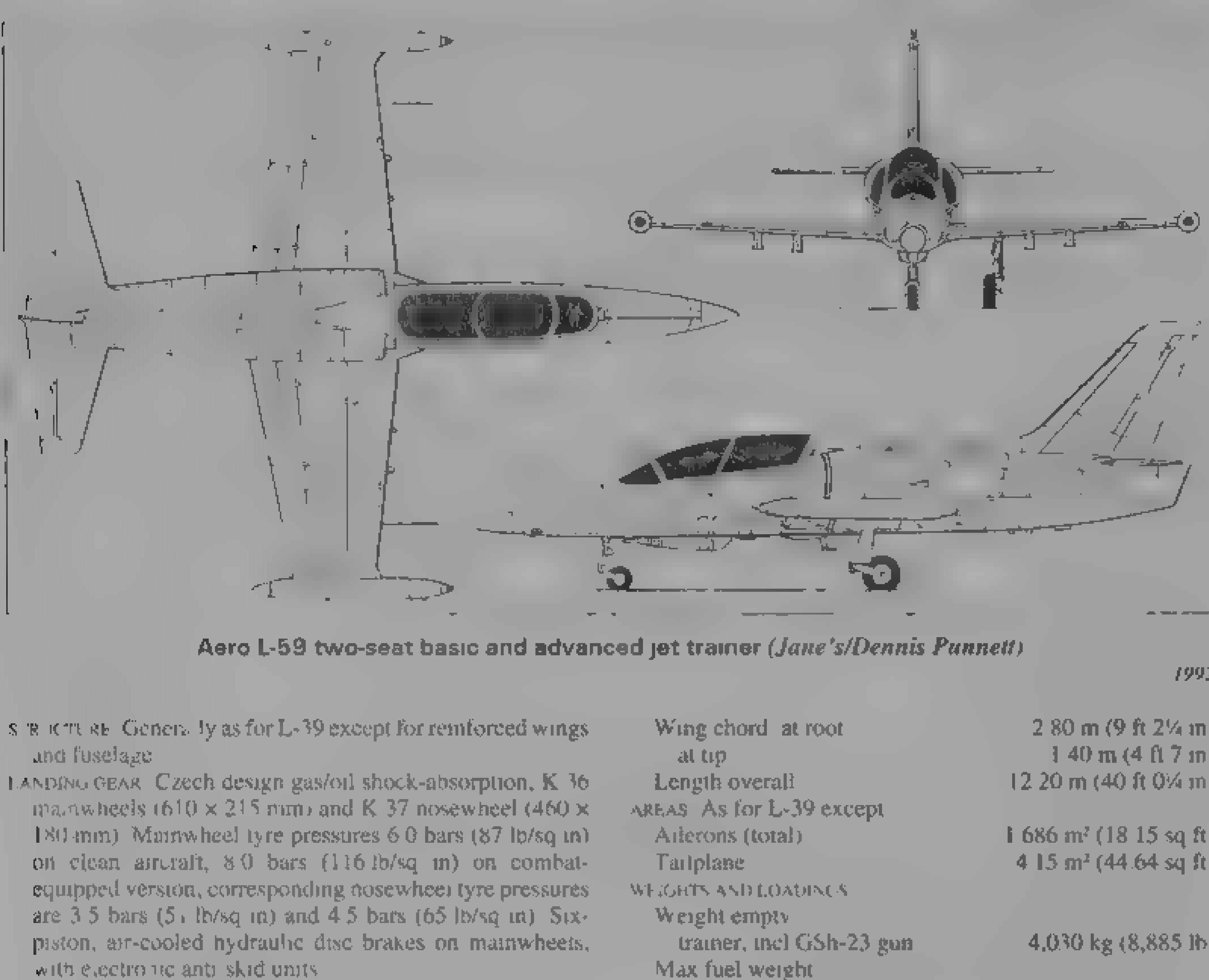
DESIGN FEATURES: Main changes are a reinforced fuselage, new and more powerful engine, upgraded avionics, more pointed nose, powered controls and enlarged tiptanks.

FLYING CONTROLS: Generally as L-39 except that ailerons and elevators have Czech-designed irreversible power controls and no tabs.



L 59 E export version for Egyptian Air Force

1995



Aero L-59 two-seat basic and advanced jet trainer *(Jane's/Dennis Punnett)*

1992

STRUCTURE: Generally as for L-39 except for reinforced wings and fuselage

LANDING GEAR: Czech design gas/oil shock-absorption. K 36 mainwheels (610 × 215 mm) and K 37 nosewheel (460 × 180 mm) Mainwheel tyre pressures 6 0 bars (87 lb/sq in) on clean aircraft, 8 0 bars (116 lb/sq in) on combat-equipped version, corresponding nosewheel tyre pressures are 3 5 bars (51 lb/sq in) and 4 5 bars (65 lb/sq in) Six-piston, air-cooled hydraulic disc brakes on mainwheels, with electronic anti skid units

POWER PLANT: One 21 57 kN (4,850 lb st) Progress (Lotarev/ZVL) DV-2 turbofan. Internal fuel in fuselage tanks (total 1,077 litres, 284 5 US gallons, 237 Imp gallons) and two 230 litre (60.8 US gallon; 50 6 Imp gallon) non-jettisonable wingtip tanks. Provision for two underwing (inboard) 150 or 350 litre (39 6 or 92 5 US gallon, 33 or 77 Imp gallon) drop tanks

ACCOMMODATION: Crew of two in tandem on Czech VS 2 zero/zero ejection seats. One piece canopy, hinged at rear and opening upward hydraulically

SYSTEMS: Cockpits pressurised (maximum overpressure 0 30 bar; 4 35 lb/sq in) and air conditioned, using engine bleed air 25 litres/min, 0 883 cu ft/min) and cooling unit. Automatic temperature control from 15 to 30°C Hydraulic system comprises first and second subsystems each with engine-driven variable flow pump with operating pressure of 150 bars (2,175 lb/sq in), maximum flow rate 25 litres (6.6 US gallons; 5 5 Imp gallons)/min. Emergency hydraulic pump for second subsystem driven by APU Main (9 kW) and standby (6 kW) generators for electrical power, plus 25 Ah Ni/Cd battery Gaseous oxygen system for crew Saphir 5M APU for engine starting and drive of standby hydraulic pump and generator

AVIONICS: *Comms* LPR 80 VHF/UHF radio with intercom LUN 3524 standby radio; Bendix/King KXP 756 transponder

Flight: Bendix/King KNS 660 flight management system includes KNR 634 VOR, KTU 709 Tacan, KDF 806 ADF, KRA 405 radar altimeter, KLN 670 GPS KAH 460 AHRS and KAD 480 air data system

Instrumentation. EFS 40 EFIS, Flight Visions FV 2000 HUD and mission computer, with video camera in front cockpit and monitor in rear cockpit

ARMAMENT: Single twin-barrel 23 mm GSh gun in underfuselage pod below front cockpit; ammunition (150 rds) housed in fuselage. Four underwing hardpoints, inner ones each with 500 kg (1 102 lb) capacity, outer ones each 250 kg (551 lb) capacity Underwing stores of former Soviet types, including bombs of up to 500 kg size and UB-16-57M (57 mm) rocket launchers

DIMENSIONS, EXTERNAL: As for L-39 except

Wing span, incl tip tanks	9 54 m (31 ft 3½ in)
Wing chord at root	2 80 m (9 ft 2¼ in)
at tip	1 40 m (4 ft 7 in)
Length overall	12 20 m (40 ft 0¼ in)

AREAS: As for L-39 except

Ailerons (total)	1 686 m² (18 15 sq ft)
Tailplane	4 15 m² (44.64 sq ft)

WEIGHTS AND LOADINGS:

Weight empty:	
trainer, incl GSh-23 gun	4,030 kg (8,885 lb)
Max fuel weight:	
internal, incl wingtip tanks	1,200 kg (2,645 lb)
external (two 350 l drop tanks)	544 kg (1 199 lb)
Max T-O weight: trainer, clean	5,390 kg (11,883 lb)
with external stores	7,000 kg (15,432 lb)
Max landing weight (on concrete)	6,000 kg (13,228 lb)
Max wing loading:	
clean	286.70 kg/m² (58.72 lb/sq ft)
at 7,000 kg (15 432 lb) max T-O weight	372 34 kg/m² (76.26 lb/sq ft)
Max power loading:	
clean	249 82 kg/kN (2 45 lb/lb st)
at 7,000 kg (15,432 lb) max T-O weight	324.45 kg/kN (3.18 lb/lb st)

PERFORMANCE (at max trainer clean T-O weight):

Max limiting Mach number	0 82
Max level speed at 5,000 m (16,400 ft)	467 kts (865 km/h, 537 mph)
Stalling speed: flaps up	116 kts (215 km/h, 134 mph)
flaps down	100 kts (185 km/h, 115 mph)
Max rate of climb at S/L	1,680 m (5,510 ft)/min
Service ceiling	11 800 m (38,725 ft)
T-O run	590 m (1,936 ft)
Landing run	770 m (2,527 ft)

Range at 7,000 m (22,975 ft) with max internal and external fuel (1,744 kg, 3,845 lb)
1,079 n miles (2,000 km; 1,243 miles)

UPDATED

AERO Ae 270 IBIS

TYPE: Single-turboprop, 9/10-passenger utility transport

PROGRAMME: Announced early 1990, originally as L-270, configuration modified 1991, originally planned in two versions (Ae 270 U and Ae 270 MP see 1993-94 *Jane's*), but revised late 1993 (see Current Versions below) and name Ibis introduced Chief designer Jan Mikula. Two prototypes and one static test airframe planned, first flight planned for 1995, certification to FAR Pt 23 Normal category (Ae 270 W) 1996

CURRENT VERSIONS: **Ae 270 W** Basic non-pressurised model (previously called Ae 270 U), with fixed landing gear, Walter M 601 F engine, Czech avionics and optional de-icing

Ae 270 P: Pressurised version, with P&WC PT6A-42 engine, Bendix/King avionics, retractable gear and de-icing as standard

Ae 270 FW and FP: Wheeled float versions of W and P

COSTS: Target price $1 2 million (1993)

DESIGN FEATURES: High aspect ratio low wing, circular cabin windows, swept back vertical tail Medium speed aerofoil section (thickness/chord ratio 17 per cent at root, 12 per cent at tip); leading-edge swept back 7° 42′, dihedral 6°, incidence 3°, twist 3°

FLYING CONTROLS: Ailerons, elevators, rudder and upper-wing roll control spoilers actuated mechanically, elevators trimmed mechanically, ailerons and rudder electromechanically, trim tab in rudder Wide-span single-slotted Fowler flaps (70 per cent of trailing-edge) actuated hydraulically Autopilot optional

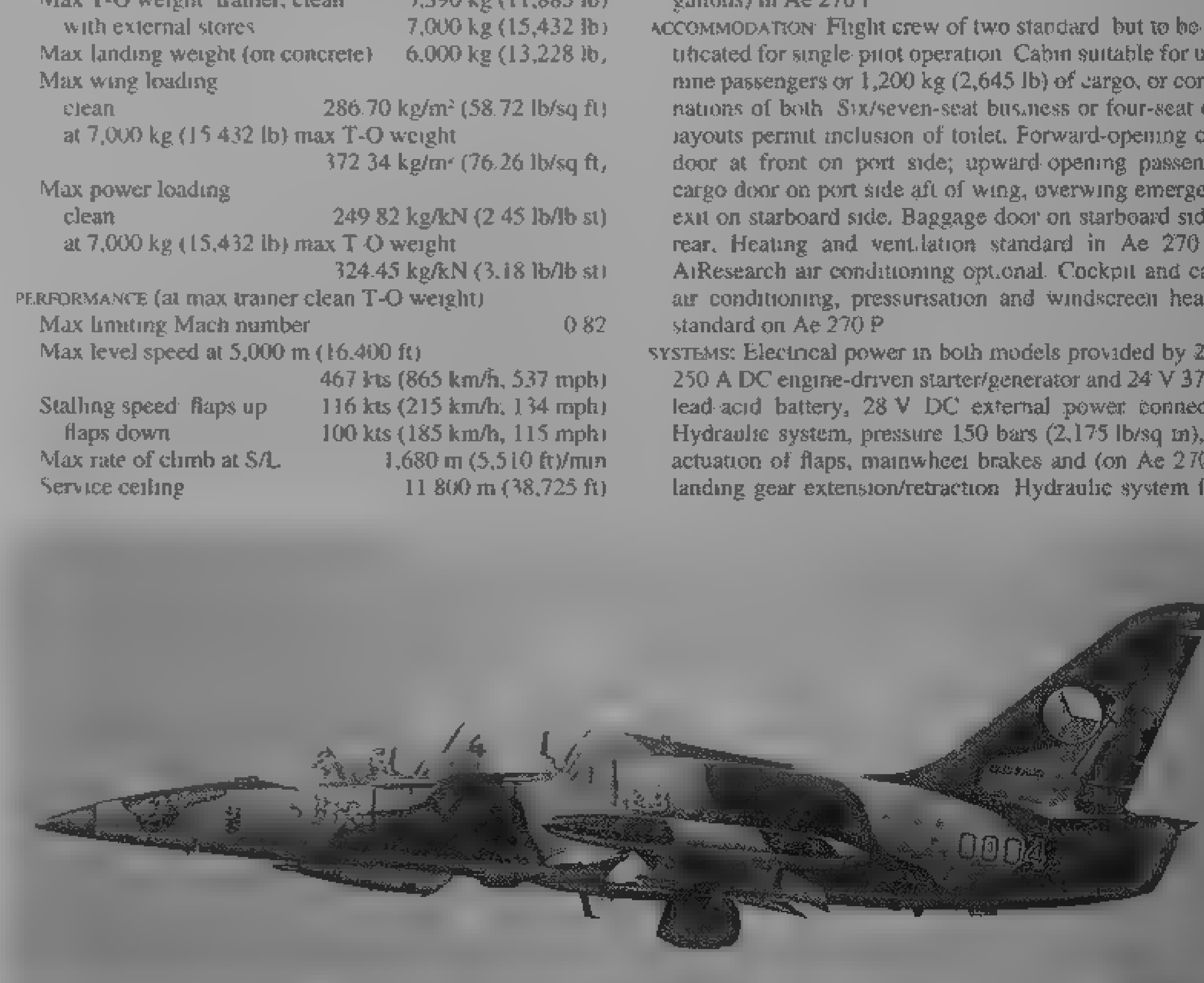
STRUCTURE: All-metal stressed skin, with fail-safe structural elements in fuselage and two-spar wings

LANDING GEAR: Tricycle type (retractable on Ae 270 P, non-retractable on Ae 270 W), with steerable nosewheel (60° by brakes, 15° by rudder pedals). Inward retraction for mainwheels, rearward for nosewheel. Oleo-pneumatic shock-absorbers in all units; hydraulic disc brakes on mainwheels Goodyear tubeless tyres: size 562 × 169 mm, pressure 5 5 bars (79 8 lb/sq in) on mainwheels, size 445 × 160 mm, pressure 3 80 bars (55 1 lb/sq in) on nosewheel Minimum ground turning radius (based on nosewheel) 4 00 m (13 ft 1½ in)

POWER PLANT: One 580 kW (778 shp) Walter M 601 F turboprop in Ae 270 W, or 634 kW (850 shp) (flat rated) Pratt & Whitney Canada PT6A-42 in Ae 270 P, three-blade constant speed reversible-pitch propeller (Avia V 508E or Hamilton Standard V 5.2 respectively). Water injection system optional for both models. Integral fuel tank in each wing, combined usable capacity 1,135 litres (300 US gallons; 250 Imp gallons). Gravity refuelling point in top of each wing Oil capacity 7 litres (1 85 US gallons; 1 5 Imp gallons) in Ae 270 W, 5 7 litres (1 5 US gallons, 1 25 Imp gallons) in Ae 270 P

ACCOMMODATION: Flight crew of two standard but to be certificated for single pilot operation Cabin suitable for up to nine passengers or 1,200 kg (2,645 lb) of cargo, or combinations of both Six/seven-seat business or four-seat club layouts permit inclusion of toilet. Forward-opening crew door at front on port side; upward opening passenger/cargo door on port side aft of wing, overwing emergency exit on starboard side. Baggage door on starboard side at rear. Heating and ventilation standard in Ae 270 W, AiResearch air conditioning optional Cockpit and cabin air conditioning, pressurisation and windscreen heating standard on Ae 270 P

SYSTEMS: Electrical power in both models provided by 28 V 250 A DC engine-driven starter/generator and 24 V 37 Ah lead acid battery, 28 V DC external power connector Hydraulic system, pressure 150 bars (2,175 lb/sq in), for actuation of flaps, mainwheel brakes and (on Ae 270 P) landing gear extension/retraction Hydraulic system flow



Aero L 59 in Czech Air Force markings (*Paul Jackson*)

1995

rate 11 litres (2.9 US gallons; 2.4 Imp gallons)/min. Landing gear and mainwheel brakes also controllable by separate emergency hand-operated valves and parking brake. AiResearch air conditioning and pressurisation system in Ae 270 P maintains differential of 0.30 bar (4.35 lb/sq in) up to flight level 7,500 m (24,600 ft). Pneumatic (engine bleed air) de-icing of wing and tailplane leading-edges standard on Ae 270 P, optional on Ae 270 W; electric de-icing of windscreens, propeller blades, engine air intakes, stall warning sensor and pitot tube standard on both models.

AVIONICS: Standard flight, navigation and engine instrumentation (VFR or IFR) to comply with FAR Pt 23.

Radar: Weather radar optional.

Flight: IFR package standard for business versions, including VOR/ILS, ADF and GPS nav.

Instrumentation: EFIS optional.

DIMENSIONS, EXTERNAL:

Wing span	13.80 m (45 ft 3¼ in)
Wing chord, at root	1.879 m (6 ft 2 in)
at tip	1.037 m (3 ft 4¾ in)
Wing aspect ratio	9.07
Length overall	12.24 m (40 ft 1 in)
Fuselage: Length	12.193 m (40 ft 0 in)
Max width	0.80 m (2 ft 7½ in)
Max depth	1.75 m (5 ft 9 in)
Height overall	4.79 m (15 ft 8½ in)
Elevator span	5.40 m (17 ft 8½ in)
Wheel track	2.83 m (9 ft 3½ in)
Wheelbase	3.53 m (11 ft 7 in)
Propeller diameter	2.60 m (8 ft 6½ in)
Propeller ground clearance	0.33 m (1 ft 1 in)
Passenger/cargo door (port, rear):	
Height	1.25 m (4 ft 1¼ in)
Width	1.25 m (4 ft 1¼ in)
Height to sill	1.30 m (4 ft 3¼ in)
Crew door (port, fwd): Height	1.20 m (3 ft 11¼ in)
Width	0.70 m (2 ft 3½ in)
Height to sill	1.30 m (4 ft 3¼ in)
Emergency exit (stbd, overwing):	
Height	0.71 m (2 ft 4 in)
Width	0.50 m (1 ft 7¾ in)

DIMENSIONS, INTERNAL:

Cabin: Length	4.98 m (16 ft 4 in)
Max width	1.44 m (4 ft 8¾ in)
Max height	1.36 m (4 ft 5½ in)
Volume	7.5 m³ (264.9 cu ft)

AREAS:

Wings, gross	21.00 m² (226.04 sq ft)
Ailerons (total)	1.00 m² (10.76 sq ft)
Trailing-edge flaps (total)	4.218 m² (45.40 sq ft)
Spoilers (total)	0.324 m² (3.49 sq ft)
Fin, incl dorsal fin	1.961 m² (21.11 sq ft)
Rudder, incl tab	1.113 m² (11.98 sq ft)
Tailplane	2.974 m² (32.01 sq ft)
Elevators (total)	1.886 m² (20.30 sq ft)

WEIGHTS AND LOADINGS:

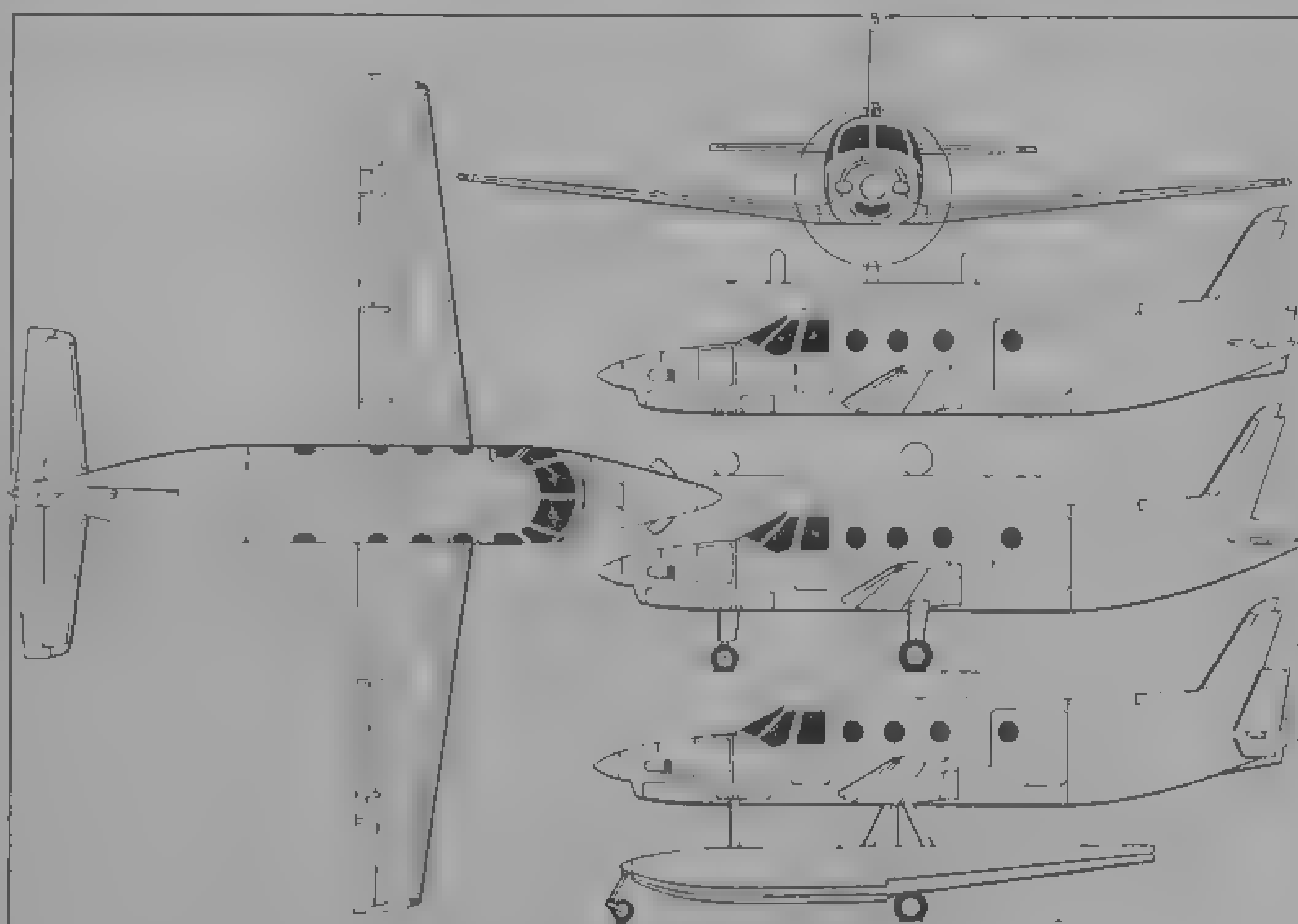
Weight empty, equipped: W	1,700 kg (3,748 lb)
P	1,788 kg (3,942 lb)
Max fuel weight: W, P	1,003 kg (2,211 lb)
Max payload: W, P	1,200 kg (2,645 lb)
Max T-O weight: W, P	3,300 kg (7,275 lb)
Max ramp weight: W, P	3,315 kg (7,308 lb)
Max landing weight: W, P	3,150 kg (6,944 lb)
Max zero-fuel weight: W	2,977 kg (6,563 lb)
P	3,065 kg (6,757 lb)
Max wing loading: W, P	157.1 kg/m² (32.2 lb/sq ft)
Max power loading: W	5.69 kg/kW (9.35 lb/shp)
P	5.21 kg/kW (8.56 lb/shp)

PERFORMANCE (estimated, at max T-O weight):

Max level speed at S/L:	
W	168 kts (311 km/h; 193 mph)
P	206 kts (382 km/h; 237 mph)
Max cruising speed at 4,000 m (13,125 ft):	
W	172 kts (319 km/h; 198 mph)
P	220 kts (408 km/h; 253 mph)
Max cruising speed at 6,000 m (19,685 ft):	
W	171 kts (316 km/h; 197 mph)
P	219 kts (405 km/h; 252 mph)
Stalling speed, engine idling:	
W, P (flaps down)	61 kts (113 km/h; 71 mph) EAS
P (flaps up)	80 kts (149 km/h; 93 mph) EAS
Max rate of climb at S/L: W	326 m (1,069 ft)/min
P	492 m (1,614 ft)/min
Service ceiling: W	8,200 m (26,900 ft)
P	9,700 m (31,825 ft)
T-O run: W	287 m (942 ft)
P	266 m (873 ft)
T-O to 15 m (50 ft): W	531 m (1,743 ft)
P	499 m (1,638 ft)
Landing from 15 m (50 ft): W	878 m (2,881 ft)
P	853 m (2,799 ft)
Landing run: W	416 m (1,365 ft)
P	409 m (1,342 ft)
Range with max payload, 45 min reserves:	
W	[illegible] n miles ([illegible] km; 174 miles)
P	121 n miles (225 km; 140 miles)
Range with max fuel, 45 min reserves at 1,500 m (4,920 ft), W at 4,000 m (13,125 ft)	890 n miles (1,648 km; 1,024 miles)
P at 6,000 m (19,685 ft)	1,230 n miles (2,278 km; 1,415 miles)

Full-size fuselage mockup of the Aero Ae 270 W Ibis utility transport

1995



Aero Ae 270 W, with additional side views of the retractable-gear Ae 270 P (top) and wheeled-float Ae 270 FW/FP (*Jane's/Mike Keep*)

1994

UPDATED

AEROTECHNIK

AEROTECHNIK

CR-686 04 Uherské Hradiště-Kunovice
Telephone: 42 (632) 49 122
Fax: 42 (632) 49 128

Produces L-13 Vivat motor glider, aircraft piston engines and hot-air balloons; also overhauls and re-engines Zlin 226 and 326, L-40 Meta Sokol and L-60 Brigadýr. Markets kits of Pottier P 220S Koala (1992-93 *Jane's*) with Walter Mikron engine, and may produce complete aircraft.

UPDATED

AEROTECHNIK L-13SDM and L-13SDL VIVAT

TYPE: Two-seat motor glider.

PROGRAMME: Original version, L-13SW, first flew September 1989; 83 produced.

CURRENT VERSIONS: **L-13SDM**: With Mikron III AE engine.

L-13SDL: With Limbach flat-four engine.

CUSTOMERS: Over 150 Vivats flying in Belgium, Canada, Czech Republic, Finland, Germany, Slovakia, South Africa, Sweden, Switzerland, UK and USA.

COSTS: L-13SDM, DM123,200; L-13SDL, DM126,800 (early 1995).

DESIGN FEATURES: Mid-wing monoplane with oval-section fuselage; low-set horizontal tail surfaces fold upward for transportation; wingtip fairings. Developed from well-known Blanik sailplane. Optimised for training role; cleared for stalling and unlimited spinning.

NACA wing sections, 63_2A615 (root), 63_2A612 (tip); dihedral 3°; incidence 4° at root, 1° at tip; sweepforward 5° at quarter-chord.

FLYING CONTROLS: Mechanical for ailerons, elevators and rudder. Slotted area-increasing flaps; DFS type airbrakes in upper and lower wing surfaces. Fixed incidence tailplane. Trim tab in each elevator.

STRUCTURE: All-metal single-spar wings with light alloy riveted skin; light alloy airbrakes, fin and tailplane; fabric covered light alloy ailerons, flaps, elevators and rudder. Forward fuselage of welded metal tube with glassfibre skin; rear fuselage is riveted light alloy semi-monocoque. Welded light alloy fuel tank.

LANDING GEAR: Mechanically semi-retractable rubber sprung monowheel with size 350 × 135-125 mm tyre (pressure 3.2 bars; 46.4 lb/sq in), non-retractable rubber sprung controllable tailwheel with size 2.00 × 50-90 tyre (pressure 1.2 bars; 17.4 lb/sq in). Retractable outrigger wheels in wing-tip fairings. Moravan mechanical brake on monowheel.

POWER PLANT: One 48.5 kW (65 hp) Aerotechnik Mikron III AE in-line (L-13SDM) or 50.0 kW (67 hp) Limbach L 2000 EO1 flat four engine (L-13SDL), driving a Hoffman HO-V26R/L 160BT (in SDM) or Mühlbauer MTV-1-A/L160 (in SDL) two-blade fixed-pitch wooden propeller. Fuel tank in centre of fuselage, maximum capacity 50 litres (13.2 US gallons; 11 Imp gallons).

ACCOMMODATION: Two seats side by side. One-piece Plexiglas bubble canopy, opened by raising upward and rearward on struts.

AVIONICS: Customer specified.

DIMENSIONS, EXTERNAL:

Wing span 16.80 m (55 ft 1½ in)

Wing aspect ratio	14.31
Length overall	8.30 m (27 ft 2¾ in)
Height overall	2.30 m (7 ft 6½ in)
AREAS:	
Wings, gross	20.20 m² (217.4 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	510 kg (1,124 lb)
Max T-O weight	720 kg (1,587 lb)
Max wing loading	35.6 kg/m² (7.3 lb/sq ft)
Max power loading: SDM	14.85 kg/kW (24.40 lb/hp)
SDL	14.40 kg/kW (23.66 lb/hp)
PERFORMANCE, POWERED (at max T-O weight):	
Never-exceed speed (V_{NE})	110 kts (205 km/h; 127 mph)
Max level speed	94 kts (175 km/h; 109 mph)
Max cruising speed	86 kts (160 km/h; 99 mph)
Stalling speed, power off	32 kts (60 km/h; 37 mph)
Rate of climb at S/L	150 m (492 ft)/min
T-O run	220 m (722 ft)
T-O to 15 m (50 ft)	420 m (1,378 ft)
Range: SDM	270 n miles (500 km; 310 miles)
SDL	307 n miles (570 km; 354 miles)
Endurance: SDM	3 h 0 min
SDL	3 h 20 min
PERFORMANCE, UNPOWERED:	
Best glide ratio at 54 kts (100 km/h; 62 mph)	23
Min rate of sink at 49 kts (90 km/h; 56 mph)	1.17 m (3.83 ft)/s
OPERATIONAL NOISE LEVELS (to ICAO Annex 16):	
T-O: SDM	64.6 dB(A)
SDL	71.1 dB(A)
Overflight at 300 m (985 ft): SDM	54.2 dB(A)
SDL	62.8 dB(A)

Aerotechnik L 13SDL Vivat two-seat motor glider *1995*

UPDATED

INTECO

INTECO SRO

Velkomoravská 1465, Staré Město, CR 686 02 Uherské Hradiště

DESIGNER: Ing Jiří Vaňý

NEW ENTRY

INTECO VM-23 VARIANT

TYPE: Four-seat light aircraft.

PROGRAMME: Prototype (OK-ZYV) made first appearance mid-1994.

DESIGN FEATURES: Conventional high-wing cabin monoplane with V bracing struts.

LANDING GEAR: Non-retractable mainwheels carried on faired-in side Vs and half-axles; fixed tailwheel.

POWER PLANT: One 103 kW (138 hp) LOM Prague M 332 flat-four engine, two-blade wooden propeller.

ACCOMMODATION: Four seats in tandem pairs. Upward-hinged window/door on each side.

No other details known at time of going to press.

NEW ENTRY

LET

LET AS, KUNOVICE

Uherské Hradiště, CR-686 04 Kunovice

Telephone: 42 (632) 41 11 11

Fax: 42 (632) 6 ... 52

DIRECTOR AND GENERAL MANAGER: Zdeněk Pernica

MANAGING DIRECTOR: Josef Skrášek

TECHNICAL DIRECTOR: Jan Fridrich

CHIEF DESIGNER: Miroslav Pešák

Established at Kunovice in 1950 producing Yak-11 trainer as C-11, subsequently involved in programmes for L-200, Z-37 and L-29 Delfin. Current main aircraft programmes are L-410/420 and L-610; also produces L-23 Super Blaník and L-33 Solo sailplanes, plus equipment for radar and computer technology. Workforce approximately 2,000 in early 1995.

Let Kunovice is a joint stock company fully owned by Aero Holding (which see). Negotiations with Fairchild Aircraft of the USA regarding formation of a new Let-Fairchild company (see 1994-95 *Jane's*) have ended. Instead, the process of asset and debt restructuring, within the Czech Republic's overall economic reform, was due to be completed in 1995 and is intended to revitalise the company with support from Czech banks.

Let has focused on upgrading the L-410/420, completing the L-610 programme, and attracting subcontract work.

UPDATED

LET L-410UVP-E and L-420

TYPE: Twin-turboprop general purpose light transport.

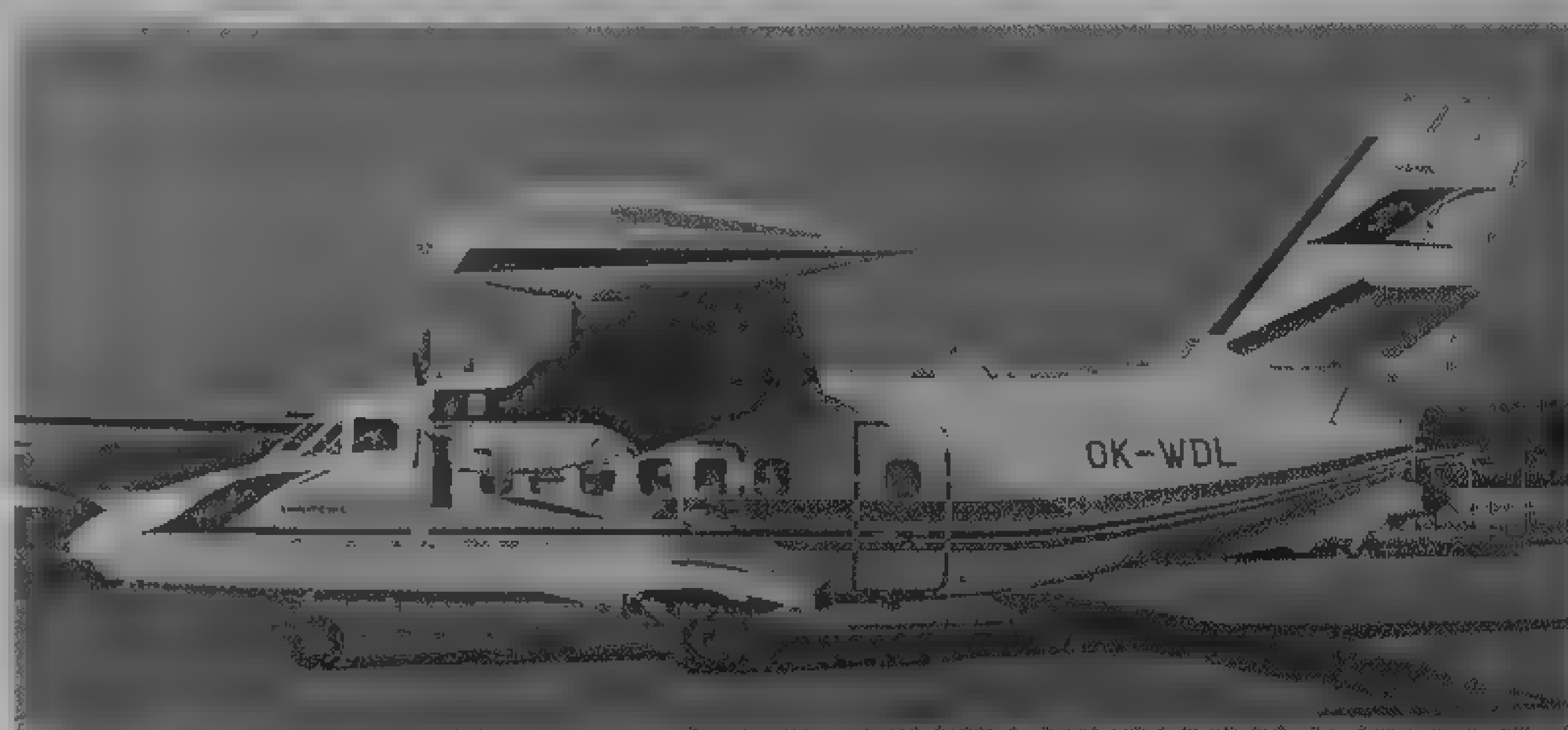
PROGRAMME: First flight 16 April 1969; in continuous production since 1970; details of prototypes and early versions in 1980-81 and earlier *Jane's*; total three prototypes (including one static test) and 146 production L-410s (one static test). L-410UVP first flight 1 November 1977; in 1980 became first non-Soviet aircraft to gain Soviet NLGS-2 certification. UVP production (512 built) ended late 1985. Present UVP-E version first flew (OK-120) 30 December 1984, received NLGS-2 certification March 1986. 1,000th aircraft of L-410 family delivered 28 November 1990. First flight of L-420 (OK-150/OK-XYA) 10 November 1993. Total 959 UVP versions (including three static test) built by early 1995, including at least 40 unsold or cancelled by former USSR. L-410/410UVP production now 1,108.

CURRENT VERSIONS: **L-410UVP-E**: Standard current production model, *description applies to this version, except where indicated*.

L-420: Improved version with M 601 F engines, detail changes and Western avionics. One prototype completed 1993. FAA certification to FAR Pt 23 Amendment 41 expected in 1995.

CUSTOMERS: L-410 production (all versions) totalled 1,031 by October 1994, of which 879 in service with Aeroflot by early 1992; UVP-E production had reached 368 by 1 December 1993, comprising 322 to former Soviet Union, 66 to Czechoslovakia and 87 to Bolivia, Brazil, Bulgaria, Denmark, Djibouti, Estonia, Germany, Hungary, India, Kazakhstan, Libya, Poland, South Africa, Sweden, Tunisia and Ukraine, customers identified by suffix numbers (such as -E10 and -E20).

Seven firm orders for L-420 up to early 1995.



Let L-410UVP-E20C twin-turboprop general purpose light transport *1995*

DESIGN FEATURES: Changes from UVP include baggage compartment and toilet moved aft to accommodate four more passengers in same fuselage length, wings reinforced to carry wingtip tanks increasing maximum range by 40 per cent, maximum flap deflection increased, spoiler setting 72° on ground, new vacuum sintered oil cooler, oil/fuel heat exchanger on each engine firewall to avoid use of additives, engine fire bottles moved to port rear wing/fuselage fairing; separate engine and propeller indicators for each engine, portable oxygen in cabin and improved PA system, fire extinguishing system in nose baggage compartment; operating ambient temperature range −50 to +50°C, design life 20,000 hours or 20,000 cycles.

Wing section NACA 63A418 at root, 63A412 at tip; dihedral 1° 45′, incidence 2° at root, −0° 30′ at tip; twist −2° 48′, sweepback 0° at quarter-chord; tailplane dihedral 7°.

FLYING CONTROLS: Mechanical for ailerons (pushrods), elevators (pushrods) and rudder (rods and cables); trim tab in port aileron and geared tab in rudder actuated electromechanically, elevator trim tab by cables; pop-up bank control surfaces ahead of ailerons rise automatically after engine failure to reduce lift on side of running engine. Hydraulic actuation of two-segment double-slotted flaps and ground spoilers/lift dumpers ahead of flaps. Fixed tailplane; dorsal and ventral fins. Bendix/King KFC 325 autopilot optional in L-420.

STRUCTURE: All-metal, two-spar torsion box wing with chemically milled skins, four wing attachment points, one-piece tailplane; fabric covered elevators and rudder.

LANDING GEAR: Retractable tricycle type, with single wheel on each unit. Hydraulic retraction, nosewheel forward, mainwheels inward to lie flat in fairing on each side of fuselage. Technometra Radotín (L-410) or Teset Semily (L-420) oleo-pneumatic shock-absorbers. Non-braking nosewheel, with servo-assisted 50° steering, fitted with 548 × 221 mm (9.00-6) tubeless tyre (550 × 225 mm on L-420), pressure 4.5 bars (65 lb/sq in). Nosewheel is also steerable by rudder pedals. Mainwheels fitted with 718 × 306 mm (12.50-10) tubeless tyres (720 × 310 mm on L-420), pressure 4.5 bars (65 lb/sq in). All wheels manufactured by Moravan Otrokovice, tyres by Barumtech Zlín. Moravan Otrokovice K38-3200.00 hydraulic three-disc brakes, parking brake and inertial anti-skid units on mainwheels. Minimum ground turning radius 13.40 m (43 ft 11½ in). Metal ski landing gear, with plastics undersurface, optional.

POWER PLANT: Two 559 kW (750 shp) Walter M 601 E turboprops in L-410 (580 kW, 778 shp M 601 F in L-420), each driving an Avia V 510 five-blade constant-speed reversible-pitch metal propeller with manual and automatic feathering and Beta control. At higher ambient temperatures, engine power can be increased to 603 kW (809 ehp) for short periods by water injection into compressor. Eight bag fuel tanks in wings, total capacity 1,290 litres (341 US gallons; 284 Imp gallons), plus additional optional 200 litres (52.8 US gallons; 44 Imp gallons) of fuel in each wingtip tank. Pressure and gravity refuelling. Fuel system operable after failure of electrical system. Total oil capacity (including oil in cooler) 22 litres (5.8 US gallons; 4.8 Imp gallons). Water tank capacity (for injection into compressor) 11 litres (2.9 US gallons; 2.4 Imp gallons).

ACCOMMODATION: Crew of one or two on flight deck, with dual controls. Standard accommodation in main cabin for 19 passengers, with pairs of adjustable seats on starboard side of aisle and single seats opposite, all at 76 cm (30 in) pitch. Baggage compartment (at rear, accessible externally and from cabin), toilet and wardrobe standard. Cabin heated by engine bleed air. Alternative layouts include

all-cargo; ambulance, accommodating six stretchers, five sitting patients and a medical attendant, accommodation for 18 parachutists and a dispatcher/instructor, firefighting configuration, carrying 16 firefighters and a pilot/observer. All-cargo version has protective floor covering, crash nets on each side of cabin, and tiedown provisions, floor is at truckbed height. Aircraft can also be equipped for aerial photography or for calibration of ground navigation aids. Double upward-opening doors aft on port side, with stowable steps; right-hand door serves as passenger entrance and exit. Both doors open for cargo loading, and can be removed for paratroop training missions. Rearward-opening door, forward on starboard side, serves as emergency exit. Additional emergency exit under wing on each side in L-420.

SYSTEMS: No APU or pressurisation systems. Casey Copter P92 6000 or Hamilton Standard R 70-3W engine bleed air air conditioning system in L-420. Duplicated hydraulic systems, main system (pressure 144 bars, 2,088 lb/sq in) actuating landing gear, flaps, spoilers, automatic pitch trim surfaces, mainwheel brakes, nosewheel steering and windscreen wipers. Emergency system for landing gear extension, flap actuation, mainwheel brakes and parking brake.

Electrical system (28 V DC) supplied by two 5.6 kW starter/generators, connected for autonomous starting, plus two 24 V 25 Ah batteries for emergency power. Two LUN 2450 inverters for three-phase AC power (200 V/115 Hz) and two PC 250 inverters for 115/26 V AC at 400 Hz. Two 3.7 kVA alternators supply power for windscreen heating and propeller de-icing. Port alternator provides for windscreen heating, starboard one for propeller blade de-icing. Two static inverters provide three-phase 36 V/400 Hz AC. Two 115 V/400 Hz inverters. One three-phase 36 V/400 Hz static inverter for standby horizon. De-icing for windscreen and propeller blades (electrical) and lower intakes (bleed air), anti-icing flaps inside each nacelle. Gumotex-Břeclav pneumatic de-icing of wing and tail leading-edges.

Two portable oxygen breathing sets on flight deck and two in passenger cabin. Fire extinguishing system for engines and nose baggage compartment.

AVIONICS (L-410): Standard instrumentation provides for flight in IMC conditions, with all basic instruments duplicated and three artificial horizons.

Comms: Two VHF transceivers with a range of 65 n miles (120 km; 75 miles) at 1,000 m (3,280 ft) altitude, passenger address system and crew intercom.

Radar: Weather radar optional.

Flight: ILS/SP-50A instrument landing system with marker beacon receiver, dual ARK-15 ADF, A-037 radio altimeter, SO-69 SSR transponder with encoding altimeter, ASI with stall warning, magnetic compass, RMIs, gyrocompasses, LUN 1205 horizon gyros, GMK 1GE and BUR-1-2G flight data recorder standard, VZLU autopilot optional.

Instrumentation: Includes rate of climb indicators and LUN 1215 turn and bank indicator.

AVIONICS (L-420): *Comms:* Bendix/King KTR 908 with KFS 598 VHF (two), KHF 950 with KCU 951 HF and KMA 24H 70 intercom (two), KXP 756 transponders (two); Pointer 3000 ELT; Fairchild A 100A cockpit voice recorder.

Radar: Bendix/King RDS 81 weather radar with GC 381A graphic unit.

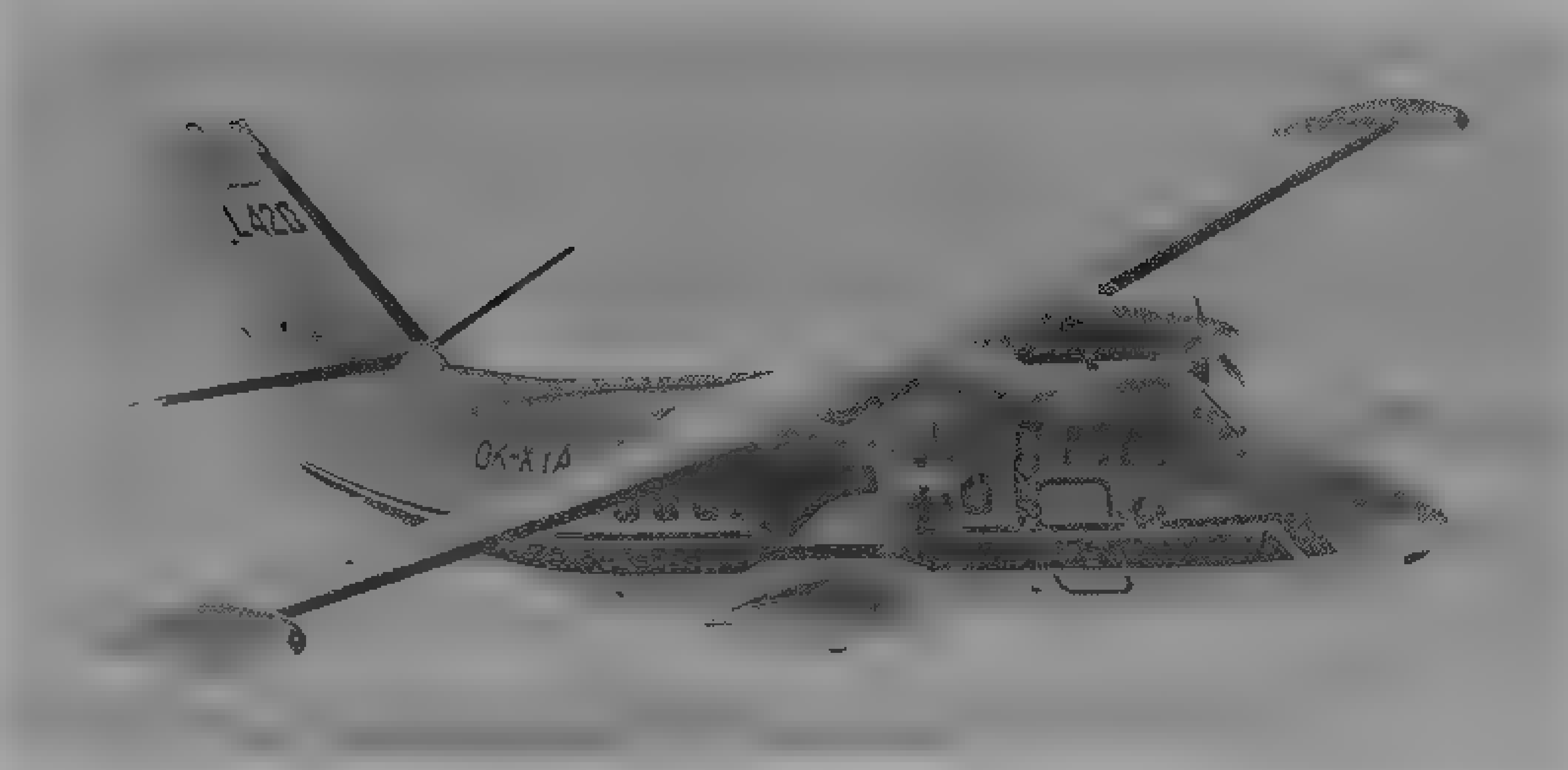
Flight: Bendix/King KNR 634A VOR/ILS/marker beacon receiver, KNS 81 RNav/VOR ILS, KMR 675 marker beacon receiver, KDF 806 ADF (two), KDM 706A DME (two) and KRA 405 radar altimeter.

Instrumentation: Bendix/King KPI 553A HSI (two), KNI 582 RMI (two), KI 204 (one) and KI 207 (one) CDIs, KDI 573 DME indicators (two), KDI 415 radar altimeter indicators (two). Loral F1000 SSF flight director recorder.

EQUIPMENT: Cockpit, instrument and passenger cabin lights, navigation lights, three landing lights in nose (each with two levels of light intensity), crew and cabin fire extinguishers, windscreen wipers and electrically heated windscreen standard.

DIMENSIONS, EXTERNAL:

Wing span: over tip tanks	19.98 m (65 ft 6½ in)
excl tip tanks	19.48 m (63 ft 11 in)
Wing chord: at root	2.534 m (8 ft 3¾ in)
at tip	1.12 m (3 ft 8 in)
Wing aspect ratio	10.88
Length overall	14.424 m (47 ft 4 in)
Fuselage: Length	13.203 m (43 ft 3¾ in)
Max width	2.08 m (6 ft 10 in)
Max depth	2.10 m (6 ft 10¾ in)
Height overall	5.829 m (19 ft 1½ in)
Tailplane span	6.785 m (22 ft 3¼ in)
Wheel track	3.65 m (11 ft 11½ in)
Wheelbase	3.666 m (12 ft 0¼ in)
Propeller diameter	2.30 m (7 ft 6½ in)
Propeller ground clearance	1.25 m (4 ft 1¼ in)
Distance between propeller centres	4.816 m (15 ft 9½ in)
Passenger/cargo door (port, rear):	
Height	1.46 m (4 ft 9½ in)
Width overall	1.25 m (4 ft 1½ in)
Width (passenger door only)	0.80 m (2 ft 7½ in)
Height to sill	0.792 m (2 ft 7¼ in)
Baggage compartment door (L-420, stbd, rear):	
Height	1.12 m (3 ft 8 in)
Width	0.56 m (1 ft 10 in)
Height to sill	0.962 m (3 ft 1¾ in)
Emergency exit (stbd, fwd):	
Height	0.97 m (3 ft 2¼ in)
Width	0.665 m (2 ft 2¼ in)
Height to sill	0.872 m (2 ft 10¼ in)
Emergency exits (L-420, beneath wing, each):	
Height	0.73 m (2 ft 4¾ in)
Width	0.51 m (1 ft 8 in)
Height to sill	1.38 m (4 ft 6¼ in)



Prototype of the Let L-420, due to be certified in 1995

1995

Let L-410UVP-E twin-turboprop 19-passenger light transport (*Jane's/Dennis Punnett*)

1986

DIMENSIONS, INTERNAL:

Cabin, excl flight deck:	
Length: L-410	6.345 m (20 ft 9¾ in)
L-420	5.655 m (18 ft 6 in)
Max width	1.95 m (6 ft 4 in)
Max height	1.66 m (5 ft 5 in)
Aisle width at 0.4 m (1 ft 3¾ in) above cabin floor	0.34 m (1 ft 1½ in)
Floor area: L-410	10.0 m² (107.6 sq ft)
L-420	8.652 m² (93.1 sq ft)
Volume: L-410	17.9 m³ (632.1 cu ft)
Baggage compartment volume:	
nose: L-410	0.60 m³ (21.2 cu ft)
L-420	0.76 m³ (26.8 cu ft)
rear: L-410	0.77 m³ (27.2 cu ft)
L-420	1.35 m³ (47.7 cu ft)

AREAS:

Wings, gross	34.86 m² (375.2 sq ft)
Ailerons (total): L-410	2.89 m² (31.11 sq ft)
L-420	2.881 m² (31.01 sq ft)
Automatic bank control flaps (total)	0.49 m² (5.27 sq ft)
Trailing-edge flaps (total): L-410	5.92 m² (63.72 sq ft)
L-420	5.894 m² (63.44 sq ft)
Spoilers (total): L-410	0.87 m² (9.36 sq ft)
L-420	0.887 m² (9.55 sq ft)
Fin: L-410	4.49 m² (48.33 sq ft)
L-420	4.596 m² (49.47 sq ft)
Rudder, incl tab: L-410	2.81 m² (30.25 sq ft)
L-420	2.702 m² (29.08 sq ft)
Tailplane: L-410	6.41 m² (69.00 sq ft)
L-420	6.534 m² (70.33 sq ft)
Elevators, incl tabs: L-410	3.15 m² (33.91 sq ft)
L-420	3.026 m² (32.57 sq ft)

WEIGHTS AND LOADINGS (L-410):

Weight empty	3,985 kg (8,785 lb)
Operating weight empty, equipped	4,160 kg (9,171 lb)
Max usable fuel	1,300 kg (2,866 lb)
Max payload	1,615 kg (3,560 lb)
Max ramp weight	6,420 kg (14,154 lb)
Max T-O weight	6,400 kg (14,110 lb)
Max zero-fuel weight	5,775 kg (12,732 lb)
Max landing weight	6,200 kg (13,668 lb)
Max wing loading	183.6 kg/m² (37.6 lb/sq ft)
Max power loading	5.72 kg/kW (9.41 lb/shp)

WEIGHTS AND LOADINGS (L-420):

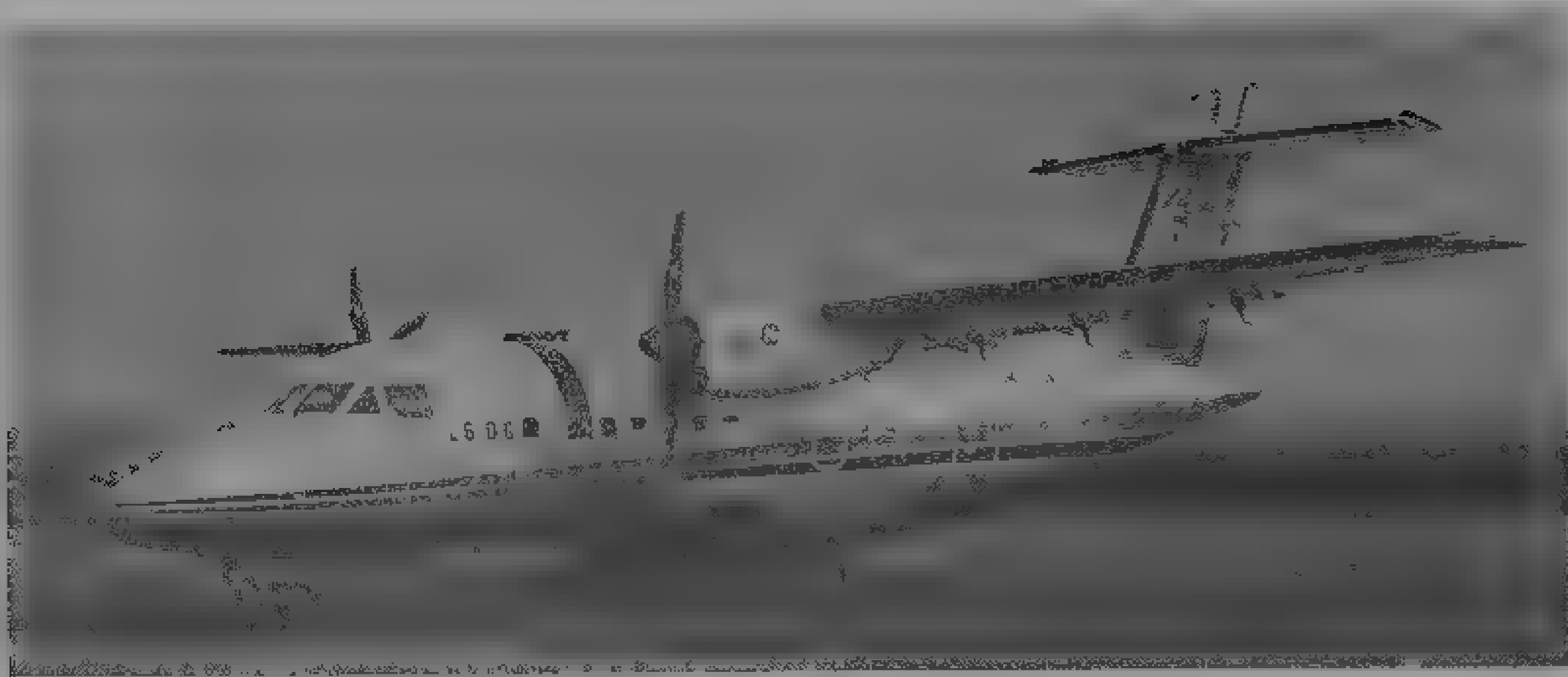
Basic weight empty	4,065 kg (8,962 lb)
Operating weight empty	4,225 kg (9,314 lb)
Max usable fuel	as L-410
Max payload	1,710 kg (3,770 lb)
Max ramp weight	6,620 kg (14,595 lb)
Max T-O weight	6,600 kg (14,550 lb)
Max zero-fuel weight	5,900 kg (13,007 lb)
Max landing weight	6,400 kg (14,110 lb)
Max wing loading	189.3 kg/m² (38.8 lb/sq ft)
Max power loading	5.69 kg/kW (9.35 lb/shp)

PERFORMANCE (L-410 at max T-O weight):

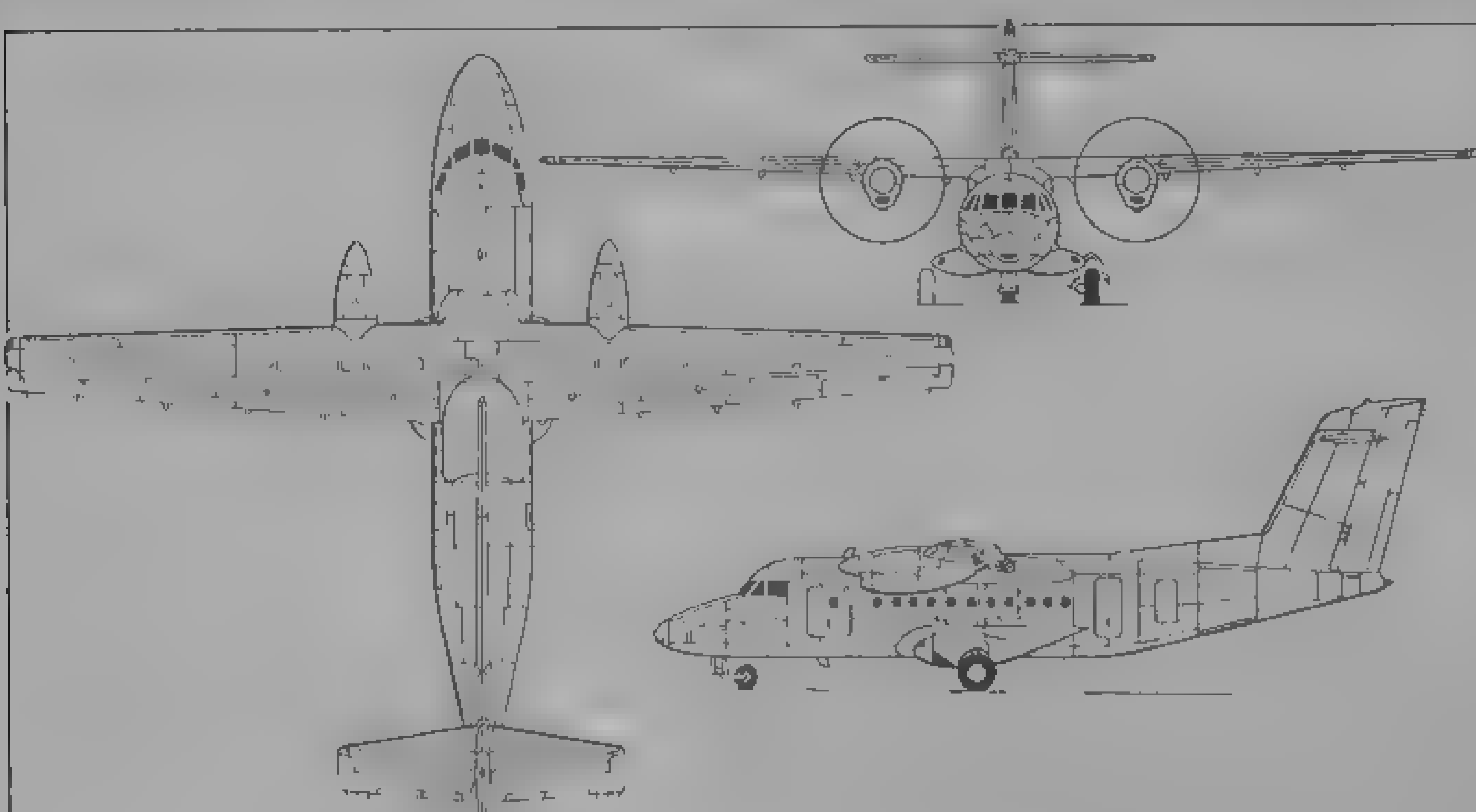
Never-exceed speed (V_{NE})	192 kts (357 km/h; 222 mph) EAS
Max level speed at 4,200 m (13,780 ft)	168 kts (311 km/h; 193 mph) EAS
Max cruising speed at 4,200 m (13,780 ft)	205 kts (380 km/h; 236 mph)
Econ cruising speed at 4,200 m (13,780 ft)	197 kts (365 km/h; 227 mph)
Stalling speed:	
flaps up	84 kts (155 km/h; 97 mph) EAS
flaps down	66 kts (121 km/h; 76 mph) EAS
Max rate of climb at S/L	444 m (1,455 ft)/min
Rate of climb at S/L, OEI	108 m (354 ft)/min
Service ceiling: practical	6,320 m (20,725 ft)
theoretical	7,050 m (23,125 ft)
Service ceiling, OEI: practical	2,700 m (8,860 ft)
theoretical	3,980 m (13,050 ft)
T-O run	445 m (1,460 ft)
T-O to 10.7 m (35 ft)	685 m (2,250 ft)
Landing from 9 m (30 ft)	480 m (1,575 ft)
Landing run	240 m (787 ft)
Range at 4,200 m (13,780 ft), max cruising speed, 30 min reserves:	
with max payload	294 n miles (546 km; 339 miles)
with max fuel and 885 kg (1,951 lb) payload	744 n miles (1,380 km; 857 miles)

PERFORMANCE (L-420 at max T-O weight, ISA, except where indicated):

Max level speed, S/L to 4,270 m (14,000 ft)	206 kts (382 km/h; 237 mph) CAS
Max cruising speed at 3,050 m (10,000 ft)	209 kts (388 km/h; 241 mph)



Let L-610G (two General Electric CT7-9D turboprops) *1995*



Let L-610G twin-turboprop 40-seat regional transport ***(Jane's/Mike Keep)*** *1992*

Econ cruising speed at 3,050 m (10,000 ft)
197 kts (365 km/h, 227 mph)
Stalling speed
flaps up 85 kts (158 km/h, 99 mph) CAS
flaps down 67 kts (123 km/h; 77 mph) CAS
Max rate of climb at S/L 381 m (1,250 ft)/min
Rate of climb at S/L, OEI 105 m (344 ft)/min
Service ceiling (30.5 m, 100 ft/min climb)
4,270 m (14,000 ft)
Service ceiling, OEI (15 m, 50 ft/min climb, at 95% of MTOW) 3,550 m (11,650 ft)
T-O run 390 m (1,280 ft)
T-O to 15 m (50 ft) 1,070 m (3,511 ft)
Accelerate/stop distance 1,050 m (3,445 ft)
Landing from 15 m (50 ft) at max landing weight
840 m (2,756 ft)
Landing run 305 m (1,000 ft)
Range at 4,270 m (14,000 ft) at max cruising speed, 45 min reserves
with max payload 301 n miles (558 km, 346 miles)
with max fuel (excl tiptanks) and 1,410 kg (3,108 lb) payload 507 n miles (940 km, 584 miles)
with max fuel (incl tiptanks) and 1,015 kg (2,237 lb) payload 737 n miles (1,365 km, 848 miles)

UPDATED

LET L-610

TYPE: Twin-turboprop regional transport.

PROGRAMME: First flight (OK 130) 28 December 1988; seven development aircraft include one (No 4) for static test; contract 18 January 1991 for General Electric to provide CT7-9D turboprops for L-610G (first two engines delivered shortly afterward); first flight of this version (No 7/OK 136) 18 December 1992. Certification to FAR Pt 25 expected in 1996; meanwhile, protocol signed late 1994 with Russian Smolensk factory under which L-610 could also be built there and its M 602 engines at Salyut plant in Moscow; since aircraft was designed originally to meet Soviet/Russian airworthiness requirements, this could lead to certification of L-610M version before end of 1995. Consideration also being given to PT6 turboprops as alternative power plant.

CURRENT VERSIONS: **L-610M:** With 1,358 kW (1,822 shp) Walter M 602 engines and five-blade propellers; weight and performance data not yet finalised. Three prototypes (OK 130/132/134).

L-610G: Version with General Electric CT7-9D turboprops, four-blade propellers and Collins digital avionics including EFIS, weather radar and autopilot. First prototype undergoing certification testing; at least four more under construction, including one designated L-610GE. *Detailed description applies to L-610G except where indicated.*

CUSTOMERS: Options received for 16 L-610Gs by January 1994.

DESIGN FEATURES: Intended to meet FAR Pt 25 (L-610G) or Russian ENLG S (L-610M) civil airworthiness requirements; wing sections MS(1)-0318D at root, MS(1)-0312 at tip; thickness/chord ratios 18.29 (root) and 12 per cent (tip); dihedral 2°; incidence 3° 8′ 38″ at root, 0° at tip; quarter-chord sweepback 1°.

FLYING CONTROLS: Ailerons, elevators and rudder actuated mechanically; rudder and both aileron trim tabs actuated by electromechanical strut. Elevator trim tabs actuated mechanically by screw-nut mechanism. Automatic spring tab in rudder. Ailerons are horn-balanced. Electrohydraulically actuated single-slotted Fowler flaps. Ground spoilers. Lateral control spoilers deflected proportionately to aileron deflection. Electrically actuated gust lock.

STRUCTURE: All metal, fail-safe stressed skin structure; circular-section fuselage between flight deck and tail; wing contains high grade aluminium and high strength steel, honeycomb spoiler panels.

LANDING GEAR: Retractable tricycle type, with single wheel on each unit. Hydraulic actuation, mainwheels retracting inward to lie flat in fairing each side of fuselage, nosewheel retracting forward. Oleo-pneumatic shock-absorber in each unit. Mainwheels are type XK 34-3000.00, with 1,050 × 390 × 480 mm tyres, type XR 25-1000.00 nosewheel has a 720 × 310 × 254 mm tyre. Hydraulic disc brakes and electronically controlled anti-skid units. Minimum ground turning radius 18.33 m (60 ft 1¾ in).

POWER PLANT: Two 1,305 kW (1,750 shp) General Electric CT7-9D turboprops in L-610G, each driving a Hamilton Standard HS 14RF-23 four-blade fully feathering metal propeller with reversible pitch. Fuel in two integral wing tanks, combined usable capacity 3,500 litres (925 US gallons, 770 Imp gallons). Pressure refuelling point in fuselage, gravity points in wings. Oil capacity 30 litres (7.9 US gallons, 6.6 Imp gallons).

ACCOMMODATION: Crew of two on flight deck, plus one cabin attendant. Standard accommodation for 40 passengers, four-abreast at seat pitch of 76 cm (30 in). Galley, two wardrobes, toilet, freight and baggage compartment, all located at rear of cabin. Alternative mixed (passenger/cargo) and all-cargo layouts available. Passenger door at rear of fuselage, freight door at front, both opening outward on port side. Outward-opening service door on starboard side, opposite passenger door, serving also as emergency exit; outward-opening emergency exit beneath wing on each side. Entire accommodation pressurised and air conditioned.

SYSTEMS: Dual Hamilton Standard R 79-3W engine bleed air air conditioning systems in L-610G. Nord Micro digital, fully automatic pressurisation system gives 0.36 bar (5.22 lb/sq in) differential at flight level of 7,200 m (23,625 ft) and a cabin altitude of 2,400 m (7,875 ft). Duplicated hydraulic systems (one main and one standby), operating at pressure of 210 bars (3,045 lb/sq in). APU in tailcone, for engine starting and auxiliary on-ground and in-flight power.

Electrical system powered by two 115/200 V 25 kVA variable frequency AC generators, plus a third 8 kVA 115/200 V three-phase AC generator driven by APU. System also includes two 115 V 400 Hz inverters (each 1.5 kVA), two 27 V DC transformer-rectifiers (each 4.5 kW), and a 25 Ah Ni/Cd battery for APU starting and auxiliary power supply. Gumotex Břeclav or Goodrich pneumatic de-icing boots on wing and tail unit leading-edges; ACT electrical anti-icing system for engine inlets, electric de-icing of propeller blade roots, windscreen, pitot static system and horn balances. Oxygen system for crew and four passengers.

AVIONICS: Collins Pro Line II and EFIS-86 standard for L-610G.

Comms: Dual 760-channel VHF; single HF (optional); ATC transponder; intercom/PA system; cockpit voice recorder.

Radar: Collins WXR-350 weather radar.

Flight: Collins APS-65 autopilot; Collins AHS-85 AHRS, dual ILS with two LOC/glide slope receivers and two marker beacon receivers, single or dual ADF; dual compasses; single or dual radio altimeters; navigation computer; flight data recorder; Cat II approach aids.

Instrumentation: Collins five-tube EFIS-86 with EADI and HSI for each crew member and central MFD; weather radar data can be displayed on HSI and/or MFD.

DIMENSIONS, EXTERNAL:

Wing span	25.60 m (84 ft 0 in)
Wing chord: at root	2.917 m (9 ft 6¾ in)
at tip	1.458 m (4 ft 9½ in)
Wing aspect ratio	11.70
Length overall	21.72 m (71 ft 3 in)
Fuselage: Length	20.533 m (67 ft 4⅜ in)
Max diameter	2.70 m (8 ft 10¼ in)
Height overall	8.19 m (26 ft 10¼ in)
Tailplane span	7.908 m (25 ft 11¼ in)
Wheel track	4.59 m (15 ft 0¾ in)
Wheelbase	6.596 m (21 ft 7¾ in)
Propeller diameter	3.50 m (11 ft 5¾ in)
Propeller fuselage clearance	0.59 m (1 ft 11¼ in)
Propeller ground clearance	1.64 m (5 ft 4½ in)
Distance between propeller centres	7.00 m (22 ft 11½ in)
Passenger door: Height	1.625 m (5 ft 4 in)
Width	0.76 m (2 ft 6 in)
Height to sill	1.448 m (4 ft 9 in)

The X-05 prototype of the Walter M 602 engined L-610M *1994*

Freight door: Height	1.30 m (4 ft 3¼ in)
Width	1.25 m (4 ft 1¼ in)
Height to sill	1.448 m (4 ft 9 in)
Service door: Height	1.286 m (4 ft 2⅔ in)
Width	0.61 m (2 ft 0 in)
Emergency exits (underwing, each):	
Height	0.915 m (3 ft 0 in)
Width	0.515 m (1 ft 8¼ in)
DIMENSIONS, INTERNAL:	
Cabin (excl flight deck): Length	11.10 m (36 ft 5 in)
Max width	2.54 m (8 ft 4 in)
Width at floor	2.02 m (6 ft 7½ in)
Aisle width	0.51 m (1 ft 8 in)
Max height	1.835 m (6 ft 0¼ in)
Floor area	22.4 m² (241.1 sq ft)
Volume	44.7 m³ (1,578.6 cu ft)
Wardrobe volume (total)	1.0 m³ (35.3 cu ft)
Baggage/freight hold volume (total)	7.5 m³ (264.9 cu ft)
AREAS:	
Wings, gross	56.0 m² (602.8 sq ft)
Ailerons (total)	3.27 m² (35.20 sq ft)
Trailing-edge flaps (total)	11.29 m² (121.52 sq ft)
Spoilers (total)	3.54 m² (38.10 sq ft)
Fin	8.30 m² (89.34 sq ft)
Rudder, incl tabs	5.54 m² (59.63 sq ft)
Tailplane	7.68 m² (82.67 sq ft)
Elevators (total, incl tabs)	5.82 m² (62.65 sq ft)
WEIGHTS AND LOADINGS (L-610G):	
Weight empty, equipped	8,730 kg (19,246 lb)
Operating weight empty	9,220 kg (20,326 lb)
Max fuel	2,700 kg (5,952 lb)
Max payload	4,200 kg (9,259 lb)
Max ramp weight	14,540 kg (32,055 lb)
Max T-O weight	14,500 kg (31,967 lb)
Max zero-fuel weight	13,420 kg (29,586 lb)
Max landing weight	14,200 kg (31,305 lb)
Max wing loading	258.9 kg/m² (53.03 lb/sq ft)
Max power loading	5.555 kg/kW (9.13 lb/shp)
PERFORMANCE (L-610G at max T-O weight):	
Never-exceed speed (V_{NE})	216 kts (400 km/h; 248 mph) EAS
Max level and max cruising speed at 7,200 m (23,620 ft)	236 kts (437 km/h; 272 mph)
Long-range cruising speed at 7,200 m (23,620 ft)	152 kts (282 km/h; 175 mph)
Approach speed	92 kts (170 km/h; 106 mph) IAS
Stalling speed:	
flaps up	95 kts (176 km/h; 110 mph) EAS
flaps down	71 kts (132 km/h; 82 mph) EAS
Max rate of climb at S/L	504 m (1,653 ft)/min
Rate of climb at S/L, OEI	140 m (459 ft)/min
Service ceiling: theoretical	8,400 m (27,560 ft)
practical	8,000 m (26,250 ft)
Service ceiling, OEI (30.5 m; 100 ft/min rate of climb):	
theoretical	5,050 m (16,570 ft)
practical	4,650 m (15,255 ft)
T-O run	528 m (1,733 ft)
T-O to 10.7 m (35 ft)	662 m (2,172 ft)
Balanced T-O field length:	
hard runway	1,090 m (3,577 ft)
unpaved surface	1,310 m (4,298 ft)
Landing from 15 m (50 ft)	645 m (2,117 ft)
Landing run without propeller reversal	405 m (1,329 ft)
Range, reserves for 45 min hold and 100 n miles (185 km; 115 mile) diversion:	
with max payload	302 n miles (560 km; 348 miles)
with 40 passengers	664 n miles (1,230 km; 764 miles)
with max fuel	1,280 n miles (2,370 km; 1,472 miles)

UPDATED

LOK

LETECKÉ OPRAVNY KBELY (Aircraft Repair Works Kbely)

Toužimská 583, CR-197 03 Prague 9-Kbely
Telephone: 42 (2) 8507685 and 8507805
Fax: 42 (2) 8501111 and 8507806
DESIGNER: L. Smrček

LOK has hitherto been known chiefly as centre for technical servicing, overhaul and repair of fixed-wing aircraft and helicopters, including restoration and reconstruction of historic aircraft; now plans to enter manufacturing area with 1993 design by Ladislav Smrček called Family Air. Teaming with Duncan Aviation of Lincoln, Nebraska, USA, announced mid-1994.

UPDATED

LOK FAMILY AIR

TYPE: Small four-seat business and sport aircraft.

PROGRAMME: Designed 1993; prototype (being built at Let Kunovice, which see) planned for completion 1995, start of series production at Kbely 1996.

DESIGN FEATURES: Four-seat low-wing cabin monoplane with T tailplane on sweptback fin and rudder. Design is to FAR Pt 23 standards; parameters include high cruising speed and low weight, fuel consumption and purchase cost.

STRUCTURE: All-metal.

LANDING GEAR: Retractable tricycle type (rearward-retracting nosewheel, inward-retracting main gear).

POWER PLANT: One 149 kW (200 hp) Textron Lycoming IO-360 flat-four engine, driving a Mühlbauer three-blade propeller.

ACCOMMODATION: Pilot and three passengers (seats in tandem pairs) in fully enclosed hardtop cabin with door on each side.

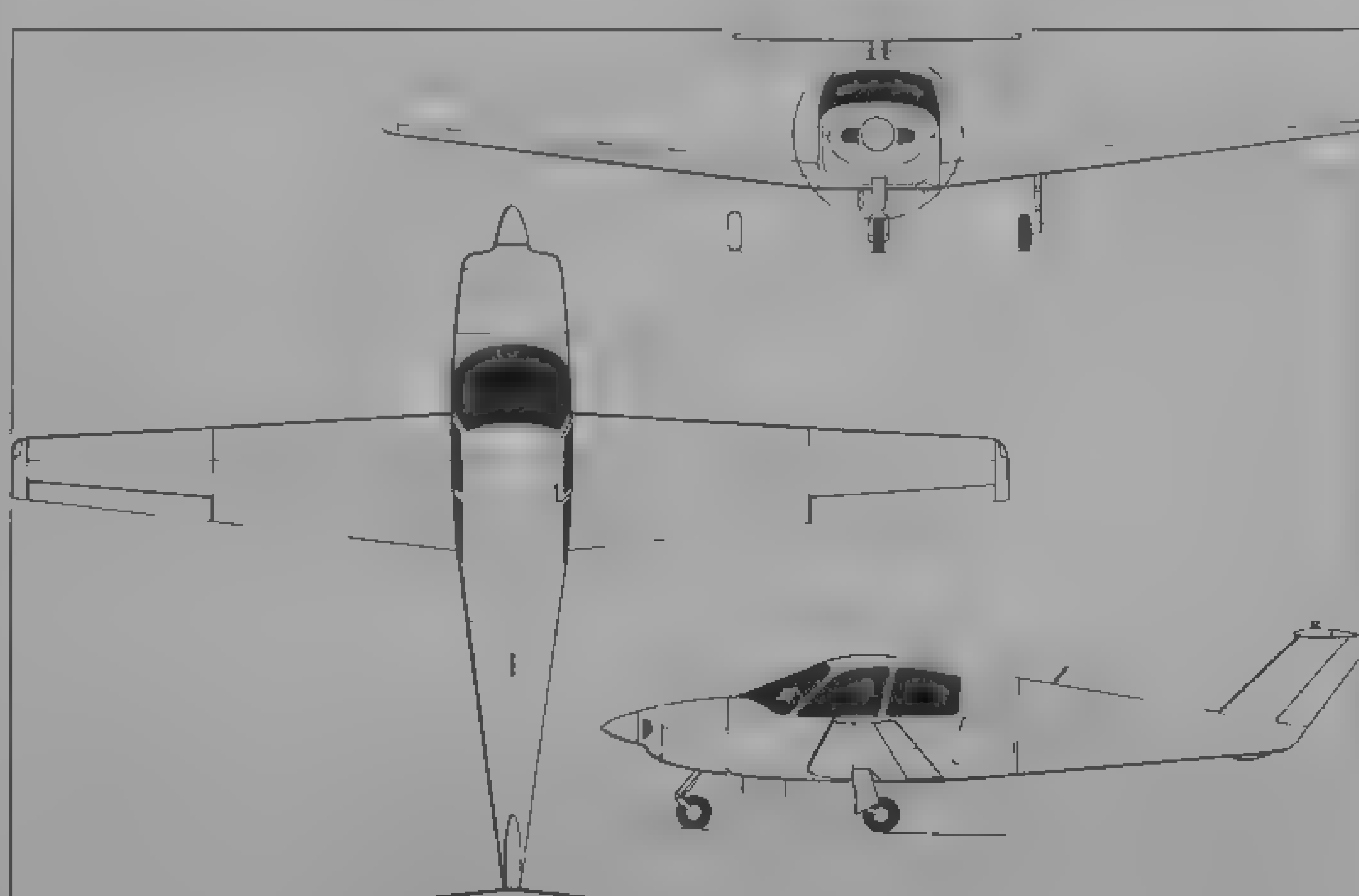
AVIONICS: Wide choice of East European or Western equipment (VFR or IFR) according to customer's requirements.

DIMENSIONS, EXTERNAL:	
Wing span	10.68 m (35 ft 0½ in)
Wing aspect ratio	10.37
Length overall	7.98 m (26 ft 2¼ in)
Height overall	2.30 m (7 ft 6½ in)
AREAS:	
Wings, gross	11.00 m² (118.4 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	550 kg (1,212 lb)
Max T-O weight	1,050 kg (2,315 lb)
Max wing loading	95.4 kg/m² (19.55 lb/sq ft)
Max power loading	7.04 kg/kW (11.57 lb/hp)
PERFORMANCE (estimated):	
Max cruising speed at 4,000 m (13,125 ft)	173 kts (320 km/h; 199 mph)
Max rate of climb at S/L, ISA	438 m (1,437 ft)/min
T-O to 15 m (50 ft) (grass)	392 m (1,286 ft)
Range, 45 min reserves:	
with max payload	648 n miles (1,200 km; 745 miles)
with max fuel	837 n miles (1,550 km; 963 miles)

UPDATED

Full size mockup of the LOK Family Air four seat light aircraft

1995



LOK Family Air (Textron Lycoming IO-360 engine) *(Jane's/James Goulding)*

1995

ZLIN

MORAVAN AS

CR-765 81 Otrokovice
Telephone: 42 (67) 922041 and 924351
Fax: 42 (67) 922340 and 922191
Telex: 62587

GENERAL DIRECTOR, MORAVAN AS: Jan Hubík
MANAGING DIRECTOR, M-AIR DIVISION: Ing Vladimír Havlík
COMMERCIAL DIRECTOR: Ing Daniel Sabat
MARKETING MANAGER: Ing Bohdan Žaček
TECHNICAL DIRECTOR: Ing Antonín Paruka
PUBLIC RELATIONS MANAGER: Ing Jiří Aron

Formed 18 September 1934 as Zlínská Letecká Akciová Společnost (Zlín Aviation Company Ltd) in Zlín, manufacture of Zlín aircraft started 1933 by Masarykova Letecká Liga (Masaryk League of Aviation); company renamed Moravan after Second World War; also now manufactures aircraft equipment. Current workforce approximately 1,250.

UPDATED

ZLIN 142

TYPE: Two-seat fully aerobatic light training, banner or glider towing and touring aircraft

PROGRAMME: Design began Winter 1977-78, prototype construction April 1978; first flight 29 December 1978. FAR Pt 23 certification (Aerobatic, Utility and Normal) 1980; production started 1981, Canadian DoT certification 26 November 1991

CURRENT VERSIONS: **Z 142 C**: Current production version, certificated in A (aerobatic trainer), U (general trainer) and N (touring) categories. *Description applies to this version*

Z 142 CAF: Military version; eight ordered by Czech Air Force

Z 242 L: Lycoming powered version of Z 142 for US market, described separately

CUSTOMERS: Total 371 (all versions) built by 1 January 1995. Exported to Algeria, Bulgaria, Canada, Cuba, Germany, Hungary, Poland, Romania, South Afric[illegible] former Yugoslavia

DESIGN FEATURES: Development of Zlin 42 M (1980-81 *Jane's*), basic, advanced and aerobatic training, glider tow-[illegible] ing and IFR [illegible]

FLYING CONTROLS: Slotted, mass balanced surfaces used for ailerons and flaps, horn balanced elevator with trim tab; ground adjustable tabs in ailerons and rudder, ailerons and elevator operated by rods, rudder by cables, fixed incidence tailplane

STRUCTURE: Mainly metal, wing has main and auxiliary spars, duralumin skins, fluted on control surfaces, metal engine cowlings, centre-fuselage is steel tube cage with composite skin panels

LANDING GEAR: Non-retractable tricycle type, with nosewheel offset to port. Oleo-pneumatic nosewheel shock absorber. Mainwheels carried on flat spring steel legs. Nosewheel steered (±38°), by rudder pedals. Mainwheels and Barum tyres size 420 × 150 mm, pressure 1.90 bars (27.6 lb/sq in) nosewheel and Barum tyre size 350 × 135 mm, pressure 2.50 bars (36.3 lb/sq in). Hydraulic disc brakes on mainwheels can be operated from either seat. Parking brake standard

POWER PLANT: One Avia M 337 AK inverted six-cylinder air-cooled in-line engine (156.5 kW, 210 hp at 2,750 rpm) with supercharger and low-pressure injection pump, driving a two-blade Avia V 500 A constant-speed metal propeller. Fuel tanks in each wing leading-edge, with combined capacity of 120 litres (31.7 US gallons, 26.4 Imp gallons). Normal category version has auxiliary 50 litre (13.2 US gallon, 11 Imp gallon) tank at each wingtip, increasing usable fuel capacity to 220 litres (58.1 US gallons, 48.4 Imp gallons). Fuel and oil systems permit inverted flying for up to 1.5 minutes. Oil capacity 12 litres (3.2 US gallons; 2.6 Imp gallons)

ACCOMMODATION: Side by side seats for two persons, instructor's seat to port. Both seats adjustable and permit use of back type parachutes. Baggage space aft of seats. Cabin and windscreen heating and ventilation standard. Forward sliding cockpit canopy. Dual controls standard

SYSTEMS: Electrical system includes 600 W 28 V engine-driven generator and 24 V 25 Ah Teledyne battery. External power source can be used for starting engine

AVIONICS: Bendix/King Silver Crown or other avionics, to customer's requirements

EQUIPMENT: Standard equipment includes cockpit, instrument and cabin lights, navigation lights, landing and taxying lights, and anti-collision light. Towing g[illegible] of up to 500 kg (1,102 lb) weight, optional

DIMENSIONS, EXTERNAL:

Wing span	9.16 m (30 ft 0½ in)
Wing aspect ratio	6.38
Wing chord, constant portion	1.42 m (4 ft 8 in)
Length overall	7.33 m (24 ft 0½ in)
Height overall	2.75 m (9 ft 0[illegible] in)
Elevator span	2.904 m (9 ft 6[illegible] in)
Wheel track	2.33 m (7 ft 7¾ in)
Wheelbase	1.66 m (5 ft 5¼ in)
Propeller diameter	2.00 m (6 ft 6¾ in)
Propeller ground clearance	0.40 m (1 ft 3¾ in)

DIMENSIONS, INTERNAL:

Cabin: Length	1.80 m (5 ft 10¾ in)
Max width	1.12 m (3 ft 8 in)
Max height	1.20 m (3 ft 11¼ in)
Baggage space	0.2 m³ (7.1 cu ft)

AREAS:

Wings, gross	13.15 m² (141.5 sq ft)
Ailerons (total)	1.408 m² (15.16 sq ft)
Trailing-edge flaps (total)	1.408 m² (15.16 sq ft)
Fin	0.54 m² (5.81 sq ft)
Rudder, incl tab	0.81 m² (8.72 sq ft)
Tailplane	1.23 m² (13.24 sq ft)
Elevator, incl tabs	1.36 m² (14.64 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility, N: Normal category):

Basic weight empty (all versions)	730 kg (1,609 lb)
Max T-O weight: A	970 kg (2,138 lb)
U	1,020 kg (2,248 lb)
N	1,090 kg (2,403 lb)
Max landing weight: A	970 kg (2,138 lb)
U	1,020 kg (2,248 lb)
N	1,050 kg (2,315 lb)
Max wing loading: A	73.76 kg/m² (15.11 lb/sq ft)
U	77.57 kg/m² (15.89 lb/sq ft)
N	82.89 kg/m² (16.98 lb/sq ft)
Max power loading: A	6.19 kg/kW (10.17 lb/hp)
U	6.51 kg/kW (10.69 lb/hp)
N	6.96 kg/kW (11.43 lb/hp)

Zlin 142 C two-seat trainer/tourer *1995*

PERFORMANCE (at relevant max T-O weight):

Never-exceed speed (VNE) (all versions)	179 kts (333 km/h, 206 mph) IAS
Max level speed at 500 m (1,640 ft):	
A, U	125 kts (231 km/h; 143 mph) IAS
N	122 kts (227 km/h, 141 mph) IAS
Max cruising speed at 500 m (1,640 ft):	
A, U	103 kts (192 km/h; 119 mph) IAS
N	100 kts (185 km/h, 115 mph) IAS
Econ cruising speed at 500 m (1,640 ft):	
A, U	93 kts (172 km/h, 107 mph) IAS
N	87 kts (161 km/h, 100 mph) IAS
Stalling speed, flaps up:	
A	56 kts (103 km/h, 64 mph) IAS
U	58 kts (107 km/h, 67 mph) IAS
N	60 kts (110 km/h, 69 mph) IAS
Stalling speed, T-O flap setting:	
A	54 kts (99 km/h, 62 mph) IAS
U	56 kts (103 km/h, 64 mph) IAS
N	57 kts (105 km/h, 66 mph) IAS
Stalling speed, flaps down:	
A	48 kts (88 km/h, 55 mph) IAS
U	50 kts (91 km/h, 57 mph) IAS
N	52 kts (95 km/h, 60 mph) IAS
Max rate of climb at S/L, ISA:	
A	312 m (1,023 ft)/min
U	288 m (945 ft)/min
N	252 m (827 ft)/min
Service ceiling: A	4,750 m (15,580 ft)
U	4,500 m (14,765 ft)
N	4,300 m (14,100 ft)
T-O run: A	231 m (758 ft)
U	236 m (775 ft)
N	252 m (827 ft)
T-O to 15 m (50 ft): A	510 m (1,674 ft)
U	560 m (1,838 ft)
N	620 m (2,035 ft)
Landing from 15 m (50 ft): A	425 m (1,395 ft)
U	440 m (1,444 ft)
N	460 m (1,510 ft)
Landing run: A	190 m (624 ft)
U	200 m (657 ft)
N	220 m (722 ft)
Range at max cruising speed:	
A, U	283 n miles (525 km, 326 miles)
N	512 n miles (950 km, 590 miles)
g limits: A	+6/-3.5
U	+5/-3
N	+3.8/-1.5

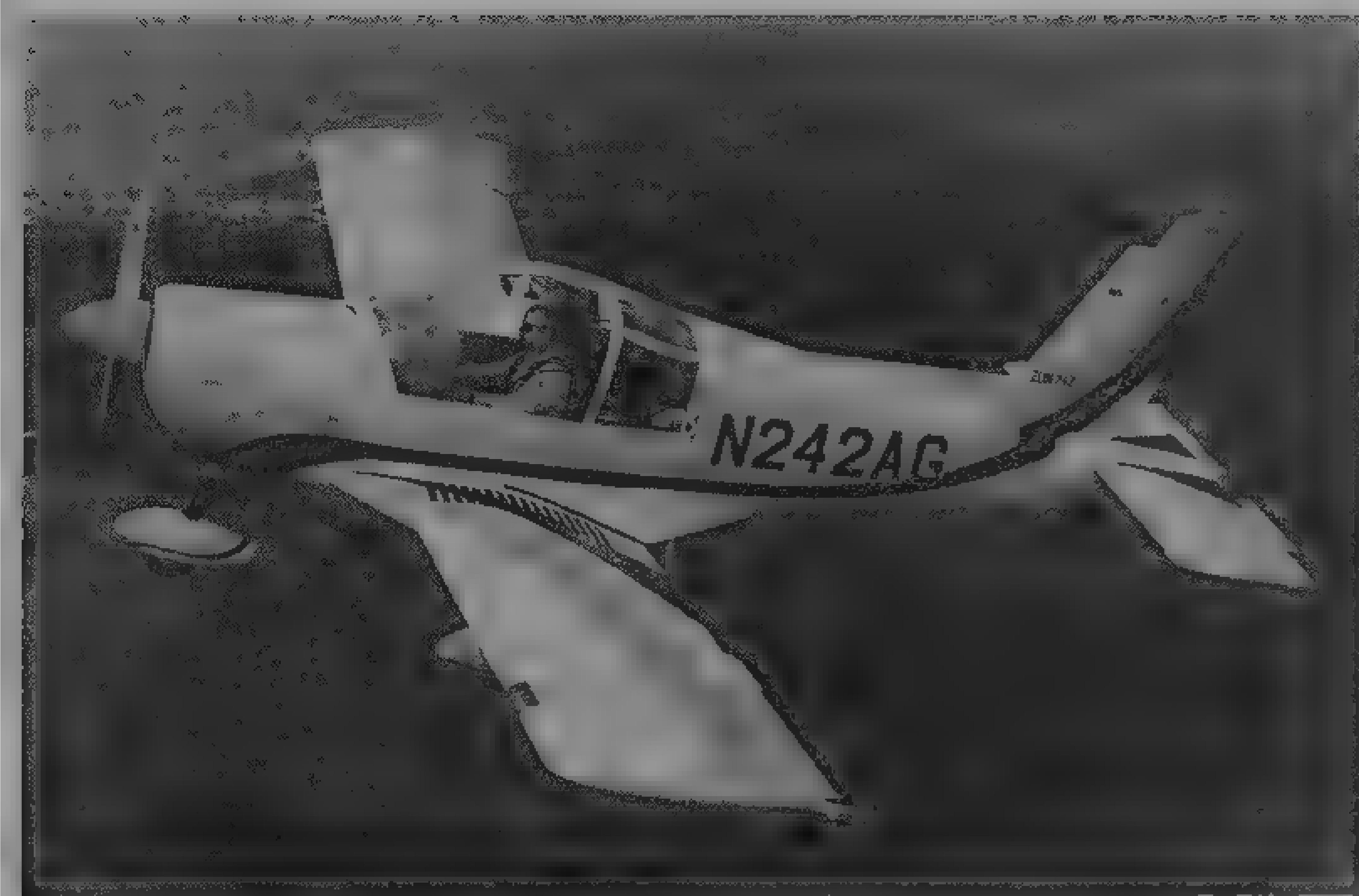
UPDATED

Zlin 142 CAF of the Czech Air Force *1994*

ZLIN 242 L

TYPE: Lycoming-powered version of Z 142.

PROGRAMME: Intended for US market; design started December 1988; first flight (OK-076) 14 February 1990; FAR Pt



Zlin 242 L (Textron Lycoming AEIO-360-A1B6 engine)

1995

23 certification (A, U and N categories) April 1992, now certificated in Australia, Canada, Sweden, UK and USA.

CUSTOMERS: Total of 31 built by January 1995: three to Slovenian Air Force, other sales to Bolivia, Canada, Sweden, UK and USA.

DESIGN FEATURES: Changes from Z 142, apart from new engine, include redesigned (and shorter) engine cowling and front fuselage, wing incidence, 0° sweep, bulged wingroot/fuselage fairing, redesigned wing and tailplane tips, redesigned fuel system and updated instruments. Spin recovery strake each side of cowling. Flying controls, structure, landing gear and accommodation details as for Z 142.

POWER PLANT: One Textron Lycoming AEIO-360-A1B6 flat-four engine (149 kW; 200 hp at 2,700 rpm), driving a Mühlbauer MTV-9-B-C/C-188-18a three-blade constant-speed wood/composites propeller. Fuel capacity 120 litres (31.7 US gallons, 26.4 Imp gallons). Normal category version wingtip tanks 55 litres (14.5 US gallons, 12.1 Imp gallons) each, bringing usable capacity to 230 litres (60.7 US gallons, 50.6 Imp gallons). Inverted flight limited to 1 minute. Oil capacity 8 litres (2.1 US gallons, 1.8 Imp gallons).

SYSTEMS: Electrical system includes 1.6 kW 28 V engine-driven generator and 24 V 19 Ah Gill battery. External power source can be used for engine starting.

AVIONICS: To customer's specification, usually from Bendix/King Silver Crown range.

EQUIPMENT: Standard equipment includes EGT gauge, fuel flow indicator, g meter and anti-collision beacon. Optional items include cockpit/instrument/cabin lights, landing/taxying lights, anti-collision lights, and towing gear for gliders of up to 500 kg (1,102 lb) weight.

DIMENSIONS, EXTERNAL:
- Wing span: 9.34 m (30 ft 7¾ in)
- Wing chord, constant portion: 1.504 m (4 ft 11¼ in)
- Wing aspect ratio: 6.34
- Length overall: 6.94 m (22 ft 9¼ in)
- Height overall: 2.95 m (9 ft 8¼ in)
- Elevator span: 3.20 m (10 ft 6 in)
- Wheel track: 2.33 m (7 ft 7¾ in)
- Wheelbase: 1.755 m (5 ft 9 in)
- Propeller diameter: 1.88 m (6 ft 2 in)
- Propeller ground clearance: 0.33 m (1 ft 1 in)

DIMENSIONS, INTERNAL: As Z 142

AREAS: As Z 142 except:
- Wings, gross: 13.758 m² (148.09 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility, N: Normal category):
- Basic weight empty (all versions): 730 kg (1,609 lb)
- Max T-O and landing weights: as Z 142
- Max wing loading: A: 70.50 kg/m² (14.44 lb/sq ft)
  - U: 74.14 kg/m² (15.18 lb/sq ft)
  - N: 79.23 kg/m² (16.23 lb/sq ft)
- Max power loading: A: 6.50 kg/kW (10.68 lb/hp)
  - U: 6.84 kg/kW (11.24 lb/hp)
  - N: 7.31 kg/kW (12.01 lb/hp)

PERFORMANCE (ISA at S/L):
- Never-exceed speed (VNE):
  - all versions: 170 kts (315 km/h; 195 mph) CAS
- Max level speed at 500 m (1,640 ft):
  - A, U: 127 kts (236 km/h; 146 mph) CAS
  - N: 124 kts (230 km/h; 143 mph) CAS
- Max cruising speed at 500 m (1,640 ft):
  - A, U: 115 kts (214 km/h; 133 mph) CAS
  - N: 114 kts (212 km/h; 132 mph) CAS
- Stalling speed:
  - flaps up: A: 60 kts (111 km/h; 69 mph) CAS
  - U: 62 kts (114 km/h; 71 mph) CAS
  - N: 64 kts (118 km/h; 74 mph) CAS
  - T-O flap setting: A: 57 kts (105 km/h; 66 mph) CAS
  - U: 58 kts (107 km/h; 67 mph) CAS
  - N: 60 kts (111 km/h; 69 mph) CAS
  - flaps down: A: 51 kts (94 km/h; 59 mph) CAS
  - U: 53 kts (97 km/h; 61 mph) CAS
  - N: 54 kts (100 km/h; 63 mph) CAS
- Max rate of climb at S/L: A: 330 m (1,082 ft)/min
  - U: 300 m (984 ft)/min
  - N: 270 m (886 ft)/min
- T-O run: A: 210 m (689 ft)
  - U: 233 m (765 ft)
  - N: 266 m (873 ft)
- T-O to 15 m (50 ft): A: 450 m (1,477 ft)
  - U: 495 m (1,624 ft)
  - N: 565 m (1,854 ft)
- Landing from 15 m (50 ft): A: 500 m (1,641 ft)
  - U: 525 m (1,723 ft)
  - N: 540 m (1,772 ft)
- Range with max fuel:
  - A: 282 n miles (523 km; 325 miles)
  - U: 275 n miles (509 km; 316 miles)
  - N: 558 n miles (1,035 km; 643 miles)
- g limits: A: +6/−3.5
  - U: +5/−3
  - N: +3.8/−1.5

UPDATED

ZLIN 143

TYPE: Four-seat basic/advanced trainer and touring aircraft.

PROGRAMME: Launched May 1991, with prototype construction beginning that Summer and first flight (Z 143 L prototype OK-074) 24 April 1992; Czech certification 10 June 1994.

CURRENT VERSIONS: **Z 143 L**: Prototype, with Textron Lycoming engine. *Detailed description applies to this version.*

Z 143: Possible future production aircraft powered by 156.5 kW (210 hp) Avia M 337 AK.

DESIGN FEATURES: For basic aerobatics (except inverted flight), glider towing and (with equipment) night and IFR training. Wing section and dihedral as for Z 142.

FLYING CONTROLS: As for Z 142.

STRUCTURE: As for Z 142.

LANDING GEAR: As for Z 142.

POWER PLANT: One Textron Lycoming O-540-J3A5 flat-six engine (175 kW; 235 hp at 2,400 rpm); Mühlbauer MTV-9-B/195-45 three-blade variable-pitch propeller. Fuel capacity as for Z 242 L except wingtip auxiliary tanks each 51 litres (13.5 US gallons, 11.2 Imp gallons) raising usable fuel to 220 litres (58.1 US gallons, 48.4 Imp gallons).

ACCOMMODATION: Four seats in 2 + 2 configuration, with pilot in front left-hand seat. All seats have four-point safety belts. Baggage compartment aft of rear seats, with external door on port side. One-piece forward-sliding canopy. Dual controls standard. Cabin and windscreen heating and ventilation standard.

SYSTEMS: As for Z 242 L.

AVIONICS: As for Z 242 L.

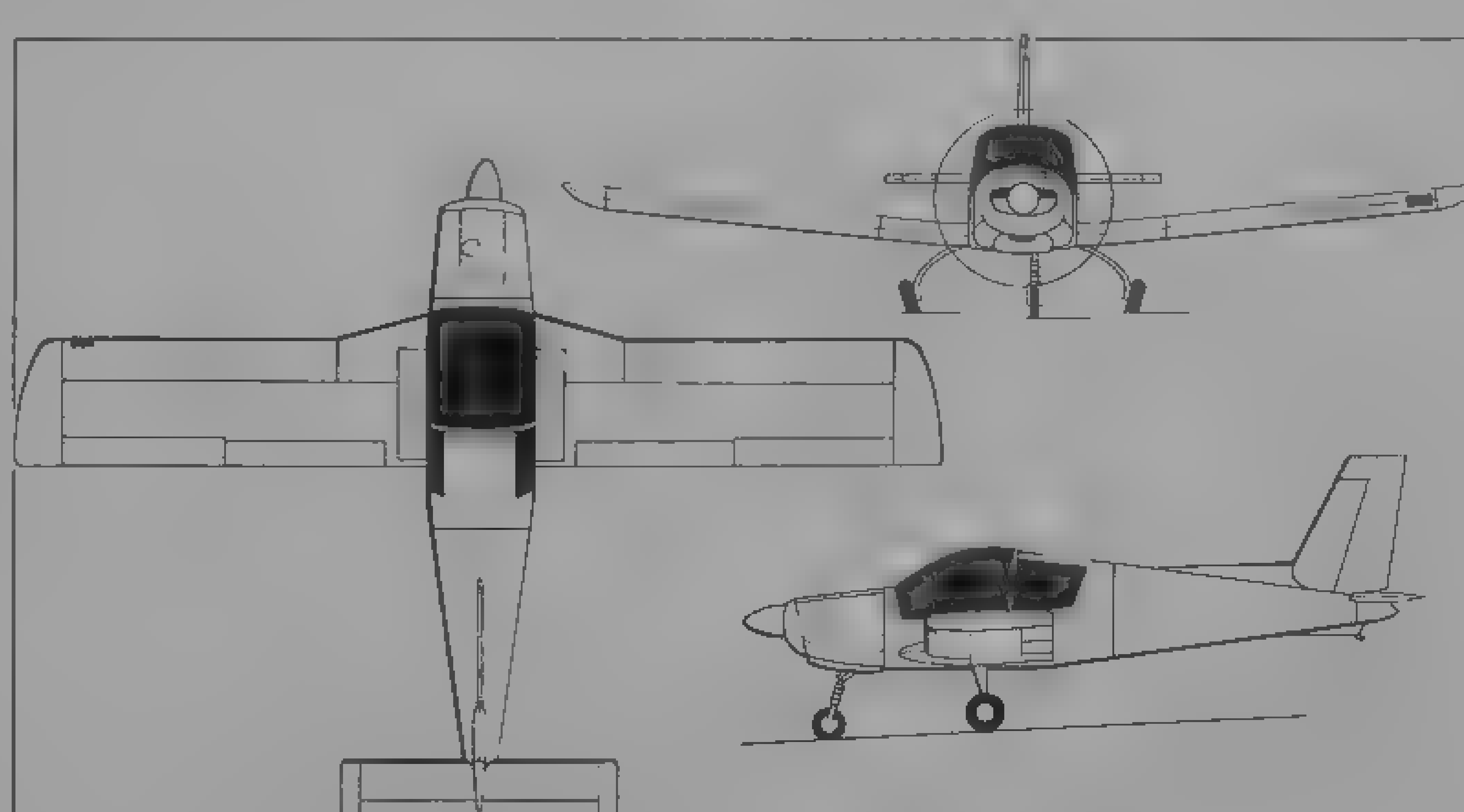
DIMENSIONS, EXTERNAL:
- Wing span: 10.136 m (33 ft 3 in)
- Wing chord, mean aerodynamic: 1.4895 m (4 ft 10⅝ in)
- Wing aspect ratio: 6.95
- Length overall: 7.58 m (24 ft 10½ in)
- Height overall: 2.91 m (9 ft 6½ in)
- Elevator span: 3.006 m (9 ft 10¼ in)
- Wheel track: 2.44 m (8 ft 0 in)
- Wheelbase: 1.75 m (5 ft 9 in)
- Propeller diameter: 1.95 m (6 ft 4¾ in)
- Propeller ground clearance: 0.28 m ([illegible] in)

DIMENSIONS, INTERNAL:
- Baggage compartment volume: 0.25 m³ (8.83 cu ft)

AREAS: As for Z 142 except:
- Wings, gross: 14.776 m² (159.05 sq ft)

WEIGHTS AND LOADINGS (U: Utility, N: Normal category):
- Weight empty, equipped: U, N: 830 kg (1,830 lb)
- Max T-O weight: U: 1,080 kg (2,381 lb)
  - N: 1,350 kg (2,976 lb)
- Max landing weight: U: 1,080 kg (2,381 lb)
  - N: 1,280 kg (2,822 lb)
- Max wing loading: U: 73.09 kg/m² (14.97 lb/sq ft)
  - N: 91.36 kg/m² (18.71 lb/sq ft)
- Max power loading: U: 6.16 kg/kW (10.13 lb/hp)
  - N: 7.70 kg/kW (12.66 lb/hp)

PERFORMANCE (ISA at S/L):
- Never-exceed speed (VNE):
  - both versions: 170 kts (315 km/h; 195 mph) CAS
- Max level speed: U: 143 kts (266 km/h; 165 mph) CAS
  - N: 141 kts (262 km/h; 163 mph) CAS
- Max cruising speed, 75% power:
  - U: 127 kts (235 km/h; 146 mph) CAS
  - N: 125 kts (232 km/h; 144 mph) CAS
- Econ cruising speed, 60% power:
  - U: 116 kts (216 km/h; 134 mph) CAS
  - N: 113 kts (209 km/h; 130 mph) CAS
- Stalling speed:
  - flaps up: U: 59 kts (108 km/h; 68 mph) CAS
  - N: 64 kts ([illegible] km/h; 73 mph) CAS
  - T-O flap setting: U: 54 kts (100 km/h; 63 mph) CAS
  - N: 58 kts (107 km/h; 67 mph) CAS
  - flaps down: U: 50 kts (91 km/h; 57 mph) CAS
  - N: 53 kts (98 km/h; [illegible] mph) CAS
- Max rate of climb: U: 444 m (1,457 ft)/min
  - N: 294 m (964 ft)/min
- T-O run: U: 170 m (558 ft)
  - N: 295 m (968 ft)
- T-O to 15 m (50 ft): U: 450 m (1,477 ft)
  - N: 640 m ([illegible] ft)



General arrangement of the Zlin 143 L (Textron Lycoming O-540-J3A5 engine) *(Jane's/Mike Keep)*

1993

Zlin 143 L four seat trainer and touring aircraft

1994

Landing from 15 m (50 ft): U	510 m (1,674 ft)
N	655 m (2,149 ft)
Landing run: U	225 m (739 ft)
N	265 m (870 ft)
Range at 3,050 m (10,000 ft), 65% power	721 n miles (1,336 km; 830 miles)
g limits	+3.8/−1.52 (Normal)
	+4.4/−1.76 (Utility)

UPDATED

ZLIN 137T AGRO TURBO

TYPE: Single-seat turboprop-powered agricultural aircraft.

PROGRAMME: First flight of XZ-37T prototype (OK 146), powered by Motorlet M 601 B, 6 September 1981 (see 1981-82 *Jane's*); first flights of lower-powered prototypes (OK-072 and OK-074) 12 July and 29 December 1983; certificated to BCAR Section K 1984, production as Z 137T started 1985; South African type approval 3 December 199[illegible].

CURRENT VERSIONS: **Z 137T**: Standard production agricultural version; available also as water bomber. *Description applies to agricultural version.*

Z 37T-2: Two-seat training version.

CUSTOMERS: Total of 53 Z 137Ts and two Z 37T-2s built by 1 January 1994 (unchanged at 1 January 1995); customer countries are Bolivia, Czech Republic, France, Hungary, Sudan and Turkey.

DESIGN FEATURES: Unbraced low wing, with NACA 33015 (root) and 44012 (tip) sections; incidence 3° at root, 0° at tip; dihedral 7° outboard of mainwheels.

FLYING CONTROLS: Primary surfaces mechanical; ground adjustable tab on each aileron, trim tab in rudder and centre of elevator. Fixed leading-edge slats forward of ailerons; pneumatically actuated double-slotted flaps; wingtip winglets; fin offset to port to counteract engine torque.

STRUCTURE: Wing all-metal single-spar with auxiliary rear spar and metal skin, centre and outer panels built integrally with fuselage; ailerons, one-piece elevator and rudder fabric covered; fuselage steel tube with fabric and metal covering.

LANDING GEAR: Non-retractable tailwheel type, with Technometra oleo-pneumatic mainwheel shock absorbers. Moravan light alloy wheels and Barum tyres. Steerable tailwheel. Mainwheel tyres size 556 × 163 × 254 mm; tailwheel tyre size 290 × 110 mm, pressure 3.45 bars (50 lb/sq in) on all units. Moravan hydraulic drum brakes on mainwheels.

POWER PLANT: One 365 kW (490 shp) Walter M 601 Z turboprop, driving an Avia VJ7-508Z three-blade constant-speed propeller. Two metal fuel tanks in wing centre-section, combined capacity 350 litres (92.5 US gallons; 77 Imp gallons). Fuel can be transported to distant airstrips in four auxiliary tanks with a combined capacity of 500 litres (132 US gallons; 110 Imp gallons). Gravity refuelling point in top of each wing. Oil capacity 7 litres (1.8 US gallons; 1.5 Imp gallons). Air intake filter.

ACCOMMODATION: Pilot in enclosed cockpit, on contoured seat with headrest. Forward-opening window/door, on starboard side, can be jettisoned in emergency. Auxiliary seat to rear for mechanic or loader. Cockpit heated, and provided with filtered fresh air intake. Two-seat training version available.

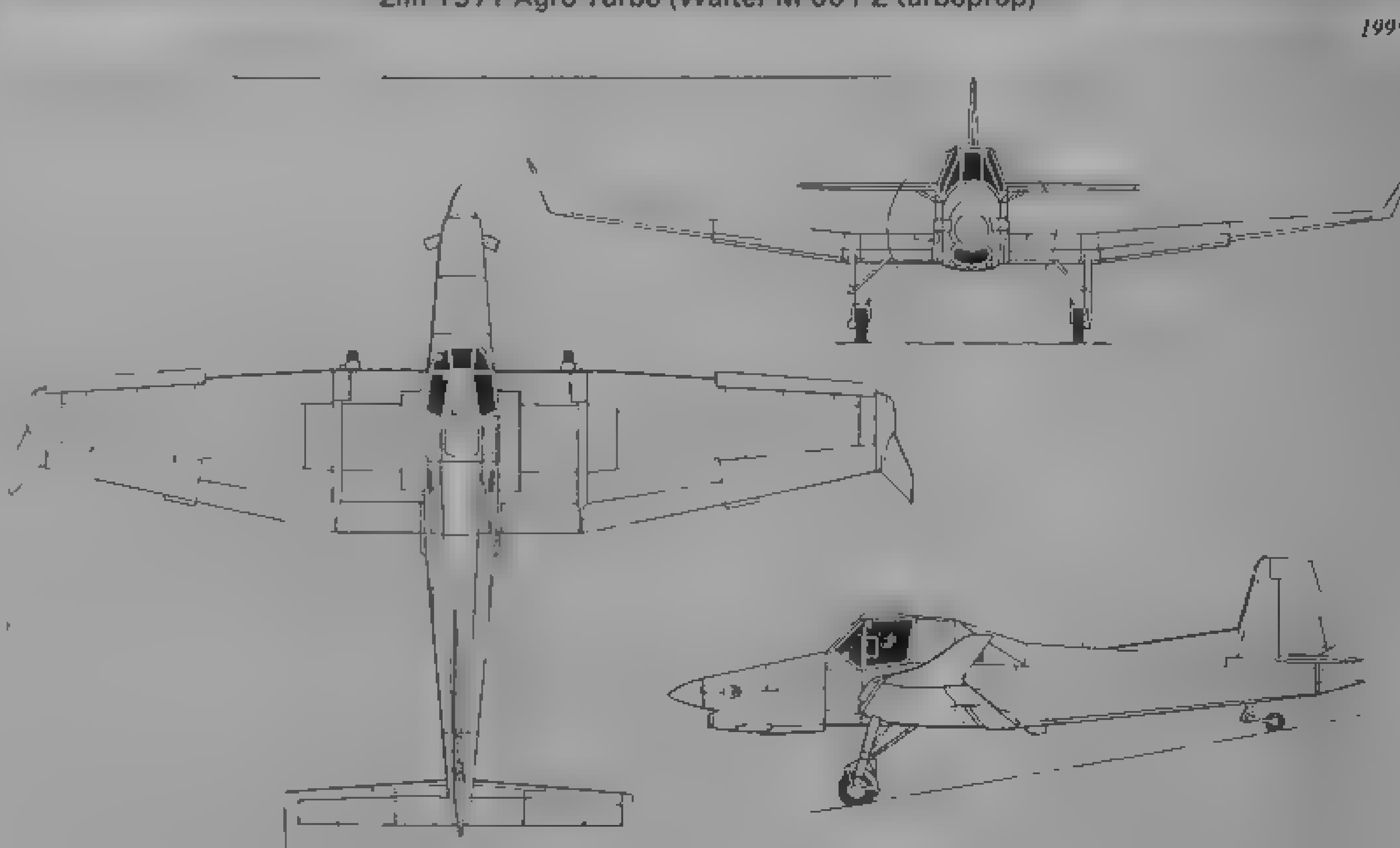
SYSTEMS: Pneumatic system of 50 bars (725 lb/sq in) pressure, reduced to 30 bars (435 lb/sq in) for agricultural equipment and flaps. Electrical power supplied by 28 V 5.6 kW DC starter/generator.

AVIONICS: *Comms*: LUN 3524 VHF radio standard.

EQUIPMENT: Hopper/tank capacity (maximum) 1,000 litres (264 US gallons; 220 Imp gallons) of liquid or 900 kg (1,984 lb) of dry chemical. Distribution system for both liquid and dry chemicals is operated pneumatically. Chemicals can be jettisoned in 5 seconds in emergency. Steel cable cutter on windscreen and each mainwheel leg; steel deflector cable runs from tip of windscreen cable cutter to tip of fin. Windscreen washer and wiper standard. Other equipment includes gyro compass, clock, rearview mirror, second (mechanic's) seat, cockpit air conditioning, ventilation and heating, and anti-collision light. Can be modified for firefighting role.

Zlin 137T Agro Turbo (Walter M 601 Z turboprop)

1995



Z 137T Agro Turbo agricultural aircraft (*Jane's/Dennis Punnett*)

1993

DIMENSIONS, EXTERNAL:

Wing span	13.63 m (44 ft 8½ in)
Wing chord: at root	2.39 m (7 ft 10 in)
at tip	1.224 m (4 ft 0¼ in)
Wing aspect ratio	6.96
Length overall (flying attitude)	10.46 m (34 ft 4 in)
Fuselage: Max width	1.70 m (5 ft 7 in)
Height overall	3.505 m (11 ft 6 in)
Elevator span	5.294 m (17 ft 4½ in)
Wheel track	3.30 m (10 ft 10 in)
Wheelbase	6.375 m (20 ft 11 in)
Propeller diameter	2.50 m (8 ft 2½ in)
Propeller ground clearance (min)	0.45 m (1 ft 5¾ in)

AREAS:

Wings, gross	26.69 m² (287.3 sq ft)
Ailerons (total)	2.428 m² (26.13 sq ft)
Trailing-edge flaps (total)	4.37 m² (47.04 sq ft)
Fin	1.185 m² (12.76 sq ft)
Rudder, incl tab	1.054 m² (11.35 sq ft)
Tailplane	2.776 m² (29.88 sq ft)
Elevator, incl tab	3.008 m² (32.38 sq ft)

WEIGHTS AND LOADINGS:

Weight empty with basic agricultural equipment	1,250 kg (2,756 lb)
Max payload	900 kg (1,984 lb)
Max fuel	280 kg (617 lb)
Max T-O weight: ferry flights	2,260 kg (4,982 lb)
agricultural, forestry and waterways work	2,525 kg (5,566 lb)
Max wing loading	89.9 kg/m² (18.41 lb/sq ft)
Max power loading	6.67 kg/kW (10.95 lb/shp)

PERFORMANCE (at 2,525 kg; 5,566 lb max T-O weight):

Never-exceed speed (VNE)	153 kts (285 km/h; 177 mph)
Max level speed at 500 m (1,640 ft)	118 kts (218 km/h; 135 mph)
Max cruising speed at 500 m (1,640 ft)	103 kts (190 km/h; 118 mph)

Working speed	78-89 kts (145-165 km/h, 90-103 mph)
Stalling speed: flaps up	48 kts (88 km/h, 55 mph)
flaps down	42 kts (77 km/h, 48 mph)
Max rate of climb at S/L	252 m (827 ft)/min
Service ceiling	5,500 m (18,040 ft)
T-O run	265 m (870 ft)
T-O to 15 m (50 ft)	580 m (1 905 ft)
Landing from 15 m (50 ft)	720 m (2,365 ft)
Landing run	300 m (985 ft)
Range with max internal fuel	188 n miles (350 km, 217 miles)
Swath width: granules	30 m (98 ft)
liquid	40 m (131 ft)
g limits	+3 2/−1 28

UPDATED

OTHER AIRCRAFT

Total of 75 **Zlin 50s** built remained unchanged at 1 January 1995; any further production would be to special order only. Last full description in 1993-94 *Jane's*

NEW ENTRY

EGYPT

AOI

ARAB ORGANISATION FOR INDUSTRIALISATION

Whilst remaining active in aircraft and engine overhaul and support, the AOI currently has no aircraft assembly programme, most recent details in the 1994-95 *Jane's*

UPDATED

ETHIOPIA

EAL

ETHIOPIAN AIRLINES SC

PO Box 1755, Addis Ababa
Telephone: 251 (1) 612222
Fax: 251 (1) 611474
Telex: 21012 ETHAIR ADDIS
GENERAL MANAGER: Capt Zelleke Demissie
DIRECTOR, AGRO AIRCRAFT MANUFACTURING:
Seifadin Mahmoud

Schweizer (see USA) Ag-Cat Super B Turbine being assembled and part-manufactured under name **Eshet** for Ethiopian use and export, first aircraft (ET AIY) rolled out 20 December 1986, same as Schweizer version, except higher tyre pressure 3 83 bars (55 58 lb/sq in) and empty weight 1,500 kg (3,307 lb). Power plant is one 559 kW (750 shp) PT6A-34AG turboprop driving 2 69 m (8 ft 10 in) Hartzell HC-B3TN-3D three-blade propeller; optional engine is 507 kW (680 shp) PT6A-15AG, optional maximum fuel load 435 litres (115 US gallons; 95 75 Imp gallons) and oil capacity 10.6 litres (2 8 US gallons, 2 3 Imp gallons)

EAL has sole rights to build, market and service Schweizer Ag-Cat throughout Africa except Algeria, Tunisia and South Africa; proportion of local manufacture being gradually increased

UPDATED

Ethiopian Airlines Eshet licence-built version of the Schweizer Ag-Cat Super B Turbine *1995*

EAL ESHET (SCHWEIZER AG-CAT SUPER B TURBINE)

TYPE: Agricultural biplane.

PROGRAMME: First flight of original Grumman Ag-Cat 27 May 1957, first deliveries 1959, production resumed by Schweizer in October 1981 with improved G-164B designated Ag-Cat Super-B, later joined by Ag-Cat Super-B Turbine. Latter being assembled and part-manufactured for Ethiopian use and export; first aircraft (ET AIY) rolled out 20 December 1986, minor changes from Schweizer version

CURRENT VERSIONS: **Ag-Cat Super-B Turbine (G-164B)** Similar to basic radial-engined Super-B, but powered by choice of 373 kW (500 shp) P&WC PT6A-11AG, 507 kW (680 shp) PT6A-15AG or 559 kW (750 shp) PT6A-34AG turboprop engines.

CUSTOMERS: Over 2,600 Ag-Cats built by Schweizer, further 15 by EAL up to early 1995

DESIGN FEATURES: Wing section NACA 4412; dihedral 3°, incidence 6°, uncowled piston engine

FLYING CONTROLS: Mechanical, with trim tab on port elevator, ground adjustable tabs on one aileron, rudder and starboard elevator; no flaps.

STRUCTURE: Each wing has two aluminium spars and sheet skin wrapped over whole upper surface and back to front spar on under surface, remainder of underside fabric covered, leading edges in five panels to simplify repair, glassfibre wingtips; light alloy ailerons, wire braced fabric covered tail surfaces on steel tube frame, welded steel tube fuselage with removable side panels

LANDING GEAR: Non-retractable tailwheel type. Cantilever spring steel legs. Cleveland mainwheels with tyres size 8 50-10, 8 ply, pressure 3 83 bars (55 6 lb/sq in) on Eshet; 2 42 bars (35 lb/sq in) for US-built version. Steerable tailwheel with tyre size 12.4-4.5, pressure 3 45 bars (50 lb/sq in). Cleveland heavy duty air-cooled hydraulic disc brakes. Parking brake

POWER PLANT: One 559 kW (750 shp) PT6A-34AG turboprop driving 2.69 m (8 ft 10 in) Hartzell HC-B3TN-3D three-blade propeller; optional engine is 507 kW (680 shp) PT6A-15AG, optional maximum fuel load 435 litres (115 US gallons, 95 75 Imp gallons) and oil capacity 10 6 litres (2 8 US gallons, 2 3 Imp gallons)

ACCOMMODATION: Single seat in enclosed cockpit. Reinforced fairing aft of canopy for turnover protection. Canopy side panels open outward and down, canopy top upward and to starboard, to provide access. Baggage compartment. Cockpit pressurised against dust ingress and ventilated by ram air. Safety padded instrument panel. Air conditioning by J B Systems optional

SYSTEMS: Hydraulic system for brakes only. Optional electrical system with 24 V alternator, navigation and/or strobe lights, external power socket, and electric engine starter

AVIONICS: *Comms:* Radio optional

EQUIPMENT: Standard equipment includes control column lock, instrument glareshield, seat belt and shoulder harness, tinted windscreen, stall warning light, refuelling steps and assist handles, tiedown rings, and urethane paint external yellow finish

Forward of cockpit, over CG, is a glassfibre hopper, capacity 1,514 litres (400 US gallons; 333 Imp gallons), for agricultural chemicals (dry or liquid); distributor beneath fuselage. Low volume, ULV or high volume spray system, with leading or trailing-edge booms. Emergency dump system for hopper load, can be used also for water bomber operations

DIMENSIONS, EXTERNAL	
Wing span: upper	12 92 m (42 ft 4½ in)
lower	12 36 m (40 ft 6¾ in)
Wing chord, constant	1 47 m (4 ft 10 in)
Wing aspect ratio: upper wing	8 7
biplane, effective mean	5 5
Length overall	8 41 m (27 ft 7¼ in)
Height overall	3.68 m (12 ft 1 in)
Tailplane span	3 96 m (13 ft 0 in)
Wheel track	2.44 m (8 ft 0 in)
Wheelbase	5 59 m (18 ft 4 in)
Propeller diameter (max)	2 74 m (9 ft 0 in)
Cockpit door: Height	0 53 m (1 ft 9 in)
Width	0 64 m (2 ft 1 in)
Height to sill	0 71 m (2 ft 4 in)
DIMENSIONS, INTERNAL	
Cockpit: Length	1 27 m (4 ft 2 in)
Max width	0 76 m (2 ft 6 in)
Max height	1 14 m (3 ft 9 in)
Hopper volume	1.51 m³ (53 5 cu ft)
AREAS	
Wings, gross	36 48 m² (392 7 sq ft)
Ailerons (total)	2.92 m² (31.4 sq ft)
Fin	1 67 m² (17 97 sq ft)
Rudder	1 12 m² (12.0 sq ft)
Tailplane	2 12 m² (22 8 sq ft)
Elevators	2 06 m² (22 2 sq ft)
WEIGHTS AND LOADINGS	
Weight empty, equipped:	
US built	1,429 kg (3,150 lb)
Eshet	1,500 kg (3,307 lb)
Certified gross weight	2 358 kg (5,200 lb)
Max T-O weight (CAM 8)	3,184 kg (7,020 lb)
Max wing loading	87 42 kg/m² (17 91 lb/sq ft)
Max power loading	5 70 kg/kW (9 36 lb/shp)
PERFORMANCE (Super-B Turbine with PT6A-15AG engine)	
Never exceed speed (VNE)	136 kts (252 km/h, 157 mph)
Working speed	113 kts (209 km/h, 130 mph)
Stalling speed, power off	56 kts (103 km/h, 64 mph)
T-O run	120 m (394 ft)
T-O to 15 m (50 ft) at 2,358 kg (5,200 lb) certificated gross weight	274 m (900 ft)
Landing from 15 m (50 ft)	407 m (1,333 ft)
Landing run	157 m (513 ft)
Range with max fuel	172 n miles (318 km, 198 miles)
Design g limits, all versions	+4 2/−1

UPDATED

FINLAND

VALMET

VALMET AVIATION INDUSTRIES INC

FIN-35600 Halli
Telephone: 358 (42) 8291
Fax: 358 (42) 829600
Telex: 28269
PRESIDENT AND CEO: Juhani Markula
DIRECTOR, TRAINING AIRCRAFT: Olli Puttonen

Valmet and predecessors have built 30 types of aircraft, including 19 of Finnish design, since 1922; current activities include production of aircraft and aero-engine parts, and maintenance, overhaul, repair and modification of aircraft and accessories, aero-engines and accessories, marine diesel engines, accessories and gears, and foundry products. Manufacture of Valmet L-90 TP Redigo reaching termination. Contract signed 1989 for Valmet to produce all tail surfaces for Saab 2000; will assemble 57 F/A-18Cs for Finnish Air Force from CKD kits during period 1995-2000, and will also co-produce fuselage dorsal and side skin panels.

Facilities in Kuorevesi and Linnavuori; workforce about 850 in early 1995.

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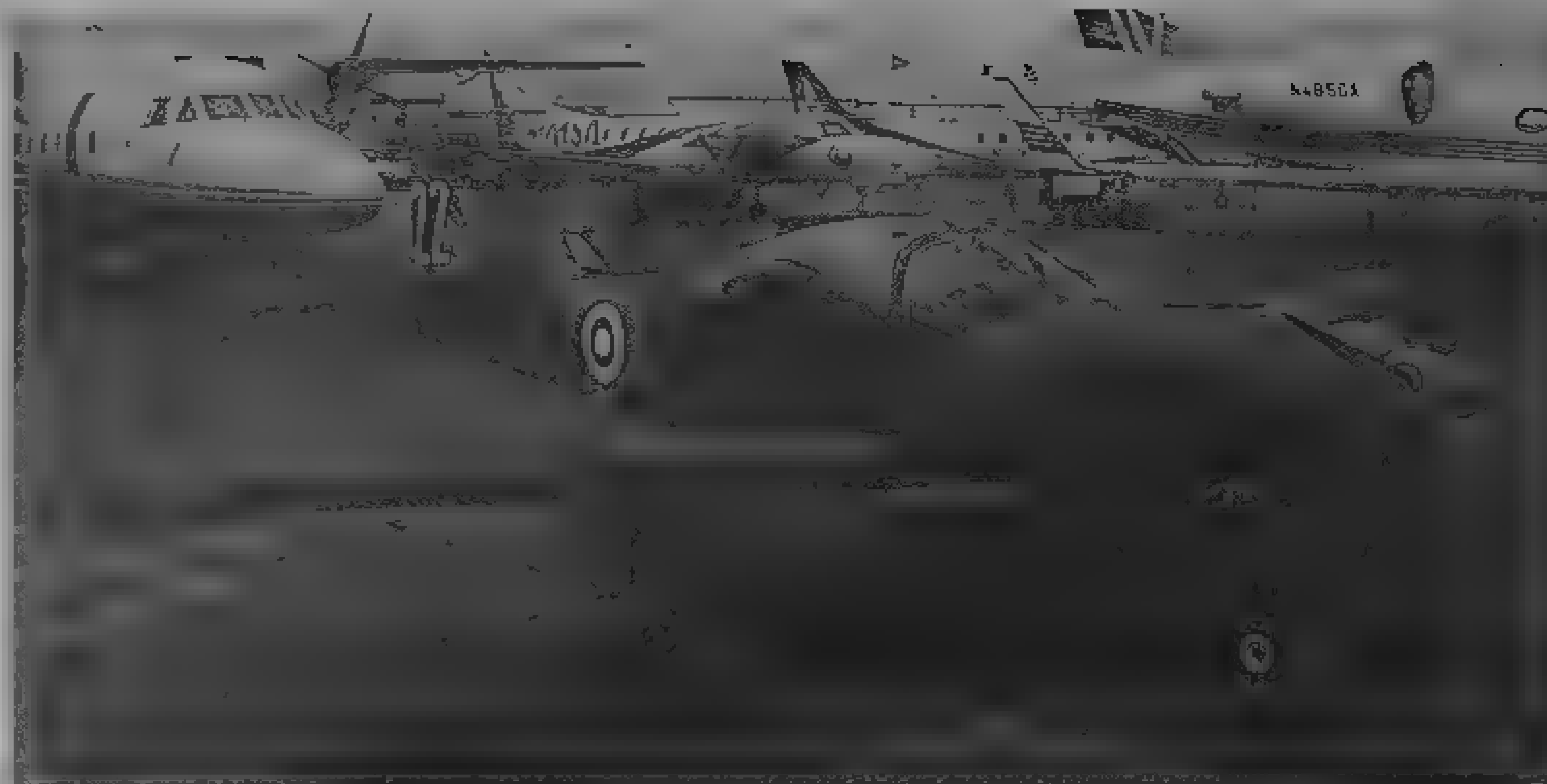


Finnish Air Force Valmet L-90 TP Redigo two/four-seat liaison aircraft *(Paul Jackson)* *1995*

VALMET L-90 TP REDIGO

TYPE: Two/four seat multistage turboprop military trainer and multipurpose aircraft.

PROGRAMME: Design started 1983; first flight of Allison powered prototype (OH-VTP) 1 July 1986; first flight of second prototype (OH-VTM), powered by Turbomeca TP 319 derated to 313 kW (420 shp), December 1987; second prototype lost in accident 28 August 1988. Finnish certification September 1991.

CUSTOMERS: Finnish Air Force ordered 10 on 6 January 1989; deliveries completed late 1993; these aircraft assigned to liaison and communications roles, replacing Piper Arrows; L-70 Vinka continues to fulfil primary training role.

Announced September 1992 18 Redigos ordered by three undisclosed customers, later identified as Mexican Navy, Eritrean Air Force and McDonnell Aircraft Co, although McAir acting as sales agent to offset Finnish F/A-18 Hornet purchase; deliveries to Mexican Naval Aviation School at Bajadas, Vera Cruz, began April 1993. Valmet announced in December 1994 that production would stop after 30 aircraft (excluding first prototype) due to lack of further orders. 29 delivered by January 1995.

REDIGO PRODUCTION

Customer	Qty	First aircraft	First flight
Valmet (1P)	1	OH-VTP	1 Jul 1986*
(2P)	1	OH-VTM	2 Dec 1987
(Demo)	1	OH-VTS	20 Jul 1993
Eritrea	8	209*	22 Nov 1993
Finland	10	RG-1	15 May 1992
Mexico (Navy)	10	MAT-042	23 Nov 1992
Total	**31**		

*Eritrean Air Force serial numbers run backwards
*Later with new rear fuselage, first flight 29 Dec 1989

DESIGN FEATURES: Designed to FAR Pt 23; also MIL-A-8866B fatigue spectrum and 30,000 landings in heavy military use, intended to cover training syllabus from primary to BAe Hawk level; additional roles can include search and rescue, photographic reconnaissance and weapons training.

Tapered wing with forward-swept inboard leading edges and turned-up tips; wing section NACA 63-218 (mod B3) at root, 63-412 (mod B3) at tip; dihedral 6° from roots; incidence 3°; twist −3°.

FLYING CONTROLS: Elevators, ailerons and rudder cable operated; geared tabs in elevators and rudder each also operate as trim tabs; Frise type ailerons, geared tab and spring tab in each aileron, starboard geared tab also trims; slotted flaps electrically actuated.

STRUCTURE: Fail-safe all-metal structure; wing has main and auxiliary spars; glassfibre used for engine cowlings, wingroot fairings, wingtips, tailcone and dorsal fin; wing fuel tanks of load-bearing sandwich construction; fluted aluminium skin on elevators and flaps.

LANDING GEAR: AP Precision Hydraulics electrohydraulically retractable tricycle type, with single wheel and oleo-pneumatic shock absorber on each unit. Nosewheel, centred by spring, retracts rearward; main units retract inward into wings. Spring-assisted lowering of all units in event of emergency. Mainwheel tyres size 6.00-6, nosewheel tyre size 5.00-5. Differential brakes on mainwheels. Parking brake. Minimum ground turning radius 5.00 m (16 ft 4¾ in).

POWER PLANT: One Allison 250-B17F turboprop (maximum power 373 kW, 500 shp), flat rated at 336 kW (450 shp), driving a Hartzell HC-B3TF-7A/T10173-15 three-blade constant-speed reversible-pitch propeller. Fuel in four wing tanks and a fuselage collector tank, total usable capacity 349 litres (92.2 US gallons; 76.8 Imp gallons). Maximum inverted flight time 30 seconds. Gravity refuelling point in top of each wing tank. Oil capacity 8.5 litres (2.25 US gallons; 1.9 Imp gallons).

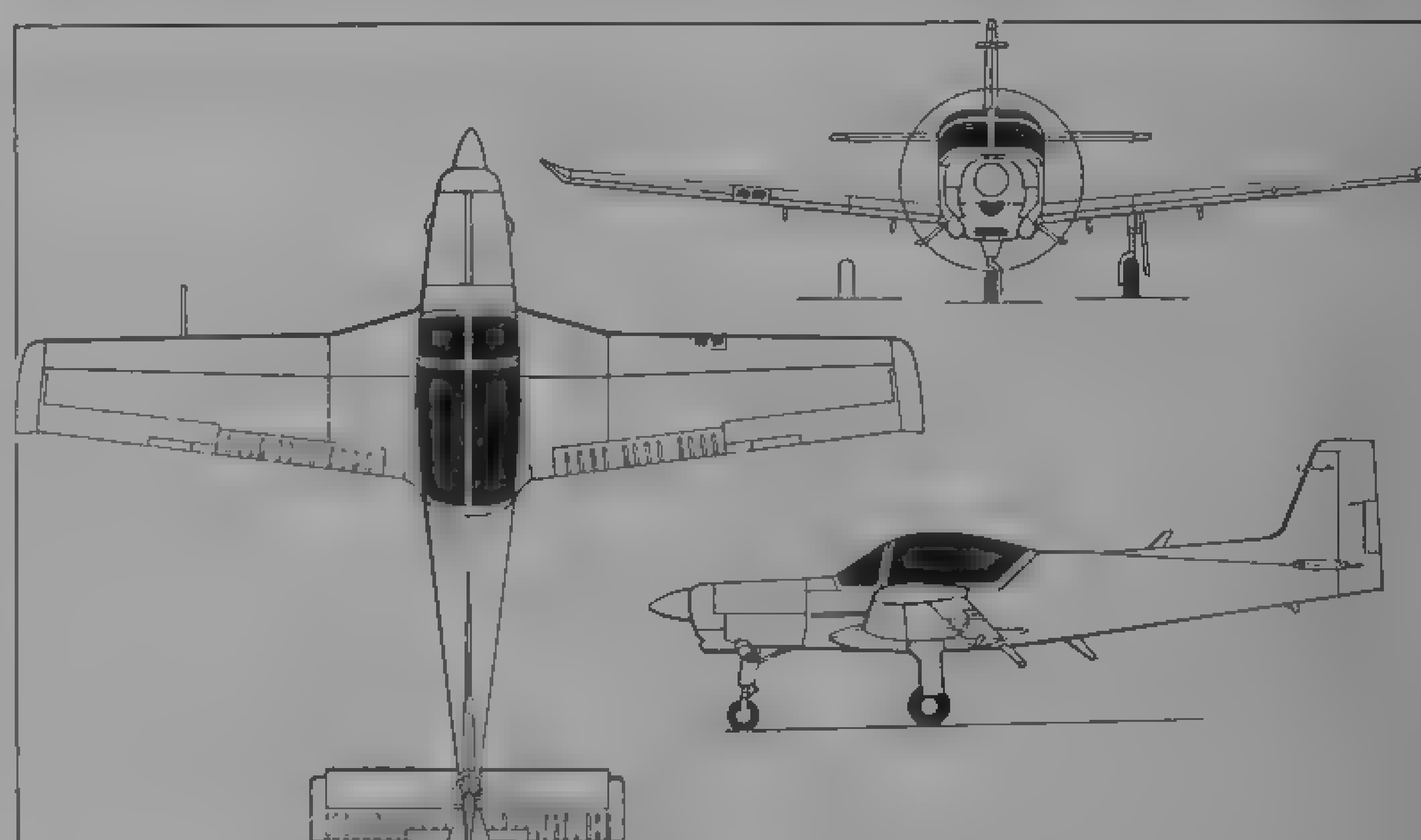
ACCOMMODATION: Instructor and pupil side by side on front seats, which are adjustable longitudinally and for rake and fitted with five-point seat belts and inertia reel shoulder harnesses. Provision for two more seats at rear, with four-point harnesses; these seats can be removed to make room for up to 200 kg (440 lb) of baggage. Dual controls standard, but instructor's or pupil's control column can be removed if desired. One-piece rearward-sliding jettisonable canopy with steel tube turnover windscreen frame. Zero/zero rocket-assisted escape system optional. As ambulance, can accommodate one stretcher patient, and a medical attendant or sitting patient, in addition to pilot. Accommodation heated by bleed air. Windscreen heated and ventilated by heat exchanger, fresh air intake and mixer unit. Auxiliary fresh air intake in fin leading-edge. Air conditioning system optional.

SYSTEMS: Electrical system is 28 V DC, powered by a 200 A engine-driven starter/generator, with a 23 Ah Ni/Cd battery and an emergency battery. Ground power receptacle. Electrohydraulic unit for landing gear. Anti-icing for engine air intake, compressor front support and propeller blades. Oxygen system optional.

AVIONICS: Bendix/King Silver Crown and Collins Pro Line II avionics packages available.

Instrumentation: Day and night VFR and IFR operation.

EQUIPMENT: Six underwing attachments, each inner point stressed for 250 kg (551 lb) and the other four for 150 kg (331 lb) each; maximum external stores load 800 kg (1,764 lb). When flown solo, can carry up to four photographic, TV, radar or reconnaissance pods plus two flares. As two-seater, typical loads can include five liferafts or emergency packs and one searchlight pod, and photo and TV pods. Provision for target towing with winch and hit counters. Landing and taxying lights in starboard wing leading-edge.



Valmet L-90 TP Redigo turboprop-powered multistage trainer *(Jane's/Mike Keep)* *1994*

DIMENSIONS, EXTERNAL:

Wing span	10.60 m (34 ft 9¼ in)
Wing chord: at root	1.827 m (6 ft 0 in)
mean aerodynamic	1.497 m (4 ft 11 in)
at tip	1.109 m (3 ft 7⅝ in)
Wing aspect ratio	7.62
Length overall	8.53 m (27 ft 11¾ in)
Fuselage: Max width	1.22 m (4 ft 0 in)
Height overall	3.20 m (10 ft 6 in)
Elevator span	3.684 m (12 ft 1 in)
Wheel track	3.367 m (11 ft 0½ in)
Wheelbase	2.112 m (6 ft 11¼ in)
Propeller diameter	2.194 m (7 ft 2⅜ in)
Propeller ground clearance	0.283 m (11⅛ in)

DIMENSIONS, INTERNAL:

Cockpit: Length	2.00 m (6 ft 6¾ in)
Max width	1.14 m (3 ft 9 in)
Height (seat cushion to canopy)	1.02 m (3 ft 4¼ in)

AREAS:

Wings, gross	14.748 m² (158.75 sq ft)
Ailerons (total, incl tabs)	1.996 m² (21.48 sq ft)
Trailing-edge flaps (total)	1.766 m² (19.01 sq ft)
Fin	0.718 m² (7.73 sq ft)
Rudder, incl tab	0.70 m² (7.53 sq ft)
Tailplane	1.609 m² (17.32 sq ft)
Elevators (total, incl tabs)	1.421 m² (15.30 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility, N: Normal category):

Weight empty, equipped	990 kg (2,183 lb)
Max fuel	303 kg (668 lb)
External stores: max	800 kg (1,764 lb)
with max fuel	600 kg (1,323 lb)
Max T-O weight: A	1,350 kg (2,976 lb)
U	1,470 kg (3,241 lb)
U (with external stores)	1,900 kg (4,189 lb)
N	1,600 kg (3,527 lb)
Max landing weight	1,600 kg (3,527 lb)
Max wing loading: A	91.54 kg/m² (18.75 lb/sq ft)
U	99.67 kg/m² (20.41 lb/sq ft)
U (with external stores)	128.83 kg/m² (26.39 lb/sq ft)
N	108.49 kg/m² (22.22 lb/sq ft)


Among the fourth generation combat aircraft,
has reliable fly-by-wire.
can deliver true simultaneous multirole capabilities.
is available before the end of the decade.
DASSAULT
AVIATION
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TEAM

Max power loading: A 4.02 kg/kW (6.61 lb/shp)
U 4.38 kg/kW (7.20 lb/shp)
U (with external stores) 5.66 kg/kW (9.31 lb/shp)
N 4.77 kg/kW (7.84 lb/shp)

PERFORMANCE (at Normal max T-O weight, ISA, with max internal fuel):
Max operating speed (VMO) 224 kts (415 km/h; 258 mph) CAS
Cruising speed at 3,050 m (10,000 ft):
max continuous power 191 kts (354 km/h; 220 mph)
75% of max continuous power 176 kts (326 km/h; 203 mph)
Stalling speed, engine idling:
flaps up 65 kts (120 km/h; 75 mph)
15° flap 60 kts (111 km/h; 70 mph)
35° flap 56 kts (104 km/h; 65 mph)
Max rate of climb at S/L 555 m (1,820 ft)/min
Time to height: 3,050 m (10,000 ft) 6 min 20 s
6,100 m (20,000 ft) 15 min 30 s
Service ceiling (engine limited) 6,340 m (20,800 ft)
T-O run 214 m (700 ft)
T-O to 15 m (50 ft) 366 m (1,200 ft)
Landing from 15 m (50 ft) 427 m (1,400 ft)
Landing run (without propeller reversal) 217 m (710 ft)
Range at 6,100 m (20,000 ft) with max internal fuel, 45 min reserves 645 n miles (1,195 km; 743 miles)
Endurance, conditions as above 6 h 20 min
g limits +7/−3.5 (Aerobatic)

UPDATED

FRANCE

AEDECO

AERONAUTICAL DESIGN COMPANY

1 rue de la Mission Marchand, F-75016 Paris
Telephone: 33 (1) 45 25 93 17
Fax: 33 (1) 50 40 98 56
MANAGING DIRECTOR: David Fabish

VERIFIED

IAR/AEDECO NOGA VI

Details of this twin-turbofan small executive aircraft design study appear under IAR/AEDECO heading in International section.

VERIFIED

AEROSPATIALE

AEROSPATIALE SNI

37 boulevard de Montmorency, F-75781 Paris Cedex 16
Telephone: 33 (1) 42 24 24 24
Fax: 33 (1) 42 24 26 19 and 45 24 54 14
Telex: AISPA 640025 F
CHAIRMAN AND CEO: Louis Gallois
EXECUTIVE VICE-PRESIDENT AND COO: Yves Michot
DEPUTY COO AND DIRECTOR, AIRCRAFT BUSINESS:
Claude Terazzoni
VICE-PRESIDENT, CORPORATE COMMUNICATION:
Patrice Kreiss
INFORMATION DEPARTMENT: André Bloch

Aerospatiale formed 1 January 1970 by French government-directed merger of Sud Aviation, Nord-Aviation and SEREB. Workforce 38,500, including 14,000 in Aircraft Business. New organisation from 1 January 1995, consists of three major businesses, plus unchanged Missiles Division (pending [illegible]

AIRCRAFT BUSINESS

DIRECTOR: Claude Terazzoni
PRESIDENT, AIRBUS OPERATION: Gerard Blanc
PRESIDENT, AEROSTRUCTURES OPERATION:
Jean Claude Chaussonnet
PRESIDENT, ATR OPERATION: Antoine Bouvier
PRESIDENT, SYSTEMS AND SERVICES OPERATION: Patrick Gavin
PRESIDENT, MAINTENANCE OPERATION: Pierre Vailles
PRESIDENT, SOCATA OPERATION: Jean-Marc de Raffin
DIRECTOR OF COMMUNICATIONS: Patrice Prevol
WORKS AND FACILITIES:
Toulouse
Nantes Bouguenais
Saint Nazaire and
Meaulte

HELICOPTER BUSINESS

PRESIDENT: Yves Michot
(See Eurocopter in International section)

SPACE AND DEFENCE BUSINESS

Formerly independent subsidiaries now subordinate to appropriate Operation.

Besides programmes listed below, Aerospatiale has 37 per cent share in Airbus Industrie (see International section); main Airbus assembly plant is at Aerospatiale base at Toulouse. Part holding in Aerospatiale (20 per cent) held by SOGEPA (which see).

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OTHER AIRCRAFT

Refer elsewhere in this section for Aerospatiale's light aircraft subsidiary **Socata**, and to International section for details of Aerospatiale involvement in **ATR** regional transport, **UHCA/VLCT** large transport, **EuroFLAG** military transport, **Eurofar** tilt-rotor, **Eurocopter** helicopters and **Supersonic Airliner** studies.

NEW ENTRY

AVIASUD

AVIASUD ENGINEERING SA

Zone Industrielle la Palud, F-83618 Fréjus Cedex
Telephone: 33 94 53 94 00
Fax: 33 94 52 12 23
Telex: 409 926
MANAGING DIRECTOR: Marc Mathot
TECHNICAL MANAGER: Bernard d'Otreppe

Details of the Sirocco single-seat microlight can be found in the 1992-93 *Jane's*. The company's latest aircraft is the AE 209 Albatros two-seat microlight, from which it is developing a version to be certificated under JAR-VLA as the AE 210 Alizé.

UPDATED

AVIASUD AE 206 MISTRAL

TYPE: Side by side two-seat microlight and ARV aircraft, designed to FAR Pt 23.

PROGRAMME: Designed for recreational flying but also suited to professional activities normally performed by high-cost conventional aeroplanes and helicopters, such as pilot training, aerial photography, TV and surveillance, banner towing and cropspraying. Design began 1983, prototype first flight May 1985; first production aircraft February 1986. An agricultural example sold to a Spanish operator has 125 litre (33 US gallon; 27.5 Imp gallon) underfuselage chemical tank.

CURRENT VERSIONS: **AE 206 Mistral**: *As detailed below.*

AE 206 US: Ultra-silent version with 3.48:1 reduction drive and larger propeller.

CUSTOMERS: 190 delivered by beginning of 1995.

COSTS: FFr220,000 (excluding VAT).

DESIGN FEATURES: Braced biplane. Wings have NACA 23012 section; leading-edge sweepback 6° 30′, dihedral 4°, incidence 7°, twist 0°.

FLYING CONTROLS: Mechanically actuated; all-moving lower wings, all moving tailplane with anti-balance tab (used also for pitch trim), and rudder.

STRUCTURE: Zicral circular-section wing spars and laminated wooden ribs, covered with PVF film; composites monocoque fuselage and fin, of glassfibre/polyester resin construction.

LANDING GEAR: Non-retractable tricycle type; floats and skis optional. Disc brakes.

POWER PLANT: One 47.7 kW (64 hp) Rotax 582 two-cylinder two-stroke engine with reduction gear, driving a three-blade fixed-pitch propeller. Fuel capacity 60 litres (16 US gallons; 13.2 Imp gallons).

DIMENSIONS, EXTERNAL:
Wing span 9.40 m (30 ft 10 in)
Wing chord, constant 0.86 m (2 ft 10 in)
Length overall 5.66 m (18 ft 6¾ in)
Height overall 2.25 m (7 ft 4½ in)
Tailplane span 2.70 m (8 ft 10¼ in)
Wheel track 1.84 m (6 ft 0½ in)
Wheelbase 1.42 m (4 ft 8 in)
Propeller diameter: normal 1.65 m (5 ft 5 in)
US version 1.75 m (5 ft 9 in)

AREAS:
Wings, gross 16.39 m² (176.42 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 205 kg (452 lb)
Baggage capacity 20 kg (44 lb)
Max T-O and landing weight 390 kg (860 lb)
Max wing loading 23.8 kg/m² (4.87 lb/sq ft)
Max power loading 8.18 kg/kW (13.44 lb/hp)

PERFORMANCE (at max T-O weight):
Never-exceed speed (VNE) 89 kts (165 km/h; 103 mph)
Max level speed 84 kts (155 km/h; 96 mph)
Max cruising speed 72 kts (133 km/h; 83 mph)
Econ cruising speed 49 kts (90 km/h; 56 mph)
Stalling speed 33 kts (60 km/h; 38 mph)
Max rate of climb at S/L 232 m (760 ft)/min
Service ceiling 4,575 m (15,000 ft)
T-O run 80 m (262 ft)
T-O to 15 m (50 ft) 200 m (657 ft)
Landing from 15 m (50 ft) 225 m (739 ft)
Range, no reserves 286 n miles (530 km; 329 miles)

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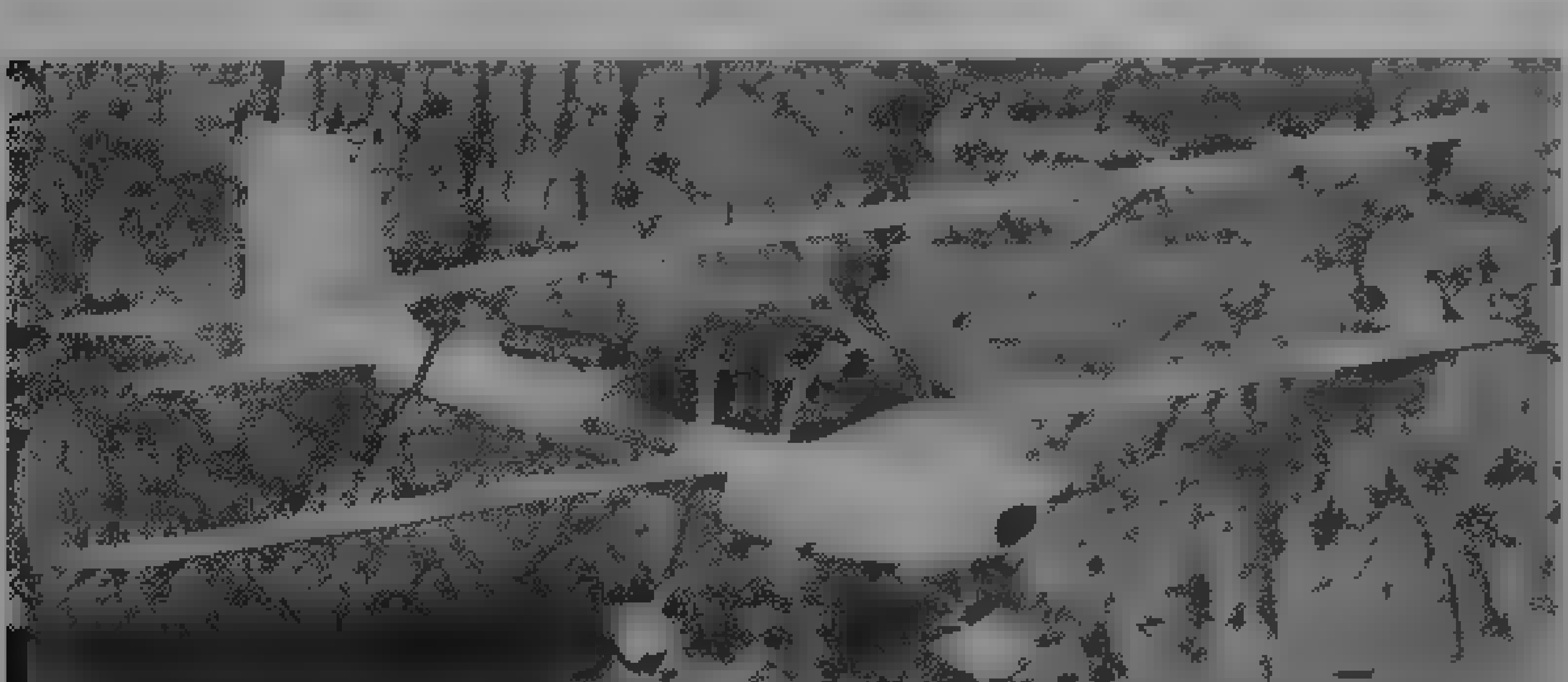
AVIASUD AE 207 MISTRAL TWIN

TYPE: Twin-engined derivative of Mistral.

CUSTOMERS: Twenty five sold by February 1994.

COSTS: FFr276,000 (excluding VAT).



Aviasud AE 206 Mistral (47.7 kW, 64 hp Rotax 582) *1993*

Aviasud AE 207 Mistral Twin with Rotax 503 second engine above wing *1993*

DESIGN FEATURES: Developed specially for aerial advertising and surveillance work, this is a standard Mistral fitted with a Rotax 582 engine forward and carrying a Rotax 503 in pusher configuration above the upper wing

WEIGHTS AND LOADINGS

Weight empty	199-230 kg (439-507 lb)
Max T-O weight	450 kg (992 lb)

PERFORMANCE

Max rate of climb at S/L	216 m (710 ft)/min

VERIFIED

AVIASUD AE 209 ALBATROS

TYPE: Two-seat microlight

PROGRAMME: Design started 1988, prototype first flight March 1991

CUSTOMERS: Sixty ordered by early 1995

COSTS: FFr140,000 with Rotax 503, FFr185,000 with Rotax 582

DESIGN FEATURES: Braced high-wing monoplane, T tail, panoramic visibility, forgiving flying characteristics, folding wings (under one minute). Wings NACA 63018 section, sweepback 2°; dihedral 0° 30′, twist 0°

FLYING CONTROLS: Mechanical actuation; ailerons, all-moving tailplane with tab for trim and anti-balance, rudder

STRUCTURE: Wing spars and control surfaces of carbonfibre remainder of airframe glassfibre/polyester or epoxy resin

LANDING GEAR: Non-retractable tailwheel type, hydraulic disc brakes. Optional retractable skis

POWER PLANT: One 37.3 kW (50 hp) Rotax 503 flat-twin engine, with 2.58:1 reduction drive to two-blade pusher propeller (optional 4:1 reduction); alternative 47.7 kW (64 hp) Rotax 582 flat-twin (2.58:1 or 3.47:1 reduction drive) or 59.7 kW (80 hp) Rotax 912 flat-four with 2.27:1 reduction drive and three-blade propeller. Fuel capacity 60 litres (16 US gallons; 13.2 Imp gallons)

DIMENSIONS, EXTERNAL:

Wing span	9.70 m (31 ft 10 in)
Wing chord, constant	1.45 m (4 ft 9 in)
Wing aspect ratio	6.77
Length overall	7.36 m (24 ft 1¾ in)
Height overall	2.13 m (7 ft 0 in)
Tailplane span	2.42 m (7 ft 11¼ in)
Wheel track	1.52 m (5 ft 0 in)
Wheelbase	5.25 m (17 ft 2¾ in)
Propeller diameter: two-blade	1.62 m (5 ft 3¾ in)
three-blade	1.70 m (5 ft 7 in)

AREAS:

Wings, gross	13.90 m² (149.62 sq ft)

WEIGHTS AND LOADINGS (Rotax 582 engine):

Weight empty	230 kg (507 lb)
Fuel weight	42 kg (92.6 lb)
Max T-O and landing weight	450 kg (992 lb)
Max wing loading	32.37 kg/m² (6.63 lb/sq ft)
Max power loading	9.43 kg/kW (15.50 lb/hp)

PERFORMANCE (Rotax 582 engine):

Never exceed speed (VNE)	100 kts (185 km/h; 115 mph)
Max level speed	86 kts (160 km/h, 99 mph)
Max cruising speed	76 kts (140 km/h, 87 mph)
Econ cruising speed	49 kts (90 km/h, 56 mph)
Stalling speed	35 kts (64 km/h, 40 mph)
Max rate of climb at S/L	251 m (825 ft)/min
Service ceiling	4,575 m (15,000 ft)
T-O run	75 m (246 ft)
T-O to 15 m (50 ft)	250 m (821 ft)
Landing from 15 m (50 ft)	280 m (919 ft)
Landing run	65 m (214 ft)
Range, no reserves	280 n miles (520 km; 323 miles)

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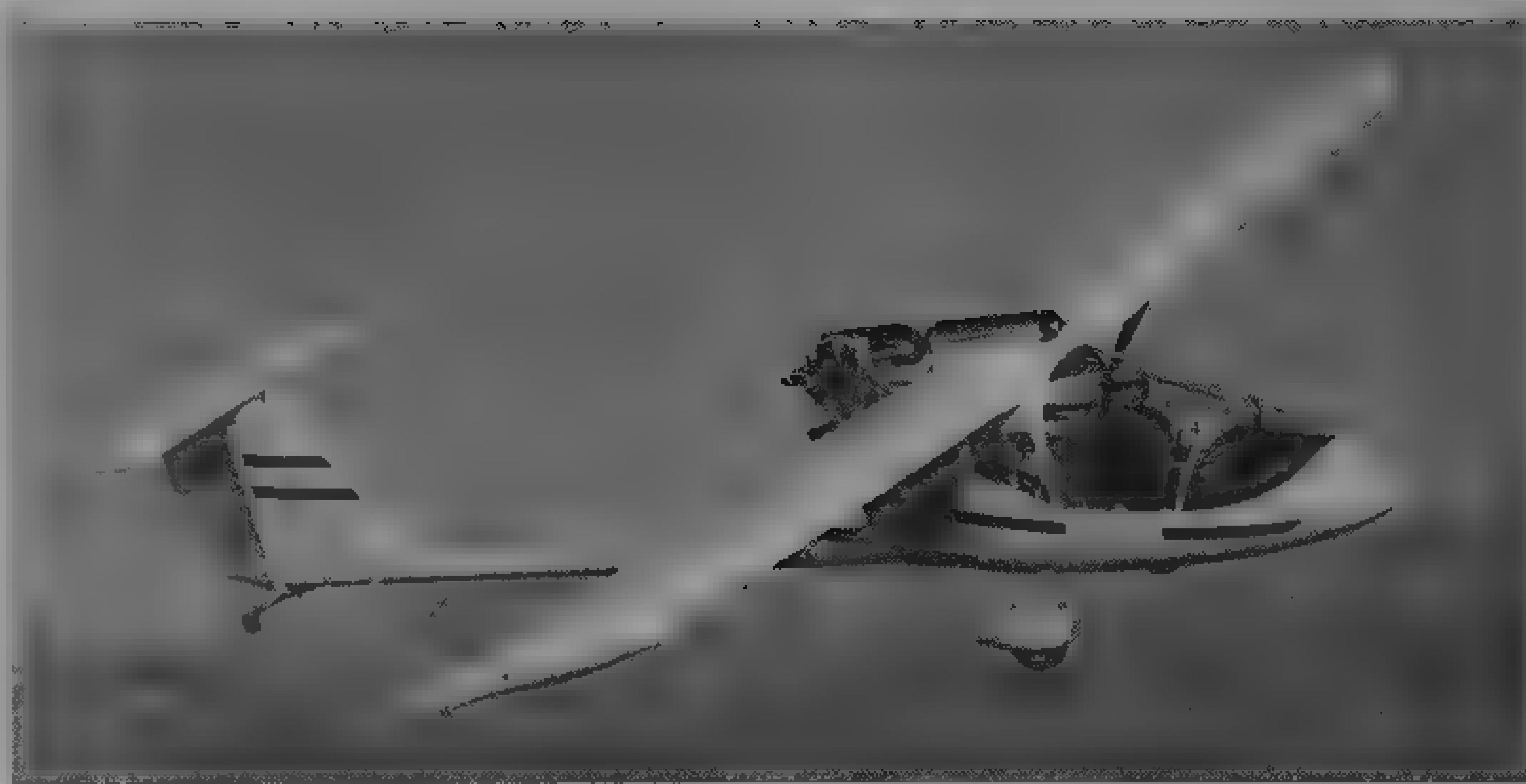

Aviasud AE 209 Albatros

1993

DASSAULT

DASSAULT AVIATION

9 Rond Point Champs Elysées-Marcel Dassault, F-75008 Paris
Telephone: 33 (1) 43 59 14 70
Fax: 33 (1) 42 56 22 49
PRESS INFORMATION OFFICE: 27 rue du Professeur Pauchet, F-92420 Vaucresson
Telephone: 33 (1) 47 95 85 85
Fax: 33 (1) 47 41 67 89

WORKS: F-92214 St Cloud, F-95101 Argenteuil, F-78141 Vélizy-Villacoublay, F-33127 Martignas, F-33701 Bordeaux-Mérignac, F-33630 Cazaux, F-64205 Biarritz-Parme, F-13801 Istres, F-74371 Argonay, F-59472 Lille-Seclin, F-86000 Poitiers

CHAIRMAN AND CEO: Serge Dassault

VICE-PRESIDENT ENGINEERING, RESEARCH, CO-OPERATION: Bruno Revellin Falcoz

VICE-PRESIDENT ECONOMICS AND FINANCE: Charles Edelstenne

VICE-PRESIDENT INDUSTRIAL AND SOCIAL AFFAIRS: Michel Herchin

SENIOR VICE-PRESIDENT INTERNATIONAL AFFAIRS: Pierre Chouzenoux

DIRECTOR OF COMMUNICATIONS: Jean-Pierre Robillard

Former Avions Marcel Dassault-Breguet Aviation formed from merger of Dassault and Breguet aircraft companies in December 1971. French government acquired 20 per cent of stock in January 1979, raised to 46 per cent in November 1981, present company name adopted April 1990. Some shares hold double voting rights so that French government has majority control, with 55 per cent. On 17 September 1992, Dassault joined with Aerospatiale in state-owned joint holding company, SOGEPA (which see), which has 35 per cent holding in Dassault Aviation. Dassault and Aerospatiale now pool resources and co-ordinate R&D strategy, although each remains separate entity

Employees in 1995 totalled 11,700. Business divided 75 per cent military, and 25 per cent civil and space. Dassault assembles and tests its civil and military aircraft in its own factories, but operates wide network of subcontractors. Other products include flight control system components, maintenance and support equipment and CAD/CAM software (CATIA). Dassault Aviation is component of Dassault Industries, which also includes Dassault Falcon Service, Dassault Belgique Aviation and Dassault Electronique

Dassault Aviation has shared in Atlantique programme with Belgium, Germany and Italy, SEPECAT (Jaguar) with UK, and Alpha Jet with Dornier. Offset manufacture of Dassault aircraft components arranged with Spain, Belgium, Greece and Egypt. Dassault makes fuselages for Fokker at Biarritz-Parme

Dassault has produced 1,100 executive jets and received orders for over 2,700 Mirages of all types, over 6,500 aircraft built since 1945

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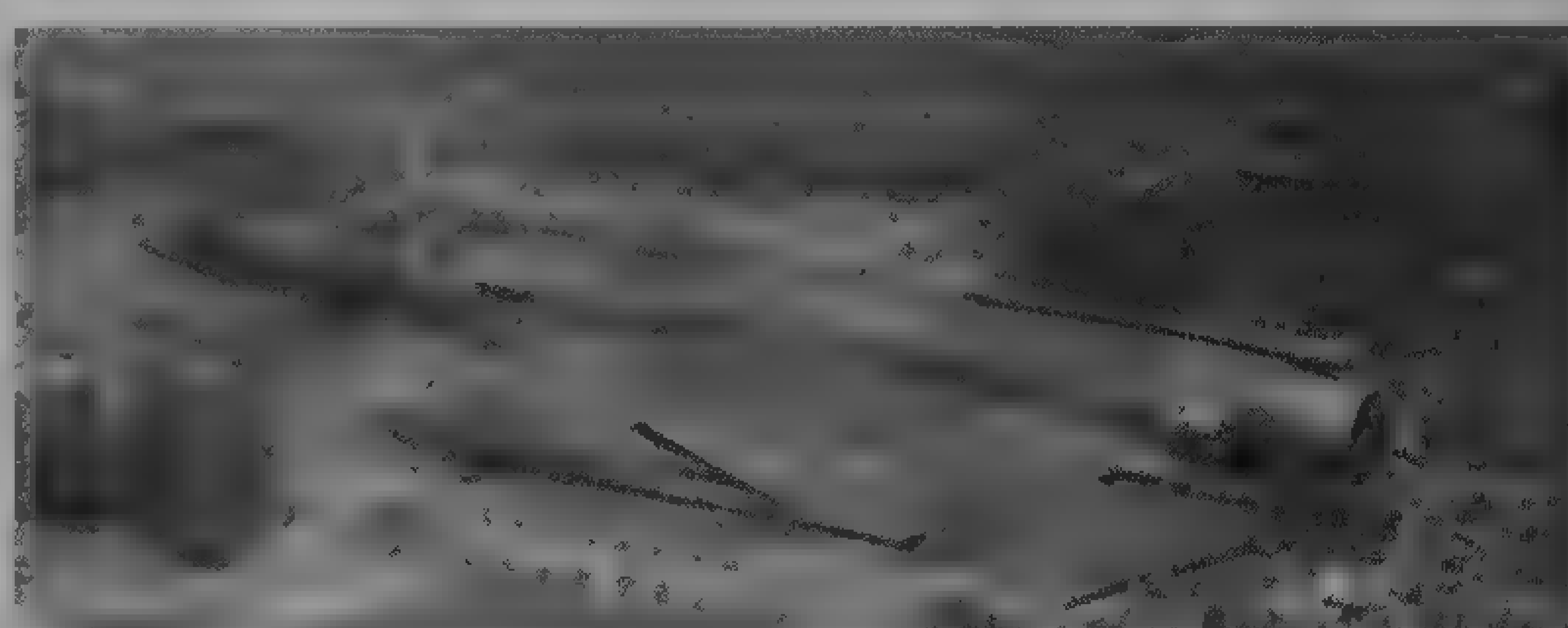


Dassault Mirage 2000N-K2 in conventional attack role with EC 2/3 *(Paul Jackson)*

1994

DASSAULT MIRAGE 2000

Indian Air Force name: Vajra (Divine Thunder)

TYPE: Multirole fighter

PROGRAMME: Selected as main French Air Force combat aircraft 18 December 1975, first developed as interceptor with SNECMA M53 and Thomson-CSF RDM multimode pulse Doppler radar; M53-5 in early production aircraft succeeded by M53-P2; fitted with RDI radar from 38th French Air Force 2000C onwards; first flight of production 2000C 20 November 1982, first flight of production two-seat 2000B, 7 October 1983, first unit, EC 1/2 'Cigognes', formed at Dijon 2 July 1984

CURRENT VERSIONS: **2000B:** Two-seat trainer counterpart of 2000C, Nos. 501-514 (Series) S3 with RDM radar and M53-5 power plant, Nos. 515-520, S4 with RDI J1-1 radar and M53-5, but Nos. 516 and 517 retrofitted with RDM, No. 521 S4-2 with RDI J2-4 and M53-5, No. 522 also S4-2, but M53-P2, Nos. 523-532 S5 with RDI J3-13 and M53-P2. See also Mirage 2000DA below

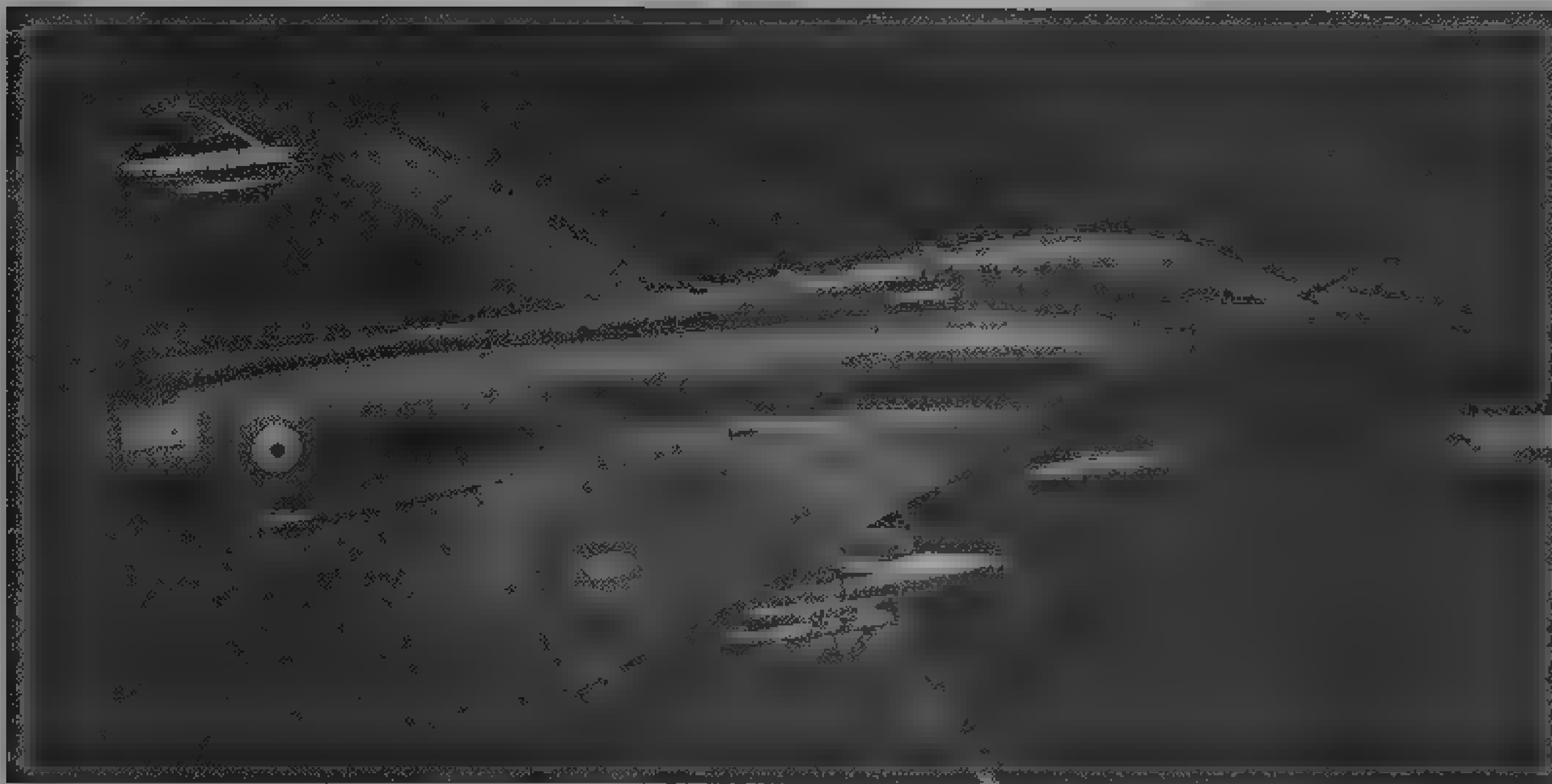
2000BOB: (Banc Optronique Biplace — Two-seat Optronics Testbed). Mirage 2000B No. 504 flown 28 June 1989 after modification by CEV at Brétigny-sur-Orge, trials of Rubis FLIR, VEH-3020 holographic HUD, night vision goggles and other electro-optical systems. Fitted with OBOGS

2000C: Standard interceptor, Nos. 1-37 built as series S1, S2 and S3 with RDM radar and M53-5 power plants, since upgraded to S3 radar standard. Loosely called Mirage **2000RDM**; Mirage 2000B and C collectively known as Mirage **2000DA** (Défense Aérienne). Surviving 30 offered to Pakistan early 1992, but not purchased. Later aircraft (loosely **2000RDI**) have RDI radar and M53-P2 power plants: Nos. 38-48 Series S4, delivered from July 1987 and later upgraded to S4-1, Nos. 49-63 S4-1, Nos 64-74 S4-2, Nos. 75-121 S5, beginning late 1990; total 121 delivered by late 1993. Equipment standards of Mirage 2000B/Cs are **S3**, incapable of launching Matra 530D (530F only), **S4** RDI J1-1 radar, **S4-1** retrofit of all S4s with improved J1-2, **S4-2** further radar upgrade to J2-4, **S4-2A** retrofit of all S4-1 and S4-2 aircraft (Nos. 38-74, 515 and 518-522) with HOTAS-type throttle and improved J2-5 radar; **S5** definitive standard with J3-13 radar and, from No. 93 onwards, Spirale chaff/flare dispenser. Conversion planned of 37 S5s to Mirage 2000C-5 (which see). *Detailed description applies to 2000C except where indicated*

2000D: Two-seat conventional attack version of 2000N, lacking ASMP missile interface and nose pitot but with Antilope 50 terrain-following/terrain-reference radar, GPS and improved ECM; first flight (D01, ex N01) 19 February 1991, second prototype, D02 (ex-N02), flown 24 February 1992, first 2000D (No. 601) delivered CEAM Mont de Marsan for trials 9 April 1993, first squadron, EC 1/3 'Navarre', achieved limited IOC (six aircraft only) 29 July 1993 at CEAM. EC 1/3 fully operational at Nancy on 31 March 1994

Initial six aircraft to 'interim baseline' configuration known as **R1N1L**, with ability to launch laser-guided weapons and Magic missiles only. Later **R1** aircraft (from No. 607) to have full range of French Air Force armament, while **R2** standard, from 1996-97, introduces Matra Apache stand-off weapons dispenser and full integrated self-defence suite

2000E: Multirole fighter for export; M53-P2 power plant throughout. Details in Customers paragraph. Baseline version for India, Egypt and Peru, differences from 2000C including RDM radar with CW illumination for Super 530D AAM, two main computers with expanded memory, modified digital databus, ULISS 52 INS, improved ECM (integrated system with VCM 65 display or, alternatively, Remora and Caiman pods), VE-130 HUD, VMC 180 head-down, and expanded weapon



Mirage 2000D of CEAM, equipped with AS 30L missile, PDLCT laser designator, two Magic AAMs *(SIRPA Air/J. P. Gauthier)*

1995

options. Abu Dhabi and Greek 2000Es have extra computing power, further armament options and improved self defence (SAMET system for Abu Dhabi, ICMS for Greece)

2000ED: Two-seat trainer counterpart of 2000E

2000N: Two-seat low altitude penetration version to deliver ASMP nuclear stand-off missile; two prototypes, first flight 3 February 1983, first 25 production aircraft (Nos. 301-325) were 2000N K1 with ASMP capability only, from July 1988 remaining aircraft, designated 2000N-K2, have full conventional and ASMP capability, production ended 1993, some K1s (of squadrons 3/4 and part of 2/4) retrofitted with partial air-to-ground capability for conventional attack. Equipment includes Antilope 5 terrain-following radar, two SAGEM inertial platforms, two improved TRT AHV-12 radio altimeters, Thomson-CSF colour CRT, Omera vertical camera, two Magic self defence missiles, and ICMS (integrated countermeasures system) comprising Sabre jamming system, Serval RWR and Spirale automatic chaff/flare dispenser system

2000N' (N Prime): Initial designation of 2000D

2000R: Single-seat day/night reconnaissance export version of 2000E but with normal radar nose, various sensor pods possible (see Avionics paragraph)

2000-3: Private venture upgrade, begun 1987, with Rafale-type multifunction (five-CRT) cockpit displays known as APSI (advanced pilot system interface); prototype BY1/F-ZJTB (ex-No. B01) flew 10 March 1988. Later received RDY radar

2000-4: Private venture integration of Matra Mica AAM. First guided flight against target drone, 9 January 1992

2000-5: Multirole upgrade incorporating -3 and -4 improvements, plus Thomson-CSF RDY radar and new central processing unit, Thomson-CSF VEH 3020 HUD and ICMS Mk 2 countermeasures, Matra Super 530D and BAe Sky Flash as alternatives to Mica, laser-guided bombs and ASMs, or Apache stand-off dispenser in air-to-ground role. First Mirage flight of RDY radar in BY1 (later numbered BY2) May 1988, first flight of full 2000-5 (two-seat) 24 October 1990 (same aircraft, initially no serial number; later reverted to B01); first single-seater, 01 (conversion of trials aircraft CY1) flown 27 April 1991. Options include SNECMA M88-P20 uprated by 4 per cent to 98.06 kN (22,046 lb st), available for export from 1996

FFr4,600 million ($830 million) conversion programme announced November 1992 for upgrading 37 late production French Air Force 2000Cs to **2000-5** standard for continued service, contract awarded 25 November 1993, only one reworked aircraft funded in 1994 defence budget, 10 more in 1995 funding, last to be completed in 2000. RDI radars from these upraded aircraft to be retrofitted in early production (RDM) Mirage 2000C's

2000S: Export attack version of 2000D; announced April 1989 for 1994 deliveries, but delayed to 1996, no known customers

CUSTOMERS: See table for rapid reference. France required seven prototypes and 372 production aircraft, reduced in late 1991 to 318 by abandonment of final 24 2000C's and 30 2000Ds and transfer of 11 single-seat aircraft to trainer contract, no Mirages funded in 1992 or 1993, but one 2000B and 14 2000C's cancelled, then re-ordered in 1994 defence budget as 2000Ds. French orders therefore total 32 2000Bs, 121 2000C's, 75 2000Ns and 90 2000Ds, with only deliveries of some of last-mentioned outstanding, final aircraft due in 2000. Mirage 2000C equipped three squadrons of EC 2 at Dijon (1984-86), three of EC 5 at Orange (1988-90) and two of EC 12 at Cambrai (squadron EC 1/12 'Cambresis' declared operational 28 April 1992, EC 2/12 'Picardie' on 1 September 1993, but conversion of EC 3/12 abandoned due to termination of production and one squadron of 2 Wing later disbanded)

Mirage 2000N deliveries began at Luxeuil 30 March 1988, EC 1/4 'Dauphine' formed 1 July 1988, now with full dual role K2 series aircraft; second (EC 2/4 'La Fayette') and third (EC 3/4 'Limousin') squadrons (both K1 aircraft) operational on 1 July 1989 and 1 July 1990 (latter detached to Istres); pending 2000D, EC 2/3 'Champagne' operational at Nancy 1 September 1991 with 2000N in conventional role. EC 1/3 'Navarre' fully operational with 2000D from 31 March 1994; EC 3/3 'Ardennes' began re-equipment, July 1994, EC 2/3 converts to 2000D (ex-2000N) 1995-96. Mirage 2000N depot servicing required every 900 hours or 36 months, whichever sooner

Egypt ordered 16 2000EMs and four BMs in December 1981, deliveries 30 June 1986 to January 1988, based at Bengal

India first ordered 36 2000Hs and four THs in October 1982; 26 Hs and four THs temporarily powered by M53-5, final 10 by M53-P2 from outset, first flight of 2000H (KF-101) 21 September 1984; first flight of 2000TH (KT-201) early 1985; No 7 IAF Squadron 'Battle Axe' formed at Gwalior AB 29 June 1985, coincident with first arrivals in India. Named Vajra (Divine Thunder), second Indian order for six Hs and three THs signed March 1986 and delivered April 1987 to October 1988 to complete No. 1 'Tigers' Squadron. Despite grey-and-blue air defence camouflage, unconfirmed report claimed Indian Mirages optimised for attack, with Antilope 5 radar and twin INS. By 1993 IAF aircraft appearing in brown-and-green low-level colours, with Spirale chaff dispensers and reinforced radomes

Peru ordered 24 2000Ps and two 2000DPs in December 1982, but reduced this to 10 2000Ps and two 2000DPs; first 2000DP handed over 7 June 1985, deliveries to Peru from December 1986, Escuadron 412 of Grupo Aéreo de Caza 4 at La Joya inaugurated 14 August 1987

Abu Dhabi ordered 18 aircraft on 16 May 1983 and took up 18 options in 1985 for a total of 22 2000EADs, eight 2000RADs and six 2000DADs, deliveries delayed from 1986 to 1989 by provision for US weapons such as Sidewinder; deliveries to Maqatra/Al Dhafra completed November 1990 for Nos 1 and 2 Shaheen (Warrior) Squadrons, Abu Dhabi 2000RADs carry COR2 multi camera pod, but alternatives include Raphael type SLAR 2000 or Harold pods, second 18 have Elettronica ELT/158 threat warning receivers and ELT/558 self-protection jammers; all with Spirale chaff/flare system. Self-defence suite code named SAMET. Deliveries 7 November 1989 to November 1990. Weapons include GEC-Marconi Hakim ASM

Greece ordered 36 2000EGMs and four 2000BGMs on 20 July 1985; handed over from 21 March 1988 and delivered from 27 April 1988 for 331 'Aegeas' and 332 'Geraki' Mire Pandos Kairou within 114 Pterix Mahis at Tanagra; deliveries suspended October 1989 at 28th aircraft, resumed 1992 and completed 18 November 1992. Spirale chaff/flare system installed, as part of ICMS self defence suite

Jordan ordered 10 2000EJs and two 2000DJs on 22 April 1988, all cancelled in August 199

Taiwan ordered 60 Mirage 2000-5s with M53-P2 power plants on 17 November 1992. First export sale for -5, deliveries begin 1996. Versions are 2000-5Ei (48 aircraft, single-seat) and 2000-5Di (12 aircraft, two-seat)

Qatar ordered 12 Mirage 2000-5s on 31 July 1994, together with Mica and Magic 2 AAMs and Apache stand off weapon. Versions are 2000-5EDA (nine, single-seat) and 2000-5DDA (three; two-seat). Delivery over three years from 1997

Total 547 firm orders (excluding seven prototypes and six company-owned trials and demonstrator aircraft) by 1 January 1995 (318 French, 229 exports), of which 404 delivered, including 157 exports. French deliveries at 1 January 1995 totalled 121 Cs, 30 Bs, 21 Ds and 75 Ns. Provisional agreement signed with Pakistan in January 1992 for 44 Mirage 2000Es, under further discussion in 1994-95

MIRAGE 2000 ORDERS

Customer	Qty	Version	First aircraft
Abu Dhabi	6	2000DAD	701
	8	2000RAD	711
	22	2000EAD	731
Egypt	16	2000EM	101
	4	2000BM	201
France	32	2000B	501
	121*	2000C	1
	90	2000D	601
	75	2000N	301
Greece	36	2000EG	210
	4	2000BG	201
India	42	2000H	KF101
	7	2000TH	KF201
Peru	10	2000P	050
	2	2000DP	193
Qatar	9	2000-5EDA	
	3	2000-5DDA	
Taiwan	48	2000-5E	
	12	2000-5D	
Sub-total	**547**		
Prototypes	7		
Development	6		
Total	**560**		

*37 being upgraded to 2000-5

COSTS: Programme unit costs: Greece $34.5 million

DESIGN FEATURES: Low-set thin delta wing with cambered section, 58° leading-edge sweep and moderately blended root, area ruled fuselage, cleared for 9g and 270°/s roll at sub- and supersonic speed carrying four air-to-air missiles

FLYING CONTROLS: Full fly-by-wire control with SFENA autopilot, two-section elevons on wing move up 16° and down 25°; inner leading-edge slat sections droop up to 17° 30′ and outer sections up to 30°, fixed strakes on intake ducts create vortices at high angles of attack that help to correct yaw excursions, small airbrakes above and below wings

STRUCTURE: Multispar metal wing, elevons have carbonfibre skins with AG5 light alloy honeycomb cores, carbonfibre/light alloy honeycomb panel covers avionics bay, most of

Dassault Mirage 2000N armed with Aerospatiale ASMP nuclear missile *(Paul Jackson)*

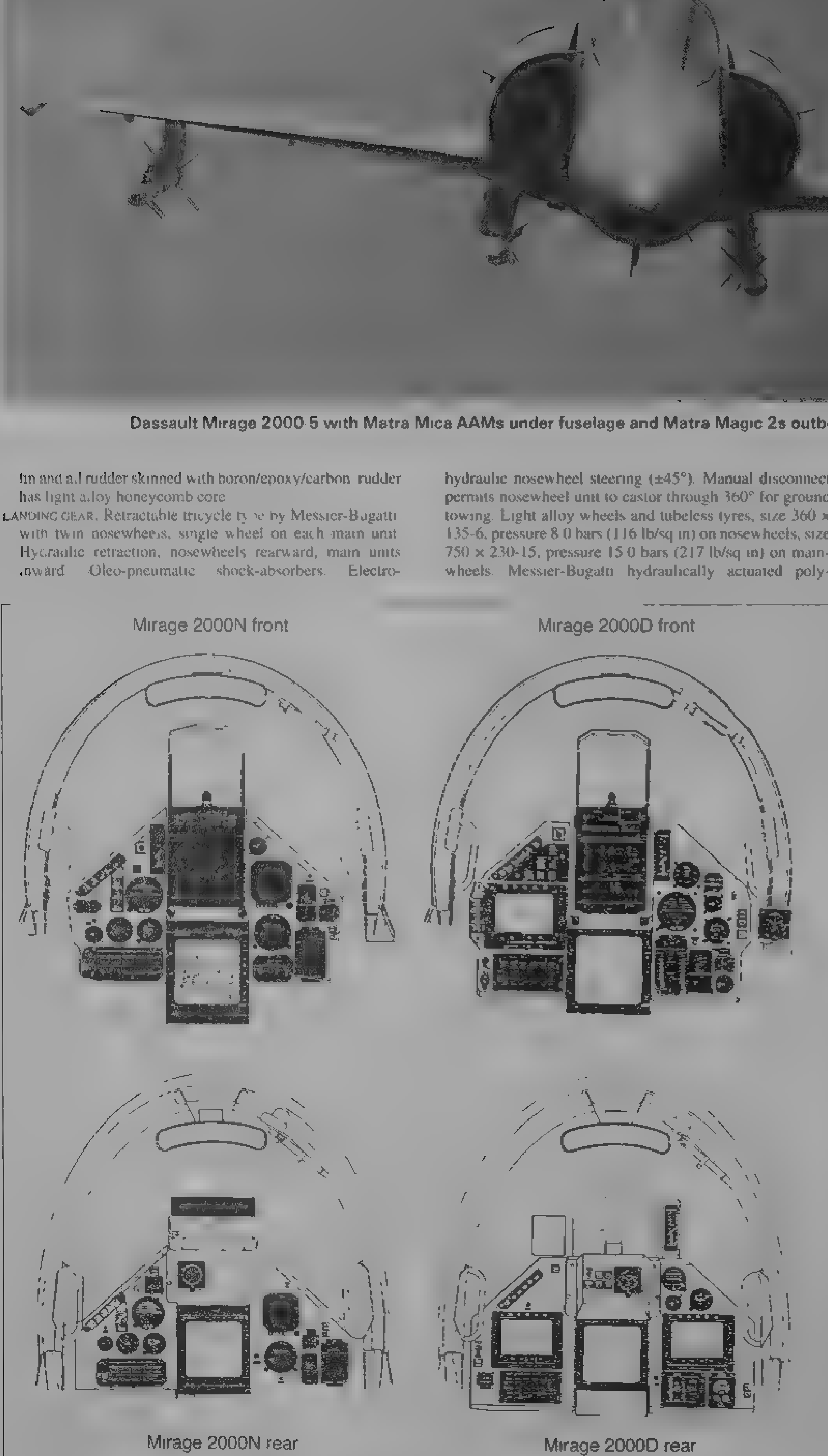
1995

Dassault Mirage 2000-5 with Matra Mica AAMs under fuselage and Matra Magic 2s outboard underwing *(Aviaplans/F. Robineau)*

1994

fin and all rudder skinned with boron/epoxy/carbon; rudder has light alloy honeycomb core

LANDING GEAR: Retractable tricycle type by Messier-Bugatti with twin nosewheels, single wheel on each main unit. Hydraulic retraction, nosewheels rearward, main units inward. Oleo-pneumatic shock-absorbers. Electro-hydraulic nosewheel steering (±45°). Manual disconnect permits nosewheel unit to castor through 360° for ground towing. Light alloy wheels and tubeless tyres, size 360 × 135-6, pressure 8.0 bars (116 lb/sq in) on nosewheels, size 750 × 230-15, pressure 15.0 bars (217 lb/sq in) on mainwheels. Messier-Bugatti hydraulically actuated polycrystalline graphite disc brakes on mainwheels, with anti-skid units. Compartment in lower rear fuselage for brake parachute, arrester hook or chaff/flare dispenser



Comparison of strike/attack Mirage 2000 cockpits

1995

POWER PLANT: One SNECMA M53-P2 turbofan, rated at 64.3 kN (14,462 lb st) dry and 95.1 kN (21,385 lb st) with afterburning or (available 1995) M53-P20 rated at 98.06 kN (22,046 lb st). Movable half-cone centrebody in each air intake

Internal wing fuel tank capacity 1,480 litres (391 US gallons; 326 Imp gallons); fuselage tank capacity 2,498 litres (660 US gallons, 549 Imp gallons) in single-seat aircraft, 2,424 litres (640 US gallons, 533 Imp gallons) in two-seat aircraft. Total internal fuel capacity 3,978 litres (1,050 US gallons, 875 Imp gallons) in 2000C and E, 3,904 litres (1,030 US gallons; 859 Imp gallons) in 2000B, N, D and S. Provision for one jettisonable 1,300 litre (343 US gallon, 286 Imp gallon) RPL-522 96 kg (212 lb) fuel tank under centre of fuselage, and a 1,700 litre (449 US gallon 374 Imp gallon) RPL 501/502 210 kg (463 lb) drop tank under each wing. Total internal/external fuel capacity 8,678 litres (2,291 US gallons, 1,909 Imp gallons) in 2000C and E, 8,604 litres (2,271 US gallons; 1,892 Imp gallons) in 2000B

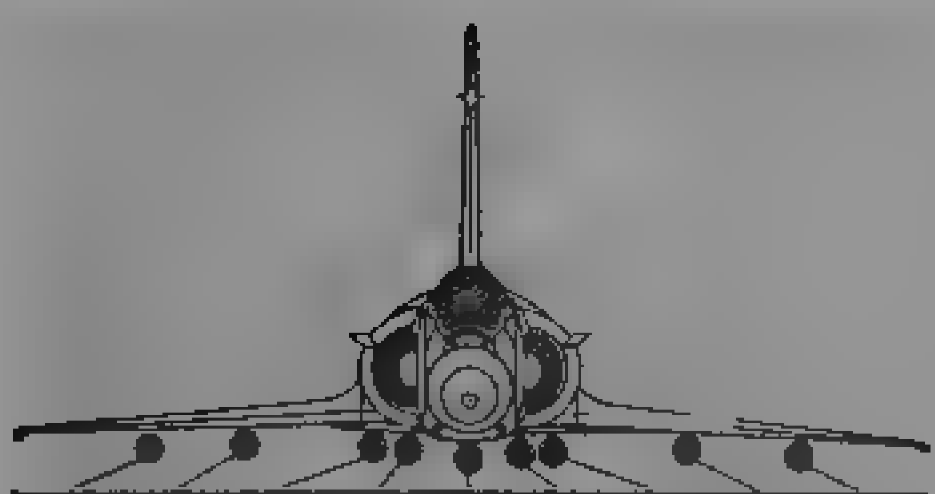
Detachable flight refuelling probe forward of cockpit on starboard side. Dassault type 541/542 tanks of 2,000 litres (528 gallons, 440 Imp gallons) are available for the 2000N, D and S wing attachments (and optional on 2000B/C), empty weight 240 kg (529 lb) each, increasing internal/external fuel to 9,204 litres (2,430 US gallons, 2,025 Imp gallons)

ACCOMMODATION: Pilot only in 2000C, on Hispano-Suiza licence-built Martin-Baker F10Q zero/zero ejection seat, in air conditioned and pressurised cockpit. Pilot initiated automatic ejection in two-seat aircraft, 500 ms delay between departures. Canopy hinged at rear to open upward and, on Mirage 2000D, covered in gold film to reduce radar signature.

SYSTEMS: ABG-Semca air conditioning and pressurisation system. Two independent hydraulic systems, pressure 280 bars (4,000 lb/sq in) each, to actuate flying control servo units, landing gear and brakes. Hydraulic flow rate 110 litres (29 US gallons; 24 Imp gallons)/min. Electrical system includes two Auxilec 20110 air-cooled 20 kVA 400 Hz constant frequency alternators (25 kVA in Mirage 2000D and 2000-5), two Bronzavia DC transformers, a SAFT 40 Ah battery and ATEI static inverter. Eros oxygen system

AVIONICS: *Comms:* TRT ERA 7000 V/UHF com transceiver, TRT ERA 7200 UHF or HQII or Thomson CNI SCP 5000 secure voice com, Thomson CNI NRAI-7A/NRAI-11 IFF transponder/interrogator

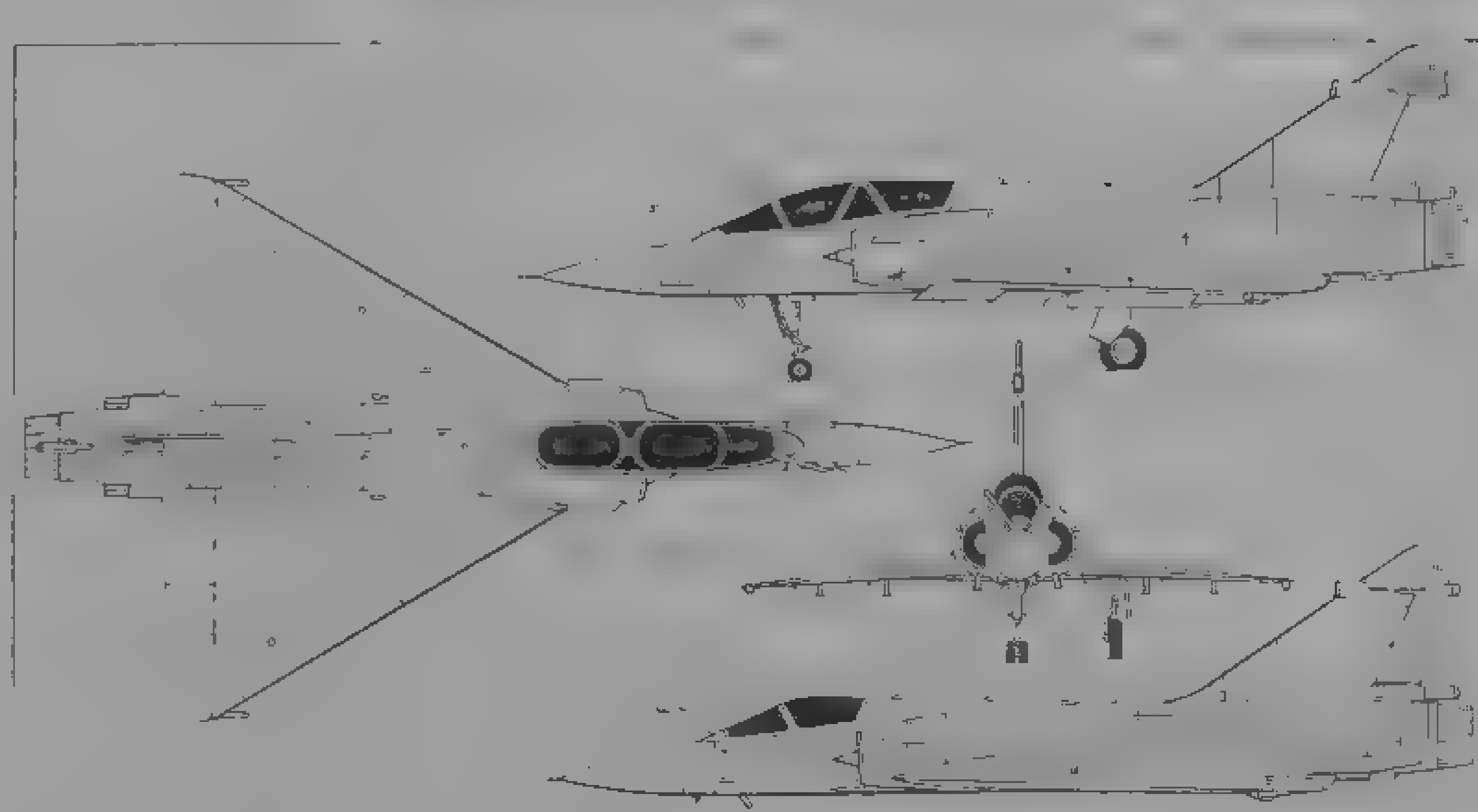
Radar: Thomson-CSF RDM multimode radar or Dassault Electronique/Thomson-CSF RDI pulse Doppler radar, each with operating range of 54 n miles (100 km; 62 miles). (Mirage 2000N/D have Dassault Electronique/Thomson-CSF Antilope terrain-following radar for automatic flight down to 61 m (200 ft) at speeds not exceeding



300	1 800	400	400	1 800	400	400	1 800	300	EXTERNAL LOADS (kg)
		●	●		●	●			MICA ACTIVE AIR-TO-AIR MISSILE
●	●						●	●	MAGIC IR MISSILE
	●						●		UNDERWING EXTRA FUEL TANK
				●					FUSELAGE EXTRA FUEL TANK
	●●●●	●	●	●●●●	●	●	●●●●		500 lb 250 kg BOMB
	●			●			●		2,000 lb 1,000 kg LASER GUIDED BOMB
		●	●	●●●●	●	●			DURANDAL BOMB
				18					BAP 100 PENETRATION BOMB
	●	●	●	●	●	●	●		BELUGA GRENADE DISPENSER
				●					F 2 PRACTICE BOMB LAUNCHER
●	●						●	●	F 4 (18) 68 mm ROCKET LAUNCHER
			●						E.O. OR I.R. WEAPON GUIDANCE POD
	●						●		AS 30 L LASER GUIDED MISSILE
				●					APACHE System
	●						●		ANTI-RADIATION MISSILE
	●						●		AIR-TO-SEA ACTIVE MISSILE
					●				FLIR POD
				●					TWIN GUN POD
				●					RECCE POD
				●					OFFENSIVE OR INTELLIGENCE ECM POD
				●					BUDDY REFUELLING POD

Mirage 2000-5 potential weapons options (excluding two internal 30 mm cannon and chaff/flare system)
1995

First test launch of Matra Apache from a Mirage 2000N
1995



Dassault Mirage 2000N, with added side view (bottom) of Mirage 2000C *(Jane's/Dennis Punnett)*
1993

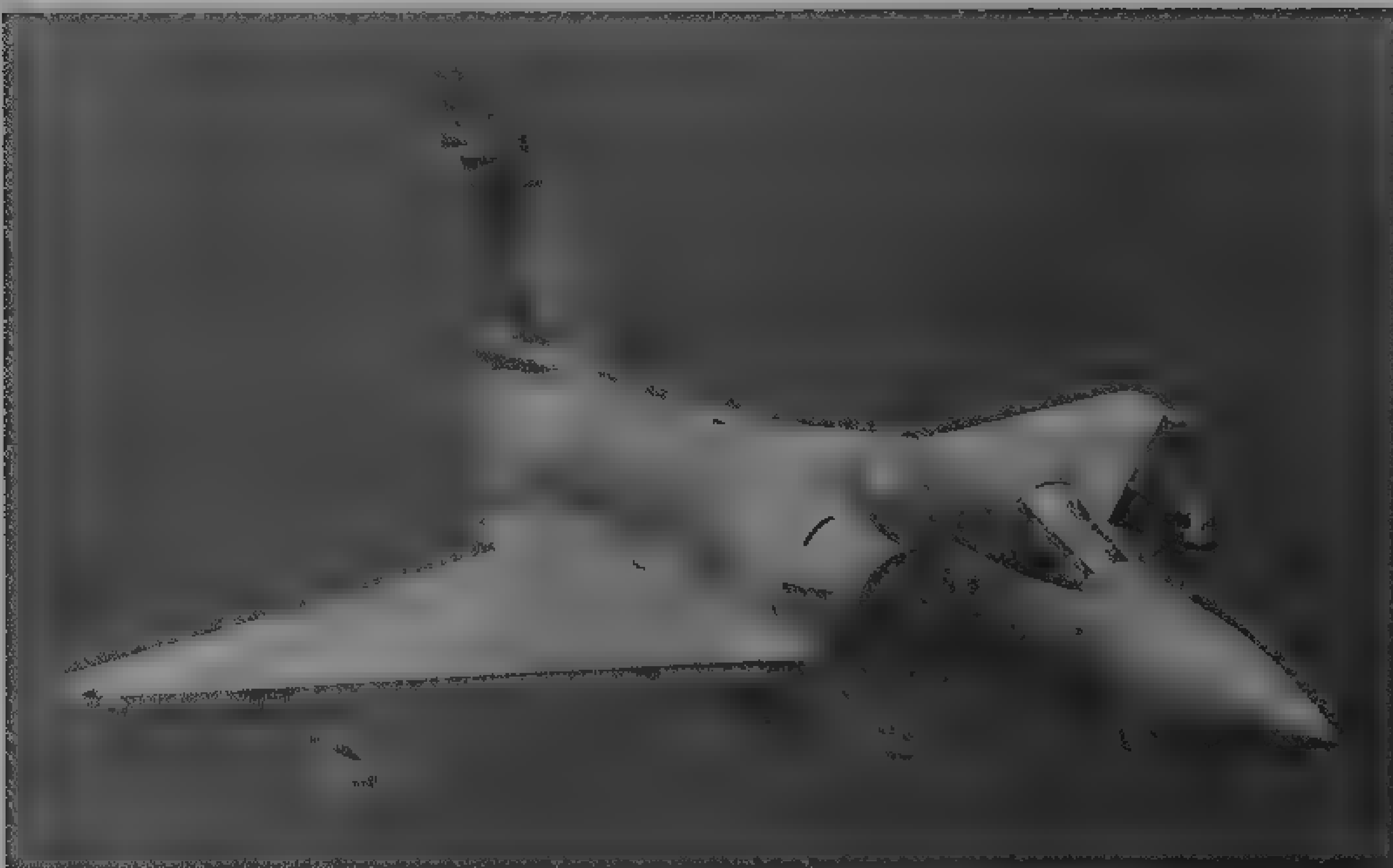
600 knots (1,112 km/h, 691 mph). Antilope 5 in 2000N includes altitude-contrast updating of navigation system Antilope 5-3C in 2000D has full terrain-reference navigation facility.) Thomson-CSF RDY multimode, multitarget radar in 2000-5

Flight SOCRAT 8900 solid state VOR/ILS and IO-300-A marker beacon receiver. TRT radio altimeter (AHV-6 in 2000B and C, AHV-9 in export aircraft, two AHV 12 in 2000N and AHV-17 in 2000-5). Thomson NC12 or Deltac Tacan. SAGEM Uliss 52 inertial platform (52E in 2000C and B 52D for export, and two 52P in 2000N/D, 52ES in 2000-5 plus integrated GPS in 2000D and 2000-5). Dassault Electronique Type 2084 central digital computer and Digibus digital databus (2084 XR in 2000D; XRI3 in 2000-5) SFENA 605 autopilot (606 in 2000N 607 in 2000D 608 in 2000-5)

Instrumentation. Sextant TMV-980 data display system (VE-130 head-up and VMC-180 head-down) (two head-down in 2000N/D). Sextant Comète multidisplay system in 2000-5

Mission Sensors of strike/attack and export versions include 570 kg (1,257 lb) Thomson-CSF Raphael SLAR pod, 400 kg (882 lb) Dassault COR2 multicamera pod or 680 kg (1,499 lb) Dassault AA-3-38 Harold long-range oblique photographic (Lorop) pod, 110 kg (243 lb) Dassault/TRT/Intertechnique Rubis FLIR pod; Thomson-CSF Atlis laser designator and marked target seeker (in pod on forward starboard underfuselage station), 340 kg (750 lb) Thomson-CSF PDLCT day/night (TV/thermal imaging) laser designator pod on Mirage 2000D (or CLDP/Atlis 2 on export aircraft); two 182 kg (401 lb) Thomson-CSF DB 3141/3163 Remora self-defence ECM pods, one 550 kg (1,213 lb), Thomson-CSF TMV 004 (CT51J) Caiman offensive or intelligence ECM pod and one 400 kg (882 lb) Thomson-CSF Astac ELINT (interferometer) pod

Self-defence: Systems in 2000C and 2000N include Thomson-CSF Serval radar warning receiver (antennae at each wingtip and on trailing edge of fin, near tip, plus VCM-65 cockpit display). Dassault Electronique Caméléon (2000N) or Sabre (2000C) jammer at base of fin (detector on fin leading-edge), and Matra Spirale comprising chaff dispensers in Karman fairings at wing trailing edge/fuselage intersection and flares in lower rear fuselage French Air Force DDM (Detecteur Depart Missile) missile plume detector requirement satisfied by 1994 purchase of SAT SAMIR system for 1995 fitment in rear of Magic launch rails (2000D/N first, but also to 2000Cs patrolling Bosnia). Spirale fitted to 2000N-K2, retrofitted to 2000N K1 and installed on 2000Cs from No. 93, earlier 2000Cs have Dassault Electronique Eclair system (Alkan LL5062 chaff and flare launcher) in place of braking parachute lacking automatic operation. Spirale on some export 2000Es. Upgrade planned of 2000E with ICMS Mk 1 (integrated countermeasures system, as in 2000EG) comprising RWR and SHR, Dassault Electronique/



Dassault Mirage 2000-5 single-seat prototype

1995

Thomson-CSF HBJ jammer (leading-edge of fin and bullet fairing at base of rudder) and Matra Spirale; automated ICMS Mk 2 of Mirage 2000-5 adds receiver/processor in nose to detect missile command links, extra pair of antennae near top of fin and additional DF antennae scabbed to existing wingtip pods (fin and secondary wingtip antennae also on Greek Mirage 2000s); ABD2000 export version of Sabre in some Mirage 2000Es

EQUIPMENT: Optional 250 kg (551 lb) Intertechnique 231-300 buddy type in flight refuelling pod

ARMAMENT: Two 30 mm DEFA 554 guns in 2000C and 2000E (not fitted in B, D, N or S), with 125 rds/gun. Nine attachments for external stores, five under fuselage and two under each wing. Fuselage centreline and inboard wing stations each stressed for 1,800 kg (3,968 lb) loads other four fuselage points for 400 kg (882 lb) each, and outboard wing points for 300 kg (661 lb) each. Typical interception weapons comprise two 275 kg (606 lb) Super 530D or (if RDM radar not modified with target illuminator) 250 kg (551 lb) 530F missiles (inboard) and two 90 kg (198 lb) 550 Magic or Magic 2 missiles (outboard) under wings. Alternatively, each of four underwing hardpoints can carry a Magic. Mica AAM (110 kg, 243 lb) optional on Mirage 2000-5. Primary weapon for 2000N is 900 kg (1,984 lb) ASMP tactical nuclear missile mounted on LM-770 centreline pylon. In air-to-surface role, the Mirage 2000 can carry up to 6,300 kg (13,890 lb) of external stores, including Matra 250 kg retarded bombs or 32.5 kg (72 lb) Thomson Brandt BAP 100 anti runway bombs; 16 Matra Durandal 219 kg (483 lb) penetration bombs; one or two 990 kg (2,183 lb) Matra BGL 1000 laser-guided bombs; five or six 305 kg (672 lb) Matra Belouga cluster bombs or 400 kg (882 lb) Thomson Brandt BM 400 modular bombs, one Rafaut F2 practice bomb launcher; US Mk 20, Mk 82, GBU 10 and GBU 12 bombs two 520 kg (1,146 lb) Aerospatiale AS 30L, Armat anti-radar, or 655 kg (1,444 lb) AM 39 Exocet anti-ship, air-to-surface missiles; four 185 kg (408 lb) Matra LR F4 rocket launchers, each with eighteen 68 mm rockets, two packs of 100 mm rockets, or a 765 kg (1,687 lb) Dassault CC 630 gun pod, containing two 30 mm guns and total 600 rounds of ammunition. Mirage 2000D and 2000-5 to receive 1,200 kg (2,646 lb) Apache standoff (81 n miles; 150 km, 93 mile) weapons dispenser in 1997. SCALP selected December 1994 to satisfy APTGD (Arme de Précision Tirée à Grande Distance) requirement for 216 to 324 n miles (400 to 600 km, 249 to 374 mile) range stealthy cruise missile, service entry in 2001. For air defence weapon training, a Cubic Corporation AIS (airborne instrumentation subsystem) pod, externally resembling a Magic missile, can replace Magic on launch rail, enabling pilot to simulate a firing without carrying actual missile

DIMENSIONS, EXTERNAL:

Wing span	9.13 m (29 ft 11½ in)
Wing aspect ratio	2.03
Length overall: 2000C, E, -5	14.36 m (47 ft 1¼ in)
2000B, N*	14.55 m (47 ft 9 in)
Height overall: 2000C, E, -5	5.20 m (17 ft 0¾ in)
2000B, N, D, S	5.15 m (16 ft 10¾ in)
Wheel track	3.40 m (11 ft 1¾ in)
Wheelbase	5.00 m (16 ft 4¾ in)

* *2000D, S and -5 versions lack nose pitot*

AREAS:

Wings, gross	41.0 m² (441.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: 2000C, E, -5	7,500 kg (16,534 lb)
2000B, N, D, S	7,600 kg (16,755 lb)
Max internal fuel: 2000C, -5	3,160 kg (6,967 lb)
2000B, N, D, S	3,100 kg (6,834 lb)
Max external fuel: 2000B, C, E, -5	3,720 kg (8,201 lb)
2000N, D, S	3,751 kg (8,270 lb)
Max external stores load	6,300 kg (13,890 lb)
T-O weight clean: 2000C, E, -5	10,860 kg (23,940 lb)
2000B, N, D, S	10,960 kg (24,165 lb)
Max T-O weight	17,000 kg (37,480 lb)
Max wing loading	414.63 kg/m² (84.97 lb/sq ft)

PERFORMANCE (M53-P2 power plant):

Max level speed: at height	Mach 2.2
at S/L	Mach 1.2
Max continuous speed: 2000C, E	Mach 2.2
2000N, D, S	Mach 1.4
Min speed in stable flight	100 kts (185 km/h, 115 mph)
Approach speed	140 kts (259 km/h, 161 mph)
Landing speed	125 kts (232 km/h, 144 mph)
Max rate of climb at S/L	17,060 m (56,000 ft)/min
Time to 15,000 m (49,200 ft) and Mach 2	4 min
Time from brake release to intercept target flying at Mach 3 at 24,400 m (80,000 ft)	less than 5 min
Service ceiling	16,460 m (54,000 ft)
Range: hi-hi-hi	1,000 n miles (1,852 km, 1,151 miles)
interdiction, hi-lo-hi	800 n miles (1,480 km, 920 miles)
attack, hi-lo-hi	650 n miles (1,205 km, 748 miles)
attack, lo-lo-lo	500 n miles (925 km, 575 miles)
with one 1,300 l and two 1,700 l drop tanks	1,800 n miles (3,333 km; 2,071 miles)
Operational loiter (2000-5) at Mach 0.8 at 7,620 m (25,000 ft) with three external tanks, four Mica and two Magic AAMs	2 h 30 min
Operational range (2000-5) for 5 min combat at Mach 0.8 at 9,145 m (30,000 ft) with four Mica and two Magic AAMs, tanks jettisoned	780 n miles (1,445 km, 898 miles)
g limits	+9.0/−4.5 normal
	+13.5/−9.0 ultimate

UPDATED

DASSAULT RAFALE (SQUALL)

TYPE: Two-seat Avion de Combat Tactique (French Air Force) or single-seat Avion de Combat Marine (French Navy) interceptor, multirole fighter and reconnaissance aircraft.

PROGRAMME: Ordered to replace French Air Force Jaguars and Navy Crusaders and Super Etendards, for early development history, see 1990-91 and earlier *Jane's*; first flight of Rafale A prototype (F-ZJRE) 4 July 1986, first flight with SNECMA M88 replacing one GE F404, 27 February 1990 (was 461st flight overall); 865th and final sortie, 24 January 1994. Rafale programme's 2,000th sortie, 5 September 1994. ACE International (Avion de Combat Européen) GIE set up in 1987 by Dassault Aviation, SNECMA, Thomson-CSF and Dassault Electronique partly to attract international partners, none found. Production launch officially authorised, 23 December 1992 (and 31 December 1992 for M88-2 power plant). First Rafale B and Rafale M ordered 26 March 1993. Four preproduction aircraft, as under:

C01: Single-seat Rafale C prototype, C01/F-ZWVR, ordered 21 April 1988, flown 19 May 1991, officially flight

Dassault Rafale A (top) making 865th and final sortie on 24 January 1994, accompanied by C01, M01, B01 and M02

1994

Three versions of Rafale in formation: B01, M01 and C01 *(Aviaplans/F. Robineau)*

1994

tested at CEV in October 1991, two months ahead of schedule; 100th sortie 12 May 1992.

M01: First navalised prototype, ordered 6 December 1988, flown 12 December 1991. Catapult trials ashore at US Naval Air Warfare Center, Patuxent River, and Lakehurst, 13 July/23 August 1992, second series of US trials 15 January/18 February 1993 followed by deck trials on *Foch*, first deck landing 19 April 1993, first deck launch 20 April 1993, although first take-offs with 'jump strut' nosewheel leg began in following month, third US trials series 18 November/16 December 1993, carrying external loads.

B01: Two-seat dual-control trainer Rafale B prototype, B01/F-ZWVS, ordered 19 July 1989 as first with RBE2 radar and Spectra defensive systems; first flight 30 April 1993, first flight with RBE2 7 July 1993.

M02: Second naval prototype, ordered 4 July 1990, first flight 8 November 1993; joint carrier trials with M01 aboard *Foch* (second series) 27 January/4 February 1994. Third series of deck trials (M02 only) aboard *Foch* begun 17 October 1994 for three weeks (total 28 launches including two at night); included maintenance, electromagnetic compatibility, RBE2 radar and Spectra ECM tests. Second Rafale C order (C02) not placed, abandoned 1991.

Test airframe, in Rafale M configuration, delivered to CEAT at Toulouse for ground trials 10 December 1991. French Air Force preference switched to operational two-seat (pilot and WSO) derivative of Rafale C in 1991, announced 1992 that 60 per cent of procurement to be two-seat, although extra cost results in cancellation of 16 aircraft.

Associated programmes include Thomson-CSF/Dassault Electronique electronic scanning RBE2 (Radar à Bayalage Electronique deux plans) multimode radar, ordered November 1989, test flights begun in Falcon 20, 10 July 1992, five Falcon 20s and four Mirage 2000s for RBE2 trials, plus final three Rafale prototypes. First RBE2 flight in Rafale 7 July 1993 (B01). Dassault Electronique/Thomson-CSF/Matra defensive aids package named Spectra (Système pour la Protection Electronique Contre Tous les Rayonnements Adverses); wholly internal IR detection, laser warning, electromagnetic detection, missile approach warning, jamming and chaff/flare launching, nine prototypes ordered, trials in Mirage 2000 from 1992, total weight 250 kg (551 lb). Development contract awarded 1991 for Thomson-TRT/SAT OSF (Optronique Secteur Frontal) with IRST, FLIR and laser rangefinder in two modules ahead of windscreen, surveillance, tracking and lock-on by port module, target identification, analysis and optical identification by starboard module, combined output in pilot's head-level display; installation in 41st and subsequent Rafales. DEFA 791 gun and Magic 2 AAMs first fired from Rafales on 5 March and 26 March 1993 respectively.

To accelerate programme, early Rafales for navy will be to SU0 interceptor standard, lacking ASMP, helmet mounted sight, OSF and voice command controls, definitive SU1 attack version will be delivered after 2000 to replace Super Etendards. Air force plans similarly limited capability for initial aircraft.

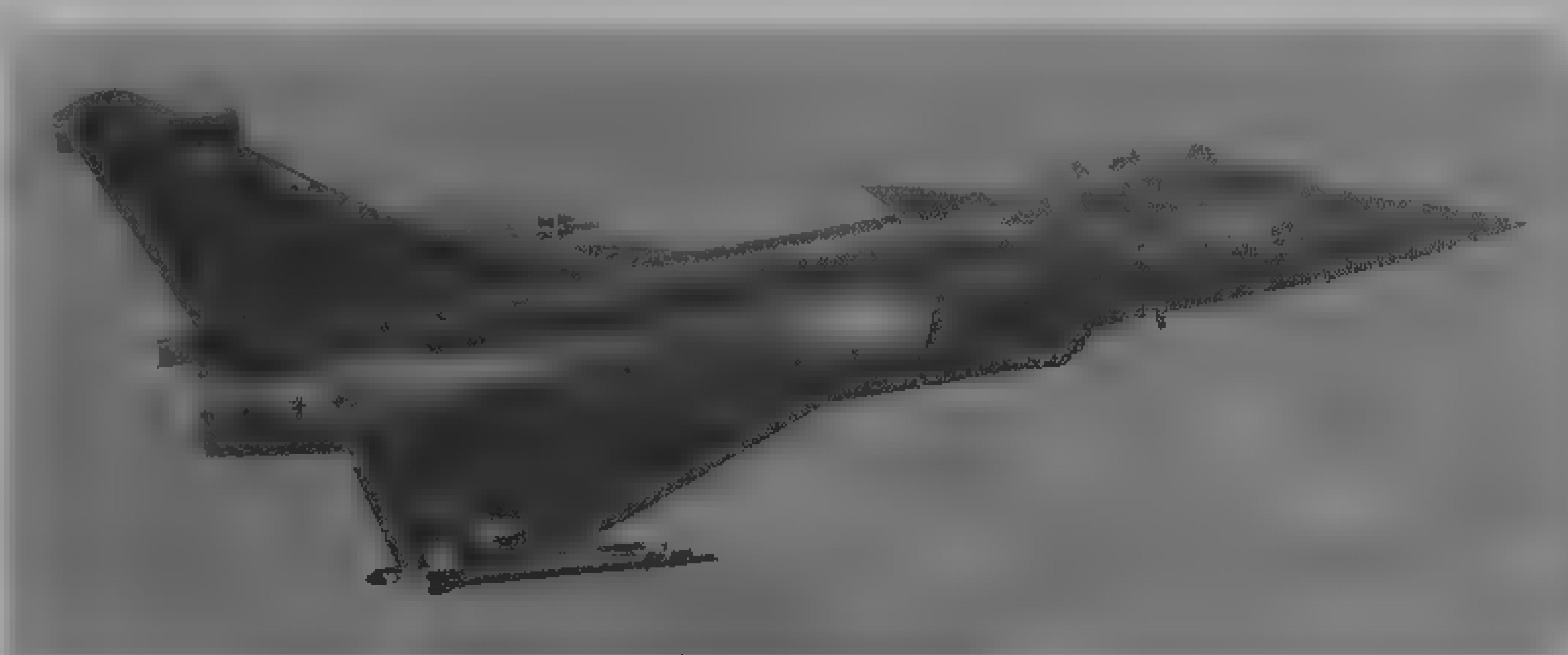
CURRENT VERSIONS: **Rafale B.** Originally planned dual control, two-seat version for French Air Force; weight 350 kg (772 lb) more than Rafale C, 3 to 5 per cent higher cost than Rafale C. Being developed into fully operational variant for either pilot/WSO or single pilot combat capability.

Rafale C: Single-seat combat version for French Air Force. *Detailed description applies to Rafale C, except where indicated.*

Rafale D: Original configuration from which production versions derived, now 'Rafale Discret' (stealthy) generic name for French Air Force versions.

Rafale M: Single-seat carrier-borne fighter; navalisation weight penalty, 610 kg (1,345 lb); take-off weight from existing French carrier *Foch* limited to 16,500 kg (36,376 lb); has 80 per cent structural and equipment commonality with Rafale C, 95 per cent systems commonality. Navy's financial share of French programme cut in 1991 from 25 to 20 per cent.

CUSTOMERS: Anticipated worldwide market for 500 aircraft in addition to originally planned 250 for French Air Force (225 Cs and 25 Bs) and 86 for French Navy; former service announced revised requirement for 234, comprising 95 Rafale Cs and 139 two-seat (pilot and WSO) combat versions, in 1992. First deliveries now expected February 1998 (18 months later than originally planned); 20 SU0/SU1-standard in naval service by 2000 for interceptor duties with 14 Flottille aboard *Foch*, replacing Crusaders, balance for delivery as S02s 2005-2009, replacing Super Etendards. Air Force deliveries originally planned for 1996-2009, including first 20 as S01s, two year postponement announced 1992, further slips in development programme delayed service-entry to early 2001. Official authorisation to launch production given 23 December 1992. Initial production contract in 1993 defence budget (formally awarded 26 March 1993), comprising one aircraft each for Air Force and Navy. Total 10 by 1995. Planned production of one Rafale in 1997, six in 1998, and five in 1999.



Dassault Rafale C prototype *(Aviaplans/F. Robineau)*

1995

Dassault Rafale C, with additional side views of carrierborne Rafale M (bottom) and two-seat Rafale B (top) *(Jane's/Dennis Punnett)*

1994

COSTS: Programme estimated at FFr155 billion (1991), including FFr40 billion for R&D, revised to FFr178 billion in 1993 and FFr198.4 billion in 1995 for 320 aircraft, R&D and industrialisation. (Naval share of programme is FFr48.71 billion in 1994 values.)

DESIGN FEATURES: Minimum weight and volume structure to hold minimum cost; thin, mid-mounted delta wing with moving canard; individual fixed, kidney-shaped intakes without shock cones.

FLYING CONTROLS: Fully fly-by-wire controls with fully modulated two-section leading-edge slats and two elevons per wing, canard incidence automatically increased to 20° when landing gear lowered, airbrake panels in top of fuselage beside leading-edge of fin. HOTAS controls, with sidestick controller on starboard console and small travel throttle lever.

STRUCTURE: Most of wing components made of carbonfibre including elevons, slats in titanium, wingroot and tip fairings Kevlar; canard made mainly by superplastic forming and diffusion bonding; fuselage 50 per cent carbonfibre; fuselage side skins of aluminium-lithium alloy, wheel and engine doors carbonfibre, fin made primarily of carbon fibre with aluminium honeycomb core in rudder.

LANDING GEAR: Hydraulically retractable tricycle type supplied by Messier Dowty, with single mainwheels and twin hydraulically steerable, nosewheels. All wheels retract forward. Designed for impact at vertical speed of 3 m (10 ft)/s, or 6.5 m (21 ft)/s in naval version, without flare-out. Michelin radial tyres. Mainwheel tyres size 810 × 275-15, pressure 16.0 bars (232 lb/sq in). Nosewheel tyre size 550 × 200-10. Messier-Bugatti carbon brakes on all three units, controlled by fly-by-wire system. Brake-chute for emergency use in cylindrical container at base of rudder. Rafale M has 'jump strut' nosewheel leg which releases energy stored in shock-absorber at end of deck take-off run, changing aircraft's attitude for climb-out without need for ski-jump ramp. 'Jump strut' advantage equivalent to 9 knots (16 km/h, 10 mph) or 900 kg (1,984 lb) extra weapon load, not to be used aboard carrier *Foch*, which to have 1° 30′ ramp giving 20 knots (37 km/h; 23 mph) or 2,000 kg (4,409 lb) advantage. Dowty Aerospace Yakima holdback fitting. Naval nosewheel steerable ±70°, or almost 360° under tow. Hydraulic (Rafale M) or tension-stored (Rafale B/C) arrester hook.

RAFALE M DECK TRIALS

Campaign	LAND Dates	LAND Location	LAND Aircraft	SEA Dates	SEA Location	SEA Aircraft
First	13 Jul - 23 Aug 1992	Patuxent & Lakehurst	M01	19 Apr - 7 May 1993	FNS *Foch*	M01
Second	15 Jan - 18 Feb 1993	Lakehurst	M01	27 Jan - 7 Feb 1994 and	FNS *Foch*	M01, M02
				11 Apr - 3 May 1994	FNS *Foch*	M01, M02
Third	18 Nov - 16 Dec 1993	Lakehurst	M01	17 Oct - Nov 1994	FNS *Foch*	M02

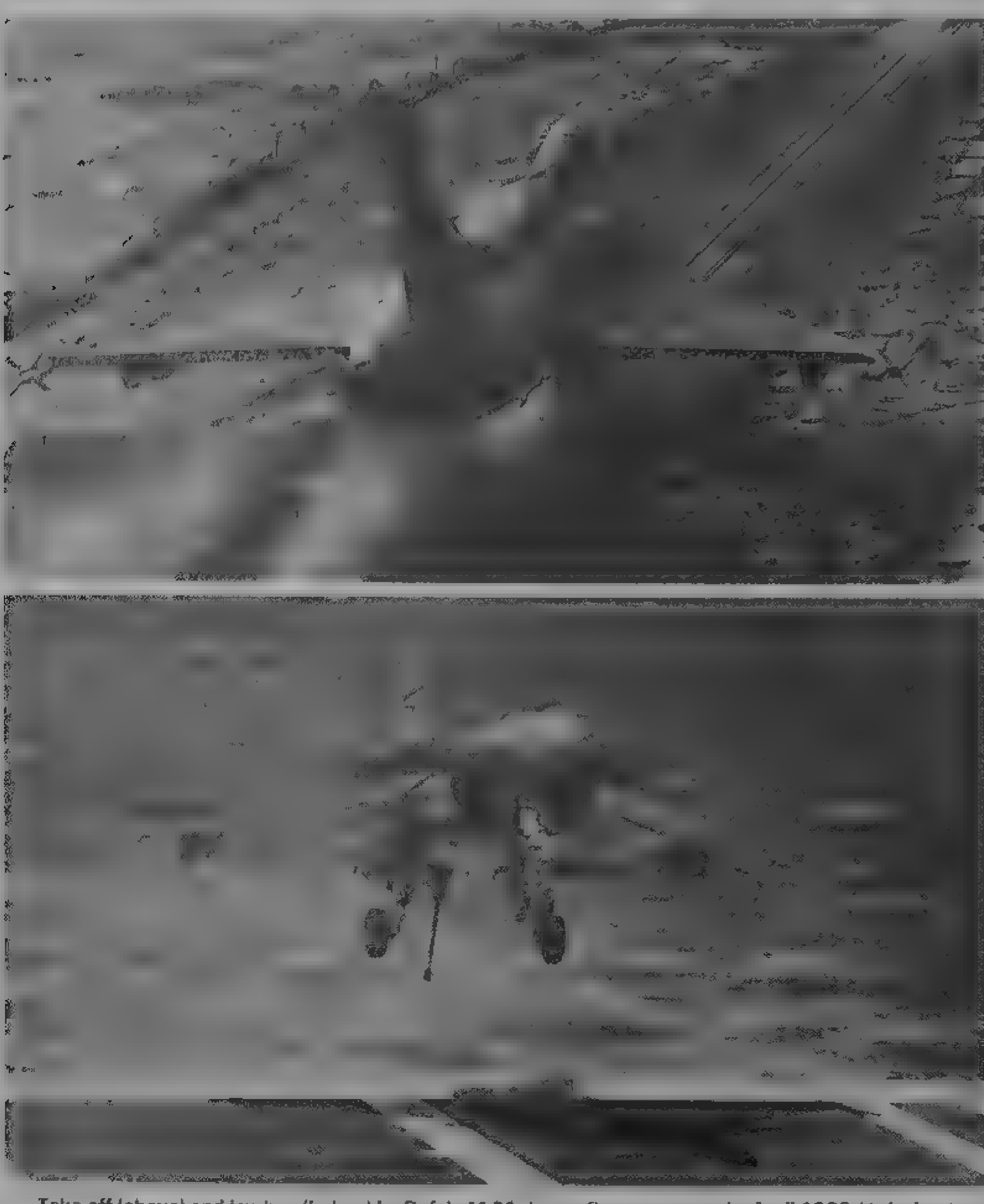
RAFALE PROCUREMENT (ACTUAL)

Year	Rafale B	Rafale M	Total
1993	1	1	2
1994	1	2	3
1995	0	5	5
Totals	**2**	**8**	**10**

RAFALE PROCUREMENT (PLANNED)

Years	Rafale B/C orders	Rafale B/C deliveries	Rafale M orders	Rafale M deliveries
1993-1994	3	0	5	0
1995-2000	59	5	11	16
2001-2012	172	229	70	70
Totals	**234**	**234**	**86**	**86**

POWER PLANT: Two SNECMA M88-2 augmented turbofans, each rated at 48.7 kN (10,950 lb st) dry and 72.9 kN (16,400 lb st) with afterburning. M88-3 of 87 kN (19,558 lb st) maximum rating in production aircraft. Internal tanks for more than 5,325 litres (1,406 US gallons; 1,171 Imp gallons) of fuel. Fuel system by Lucas Air Equipement and Zenith Aviation, equipment by Intertechnique. One 1,700 litre (449 US gallon; 374 Imp gallon) drop tank on centreline; 2,000 litre (528 US gallon; 440 Imp gallon) drop tank on each inboard underwing pylon and/or 1,300 litre (343 US gallon; 286 Imp gallon) tank on each centre underwing pylon. Maximum external fuel 6,600 litres (1,742 US gallons; 1,452 Imp gallons). Pressure refuelling in seven minutes, or four minutes for internal tanks only. Fixed (detachable) in-flight refuelling probe on all versions.



Take-off (above) and landing (below) by Rafale M 01 during first carrier trials, April 1993 *(Aviaplans)* *1994*

ACCOMMODATION: Pilot only, on Hispano-Suiza licence-built Martin Baker Mk 16 zero/zero ejection seat, reclined at angle of 29°. One-piece Sully Products Spéciaux blister windscreen/canopy, hinged to open sideways to starboard. Canopy gold-coated to reduce radar reflection.

SYSTEMS: Technofan bootstrap cockpit air conditioning system. Dual hydraulic circuits, pressure 350 bars (5,075 lb/sq in), each with two Messier-Bugatti pumps and Bronzavia ancillaries. Auxilec variable frequency electrical system, with two 30/40 kVA Auxilec alternators. Triplex digital plus one dual analog fly-by-wire flight control system, integrated with engine controls and linked with weapons system. Air Liquide OBOGS, EROS oxygen system. Microturbo APU.

AVIONICS: Provision for more than 780 kg (1,720 lb) of avionics equipment and racks.

Comms: EAS V/UHF and TRT Saturn UHF radios. TEAM intercom; Sextant Avionique voice activated radio controls and voice alarm warning system. Thomson-CSF/CNI IFF. Chelton aerials.

Radar: GIE Radar (Thomson-CSF/Dassault Electronique) RBE2 look-down/shoot-down radar, able to track up to eight targets simultaneously, with automatic threat assessment and allocation of priority.

Flight: SOCRAT VOR/ILS. SAGEM Sigma RL90 INS (interface with carrier's navigation on Rafale M). Sigma RL-90 ring-laser gyro INS, Thomson-CSF/CNI radio altimeter and SFIM/Dassault Electronique flight recorder. Sextant Avionique GPS.

Instrumentation: Digital display of fuel, engine, hydraulic, electrical, oxygen and other systems information on collimated eye-level display and two lateral multifunction touch-sensitive colour LCD displays by Sextant. Fourth cockpit screen is head level tactical navigation/sensor display. Sextant Avionique CTH 3022 wide-angle, holographic HUD. Sextant/Intertechnique OPSIS helmet-mounted sight.

Mission: Thomson-TRT/SAT OSF electro-optical sensors. Communications via SINTAC/JTIDS. Various reconnaissance, ECM, FLIR and laser designation pods.

Self defence: Spectra radar warning and ECM suite by Thomson-CSF, Dassault Electronique and Matra.

EQUIPMENT: Integral fold-down ladder in Rafale M.

ARMAMENT: One 30 mm Giat DEFA 791B cannon in side of port engine duct. Fourteen Alkan external stores attachments: two on fuselage centreline, two beneath engine intakes, two astride rear fuselage, six under wings and two at wingtips. Forward centreline position deleted on Rafale M. Normal external load 6,000 kg (13,228 lb), maximum permissible, 8,000 kg (17,637 lb). In strike role, one Aerospatiale ASMP stand-off nuclear weapon. In interception role, up to eight Mica AAMs (with IR or active homing) and two underwing fuel tanks, or six Micas and 5,700 litres (1,505 US gallons; 1,254 Imp gallons) of external fuel. In air-to-ground role, typically sixteen 227 kg (500 lb) bombs, two Micas and two 1,300 litre (343 US gallon; 286 Imp gallon) tanks, or two Apache stand-off weapon dispensers, two Micas and 5,700 litres of external fuel, or FLIR pod, Atlis laser designator pod, two 1,000 kg (2,205 lb) laser-guided bombs, two AS.30L laser ASMs, four Micas and single 1,700 litre (449 US gallon; 374 Imp gallon) tank. In anti-ship role, two Exocet or projected ANS sea-skimming missiles, four Micas and 4,300 litres (1,135 US gallons; 946 Imp gallons) of external fuel.

DIMENSIONS, EXTERNAL:

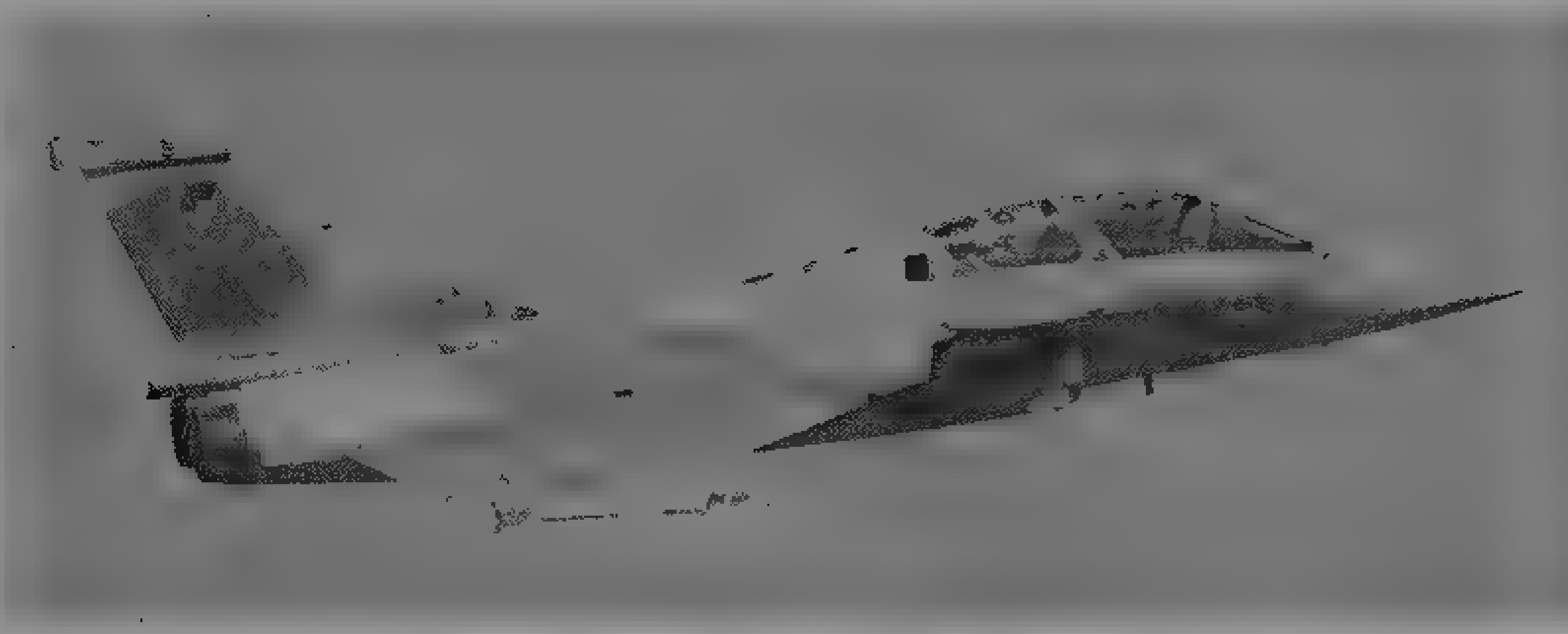
Wing span, incl wingtip missiles	10.90 m (35 ft 9¼ in)
Length overall	15.30 m (50 ft 2⅜ in)
Height overall (Rafale D)	5.34 m (17 ft 6¼ in)

AREAS:

Wings, gross	46.00 m² (495.1 sq ft)

WEIGHTS AND LOADINGS (estimated):

Basic weight empty, equipped	
Rafale D	9,060 kg (19,973 lb)
Rafale M	9,670 kg (21,319 lb)



Dassault Rafale B01, the first two-seat aircraft

1995

Rafale B prototype wearing insignia of strategic strike (Mirage IVP) squadron EB 2/91 to indicate aircraft's potential in this role *(Paul Jackson)*

1995

External load: normal	6,000 kg (13,228 lb)
max	8,000 kg (17,637 lb)
Max ramp weight: initial version	19,500 kg (42,990 lb)
developed version	21,500 kg (47,399 lb)

PERFORMANCE (estimated):

Max level speed: at altitude	Mach 2
at low level	750 kts (1,390 km/h, 864 mph)
Approach speed	115 kts (213 km/h, 132 mph)
T-O distance: air defence	400 m (1,312 ft)
attack	600 m (1,969 ft)

Radius of action: low-level penetration with 12× 250 kg bombs, four Mica AAMs and 4,300 litres (1,135 US gallons, 946 Imp gallons) of external fuel in three tanks 590 n miles (1,093 km, 679 miles)

air-to-air, long-range with eight Mica AAMs and 6,600 litres (1,742 US gallons, 1,452 Imp gallons) of external fuel in four tanks, 12,200 m (40,000 ft) transit 1,000 n miles (1,852 km, 1,151 miles)

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UPDATED

DASSAULT ATLANTIQUE 2

TYPE: Twin-turboprop maritime patrol aircraft. Former designation Atlantique Nouvelle Génération (ANG).

PROGRAMME: Design definition began July 1977, development began September 1978, first flight Atlantic 1 converted to ATL2 prototype 8 May 1981, first flight second converted prototype 26 March 1982, production authorised 24 May 1984; first flight production aircraft 19 October 1988, 23 Flottille declared operational with three Atlantiques 1 February 1991

CURRENT VERSIONS: **Atlantique 2**: Standard aircraft equipped to attack surface and submarine targets, lay mines, transport personnel and freight, protect offshore interests and fly search and rescue. *Detailed description applies to this version*

Jet Atlantique: Proposed for RAF in 1991, two podded turbofans underwing (AlliedSignal TFE731 considered) in addition to turboprops; main power plant change from Tyne to Allison T406 or General Electric T407 offered

Atlantique II Plus: Revised offer to RAF, 1994, two Allison AE 2100 turboprops (only); 1 hour 30 minutes extra endurance. UK industrial partners sought

Atlantique 3: Developed version, see Addenda.

Europatrol: Dassault proposal for European maritime patrol replacement for cancelled Lockheed P-7, 1990; not necessarily based on Atlantique 2

CUSTOMERS: French Navy required 42 production Atlantique 2s, but total cut to 30 in 1992 budget, first two funded 1985, Nos. 28-30 included in 1992 budget, funding for three per year since 1990, but only 28 contracted from Dassault by January 1994, deliveries one, two, six, six and four in 1989-93, then three per year. First squadron, 23 Flottille at Lann Bihoué, completed in 1991 with eight aircraft, co-located 24 F following from 1992, 21 and 22 F to re-equip from Atlantic 1s at Nîmes-Garons, 1994-98, 21 F operational from 1 February 1994 with first three aircraft

COSTS: 1977 estimates of FFr3,046 million R&D and FFr21,462 million production, FFr800 million over budget by 1991

DESIGN FEATURES: Aerodynamically conventional mid-wing twin-turboprop aircraft with double-bubble fuselage, retractable radome, weapons bay and ejectable stores stowage in lower fuselage section, avionics pods at tips of wings and fin, underwing stores stations for anti-ship or self defence missiles

Wing section NASA 64 series, incidence 3°, dihedral 6° outboard of engines, sweepback 9° on leading-edge

FLYING CONTROLS: All fully powered by SAMM tandem hydraulic power units, no trim tabs, ailerons assisted by three spoilers on each wing, some of which also act as air brakes; fixed tailplane, three segments of slotted flaps on each wing

STRUCTURE: Employs refined honeycomb panel bonding technique to improve corrosion resistance and maintainability of original structure; wing torsion box, pressure cabin walls, flaps and large doors made of bonded honeycomb panels, weapon bay and nose landing gear doors slide over external skin to open

Most members of original SECBAT Atlantic 1 consortium are sharing manufacture, including Dassault Aviation, SABCA, SONACA, DASA (MBB and Dornier), Alenia and Aerospatiale. Tyne engines are made by Rolls-Royce, FN and DASA (MTU), propellers by Ratier and British Aerospace

LANDING GEAR: Retractable tricycle type, by Messier-Bugatti, with twin wheels on each unit. Hydraulic retraction, nosewheels rearward, main units forward into engine nacelles. Kléber-Colombes tyres, size 39 × 13-20 on mainwheels, pressure 12 bars (170 lb/sq in), 26 × 7.75-13 on nosewheels, pressure 6.5 bars (94 lb/sq in). Messier-Bugatti disc brakes and Modistop anti-skid units

POWER PLANT: Two 4,549 kW (6,100 ehp) Rolls-Royce Tyne RTy 20 Mk 21 turboprops, each driving a four-blade Ratier/British Aerospace constant speed metal propeller type PD 249/476/3 on prototypes. Four pressure-refuelled integral fuel tanks in wings, with total capacity of 23,120 litres (6,108 US gallons; 5,085 Imp gallons). Updated gauging system. Oil capacity 100 litres (26.4 US gallons; 22 Imp gallons)

ACCOMMODATION: Normal flight crew of 10 to 12, comprising observer in glazed nose, pilot, co-pilot and flight engineer on flight deck, radio-navigator, ESM/ECM/MAD operator, radar-IFF operator, tactical co-ordinator and two acoustic sensor operators at stations on starboard side of tactical compartment, and two optional observers in beam positions at rear. Rest/relief crew compartment in centre of fuselage. Primary access via extending airstair door in bottom of rear fuselage. Emergency exits above and below flight deck and on each side, above wing trailing-edge

SYSTEMS: Air conditioning system supplied by two compressors driven by gearboxes. Heat exchangers and bootstrap system for cabin temperature control. Duplicated hydraulic system, pressure 186 bars (2,700 lb/sq in), to operate flying controls, landing gear, flaps, weapons bay doors and retractable radome. Hydraulic flow rate 17.85 litres (4.7 US gallons, 3.9 Imp gallons)/min

Three basic electrical systems: variable frequency three-phase 115/200 V AC system, with two 60/80 kVA Auxilec alternators and modernised control and protection equipment; fixed frequency three-phase 115/200 V 400 Hz AC system, with four 15 kVA Auxilec Auxivar generators, two on each engine, 28 V DC system, with four 6 kW transformer-rectifiers supplied from variable frequency AC system, and one 40 Ah battery. One 60 kVA emergency AC generator, driven at constant speed by APU

Individual oxygen bottles for emergency use. Air Equipement/Kléber-Colombes pneumatic de-icing system on wing and tail leading-edges. Electric anti-icing for engine air intake lips, propeller blades and spinners. Turbomeca/ABG-Semca Astadyne gas-turbine APU for engine starting, emergency electrical supply, and air conditioning on ground

AVIONICS: *Comms*: HF com by LMT, UHF AM/FM by SINTRA. IFF transponder

Radar: Thomson-CSF Iguane retractable radar immediately forward of weapons bay

Flight: Tacan and DME by Thomson-CSF, VHF AM/FM com by SOCRAT, VOR/ILS by EAS, TRT radio altimeter, Collins MF radio compass, ADF, HSI and autopilot/flight director by SFENA, dual SAGEM Uliss 53 inertial navigation systems coupled to a Navstar GPS

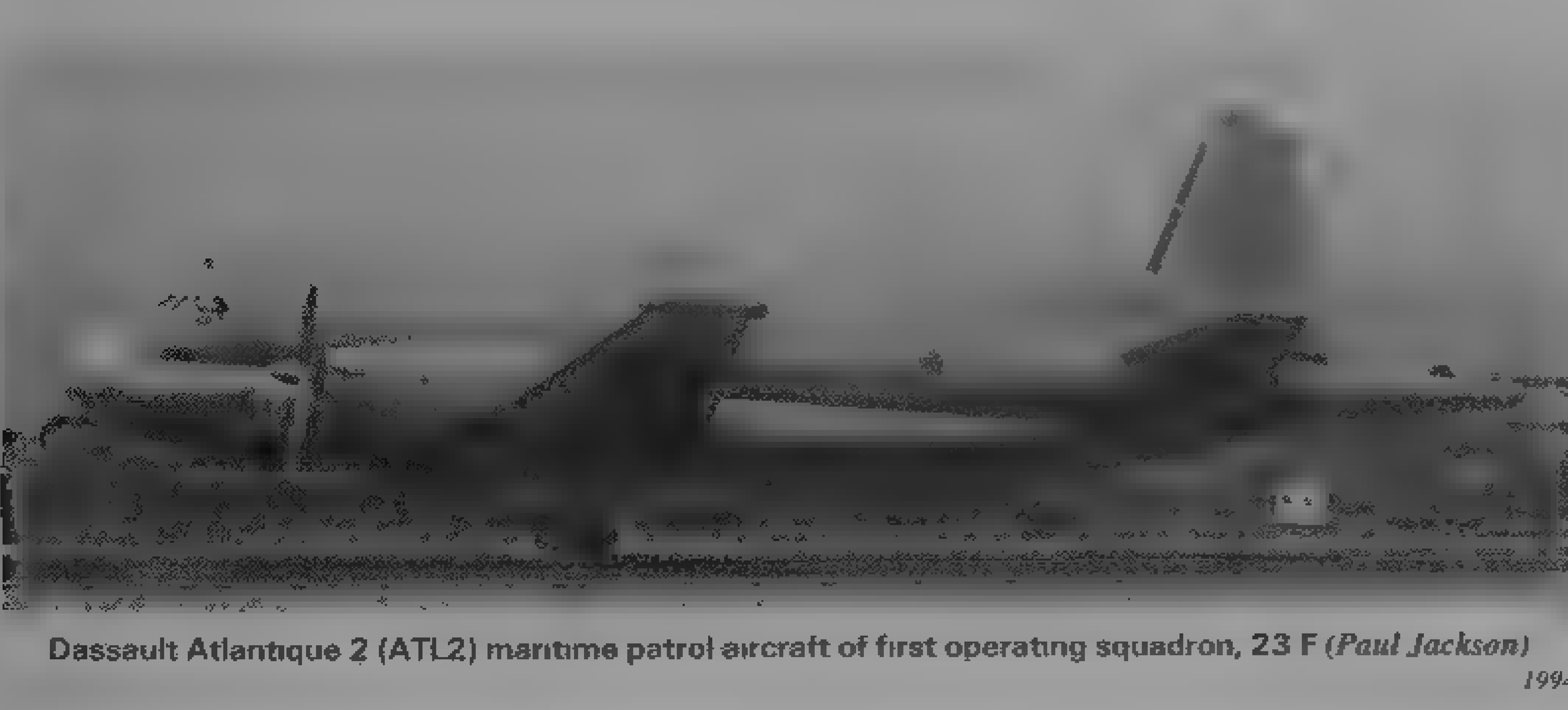
Mission: SAT/TRT Tango FLIR sensor in turret under nose. Radar has integrated LMT IFF interrogator and SECRE decoder. Sextant Avionique MAD in lengthened tail sting. Thomson-CSF Arar 13A radar detector for ESM. Thomson-CSF Sadang system for processing active and passive acoustic detection data. A distributed data processing system around a databus, with a CIMSA Mitra 125X tactical computer (512 kbyte memory), two Dassault Electronique bus computers, two SAGEM magnetic bubble mass memories and Thomson-CSF display subsystem. SAGEM high-speed printer and terminal display, Sextant Avionique navigation table and air data computer

EQUIPMENT: More than 100 sonobuoys, with Alkan pneumatic launcher, in compartment aft of weapons bay, where whole of upper and lower fuselage provides storage for sonobuoys and 160 smoke markers and flares. Thomson-TRT 35 cameras in starboard side of nose and in bottom of rear fuselage

ARMAMENT: Main weapons bay in unpressurised lower fuselage can accommodate all NATO standard bombs, eight depth charges, up to eight Mk 46 homing torpedoes, seven French Murène advanced torpedoes or two air-to-surface missiles (typical load comprises three torpedoes and one AM 39 Exocet or AS 37 Martel missile). Four underwing attachments for external stores, including two or four ARMAT or Magic missiles, or future air-to-surface and air-to-air missiles or pods.

DIMENSIONS, EXTERNAL:

Wing span: incl wingtip pods	37.42 m (122 ft 9¼ in)
excl wingtip pods	37.30 m (122 ft 4½ in)
Wing aspect ratio	11.56
Length overall	33.63 m (110 ft 4 in)
Height overall	10.89 m (35 ft 8¾ in)
Fuselage: Max depth	4.00 m (13 ft 1½ in)



Dassault Atlantique 2 (ATL2) maritime patrol aircraft of first operating squadron, 23 F *(Paul Jackson)*

1994

Dassault Atlantique 2 with radome lowered *(Aviaplans/F. Robineau)*

1995

Tailplane span 12.31 m (40 ft 4⅝ in)
Wheel track (c/l of shock-struts) 9.00 m (29 ft 6¼ in)
Wheelbase 9.40 m (30 ft 10 in)
Propeller diameter 4.88 m (16 ft 0 in)
Distance between propeller centres 9.00 m (29 ft 6¼ in)

DIMENSIONS, INTERNAL:
Cabin, incl rest compartment, galley, toilet, aft observers' stations: Length 18.50 m (60 ft 8½ in)
Max width 3.60 m (11 ft 9¾ in)
Max height 2.00 m (6 ft 6¾ in)
Floor area 155.0 m² (1,668 sq ft)
Volume 92.0 m³ (3,250 cu ft)
Main weapons bay: Length 9.00 m (29 ft 6¼ in)
Width [illegible]
Depth 1.00 m (3 ft 3¼ in)

AREAS:
Wings, gross 120.34 m² (1,295.3 sq ft)
Ailerons (total) 5.26 m² (56.62 sq ft)
Flaps (total) 26.42 m² (284.38 sq ft)
Spoilers (total) 1.66 m² (17.87 sq ft)
Fin, incl dorsal fin 10.68 m² (114.96 sq ft)
Rudder 5.96 m² (64.15 sq ft)
Tailplane 24.20 m² (260.49 sq ft)
Elevators (total) 8.30 m² (89.34 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped, standard mission 25,700 kg (56,659 lb)
Max weapon load: internal 2,500 kg (5,511 lb)
external 3,500 kg (7,716 lb)
Max fuel 18,500 kg (40,785 lb)
Standard mission T-O weight:
ASW or ASSW mission 44,200 kg (97,440 lb)
combined ASW/ASSW mission 45,000 kg (99,200 lb)
Max T-O weight 46,200 kg (101,850 lb)
Normal design landing weight 36,000 kg (79,365 lb)
Max landing weight 46,000 kg (101,400 lb)
Max zero-fuel weight 32,500 kg (71,650 lb)
Max wing loading 385 kg/m² (78.96 lb/sq ft)
Max power loading 5.07 kg/kW (8.34 lb/ehp)

PERFORMANCE (at T-O weight of 45,000 kg, 99,200 lb except where indicated):
Max Mach number 0.73
Max level speed:
at optimum height 350 kts (648 km/h, 402 mph)
at S/L 320 kts (592 km/h, 368 mph)
Max cruising speed at 7,620 m (25,000 ft) 300 kts (555 km/h, 345 mph)
Normal patrol speed, S/L to 1,525 m (5,000 ft) 170 kts (315 km/h, 195 mph)
Stalling speed, flaps down 90 kts (167 km/h, 104 mph)
Max rate of climb at S/L:
AUW of 30,000 kg (66,140 lb) 884 m (2,900 ft)/min
AUW of 40,000 kg (88,185 lb) 610 m (2,000 ft)/min
Rate of climb at S/L, OEI:
AUW of 30,000 kg (66,140 lb) 365 m (1,200 ft)/min
AUW of 40,000 kg (88,185 lb) 213 m (700 ft)/min
Service ceiling 9,145 m (30,000 ft)
Runway LCN at max T-O weight 60
T-O to 10.7 m (35 ft) 1,840 m (6,037 ft)
Landing from 15 m (50 ft) 1,500 m (4,922 ft)
170 knot turning radius at AUW of 40,000 kg (88,185 lb):
at: 30° bank 1,380 m (4,530 ft)
45° bank 800 m (2,625 ft)
60° bank 460 m (1,510 ft)
Typical mission profiles, with reserves of 5% total fuel, 5% of fuel consumed and 20 min hold:
anti-ship mission: T-O with max fuel and one AM 39 missile, fly 1,800 n miles (3,333 km, 2,071 miles) to target area, descend for 2 h search and attack at 90 m (300 ft), return to base
anti-submarine mission: T-O at 44,300 kg (97,665 lb) AUW with 15,225 kg (33,565 lb) of fuel, four Mk 46 torpedoes, 78 sonobuoys, and a full load of markers and flares, cruise to search area at 290 kts (537 km/h, 333 mph) at 7,620 m (25,000 ft), descend for 8 h low altitude patrol at 600 n miles (1,110 km, 690 miles) from base, or 5 h patrol at 1,000 n miles (1,850 km, 1,150 miles) from base; return to base at 9,145 m (30,000 ft). Total mission time 12 h 31 min
Ferry range with max fuel 4,900 n miles (9,075 km, 5,639 miles)
Max endurance 18 h

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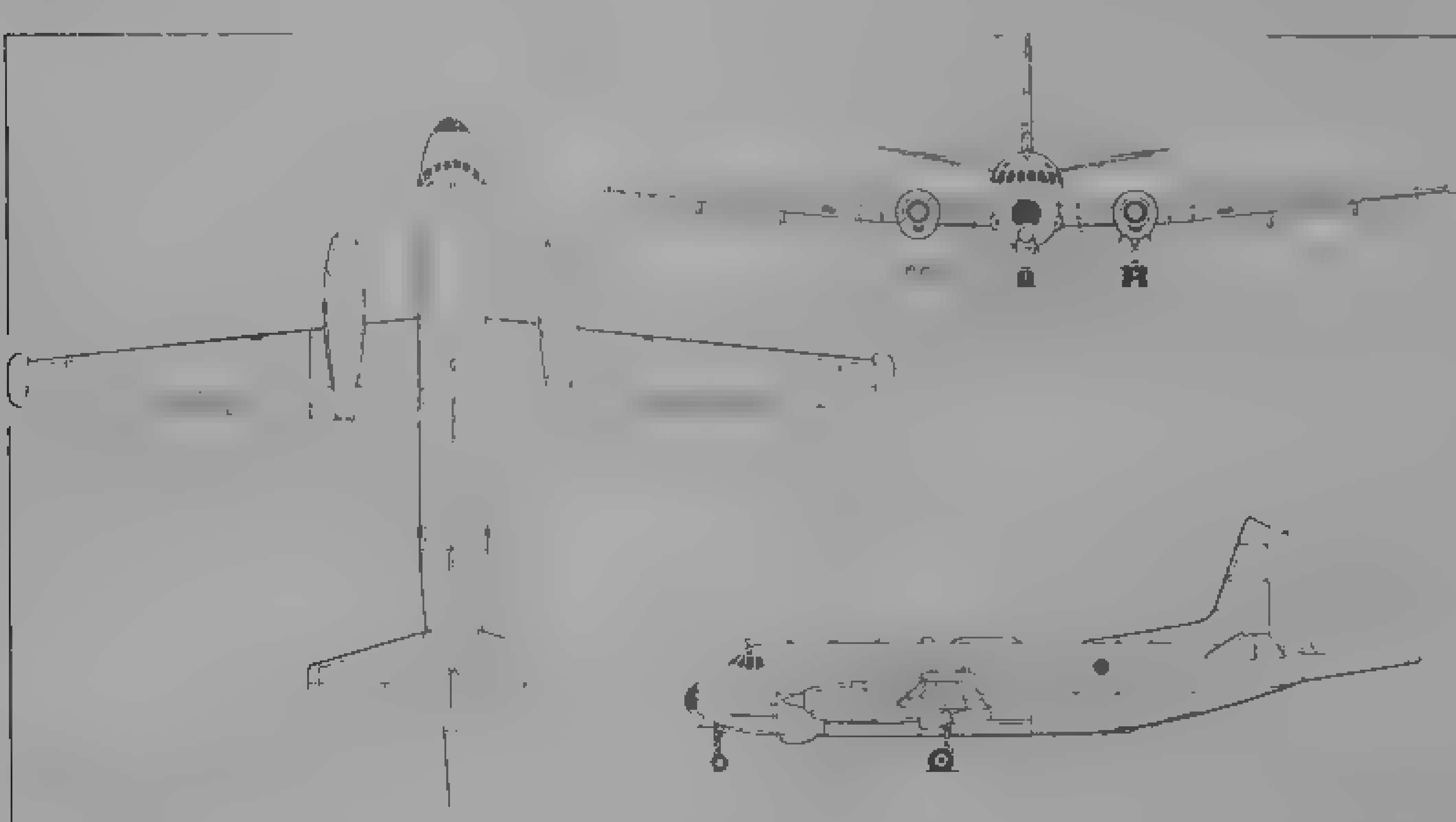


Dassault Atlantique 2 (ATL2) twin turboprop maritime patrol aircraft *(Jane's/Dennis Punnett)*

1993

DASSAULT FALCON 50

Spanish Air Force designation: T.16

TYPE: Three-turbofan long-range business transport.

PROGRAMME: First flight of prototype (F-WAMD) 7 November 1976, second prototype 18 February 1978, first (and only) preproduction 13 June 1978, French certification 27 February 1979; FAA certification 7 March 1979, deliveries began July 1979. Available in sigint version from 1994.

CUSTOMERS: Total 241 sold to 30 countries between July 1979 and 1 January 1995, seven delivered in 1994, adopted by governments of Burundi, Djibouti, France, Iraq, Jordan, Libya, Morocco, Portugal, Rwanda, South Africa, Spain, Sudan and former Yugoslavia, three for Italian Air Force convertible for medevac. Falcon 50EX: see Addenda.

DESIGN FEATURES: New design with new technology wing and sharply waisted rear fuselage and engine pod designed by computational fluid dynamics; wing has compound leading-edge sweep (24° 50′ to 29° at quarter-chord) and optimised section. Three-engine layout permits overflight of oceans and desert areas within public transport regulations.

FLYING CONTROLS: Fully powered controls with artificial feel; variable incidence anhedral tailplane with dual electrical actuation, drooped leading-edge inboard and slats outboard, double-slotted flaps, three two-position airbrake/spoiler panels on each wing.

STRUCTURE: All metal, circular-section fuselage with rear baggage compartment inside pressure cabin, wing boxes are integral fuel tanks bolted to carry-through box.

Dassault announced June 1991 arrangement for MiG to produce tail surfaces for Falcon 900 in Russia (first delivery due Summer 1995), otherwise, fuselages and tail surfaces made by Aerospatiale at Saint Nazaire and Méaulte and cowlings by Hurel Dubois at Vélizy-Villacoublay.

LANDING GEAR: Retractable tricycle type by Messier-Bugatti, with twin wheels on each unit. Hydraulic retraction, main units inward, nosewheels forward. Nosewheels steerable ±60° for taxying, ±180° for towing. Mainwheel tyres size 26 × 6.6-14 in, pressure 14.34 bars (208 lb/sq in). Nosewheel tyres size 14.5 × 5.5-6 in, pressure 8.96 bars (130 lb/sq in). Four-disc brakes designed for 400 landings with normal energy braking. Minimum ground turning radius (about nosewheels) 13.54 m (44 ft 5 in).

POWER PLANT: Three AlliedSignal TFE731-3 turbofans, each rated at 16.5 kN (3,700 lb st) for take-off. Two engines pod-mounted on sides of rear fuselage, third attached by two top mounts. Thrust reverser on centre engine. Fuel in integral tanks, with capacity of 5,787 litres (1,529 US gallons; 1,273 Imp gallons) in wings and 2,976 litres (786 US gallons, 655 Imp gallons) in fuselage tanks. Total fuel capacity 8,763 litres (2,315 US gallons; 1,928 Imp gallons). Single-point pressure fuelling.

ACCOMMODATION: Crew of two side by side on flight deck, with full dual controls and airline type instrumentation. Third seat to rear of co-pilot. Various cabin configurations available, based on two alternative toilet locations. Aft cabin toilet allows eight/nine-passenger arrangement, with four chairs in forward cabin, facing each other in pairs, and three-place sofa and two facing chairs in rear cabin. Wardrobe, galley and crew toilet located forward, in entrance area. Alternatively, forward toilet, facing door, makes possible a lounge in rear cabin, furnished with four/five-place angle sofa and chair. This rear lounge is separated from forward cabin by either a wardrobe and refreshment/

Dassault Falcon 50 business transport for up to 12 passengers

1994

recreation console, or by two additional seats, raising cabin accommodation to 12 persons. After removing forward cabin equipment (wardrobe and galley) and seats, cabin will accommodate up to three stretchers, two doctors and medical equipment, or freight. Rear baggage compartment is pressurised and air conditioned, and has capacity of 1,000 kg (2,200 lb). Access is by separate door on port side

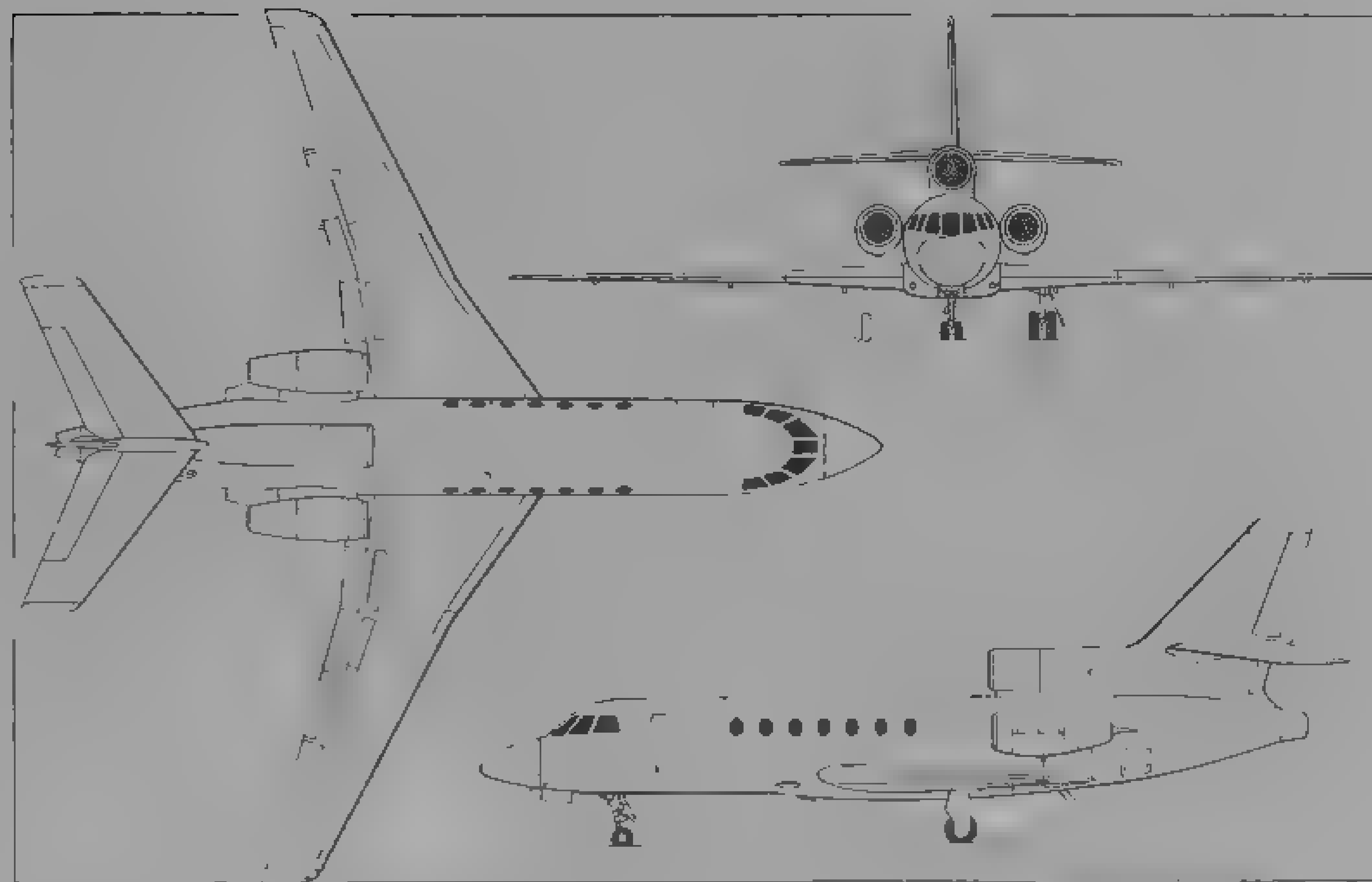
SYSTEMS: Air conditioning system utilises bleed air from all three engines. Maximum pressure differential 0.61 bar (8.8 lb/sq in). Pressurisation maintains a maximum cabin altitude of 2,440 m (8,000 ft) to a flight altitude of 13,700 m (45,000 ft). Two independent hydraulic systems, pressure 207 bars (3,000 lb/sq in), with three engine-driven pumps and one emergency electric pump, actuate primary flying controls, flaps, slats, landing gear, wheel brakes, airbrakes and nosewheel steering. Plain reservoir, pressurised by bleed air at 1.47 bars (21 lb/sq in). 28 V DC electrical system, with a 9 kW 28 V DC starter/generator on each engine and two 23 Ah batteries. Automatic emergency oxygen system. Optional 9 kW AlliedSignal APU

AVIONICS: *Comms*: Dual Collins VHF and transponders

Radar: Honeywell Primus 400 weather radar standard

Flight: Dual Collins VOR, DME and ADF. Collins FCS 80F autopilot, ADC 80 air data computer standard, APS-85 digital autopilot optional, autotune FMS (Global GNS 1000 or UNS 1) with digital radio controllers, Honeywell laser inertial reference systems (which may replace gyro reference systems) and Omega optional

Instrumentation: Dual Collins five-tube EFIS-85 standard, advanced symbology digital EFIS 86C, ADS 82, AHS 85 AHRS and Pro Line com/nav/pulse optional, making possible certificated Cat. II operation.



Dassault Falcon 50 long-range three-turbofan business transport (*Jane's Dennis Punnett*) *1976*

DIMENSIONS, EXTERNAL:

Wing span	18.86 m (61 ft 10½ in)
Wing chord (mean)	2.84 m (9 ft 3¾ in)
Wing aspect ratio	7.60
Length overall	18.52 m (60 ft 9¼ in)
fuselage	17.66 m (57 ft 11 in)
Height overall	6.97 m (22 ft 10½ in)
Tailplane span	7.74 m (25 ft 4¾ in)
Wheel track	3.98 m (13 ft 0¾ in)
Wheelbase	7.24 m (23 ft 9 in)
Passenger door: Height	1.52 m (4 ft 11¾ in)
Width	0.80 m (2 ft 7½ in)
Height to sill	1.30 m (4 ft 3¼ in)
Emergency exits (each side, over wing):	
Height	0.92 m (3 ft 0¼ in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin, incl forward baggage space and rear toilet:	
Length	7.16 m (23 ft 6 in)
Max width	1.86 m (6 ft 1¼ in)
Max height	1.79 m (5 ft 10½ in)
Volume	20.15 m³ (711.6 cu ft)
Baggage space	0.75 m³ (26.5 cu ft)
Baggage compartment (rear)	2.55 m³ (90 cu ft)

AREAS:

Wings, gross	46.83 m² (504.1 sq ft)
Horizontal tail surfaces (total)	13.35 m² (143.7 sq ft)
Vertical tail surfaces (total)	9.82 m² (105.7 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	9,150 kg (20,170 lb)
Max payload: normal	1,570 kg (3,461 lb)
optional	2,170 kg (4,784 lb)
with max fuel	1,130 kg (2,491 lb)
Max fuel	7,040 kg (15,520 lb)
Max T-O and ramp weight:	
standard	17,600 kg (38,800 lb)
optional	18,500 kg (40,780 lb)
Max zero-fuel weight: standard	11,000 kg (24,250 lb)
optional	11,600 kg (25,570 lb)
Max landing weight	16,200 kg (35,715 lb)
Max wing loading: standard	375.8 kg/m² (76.97 lb/sq ft)
optional	395.0 kg/m² (80.90 lb/sq ft)
Max power loading: standard	356.7 kg/kN (3.49 lb/lb st)
optional	374.9 kg/kN (3.67 lb/lb st)

PERFORMANCE:

Max operating Mach number (M_{MO}) 0.86

Max operating speed (V_{MO}):

at S/L 350 kts (648 km/h; 402 mph) IAS

at 7,225 m (23,700 ft) 370 kts (685 km/h; 425 mph) IAS

Max cruising speed Mach 0.82 or 475 kts (880 km/h; 546 mph)

Long-range cruising speed at 10,670 m (35,000 ft) Mach 0.75 (430 kts; 797 km/h; 495 mph)

Approach speed, eight passengers and 45 min long-range reserves 99.5 kts (184 km/h; 115 mph)

Max operating altitude 13,715 m (45,000 ft)

FAR 25 balanced T-O field length with eight passengers and fuel for 3,500 n miles (6,482 km; 4,028 miles) 1,365 m (4,480 ft)

FAR 121 landing distance with eight passengers and 45 min long-range reserves 1,025 m (3,350 ft)

Range at Mach 0.75 with eight passengers and 45 min long-range reserves 3,500 n miles (6,482 km; 4,028 miles)

UPDATED

Flight deck and cabin of French Air Force VVIP Falcon 50 (*Paul Jackson*) *1995*

DASSAULT FALCON 900B

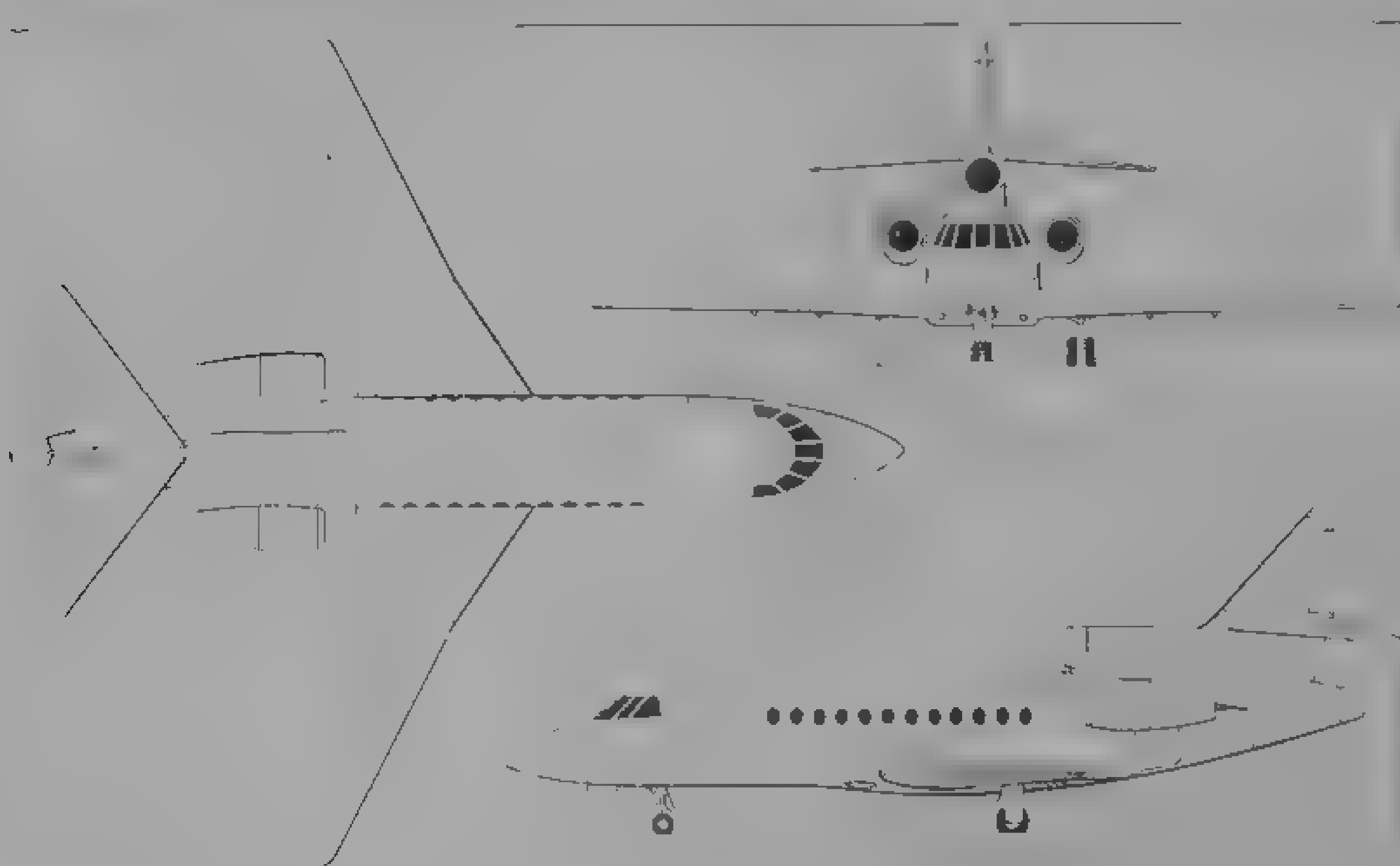
Spanish Air Force designation: T.18

TYPE: Three-turbofan intercontinental business transport

PROGRAMME: Falcon 900 announced 27 May 1983, first flight of prototype (F-GIDE *Spirit of Lafayette*) 21 September 1984, second aircraft (F-GFJC) 30 August 1985, flew non-stop 4,305 n miles (7,973 km; 4,954 miles) Paris to Little Rock, Arkansas, September 1985, returned Teterboro, New Jersey, to Istres, France, at Mach 0.84; French and US certification March 1986, including status close to FAR Pts 25 and 55 for damage tolerance of entire airframe. Prototype Falcon 900 in use as testbed (first flight 12 April 1994) for new laminar flow wing section intended to provide significant reductions in drag. New section installed as sleeve

Dassault Falcon 900B long-range business jet

1995



Dassault Falcon 900B (three AlliedSignal TFE731 turbofans) ***(Jane's/Dennis Punnett)***

1985

on inner wing and designed to demonstrate hybrid laminar flow with boundary layer suction via seven channels in laser-drilled titanium skin over some 10 per cent chord of upper wing surface. Following test programme modified aircraft has returned to Dassault Falcon Service to validate laminar flow capability under normal commercial operating conditions.

CURRENT VERSIONS: **Falcon 900:** Standard version up to 1992; specifications in 1992-93 *Jane's* and earlier applied to this version; 20 kN (4,500 lb st) TFE731-5AR-1C turbofans.

Falcon 900B: French and UK certification received end 1991; complies with FAR Pt 36 Stage III and ICAO 16 noise requirements; approved for Cat. II approaches, for operations from unpaved fields; re-engined with AlliedSignal TFE731-5BR-1C turbofans, to give 5.5 per cent power increase, initial cruising altitude 11,885 m (39,000 ft) and NBAA IFR range increased by 100 n miles (185 km; 115 miles); retrofit to be offered. *Detailed description applies to this version, except where indicated.*

Falcon 900EX: Long-range development of 900B, announced October 1994. Re-engined with 22.24 kN (5,000 lb st) AlliedSignal TFE731-60 turbofans, to give 5.5 per cent increase in retained thrust at 12,200 m (40,000 ft) and more than 8 per cent improvement in cruise specific fuel consumption. Engine nacelles, pylons, thrust reversers and portions of centre engine S-duct redesigned. maximum fuel capacity increased to 11,765 litres (3,108 US gallons; 2,588 Imp gallons) by increasing capacity of centre-fuselage tank to 753 kg (1,660 lb) and addition of tank in rear fuselage (capacity 240 kg (530 lb)). Upgraded standard avionics comprise fully integrated Honeywell Primus 2000 suite with five-tube 20 × 17.75 cm (8 × 7 in) colour EFIS, three IC-800 integrated avionics computers, dual FMZ-2000 flight management systems with a third optional, dual fail-operational autopilot, T-O to landing autothrottle, dual Laseref III inertial reference systems with third optional, Primus colour weather radar, optional single or dual 12-channel GPS, multichannel satcom, communications management unit (CMU) and Flight Dynamics head-up display. Risk sharing partners, representing 20 per cent of total development investment, are: AlliedSignal (engines), Honeywell (primary avionics), SABCA (centre engine intake cowlings), Hellenic Aircraft Industries (rear fuselage fuel tank), Latecoère (T5 fuselage section and engine pylons), and Alenia (nacelles and centre engine thrust reverser). Prototype (F-WREX) rolled out 13 March 1995; first flight 1 June 1995; certification March 1996; first delivery (to launch customer Sony of Japan) April 1996; orders totalled 10 by February 1995.

Japan ASDF: Two Falcon 900s for long-range maritime surveillance entered service September 1989; US search radar, special communications radio, operations control station, UH-25A-style search windows and drop hatch for sonobuoys, markers and flares.

CUSTOMERS: Total 142 of all versions sold to 30 countries by 1 January 1995; government/VIP versions operated by Algeria, Australia, France, Gabon, Malaysia, Nigeria, Saudi Arabia, Spain, Syria and United Arab Emirates. F-WWFJ, completed 17 June 1988, was 1,000th of Falcon series; 18 delivered in 1994.

COSTS: Standard equipped 900EX $25.95 million (1994).

DESIGN FEATURES: Larger cross-section and cabin length than Falcon 50; wing adapted from Falcon 50 but increased span and area, and optimised for Mach 0.84 cruise; quarter-chord sweepback on outer wings 24° 30′, dihedral 0° 30′. Added economy and further power increase of engines achieved by mixer compound nozzle tailpipe, mixing cold and hot flows.

FLYING CONTROLS: Fully powered flying controls with artificial feel; full-span slats and double-slotted Fowler flaps; tailplane incidence adjustable by two independent electric screwjacks; three-position airbrakes.

STRUCTURE: Design and manufacture computer assisted; damage-tolerant structure; extensive use of carbonfibre and aramid (Kevlar); Kevlar radome, wingroot fairings and tailcone; standard 12 windows can be increased to 18; secondary rear cabin pressure bulkhead allows access to baggage in flight and additional protection against pressure loss. Nosewheel doors of Kevlar; mainwheel doors of carbonfibre. Kevlar air intake trunk for centre engine, and rear cowling for side engines. Carbonfibre central cowling around all three engines.

LANDING GEAR: Retractable tricycle type by Messier-Bugatti, with twin wheels on each unit. Hydraulic retraction, main units inward, nosewheels forward. Oleo-pneumatic shock absorbers. Mainwheels fitted with Michelin radial tyres size 29 × 7.7-15, pressure 13.0 bars (189 lb/sq in). Nosewheel tyres size 17.5 × 5.75-8, pressure 10.0 bars (145 lb/sq in). Hydraulic nosewheel steering (±60° for taxying, ±180° for towing). Messier-Bugatti triple-disc carbon brakes and anti-skid system. Minimum ground turning radius (about nosewheels) 13.54 m (44 ft 5 in).

POWER PLANT: Three AlliedSignal TFE731-5BR-1C turbofans, each rated at 21.13 kN (4,750 lb st) at ISA + 8°C. Thrust reverser on centre engine. Fuel in two integral tanks in wings, centre-section tank, and two tanks under floor of forward and rear fuselage. Total fuel capacity 10,825 litres (2,860 US gallons; 2,381 Imp gallons).

ACCOMMODATION: Type III emergency exit on starboard side of cabin permits wide range of layouts for up to 19 passengers. Flight deck for two pilots, with central jump-seat. Flight deck separated from cabin by door, with crew wardrobe and baggage locker on either side. Galley at front of main cabin, on starboard side opposite main cabin door. Passenger area is divided into three lounges. Forward zone has four 'sleeping' swivel chairs in facing pairs with tables. Centre zone is dining area, with two double seats facing a transverse table. On starboard side, storage cabinet contains foldaway bench, allowing five to six persons to be seated around table, while leaving emergency exit clear. In rear zone, inward-facing three-seat settee on starboard side converts into a bed. On port side, two armchairs are separated by a table. At rear of cabin, a door leads to toilet compartment, on starboard side, and a second structural plug

Experimental laminar flow wing section installed on prototype Falcon 900

1995

door to large rear baggage area. Baggage door is electrically actuated.

Other interior configurations available. Alternative eight-passenger configuration has bedroom at rear and three personnel seats in forward zone. A 15-passenger layout divides a VIP area at rear from six (three-abreast) chairs forward; full fuel can still be carried with 15 passengers. The 18-passenger scheme has four rows of three-abreast airline type seats forward, and VIP lounge with two chairs and settee aft. Many optional items, including additional windows, front toilet unit, video system with one or more monitors, 'Airshow 200' navigation display system, compact disc deck, aft cabin partition, one or two couches in aft cabin convertible to bed(s), storage cabinet in baggage hold, aft longitudinal table, individual listening devices for passengers, lifejackets and rafts.

SYSTEMS: Air conditioning system uses engine bleed air or air from AlliedSignal GTCP36-150 APU installed in rear fuselage. Softair pressurisation system, with maximum differential of 0.64 bar (9.3 lb/sq in), maintains sea level cabin environment to height of 7,620 m (25,000 ft), and cabin equivalent of 2,440 m (8,000 ft) at 15,550 m (51,000 ft). Cold air supply by single oversize air cycle unit. Two independent hydraulic systems, pressure 207 bars (3,000 lb/sq in), with three engine-driven pumps and one emergency electric pump, actuate primary flying controls, flaps, slats, landing gear retraction, wheel brakes, air brakes, nosewheel steering and thrust reverser. Bootstrap hydraulic reservoirs. DC electrical system supplied by three 9 kW 28 V Auxilec starter/generators and two 23 Ah batteries. Heated bleed air anti-icing of wing leading edges, intakes and centre engine duct, electrically heated windscreens. Eros (SFIM/Intertechnique) oxygen system.

AVIONICS: *Comms:* Collins Pro Line II avionics including dual TDR 94D transponders, dual VHF 22A, dual Bendix/King KHF 950 HF com.

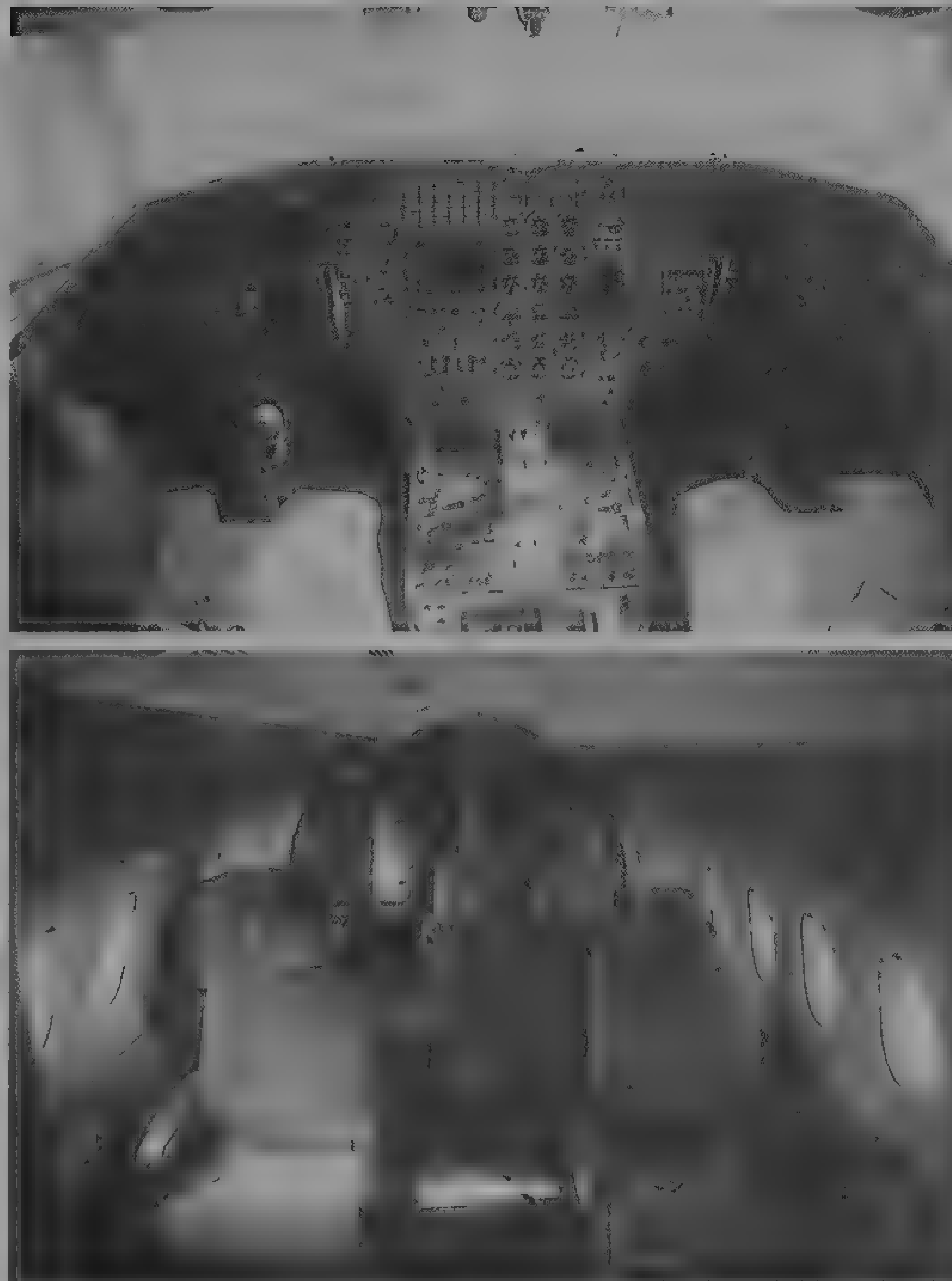
Radar: Honeywell Primus 870 colour weather radar.

Flight: Dual Honeywell FMZ 800 flight management system, associated with two AZ 810 air data computers and two Honeywell Laseref II laser ring inertial reference systems. Collins dual VIR 32 VOR/ILS/marker beacon receiver; dual ADF 60B, dual DME 42, and Sperry RT 300 radio altimeter. Dual bi-directional Honeywell ASCB digital databus operating in conjunction with dual SPZ 8000 flight director/autopilot.

Instrumentation: Honeywell EDZ 820 five-tube EFIS.

DIMENSIONS, EXTERNAL:

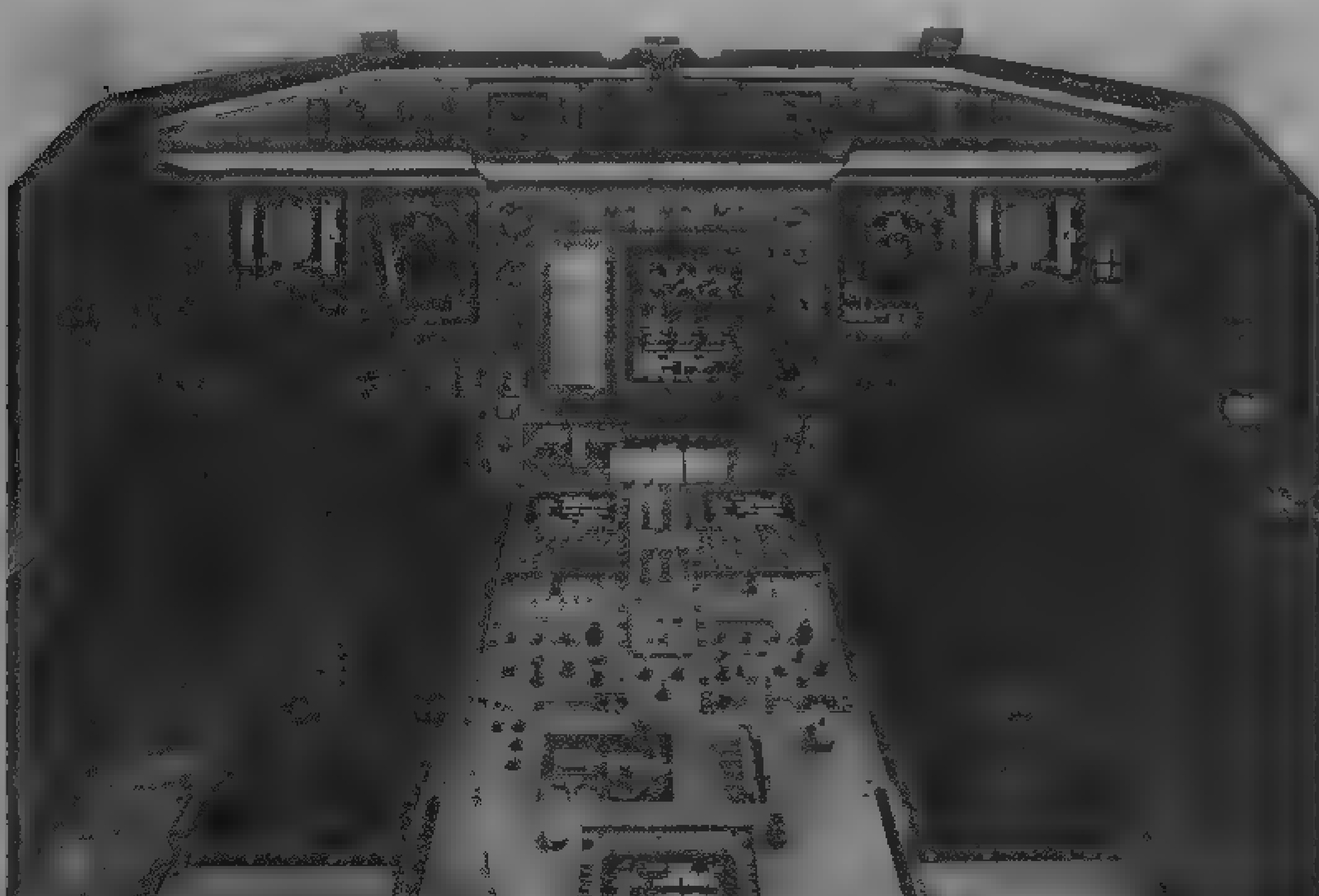
Wing span	19.33 m (63 ft 5 in)
Wing chord: at root	4.08 m (13 ft 4⅝ in)
at tip	1.12 m (3 ft 8 in)
Wing aspect ratio	7.62
Length overall	20.21 m (66 ft 3¾ in)
Fuselage: Max diameter	2.50 m (8 ft 2½ in)
Height overall	7.55 m (24 ft 9¼ in)
Tailplane span	7.74 m (25 ft 4¾ in)
Wheel track	4.45 m (14 ft 7¼ in)
Wheelbase	7.93 m (26 ft 0¼ in)
Passenger door: Height	1.72 m (5 ft 7¾ in)
Width	0.80 m (2 ft 7½ in)
Height to sill	1.79 m (5 ft 10½ in)
Emergency exit (overwing, stbd):	
Height	0.91 m (2 ft 11¾ in)
Width	0.53 m (1 ft 8¾ in)



Flight deck and cabin of French President's Falcon 900 (*Paul Jackson*) 1995

DIMENSIONS, INTERNAL:

Cabin, excl flight deck, incl toilet and baggage compartments: Length	11.90 m (39 ft 0½ in)
Max width	2.34 m (7 ft 8¼ in)
Width at floor	1.86 m (6 ft 1¼ in)
Max height	1.87 m (6 ft 1½ in)
Volume	35.90 m³ (1,268 cu ft)
Rear baggage compartment volume	3.60 m³ (127 cu ft)
Flight deck volume	3.75 m³ (132 cu ft)



Flight deck of Falcon 900EX 1995

AREAS:

Wings, gross	49.00 m² (527.43 sq ft)
Vertical tail surfaces (total)	9.82 m² (105.7 sq ft)
Horizontal tail surfaces (total)	13.35 m² (143.7 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped (typical): 900B	10,240 kg (22,575 lb)
900EX	10,829 kg (23,875 lb)
Operating weight empty	10,545 kg (23,248 lb)
Max payload	2,185 kg (4,817 lb)
Payload with max fuel	1,385 kg (3,053 lb)
Max fuel: 900B	8,690 kg (19,158 lb)
900EX	9,446 kg (20,825 lb)
Max ramp weight: 900EX	22,000 kg (48,500 lb)
Max T-O weight: 900B	20,640 kg (45,500 lb)
900EX	21,909 kg (48,300 lb)
Max landing weight	19,050 kg (42,000 lb)
Normal landing weight	12,250 kg (27,000 lb)
Max zero-fuel weight: 900B	12,800 kg (28,220 lb)
900EX	14,000 kg (30,865 lb)
Max wing loading	421.2 kg/m² (86.27 lb/sq ft)
Max power loading	325.60 kg/kN (3.19 lb/lb st)

PERFORMANCE (at AUW of 12,250 kg; 27,000 lb, except where indicated):

Max operating speed: 900, 900B
at S/L: Mach 0.87 (350 kts; 648 km/h; 403 mph IAS)
between 3,050-7,620 m (10,000-25,000 ft): Mach 0.84 (370 kts; 685 km/h; 425 mph IAS)

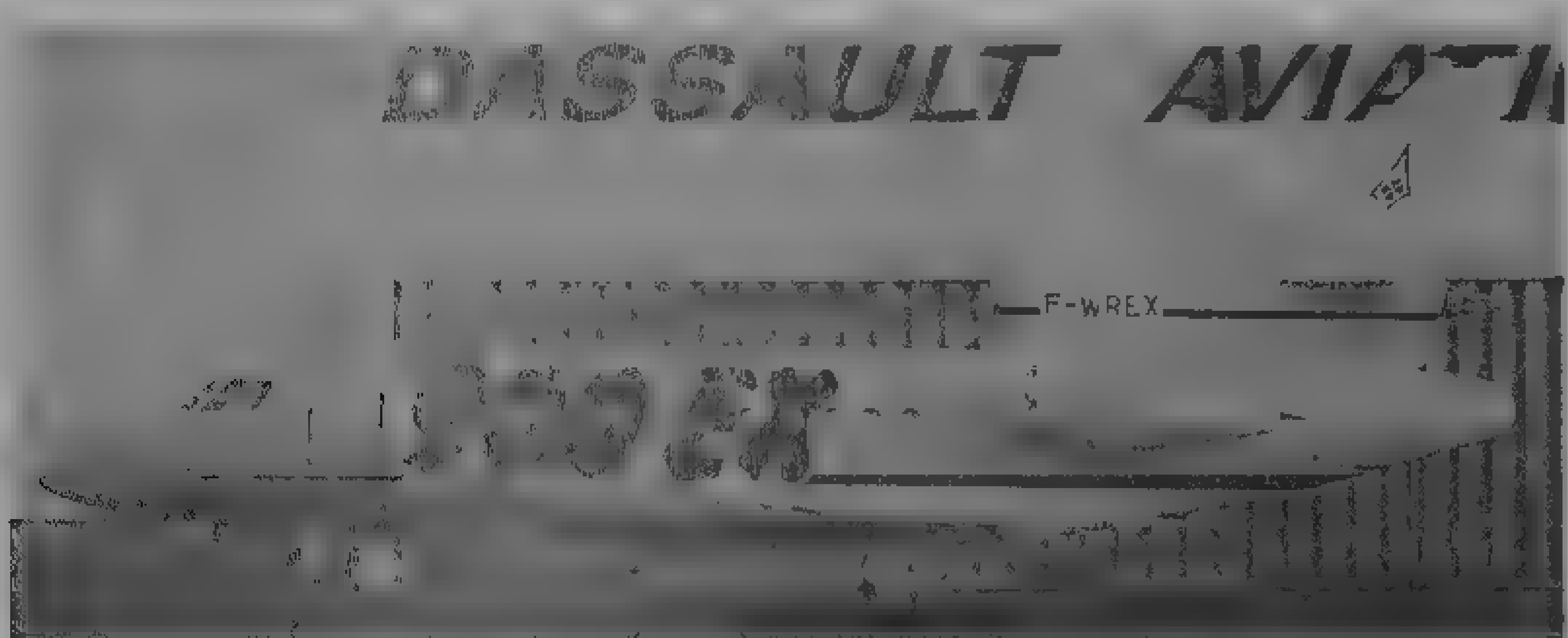
Max cruising speed at 8,230 m (27,000 ft):
900, 900B: 500 kts (927 km/h; 575 mph)

Econ cruising speed: 900: Mach 0.75

Approach speed, eight passengers and fuel reserves:
900, 900B, 900EX: 108 kts (200 km/h; 125 mph)

Prototype Dassault Falcon 2000 business transport

1995



Dassault Falcon 900EX, rolled out 13 March 1995

1995

Stalling speed: 900, 900B, 900EX clean
106 kts (196 km/h; 122 mph)
900, 900B, 900EX, landing configuration
85 kts (158 km/h; 98 mph)
Max cruising altitude
900, 900B, 900EX 15 550 m (51 000 ft)
Balanced T-O field length with full tanks, eight passengers and baggage: 900 1,515 m (4,970 ft)
900B 1,426 m (4,679 ft)
900EX 1 535 m (5,036 ft)
FAR 91 landing field length at AUW of 12,250 kg (27 000 lb): 900 700 m (2,300 ft)
Range at Mach 0.75 with max fuel and NBAA IFR reserves: 900B, eight passengers
4,000 n miles (7 408 km; 4 603 miles)
900, eight passengers
3,900 n miles (7,229 km; 4,488 miles)
900EX, eight passengers
4,500 n miles (8,334 km, 5 178 miles)

UPDATED

DASSAULT FALCON 2000

TYPE: Follow-on to Falcon 20/200 as transcontinental wide-body business transport

PROGRAMME: Announced Paris Air Show 1989 as Falcon X, launched as Falcon 2000 on 4 October 1990, following first orders; Alenia joined as 25 per cent risk sharing partner February 1991, with responsibility for rear fuselage section and engine nacelles; selection of GE/AlliedSignal CFE738 announced 2 April 1990; first flight (F-WNAV) 4 March 1993, (one prototype only; third airframe (F-WWFA) was second to fly, on 10 May 1994, ferried 'green' to US subsidiary Dassault Falcon Jet Corporation at Little Rock, Arkansas, 13 July 1994 for completion as US demonstrator, and set two world speed records 31 October to 1 November 1994 flying Los Angeles (Chino) to Bangor, Maine, in 4 hours 36 minutes 27 seconds and Bangor to Paris in 5 hours 26 minutes 12 seconds; Dassault demonstrator, second airframe (F-WNEW), flew 11 July 1994. JAA certification to JAR 25 obtained 30 November 1994, at which time five aircraft (prototype, two demonstrators and two customer aircraft) had accumulated 1,055.5 flight hours. FAR Pt 25 and FAR Pt 36 Stage 3 noise levels certification 2 February 1995; first delivery (F-WNEW/ZS-NNF) to South African customer) 16 February 1995

CUSTOMERS: Total 60 commitments received by late 1994, total market estimated at more than 300 in 10 years

COSTS: Basic price $16.5 million (1994)

DESIGN FEATURES: Same fuselage cross-section as Falcon 900, but 1.98 m (6 ft 6 in) shorter. Falcon 900 wing with modified leading-edge and no inboard slats; sweepback at quarter-chord 24° 50' to 29°

STRUCTURE: Largely as for Falcon 900. Rear fuselage, including engine pods and pylons, by Alenia and Piaggio; thrust reversers by Dee Howard

POWER PLANT: Two GE/AlliedSignal CFE738 turbofans, each rated at 26.7 kN (6,000 lb st). Usable fuel capacity 6,865 litres (1,814 US gallons, 1,510 Imp gallons)

ACCOMMODATION: Up to 19 passengers and two flight crew; standard passenger accommodation is four seats in forward lounge and four seats and a two-person sofa in aft lounge. Pressurised, flight accessible baggage compartment at rear of cabin

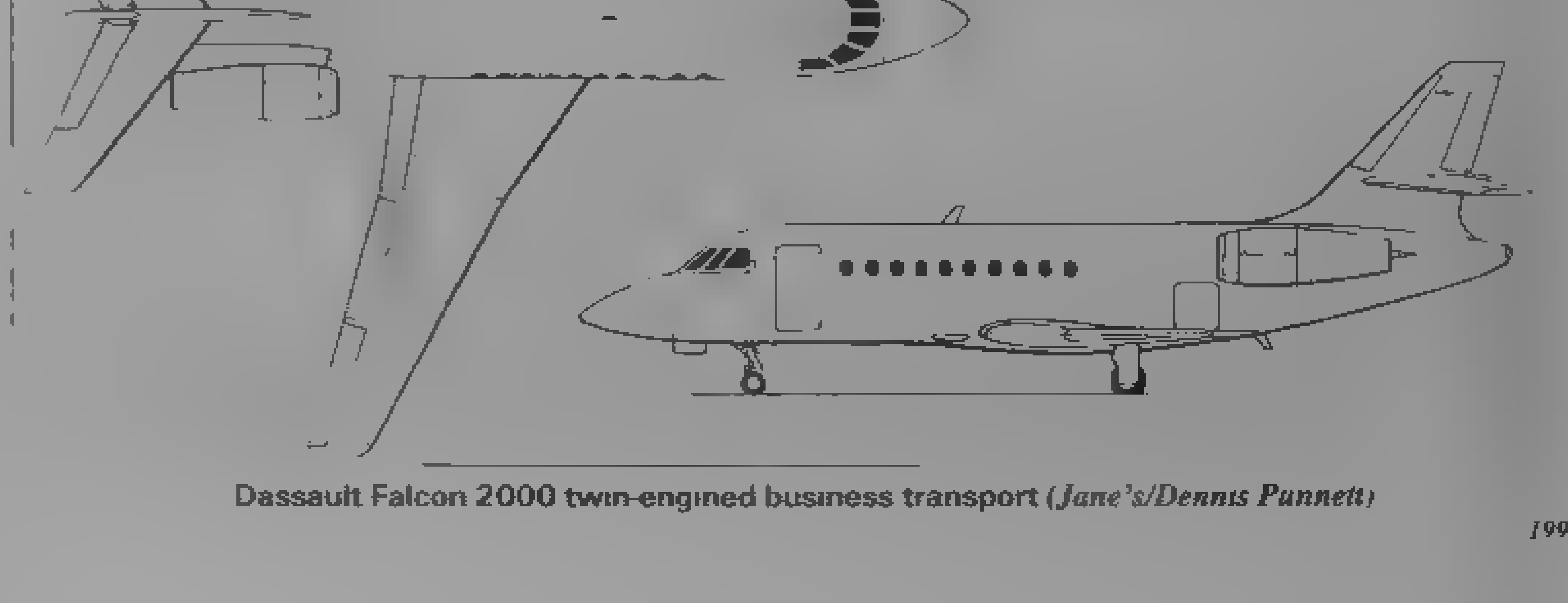
AVIONICS: Collins Pro Line IV

Comms: Dual com/nav; dual Mode-S transponders; dual RTU-4020 radio tuning units, optional Bendix/King HF transceiver

Radar: Collins WXR 840 colour weather radar standard, TWR-850 Doppler weather radar optional

Flight: Honeywell FMZ-2000 flight management system and Cat II autopilot standard. Collins dual DME, dual ADF, dual AHRS and dual digital air data computers linked to dual-channel integrated avionics processor system (IAPS). Honeywell Laseref IRS, flight data recorder, satcom and traffic alert and collision avoidance system (TCAS) optional

Instrumentation: Collins Pro Line IV four-tube EFIS. Sextant Avionique three-tube engine indicating electronic



Dassault Falcon 2000 twin-engined business transport (*Jane's/Dennis Punnett*)

1991

display (EIED), Flight Dynamics HUD to be installed for testing in prototype March 1995, available as an option from late 1995 with certification for Cat. III landings.

DIMENSIONS, EXTERNAL:
Wing span 19.33 m (63 ft 5 in)
Wing aspect ratio 7.62
Length overall 20.23 m (66 ft 4½ in)
Height overall 6.98 m (22 ft 10¾ in)

DIMENSIONS, INTERNAL:
Cabin: Length 7.98 m (26 ft 2¼ in)
Max width 2.34 m (7 ft 8¼ in)
Max height 1.87 m (6 ft 1½ in)
Volume 28.00 m³ (989.6 cu ft)
Baggage volume: standard 4.00 m³ (141.3 cu ft)
optional 5.40 m³ (190.7 cu ft)

AREAS:
Wings, gross 49.02 m² (527.65 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 8,936 kg (19,700 lb)
Max payload 1,390 kg (3,064 lb)
Max fuel weight 5,513 kg (12,154 lb)
Max ramp weight 15,966 kg (35,200 lb)
Max T-O weight 15,875 kg (35,000 lb)
Max landing weight 14,970 kg (33,000 lb)
Max zero-fuel weight 13,000 kg (28,660 lb)
Max wing loading 323.8 kg/m² (66.33 lb/sq ft)
Max power loading 297.6 kg/kN (2.92 lb/lb st)

PERFORMANCE (estimated, at max T-O weight, ISA, except where indicated):
Max operating Mach number (M_{MO}) 0.85-0.87
Max operating speed (V_{MO}) 350 kts (648 km/h; 403 mph) IAS
Max cruising speed at 11,890 m (39,000 ft) Mach 0.83-0.85
Certificated ceiling 14,330 m (47,000 ft)
Balanced T-O field length, eight passengers, ISA + 15°C 1,635 m (5,365 ft)
FAR 91 landing field length, eight passengers, ISA, at S/L 780 m (2,560 ft)
Range with max fuel, eight passengers and NBAA IFR reserves 3,000 n miles (5,556 km; 3,452 miles)
g limits +2.64/−1

UPDATED

DASSAULT FALCON 9000

After conducting initial design studies and market assessment for this proposed 8- to 19-passenger very long-range business jet, Dassault decided in Summer 1994 not to proceed with development.

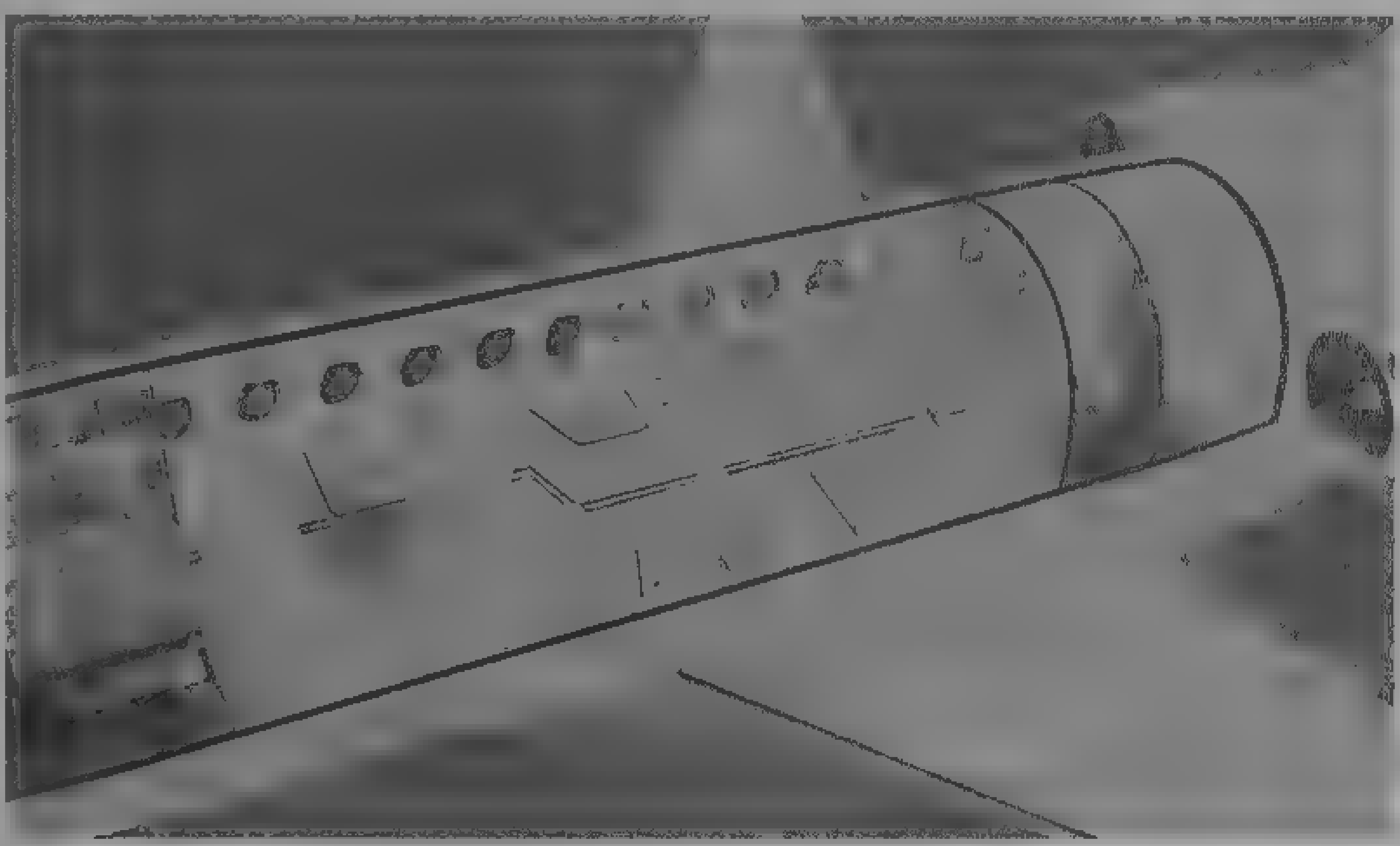
UPDATED

OTHER AIRCRAFT

Details of the Anglo-French **SEPECAT Jaguar** programme have appeared in the International section of previous issues of *Jane's*. Jaguar continues in production in India (see HAL entry). The Dassault/DASA **Alpha Jet** is no longer in production.

NEW ENTRY

Falcon 2000 in landing configuration, with double-slotted flaps and leading-edge slats deployed *1994*



Typical cabin configuration of Falcon 2000 *1995*

DYN'AERO

SOCIÉTÉ DYN'AERO

Aerodrome Darois, F-21121 Dijon
CHAIRMAN: Christophe Robin
DESIGN ASSOCIATE: Michel Colomban

Dyn'Aero formed September 1992 by Christophe Robin, son of Pierre Robin, the founder of Robin aircraft; his initials (CR) appear in aircraft designations. Initial product was prototype of small, all-wood aerobatic biplane; first flight 27 August 1992. CR 100 monoplane was then designed and flown. Two new designs derived from CD-100 announced in March 1995: CR-110 and the CR-120; simultaneously MCR-01 biplane also announced.

NEW ENTRY

DYN'AERO CR-100 and CR-110

TYPE: Sporting and aerobatic monoplane; available complete or as a kit.

PROGRAMME: Prototype (F-PDYN) completed December 1992. Production rate about one per month; first five CR 100s flew total of 600 hours of aerobatics in first year of operations.

CURRENT VERSIONS: **CR-100:** Basic version, described below.
CR-110: Uprated version with 149 kW (200 hp) engine.

CUSTOMERS: Five built up to early 1995; two CR-100s ordered March 1995 by Armee de l'Air; 10 to be produced in 1995. Several French aerobatic pilots have reportedly shown interest.

COSTS: FFr400,000 as a kit without engine; about FFr600,000 assembled, with engine and instruments.

DESIGN FEATURES: Single-engine low-wing monoplane, conventional tail layout with low tailplane.

FLYING CONTROLS: Conventional mechanical ailerons, elevator and rudder. Elevator tab for pitch trim. Fixed tab on ailerons and rudder.

LANDING GEAR: Fixed tailwheel type. Spats on mainwheel legs.

POWER PLANT: One 134 kW (180 hp) Textron Lycoming or (CR 110) 149 kW (200 hp) engine. Compatible with alternative engines 119 kW (160 hp) and above. Fixed- or variable-pitch propellers may be fitted.

ACCOMMODATION: Two seats, side by side.

SYSTEMS: Electrical system: 12 V 30 Ah battery; alternator fit appropriate to engine.

AVIONICS: Customer specified.

WEIGHTS AND LOADINGS:
Max T-O weight 760 kg (1,676 lb)

PERFORMANCE (at max T-O weight):
Max cruising speed 154 kts (285 km/h; 177 mph)
Manoeuvre speed (V_M) 140 kts (260 km/h; 161 mph)
g limits +8/−6

NEW ENTRY

DYN'AERO CR-120

TYPE: Sporting and aerobatic monoplane, available complete or as a kit.

PROGRAMME: To fly Summer 1995.

DESIGN FEATURES: Specialist aerobatic aircraft with particularly large ailerons (2.70 m, 8 ft 10¼ in).

PERFORMANCE:
Roll rate (calculated) at 140 kts (260 km/h; 161 mph) 195-275°/s

NEW ENTRY

DYN'AERO MCR-01

TYPE: Sporting and aerobatic biplane; kit version of the MC 100 Ban-bi designed by Michel Colomban. MCR identifies Michel/Christophe Robin.

PROGRAMME: To fly Summer 1995; 15 to be produced in 1995.

STRUCTURE: Metal skins, carbonfibre longerons and monocoque carbon fuselage.

POWER PLANT: One 60 kW (80 hp) Rotax 912 engine.

PERFORMANCE:
Max cruising speed 154 kts (285 km/h; 177 mph)
Range on 60 l (15.8 US gallons; 13.2 Imp gallons) of fuel 540 n miles (1,000 km; 621 miles)

NEW ENTRY

FOURNIER

AVIONS FOURNIER

René Fournier, F-37270 Athée sur Cher
Telephone: 33 47 50 68 30
Fax: 33 47 50 24 22
Arc Atlantique Aviation, BP 102, F-01213 Ferney Voltaire
Telephone: 33 50 40 88 41
Fax: 33 50 40 88 42
Tours Aviation, Tours/St Symphorien Airport, F-37100 Tours
Telephone: 33 47 51 25 64
Fax: 33 47 54 29 49

Some René Fournier aircraft produced by Tours Aviation. Fournier RF-6 adopted and converted as T67 by Slingsby in UK (which see). RF-9 now being produced by EIS in Germany (which see). Arc Atlantique Aviation created to produce the RF-47.

VERIFIED

FOURNIER RF-47

TYPE: Two-seat light aircraft.

PROGRAMME: First flight 9 April 1993 (F-WNDF), certification to JAR-VLA July 1994; produced also in kits.

DESIGN FEATURES: Designed as very light club trainer and private aircraft with clearance for spinning, but not aerobatics.

FLYING CONTROLS: Conventional ailerons, elevators and rudder; fixed tailplane with trim tab in elevator; slotted flaps.

STRUCTURE: First aircraft has wooden fuselage and wood and fabric wings; second aircraft has wing spar and other components in new wood/CFRP/wood sandwich, which halves weight of main spar.

LANDING GEAR: Tricycle landing gear with steering by brakes; tailwheel landing gear optional.

POWER PLANT: Prototype has 67 kW (90 hp) Sauer modification of Volkswagen engine running at maximum 2,700 rpm. Second aircraft fitted with 67 kW (90 hp) Limbach L 2400 engine also intended for production aircraft. Fuel 84 litres (22.2 US gallons; 18.5 Imp gallons).

Fournier RF-47 light trainer and club aircraft; further illustrations in Addenda *1995*

ACCOMMODATION: Two seats side by side under single-piece, rear hinged canopy.

DIMENSIONS, EXTERNAL:

Wing span	10.00 m (32 ft 9¾ in)
Wing aspect ratio	9.15
Length overall	6.44 m (21 ft 1½ in)
Height overall	2.22 m (7 ft 3½ in)

AREAS:

Wings, gross	10.93 m² (117.6 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's weight empty	395 kg (871 lb)
Max T-O weight	620 kg (1,367 lb)
Max wing loading	56.72 kg/m² (11.62 lb/sq ft)
Max power loading	9.24 kg/kW (15.19 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	124 kts (230 km/h; 143 mph)
Max level speed	108 kts (200 km/h; 124 mph)
Normal cruising speed	97 kts (180 km/h; 112 mph)
Stalling speed: flaps up	46 kts (85 km/h; 53 mph)
flaps down	42 kts (78 km/h; 48 mph)
Max rate of climb at S/L	240 m (787 ft)/min
Service ceiling	4,000 m (13,125 ft)
T-O run	290 m (951 ft)
T-O to 15 m (50 ft)	455 m (1,493 ft)
Landing from 15 m (50 ft)	415 m (1,362 ft)
Landing run	175 m (574 ft)
Endurance	5 h
Max crosswind for T-O/landing	25 kts (46 km/h; 29 mph)
g limits, Utility category	+4.4/−2.2

UPDATED

GUIMBAL

BRUNO GUIMBAL

Production plans are understood to have been abandoned of the Guimbal G2 Cabri two-seat light helicopter last described in the 1994-95 *Jane's*.

UPDATED

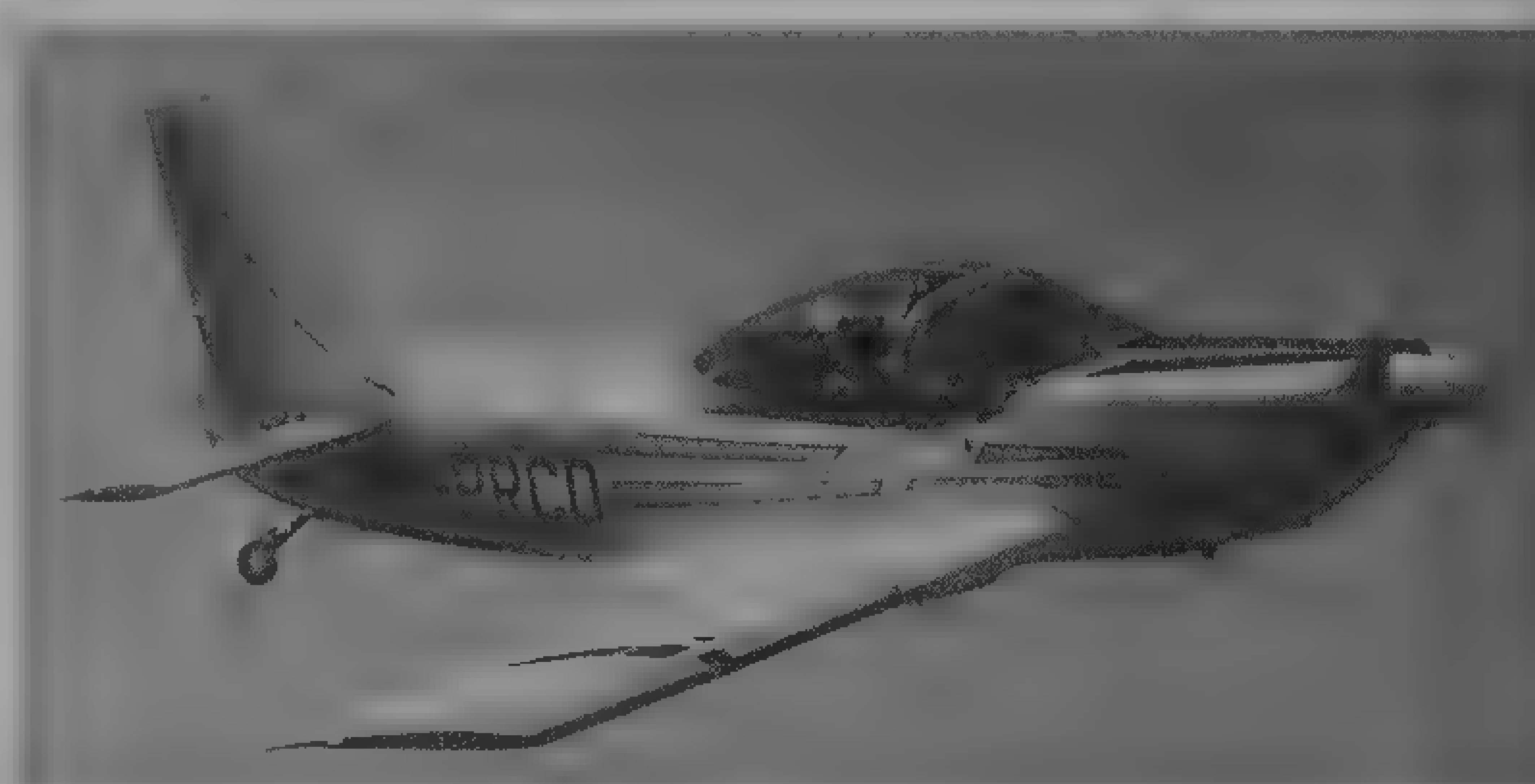
JURCA

MARCEL JURCA

3 Allees des Borges, F-94430 Chennevieres S/M
Telephone and Fax: 33 (1) 45 94 01 38

M Marcel Jurca has designed a series of high-performance light aircraft and replicas of Second World War fighters. Jurca aircraft (some available to amateur builders) are MJ2/MJ22 Tempete, MJ3 Dart, MJ4 Shadow, MJ5 Sirocco, MJ51 Sperocco, and MJ53 Autan, MJ7 two-third size Mustang Replica, MJ77 three-quarter size two-seat Mustang, MJ8 three-quarter size FW190 Replica, MJ10 three-quarter size Spitfire Replica, MJ12 three-quarter size P-40 Replica, MJ100 full size Spitfire Replica; MJ9 three-quarter Bf 109 Replica, MJ90 full size Bf 109 Replica. Up to the beginning of 1995, 131 MJ aircraft had been registered and flown including 39 MJ2s and 66 MJ5s.

UPDATED



Jurca MJ53 Autan side by side two-seater with 149 kW (200 hp) Textron Lycoming engine *1995*

JURCA MJ5 SIROCCO

TYPE: Tandem two-seat development of MJ2 Tempete.

PROGRAMME: Prototype first flight 3 August 1962, powered by 78.5 kW (105 hp) Potez 4 E-20 engine; factory built model subsequently awarded certificate of airworthiness in Utility category. Version for amateur construction is generally similar to factory built version.

DESIGN FEATURES: Versions available with fixed or retractable gear; retractable tailwheel also available.

POWER PLANT: Engines available include the Textron Lycoming series of the following powers: 86 kW (115 hp), 112 kW (150 hp), 119 kW (160 hp), 134 kW (180 hp) and 149 kW (200 hp).

The details which follow refer to a Sirocco with an 86 kW (115 hp) Textron Lycoming O-235-C2B engine and 1.85 m (6 ft 0¾ in) diameter propeller.

Preparation of Jurca MJ100 full-size Spitfire Replica F-WGML for its first flight, 14 October 1994 *1995*

DIMENSIONS, EXTERNAL:

Wing span	7.00 m (23 ft 0 in)
Wing aspect ratio	4.90
Length overall	6.15 m (20 ft 2 in)
Height overall, tail up	
with modified rudder	2.60 m (8 ft 6¼ in)
standard rudder	2.80 m (9 ft 2¼ in)

AREAS:

Wings, gross	10.00 m² (107.64 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	430 kg (947 lb)
Max T-O weight	680 kg (1,499 lb)
Max wing loading	68.0 kg/m² (13.92 lb/sq ft)
Max power loading	7.93 kg/kW (13.04 lb/hp)

PERFORMANCE (at max T-O weight):

Max level speed	127 kts (235 km/h; 146 mph)
Cruising speed	116 kts (215 km/h; 134 mph)
Stalling speed	44 kts (80 km/h; 50 mph)
Time to 1,000 m (3,280 ft)	4 min
Service ceiling	5,000 m (16,400 ft)
T-O run	250 m (820 ft)
Landing run	200 m (655 ft)
Endurance	4 h 20 min

VERIFIED

MUDRY

AVIONS MUDRY et CIE

Aérodrome de Bernay, BP 214, F-27302 Bernay
Telephone: 33 32 43 47 34
Fax: 33 32 43 47 90
Telex: MUDRY 180 587 F
DIRECTORS GENERAL:
Auguste Mudry (President)
Danielle Baron (Assistant Director General)
CHIEF DESIGNER: Jean Marie Klinka

Mudry Aviation Ltd

Flagler County Airport, Box 18T 7, Florida 32110, USA
Telephone: 1 (904) 437 9700
Fax: 1 (904) 437 1170
PRESIDENT: Daniel Heligoin

Company established at Bernay 1958 and operated alongside CAARP of Beynes; two companies consolidated at Bernay; design office at Courcelles; total workforce 50. CAP stands for Co-opération des Ateliers de la région Parisienne. Plan to certify Sukhoi Su-26MX in France lapsed for administrative reasons. CAP X no longer to be produced in Russia. Mudry has manufactured Aéronautic Baroudeur microlight in small numbers. Production of CAP 21 (1993-94 and earlier *Jane's*) has ended.

UPDATED

Mudry CAP 231 EX single-seat aerobatic aircraft 1994

MUDRY CAP 10 B

TYPE: Two-seat aerobatic and club aircraft.

PROGRAMME: First flight August 1968; certificated 4 September 1970; FAA certification for day and night VFR 1974.

CURRENT VERSIONS: **CAP 10 B**: Current production version with enlarged rudder and ventral fin.

CAP 10 R: Glider tug (remorqueur).

CUSTOMERS: Total 275 CAP 10/10 Bs produced by early 1995; deliveries in 1994 included two to South Korea for evaluation, with possible large order to follow. French Air Force operates 56 at Ecole de l'Air at Salon de Provence and Ecole de Formation Initiale du Personnel Navigant (EFIPN 307) at Avord. French Navy operates eight at 51 Escadrille de Servitude at Rochefort/Soubise.

COSTS: FFr756,000 ex works Bernay.

DESIGN FEATURES: Derived from Piel Emeraude. Wing section NACA 23012; dihedral 5°; incidence 0°.

FLYING CONTROLS: Slotted ailerons; trim tabs on both elevators, balance tab on rudder; tailplane incidence adjustable on ground; plain flaps.

STRUCTURE: All-spruce single-spar wing torsion box, rear auxiliary spar; okoumé ply skin on wing and fuselage with polyester fabric covering; double skin on forward fuselage; fin spar integral with fuselage and tailplane.

LANDING GEAR: Non-retractable tailwheel type. Mainwheel legs of light alloy, with ERAM type 9 270 C oleo-pneumatic shock-absorbers. Single wheel on each main unit, tyre size 380 × 150 mm. Solid tailwheel tyre, size 6 × 200. Tailwheel is steerable by rudder linkage but can be disengaged for ground manoeuvring. Hydraulically actuated mainwheel disc brakes (controllable from port seat) and parking brake. Streamline fairings on mainwheels and legs.

POWER PLANT: One 134 kW (180 hp) Textron Lycoming AEIO-360-B2F flat-four engine, driving a Hoffmann two-blade fixed-pitch wooden propeller. Standard fuel tank aft of engine fireproof bulkhead, capacity 72 litres (19 US gallons; 16 Imp gallons). Optional auxiliary tank, capacity 75 litres (20 US gallons; 16.5 Imp gallons), beneath baggage compartment. Inverted fuel and oil (Aviat/Christen) system permits continuous inverted flight.

ACCOMMODATION: Side by side adjustable seats for two persons, with provision for back parachutes, under rearward sliding and jettisonable moulded transparent canopy. Special aerobatic shoulder harness standard. Space for 20 kg (44 lb) of baggage aft of seats in training and touring models.

SYSTEMS: Electrical system includes Delco-Remy 40 A engine-driven alternator and STECO ET24 Ni/Cd battery.

AVIONICS: Bendix/King avionics standard.

DIMENSIONS, EXTERNAL:

Wing span	8.06 m (26 ft 5¼ in)
Wing aspect ratio	5.99
Length overall	7.16 m (23 ft 6 in)
Height overall	2.55 m (8 ft 4¼ in)
Tailplane span	2.90 m (9 ft 6 in)
Wheel track	2.06 m (6 ft 9 in)

DIMENSIONS, INTERNAL:

Cockpit: Max width	1.054 m (3 ft 5½ in)

AREAS:

Wings, gross	10.85 m² (116.79 sq ft)
Ailerons (total)	0.79 m² (8.50 sq ft)
Vertical tail surfaces (total)	1.32 m² (14.25 sq ft)
Horizontal tail surfaces (total)	1.86 m² (20.0 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility):

Weight empty, equipped: A, U	550 kg (1,213 lb)
Fuel weight: A	54 kg (119 lb)
U	108 kg (238 lb)
Max T-O weight: A	760 kg (1,675 lb)
U	830 kg (1,829 lb)
Max wing loading: A	70.05 kg/m² (14.35 lb/sq ft)
U	76.50 kg/m² (15.67 lb/sq ft)
Max power loading: A	5.66 kg/kW (9.31 lb/hp)
U	6.19 kg/kW (10.16 lb/hp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (V_{NE})	183 kts (340 km/h; 211 mph)
Max level speed at S/L	146 kts (270 km/h; 168 mph)
Max cruising speed (75% power)	135 kts (250 km/h; 155 mph)
Stalling speed: flaps up	52 kts (95 km/h; 59 mph) IAS
flaps down	43 kts (80 km/h; 50 mph) IAS
Max rate of climb at S/L	480 m (1,575 ft)/min
Service ceiling	5,000 m (16,400 ft)
T-O run	350 m (1,149 ft)
T-O to 15 m (50 ft)	450 m (1,477 ft)
Landing from 15 m (50 ft)	600 m (1,968 ft)
Landing run	360 m (1,182 ft)
Range with max fuel	539 n miles (1,000 km; 621 miles)
g limits	+6/−4.5

UPDATED

Mudry CAP 10 B two-seat aerobatic light aircraft *(Paul Jackson)* 1995

MUDRY CAP 231

TYPE: Single-seat competition aerobatic aircraft.

PROGRAMME: First flight (F-WZCI) April 1990; French certification 25 July 1990. Flown by 10 pilots in 1990 World Aerobatic Championships.

CURRENT VERSIONS: **CAP 231**: Standard aerobatic version, *as described*.

CAP 231 EX: Improved version; described separately.

CUSTOMERS: First aircraft delivered to Tony Bianchi in UK 1990; seven to Moroccan Air Force's 'Marche Verte' aerobatic team; 24th CAP 231 completed October 1994.

DESIGN FEATURES: Some of 10 CAP 230s converted to CAP 231; main differences include elevator servo tab, forward swept wingroots and optional Mühlbauer three-blade propeller. Wing section V16F, thickness/chord ratio 16 per cent; dihedral 1° 30′; no twist.

FLYING CONTROLS: Two elevator trim tabs, one also acting as servo tab; four-section ailerons cover three-quarters of span; servo tabs on outer ailerons.

STRUCTURE: All-wood structure, single-spar wing; wooden skins; non-flammable laminated plastics engine cowling.

LANDING GEAR: Non-retractable tailwheel type. Cantilever glassfibre main legs, with wheel fairings. Cleveland disc brakes.

POWER PLANT: One 224 kW (300 hp) Textron Lycoming AEIO-540-L1B5D flat-six engine, driving a two-blade Hartzell HC-C2YR-4CF constant-speed propeller or a three-blade Mühlbauer MTV-9BC 200-15. Fuel capacity 65 litres (17.2 US gallons; 14.3 Imp gallons). Aviat/Christen inverted oil system.

ACCOMMODATION: Single glassfibre seat under sideways-opening canopy, hinged to starboard. Space for 35 kg (72 lb) baggage behind pilot. Special aerobatic shoulder harness.

DIMENSIONS, EXTERNAL:

Wing span	8.08 m (26 ft 6 in)
Wing aspect ratio	6.62
Length overall	6.75 m (22 ft 1¾ in)
Height overall	1.90 m (6 ft 2¾ in)
Tailplane span	2.82 m (9 ft 3 in)
Wheel track	2.40 m (7 ft 10½ in)

AREAS:

Wings, gross	9.86 m² (106.13 sq ft)
Ailerons (total)	0.92 m² (9.90 sq ft)
Horizontal tail surfaces (total)	3.89 m² (41.87 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, N: Normal):

Weight empty	630 kg (1,389 lb)
Max T-O weight: A	730 kg (1,609 lb)
N	820 kg (1,807 lb)
Max wing loading: A	74.04 kg/m² (15.16 lb/sq ft)
N	83.16 kg/m² (17.03 lb/sq ft)
Max power loading: A	3.26 kg/kW (5.36 lb/hp)
N	3.67 kg/kW (6.03 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	216 kts (400 km/h, 248 mph)
Max level speed at S/L	178 kts (330 km/h, 205 mph)
Max cruising speed (75% power)	162 kts (300 km/h, 186 mph)
Stalling speed	49 kts (90 km/h, 56 mph)
Max rate of climb at S/L	960 m (3,150 ft)/min
Rate of roll at 161 kts (300 km/h, 186 mph)	270°/s
T-O run	150 m (490 ft)
T-O to 15 m (50 ft)	200 m (656 ft)
Landing from 15 m (50 ft)	450 m (1,476 ft)
Landing run	400 m (1,312 ft)
Range with max fuel	194 n miles (360 km, 223 miles)
g limits	±10

UPDATED

MUDRY CAP 231 EX

TYPE: Single-seat competition aerobatic aircraft.

PROGRAMME: First flight 18 December 1991 (F-WZCI) with Barrett 194 kW (260 hp) engine. Won 1993 European Aerobatic Championship in Grosseto, Italy.

CUSTOMERS: Six produced by October 1994, including two sponsored by Breitling and one to Aero Club d'Italia.

COSTS: Price $220,000 ready to fly in USA certificated for exhibition, with normal Mudry warranties; $155,000 if delivered without engine, propeller, paint and flight testing. Exact dollar price depends on exchange rate.

DESIGN FEATURES: Wing in carbonfibre produced by Extra (see Germany), similar to wing of Extra 260, but with different rear spar/fuselage attachment and different aileron assister 'spades'; bare wing weighs 90 kg (198 lb); aerofoil is modified symmetrical V16F, thickness/chord ratio 15 per cent at root, 12.5 per cent at tip; area greater than CAP 230 but [illegible].

FLYING CONTROLS: All push-pull rods with forces equal in all axes; stick movement reduced to 18 cm (7 in) in both axes; ailerons cover most of trailing-edge and assisted by 'spades'; elevator geared tab; two footrests on rudder pedals for aerobatics and cross-country flying.

STRUCTURE: Steel tube fuselage; carbonfibre wing.

LANDING GEAR: Glassfibre bow main landing gear, with Cleveland hydraulic brakes and parking brake; mainwheel tyres 5.00-5; improved tailwheel.

POWER PLANT: One 224 kW (300 hp) Textron Lycoming AEIO-540 flat six engine, driving a Mühlbauer MTV9 BC/200-15 propeller; 300 hp is continuous power; electric starting. One 60 litre (15.8 US gallon; 13.2 Imp gallon) ferry tank in each wing, one 67 litre (17.7 US gallon; 14.7 Imp gallon) aerobatic tank in fuselage; electric contents gauges for wing tanks, sight tube for fuselage tank; average cruising fuel consumption at 145 knots (270 km/h, 167 mph) is 45 litres (11.9 US gallons; 9.9 Imp gallons)/h.

ACCOMMODATION: Pilot has custom seat clipped into cockpit; elbow supports for high g loads; throttle quadrant moved rearwards; rudder pedals adjustable over 15 cm (5½ in).

SYSTEMS: Battery and connectors located to simplify engine starting by jump leads.

DIMENSIONS, EXTERNAL: As for CAP 231 except:

Wing span	7.40 m (24 ft 3¼ in)
Wing aspect ratio	5.86

WEIGHTS AND LOADINGS: As for CAP 231 except:

Weight empty	603 kg (1,329 lb)

PERFORMANCE: As for CAP 231 except:

Max rate of climb at S/L	1,050 m (3,445 ft)/min
Rate of roll: at 161 kts (300 km/h, 186 mph)	330°/s
at 176 kts (327 km/h, 203 mph)	360°/s

UPDATED

MUDRY CAP 232

TYPE: Single-seat competition aerobatic aircraft.

PROGRAMME: Prototype (F-WZCH) first flew 7 July 1994. French certification and first sales March 1995. Illustration in Addenda. Will replace CAP 231 EX.

COSTS: FFr1.2 million.

DESIGN FEATURES: Similar to, and improvement on, CAP 231 EX. Carbonfibre wing produced in France. Very high roll rates; see under Performance.

FLYING CONTROLS: Conventional mechanical ailerons, elevator and rudder. Electrically actuated elevator tab, elevator servo tab to reduce stick forces. Almost full-span ailerons for high roll rates.

STRUCTURE: Two-spar carbonfibre wings; 10 ribs.

LANDING GEAR: Fixed tailwheel type; mainwheel tyres 500 × 5.

POWER PLANT: One 224 kW (300 hp) Textron Lycoming AEIO-540-L1B5 flat-six engine, driving a constant-speed Mühlbauer MTV-9-BC-C200-15 or RTV 14 BC-C190-17 four-blade propeller. Total fuel capacity 189.3 litres (50.0 US gallons; 41.6 Imp gallons) in one fuselage tank and two wing tanks. Fuel and oil system designed for prolonged inverted flight.

ACCOMMODATION: Single seat under rear-hinged canopy. Baggage hold behind pilot.

SYSTEMS: Electrical system includes engine-driven alternator and 12 V 60 Ah battery.

AVIONICS: Customer specified.

Comms: Radio and transponder optional.

Flight: GPS optional.

EQUIPMENT: Sighting frame can be attached to wingtip for competition aerobatic purposes; assists in judging exact verticals.

DIMENSIONS, EXTERNAL:

Wing span	7.39 m (24 ft 3 in)
Wing chord: at root	1.83 m (6 ft 0 in)
at tip	0.91 m (3 ft 0 in)
Wing aspect ratio	5.39
Length overall	6.76 m (22 ft 2 in)
Tailplane span	2.74 m (9 ft 0 in)
Wheel track	1.75 m (5 ft 9 in)
Propeller diameter	1.90 m (6 ft 2¾ in)
Propeller ground clearance	0.30 m (1 ft 0 in)

AREAS:

Wings, gross	10.13 m² (109.0 sq ft)
Ailerons (total)	1.00 m² (10.76 sq ft)
Fin	0.55 m² (5.92 sq ft)
Rudder	0.77 m² (8.29 sq ft)
Tailplane	1.02 m² (10.99 sq ft)
Elevators	1.11 m² (11.93 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	590 kg (1,300 lb)
Max payload	227 kg (500 lb)
Fuel weight	123 kg (270 lb)
Max T-O and landing weight	816 kg (1,800 lb)
Max wing loading	80.63 kg/m² (16.51 lb/sq ft)
Max power loading	3.65 kg/kW (6.00 lb/hp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (VNE)	218 kts (403 km/h, 250 mph)
Max level speed	183 kts (339 km/h; 211 mph)
Manoeuvre speed (VA)	173 kts (320 km/h, 199 mph)
Econ cruising speed	145 kts (269 km/h, 167 mph)
Stalling speed, power off	57 kts (105 km/h, 65 mph)
Max rate of climb at S/L	914 m (3,000 ft)/min
Rate of roll at manoeuvre speed	420°/s
Service ceiling	4,575 m (15,000 ft)
T-O run	150 m (492 ft)
T-O to 15 m (50 ft)	180 m (591 ft)
Landing from 15 m (50 ft)	450 m (1,477 ft)
Range with max fuel, 45% power	647 n miles (1,200 km; 745 miles)
g limits	±10

UPDATED

REIMS AVIATION

REIMS AVIATION SA

Aérodrome de Reims Prunay, BP 2745, F-51062 Reims Cedex
Telephone: 33 26 48 46 46
Fax: 33 26 49 13 60
Telex: REMAVIA 830754 F
PRESIDENT AND DIRECTOR GENERAL: Jean-Paul Chauffour
MARKETING MANAGER: Yves de Vriendt
EXTERNAL RELATIONS: Christian Jousset

Originally Société Nouvelle des Avions Max Holste, founded 1956. Reims Aviation licensed to manufacture Cessna aircraft for sale in Europe, Africa and Asia, but stopped making small piston-engined types when Cessna did. Reims had built 6,343 aircraft of all types by 1 January 1995. Reims developed twin-turboprop F 406 Caravan II (see below); programme continues, but Cessna sold its 49 per cent share in Reims Aviation to Compagnie Française Chauffour Investissement (CFCI) in early 1989. Reims Aviation supervised in 1993 by Comité Interministériel de Restructuration Industrielle (CIRI), seeking investment from new risk-sharing partners.

Reims makes components for Dassault Falcons, ATR 42/72 and Airbus A300/A310; partnership work on A330/A340. Other activity is maintenance of general aviation aircraft. Workforce was 350 in 1995, office and factory floor space covers 28,300 m² (304,500 sq ft).

UPDATED

REIMS F 406 CARAVAN II

TYPE: Twin-turboprop unpressurised light business and utility transport.

PROGRAMME: Announced mid-1982, first flight (F-WZLT) 22 September 1983, French certification 21 December 1984, FAA later; first flight production F 406 (F-ZBEO) 20 April 1985.

CURRENT VERSIONS: **F 406 Caravan II**: Passenger, freight (with underbelly cargo pod), target towing and coastal patrol version, last named with underfuselage pod containing Terma SLAR and SAT IR linescanner.

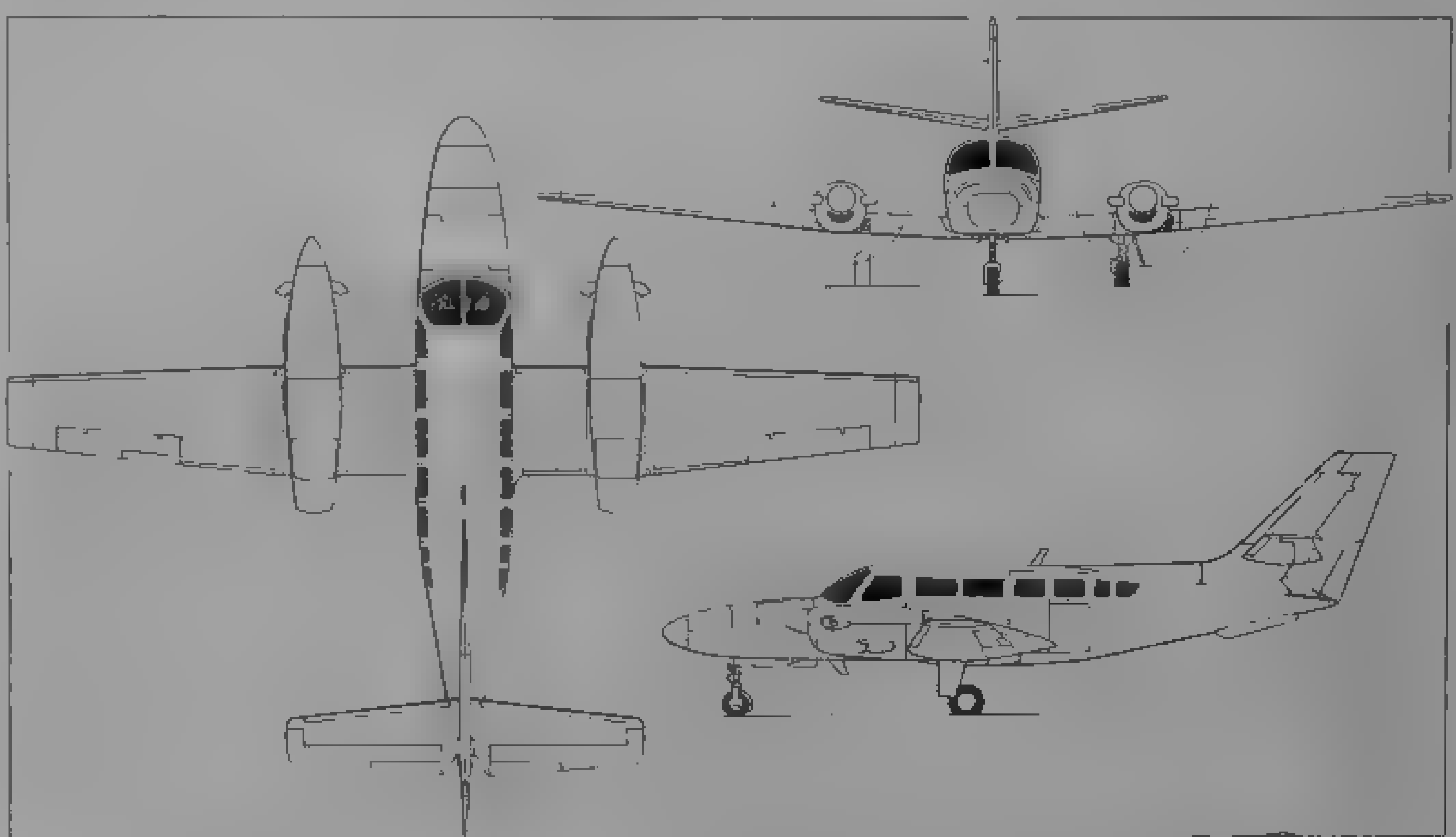
Vigilant: Version for Scottish Fisheries Protection Agency with new belly radome containing GEC-Marconi Seaspray 2000 radar.

CUSTOMERS: Total 78 of the initial production of 85 ordered by 1994, 72 delivered. French Customs Service received eight in Polmar II configuration, fitted with Sextant Nadir in Gemini navigation system and Bendix/King 1500 radar in belly radome and was due to take delivery in 1995 of two in Surmar configuration with Texas Instruments AN/APS-134 surveillance radar and Litton night vision system, first Surmar (No. 74) handed over 11 January 1995. French Army uses two for target towing, largest fleet is 28 flying with Aviation Lease Holland BV as freighters. Scottish Fisheries has two Vigilants for fisheries patrol. Zimbabwe purchased four Caravan IIs for rural development programme. National Jet Systems Australia has ordered three Vigilants for delivery early 1996 as coastal surveillance aircraft equipped with Texas Instruments radar.

COSTS: Standard aircraft $2,117,000 (1994).

DESIGN FEATURES: Extrapolated from Cessna Conquest airframe; wing section NACA 23018 at root and 23012 at tip; dihedral 3° 30′ on centre-section, 4° 55′ on outer panels; twist −3°; incidence 2° at root, fin offset 1° to port, tailplane dihedral 9°; cabin not pressurised.

FLYING CONTROLS: Conventional, with trim tabs in elevators, port aileron and rudder, hydraulically operated Fowler flaps.



Reims F 406 Caravan II light business and utility transport *(Jane's/Dennis Punnett)* 1993

STRUCTURE: Conventional light metal with three-spar fail-safe wing centre-section to SFAR 41C, two-spar outer wings.

LANDING GEAR: Hydraulically retractable tricycle type with single wheel on each unit. Main units retract inward into wing, nosewheel rearward. Emergency extension by means of a 138 bar (2,000 lb/sq in) rechargeable nitrogen bottle. Cessna oleo-pneumatic shock absorbers. Main units of articulated (trailing link) type. Single-disc hydraulic brakes. Parking brake.

POWER PLANT: Two Pratt & Whitney Canada PT6A-112 turboprops (each 373 kW; 500 shp), each driving a McCauley 9910535-2 three-blade reversible-pitch and automatically feathering metal propeller. Fuel capacity 1,823 litres (481 US gallons; 401 Imp gallons).

ACCOMMODATION: Crew of two and up to 12 passengers, in pairs facing forward, with centre aisle, except at rear of cabin in 12/14-seat versions. Alternative basic configurations for six VIP passengers in reclining seats in business version, and for operation in mixed passenger/freight role. Business version has partition between cabin and flight deck, and toilet on starboard side at rear. Split main door immediately aft of wing, on port side, with built-in airstair in downward-hinged lower portion. Optional cargo door forward of this door to provide single large opening. Overwing emergency exit on each side. Passenger seats removable for cargo carrying, or for conversion to ambulance, air photography, maritime surveillance and other specialised roles. Baggage compartments in nose, with three doors, at rear of cabin and in rear of each engine nacelle. Ventral cargo pod optional.

SYSTEMS: Freon air conditioning system of 17,500 BTU capacity, plus engine bleed air and electric boost heating. Electrical system includes 28 V 250 A starter/generator on each engine and 39 Ah Ni/Cd battery. Hydraulic system, pressure 120 bars (1,750 lb/sq in), for operation of landing gear. Separate hydraulic system for brakes. Goodrich pneumatic de-icing of wings and tail unit, and electric windscreen de-icing, optional.

AVIONICS: Standard Bendix/King Silver Crown. Gold Crown optional.

Comms: Dual Bendix/King transceivers.

Radar: Bendix/King RDS 82 weather radar optional.

Flight: Dual ADF and marker beacon receiver. Autopilot optional.

Instrumentation: Provision for equipment to FAR Pt 135A standards, including dual controls and instrumentation for co-pilot.

EQUIPMENT: Optional cargo interior includes heavy duty sidewalls, utility floorboards, cabin floodlighting and cargo restraint nets.

DIMENSIONS, EXTERNAL:

Wing span	15.08 m (49 ft 5¾ in)
Wing aspect ratio	9.69
Length overall	11.89 m (39 ft 0¼ in)
Height overall	4.01 m (13 ft 2 in)
Tailplane span	5.87 m (19 ft 3 in)
Wheel track	4.28 m (14 ft 0½ in)
Wheelbase	3.81 m (12 ft 5¾ in)
Propeller diameter	2.36 m (7 ft 9 in)
Cabin door: Height	1.27 m (4 ft 2 in)
Width	0.58 m (1 ft 10¾ in)
Cargo double door (optional):	
Total width	1.24 m (4 ft 1 in)

DIMENSIONS, INTERNAL:

Cabin (incl flight deck): Length	5.71 m (18 ft 8¾ in)
Max width	1.42 m (4 ft 8 in)
Max height	1.31 m (4 ft 3½ in)
Min height (at rear)	1.21 m (3 ft 11⅝ in)
Width of aisle	0.29 m (11½ in)
Volume	8.64 m³ (305 cu ft)
Baggage compartment (nose):	
Length	2.00 m (6 ft 6¾ in)
Volume	0.74 m³ (26.0 cu ft)
Nacelle lockers: Length	1.55 m (5 ft 1¼ in)
Width	0.73 m (2 ft 4¾ in)
Baggage volume: total, internal	2.22 m³ (78.5 cu ft)
incl cargo pod	3.52 m³ (124.3 cu ft)

AREAS:

Wings, gross	23.48 m² (252.75 sq ft)
Ailerons (total)	1.36 m² (14.64 sq ft)
Trailing-edge flaps	3.98 m² (42.84 sq ft)
Fin	4.05 m² (43.59 sq ft)
Rudder, incl tab	1.50 m² (16.15 sq ft)
Tailplane	5.81 m² (62.54 sq ft)
Elevators, incl tabs	1.66 m² (17.87 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	2,460 kg (5,423 lb)
Max payload	1,563 kg (3,446 lb)
Max fuel	1,444 kg (3,183 lb)
Max ramp weight	4,502 kg (9,925 lb)
Max T-O and landing weight	4,468 kg (9,850 lb)
Max zero-fuel weight	3,856 kg (8,500 lb)
Max wing loading	190.3 kg/m² (38.97 lb/sq ft)
Max power loading	5.99 kg/kW (9.85 lb/shp)

PERFORMANCE:

Max operating Mach number (MMO)	0.52
Max operating speed (VMO)	229 kts (424 km/h; 263 mph) IAS
Max cruising speed	246 kts (455 km/h; 283 mph)
Econ cruising speed	200 kts (370 km/h; 230 mph)
Stalling speed: clean	94 kts (174 km/h; 108 mph) IAS
wheels and flaps down	81 kts (150 km/h; 93 mph) IAS
Max rate of climb at S/L	564 m (1,850 ft)/min
Rate of climb at S/L, OEI	121 m (397 ft)/min
Service ceiling	9,145 m (30,000 ft)
Service ceiling, OEI	4,935 m (16,200 ft)
T-O run	526 m (1,725 ft)
T-O to 15 m (50 ft)	803 m (2,635 ft)
Landing from 15 m (50 ft), without reverse pitch	674 m (2,212 ft)
Range with max fuel, at max cruising speed, 45 min reserves	1,153 n miles (2,135 km; 1,327 miles)

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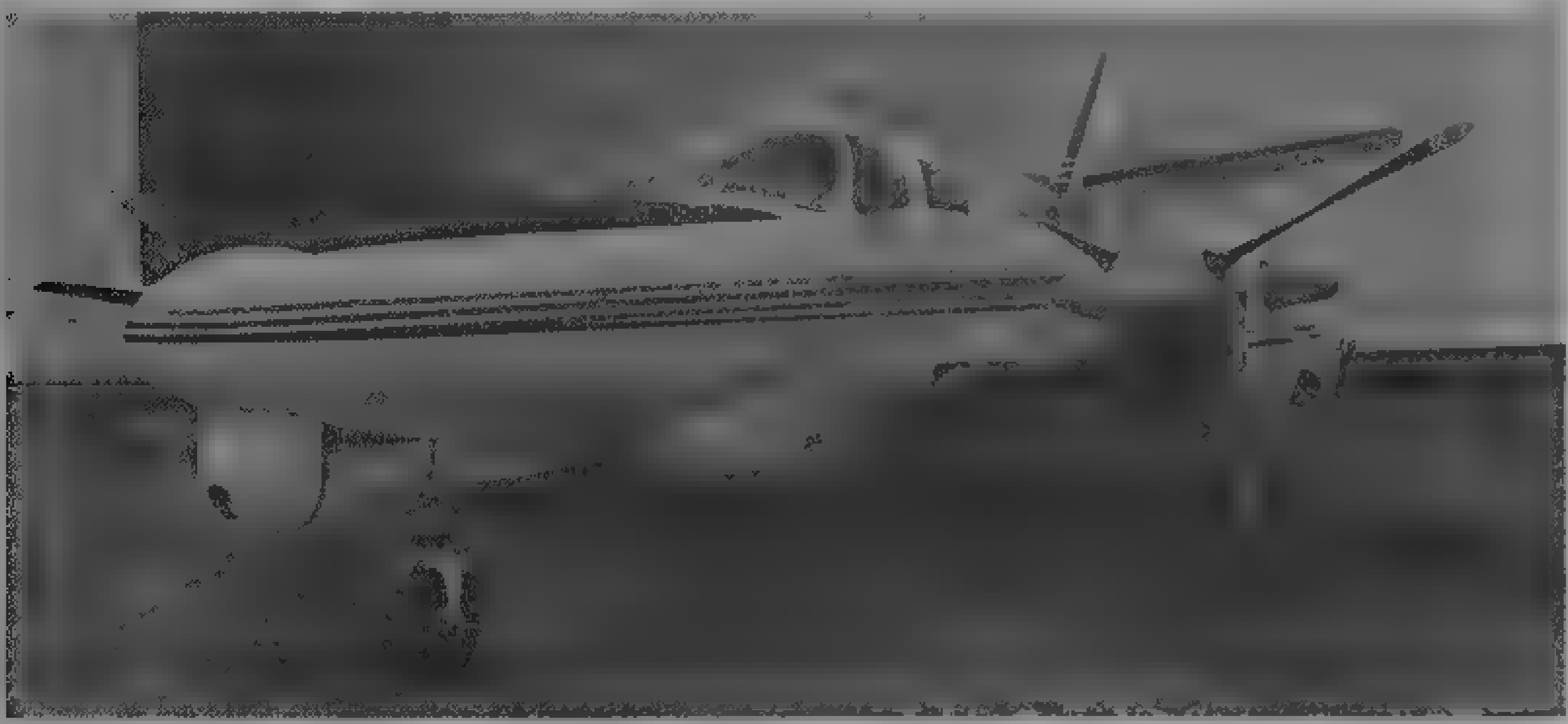

Reims F 406 Polmar II surveillance aircraft of the French Customs Service

1995

ROBIN

AVIONS PIERRE ROBIN

1 route de Troyes, Darois, F-21121 Fontaine-les-Dijon Cedex
Telephone: 33 80 44 20 50
Fax: 33 80 35 60 80
Telex: 350 818 ROBIN F
PRESIDENT AND DIRECTOR GENERAL: Georges Megrelis
DOMESTIC AND SALES MANAGER: Michel Pelletier
PUBLIC RELATIONS: Jacques Bigenwald

Formed October 1957 as Centre Est Aéronautique; name changed to Avions Pierre Robin 1969; acquired July 1988 by Compagnie Française Chauffour Investissement (CFCI) and incorporated into Aéronautique Service group with Robin SA (after-sales support company of Dijon Val Suzon) and SN Centrair sailplane manufacturer; Pierre Robin left company 1990. Total of 3,353 aircraft produced by January 1995; 61 aircraft delivered in 1994 and 33 in first half of 1995. Factory area 11,500 m² (123,785 sq ft); workforce 110.

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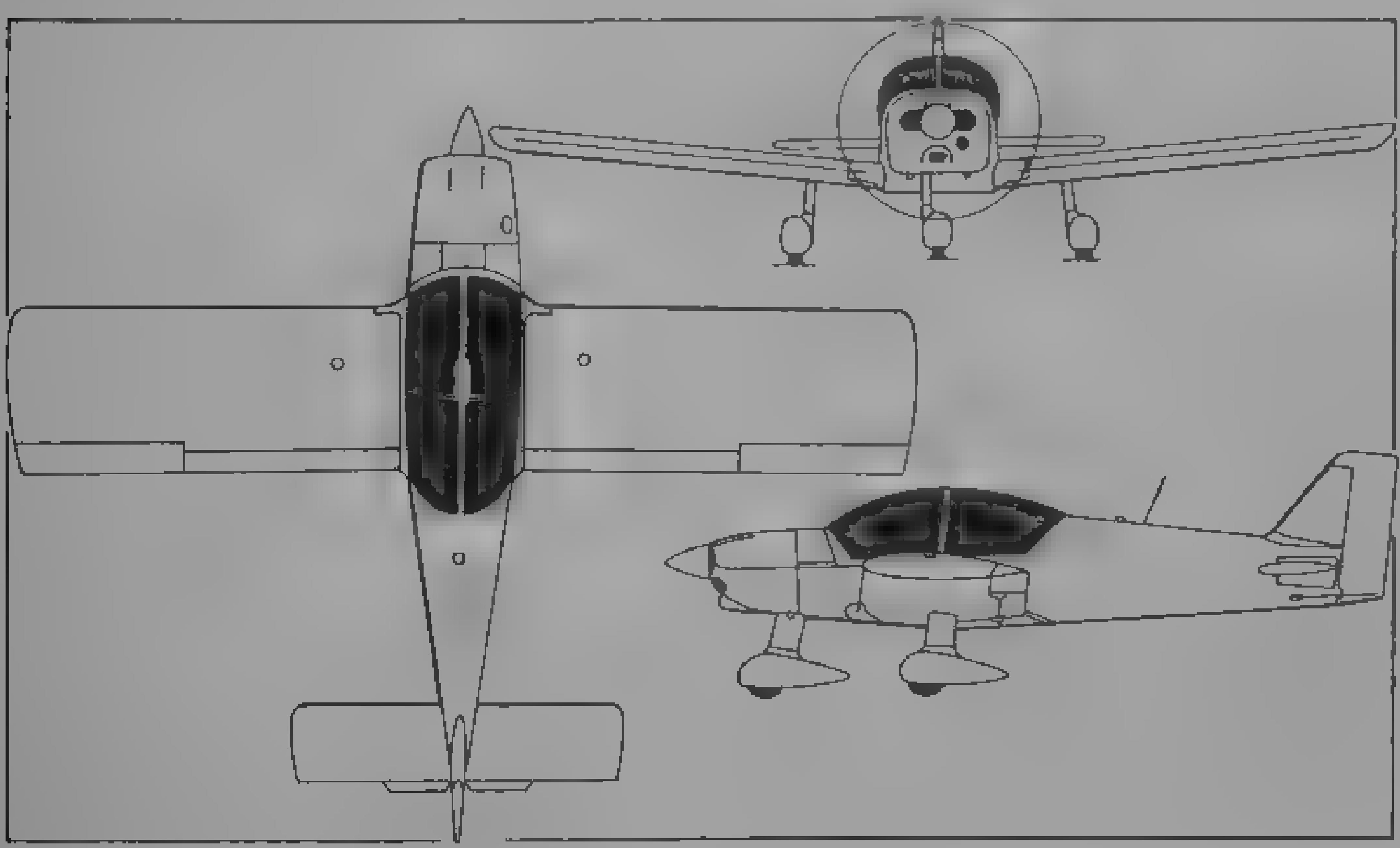


Robin 200 (HR 200/120B) two-seat trainer *(Jane's/Paul Jackson)*

1995

ROBIN 200

TYPE: Two-seat light trainer.

PROGRAMME: New production version of Robin HR 200/120B, which had first flown in 1971 and was built through much of 1970s (see 1977-78 *Jane's*); incorporates minor modifications.

CUSTOMERS: 39 Robin 200s built by early 1995, 14 delivered in 1994; over 280 HR 200s and R 2160s of all versions built since 1971.

COSTS: FFr420,550 with Package 1 avionics; FFr497,785 with Package 2.

DESIGN FEATURES: As for HR 200/120B but with new instrument panel, adjustable seats, new engine cowlings and propeller spinner, and improved anti-corrosion treatment. Wing section NACA 64A515 (mod); dihedral 6° 18′ from roots; incidence 6°; no sweepback.

FLYING CONTROLS: Cable-actuated Frise-type ailerons, one-piece all-moving tailplane with trim and anti-balance tabs, and rudder; electrically actuated trailing-edge slotted flaps.

STRUCTURE: All-metal; aluminium alloy stressed skin and ribs.

LANDING GEAR: Non-retractable tricycle type, with single wheel and tyre of similar size on each unit, nosewheel leg offset to starboard, steered by rudder bar, streamline leg and wheel fairings, damped tailskid, hydraulic disc brakes and parking brake.

POWER PLANT: One 88 kW (118 hp) Textron Lycoming O-235-L2A flat-four engine, driving a two-blade fixed-pitch propeller. Fuel capacity 120 litres (31.7 US gallons; 26.4 Imp gallons). Auxiliary tanks optional.

ACCOMMODATION: Pilot and passenger side by side under forward sliding jettisonable canopy with anti-glare tint, dual stick controls; dual left-hand throttles, dual toe brakes.

SYSTEMS: Cabin ventilated and heated, with windscreen defrosting standard. Electrical system includes 12 V 32 Ah battery, 12 V 50 A alternator and starter.

AVIONICS: Customer selection; following are available:

Comms: Bendix/King KY 97 or KX 155-38 transceivers; SPA 400 intercom, dual PTT buttons, KT 76A transponder with ACK 30 height encoder.

Flight: KI 208 VOR, KY 97 or KX 155-38 nav/com.

Flight hour recorder

Instrumentation. Vacuum-driven gyro horizon and direction indicator (engine-driven pump), electric turn and slip indicator, magnetic compass, rate of climb indicator and rest of blind-flying instruments.

EQUIPMENT: Navigation lights, strobe lights, landing light

DIMENSIONS, EXTERNAL:
- Wing span 8.33 m (27 ft 4 in)
- Wing chord, constant 1.50 m (4 ft 11 in)
- Wing aspect ratio 5.55
- Length overall 6.64 m (21 ft 9¾ in)
- Height overall 1.94 m (6 ft 4½ in)
- Tailplane span 2.64 m (8 ft 8 in)
- Wheel track 2.88 m (9 ft 5½ in)
- Wheelbase 1.465 m (4 ft 9¾ in)

AREAS:
- Wings, gross 12.50 m² (134.5 sq ft)
- Ailerons, total 1.06 m² (11.41 sq ft)
- Trailing-edge flaps, total 1.34 m² (14.42 sq ft)
- Elevators, inc. tabs 2.03 m² (21.85 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty 525 kg (1,157 lb)
- Max T-O weight 780 kg (1,719 lb)
- Max wing loading 62.4 kg/m² (12.78 lb/sq ft)
- Max power loading 8.86 kg/kW (14.57 lb/hp)

PERFORMANCE:
- Cruising speed, 75% power 121 kts (225 km/h, 140 mph)
- Stalling speed 50 kts (92 km/h, 57 mph)
- Max rate of climb at S/L 234 m (768 ft)/min
- Range 566 n miles (1,050 km, 652 miles)
- Endurance 4 h 35 min

UPDATED

ROBIN R 2160

TYPE: Two-seat aerobatic light aircraft.

PROGRAMME: Certificated in France in mid-1978 and in USA (FAR Pt 23 Aerobatic and Utility category) 15 November 1982. Some aircraft assembled in Canada (1983-1985). Production then ceased, but restarted in France January 1994.

CUSTOMERS: Total 107 sold in Europe, Australia, Canada and USA, including four delivered in 1994 from re-launched production.

DESIGN FEATURES: Low-wing, section NACA 23015; dihedral 6° 20'; incidence 3° at root.

FLYING CONTROLS: Fully balanced slotted ailerons, all-moving tailplane with anti-balance tabs each side. Horn balanced rudder; no tab. Slotted flaps.

STRUCTURE: Aluminium alloy spars and skinning; semi-monocoque.

LANDING GEAR: Non-retractable tricycle type with fairing, oleo-pneumatic shock-absorber and tyre (380 × 150 mm) on each leg. Cleveland disc brakes on mainwheels. Nosewheel steering through rudder bar.

POWER PLANT: One 119 kW (160 hp) Textron Lycoming O-320-D2A flat-four engine, driving a Sensenich 74DM6S5-2-64 two-blade fixed-pitch propeller. Fuselage fuel tank, capacity 120 litres (31.7 US gallons; 26.4 Imp gallons). If operated in Utility category, optional fuel tank of 160 litres (42.3 US gallons; 35.2 Imp gallons).

ACCOMMODATION: Two seats side by side.

SYSTEMS: 12 V electrical system.

AVIONICS: *Flight:* VOR, ADF, ILS, GPS and other items, at customer's choice.

Instrumentation: Blind-flying panel optional.

DIMENSIONS, EXTERNAL:
- Wing span 8.33 m (26 ft 4 in)
- Wing chord, constant 1.56 m (5 ft 1¼ in)
- Wing aspect ratio 5.33
- Length overall 7.09 m (23 ft 3¼ in)
- Height overall 2.13 m (7 ft 0 in)
- Tailplane span 3.03 m (9 ft 11¼ in)
- Wheel track 2.91 m (9 ft 6½ in)
- Wheelbase 1.44 m (4 ft 8¾ in)
- Propeller diameter 1.88 m (6 ft 2 in)

DIMENSIONS, INTERNAL:
- Cabin: Width 1.05 m (3 ft 5¼ in)

AREAS:
- Wings, gross 13.01 m² (140.0 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty 560 kg (1,235 lb)
- Max T-O weight: Aerobatic 800 kg (1,764 lb)
  - Utility 900 kg (1,984 lb)
- Max wing loading: Aerobatic 61.5 kg/m² (12.6 lb/sq ft)
  - Utility 69.2 kg/m² (14.2 lb/sq ft)
- Max power loading: Aerobatic 6.71 kg/kW (11.02 lb/hp)
  - Utility 7.55 kg/kW (12.40 lb/hp)

PERFORMANCE (at Aerobatic max T-O weight, S/L, ISA):
- Never-exceed speed (VNE) 180 kts (333 km/h, 207 mph)
- Max level speed 138 kts (256 km/h, 159 mph)
- Cruising speed, at 2,290 m (7,500 ft), 75% power 130 kts (241 km/h, 150 mph)
  - at 3,350 m (11,000 ft), 65% power 126 kts (233 km/h, 145 mph)
- Stalling speed: flaps up 52 kts (96 km/h, 60 mph)
  - flaps down 47 kts (87 km/h, 54 mph)
- Max rate of climb at S/L 312 m (1,025 ft)/min
- Service ceiling (30.5 m; 100 ft/min rate of climb) 4,575 m (15,000 ft)
- Range at 65% power 513 n miles (950 km, 590 miles)
- g limits +6/−3

UPDATED

Robin R 2160 aerobatic two-seater *(Paul Jackson)*

1995

ROBIN DR 400 DAUPHIN

TYPE: Three/four-seat light training and touring aircraft.

PROGRAMME: First flight original DR 400 Petit Prince 15 May 1972. French and UK certification 1977. DR 400 Dauphin introduced 1979, improvements introduced 1988 and 1993. 'Model 93' is latest standard.

CURRENT VERSIONS: **DR 400/120 Dauphin 2+2:** Production version with 83.5 kW (112 hp) engine, to carry two adults and two children.

DR 400/140B Dauphin 4: Full four-seater with 119 kW (160 hp) engine.

CUSTOMERS: Recent production 24 Dauphin 2+2 and 17 Dauphin 4 in 1992, nine Dauphin 2+2 and nine Dauphin 4 in 1993, 13 Dauphin 2+2 and nine Dauphin 4 in 1994.

DESIGN FEATURES: Classic Jodel design, wing section NACA 23013.5 modified with leading-edge droop; centre panels parallel chord, slight twist, outer panels tapered with dihedral 14°, twist −6.

FLYING CONTROLS: Slab tailplane with trimmable anti-balance tab, interchangeable ailerons, plain flaps.

STRUCTURE: All-wood, single box spar with ribs threaded over box, plywood covered leading-edge box; fabric covering elsewhere; fuselage plywood covered, flaps all metal and interchangeable.

LANDING GEAR: Non-retractable tricycle type, with oleo-pneumatic shock-absorbers and hydraulically actuated disc brakes. All three wheels and tyres are size 380 × 150 mm, pressure 1.57 bars (22.8 lb/sq in) on nose unit, 1.77 bars (25.6 lb/sq in) on main units. Nosewheel steerable via rudder bar. Fairings over all three legs and wheels. Tailskid with damper. Toe brakes and parking brake.

POWER PLANT: *Dauphin 2+2.* One 83.5 kW (112 hp) Textron Lycoming O-235-L2A flat-four engine, driving a Sensenich 72CKS 6-0-56 two-blade fixed-pitch metal propeller, or Hoffmann two-blade fixed-pitch wooden propeller.

Dauphin 4. One Textron Lycoming O-320-D flat-four engine developing 104.4 kW (140 hp) at 2,300 rpm and 119 kW (160 hp) at 2,700 rpm.

Both versions, fuel tank in fuselage, usable capacity 100 litres (26.4 US gallons; 22 Imp gallons), optional 50 litre (13.2 US gallon; 11 Imp gallon) auxiliary tank. Oil capacity 5.7 litres (1.5 US gallons; 1.25 Imp gallons).

ACCOMMODATION: Enclosed cabin, with seats for three or four persons. Maximum weight of 154 kg (340 lb) on front pair and 136 kg (300 lb), including baggage, at rear in Dauphin 2+2. Additional 55 kg (121 lb) of disposable load in Dauphin 4. Access via forward-sliding jettisonable transparent canopy. Dual controls standard. Cabin heated and ventilated. Baggage compartment with internal access.

SYSTEMS: Standard equipment includes a 12 V 50 A alternator, 12 V 32 Ah battery, electric starter, audible stall warning and windscreen de-icing.

AVIONICS: Radio, blind flying equipment, and navigation, landing and anti-collision lights, to customer's requirements.

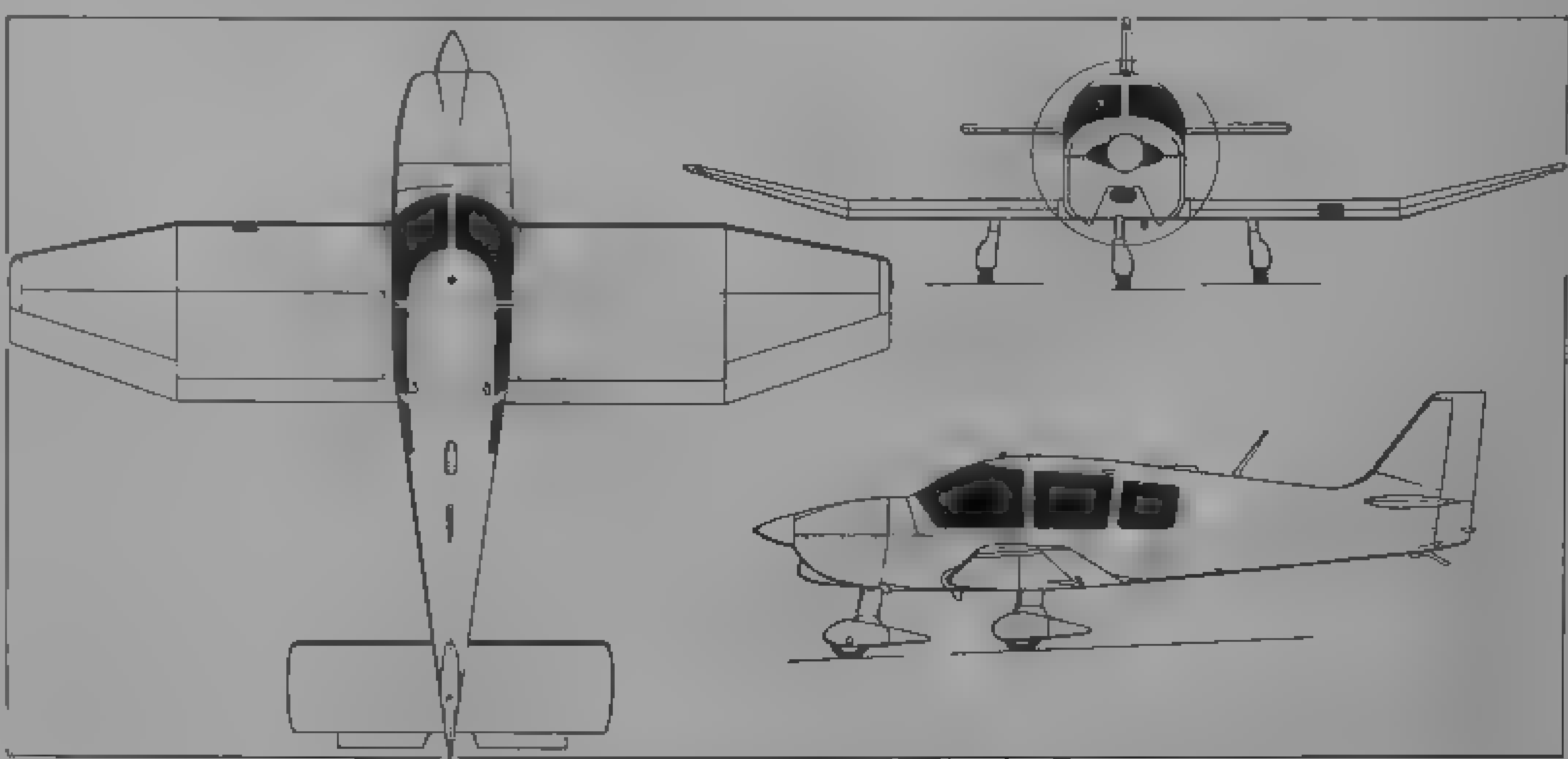
DIMENSIONS, EXTERNAL:
- Wing span 8.72 m (28 ft 7¼ in)
- Wing chord:
  - centre-section, constant 1.71 m (5 ft 7½ in)
  - at tip 0.90 m (2 ft 11½ in)
- Wing aspect ratio 5.59
- Length overall 6.96 m (22 ft 10 in)
- Height overall 2.23 m (7 ft 3¾ in)
- Tailplane span 3.20 m (10 ft 6 in)
- Wheel track 2.60 m (8 ft 6¼ in)
- Wheelbase 5.20 m (17 ft 0¾ in)
- Propeller diameter 1.78 m (5 ft 10 in)

DIMENSIONS, INTERNAL:
- Cabin: Length 1.62 m (5 ft 3¾ in)
  - Max width 1.10 m (3 ft 7¼ in)
  - Max height 1.23 m (4 ft 0½ in)
- Baggage volume 0.39 m³ (13.75 cu ft)

AREAS:
- Wings, gross 13.60 m² (146.39 sq ft)
- Ailerons, total 1.15 m² (12.38 sq ft)
- Flaps, total 0.70 m² (7.53 sq ft)
- Fin 0.61 m² (6.57 sq ft)
- Rudder 0.63 m² (6.78 sq ft)
- Horizontal tail surfaces, total 2.88 m² (31.00 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty, equipped: 2+2 535 kg (1,179 lb)
  - 4 580 kg (1,279 lb)
- Max baggage: 2+2, 4 40 kg (88 lb)
- Max T-O and landing weight: 2+2 900 kg (1,984 lb)
  - 4 1,000 kg (2,205 lb)
- Max wing loading: 2+2 66.2 kg/m² (13.56 lb/sq ft)
  - 4 73.5 kg/m² (15.05 lb/sq ft)
- Max power loading: 2+2 10.78 kg/kW (17.71 lb/hp)
  - 4 8.38 kg/kW (13.78 lb/hp)

PERFORMANCE (at max T-O weight):
- Never exceed speed (VNE):
  - 2+2, 4 166 kts (308 km/h, 191 mph)
- Max level speed at S/L:
  - 2+2 130 kts (241 km/h, 150 mph)
  - 4 143 kts (265 km/h, 165 mph)
- Max cruising speed: 2+2 116 kts (215 km/h, 133 mph)
  - 4 117 kts (216 km/h, 134 mph)



Robin DR 400/120 Dauphin 2+2 *(Jane's/Mike Keep)*

1993

Stalling speed, flaps down
2+2 45 kts (82 km/h, 51 mph)
4 47 kts (87 km/h, 54 mph)
Max rate of climb at S/L: 2+2 183 m (600 ft)/min
4 264 m (865 ft)/min
Service ceiling: 2+2 3,660 m (12,000 ft)
4 4,265 m (14,000 ft)
T-O run: 2+2 235 m (771 ft)
4 245 m (804 ft)
T-O to 15 m (50 ft): 2+2 535 m (1,755 ft)
4 485 m (1,591 ft)
Landing from 15 m (50 ft): 2+2 460 m (1,510 ft)
4 470 m (1,542 ft)
Landing run: 2+2 200 m (656 ft)
4 220 m (722 ft)
Range with standard fuel at max cruising speed, no reserves: 2+2, 4 464 n miles (860 km, 534 miles)

UPDATED

ROBIN DR 400/160 MAJOR

TYPE: Four-seat light aircraft.

PROGRAMME: First flight of original DR 400 Chevalier 29 June 1972, certificated France and UK same year; Major introduced 1980.

CUSTOMERS: Total 129 delivered by January 1995, including three in 1994.

DESIGN FEATURES: Main differences from Dauphin (see preceding entry) are external baggage compartment door on port side and extended wingroot leading-edges to house additional fuel tanks.

Differences from Dauphin listed below

POWER PLANT: One 119 kW (160 hp) Textron Lycoming O-320-D flat-four engine, driving a Sensenich two-blade metal fixed-pitch propeller. Fuel tank in fuselage, capacity 110 litres (29 US gallons, 24 Imp gallons), and two tanks in wingroot leading-edges, giving total capacity of 190 litres (50 US gallons, 41.75 Imp gallons), of which 182 litres (48 US gallons, 40 Imp gallons) are usable. Provision for auxiliary tank, raising total capacity to 250 litres (66 US gallons, 55 Imp gallons). Oil capacity 7.5 litres (2 US gallons, 1.6 Imp gallons).

ACCOMMODATION: Seating for four persons, on adjustable front seats (maximum load 154 kg, 340 lb total) and rear bench seat (maximum load 154 kg, 340 lb total). Forward sliding transparent canopy. Up to 40 kg (88 lb) of baggage can be stowed aft of rear seats when four occupants are carried.

DIMENSIONS, EXTERNAL:
Wing aspect ratio 5.35
Propeller diameter 1.83 m (6 ft 0 in)
Baggage door: Height 0.47 m (1 ft 6½ in)
Width 0.55 m (1 ft 9½ in)

AREAS:
Wings, gross 14.20 m² (152.8 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 570 kg (1,257 lb)
Max T-O and landing weight 1,050 kg (2,315 lb)
Max wing loading 74.2 kg/m² (15.20 lb/sq ft)
Max power loading 8.82 kg/kW (14.47 lb/hp)

PERFORMANCE (at max T-O weight):
Never-exceed speed (V_{NE}) 166 kts (308 km/h, 191 mph)
Max level speed at S/L 146 kts (271 km/h, 168 mph)
Max cruising speed (75% power) at 2,440 m (8,000 ft) 132 kts (245 km/h, 152 mph)
Econ cruising speed (65% power) at 3,200 m (10,500 ft) 130 kts (241 km/h, 150 mph)
Stalling speed: flaps up 56 kts (103 km/h, 64 mph)
flaps down 50 kts (93 km/h, 58 mph)
Max rate of climb at S/L 255 m (836 ft)/min
Service ceiling 4,115 m (13,500 ft)
T-O run 295 m (968 ft)
T-O to 15 m (50 ft) 590 m (1,936 ft)
Landing from 15 m (50 ft) 545 m (1,788 ft)
Landing run 250 m (820 ft)
Range with standard fuel at econ cruising speed, no reserves 825 n miles (1,530 km, 950 miles)

UPDATED

ROBIN DR 400/180 REGENT

TYPE: Four/five-seat light aircraft.

PROGRAMME: First flight 27 March 1972, certificated 10 May 1972.

CUSTOMERS: Total 320 delivered, including 15 in 1992, 19 in 1993, eight in 1994.

DESIGN FEATURES: Typical Jodel design, two seat rear bench.

Differences from DR 400/160 listed below

POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-A flat-four engine. Fuel tankage unchanged.

ACCOMMODATION: Basically as for DR 400/160. Baggage capacity 60 kg (132 lb).

DIMENSIONS, EXTERNAL:
Propeller diameter 1.93 m (6 ft 4 in)

WEIGHTS AND LOADINGS:
Weight empty, equipped 600 kg (1,322 lb)
Max T-O and landing weight 1,100 kg (2,425 lb)
Max wing loading 77.7 kg/m² (15.91 lb/sq ft)
Max power loading 8.21 kg/kW (13.47 lb/hp)

PERFORMANCE (at max T-O weight):
Max level speed at S/L 150 kts (278 km/h, 173 mph)

Robin DR 400/140B Dauphin 4

1995

Max cruising speed (75% power) at 2,285 m (7,500 ft) 140 kts (260 km/h, 162 mph)
Econ cruising speed (60% power) at 3,660 m (12,000 ft) 132 kts (245 km/h, 152 mph)
Stalling speed: flaps up 57 kts (105 km/h, 65 mph)
flaps down 52 kts (95 km/h, 59 mph)
Max rate of climb at S/L 252 m (825 ft)/min
Service ceiling 4,720 m (15,475 ft)
T-O run 315 m (1,035 ft)
T-O to 15 m (50 ft) 610 m (2,000 ft)
Landing from 15 m (50 ft) 530 m (1,740 ft)
Landing run 249 m (817 ft)
Range with standard fuel at 65% power, no reserves 783 n miles (1,450 km, 900 miles)

UPDATED

ROBIN DR 400 REMO 180R

TYPE: Glider tug and four/five-seat light aircraft.

PROGRAMME: First flight and certification 1972 as DR 400/180R (Remorqueur, abbreviated Remo); flown 1985 with Porsche PFM 3200 engine as DR 400RP or Remo 212, became first Porsche powered aircraft to be certificated. Remo 212 production ceased 1990 after 29 had been built (details in 1991-92 *Jane's*).

CUSTOMERS: Total 299 Remos delivered by January 1994, including nine Remo 180Rs in 1992 and six in 1993.

DESIGN FEATURES: Same as Regent except no external baggage door, and baggage compartment covered in transparent Plexiglas to maximise rearward view, towing hook under tail, Dauphin wing without extended wingroot leading-edges.

Differences from DR 400/180 listed below

POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-A flat-four engine, driving (for glider towing) a Sensenich 76 EM 8S5 058 or Hoffmann HO-27-HM-180/138 two-blade propeller. For touring, a coarser pitch Sensenich 76 EM 8S5 064 propeller of same diameter can be fitted.

AREAS:
Wings, gross 13.60 m² (146.39 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 560 kg (1,234 lb)
Max T-O and landing weight 1,000 kg (2,205 lb)
Max wing loading 73.5 kg/m² (15.05 lb/sq ft)
Max power loading 7.46 kg/kW (12.25 lb/hp)

PERFORMANCE (glider tug, at max T-O weight):
Max level speed 146 kts (270 km/h, 168 mph)
Cruising speed (70% power) at 2,440 m (8,000 ft) 124 kts (230 km/h, 143 mph)
Stalling speed, flaps down 47 kts (87 km/h, 54 mph)
Max rate of climb at S/L 336 m (1,100 ft)/min
Max rate of climb at S/L, towing two-seat sailplane 210 m (690 ft)/min
Service ceiling 6,100 m (20,000 ft)
T-O to 15 m (50 ft), towing single-seat sailplane 375 m (1,230 ft)
Landing from 15 m (50 ft) 470 m (1,542 ft)
Range at econ cruising speed, with auxiliary fuel, no reserves 647 n miles (1,200 km, 745 miles)

VERIFIED

ROBIN DR 400/200R REMO 200

TYPE: Glider tug, based on DR 400 Remo 180R.

PROGRAMME: Deliveries started 1993, four delivered in 1994.

DESIGN FEATURES: More powerful version of DR 400 Remo 180R, with 149 kW (200 hp) Textron Lycoming IO-360 engine driving a constant-speed propeller. Fitted with a double silencer, noise has been measured as 5.5 dBA less than the JAR certification requirement.

*PERFORMANCE TOWING GLIDER (based on tug weight 800 kg; 1,764 lb and a heavy glider of 600 kg; 1,323 lb, take-off from short grass, ISA):
T-O run 245 m (804 ft)
T-O to 15 m (50 ft) 475 m (1,558 ft)
Rate of climb 258 m (846 ft)/min

* *Max glider weight 1,145 kg (2,524 lb)*

UPDATED

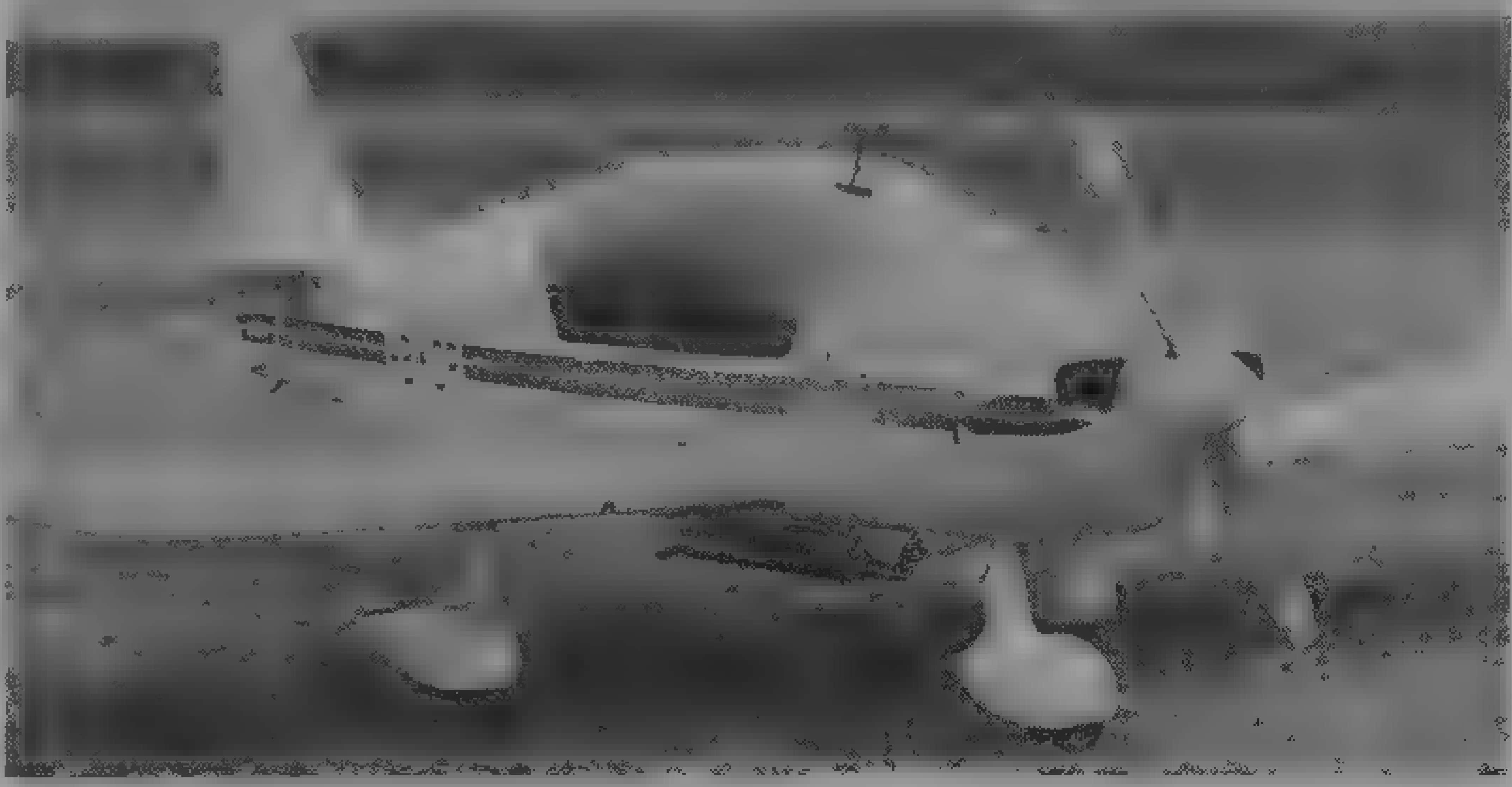
ROBIN R 3000 SERIES

TYPE: Four-seat light aircraft.

PROGRAMME: Development began 1978, two prototype R 3140s flew 1980 and 1981, second with compound taper wing; marketing of R 3000 assigned to Socata from 1 September 1983 to 1 February 1988; manufacture of Series 120 ended 1987.

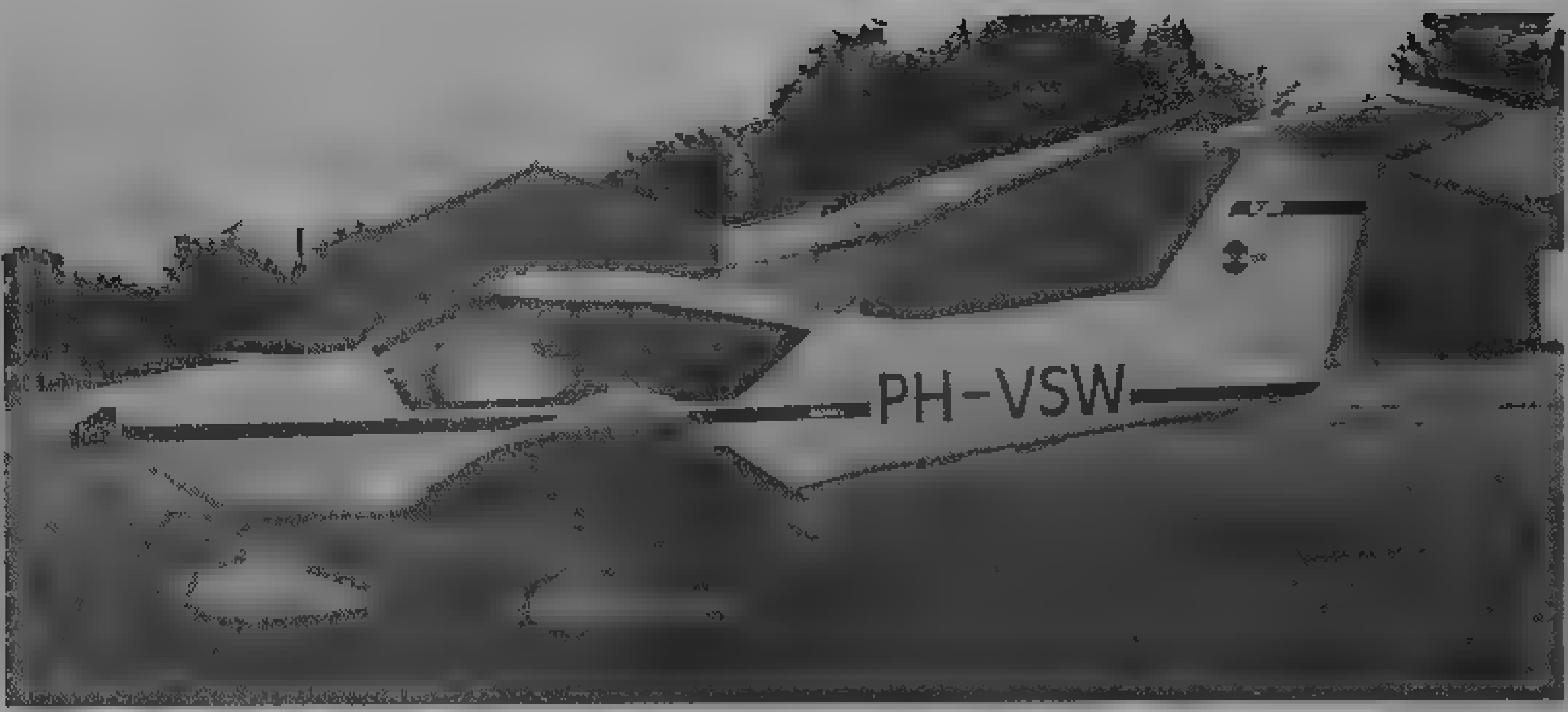
CURRENT VERSIONS: **R 3000/140**: Formerly R 3140L, certificated 13 October 1983.

R 3000/160: Replaced Series 120, received US FAA certification December 1992.



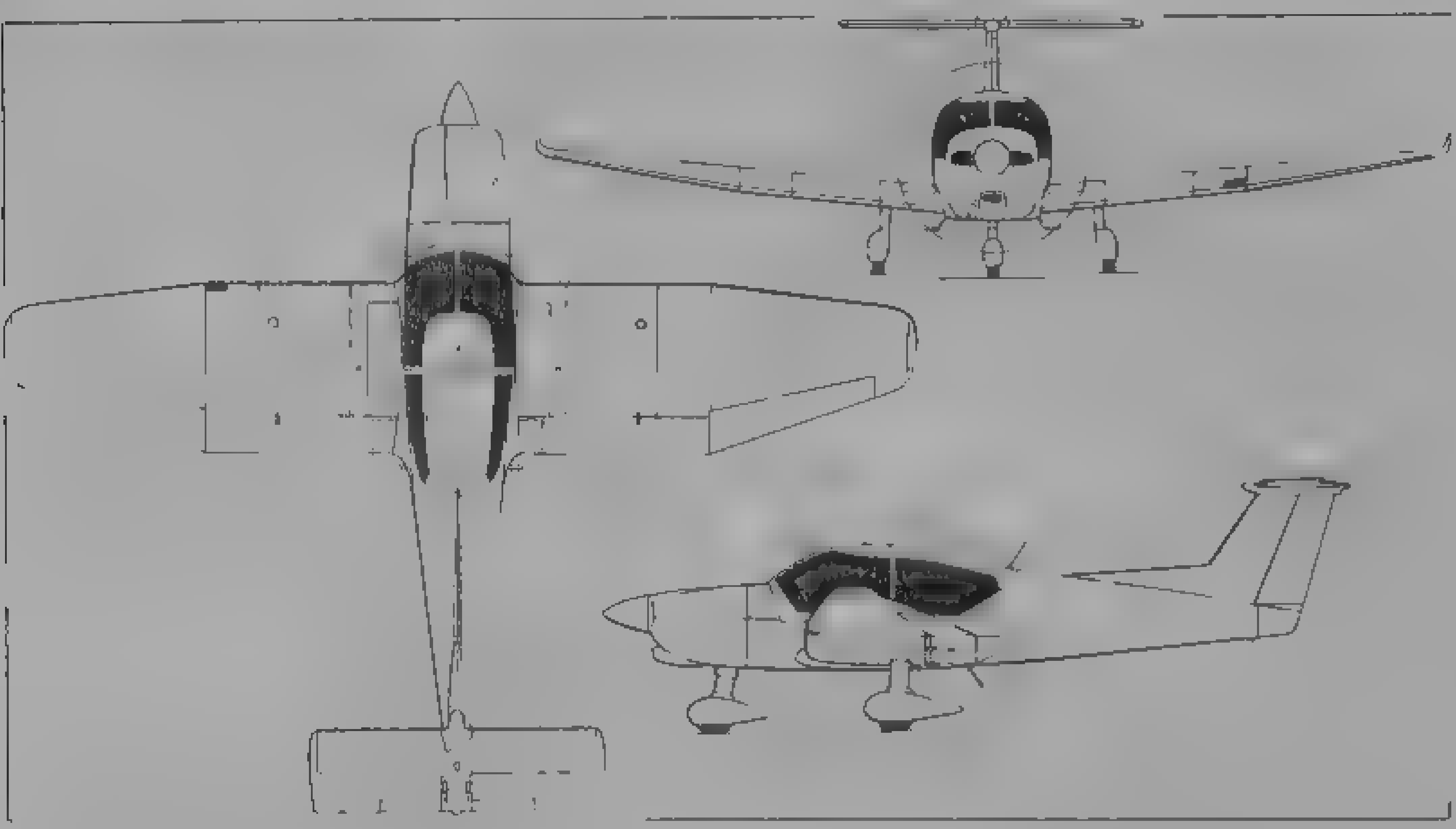
Robin Remo 200 glider tug and four/five-seat light aircraft. Note double silencer to reduce noise when towing gliders

1994



Robin R 3000/160 four-seat light aircraft *(John Cook)*

1992


Robin R 3000/140 (O-320-D2A engine) *(Jane's/Dennis Punnett)*

1984

CUSTOMERS: Total 70 (all versions) delivered, including two in 1994

DESIGN FEATURES: All-metal airframe with 'flat' version of model wing, original intention that one single airframe should accept all different engines; seven proposed versions not produced

Wing section NACA 43013.5 on constant chord inner panels and 43010.5 on tapered outer panels, dihedral 6°; incidence 3°. T tail.

FLYING CONTROLS: Fixed tailplane, full-span elevator balance/trim tabs, electrically actuated slotted flaps.

STRUCTURE: All light alloy except glassfibre engine cowlings, single-spar wing

LANDING GEAR: Non-retractable tricycle type. Nosewheel steerable via rudder pedals, is self-centring and locks automatically after take-off. Robin long-stroke low-pressure oleo-pneumatic shock-absorbers. Mainwheel tyres size 380 × 150-6. Nosewheel tyre size 5.00-5. Cleveland disc brakes. Streamline polyester fairings on all three legs and wheels. Hydraulic disc brakes. Parking brake

POWER PLANT: *R 3000/140:* One 119.3 kW (160 hp) Textron Lycoming O-320-D2A flat four engine, driving a Sensenich 74DMS5-2-64 two-blade fixed-pitch metal propeller. Two integral fuel tanks in wing leading-edges, with total capacity of 160 litres (42.25 US gallons; 35.2 Imp gallons) standard, or 200 litres (52.8 US gallons; 44 Imp gallons) optional. Oil capacity 7.5 litres (2 US gallons; 1.6 Imp gallons).

R 3000/160: One 134 kW (180 hp) Textron Lycoming O-320-A flat four engine. Standard fuel capacity 225 litres (59.4 US gallons; 49.5 Imp gallons)

ACCOMMODATION: Four seats in pairs in enclosed cabin, with dual controls and brakes. Adjustable front seats, with inertia reel safety belts. Removable rear seats, with belts. Carpeted floor. Forward-sliding jettisonable and tinted transparent canopy, with safety lock, accessible from both sides. Automatically retracting step on each side. Baggage capacity 40 kg (88 lb). Cabin heated and ventilated. Windscreen demister

SYSTEMS: Electrical system includes 12 V 60 A alternator and 12 V 32 Ah battery

AVIONICS: Three incremental standards of optional avionics and equipment available: Series I, II and III

Comms: Series II comprises Becker AR 2009/25 720-channel VHF. Series III adds Becker ATC 2000 transponder or Bendix/King KT 76A transponder

Flight: Series II equipment includes NR 2029 VOR/LOC receiver and indicator or Bendix/King KX 155/08 nav/com with audio and KI 203 VOR indicator. Series III adds Becker 2079 ADF or Bendix/King KR 87 digital ADF

Instrumentation: Series I comprises horizon and directional gyros with vacuum pump, Type 9100 electric turn co-ordinator, rate of climb indicator and C 2400 magnetic compass (exchange for standard C 2300)

EQUIPMENT: Optional mission equipment includes agricultural spraygear with underwing spraybars and chemical tank, capacity 350 litres (92.5 US gallons; 77 Imp gallons). Equipment forming part of avionics packages can be found under Avionics. Position lights and two beacons, anti-collision light and instrument panel lighting

DIMENSIONS, EXTERNAL:

Wing span	9.81 m (32 ft 2¼ in)
Wing chord: at root	1.72 m (5 ft 7¾ in)
at tip	0.655 m (2 ft 1¾ in)
Wing aspect ratio	6.65
Length overall	7.51 m (24 ft 7¾ in)
Height overall	2.66 m (8 ft 8¾ in)
Tailplane span	3.20 m (10 ft 6 in)
Wheel track	2.64 m (8 ft 8 in)
Wheelbase	1.74 m (5 ft 8½ in)
Propeller diameter	1.83 m (6 ft 0 in)
Propeller ground clearance	0.30 m (11¾ in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.70 m (8 ft 10¼ in)
Max width	1.14 m (3 ft 8¾ in)
Max height	1.20 m (3 ft 11¼ in)
Floor area	2.60 m² (28.0 sq ft)
Volume (incl baggage space)	2.4 m³ (84.75 cu ft)
Baggage space	0.43 m³ (15.2 cu ft)

AREAS:

Wings, gross	14.47 m² (155.75 sq ft)
Ailerons (total)	1.32 m² (14.21 sq ft)
Trailing-edge flaps (total)	2.02 m² (21.74 sq ft)
Vertical tail surfaces (total)	1.30 m² (14.00 sq ft)
Horizontal tail surfaces (total)	2.44 m² (26.26 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: 140	600 kg (1,323 lb)
160	650 kg (1,433 lb)
Max T-O and landing weight: 140	1,050 kg (2,315 lb)
160	1,150 kg (2,535 lb)
Max wing loading: 140	72.6 kg/m² (14.86 lb/sq ft)
160	79.5 kg/m² (16.28 lb/sq ft)
Max power loading: 140	10.10 kg/kW (16.54 lb/hp)
160	8.58 kg/kW (14.08 lb/hp)

PERFORMANCE (at max T-O weight):

Max level speed at S/L:	
140	135 kts (250 km/h; 155 mph)
160	146 kts (270 km/h; 168 mph)
Max cruising speed (75% power) at optimum altitude:	
140	130 kts (240 km/h; 149 mph)
160	138 kts (255 km/h; 158 mph)
Econ cruising speed (65% power):	
140	119 kts (220 km/h; 136 mph)
160	128 kts (238 km/h; 148 mph)
Stalling speed, flaps down:	
140	47 kts (87 km/h; 54 mph)
160	49 kts (91 km/h; 57 mph)
Max rate of climb at S/L: 140	258 m (846 ft)/min
160	267 m (875 ft)/min
Service ceiling: 140	4,265 m (14,000 ft)
160	4,575 m (15,000 ft)
T-O run: 140	280 m (920 ft)
160	310 m (1,017 ft)
T-O to 15 m (50 ft): 140	525 m (1,725 ft)
160	565 m (1,854 ft)
Landing from 15 m (50 ft): 140	490 m (1,610 ft)
160	540 m (1,772 ft)
Landing run: 140	190 m (625 ft)
160	210 m (690 ft)
Range with max standard fuel, no reserves:	
75% power: 140	605 n miles (1,120 km; 696 miles)
160	804 n miles (1,490 km; 925 miles)
65% power: 140	640 n miles (1,185 km; 736 miles)
160	868 n miles (1,610 km; 1,000 miles)
Range with max optional fuel, no reserves:	
75% power: 140	756 n miles (1,400 km; 870 miles)
65% power: 140	799 n miles (1,480 km; 919 miles)

UPDATED

ROBIN DR 400 REMO V6

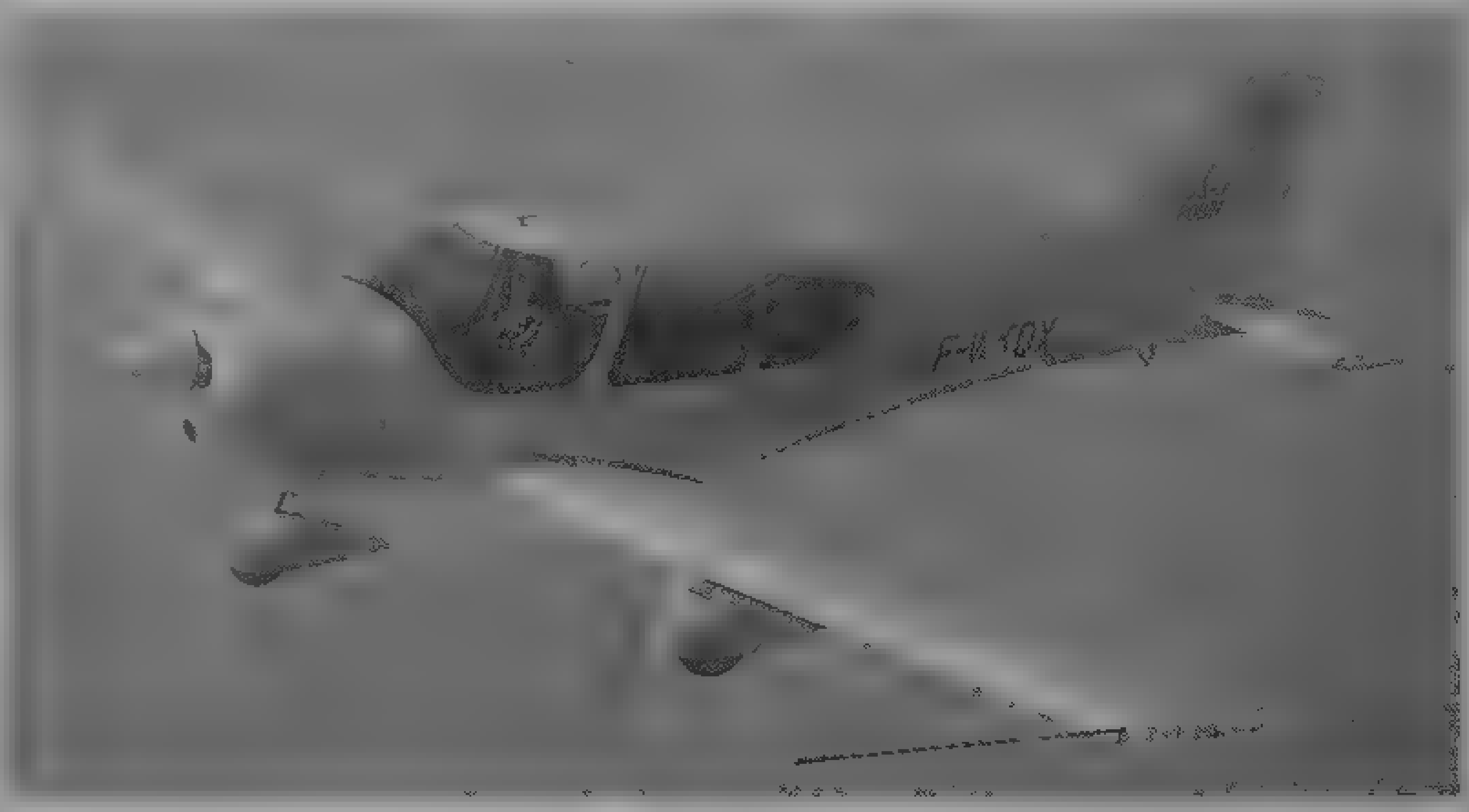
TYPE: Glider tug. Illustrated in Addenda

PROGRAMME: First flight (F-WGXT) 6 June 1995

DESIGN FEATURES: Water-cooled engine; offers improved climb performance, lower noise and improved fuel efficiency, compared with earlier Remo versions of DR 400

POWER PLANT: One 138 kW (185 hp) France Aeromoteur FAM 200 V6 engine

NEW ENTRY


Robin X4 demonstrator

1995

ROBIN X4

TYPE: Experimental four-seat light aircraft.

PROGRAMME: First flight (F-WKQX) 25 February 1991, exhibited at 1991 Paris Air Show. Objective to exploit comparative wind tunnel evaluation of new aerodynamics, including laminar sections, compared with DR 400; also to examine composite and mixed metal/composite structures. Aircraft undergoing tests to investigate cooling, drag reduction, improved control system and enhanced flight performance with NLF aerofoil section.

DESIGN FEATURES: Single 86.5 kW (116 hp) Textron Lycoming engine; wing is wooden to facilitate rapid modification, fuselage composites. New wing with NLF type aerofoil fitted 1994.

X4 providing data for **New Light Aircraft** with four seats, retractable landing gear and constant-speed propeller, due to fly early 1996.

UPDATED

SOCATA

SOCIETE DE CONSTRUCTION D'AVIONS DE TOURISME ET D'AFFAIRES (Subsidiary of Aerospatiale)

Le Terminal BAT 413, Zone d'Aviation d'Affaires, F-93352 Le Bourget Cedex
Telephone: 33 (1) 49 34 69 69/84
Fax: 33 (1) 49 34 69 71
Telex: SOCATA 520 828 F

WORKS AND AFTER-SALES SERVICE: Aérodrome de Tarbes-Ossun Lourdes, BP 930, F-65009 Tarbes Cedex
Telephone: 33 62 41 76 00
Fax: 33 62 41 76 54

PRESIDENT AND DIRECTOR GENERAL:
Jean Marc de Raffin Dourny

SALES DIRECTOR: Christophe van den Broek

TECHNICAL DIRECTOR: Jean-Louis Rabilloud

INFORMATION AND COMMUNICATION: Caroline Valette

Formed 1966 as a subsidiary of Aerospatiale responsible for light aircraft; sales of TB series, including turboprop TBM 700, totalled over 1,700 by early 1995, of which majority delivered; also makes components for Airbus A300/320/330/340, Lockheed C-130, ATR 42, Dassault Falcons, and Eurocopter Super Puma, Dauphin and Ecureuil, overhauls Morane-Saulnier MS 760 Paris. Covered floor area 57,000 m² (613,450 sq ft), workforce 1,000. New TB 320 Tangara described in Addenda.

UPDATED

SOCATA TB 9 TAMPICO CLUB, TB 10 TOBAGO and TB 200 TOBAGO XL

TYPE: Four/five-seat light aircraft.

PROGRAMME: Design launched 1975, first flight of original TB 10 (F-WZJP), powered by 119 kW (160 hp) Textron Lycoming O-320, 23 February 1977, second prototype powered by 134 kW (180 hp) Textron Lycoming.

CURRENT VERSIONS: **TB 9 Tampico Club**: Four-seater with 119 kW (160 hp) Textron Lycoming O-320-D2A and Sensenich fixed-pitch propeller; superseded Tampico FP and CS in 1989 (see 1988-89 *Jane's*); fuel capacity 158 litres (41.75 US gallons, 34.75 Imp gallons); non-retractable landing gear, first flight 9 March 1979, French certification 27 September 1979.

TB 10 Tobago: Four/five-seater with 134 kW (180 hp) Textron Lycoming O-360-A1AD and non-retractable landing gear; French certification 26 April 1979, FAA certification 27 November 1985. *Detailed description applies to this version, except where indicated.*

TB 200 Tobago XL: Four/five-seater with 149 kW (200 hp) Textron Lycoming IO-360-A1B6; otherwise generally as TB 10, first flight 27 March 1991, French certification 30 October 1991.

CUSTOMERS: Total 282 Tampico Clubs ordered by early 1995, of which 280 delivered, 68 delivered in 1992 and 87 ordered. Italian Aero Club ordered 47 plus another 63, for allocation to 90 Italian flying clubs from January 1991, 14 ordered 1991 (and 12 more 1993) by Embry Riddle Aeronautical University, among recent orders are two IFR equipped for professional pilot training with Aeroavia based at Tires, Portugal. See table.

Total 615 TB 10 Tobagos ordered by early 1995, of which 597 delivered, six delivered in 1994 and 23 ordered, eight used by SFACT for flying training for French air traffic controllers, 38 ordered December 1993 by People's Republic of China College of Aviation at Sichuan and delivered in 1994.

DESIGN FEATURES: Wing section RA 16 3C3, thickness/chord ratio 16 per cent, dihedral 4° 30'.

FLYING CONTROLS: Slab tailplane with anti-balance tab, ground adjustable tabs on ailerons and rudder; strakes on lower edges of fuselage just aft of wing control turbulence under rear fuselage; electrically actuated flaps.

STRUCTURE: Conventional light alloy; single-spar wing. GFRP tips and engine cowlings. Triple anti-corrosion protection.

LANDING GEAR: Non-retractable tricycle type, with steerable nosewheel. Oleo-pneumatic shock absorber in all three units. Mainwheel tyres size 6.00-6, 6 ply rating, pressure 2.3 bars (33 lb/sq in). Glassfibre wheel fairings on all three units. Hydraulic disc brakes. Parking brake.

POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-A1AD flat-four engine, driving a Hartzell two-blade constant-speed propeller. Two integral fuel tanks in wing leading-edges, total capacity 210 litres (55.5 US gallons, 46 Imp gallons), of which 204 litres (54 US gallons, 45 Imp gallons) are usable. Oil capacity 7.5 litres (2 US gallons, 1.6 Imp gallons).

ACCOMMODATION: Four or five seats in enclosed cabin, with dual controls. Adjustable front seats with inertia reel seat belts. Removable rear bench seat with safety belts. Sharply inclined low-drag windscreen. Access via upward hinged window/doors of glassfibre. Baggage compartment aft of cabin, with external door on port side. Cabin carpeted, soundproofed, heated and ventilated. Windscreen defrosting standard.

Socata TB 9 Tampico Club assembled in the USA *1995*

SYSTEMS: Electrical system includes 12 V 60 A alternator and 12 V 32 A battery. TB 200 has 28 V 70 A alternator and 24 V 10 Ah battery. Hydraulic system for brakes only.

AVIONICS: Bendix/King Silver Crown avionics to customer's specification.

Comms: VHF transceiver.

Flight: VHF-VOR feeder.

Instrumentation: Basic nav pack includes rate of climb indicator, electric turn and bank indicator, horizontal and directional gyro, true airspeed indicator, EGT and outside air temperature indicators.

EQUIPMENT: Includes armrests for all seats, map pockets, anti-glare visors, stall warning indicator, tiedown fittings and towbar, landing and navigation lights, four individual cabin lights and instrument panel lighting.

DIMENSIONS, EXTERNAL (TB 9 and TB 10):

Wing span	9.76 m (32 ft 0¼ in)
Wing chord, constant	1.22 m (4 ft 0 in)
Wing aspect ratio	8.00
Length overall: TB 10	7.63 m (25 ft 0¼ in)
TB 200	7.70 m (25 ft 3 in)
Height overall	3.02 m (9 ft 11 in)
Tailplane span	3.20 m (10 ft 6 in)
Wheel track	2.33 m (7 ft 7¾ in)
Wheelbase	1.96 m (6 ft 5 in)
Propeller diameter	1.88 m (6 ft 2 in)
Propeller ground clearance	0.10 m (4 in)
Cabin doors (each): Width	0.90 m (2 ft 11½ in)
Height	0.76 m (2 ft 6 in)
Baggage door: Width	0.64 m (2 ft 1¼ in)
Max height	0.44 m (1 ft 5¼ in)

DIMENSIONS, INTERNAL (TB 9 and TB 10):

Cabin: Length:	
firewall to rear bulkhead	2.53 m (8 ft 3½ in)
panel to rear bulkhead	2.00 m (6 ft 6¾ in)
Max width: at rear seats	1.28 m (4 ft 2¼ in)
at front seats	1.15 m (3 ft 9¼ in)
Max height	1.12 m (3 ft 8 in)

AREAS (TB 9 and TB 10):

Wings, gross	11.90 m² (128.1 sq ft)
Ailerons (total)	0.91 m² (9.80 sq ft)
Trailing-edge flaps (total)	3.72 m² (40.04 sq ft)

SOCATA EQUIPPED FLYING SCHOOLS

Country	Operator	TB 9C Tampico Club	TB 10/200 Tobago	TB 20 Trinidad
Australia	HDH		26	5
	Ansett		24 (+ 6)	
Canada	White Aviation			3
China	CAAC		38	33
France	SEFA		45	52
	ESMA	2		3
	IAAG	4		8
	CIPRA		3	4
	AIF	2 (+ 2)	1	4
	TAF			5
Germany	various		20	20
India	IGRUA			8
Indonesia	Jaemco	2		
	IAL	4		
Israel	IDF/AF			22
Italy	AeCI	82 (+ 28)		
Morocco	RAM			10
Mozambique	ENA		2	
Poland	OKL	1 (+ 4)		
Portugal	Vega	3		2
Spain	Panavia	5	5	3
	Senasa		20	
Thailand	CATC	5		
Tunisia	NFST	4		2
Turkey	ESAC			6
USA	Navy			6
	Westair	5		
	UND	3 (+ 2)		
	Embry Riddle	24 (+ 16)		
	Parks College	14 (+ 7)		
Totals		**160 (+ 59)**	**184 (+ 6)**	**196**

Totals are orders (and options)

Socata Tobago (nearest) and two Trinidads

1995

Fin 0.88 m² (9.47 sq ft)
Rudder 0.63 m² (6.78 sq ft)
Horizontal tail surfaces (total) 2.56 m² (27.56 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, with unusable fuel and oil
TB 9 655 kg (1,444 lb)
TB 10 700 kg (1,543 lb)
TB 200 715 kg (1,576 lb)
Max baggage: TB 9 45 kg (100 lb)
TB 10 65 kg (143 lb)
Max T-O weight: TB 9 1,058 kg (2,332 lb)
TB 10, TB 200 1,150 kg (2,[illegible] lb)
Max wing loading: TB 9 88.91 kg/m² (18.21 lb/sq ft)
TB 10, TB 200 96.64 kg/m² (19.79 lb/sq ft)
Max power loading: TB 9 8.87 kg/kW (14.58 lb/hp)
TB 10 8.57 kg/kW (14.08 lb/hp)
TB 200 7.72 kg/kW (12.68 lb/hp)

PERFORMANCE (at max T-O weight):
Max level speed: TB 9 122 kts (226 km/h; 140 mph)
TB 10 133 kts (247 km/h; 153 mph)
TB 200 140 kts (259 km/h; 161 mph)
Max cruising speed (75% power)
TB 9 107 kts (198 km/h; 123 mph)
TB 10 127 kts (235 km/h; 146 mph)
TB 200 130 kts (240 km/h; 149 mph)
Econ cruising speed (65% power)
TB 9 100 kts (185 km/h; 115 mph)
TB 10 117 kts (217 km/h; 135 mph)
TB 200 121 kts (224 km/h; 139 mph)
Stalling speed:
flaps up: TB 9 58 kts (107 km/h; 67 mph)
TB 10 61 kts (112 km/h; 70 mph)
flaps down: TB 9 48 kts (89 km/h; 56 mph)
TB 10 52 kts (97 km/h; 60 mph)
TB 200 53 kts (98 km/h; 61 mph)
Max rate of climb at S/L: TB 9 229 m (750 ft)/min
TB 10 240 m (790 ft)/min
TB 200 305 m (1,000 ft)/min
Service ceiling: TB 9 3,810 m (12,500 ft)
TB 10, TB 200 3,960 m (13,000 ft)
T-O run: TB 9 340 m (1,116 ft)
TB 10 325 m (1,067 ft)
T-O to 15 m (50 ft): TB 9 520 m (1,706 ft)
TB 10 505 m (1,657 ft)
TB 200 460 m (1,510 ft)
Landing from 15 m (50 ft): TB 9 420 m (1,378 ft)
TB 10 425 m (1,395 ft)
TB 200 450 m (1,476 ft)
Landing run: TB 9 195 m (640 ft)
TB 10 190 m (623 ft)
Range with max standard fuel, allowances for T-O, climb, econ power cruise and descent, 45 min reserves
TB 9 450 n miles (834 km; 518 miles)
TB 10 653 n miles (1,210 km; 752 miles)
TB 200 590 n miles (1,093 km; 678 miles)

UPDATED

SOCATA TB 20 and 21 TRINIDAD TC

Israel Defence Force name: Pashosh (Lark)

TYPE: Four/five-seat touring and IFR training aircraft.

PROGRAMME: First flight TB 20 (F-WDBA) 14 November 1980, French certification 18 December 1981, FAA certification 27 January 1984, first delivery (F-WDBB) 23 March 1982, first flight TB 21, 24 August 1984, French certification 23 May 1985; FAA certification 5 March 1986.

CURRENT VERSIONS: **TB 20 Trinidad**: Basic version with 186 kW (250 hp) Textron Lycoming IO-540-C4D5D.

TB 21 Trinidad TC: Turbocharged version with 186 kW (250 hp) Textron Lycoming TIO-540-AB1AD.

CUSTOMERS: Total orders 536 TB 20s and 66 TB 21s by early 1995, 516 TB 20s and 64 TB 21s delivered by then, 32 TB 20 and two TB 21 delivered in 1994 and 24 TB 20 and three TB 21 ordered, orders for civilian pilot training include 45 for French SFACT and others for IAAG and CIPRA, others in Australia, India and Tunisia, delivery of 28 to China completed October 1989, followed by four more TB 20 ordered December 1993. Undisclosed quantity of TB 20s ordered for Israel Defence Force/Air Force as primary trainers, expected from US assembly. See table.

DESIGN FEATURES: Mainly as for Tobago, dihedral 6° 30′.

FLYING CONTROLS: As Tobago, but rudder trim and flap preselector added.

STRUCTURE: Largely as Tobago.

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel on each unit. Free-fall emergency extension. Steerable nosewheel retracts rearward. Main units retract inward into fuselage. Hydraulic disc brakes. Parking brake.

POWER PLANT: One Textron Lycoming flat six engine, as described in variant listings, driving a Hartzell HC-C2YK-1BF/F8477-4 two-blade metal propeller. Fuel tanks in wings, total usable capacity 326 litres (86 US gallons; 71.75 Imp gallons). Oil capacity 12.6 litres (3.3 US gallons; 2.8 Imp gallons).

SYSTEMS: Self-contained electrohydraulic system for landing gear actuation. Eros oxygen system is standard in TB 21. De-icing.

AVIONICS: Include PA, three-axis autopilot with altitude preselect, HSI, RMI, R/Nav and Stormscope.

EQUIPMENT: In addition to basic nav pack described in Tampico/Tobago entry, current aircraft have as standard equipment a heated pitot, emergency static vent, cylinder head temperature gauge, emergency lighting systems, tinted windows and storm window.

DIMENSIONS, EXTERNAL: As for TB 10, except:
Length overall 7.71 m (25 ft 3½ in)
Height overall 2.85 m (9 ft 4¼ in)
Tailplane span 3.64 m (11 ft 11¼ in)
Wheelbase 1.91 m (6 ft 3¼ in)
Propeller diameter 2.03 m (6 ft 8 in)

AREAS: As for TB 10, except:
Horizontal tail surfaces (total) 3.06 m² (32.94 sq ft)

WEIGHTS AND LOADINGS:
Weight empty: TB 20 800 kg (1,763 lb)
TB 21 844 kg (1,861 lb)
Max baggage: TB 20, TB 21 65 kg (143 lb)
Max T-O weight: TB 20, TB 21 1,400 kg (3,086 lb)
Max wing loading
TB 20, TB 21 117.6 kg/m² (24.10 lb/sq ft)
Max power loading
TB 20, TB 21 7.51 kg/kW (12.35 lb/hp)

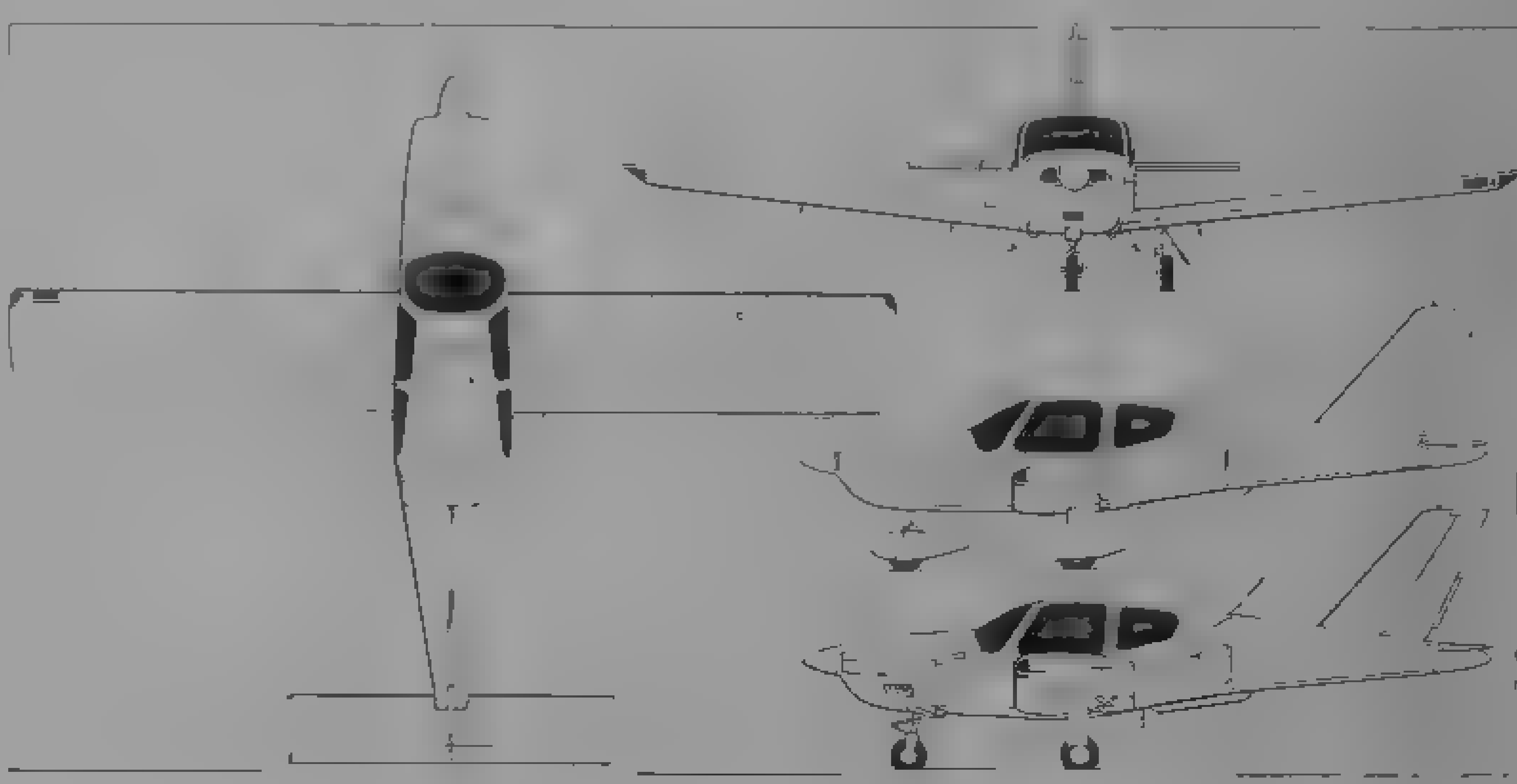
PERFORMANCE (at max T-O weight):
Max level speed: TB 20 167 kts (310 km/h; 192 mph)
TB 21 at 4,575 m (15,000 ft)
200 kts (370 km/h; 230 mph)
Max cruising speed (75% power) at 2,440 m (8,000 ft):
TB 20 164 kts (303 km/h; 188 mph)
Best power cruising speed (75% power) at 7,620 m (25,000 ft): TB 21 187 kts (347 km/h; 215 mph)
Econ cruising speed (65% power):
TB 20 at 3,660 m (12,000 ft)
160 kts (296 km/h; 184 mph)
TB 21 at 7,620 m (25,000 ft)
170 kts (315 km/h; 195 mph)
Stalling speed: flaps up
TB 20 64 kts (118 km/h; 74 mph)
TB 21 66 kts (121 km/h; 75 mph)
flaps and wheels down
TB 20 54 kts (99 km/h; 62 mph)
TB 21 55 kts (101 km/h; 63 mph)
Rate of climb: TB 20 at S/L 384 m (1,260 ft)/min
TB 21 at 610 m (2,000 ft) 332 m (1,090 ft)/min
TB 21 at 5,180 m (17,000 ft) 244 m (800 ft)/min
Service ceiling: TB 20 6,100 m (20,000 ft)
TB 21 7,630 m (25,000 ft)
T-O run: TB 20 295 m (968 ft)
TB 21 330 m (1,083 ft)
T-O to 15 m (50 ft): TB 20 479 m (1,572 ft)
TB 21 540 m (1,772 ft)
Landing from 15 m (50 ft): TB 20 530 m (1,739 ft)
TB 21 540 m (1,772 ft)
Landing run: TB 20 230 m (755 ft)
Range with max fuel, allowances for T-O, climb, cruise at best econ setting and descent, 45 min reserves:
TB 20 at 75% power at 2,135 m (7,000 ft)
885 n miles (1,640 km; 1,019 miles)
TB 20 at 65% power at 3,050 m (10,000 ft)
964 n miles (1,785 km; 1,109 miles)
Range with max fuel, no reserves:
TB 21 at 75% power at 7,620 m (25,000 ft)
890 n miles (1,648 km; 1,024 miles)
TB 21 at 65% power at 7,620 m (25,000 ft)
1,030 n miles (1,907 km; 1,185 miles)
Max ferry range at 6,100 m (20,000 ft)
TB 20 1,158 n miles (2,145 km; 1,333 miles)

UPDATED

SOCATA TB 31 OMEGA

TYPE: Turboprop trainer.

PROGRAMME: Developed as private venture. First flight (F-WOMG) 30 April 1989, offered as new aircraft or as retrofit for Epsilon. See 1993-94 and earlier *Jane's* for full description.



Socata TB 21 Trinidad TC, with additional side view (centre) of TB 10 Tobago *(Jane's/Dennis Punnett)*

1993

POWER PLANT: One 485 kW (650 shp) Turbomeca Arrius 2D turboprop, with FADEC, derated to 268 kW (360 shp) and fitted with a hydromechanical Hartzell propeller turning at 2,377 rpm. Fuel capacity in wing leading-edges of 278 litres (73.3 US gallons; 61.2 Imp gallons). Provision for two minutes of inverted flying.

ACCOMMODATION: Tandem Martin-Baker Mk 15FC through-canopy ejection seats with zero altitude, 60 knot (111 km/h; 69 mph) capability. One-piece canopy hinged to starboard; MDC at junction of canopy frame for manual emergency evacuation.

ARMAMENT: Armed versions available; four underwing hardpoints.

DIMENSIONS, EXTERNAL:

Wing span	7.92 m (25 ft 11¾ in)
Wing aspect ratio	6.71
Length overall	7.81 m (25 ft 7½ in)
Height overall	2.68 m (8 ft 9½ in)

AREAS:

Wings, gross	9.35 m² (100.6 sq ft)

WEIGHTS AND LOADINGS (approx):

Weight empty, equipped	965 kg (2,127 lb)
Max payload	1,140 kg (2,513 lb)
Fuel weight	222 kg (489 lb)
Max T-O and landing weight	1,500 kg (3,307 lb)
Max wing loading	161.1 kg/m² (33.0 lb/sq ft)
Max power loading	4.03 kg/kW (6.62 lb/shp)

PERFORMANCE:

Never-exceed speed (VNE)	321 kts (595 km/h; 370 mph) CAS
Max level speed:	
at 3,050 m (10,000 ft)	250 kts (463 km/h; 288 mph)
at 7,620 m (25,000 ft)	262 kts (485 km/h; 302 mph)
Econ cruising speed (75% power)	191 kts (354 km/h; 220 mph)
Stalling speed, power off, 25° flap, landing gear up or down	68 kts (126 km/h; 79 mph)
Max rate of climb at S/L	640 m (2,100 ft)/min
Service ceiling	9,145 m (30,000 ft)
T-O to 15 m (50 ft)	570 m (1,870 ft)
Range at 75% power at 6,100 m (20,000 ft), 20 min reserves	706 n miles (1,308 km; 813 miles)
g limits	+7/−3.5

UPDATED

SOCATA TBM 700

TYPE: Six/seven-passenger pressurised business and multirole aircraft.

PROGRAMME: Three prototypes built: first flights 14 July 1988 (F-WTBM), 3 August 1989 (F-WKPG) and 11 October 1989 (F-WKDL). French certification received 31 January 1990; FAR Pt 23 type approval awarded 28 August 1990; first delivery 21 December 1990; Canadian public transport certification 1993. TBM 700 offered to SFACT as part of a new pilot training system. A TBM 700 flew round the world in 1993 in 80 hours, making 18 stops on the way.

CURRENT VERSIONS: **TBM 700:** Socata now offering military medevac, target towing, ECM, freight, maritime patrol and vertical photography versions.

TBM 700S: Stretched version, described separately.

CUSTOMERS: Total 106 delivered by early 1995, 13 delivered in 1994. Deliveries to French Air Force began 27 May 1992 with first of initial six for liaison duties with Groupe Aérien d'Entrainement et de Liaison (GAEL) and ETE 43; further six supplied 1993-94 (also for ETE 41 and ETE 44 plus CEAM); two to French Army 1994; one to CEV 1994; total French military receipts, 15.

COSTS: Standard aircraft $1.476 million (1992).

DESIGN FEATURES: Wing of Aerospatiale RA 16-43 root section with 6° 30′ dihedral from roots; twin strakes under rear fuselage; sweptback fin (with dorsal fin) and mass balanced rudder; non-swept tailplane with mass balanced elevators.

FLYING CONTROLS: Mechanical (pushrod/cable) controls, with electrically actuated trim tabs in port aileron, rudder and each elevator; scaled down ATR single-slotted Fowler flaps, also electrically actuated, along 71 per cent of each wing trailing-edge; slotted spoiler forward of each flap at outer end, linked mechanically to aileron; yaw damper.

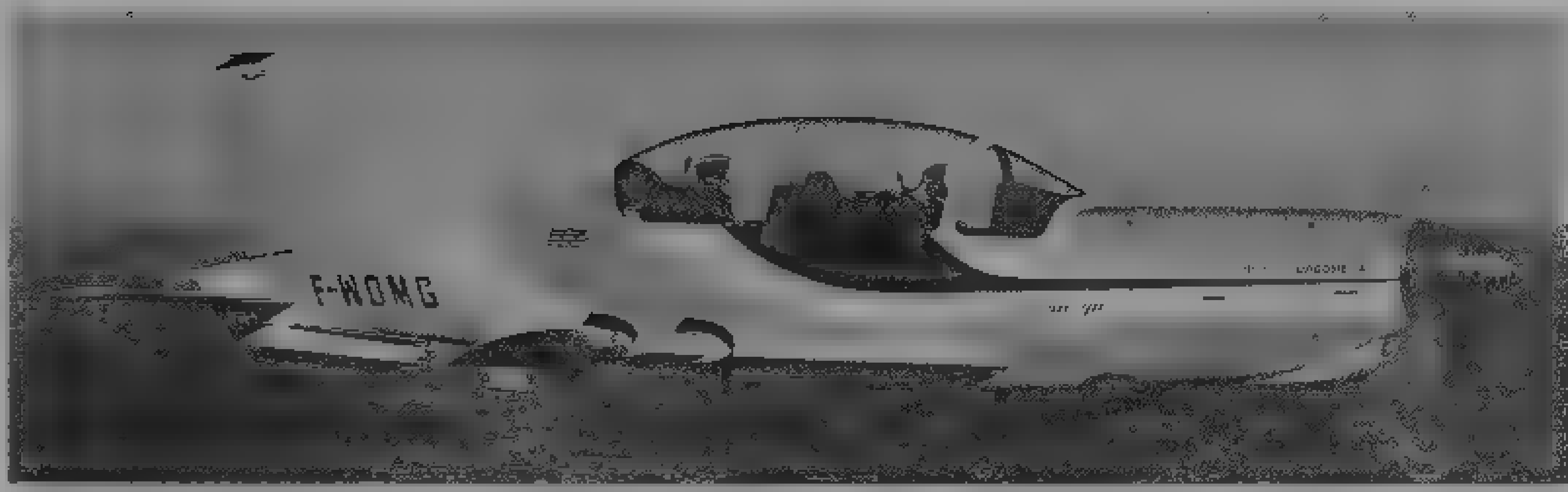
STRUCTURE: Mainly of light alloy and steel except for control surfaces, flaps, most of tailplane and fin of Nomex honeycomb bonded to metal sheet; wing leading-edges and landing gear doors GFRP/CFRP; tailcone and wingtips GFRP; two-spar torsion box forms integral fuel tank in each wing.

LANDING GEAR: Hydraulically retractable tricycle type, with emergency manual operation. Inward retracting main units of trailing-link type; rearward-retracting steerable nosewheel (±28°). Parker hydraulic disc brakes. Minimum ground turning radius (based on nosewheel) 23.98 m (78 ft 8 in).

POWER PLANT: One 522 kW (700 shp) Pratt & Whitney Canada PT6A-64 turboprop, driving a Hartzell four-blade constant-speed fully feathering reversible-pitch metal propeller. Fuel in integral tank in each wing, combined usable capacity 1,080 litres (285 US gallons; 237.5 Imp gallons). Gravity filling point in top of each tank. Oil capacity 12 litres (3.175 US gallons; 2.6 Imp gallons).

ACCOMMODATION: Adjustable seats for one or two pilots at front. Dual controls standard. Four seats in club layout aft of these, with centre aisle, or five seats in high-density layout. Upward/downward opening split door on port side aft of wing, with integral airstairs in lower half; overwing emergency exit on starboard side. Individual emergency oxygen mask for each passenger. Pressurised baggage compartment at rear of cabin, with internal access only; additional unpressurised compartment in nose, between engine and firewall, with external access via door on port side.

SYSTEMS: Engine bleed air pressurisation (to 0.43 bar; 6.2 lb/sq in) and air cycle (optionally Freon) air conditioning. Hydraulic system for landing gear only. Electrical system powered by two 28 V 200 A engine-driven starter/generators (one main, one standby) and a 28 V

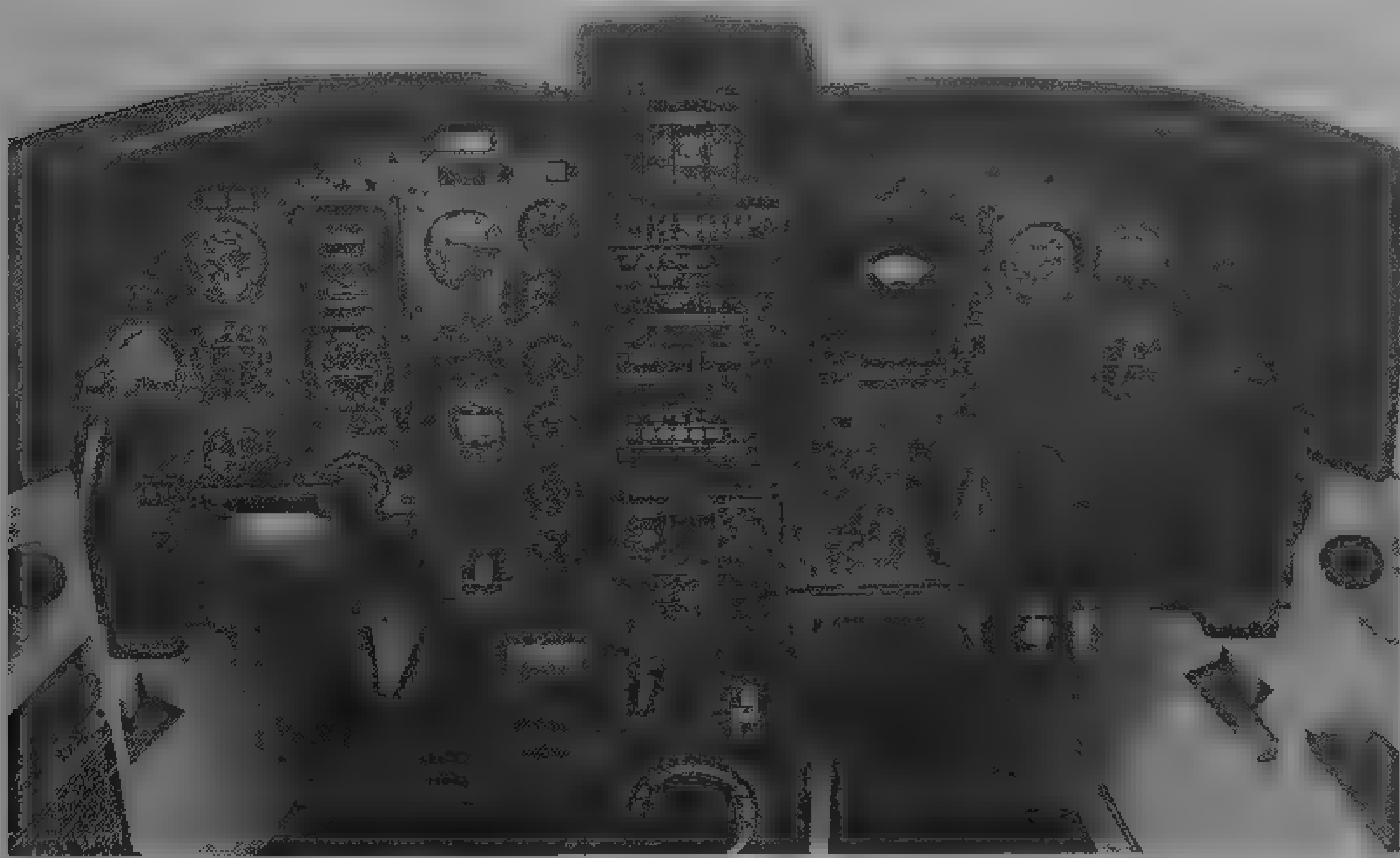


Socata TB 31 Omega trainer

1995

French Air Force TBM 700 six/seven-passenger pressurised turboprop *(Paul Jackson)*

1995



Instrument panel of Socata TBM 700

1995

40 Ah Ni/Cd battery. Pneumatic rubber-boot de-icing of wing/tailplane/fin leading-edges. Propeller blades anti-iced electrically, engine inlets by exhaust air. Electric anti-icing and hot air demisting of windscreen

AVIONICS: Bendix/King Silver Crown digital IFR package

Comms: KY 196 VHF transceiver; KT 79 transponder; KMA 24H interphone

Radar: Weather radar optional

Flight: KX 165 nav/com, KNS 80 R/Nav, KR 21 marker beacon receiver; KR 87 ADF, KFC 275 autopilot with KAS 297C altitude preselect/alerter. Optional GPS

Instrumentation: Optional EFIS

DIMENSIONS, EXTERNAL:

Wing span	12.16 m (39 ft 10¼ in)
Wing chord, mean aerodynamic	1.51 m (4 ft 11½ in)
Wing aspect ratio	8.21
Length overall	10.43 m (34 ft 2⅝ in)
Height overall	3.99 m (13 ft 1 in)
Elevator span	4.88 m (16 ft 0 in)
Propeller diameter	2.31 m (7 ft 7 in)

DIMENSIONS, INTERNAL:

Cabin: Length (between pressure bulkheads)	4.56 m (14 ft 11½ in)
Max width	1.24 m (4 ft 0¾ in)
Max height	1.24 m (4 ft 0¾ in)
Volume	6.50 m³ (229.5 cu ft)
Baggage compartment volume: front	0.25 m³ (8.83 cu ft)
rear	0.90 m³ (31.8 cu ft)

AREAS:

Wings, gross	18.00 m² (193.75 sq ft)
Vertical tail surfaces (total)	2.56 m² (27.55 sq ft)
Horizontal tail surfaces (total)	4.76 m² (51.24 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	1,826 kg (4,025 lb)
Fuel weight (usable)	866 kg (1,910 lb)
Baggage: front	20 kg (44 lb)
rear	60 kg (132 lb)
Max T-O weight	2,984 kg (6,578 lb)
Max ramp weight	3,000 kg (6,613 lb)
Max landing weight	2,835 kg (6,250 lb)
Max wing loading	165.8 kg/m² (33.95 lb/sq ft)
Max power loading	5.72 kg/kW (9.48 lb/shp)

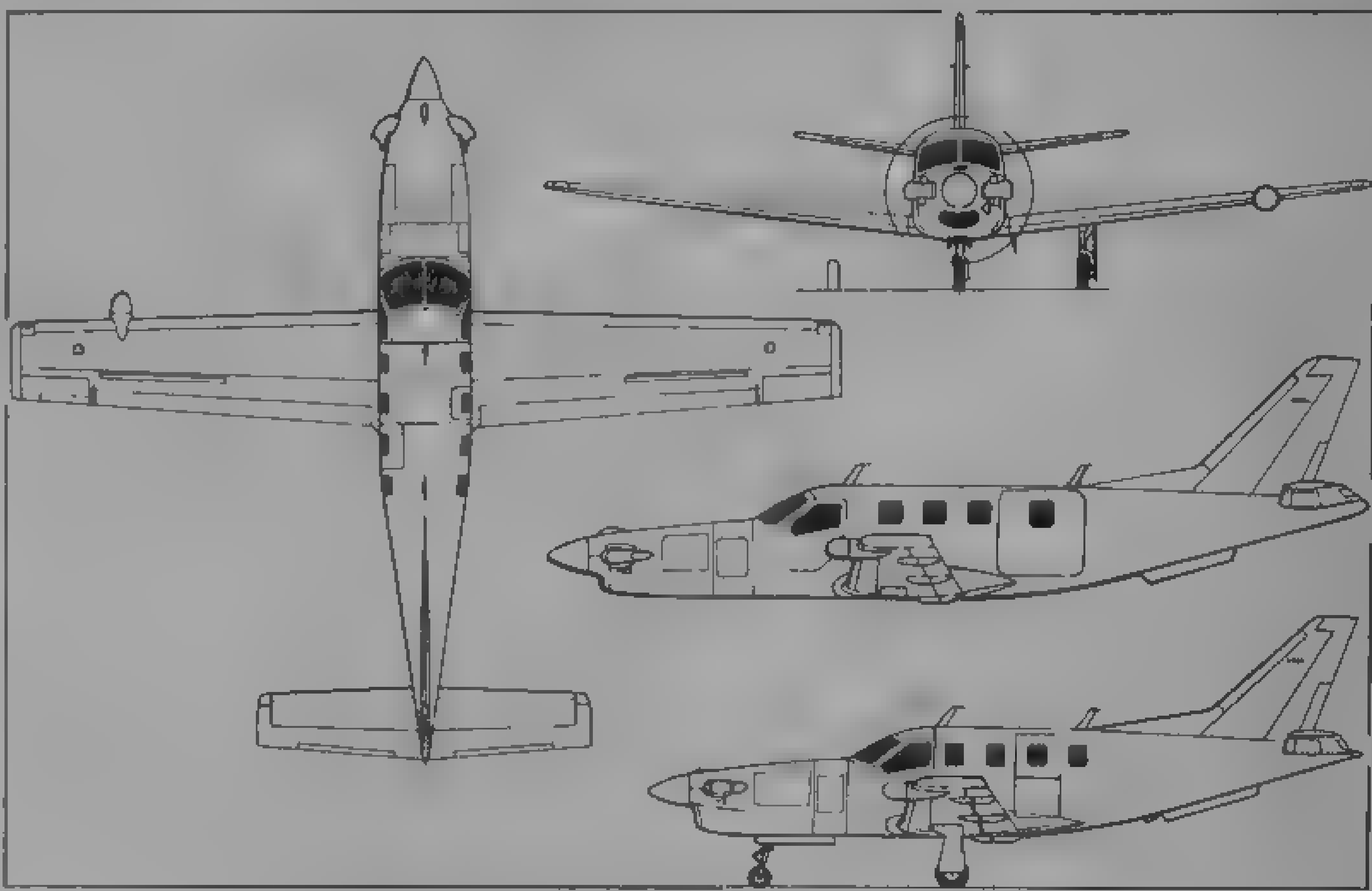
PERFORMANCE (A at AUW of 2,500 kg, 5,511 lb, B at max T-O weight):

Max cruising speed at 7,620 m (25,000 ft): A	300 kts (555 km/h, 345 mph)
Max cruising speed at 9,150 m (30,000 ft): A	294 kts (544 km/h, 338 mph)
Stalling speed, flaps and landing gear down	61 kts (113 km/h, 71 mph)
Max rate of climb at S/L: A	725 m (2,380 ft)/min
Certificated ceiling	9,150 m (30,000 ft)
Range: B with max payload, 45 min reserves: at max speed	1,000 n miles (1,852 km, 1,151 miles)
at long-range cruising speed	1,260 n miles (2,333 km, 1,450 miles)
B with max fuel, no reserves: at max speed	1,280 n miles (2,370 km, 1,473 miles)
at long-range cruising speed	1,610 n miles (2,982 km, 1,853 miles)
g limits: B	+3.8/−1.5

UPDATED

Artist's impression of stretched TBM 700S

1995



Socata TBM 700 and stretched TBM 700S (*Jane's/Dennis Punnett*)

1995

SOCATA TBM 700S

TYPE: Stretched version of TBM 700.

PROGRAMME: Marketing began 1994; programme timetable not published.

DESIGN FEATURES: Intended to compete with Pilatus PC-12; fuselage stretched by 1.10 m (3 ft 7¼ in) and fitted with cargo door, uprated engine, increased cruising speed and 410 kg (904 lb) of additional payload. *Description as TBM 700, except for following:*

POWER PLANT: One Pratt & Whitney Canada PT6A turboprop re-rated to 634 kW (850 shp) driving a Hartzell HC-E4N-3/E9083S(K) all-metal, four-blade, constant-speed propeller. Fuel capacity 1,100 litres (291 US gallons; 242 Imp gallons), of which 1,066 litres (282 US gallons; 234 Imp gallons) usable.

DIMENSIONS, EXTERNAL:

Wing span	12.68 m (41 ft 7¼ in)
Wing aspect ratio	8.93
Length overall	11.76 m (38 ft 7 in)
Height overall	4.36 m (14 ft 3⅝ in)
Tailplane span	4.99 m (16 ft 4½ in)
Wheel track	3.87 m (12 ft 8⅜ in)
Wheelbase	3.42 m (11 ft 2⅝ in)
Cargo door: Height	1.15 m (3 ft 9¼ in)
Width	1.23 m (4 ft 0½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	5.17 m (16 ft 11½ in)
Max width	1.21 m (3 ft 11⅝ in)
Max height	1.22 m (4 ft 0 in)

WEIGHTS AND LOADINGS:

Weight empty	2,200 kg (5,850 lb)
Max useful load	1,550 kg (3,417 lb)
Baggage: front	50 kg (110 lb)
rear	100 kg (220 lb)
Max T-O weight	3,750 kg (8,267 lb)
Max ramp weight	3,765 kg (8,300 lb)
Max landing weight	3,565 kg (7,859 lb)

PERFORMANCE:

Max cruising speed at 7,930 m (26,000 ft)	280 kts (519 km/h, 322 mph)
Long-range cruising speed at 9,150 m (30,000 ft)	252 kts (467 km/h, 290 mph)
Time to 6,100 m (20,000 ft)	14 min
9,150 m (30,000 ft)	28 min
T-O to 15 m (50 ft)	730 m (2,395 ft)
Landing from 15 m (50 ft): without reverse pitch	730 m (2,395 ft)
with reverse pitch	550 m (1,805 ft)

NEW ENTRY

SOGEPA

SOCIETE DE GESTION DE PARTICIPATIONS AERONAUTIQUES

PRESIDENT: Louis Gallois (Aerospatiale)

VICE-PRESIDENT: Serge Dassault (Dassault Aviation)

Under inter-company agreement signed on 17 September 1992 and published in December, state-owned holding company SOGEPA acquired part holdings in both Aerospatiale and Dassault Aviation as a means of linking the two companies more closely. SOGEPA was formed in 1977, but remained dormant until 1992.

In February 1993, M Levi, Director of French space agency CNES, and Henri Martre, Chairman of aerospace industry association GIFAS, were appointed government representatives on the SOGEPA board. M Michot, Assistant Director General of Aerospatiale, and Charles Edelstenne, Dassault Aviation Vice-President for Economics and Finance, were appointed administrators of SOGEPA. Serge Dassault was appointed SOGEPA representative on Aerospatiale board; M Michot and M Renon, President of engine manufacturer SNECMA, joined Dassault Aviation board.

A strategic committee was appointed in SOGEPA, chaired for first year by Bruno Revellin-Falcoz (Dassault Vice-President Engineering, Research and Co-operation). Aerospatiale is represented by M Michot, Claude Terazzoni (Director of Aircraft Group), and M Delaye (Director of Space and Defence Group). Dassault Aviation is represented by Bruno Revellin-Falcoz, Charles Edelstenne (Vice-President Economics and Finance) and Michel Herchin (Vice-President Industrial and Social Affairs). A three-year joint research programme has been presented by both companies to Ministry of Defence armament directorate (DGA).

SOGEPA has taken 35 per cent share of Dassault Aviation capital and 20 per cent of Aerospatiale. French bank Credit Lyonnais bought 20 per cent share in Aerospatiale, thereby injecting new capital, in January 1993. Membership of SOGEPA is open to partners from other, and particularly European, countries.

VERIFIED

GERMANY

ABS — *see EIS*

DASA

DAIMLER-BENZ AEROSPACE AG

PO Box 801109, D-81663 Munich
Telephone: 49 (89) 607-0
Fax: 49 (89) 607 26481 and 607 34239
Telex: 5287-0 DASAM D
Teletext: 89720+DASAM D
PRESIDENT OF BOARD OF MANAGEMENT AND CEO:
Dr Manfred Bischoff
EXECUTIVE VICE-PRESIDENT: Dr Andreas Sperl
SENIOR VICE-PRESIDENT, CORPORATE PLANNING AND TECHNOLOGY: Dr Rudiger Grube
SENIOR VICE-PRESIDENT, COMMUNICATIONS: Christian Poppe
VICE-PRESIDENT, PRESS AND INFORMATION:
Andreas Breitsprecher

Former Deutsche Aerospace (DASA), established 19 May 1989, was renamed Daimler-Benz Aerospace on 1 January 1995 (but retained DASA initials) and is the aircraft, defence, space and propulsion systems arm of the Daimler-Benz group, integrates Dornier, former Messerschmitt-Bölkow-Blohm (MBB), MTU (Motoren- und Turbinen-Union München) and former Telefunken SystemTechnik (TST); major reorganisation completed on 30 September 1992 included merger of TST (Ulm) with MBB (Ottobrunn) and transfer of Deutsche Aerospace business to former MBB, now trading as Daimler-Benz Aerospace AG, former Deutsche Aerospace changed name to Daimler-Benz Luft- und Raumfahrt Holding AG, simultaneously, German government transferred its 20 per cent share in Deutsche Airbus (Hamburg) to Deutsche Aerospace with retrospective effect from 1 January 1992. Hamburg company now operating as Daimler-Benz Aerospace Airbus, a subsidiary of Daimler-Benz Aerospace.

Workforce 86,000 at 31 December 1993. Total workforce reductions between 1993 and 1996 will reach 16,000 and six sites are to be closed. Turnover and new orders declined in 1993. Company organised into groups covering Aircraft, Space Systems, Propulsion Systems, and Defence and Civil Systems, all groups aim at international strategic co-operation.

Efforts to become an international competitor and equal partner in international programmes have included MTU general co-operation agreement with Pratt & Whitney, formation of Eurocopter with Aerospatiale, and senior membership of Airbus consortium through Daimler-Benz Aerospace Airbus. An MoU was signed in September 1993 covering co-operation between DASA and two all-Russian materials institutes on aluminium lithium alloys.

Deutsche Aerospace negotiated throughout 1992 to acquire 51 per cent of Netherlands company Fokker, on 27 April 1993, DASA acquired 78 per cent of a Fokker holding company shared with the Netherlands government, new capital also injected; DASA will acquire remaining government holding in three years. Fokker aircraft line to continue and new Fokker 70 (which see) developed rapidly during 1993.

Former East German Elbe Flugzeugwerke incorporated into Deutsche Aerospace Airbus and Flugzeugwerke Ludwigsfelde into DASA Propulsion Group during 1991.

Aircraft Group consists of Military Aircraft, Daimler-Benz Aerospace Airbus, Regional Airliners, Fokker and Eurocopter Deutschland, activities include Airbus family, Eurofighter 2000, Tornado, Alpha Jet, Dornier regional airliners and helicopters (last-mentioned detailed under Eurocopter SA in International section, Fokker in Netherlands section). Participation in Airbus consortium is 37.9 per cent.

Space Systems Group consists of Satellite Systems Division and Space Infrastructure Division. Group produces satellites for environmental and weather observation, reconnaissance and verification; international activities include Ariane 4 and 5 and Columbus space station (APM); group is developing concepts for new applications and potential commercialisation.

Defence and Civil Systems Group consists of Dynamic Systems, Sensor Systems, Information and Communication Systems, Radar and Radio Systems Divisions, products include anti-tank, anti-ship and anti-aircraft missiles, dispenser systems, UAVs, radar, and systems for training, ammunition disposal, environmental protection, traffic control, air traffic systems and other high-technology civil applications.

Propulsion Systems Group consists of Aircraft Division. Aircraft propulsion projects include repair and overhaul of large civil engines and military engines, and joint development with Rolls-Royce, IAE, Pratt & Whitney and Turbomeca of such engines as RB199, EJ200, V2500, PW300, RTM 322 and MTR 390.

Aircraft Group divisions and their products, and activities of Space Systems and Propulsion Systems, are described below.

UPDATED

MILITARY AIRCRAFT DIVISION (Component of Daimler-Benz Aerospace, Aircraft Group)

PO Box 801160, D-81663 Munich 80
Telephone: 49 (89) 607-0
Fax: 49 (89) 607 28740
HEAD OF STRATEGIC BUSINESS UNIT: Aloysius Rauen
PRESS AND INFORMATION: Wolfram Wolf

Major military aircraft activities of Group include aircraft armament and airborne reconnaissance systems, disarmament verification systems (the former PRISMA system and BICES), simulation and training systems, and research into advanced aircraft systems, materials and manufacturing technologies. Division also makes Airbus subassemblies. The following entry on terminated programme appears for purposes of record.

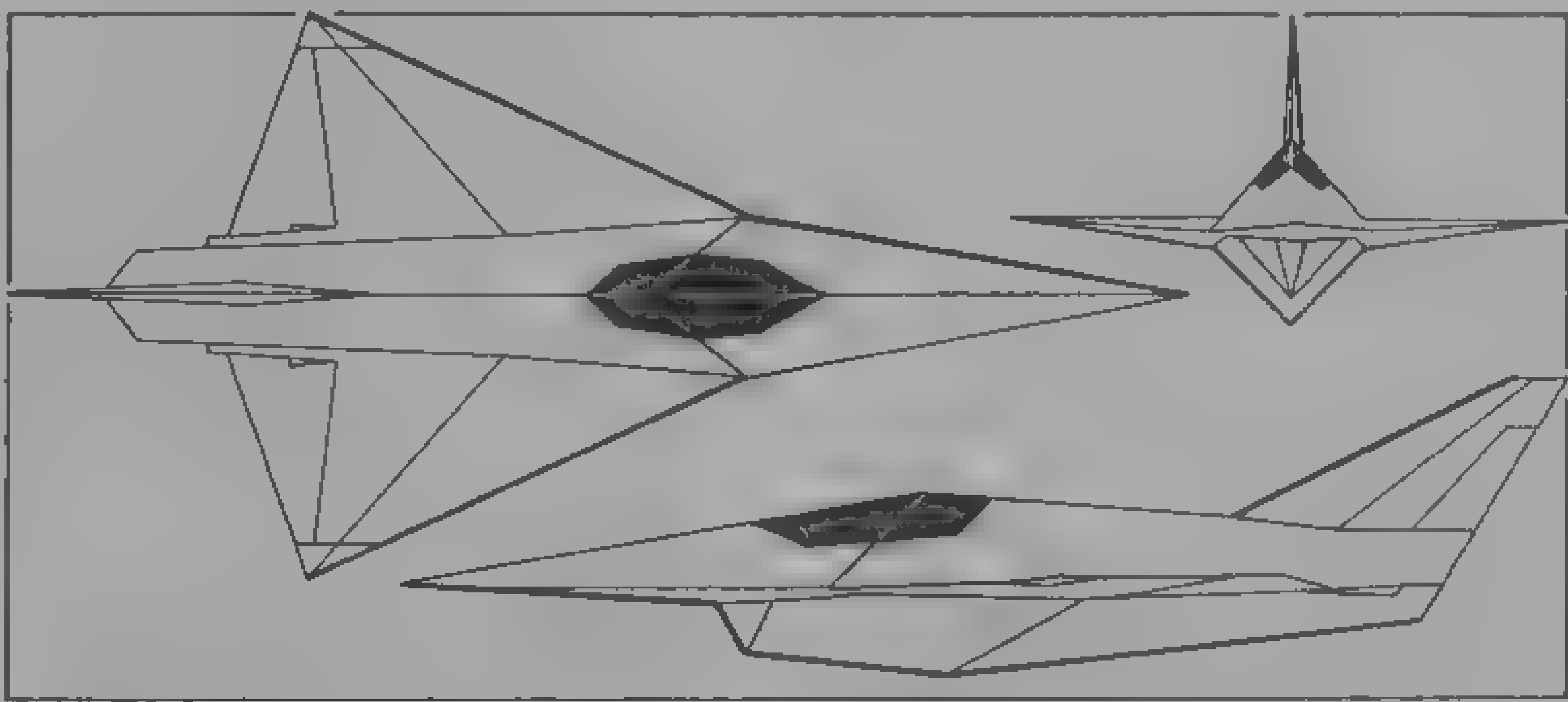
UPDATED

MBB LAMPYRIDAE

TYPE: Low-observables fighter demonstrator.

PROGRAMME: Partly declassified in February 1995. Launched under Luftwaffe contract in 1981 by then MBB (Messerschmitt-Bolkow-Blohm), codenamed Lampyridae (Latin for Firefly) or Medium-Range Missile Fighter. Wind tunnel testing in 1985 on 1:3.5 scale low-speed model and 1:20 transonic model, radar cross-section analysed on full-sized mockup (length overall 16 m, 52 ft). Programme culminated in 1987 with 15 'flights' by manned, but unpowered 1:1.33 scale aircraft in German-Netherlands wind tunnel at Emmeloord, simulated speeds up to 120 knots (222 km/h, 138 mph) and small-amplitude movements about all axes. Radar signature targets were met (and probably bettered Lockheed F-117A Nighthawk from frontal aspect, despite latter's more than double number of facets).

DESIGN FEATURES: Stealth fighter with I band radar signature 20 to 30 dB below that of conventional combat aircraft. Faceted design adopted before F-117 configuration declassified, demonstrated sound aerodynamic qualities in spite of polyhedral configuration, concept differed from F-117 in being interceptor, employing frontal stealthiness for 'first shot' capability at medium range, thereby obviating dogfighting. Lift generation by vortices from sharp leading-edges.



MBB (Daimler-Benz Aerospace) Lampyridae mid-1980s stealth fighter project (*Jane's/Paul Jackson*) 1995

DIMENSIONS, EXTERNAL (manned model):

Wing span	12 m (39 ft)
Length overall	6 m (20 ft)

NEW ENTRY

OTHER AIRCRAFT

Refer to International section for Daimler-Benz Aerospace Military Aircraft Division participation in the **Panavia Tornado, Eurofighter 2000, Rockwell/DASA X-31A** and **Ranger 2000** and **Aermacchi/DASA PTS 2000** programmes, plus *Jane's Aircraft Upgrades* for the DASA **F-4F Phantom ICE** (improved combat effectiveness) programme.

NEW ENTRY

DAIMLER-BENZ AEROSPACE AIRBUS GmbH

PO Box 950109, Kreetslag 10, D-21111 Hamburg
Telephone: 49 (40) 7437 0
Fax: 49 (40) 743 4422
Telex: 21950-0 DA D
WORKS: Hamburg, Bremen, Einswarden, Varel, Stade, Munich, Laupheim, Speyer, Dresden
PRESIDENT AND CEO: Dr Gustav Humbert
CHAIRMAN, SUPERVISORY BOARD: Jurgen E. Schrempp
DIRECTOR, ENGINEERING DESIGN AND TECHNOLOGY:
Jurgen Thomas
DIRECTOR, MANUFACTURING: Gerhard Eisen
DIRECTOR, PERSONNEL: Hans-Joachim Gante
PRESS AND INFORMATION: Dietmar Plath

Daimler-Benz Aerospace Airbus develops and manufactures about one-third of Airbus airliner family and about one-quarter of Fokker 100. Through the organisation Airspares and acting on behalf of Airbus Industrie, Deutsche Aerospace Airbus responsible for provision of spare parts worldwide for Airbus fleet. In Aircraft Service Centre (ASC) in Lemwerder Transall (being life-extended to 2010) is just one of many aircraft maintained and overhauled.

Daimler-Benz Aerospace Airbus (22,000 employees in 10 locations) produces fuselage sections and vertical tails and is main cabin furnishing centre for Airbus family (except for A330/A340); fits all movable wing parts to wing torsion boxes produced by British Aerospace. A321, a stretched version of A320, is assembled by Daimler-Benz Aerospace Airbus. Aft fuselage for Fokker 100 is manufactured by Elbe Flugzeugwerke GmbH in Dresden.

UPDATED

OTHER AIRCRAFT

Refer to the International section for Daimler-Benz Aerospace Airbus participation in the **SATIC Airbus Super Transporter, Very Large Commercial Transport/Ultra-High Capacity Transport/New Large Aircraft (VLCT/UHCA/NLA), Future Large Aircraft (FLA), Supersonic Commercial Transport (SCT)** and **Cryoplane** projects, plus *Jane's Aircraft Upgrades* for the **C-160 Transall** life extension programme.

NEW ENTRY

DORNIER LUFTFAHRT GmbH (Subsidiary of Dornier GmbH – part of Daimler-Benz Aerospace AG)

HEADQUARTERS: Dornier Airfield, PO Box 1103, D-82230 Wessling
Telephone: 49 (8153) 30-0
Fax: 49 (8153) 30-2055
Telex: 526540 DOAS

Dornier GmbH, formerly Dornier Metallbauten, formed 1922 by late Professor Claude Dornier; has operated as a GmbH since 22 December 1972. Daimler-Benz AG acquired majority holding (65.5 per cent) in Dornier GmbH in 1985, but had reduced this to 57.55 per cent by 1 January 1989 when new three-group Dornier company structure came into being with Silvius Dornier (21.22 per cent) and Claudius Dornier heirs (21.22 per cent) as other shareholders. Daimler-Benz shareholding since assumed by Daimler-Benz Aerospace AG.

All of Dornier's aviation activities now undertaken by Dornier Luftfahrt GmbH at Oberpfaffenhofen, which is a wholly owned subsidiary of Dornier GmbH. Dornier Luftfahrt is now the basis of Daimler-Benz Aerospace Regional Aircraft Division.

Dornier Luftfahrt GmbH manufactures the Dornier 328 and 228 regional airliners, is subcontractor to Daimler-Benz Aerospace Airbus, supports the 18 NATO Boeing E-3A Sentry AWACS and three NATO Trainer/Cargo Aircraft (TCA), provides technical and logistic servicing of German Navy Dassault Atlantic 1 and contributes to Atlantique 2, performs life extension modifications to 168 Bell UH-1D helicopters, and is service centre for business jets and regional turboprops.

UPDATED

REGIONAL AIRCRAFT DIVISION

PO Box 1103, D-82230 Wessling
Telephone: 49 (8153) 30-0
Fax: 49 (8153) 30-2055
DIVISIONAL CHIEF EXECUTIVE: Hansjorg Kranzle
PRESS AND INFORMATION: Dr Theodor Benien

UPDATED

DORNIER 228-212

TYPE: Twin-turboprop STOL light transport.

PROGRAMME: First flight of Dornier 228-100 prototype (D-IFNS) 28 March 1981, first flight 228-200 prototype (D-ICDO) 9 May 1981. British CAA certification 17 April 1984, FAR Pt 23 and Appendix A Pt 135 11 May 1984, Australian 11 October 1985; production possibly to be transferred to Harbin Aircraft Manufacturing Company in China.

CURRENT VERSIONS: For earlier production versions, see 1991-92 and earlier *Jane's*.

228-212: Current production version in Europe, certificated August 1989, introduced to increase payload on short routes; innovations include increased engine power, stronger landing gear, carbon brakes, improved anti-skid, two strakes under rear fuselage, increased maximum speed with flaps extended (V_{FE}), modified flying controls and new avionics. *Detailed description applies to this version.*

228-201: Indian production version; licence production agreement with Hindustan Aeronautics signed 29 November 1983; five complete 228-201s delivered to regional airline Vayudoot 1984-85, three 228-101s delivered to Indian Coast Guard 1986-87; first complete sets of components delivered early 1985, first flight of HAL assembled 228, 31 January 1986; see Indian section for further details.

228 Troop: Carries 17, 20 or 22 fully equipped troops, adaptable for paratrooping, fold-up seats at cabin sides. Lightweight toilet, roller door, military nav/com and loadmaster intercom.

228 Paratroop: Carries 16, 19 or 21 persons, plus jumpmaster; no toilet.

228 Ambulance: Six stretchers in pairs and nine sitting patients/attendants, optional small galley, toilet, refrigerator, oxygen system and cabin intercom.

228 Cargo: As 228-212, but with all superfluous equipment removed, modified to US FARs, maximum payload 2,340 kg (5,159 lb) in 16.34 m³ (577 cu ft) cabin, large double door, six cargo nets at 140 cm (55 in) intervals secured to aluminium frames and seat rails, reinforced cabin floor, smoke detectors and glassfibre panels on sidewalls.

228 Maritime patrol, Maritime pollution surveillance and **Photogrammetry/geo-survey:** Described separately.

CUSTOMERS: Total 227 ordered and 224 delivered by June 1995.

DESIGN FEATURES: Special Dornier wing with Do A-5 supercritical aerofoil, 8° leading-edge sweep on outer wing panels' raked tips, no dihedral or anhedral. German certification accepted in Bhutan, Canada, India, Japan, Malaysia, Nigeria, Norway, Sweden and Taiwan.

FLYING CONTROLS: Mechanically actuated, variable incidence tailplane with actuator switch on aileron wheel; horn balanced elevators; rudder trim tab, single-slotted Fowler flaps augmented by drooping ailerons, two strakes under rear fuselage for low-speed stability.

STRUCTURE: Two-spar wing box mainly light alloy structure but with CFRP wingtips and tips of tailplane and elevators, GFRP nosecone, tips of rudder and fin, Kevlar landing gear fairings and in part of wing ribs, hybrid composites in fin leading-edge, fuselage unpressurised, built in five sections.

LANDING GEAR: Retractable tricycle type, with single mainwheels and twin-wheel nose unit, main units retract inward into fuselage fairings, hydraulically steerable nosewheels retract forward. Goodyear wheels and tyres, size 8.50-10 on mainwheels (10 ply rating), size 6.00-6, 6 ply rating, on nosewheels, low-pressure tyres optional. Bendix carbon brakes on mainwheels.

POWER PLANT: Two 578.7 kW (776 shp) AlliedSignal TPE331-5-252D turboprops, each driving a Hartzell HC-B4TN-5ML/LT10574 four-blade constant-speed fully feathering reversible-pitch metal propeller. Primary wing box forms integral fuel tank with total usable capacity 2,386 litres (630 US gallons; 525 Imp gallons); oil capacity per engine 5.9 litres (1.56 US gallons; 1.30 Imp gallons).

Dornier 228-212 of Flexair

1992

ACCOMMODATION: Crew of one or two, pilots' seats adjustable fore and aft, two-abreast seating with central aisle; maximum capacity 19, flight deck door on port side; combined two-section passenger and freight door, with integral steps, on port side of cabin at rear, one emergency exit on port side of cabin, two on starboard side; baggage compartment at rear of cabin, accessible externally and from cabin, capacity 210 kg (463 lb). Enlarged baggage door optional, additional baggage space in fuselage nose, with separate access, capacity 120 kg (265 lb); modular units using seat rails for rapid changes of role.

SYSTEMS: Entire accommodation heated and ventilated, air conditioning system optional, heating by engine bleed air. Hydraulic system, pressure 207 bars (3,000 lb/sq in), for landing gear, brakes and nosewheel steering, hand pump for emergency landing gear extension. Primary 28 V DC electrical system, supplied by two 28 V 250 A engine-driven starter/generators and two 24 V 25 Ah Ni/Cd batteries; two 350 VA inverters supply 115/26 V 400 Hz AC system. Air intake anti-icing standard, de-icing system optional for wing and tail unit leading-edges, windscreen and propellers.

AVIONICS: *Comms:* Standard avionics include dual Bendix/King KY 196 VHF com, KT 76A transponder, Becker audio selector and intercom.

Radar: Weather radar optional.

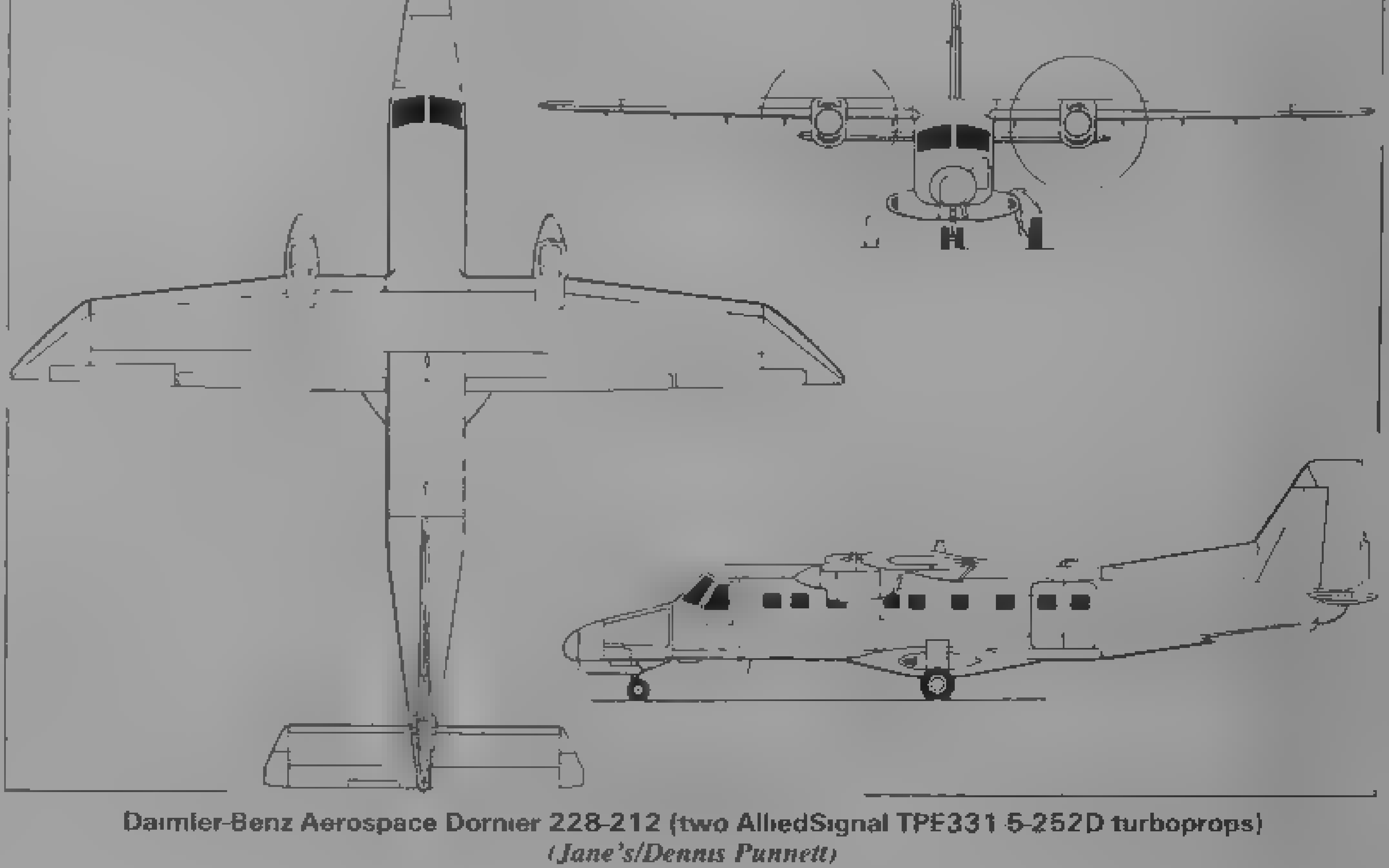
Flight: Dual KN 53 VOR/ILS and KN 72 VOR/LOC converters, KMR 675 marker beacon receiver, dual or single KR 87 ADF; dual or single Aeronetics 7137 RMI; dual or single DME. Autopilot optional to permit single-pilot IFR operation.

Instrumentation: IFR instrumentation standard, comprising dual Honeywell GH14B gyro horizons; dual Bendix/King KPI 552 HSIs, dual ASIs, dual altimeters, dual ADIs, dual VSIs.

EQUIPMENT: Standard equipment includes complete internal and external lighting, hand fire extinguisher, first aid kit, gust control locks and tiedown kit.

DIMENSIONS, EXTERNAL:

Wing span	16.97 m (55 ft 8 in)
Wing aspect ratio	9.00
Length overall	16.56 m (54 ft 4 in)
Height overall	4.86 m (15 ft 11½ in)
Tailplane span	6.45 m (21 ft 2 in)
Wheel track	3.30 m (10 ft 10 in)
Wheelbase	6.29 m (20 ft 7½ in)
Propeller diameter	2.69 m (8 ft 10 in)
Propeller ground clearance	1.08 m (3 ft 6½ in)
Passenger door (port, rear): Height	1.34 m (4 ft 4¾ in)
Width	0.64 m (2 ft 1¼ in)
Height to sill	0.91 m (2 ft 11¾ in)
Freight door (port, rear): Height	1.34 m (4 ft 4¾ in)
Width, incl passenger door	1.28 m (4 ft 2½ in)
Emergency exits (each): Height	0.66 m (2 ft 2 in)
Width	0.48 m (1 ft 7 in)
Baggage door (nose): Height	0.50 m (1 ft 7¾ in)
Width	1.20 m (3 ft 11¼ in)



Daimler-Benz Aerospace Dornier 228-212 (two AlliedSignal TPE331-5-252D turboprops)
(Jane's/Dennis Punnett)

1993

Standard baggage door (rear)
- Height 0.90 m (2 ft 11½ in)
- Width 0.53 m (1 ft 9 in)

DIMENSIONS, INTERNAL:
- Cabin, excl flight deck and rear baggage compartment:
  - Length 7.08 m (23 ft 2¾ in)
  - Max width 1.346 m (4 ft 5 in)
  - Max height 1.55 m (5 ft 1 in)
  - Floor area 9.56 m² (102.9 sq ft)
  - Volume 14.70 m³ (519.1 cu ft)
- Rear baggage compartment volume 2.60 m³ (91.8 cu ft)
- Nose baggage compartment volume 0.89 m³ (31.4 cu ft)

AREAS:
- Wings, gross 32.00 m² (344.3 sq ft)
- Ailerons (total) 2.708 m² (29.15 sq ft)
- Trailing-edge flaps (total) 5.872 m² (63.21 sq ft)
- Fin, incl dorsal fin 4.50 m² (48.44 sq ft)
- Rudder, incl tab 1.50 m² (16.15 sq ft)
- Horizontal tail surfaces (total) 8.33 m² (89.66 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty, standard 3,258 kg (7,183 lb)
- Operating weight empty 3,739 kg (8,243 lb)
- Max payload 2,201 kg (4,852 lb)
- Max fuel weight 1,885 kg (4,155 lb)
- Max ramp weight 6,430 kg (14,175 lb)
- * Max T-O weight 6,400 kg (14,110 lb)
- Max landing weight 6,100 kg (13,448 lb)
- Max wing loading 200.0 kg/m² (40.96 lb/sq ft)
- Max power loading 5.53 kg/kW (9.09 lb/shp)

* *Increasable to 6,600 kg (14,550 lb) in special cases*

PERFORMANCE (at max T-O weight, S/L, ISA, except where indicated):
- Never-exceed speed (VNE) 255 kts (472 km/h, 293 mph) IAS
- Max operating speed (VMO) 223 kts (413 km/h, 256 mph) IAS
- Max cruising speed: at S/L 222 kts (411 km/h, 255 mph)
  - at 3,050 m (10,000 ft) 234 kts (434 km/h, 269 mph)
- Cruising speed at 4,575 m (15,000 ft), average cruise weight of 5,300 kg (11,684 lb) 220 kts (408 km/h, 253 mph)
- Econ cruising speed 180 kts (333 km/h, 207 mph)
- Stall ng speed: flaps up 73 kts (136 km/h, 84 mph) IAS
  - flaps down 69 kts (128 km/h, 80 mph) IAS
- Max rate of climb 570 m (1,870 ft)/min
- Rate of climb, OEI 134 m (440 ft)/min
- Service ceiling, 30.5 m (100 ft)/min rate of climb 8,535 m (28,000 ft)
- Service ceiling, OEI, 15 m (50 ft)/min rate of climb 3,960 m (13,000 ft)
- T-O run 671 m (2,200 ft)
- T-O to 10.7 m (35 ft) 793 m (2,605 ft)
- Accelerate/stop distance, with anti-skid 710 m (2,330 ft)
- Landing from 15 m (50 ft) at max landing weight 402 m (1,320 ft)
- Range at 3,050 m (10,000 ft) with 19 passengers, reserves for 50 n mile (93 km, 57 mile) diversion, 45 min hold and 5% fuel remaining: at max cruising speed 560 n miles (1,038 km, 645 miles)
  - at max range speed 630 n miles (1,167 km, 725 miles)
- Range with 775 kg (1,708 lb) payload, conditions as above: at max cruising speed 1,160 n miles (2,148 km; 1,335 miles)
  - at max range speed 1,320 n miles (2,445 km, 1,519 miles)

UPDATED

DORNIER 228 MARITIME PATROL

PROGRAMME: Developed for Indian Coast Guard, Royal Thai Navy and others for maritime and fisheries patrol and border patrol.

DESIGN FEATURES: Modifications to standard 228 include major corrosion protection, radome beneath fuselage, four wing hardpoints for searchlight, Micronair spraypod and other equipment, roller door for dropping survival equipment and chute in rear cabin for dropping smoke markers and flares.

POWER PLANT: As for standard 228, with optional auxiliary fuel tanks to increase fuel capacity to 2,886 litres (762 US gallons, 635 Imp gallons).

ACCOMMODATION: Pilot and co-pilot with full dual controls and instruments as standard; co-pilot operates optional searchlight, two bubble observation windows in front of cabin (180° view) and photography window on port side which can be opened in flight. Console for radar operator on port side of cabin incorporating radar display, digital navigation display and intercom controls. Rest area on starboard side of rear cabin with optional folding table, galley or refrigerator and toilet.

AVIONICS: Standard items as detailed for 228-212.

Comms: Optional exchange to Collins Pro Line II including Collins AN/ARC-182 VHF/UHF transceiver.

Radar: Weather radar optional.

Flight: Optional Collins Pro Line II DF-301E VHF/UHF direction-finder, Collins ALT-55B radio altimeter, low-altitude warning system, Global/Wulfsberg GNS-500-5 nav system with search pattern mode standard. GPS and Loran C optional.

Mission: Options include Bendix/King RDR 1500B maritime surveillance radar with 360° scan in underfuselage radome. Optional Litton AN/APS 504(V)5, THORN EMI Super Searcher and Eaton AN/APS 128. Day/night mission equipment includes Honeywell forward-looking infra-red system (FLIR), stabilised long-range observation system (SLOS), night vision goggles, Spectrolab 80 Mcd searchlight, markers and flares, loud hailer and Nikon hand-held camera with data annotation.

UPDATED

Dornier 228-212 maritime pollution surveillance aircraft for the Netherlands Coast Guard *1993*

DORNIER 228 MARITIME POLLUTION SURVEILLANCE

PROGRAMME: Developed for Netherlands Coast Guard (Kustwacht) and Finnish Frontier Guard.

DESIGN FEATURES: Modifications for pollution control as for Maritime Patrol version, but with large floor cutout to carry an IR/UV scanner plus photographic, television and IR cameras.

POWER PLANT: As for Maritime Patrol version.

ACCOMMODATION: Crew as for Maritime Patrol version. Main operator workstation on port side at front of cabin, with all necessary controls and displays for remote sensing equipment, equipment rack for all computers, video recorders, power supplies and hard copy units on port side in mid cabin, observer workstation with similar controls and displays as in operator console, is at rear of cabin, in front of toilet compartment. Two bubble observation windows port and starboard in front of cabin, each bulged to give 180° view; two optical photo windows (one port and one starboard) in rear cabin can be opened in flight; rest area on starboard side of mid-cabin has seats and folding table.

AVIONICS: *Radar:* Bendix/King RDR 1400C weather and search radar with 46 cm (18 in) antenna. Dornier 228s of Finnish Frontier Guard being fitted with GEC Marconi Avionics Seaspray 2000 radar integrated with multirole electro-optical turret via MIL-STD-1553 databus.

Flight: As for Maritime Patrol version, but also Racal R-Nav II navigation management system with search pattern mode, Decca, GPS.

Mission: Primary surveillance sensors from Terma Elektronik AS, Denmark, include Terma side-looking airborne radar (SLAR) with underfuselage antenna, and Daedalus ABS 3500 bi spectral IR/UV scanner. To secure evidence of pollution, 228 equipped with downward-looking colour television, Nikon photographic and IR cameras and, for photographic documentation, Nikon hand-held camera interfacing with navigation system.

UPDATED

DORNIER 228 PHOTOGRAMMETRY/GEO-SURVEY

PROGRAMME: Besides being used in a purely photogrammetric version, 228 can serve wide variety of users as working platform in earth sciences field. The 228 allows good access to sensors and other equipment both in flight and for maintenance.

DESIGN FEATURES: Modifications to standard 228 as for Maritime Patrol version, but production model includes large sliding hatch in cabin floor for sensor installation. Wing hardpoints support different sensors, and various antennae are mounted on fuselage and tail.

POWER PLANT: As for Maritime Patrol version.

ACCOMMODATION: Crew dependent on mission, but basically as described for Maritime Patrol version.

AVIONICS: As for Maritime Patrol version.

OPTIONAL EQUIPMENT: Photogrammetry version has aerial survey cameras installed in floor cutout, Wild or Zeiss navigation telescope, operator station, flight track camera, intercom system, toilet modified as darkroom, rest area with folding table, and small galley or refrigerator.

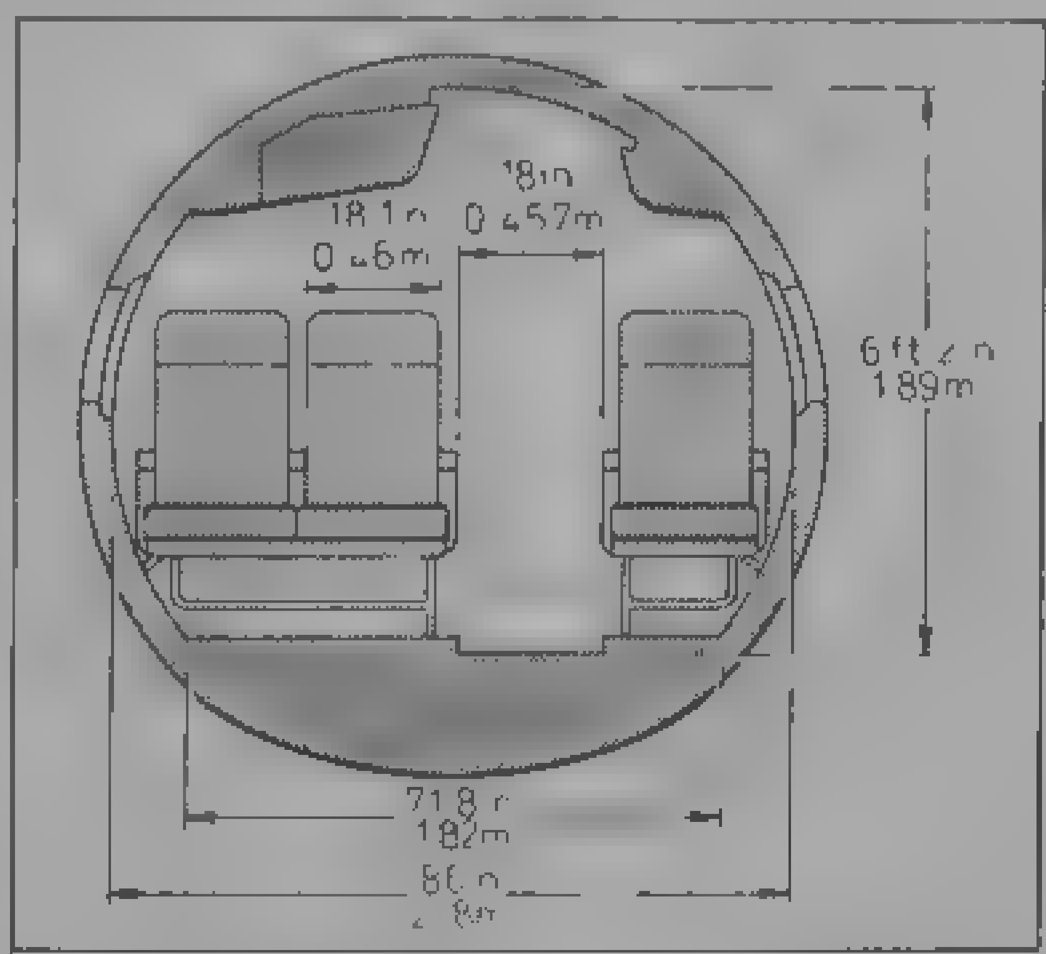
Geo-survey version has VLF electromagnetometer mounted in nose thimble, magnetometer in tail sting, VLF or proton magnetometer installed in wingtips, electromagnetic reflection system mounted on wing hardpoints, and gamma-ray detector in lower fuselage. Aerial survey camera installed in floor cutout in rear fuselage.

VERIFIED

DORNIER 328

TYPE: Twin-turboprop pressurised high-speed regional transport.

PROGRAMME: Development relaunched 3 August 1988, first flight (D-CHIC) 6 December 1991, first flights of second

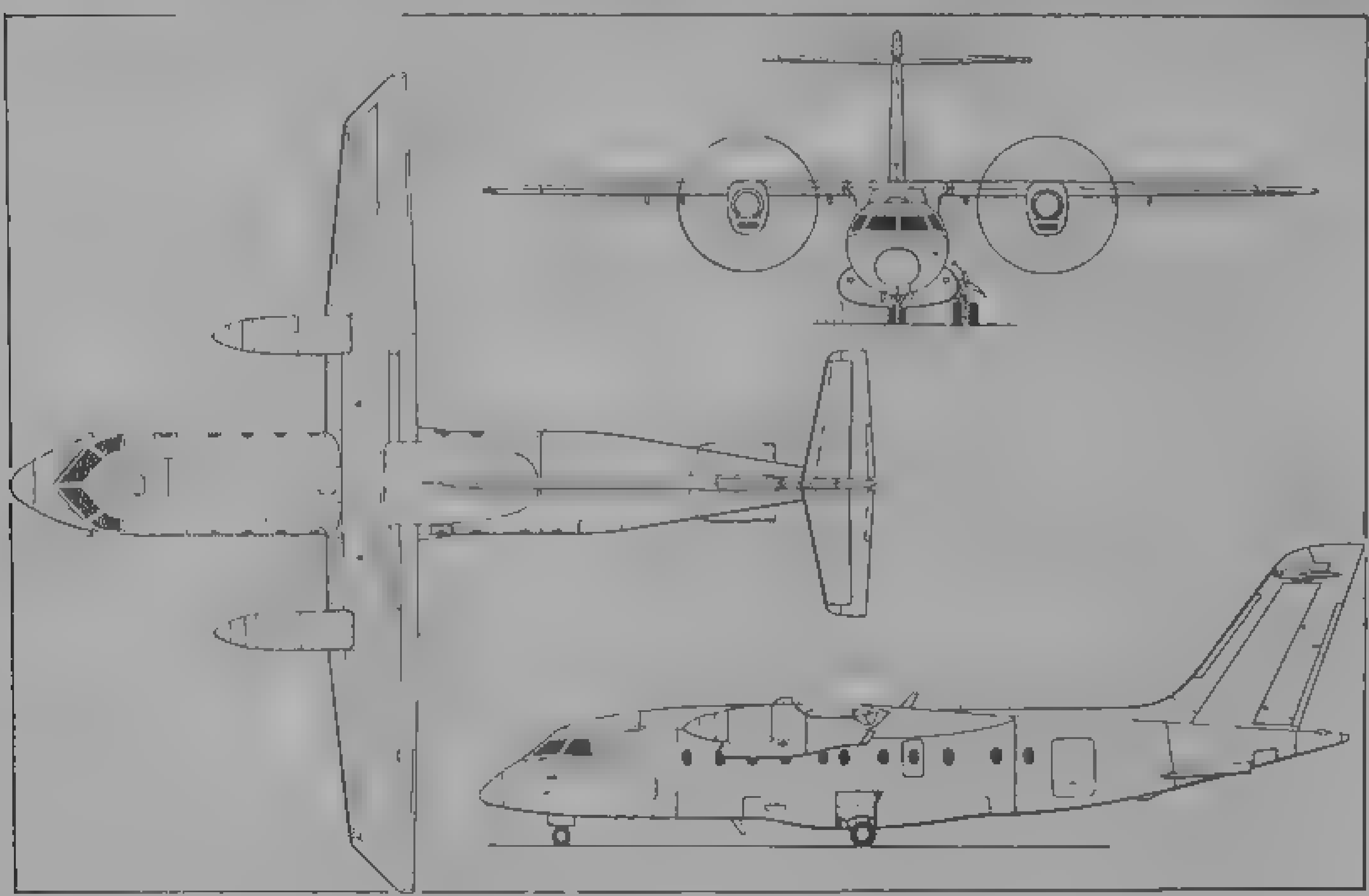


Cabin cross-section of Dornier 328-100 *(Jane's/Mike Keep)* *1994*

Swiss regional Air Engiadina has operated Dornier 328s since 1993 *1995*

Dornier 328 flight deck with Honeywell Primus 2000 flight deck avionics including five tubes for flight instruments, systems and EICAS functions

1993



Dornier 328 (two P&WC PW119B turboprops) 30/33-passenger transport *(Jane's/Dennis Punnett)*

1991

aircraft (D-CATI) 4 June 1992 and third development aircraft (D-CDOL) 20 October 1992, first flight of first production aircraft (D-CITI) 23 January 1993. European 14-country JAA 25 certification obtained 15 October 1993, FAA certification followed 10 November 1993 first delivery, to Air Engiadina, 21 October 1993. LBA/FAA certification of 328-110 achieved November 1994. Some 328s may be produced in Mexico

CURRENT VERSIONS: **328-100** Standard version, *as detailed.*

328-110: Maximum T-O weight increased to 13,990 kg (30,843 lb), range increased to 1,000 n miles (1,852 km, 1,150 miles)

328-120: Further development offering improved short-field performance and incorporating elements of proposed improved performance kit (IPK), 5 per cent increase in thermodynamic power of PW119B engines; 100 mm (3.94 in) increase in propeller diameter; ground spoilers, enlarged dorsal and ventral fins, T-O field length 800 m (2,625 ft). JAA certification anticipated late 1995, followed by first delivery to launch customer Formosa Air lines (five)

CUSTOMERS: Initial customers included Horizon Air of USA (now reduced to 20 firm + 40 optioned) and Air Engiadina of Switzerland (three); total of 76 firm orders and 75 options from 17 customers by June 1995. Potential market seen as more than 400 by year 2006

DESIGN FEATURES: Combines basic TNT supercritical wing of Dornier 228 with new pressurised fuselage from NRT (Neue Rumpf Technologien) programme, internal volume designed to give passengers more seat width than in a Boeing 727 or 737 and stand-up headroom in aisle; target 78 dB noise level for 75 per cent of passengers

FLYING CONTROLS: As for 228, but with new flaps and optional lateral control (one) and ground (two) spoilers ahead of each aileron, trim tab in each elevator and rudder

STRUCTURE: Wing mainly light alloy structure; entire rear fuselage and tail surfaces of CFRP, except dorsal fin made of Kevlar/CFRP sandwich and aluminium alloy tailplane leading-edge; Kevlar/CFRP sandwich also used for wing trailing-edge structure, nosecone, tailcone and for long wing/fuselage fairing housing system components outside pressure hull, cabin doors of superplastic formed aluminium alloy; engine nacelles of superplastic formed titanium and carbon composite.

Daewoo Heavy Industries of South Korea manufactures fuselage panels, which are assembled into complete fuselages by risk-sharing partner Aermacchi in Italy which also manufactures flight deck structure, engine nacelles and doors by Westland Aerostructures, wings, rear fuselage and tail surfaces by Daimler-Benz Aerospace Airbus at Neuaubing, final assembly at Oberpfaffenhofen. Daewoo share represents about 20 per cent of manufacturing time

LANDING GEAR: ERAM (with SHL of Israel) retractable tricycle type, with twin Bendix wheels on each unit, nose unit retracts forward main units into Kevlar/CFRP sandwich unpressurised fairings on fuselage sides, tyre pressures 4.4 bars (64 lb/sq in) on nose unit, 8.0 bars (116 lb/sq in) on main units, Bendix brakes

POWER PLANT: Two Pratt & Whitney Canada PW119B turboprops, each rated at 1,625 kW (2,180 shp) for take-off and each driving a Hartzell six-blade composites propeller with electronic synchrophasing. Improved performance kit optional, all fuel in wing tanks, total capacity 4,268 litres (1,133 US gallons, 939 Imp gallons)

ACCOMMODATION: Flight crew of two and cabin attendant(s). Main cabin seats 30-33 passengers, three-abreast at 79 cm (31 in) or 76 cm (30 in) pitch, with single aisle, galley to rear of passenger seats, toilet at rear of cabin; large baggage hold between passenger cabin and rear pressure bulkhead, with external access via baggage door in port side, crew/passenger airstair door at front on port side, with Type III emergency exit opposite, Type III emergency exit on port side at rear of cabin, with service door Type II exit at rear on starboard side

SYSTEMS: Air conditioning and pressurisation systems standard (maximum differential 0.47 bar; 6.75 lb/sq in). Hydraulic and two independent AC/DC electrical systems housed in main landing gear fairings. APU optional

AVIONICS: Honeywell Primus 2000 avionics

Comms: Primus II digital radio system standard

Radar: Primus 650 weather radar standard, Primus 870 colour weather radar optional

Flight: AFCS, FMS and EICAS (automatic flight control system, flight management system, and electronic indication, caution and advisory system), digital air data computer; AHRS with advanced fibre optic laser gyros, radar altimeter, standard. Options include Honeywell traffic alert and collision avoidance system (TCAS), GPS, MLS and Laseref II laser inertial reference system

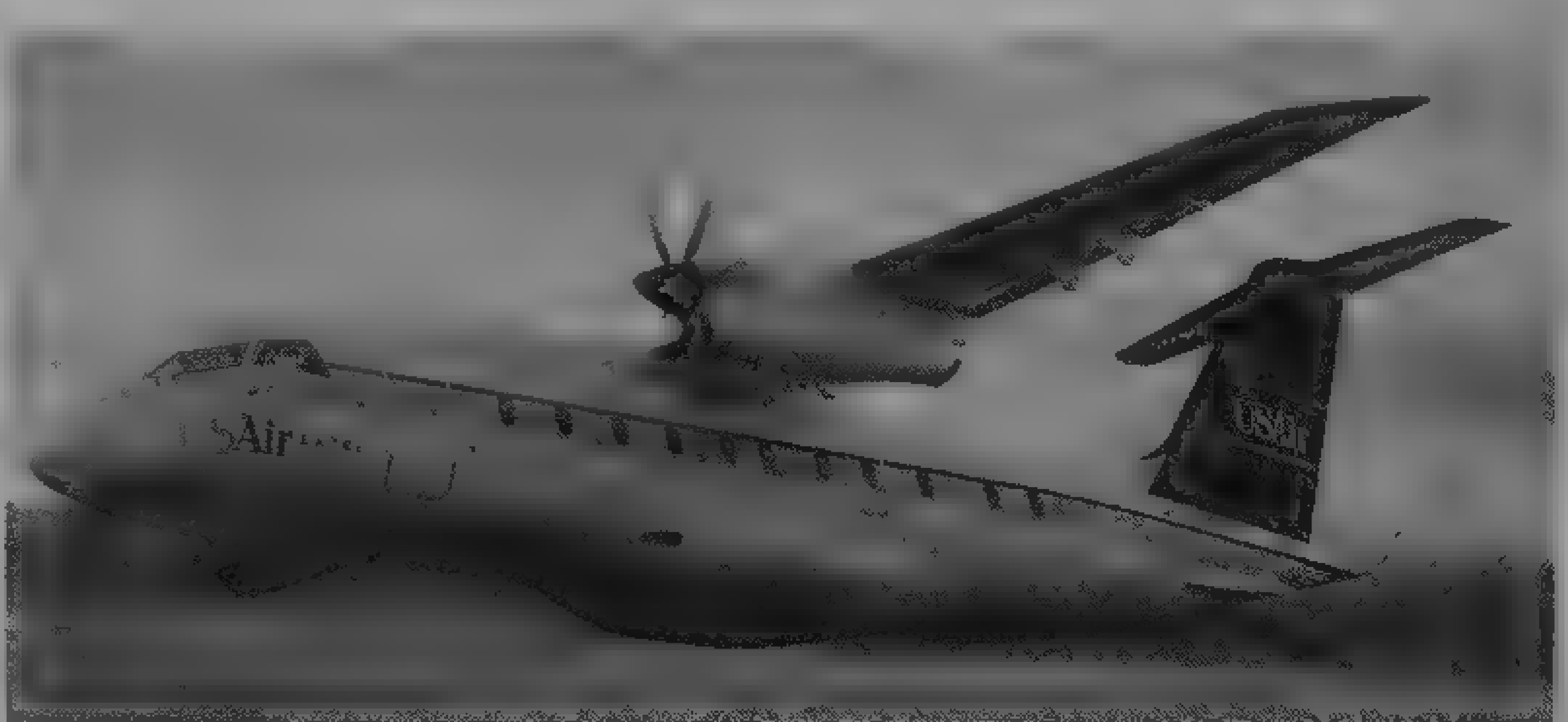
Instrumentation: Primus 2000 integrated five-tube EFIS standard. Horizon Air fitting head-up guidance system allowing Cat IIIa landings

DIMENSIONS, EXTERNAL:

Wing span	20.98 m (68 ft 10 in)
Length overall	21.28 m (69 ft 9¾ in)
Fuselage: Length	20.92 m (68 ft 7⅝ in)
Max width	2.415 m (7 ft 11 in)
Max depth	2.426 m (7 ft 11½ in)
Height overall	7.239 m (23 ft 9 in)
Elevator span	6.70 m (21 ft 11¾ in)
Wheel track (c/l of shock-struts)	3.22 m (10 ft 6¾ in)
Wheelbase	7.422 m (24 ft 4¼ in)
Propeller diameter	3.60 m (11 ft 9¾ in)
Propeller fuselage clearance	0.735 m (2 ft 5 in)
Passenger door (fwd, port): Height	1.70 m (5 ft 7 in)
Width	0.70 m (2 ft 3½ in)
Service door (rear, stbd): Height	1.25 m (4 ft 1¼ in)
Width	0.51 m (1 ft 8 in)
Baggage door (rear, port): Height	1.40 m (4 ft 7 in)
Width	0.92 m (3 ft 0¼ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	10.27 m (33 ft 8¼ in)
Max width	2.18 m (7 ft 2 in)
Width at floor	1.83 m (6 ft 0 in)
Max height in aisle	1.89 m (6 ft 2½ in)
Baggage hold volume	6.30 m³ (222.5 cu ft)



Dornier 328 operated by USAir

1995

WEIGHTS AND LOADINGS

Operating weight empty	8,920 kg (19 665 lb)
Max payload	3,690 kg (8,135 lb)
Max baggage load	750 kg (1,653 lb)
Max T-O weight	13,990 kg (30,842 lb)
Max zero-fuel weight	12,610 kg (27,800 lb)
Max landing weight	13,230 kg (29,167 lb)
Max power loading	
normal T-O	4 94 kg/kW (8 13 lb/shp)
short field T-O	4 20 kg/kW (6 90 lb/shp)

PERFORMANCE

Max operating speed (VMO)	270 kts CAS (500 km/h, 311 mph)
Max operating Mach number (MMO)	0.59
Max cruising speed at 6,100 m (20,000 ft)	335 kts (620 km/h, 388 mph)
Design cruising altitude: normal	7,620 m (25,000 ft)
optional	9,450 m (31,000 ft)
Required T-O field length	1,100 m (3,610 ft)
Landing field length	1,010 m (3,315 ft)

Range at max cruising speed with 30 passengers, with allowance for 100 n mile (185 km 115 mile) diversion and 45 min hold at 7,620 m (25,000 ft, 900 n miles (1,666 km, 1,035 miles)
at 9,450 m (31,000 ft) 1 000 n miles (1 852 km, 1,150 miles)

UPDATED

SPACE INFRASTRUCTURE DIVISION (Component of Daimler-Benz Aerospace, Space Systems Group)

Daimler-Benz Aerospace AG (ERNO Raumfahrttechnik GmbH), PO Box 105909, Hunefeldstrasse 1 5, D-28059 Bremen
Telephone 49 (421) 539 5326
Fax: 49 (421) 535109
WORKS: Bremen and Ottobrunn

Besides concepts, development, system tasks, integration and operation of orbital infrastructure and major components of European Ariane 4 and 5 launchers, this division is responsible for DASA participation in the hypersonic technology programme under the Sanger name All essential concept tasks in this programme are concentrated in the Division's centre of competence at Munich/Ottobrunn

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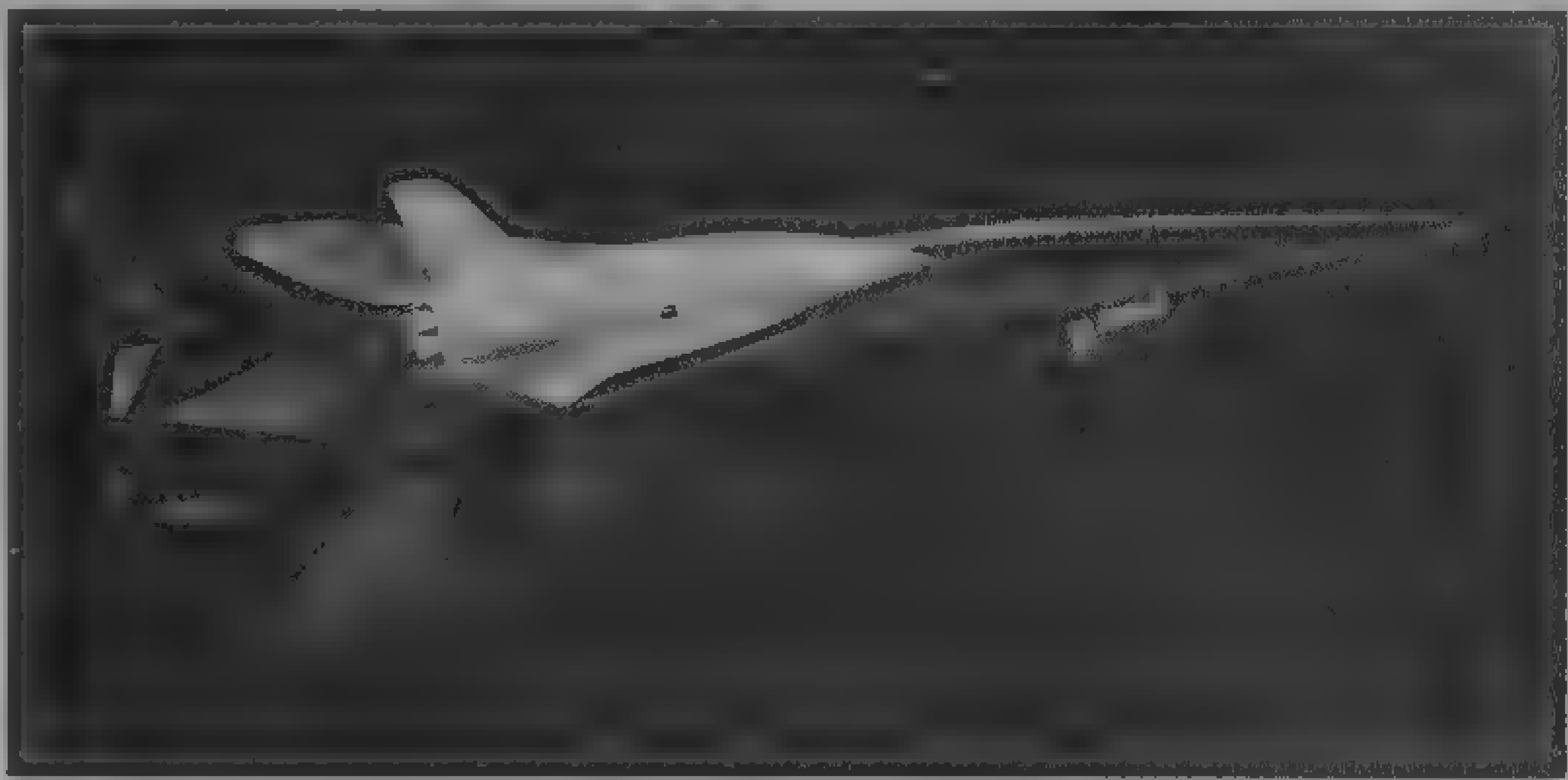


Artist's impression of the Sänger fully reusable space vehicle towards which some of DASA Space Infrastructure Division's work is directed *1993*

EIS AIRCRAFT GmbH

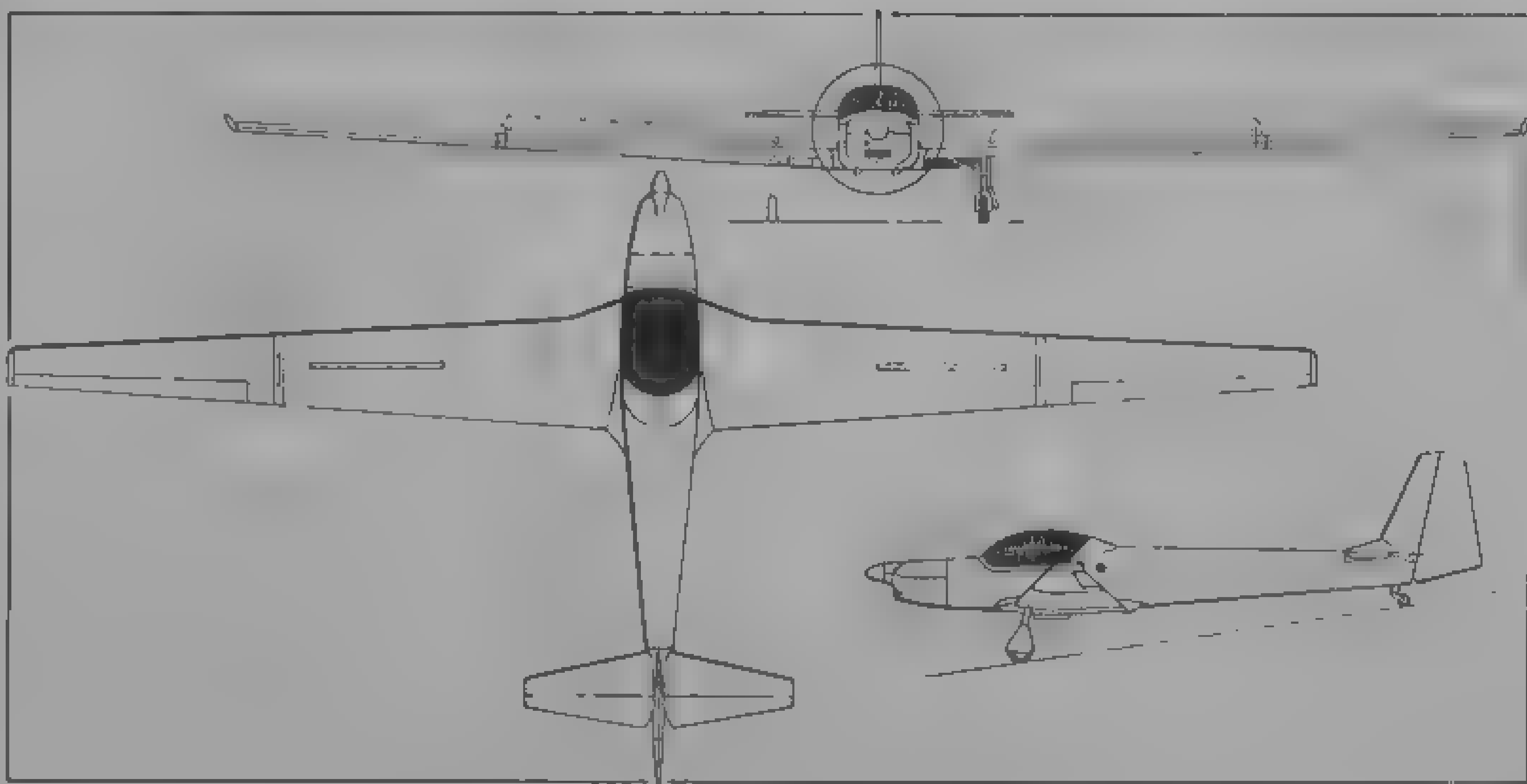
Flugplatz Dahlemer-Binz, D-53949 Dahlem 1
Telephone. 49 (2447) 808-0
Fax: 49 (2447) 8113
MANAGING DIRECTOR: Dipl Ing Willy Reinhardt
OPERATIONS DIRECTOR J Reinhardt

EIS (Equipment, Interior and Services) took over the activities of former ABS Aircraft on 10 March 1994 EIS builds the RF-9 designed by Fournier in France and owns the discontinued Hoffman H-40 design and prototype, described in these pages of the 1993-94 *Jane's*

UPDATED

EIS RF-9

TYPE Two-seat motor glider
PROGRAMME: French Fournier RF-9 adopted for production, first exhibited at Paris Air Show 1993 Production yet to be started
DESIGN FEATURES Outer wing panels fold for hangarage
FLYING CONTROLS Conventional with wing-mounted spoilers to control glide gradient
STRUCTURE: All-wood
LANDING GEAR. Wide-track tailwheel layout with inward retracting mainwheels, foot-operated wheel brakes
POWER PLANT: One 59 7 kW (80 hp) Rotax 912A-3 water-cooled four-cylinder four-stroke driving a Hoffman HO-V62 hydraulic constant-speed and feathering propeller Full throttle gives 2,420 propeller rpm
ACCOMMODATION Side by side seating with adjustable seats and parachute recesses, heating by engine-cooling liquid and three position fresh air intake, baggage compartment



Fournier RF-9 now produced in Germany by EIS Aircraft *(Jane's/Mike Keep)* *1994*

DIMENSIONS, EXTERNAL

Wing span	17 30 m (56 ft 9 in)
Wing aspect ratio	16 63
Width, wings folded	10 00 m (32 ft 9¾ in)
Length overall	8 06 m (26 ft 5¼ in)
Height overall	1 93 m (6 ft 4 in)

AREAS

Wings, gross	18 00 m² (193 7 sq ft)

WEIGHTS AND LOADINGS

Manufacturer's weight empty	520 kg (1,146 lb)
Max T-O weight	745 kg (1,642 lb)
Max wing loading	41 38 kg/m² (8 47 lb/sq ft)
Max power loading	12.5 kg/kW (20 5 lb/hp)

PERFORMANCE, POWERED

Never-exceed speed (VNE)	135 kts (250 km/h, 155 mph)
Cruising speed	102 kts (190 km/h, 118 mph)
Stalling speed	38 kts (70 km/h, 44 mph)
Max rate of climb at S/L	270 m (885 ft)/min
Service ceiling	approx 5,000 m (16,400 ft)
T-O to 15 m (50 ft)	400 m (1,312 ft)
Range, cruising with engine	539 n miles (1,000 km, 621 miles

PERFORMANCE, UNPOWERED

Best glide ratio	29
Min rate of sink	0 8 m (2 6 ft)/s

NOISE LEVEL

To German LSL Chapter 6	55 dBA

UPDATED

EXTRA

EXTRA-FLUGZEUGBAU GmbH

Flugplatz Dinslaken Schwarze Heide, D-46569 Hunxe
Telephone 49 (2858) 6851
Fax 49 (2858) 7124
MANAGING DIRECTOR: Walter Extra

VERIFIED

EXTRA 300

TYPE. Specialist aerobatic aircraft in single- and two-seat versions.
PROGRAMME: Design began January 1987, first flight (D-EAEW) 6 May 1988, LBA certification 16 May 1990; certificated FAA FAR Pt 23 Amendment 33 Normal and Aerobatic categories for USA and Europe; production started October 1988, production two EA 300s per month.
CURRENT VERSIONS. **Extra 300:** Two-seat aircraft. *Details apply to this version*

Extra 300/S. Single-seat version of 300 with same power plant, wing shortened by 50 cm (19½ in) and more powerful ailerons; first flight (D-ESEW) 4 March 1992, certificated March 1992. US. FAA and French certification

Extra 300/L: Modified version, first aircraft (D-EUWH) delivered November 1994
CUSTOMERS: Six Extra 300s delivered to Chilean Air Force 1989-90; 58 (including prototype) two-seat aircraft built by January 1995, 11 delivered in 1994: five to USA, two each to Chile, Mexico and UK. Further 27 EA 300/S produced by January 1995, including 10 in 1994 (eight to USA, one each to France and Hungary). Two EA 300/L built, of which one delivered (Germany) in 1994. Total EA 300 production, 87
COSTS: German price of both 300 and 300/S, DM310,000 without tax (1994) Noise reduction system adds DM3,883
DESIGN FEATURES: Designed for unlimited competition aerobatics; tapered, square-tipped wing with 4° leading-edge sweepback; aerofoil symmetrical MA 15 at root, MA 12 at tip, no twist or dihedral
FLYING CONTROLS: Rod and cable operated conventional, nearly full span ailerons; fixed tailplane, trim tab in starboard elevator
STRUCTURE. Fuselage (excluding tail surfaces) of steel tube frame with part aluminium, part fabric covering, wing spars of carbon composites and shells of carbon composite sandwich, tail surfaces of carbon spars and glassfibre shells.

LANDING GEAR: Fixed cantilever composite arch main gear with single polyamid faired wheels, Cleveland brakes; leaf spring steerable tailwheel

POWER PLANT: One Textron Lycoming AEIO-540-L1B5 flat-six engine giving 224 kW (300 hp), driving Muhlbauer MTV-9-B-C/C 200-15 three-blade constant-speed propeller (MTV-14 optional). With either standard or four-blade propeller and Gomolzig Type 3 silencer, both Extra 300s meet German and US noise limits. Usable fuel capacity 38 litres (10 US gallons, 8.4 Imp gallons) AvGas 100LL in fuselage tank and 60 litres (15.9 US gallons, 13.2 Imp gallons) in each wing tank. Maximum 15 litres (4 US gallons, 3.3 Imp gallons) oil in Normal category, 11.4 litres (3 US gallons, 2.5 Imp gallons) for aerobatics

ACCOMMODATION: Pilot and co-pilot/passenger in tandem under single-piece canopy opening to starboard, additional transparencies in lower sides of cockpit

SYSTEMS: 12 V generator and battery

AVIONICS: *Comms*: Becker AR 3201 VHF radio standard

DIMENSIONS, EXTERNAL	
Wing span: 300	8.00 m (26 ft 3 in)
300/S	7.50 m (24 ft 7¼ in)
Wing chord	
at root: 300, 300/S	1.85 m (6 ft 0¾ in)
at tip: 300	0.83 m (2 ft 8¾ in)
300/S	0.93 m (3 ft 0½ in)
Wing aspect ratio: 300	5.98
300/S	5.39
Length overall: 300	7.12 m (23 ft 4½ in)
300/S	6.65 m (21 ft 9¾ in)
Height overall: 300, 300/S	2.62 m (8 ft 7¼ in)
Tailplane span: 300	3.20 m (10 ft 6 in)
Wheel track: 300	1.80 m (5 ft 10¾ in)
Propeller diameter: MTV-9	2.00 m (6 ft 6¾ in)
MTV-14	1.90 m (6 ft 2¾ in)
AREAS	
Wings, gross: 300	10.70 m² (115.17 sq ft)
300/S	10.44 m² (112.38 sq ft)
WEIGHTS AND LOADINGS	
Weight empty: 300	630 kg (1,389 lb)
Max T-O weight	
300, Aerobatic, and 300/S	820 kg (1,808 lb)
300, Aerobatic, two-seat	870 kg (1,918 lb)
300, Normal	950 kg (2,094 lb)
Max wing loading	
300, solo Aerobatic	76.5 kg/m² (15.67 lb/sq ft)
300, Normal	88.8 kg/m² (18.19 lb/sq ft)
300/S	91.0 kg/m² (18.64 lb/sq ft)
Max power loading	
300, solo Aerobatic	3.72 kg/kW (6.12 lb/hp)
300, Normal	4.24 kg/kW (6.98 lb/hp)
300/S	3.66 kg/kW (6.02 lb/hp)
PERFORMANCE	
Never-exceed speed (VNE)	220 kts (407 km/h, 253 mph)
Max level speed	185 kts (343 km/h, 213 mph)
Max manoeuvring speed	158 kts (293 km/h, 182 mph)
Stalling speed	55 kts (102 km/h, 64 mph)
Max rate of climb at S/L	1,005 m (3,300 ft)/min
T-O to 15 m (50 ft)	approx 248 m (814 ft)
Landing from 15 m (50 ft)	approx 548 m (1,798 ft)
Range, 45 min reserves	526 n miles (974 km, 605 miles)
g limits: solo Aerobatic	±10
two-seat Aerobatic	±8
Normal	+6/−3

UPDATED

EXTRA 400

TYPE: Six-seat, high-performance touring aircraft

PROGRAMME: Announced February 1993; first flight expected 1995; will be certificated to JAR 23

DESIGN FEATURES: High-wing, T tail layout with single piston engine; spacious cabin; gust response system for smooth flight, low external noise

STRUCTURE: Composites structural and non-structural parts

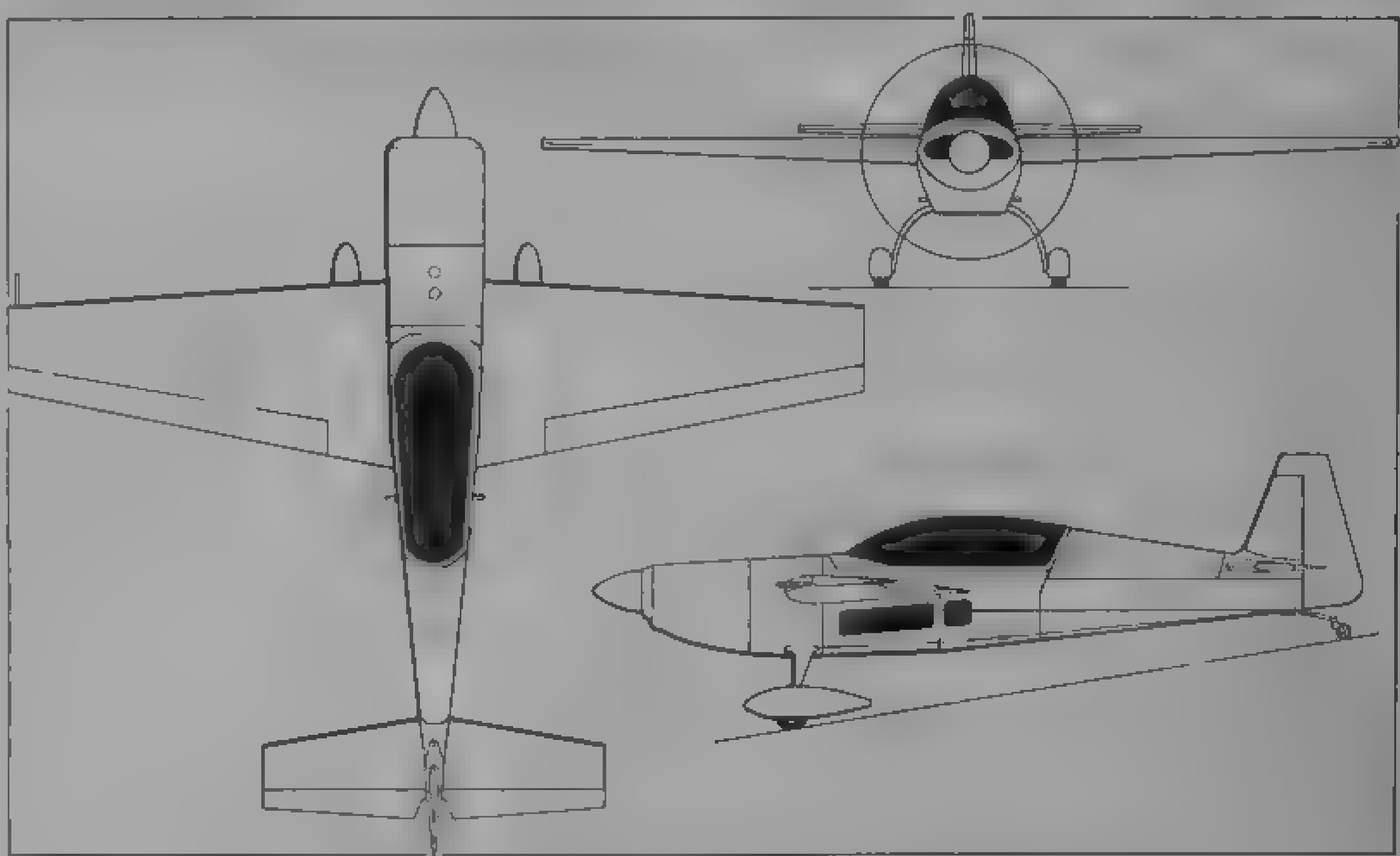
LANDING GEAR: Retractable

POWER PLANT: One 261 kW (350 hp) Teledyne Continental Voyager 550 six-cylinder liquid-cooled engine

UPDATED

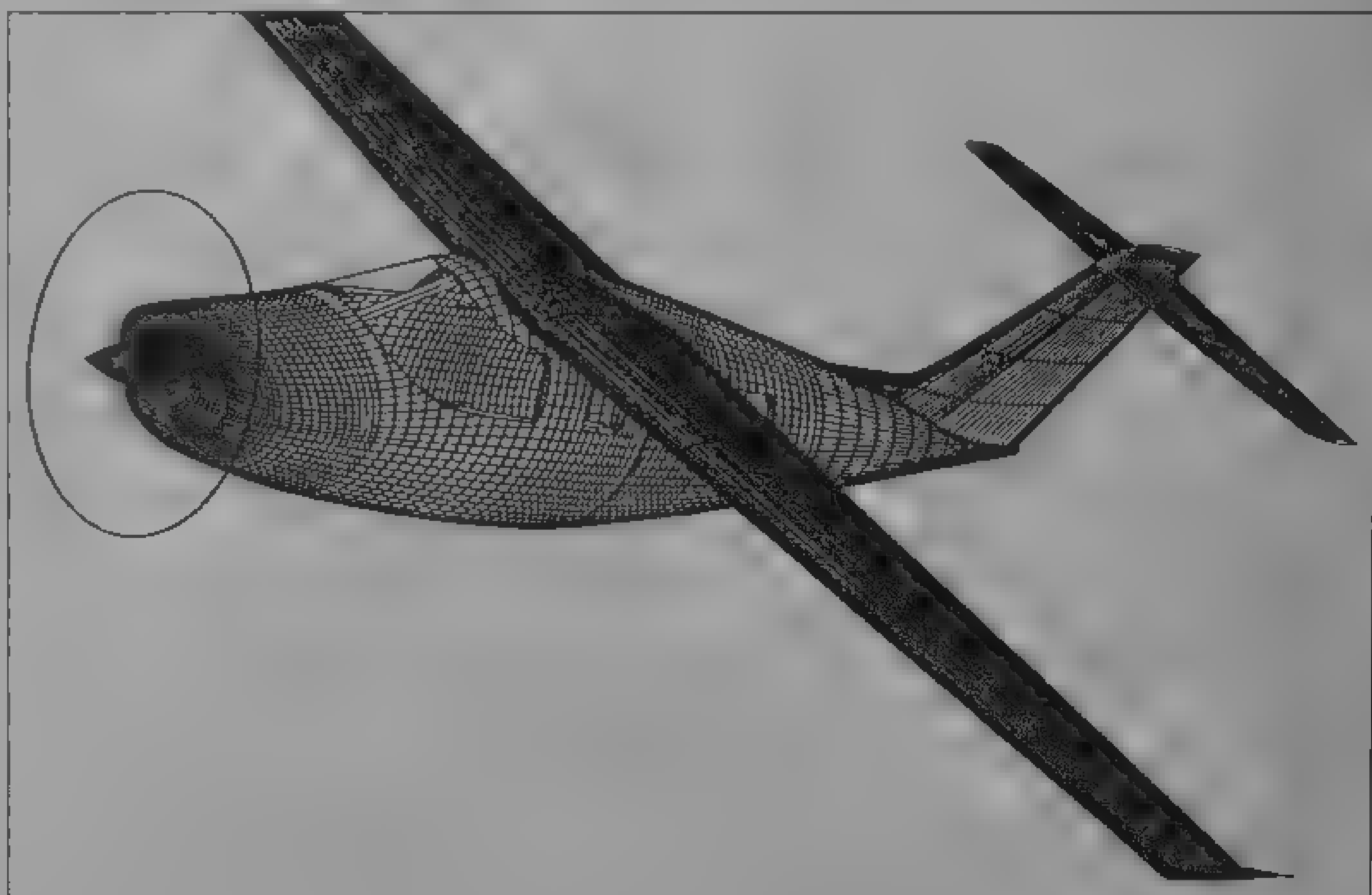
Extra 300 with single-seat Extra 300/S behind

1995



Extra 300 competition aerobatic aircraft *(Jane's/Mike Keep)*

1993



Computer-generated image of Extra 400 six-seat touring aircraft

1994

GROB

BURKHART GROB LUFT- UND RAUMFAHRT GmbH & Co KG (Associated with Grob-Werke GmbH & Co KG)

PO Box 1257, D-87712 Mindelheim; alternative address, Am Flugplatz, D-86874 Tussenhausen-Mattsies
Telephone: 49 (8268) 998-0/122
Fax: 49 (8268) 998-124/218
Telex: 539623

PRESIDENT AND CEO: Dr hc Dipl Ing Burkhart Grob

VICE-PRESIDENTS:
Dipl Ing Klaus-Harald Fischer
Dipl Ing Roland Rischer

MARKETING MANAGER: Konrad Lewald

Company founded 1971; has built more than 3,500 aircraft; name changed from Burkhart Grob Flugzeugbau to Burkhart Grob Luft- und Raumfahrt GmbH with light and heavy sections; light section produces G 103C Twin III Acro two-seat sailplane, G 103C Twin III SL motor glider with retractable engine and the G 115 and GF 200 aircraft; heavy section deals with Egrett (see International section), the Strato 2C described in this entry and with space activities in support of Weltraum-Institut Berlin.

German Luftwaffe cancelled LAPAS reconnaissance system based on Grob G-520 Strato 1 (Egrett) in February 1993.

UPDATED

GROB G 115

Royal Navy (Fleet Air Arm) name: Heron

TYPE: Two-seat light aircraft.

PROGRAMME: First flight November 1985, first flight of second prototype Spring 1986 with taller fin and rudder and relocated tailplane; LBA certification to FAR Pt 23 on 31 March 1987; British certification February 1988, later gained full public transport certification and German spinning clearance, production suspended briefly in 1988 after 88 aircraft, resumed in September 1989, then terminated August 1990 after total production of 107 G 115/115As. Power plants and equipment updated and designations changed late 1992 for 1993 product line; production four in 1993; 34 in 1994, 40 planned for 1995.

CURRENT VERSIONS: **G 115B**: Original G 115A upgraded from 85.8 kW (115 hp) to 119 kW (160 hp); new-build prototype (D-ELCF) completed 1991; this aircraft, plus one conversion from G 115A, sold in Australia.

G 115C: 1994 model with 119 kW (160 hp) Textron Lycoming O-320 engine, fuel in wings, modified tail and many other improvements, first flight (D-EPBG) 26 January 1993, certificated in USA in August 1993; 12 built in 1994 (see also Bavarian, below).

G 115C2: As C but powered by 134 kW (180 hp) engine. Second prototype 115C (D-ERAF) upgraded to 115C2 in 1994, 13 new-build in 1994.

G 115D: Fully aerobatic version of G 115C powered by 134 kW (180 hp) Textron Lycoming AEIO-360; intended as professional trainer and glider tug. Prototype (D-EVSA) first flown 2 March 1993, further one built in 1993, four in 1994.

G 115D2: As D but powered by 119 kW (160 hp) engine. Prototype 115D (D-EVSA) upgraded to 115D2 in 1994, further five built in 1994 for operation by civilian contractor for Royal Navy.

G 115 Bavarian: Special version of G 115C for International Aero Club of Florida, USA, includes fuel moved to wings, more transparency area in canopy and new instrument panel, modified wing section and tail surfaces; deliveries started 1994.

COSTS: G 115C price DM212,000 without tax, G 115C2 DM237,000, G 115D DM275,000, G 115D2 DM255,000.

DESIGN FEATURES: Low-wing monoplane; wing section Eppler E 696; dihedral 5°, incidence 2°.

FLYING CONTROLS: Conventional; dual controls, aileron wheels in G 115C and sticks in G 115D; trim tab in port elevator; electrically operated flaps.

STRUCTURE: GFRP airframe.

LANDING GEAR: Non-retractable tricycle type, with wheel fairings; steerable nosewheel, size 5.00-5; mainwheels size 6.00-6, cantilever spring suspension, hydraulic toe-operated brakes, parking brake.

POWER PLANT: *G 115C*: One 119 kW (160 hp) Textron Lycoming O-320-D1A, driving two-blade fixed-pitch propeller. *G 115C2*: 134 kW (180 hp) Textron Lycoming O-360-A1F6 with two-blade constant-speed propeller. *G 115D*: One 134 kW (180 hp) Textron Lycoming AEIO-360-B1F, driving two-blade constant-speed propeller. *G 115D2*: 119 kW (160 hp) AEIO-320-D1B with two-blade fixed-pitch propeller. Both power plants have exhaust silencer, electric starter and oil cooler. Fuel capacity increased to 140 litres (37 US gallons; 30.8 Imp gallons) in two wing tanks with main mechanical and electric booster fuel pumps.

ACCOMMODATION: Two seats side by side under one-piece rearward-sliding framed canopy; dual controls, baggage space behind seats, with restraining net; heating, four-point harness in G 115Cs, five-point in G 115Ds.

SYSTEMS: Electrical 24 V alternator and battery.

AVIONICS: To customer's requirements.

Instrumentation: Optional full IFR.

DIMENSIONS, EXTERNAL:

Wing span	10.00 m (32 ft 9¾ in)
Wing aspect ratio	8.19
Length overall	7.60 m (24 ft 11¼ in)
Height overall	2.40 m (7 ft 10½ in)
Wheel track	1.61 m (5 ft 3¼ in)
Wheelbase	2.50 m (8 ft 2½ in)

AREAS:

Wings, gross	12.21 m² (131.43 sq ft)

WEIGHTS AND LOADINGS (Normal category):

Basic weight empty: C	650 kg (1,433 lb)
D	660 kg (1,455 lb)
Max T-O weight: C, D	990 kg (2,183 lb)
Max landing weight: C, D	920 kg (2,028 lb)
Max wing loading: C, D	81.1 kg/m² (16.61 lb/sq ft)
Max power loading: C, D	7.38 kg/kW (12.13 lb/hp)

PERFORMANCE:

Never exceed speed (VNE):	
C, C2, D	184 kts (341 km/h; 211 mph)
Max level speed at S/L, constant-speed propeller:	
C	135 kts (250 km/h; 155 mph)
D	146 kts (270 km/h; 168 mph)
Cruising speed, 75% power, constant-speed propeller:	
C	130 kts (240 km/h; 149 mph)
D	135 kts (250 km/h; 155 mph)
Stalling speed, flaps down:	
C, D	46 kts (85 km/h; 53 mph)
Max rate of climb at S/L: C	387 m (1,270 ft)/min
D	329 m (1,080 ft)/min
Service ceiling: C, D	4,875 m (16,000 ft)
T-O run: C	240 m (788 ft)
D	210 m (689 ft)
Landing run: C, D	180 m (591 ft)
Range, no reserves:	
C	650 n miles (1,204 km; 748 miles)
D	520 n miles (963 km; 598 miles)
Endurance: C	7 h 0 min
D	5 h 40 min
g limits: C	+4.4/−1.8
D	+6/−3

UPDATED

GROB G 115T ACRO

TYPE: Military and commercial pilot trainer.

PROGRAMME: Design began 1991, originally aimed at US Air Force Enhanced Flight Screener competition, first flight (D-EMGT) 11 June 1992; aircraft designed to conform to all relevant US MIL handling and layout standards and specifications for pilot trainers, but civilian use also expected, production to start in 1996, 12 for UAE AF.

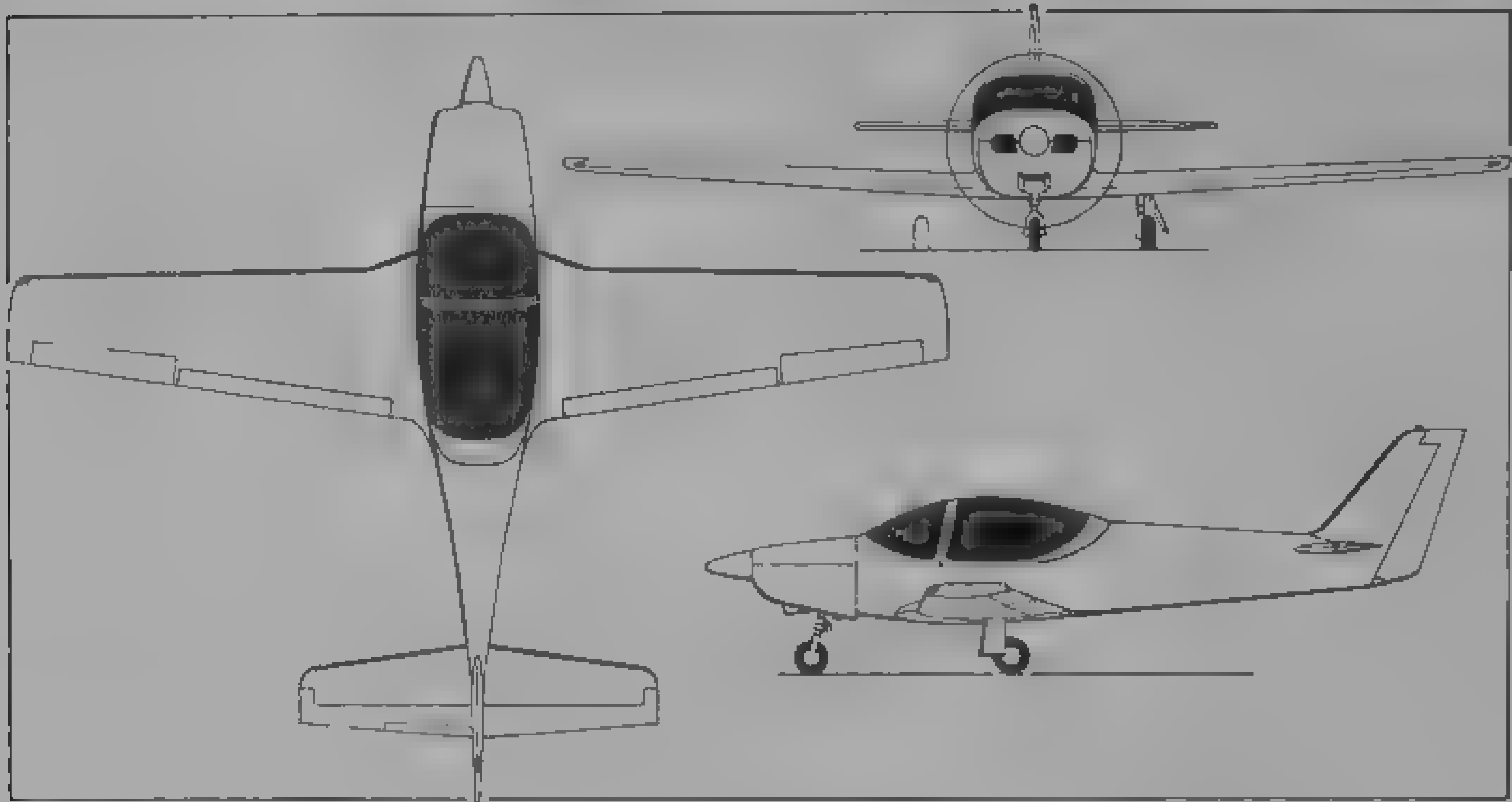
COSTS: DM542,200 without tax.

DESIGN FEATURES: Low power loading, high wing loading, smooth accurate external form, low structure weight and low-drag laminar aerofoil give good aerobatic performance at full gross weight, cockpit and control layout dimensioned for two occupants in full military equipment.

Grob G 115D2 Heron operated by Shorts for Royal Navy pilot grading

Grob G 115T Acro

1995



Grob G 115T Acro military and commercial pilot trainer (one Textron Lycoming AEIO-540)
(Jane's/Mike Keep)

1994

FLYING CONTROLS: Control columns with sticktop electric elevator trim, adjustable rudder pedals and duplicated toe operated brakes; handling meets MIL specifications, control surfaces operated by pushrods for low friction, electrically operated Fowler flaps

STRUCTURE: All-composites structure laid up by hand without autoclaving for ease of repair in field

LANDING GEAR: Retractable tricycle type with electro-hydraulic actuation, oleo dampers, steerable nosewheel, foot-powered hydraulic disc brakes, mainwheels 6.00-5, nosewheel 5.00-5

POWER PLANT: One Textron Lycoming AEIO-540-D4A5 flat six engine driving a constant speed three-blade propeller; power output 194 kW (260 hp) at full 2,700 rpm and 175 kW (235 hp) at German noise-limited 2,400 rpm; exhaust silencer to keep noise below 68 dBA. Christen all attitude oil system, EGT and cylinder head temperature gauges. Fuel capacity 280 litres (74 US gallons, 61.6 Imp gallons) located in wings, mechanical fuel pump with electric booster

ACCOMMODATION: Two pilots side by side with room for crash helmets and parachutes, rudder pedals and seats adjustable, instrument panel space for two full blind flying panels and airways radio; five-point harness; full transparent sliding canopy, cabin heater and windscreen demister standard

SYSTEMS: Electrical system 24 V DC with 25 Ah Ni/Cd battery and 70 VA alternator; full night lighting with integral instrument lighting, heated pitot and alternate static source

AVIONICS: *Instrumentation*: Basic flight instruments only; full IFR optional

DIMENSIONS, EXTERNAL:

Wing span	10.00 m (32 ft 9¾ in)
Wing aspect ratio	7.63
Length overall	8.20 m (26 ft 10¾ in)
Height overall	2.57 m (8 ft 5¼ in)
Tailplane span	3.80 m (12 ft 5⅝ in)

DIMENSIONS, INTERNAL:

Cabin: Width	1.25 m (4 ft 1¼ in)
Height, from floor	1.20 m (3 ft 11¼ in)

AREAS:

Wings, gross	13.1 m² (141.0 sq ft)
Vertical tail surfaces (total)	1.62 m² (17.40 sq ft)
Horizontal tail surfaces (total)	3.04 m² (32.72 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's weight empty, according to equipment	850-890 kg (1,874-1,962 lb)
Max T-O weight	1,300 kg (2,866 lb)
Max wing loading	99.24 kg/m² (20.33 lb/sq ft)
Max power loading: 260 hp	6.71 kg/kW (11.02 lb/hp)
235 hp	7.42 kg/kW (12.20 lb/hp)

PERFORMANCE:

Never exceed speed (VNE)	230 kts (426 km/h, 264 mph)
Max cruising speed, 75% power, at 1,525 m (5,000 ft)	165 kts (306 km/h, 190 mph)
Stalling speed, flaps and gear down	57 kts (106 km/h, 66 mph)
Max rate of climb at S/L	426 m (1,400 ft)/min
Service ceiling	5,490 m (18,000 ft)
T-O run	311 m (1,021 ft)
Landing run	220 m (722 ft)
Range	707 n miles (1,310 km; 814 miles)
Endurance	4 h 30 min
g limits at max T-O weight	+6/−3

UPDATED

GROB GF 200, 250, 300 and 350

TYPE: Business and executive aircraft

PROGRAMME: Announced early 1988; developed with support of German Ministry of Development and Technology; first flight of unpressurised prototype (D-EFKH) 26 November 1991, originally planned Porsche engine replaced by 201 kW (270 hp) Textron Lycoming TIO-540; this to be replaced by 231 kW (310 hp) water-cooled engine, certification and deliveries planned for mid-1996

CURRENT VERSIONS: **GF 200**: Four-seat, powered by Teledyne Continental TSIOL-550 piston engine and unpressurised. *As described*

GF 250/6: Stretched, six-seat version, 261 kW (350 hp) piston engine. **GF 300**: 313 kW (420 shp) Allison turboshaft, pressurised, six seats. **GF 350**: Twin Allison engines, pressurised; six to eight seats. Further information in Addenda

COSTS: Standard unpressurised aircraft, no IFR, DM445,000 without tax

DESIGN FEATURES: Advanced profile wing with upswept tips, centre-mounted engine drives rear-mounted propeller through carbon composite extension shaft, sweptback fins and rudders above and below tailcone; T tail, buried engine installation greatly reduces noise

FLYING CONTROLS: Variable incidence tailplane and elevators, rudders in upper and lower fins; upper rudder locked central in early 1994; small strakes on both fins; strakes at wingroots, electrically operated area-extending Fowler flaps

STRUCTURE: All-composites airframe

LANDING GEAR: Tricycle retracting, main gear has levered suspension and hydraulically actuated wheel brakes; main legs retract inward, nose leg carries taxying light and retracts forward

POWER PLANT: One Teledyne Continental TSIOL-550 flat-six engine giving 231 kW (310 hp) at 2,500 rpm, prototype flew with three-blade constant-speed Muhlbauer pusher propeller driven by Grob composites shaft; five-blade propeller of 1.80 m (5 ft 10¾ in) diameter considered, standard fuel tankage 350 litres (92.5 US gallons, 77 Imp gallons)

ACCOMMODATION: Pilot plus three passengers in pressurised cabin, after first unpressurised batch, access on port side between seat rows through split upward- and downward-opening door with integral airstairs

SYSTEMS: 28 V 70 A electrical system also powers hydraulic landing gear retraction

DIMENSIONS, EXTERNAL:

Wing span	11.00 m (36 ft 0 in)
Wing aspect ratio	9.69
Fuselage length	8.70 m (28 ft 6½ in)
Height overall	3.42 m (11 ft 2½ in)

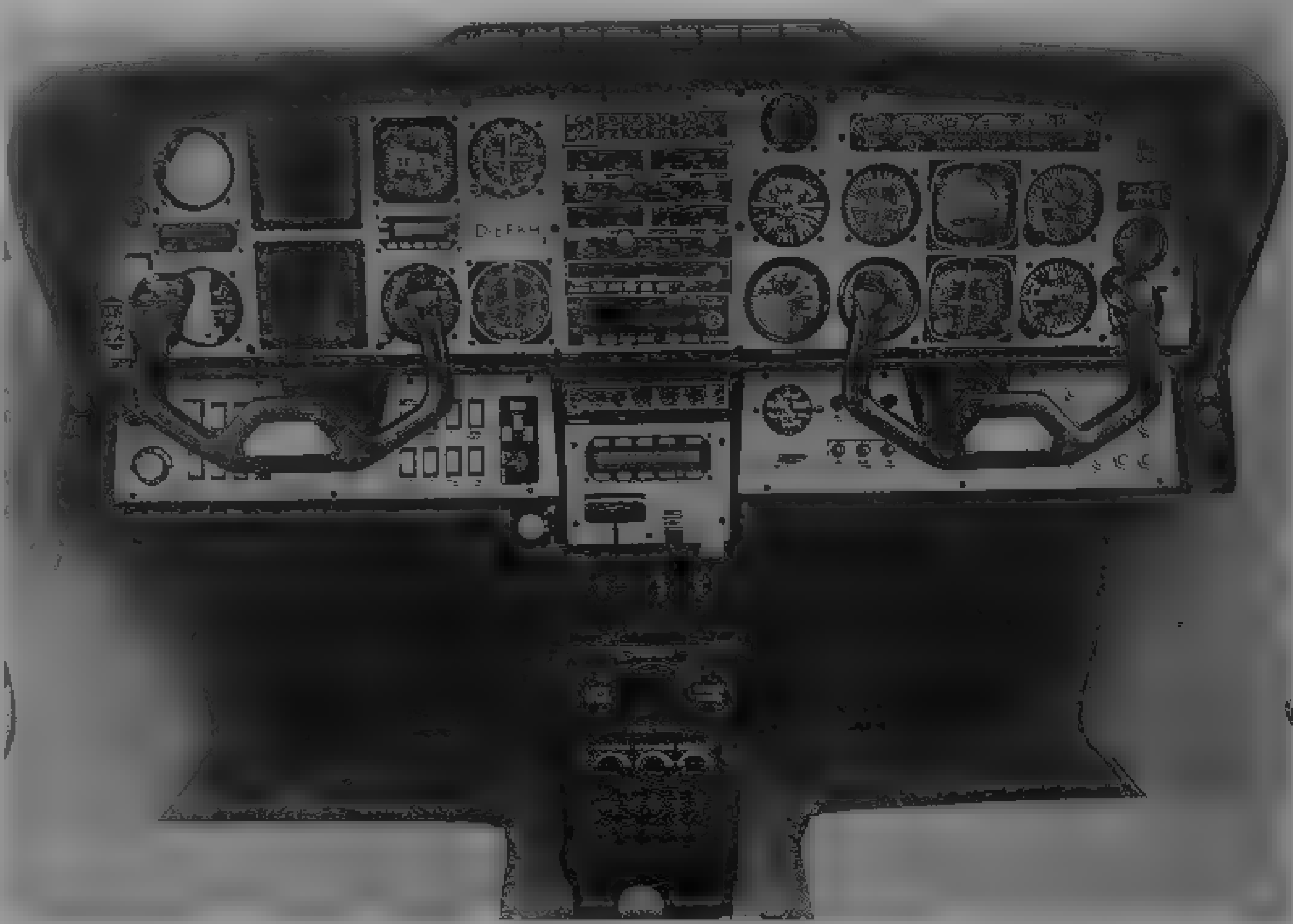
AREAS:

Wings, gross: flaps retracted	12.53 m² (134.9 sq ft)
flaps extended	14.09 m² (151.7 sq ft)

Following data for 231 kW (310 hp) power plant.

WEIGHTS AND LOADINGS:

Payload	600 kg (1,323 lb)
Max baggage weight	50 kg (110 lb)
Max fuel weight	252 kg (555 lb)



Instrument panel of the Grob GF 200 prototype

1995

Max T-O weight	1,700 kg (3,747 lb)
Max wing loading	135.7 kg/m² (27.8 lb/sq ft)
Max power loading	7.36 kg/kW (12.09 lb/hp)

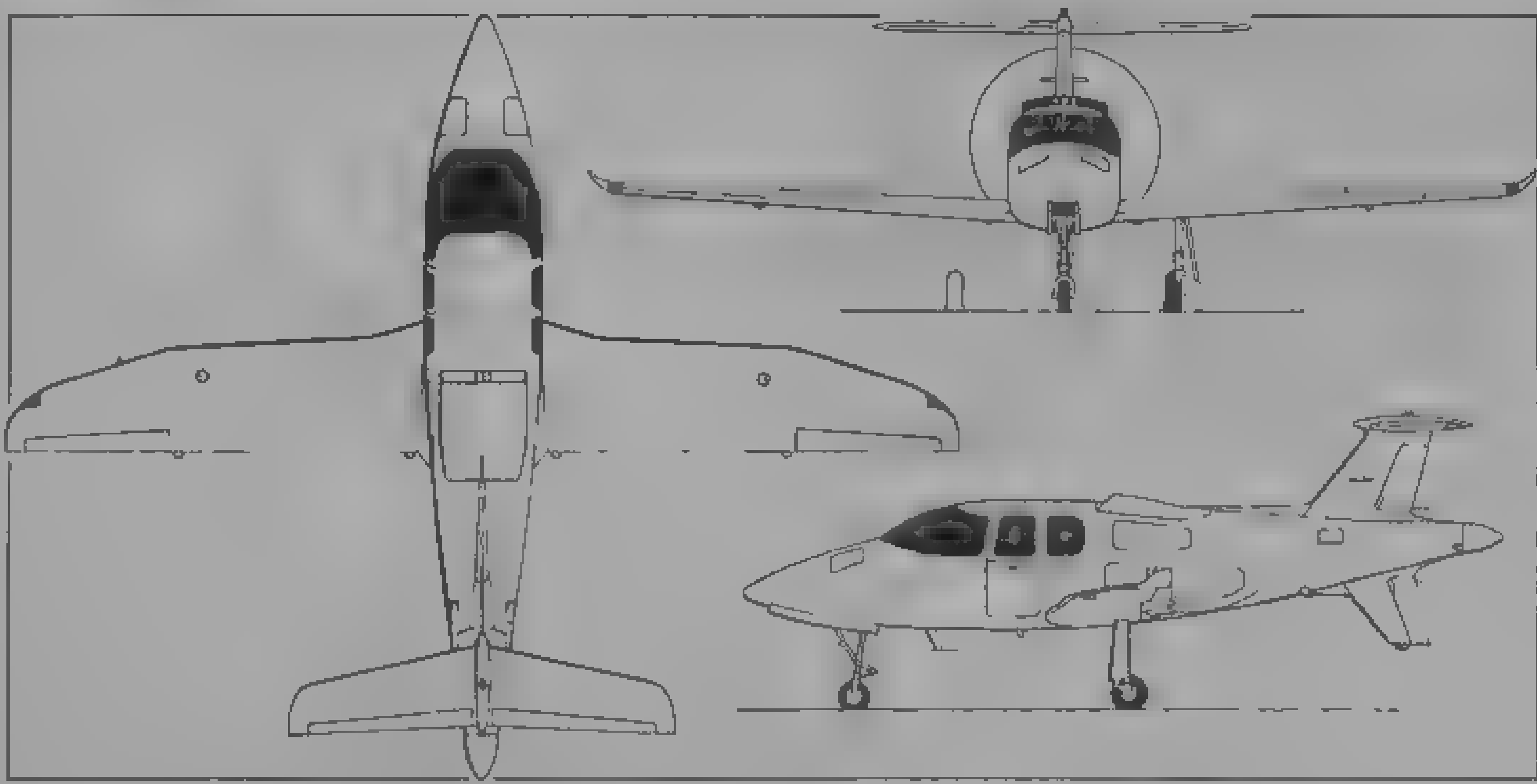
PERFORMANCE:

Max cruising speed	227 kts (420 km/h; 261 mph)
Cruising speed, 75% power, at 6,710 m (22,000 ft)	202 kts (374 km/h, 232 mph)
Max rate of climb: at S/L	372 m (1,220 ft)/min
at 6,100 m (20,000 ft)	300 m (985 ft)/min
T-O run	362 m (1,188 ft)
Landing run	332 m (1,089 ft)
Max range, 75% power, at 6,710 m (22,000 ft), 45 min reserves	1,244 n miles (2,304 km, 1,431 miles)

UPDATED

Unpressurised prototype of Grob GF 200

1995



Grob GF 200 all-composites four-seat touring aircraft *(Jane's/Mike Keep)*

1988

GROB G 850 STRATO 2C

TYPE: High-altitude, long-endurance stratospheric and climatic research aircraft.

PROGRAMME: Development began under contract from German Ministry of Research and Technology's DLR research establishment at Oberpfaffenhofen April 1992, tooling began October 1992; engine installation changed from tractor to pusher configuration Spring 1993, full power plant ground tests began 22 December 1994, first flight (D-CDLR) 31 March 1995, delivery end 1996. Industrieanlagen Betriebsgesellschaft (IAGB) responsible for power plant engineering.

CUSTOMERS: German DLR.

COSTS: Reported contract value for one aircraft DM75 million.

DESIGN FEATURES: World's largest composites construction aircraft. Range sufficient to observe North or South Poles for eight hours operating from neighbouring continents; high-aspect ratio wing with laminar aerofoil and low wing loading.

FLYING CONTROLS: Conventional control surfaces and flaps with servo tabs, differential spoilers, and speed brakes.

STRUCTURE: Completely in wet laid-up composites (mainly CFRP).

LANDING GEAR: Retractable tricycle type; mainwheels retract into fuselage blisters, hydraulic brakes.

POWER PLANT: Compound power plant based on two 300 kW (402 hp) Teledyne Continental TSIOL-550 liquid-cooled flat-six piston engines, driving Muhlbauer wooden (composites coated) variable-pitch feathering five-blade propellers through reduction gearboxes. AlliedSignal turbocharger with 3.0 pressure ratio driven by exhaust of each engine, after driving turbocharger, exhaust gases ducted to turbine of two-stage centrifugal turbocharger based on core of P&WC PW127 turboprop, which then feeds compressed fresh intake air to intake scroll of engine turbocharger and thence to engine; total pressure ratio of second turbocharger 18, and air throughput at S/L 10 kg (22 lb)/s, automatic wastegate maintains engine power constant up to maximum altitude; exhaust from large turbocharger provides extra jet thrust equal to 12 per cent of propeller thrust. to ensure heat dissipation at extreme altitudes, two intercoolers set in charge airstream of external turbocharger and third intercooler located between engine turbocharger and cylinders; two further radiators handle engine oil cooling and engine coolant (see accompanying drawing).

ACCOMMODATION: Two pilots side by side and two scientists in the cabin.

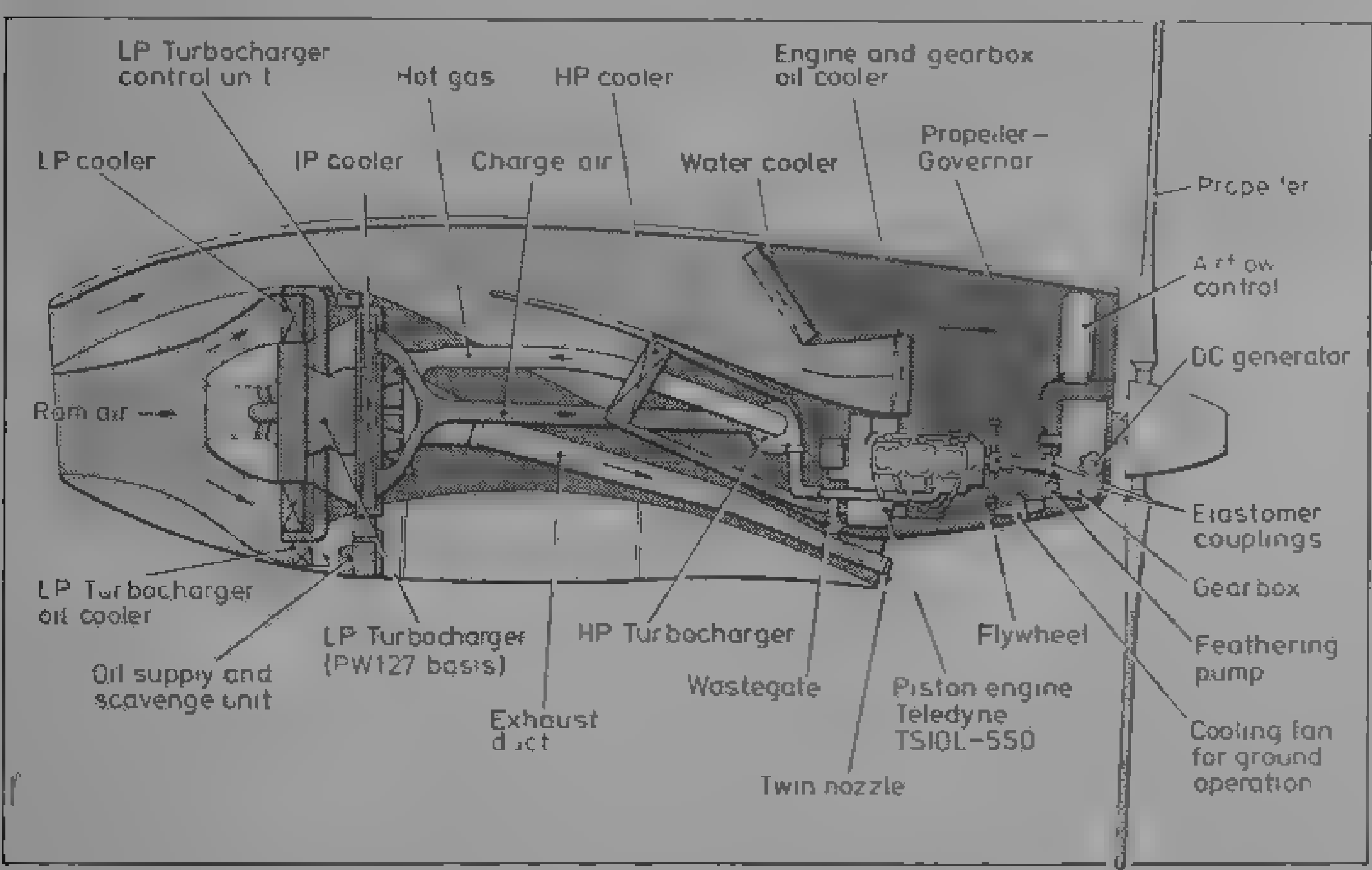
SYSTEMS: Cabin air conditioning and pressurisation from engine bleed air. Provision for pressure suits. Hardpoints on fuselage and wings for external payloads; oil-cooled engine-driven 28 V generator provides aircraft electrical power.

DIMENSIONS, EXTERNAL:

Wing span	56.50 m (185 ft 4½ in)
Wing aspect ratio	22.02
Fuselage: Length	24.00 m (78 ft 9 in)
Max diameter	2.30 m (7 ft 6½ in)
Propeller diameter	6.00 m (19 ft 8¼ in)

DIMENSIONS, INTERNAL:

Pressure cabin: Length	5.50 m (18 ft 0½ in)
Max width	2.00 m (6 ft 6¾ in)



Wing-mounted power plant installation of the Grob Strato 2C, showing the location of the major components and the air flow paths *(Jane's/Mike Keep)*

1994

AREAS:

Wings, gross	145.0 m² (1,560.8 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's weight empty	6,650 kg (14,661 lb)
Max fuel weight	5,700 kg (12,566 lb)
Max T-O weight	13,350 kg (29,431 lb)
Max wing loading	92.1 kg/m² (18.9 lb/sq ft)
Max power loading	22.25 kg/kW (36.56 lb/hp)

PERFORMANCE:

Cruising speed: at 24,000 m (78,740 ft), design mission	280 kts (520 km/h, 323 mph)
at 18,000 m (59,050 ft), long endurance mission	186 kts (345 km/h, 214 mph)
Design altitude	26,000 m (85,300 ft)
Range with 800 kg (1,764 lb) payload: 8 h at 24,000 m (78,740 ft)	3,779 n miles (7,000 km, 4,349 miles)
Range on long endurance mission, four crew and 1,000 kg (2,205 lb) payload, 48 h at 18,000 m (59,050 ft)	9,773 n miles (18,100 km, 11,246 miles)

UPDATED

GROB G 109B

TYPE: Two-seat light aircraft and motor glider.

PROGRAMME: Prototype G 109 first flown 14 March 1980, 56 kW (75 hp) Limbach engine, certified in 17 countries, including USA to JAR 22, total 150 G 109A built, followed in 1983-86 by 250 G 109Bs with modified wing of increased span and 67 kW (90 hp) Grob 2500 engine, production terminated 1986. Reinstated January 1991, reverting to Limbach engine; 76 built, including 53 to RAF Air Cadets as **Vigilant T. Mk 1**, final delivery March 1991; line reopened 1995.

CURRENT VERSIONS: **Grob 109B**: Standard version.

Grob 109B Ranger: Export version with dual ignition and customer specified avionics.

DESIGN FEATURES: Economical light aircraft and motor glider; low drag due to glider-like design with high aspect ratio and laminar aerofoil section; wings fold back for compact hangarage, needing a floor space of 2.06 m (6 ft 9 in) by 10.49 m (34 ft 5 in).

Wings of Eppler E 580 section, thickness/chord ratio 16.1 per cent from root to tip; dihedral 3°, incidence 2°; no sweepback; Schempp-Hirth airbrakes on upper surface only; fixed incidence tailplane.

Grob 109B with wings stowed for compact hangarage

1995

FLYING CONTROLS Conventional ailerons, elevator and rudder. Elevator tab for pitch trim.

STRUCTURE Wings GFRP and CFRP with ailerons of GFRP; fuselage and tail surfaces GFRP, apart from CFRP rudder.

LANDING GEAR Non-retractable tailwheel type, mainwheels 380 × 150 mm, pressure 2.5 bars (36.25 lb/sq in) with hydraulic disc brakes and speed fairings. Tailwheel 250 × 85 mm.

POWER PLANT: One 67.1 kW (90.0 hp) Grob 2500 flat-four. Fuel capacity 118.2 litres (31.2 US gallons, 26.0 Imp gallons).

ACCOMMODATION Two seats side by side; full dual controls. Two doors, hinged on canopy centreline open upwards.

SYSTEMS Electrical system, engine-driven alternator and 12 V 30 Ah battery.

AVIONICS: *Comms* Radio standard, transponder optional.

Flight: Optional VOR, ADF, DME and electric variometer.

DIMENSIONS, EXTERNAL

Wing span	17.37 m (57 ft 0 in)
Wing aspect ratio	15.9
Length overall	7.92 m (26 ft 0 in)
Height overall	1.68 m (5 ft 6 in)

AREAS

Wings, gross	18.95 m² (204.0 sq ft)

WEIGHTS AND LOADINGS

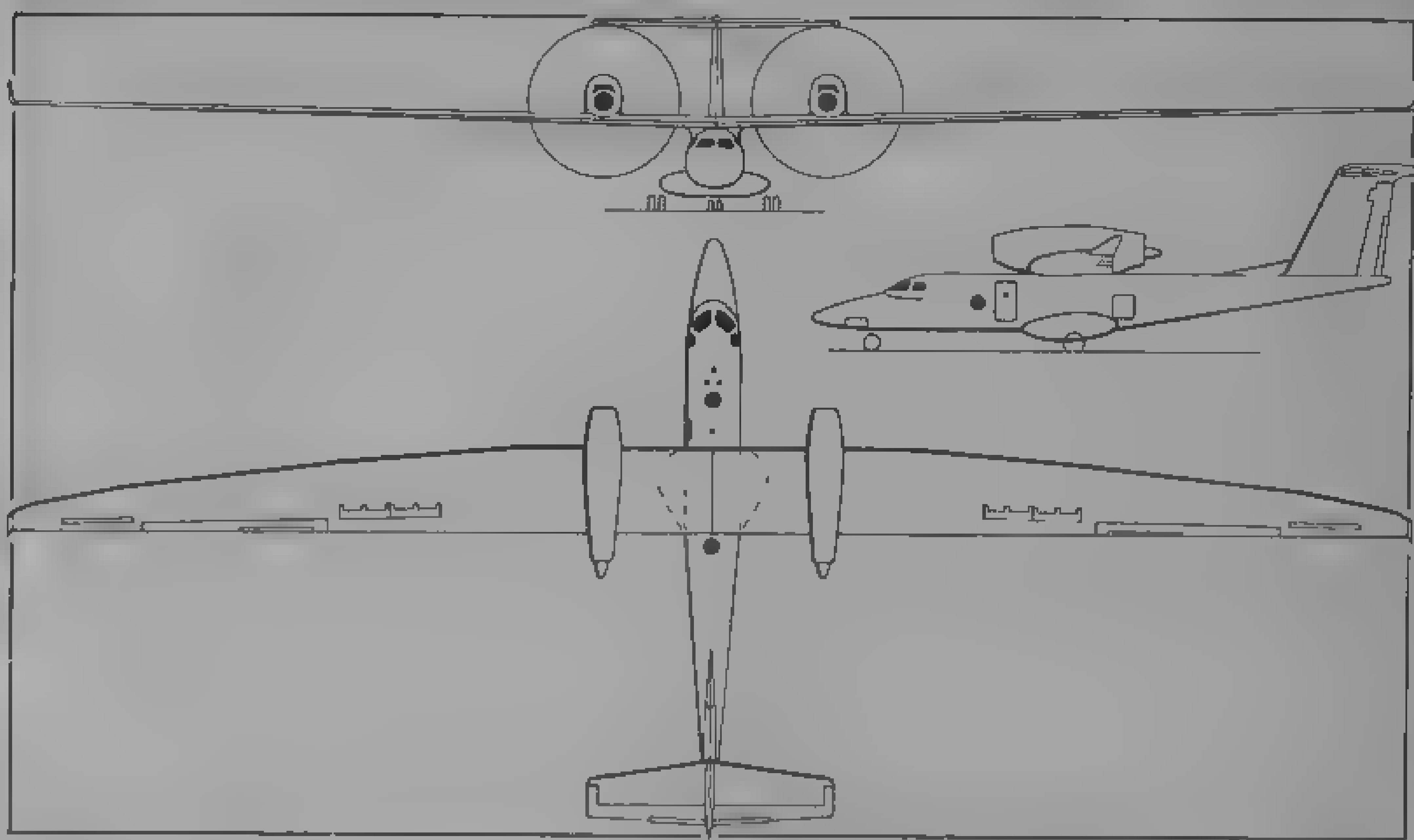
Weight empty	618.7 kg (1,364 lb)
Max payload	229.5 kg (506 lb)
Max T-O weight	848.2 kg (1,870 lb)
Max wing loading	44.8 kg/m² (9.2 lb/sq ft)
Max power loading	12.64 kg/kW (20.77 lb/hp)

PERFORMANCE, POWERED (at max T-O weight, ISA)

Never-exceed speed (VNE)	130 kts (240 km/h, 150 mph)
Max cruising speed at S/L	108 kts (200 km/h; 124 mph)
Stalling speed, power off	39 kts (72 km/h; 44 mph)
Max rate of climb at S/L	198 m (649 ft)/min
T-O run	196 m (643 ft)
T-O distance to 15 m (50 ft)	320 m (1,050 ft)

First flight of Grob Strato 2C, 31 March 1995

1995



Grob Strato 2C high-altitude long endurance surveillance aircraft *(Jane's/Mike Keep)*

1994

Grob 109B light aircraft and motor glider

1995

Range with max internal fuel
 at 76 kts (140 km/h, 87 mph)
 970 n miles (1,798 km, 1,117 miles)
 at 100 kts (185 km/h, 115 mph)
 619 n miles (1,148 km, 713 miles)

PERFORMANCE, UNPOWERED

Best glide ratio at 62 kts (115 km/h, 71 mph)	28
Min rate of sink, at 58 kts (107 km/h, 67 mph)	1.10 m (3.61 ft)/s

NEW ENTRY

RHEIN-FLUGZEUGBAU GmbH
(Owned by ABS International)

Flugplatz, PO Box 100708, D-41007 Mönchengladbach
Telephone: 49 (2161) 6820
Fax: 49 (2161) 682200
Telex: 852 506
OWNER: Albert Blum
PRESIDENT: Hartmut Stiegler
CHIEF DESIGNER: Christoph Fischer
MARKETING MANAGER: Hans-Jörg Brandt

RFB sold by MBB to ABS International in 1990. Workforce is 250 and annual sales DM50 million.

RFB specialises in development and manufacture of GFRP wings and fuselages, components and assemblies of light alloy, steel and GFRP for aircraft in quantity production by other German companies, and spare parts and ground equipment.

Under contract to German government, RFB services military aircraft, and provides target towing flights and other services with special aircraft. It has Luftfahrt-Bundesamt (LBA) approval for aircraft development, manufacture, maintenance and overhaul; operates a factory certificated service centre for Beech, Mitsubishi, Partenavia and Piper aircraft, Bendix/King, Becker and Collins avionics, and P&WC PT6 engines, also airline components, parachutes, liferafts, lifejackets, evacuation slides for L-1011, 737/757/767 and MD-11 airliners; repair and overhaul of composite structural components.

Work on specialist ground effect vehicles on lines of its earlier Lippisch-type X113 and X114 has been continued with improved patented Power Augmentation System.

RFB has been engaged for many years in developing specialised applications for ducted propellers, one of which led to Fantrainer.

VERIFIED

RFB FANTRAINER 800

TYPE: Two-seat military trainer

PROGRAMME: Announced at Paris Air Show 1993 as more powerful version of Fantrainer 600 (1990-92 *Jane's*)

CUSTOMERS: No customer yet confirmed

DESIGN FEATURES: Same airframe and same turboshaft/shrouded fan propulsion system (although developing more power) as Fantrainer 600; same adaptable cockpit section, but added rocket escape system

FLYING CONTROLS: As earlier Fantrainers

STRUCTURE: Forward fuselage based on GFRP keel structure carrying all main loads with side shells forming cockpit contour and canopy layout, all-composites wings autoclaved for long life (Royal Thai Air Force airframes have suffered no deterioration from damp or heat), rear fuselage and tail surfaces metal stressed skin

LANDING GEAR: Retractable tricycle type, with main gear built in single removable assembly, nosewheel retracts upwards and forwards into nose fairing

POWER PLANT: One Allison 250-C30 turboshaft, with output uprated to as much as 597 kW (800 shp) by end 1993 with no increase in size or weight, engine drives five-blade wooden fan turning in close-fitting ring duct, fan designed to absorb up to 746 kW (1,000 hp); engine exhaust protects fan from icing. Fuel: see under Weights and Loadings

ACCOMMODATION: Two pilots in tandem on fixed seats; UPC rocket extraction system can save pilots in zero/zero conditions, firing of extraction rockets separated by 0.5 seconds, environmental control system optional. Cockpit and canopy contours can be adapted to simulate operational aircraft

SYSTEMS: As Fantrainer 600

AVIONICS: Customer choice

DIMENSIONS, EXTERNAL:

Wing span	9.74 m (31 ft 11½ in)
Length overall	9.48 m (31 ft 1¼ in)
Height overall	3.16 m (10 ft 4½ in)
Wheel track	1.94 m (6 ft 4½ in)
Wheelbase	3.89 m (12 ft 9¼ in)

RFB Fantrainer 800 prototype (one uprated Allison 250-C30 turboshaft)

1994

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility):

Weight empty: A, U	1,180 kg (2,601 lb)
Weight of two pilots with parachutes	200 kg (441 lb)
Other payload: A	64 kg (141 lb)
U	156 kg (344 lb)
Max fuel weight, internal: A	176 kg (388 lb)
U	384 kg (846 lb)
Max fuel weight, external: U	400 kg (882 lb)
Max T-O weight: A	1,600 kg (3,527 lb)
U	2,310 kg (5,093 lb)
Max landing weight: U	2,000 kg (4,409 lb)
Max power loading: A	2.68 kg/kW (4.41 lb/shp)
U	3.87 kg/kW (6.37 lb/shp)

PERFORMANCE (at max Aerobatic T-O weight):

Max level speed at 4,575 m (15,000 ft)	259 kts (480 km/h; 298 mph)
Cruising speed at 4,575 m (15,000 ft)	243 kts (450 km/h; 280 mph)
Stalling speed	61 kts (113 km/h; 71 mph)
Max rate of climb at S/L	900 m (2,952 ft)/min
Rate of climb at 4,575 m (15,000 ft)	780 m (2,559 ft)/min
T-O and landing run	250 m (820 ft)
Range at 3,050 m (10,000 ft), max internal fuel, 45 min reserves	561 n miles (1,040 km; 646 miles)
Endurance at 3,050 m (10,000 ft), max internal fuel, 45 min reserves	4 h 6 min
g limits: A	+6/−3
U	+4.4/−1.76

UPDATED

OTHER AIRCRAFT

Details of the **Rockwell/DASA Ranger 2000**, for which RFB fabricated three sets of components, appear in the International section. Production plans for the **MFI-10C Vipan/Phönix** (see 1994-95 *Jane's*) remain in abeyance.

NEW ENTRY

RUSCHMEYER

RUSCHMEYER LUFTFAHRTTECHNIK GmbH

Segelfliegerweg 41, D-49324 Melle
Telephone: 49 (5422) 9493-0
Fax: 49 (5422) 9493-99

PRESIDENT: Horst Ruschmeyer

VICE-PRESIDENT: Dr Dietmar Kaiser

Government of Lower Saxony and Federal Government have invested in company. Current production rate 30 aircraft per year, second factory to be started to raise production to 100 aircraft per year. Ultimate aircraft is to be powered by Allison turboprop driving five-blade propeller.

UPDATED

RUSCHMEYER R 90-230 RG

TYPE: Four-seat touring aircraft

PROGRAMME: Development of original MF-85 started 1985; first prototype MF-85P-RG (V0001) flew with Porsche; changed to R 90-230 RG using flat rated Textron Lycoming IO-540 after cessation of Porsche production in March 1990; first flight of prototype V001 (D-EEHE) 8 August 1988, first flight of V002 (D-EERO) 25 September 1990; V003 (D-EERH) first flight 12 February 1992, LBA certification June 1992. FAA certification 24 June 1994, CAA and JAA certification to follow

CURRENT VERSIONS: **R 90-230 RG**: Current production aircraft, approximately 20 (including prototypes) delivered January 1995, *description applies to this version*

R 90-230 FG: Non-retractable landing gear version of RG; 175 kW (235 hp) Textron Lycoming O-540-J, derated to 2,300 rpm and about 164 kW (220 hp), first flight (D-EECR) 30 March 1994, certification and production mid-1995

R 90-180 FG: Non-retractable landing gear version, 149 kW (200 hp) Textron Lycoming IO-360, flat rated at 134 kW (180 hp); same external form, but much modified structure; detail design began early 1994, production start expected 1996

Aerobatic trainer: Will have jettisonable doors, systems for inverted flight and provision for parachutes, available by 1996

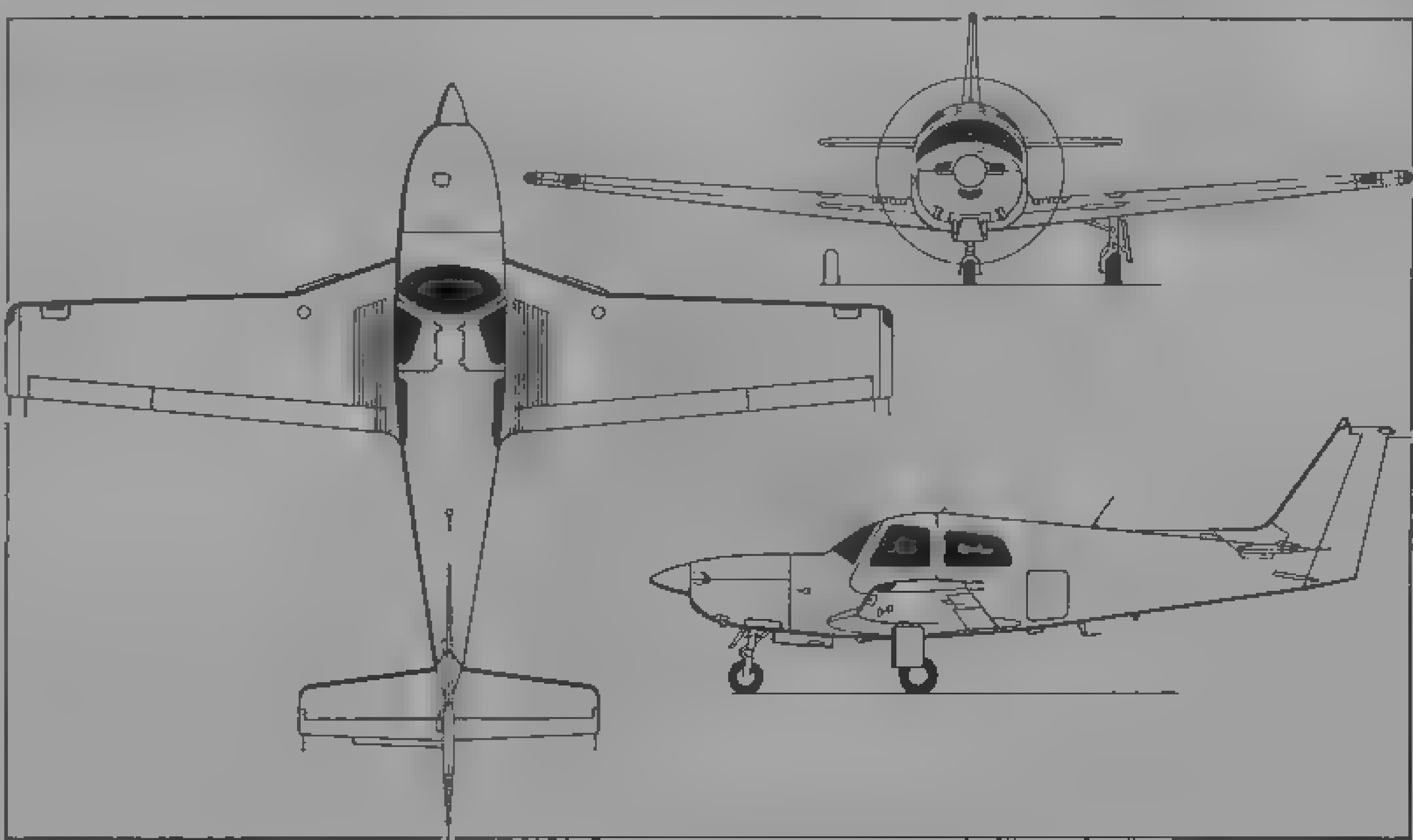
R 90-350T RG: Intended top model of family, turbocharged 186 kW (250 hp) to replace 224 kW (300 hp) piston engine; intended cruising speed 234 knots (435 km/h; 270 mph) at 7,620 m (25,000 ft)

COSTS: Price of first production version DM372,000 plus VAT (1995) without avionics and optional items

DESIGN FEATURES: Objectives were high performance by low-drag all-composites airframe, use of derated engine

Ruschmeyer R 90-230 RG with retractable landing gear

1994



Ruschmeyer R 90-230 RG (*Jane's/Mike Keep*)

1993

requiring less cooling, reduced noise by lower engine rpm, special silencer and matched four-blade constant speed propeller, consequently reduced fuel consumption and emissions; noise level under German regulations demonstrated 66 dBA, 8 dBA below limit, also 10.2 dBA below ICAO Chapter 10 limit

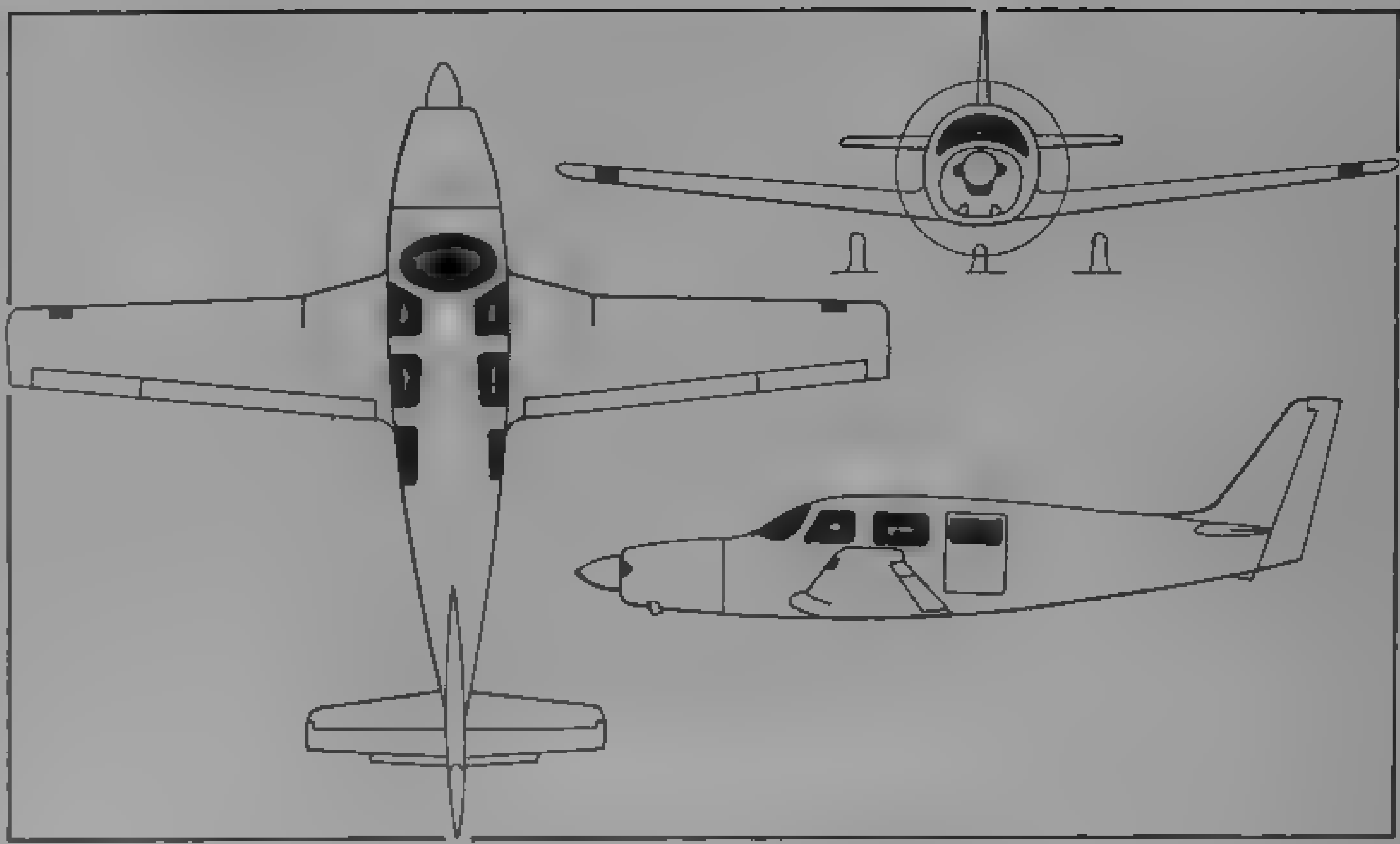
FLYING CONTROLS: Conventional, all push/pull rod operated to minimise friction, dual controls with sticks standard, fixed tailplane, combined trim and anti-balance tab on port elevator; stall strips on inboard wing leading-edge; three-position Fowler flaps operated by electrohydraulic system are linked to elevator to avoid trim changes

STRUCTURE: All composites moulded airframe with 70 per cent fewer parts than equivalent metal structure. Ruschmeyer qualified BASF Palatal A430 resin fibre composite material for aviation, advantages are durability at up to 72°C ambient, improved strength, field repair without special tools, negligible allergic risks during manufacture, and material is recyclable. GFRP with Rohacell foam cores and CFRP reinforcement round doors, steel tube running from firewall, over roof and into tail supports doors and protects against roll-over; components earth bonded to German and FAA standards. Meets 1.75 safety factor for composite airframes. Airframe certificated for 18,000 flying hours

LANDING GEAR: Retractable tricycle type, trailing-link levered mainwheel suspension retracts inward and covered by mechanically linked doors, foot-powered hydraulic disc brakes, nosewheel retracts rearward, also covered by doors

POWER PLANT: One Textron Lycoming IO-540-C4D5 flat-six engine, derated to 171.5 kW (230 hp) at 2,400 rpm, with exhaust silencer and special induction and cooling system. Mühlbauer MTV-14-B four-blade composites constant-speed propeller with 7.5 cm (3 in) spacer. Adjustable cowl flaps. Standard fuel 250 litres (66 US gallons; 55 Imp gallons), usable fuel 236 litres (62.3 US gallons; 52 Imp gallons) in integral tanks in inner wings. Fuel 100/100LL Avgas. Oil capacity 11.4 litres (3 US gallons; 2.5 Imp gallons)

ACCOMMODATION: Four-seat interior with ergonomically designed seats, three-point harness, upward-opening gull wing doors; heating and ventilation system with electric blower; baggage compartment for 50 kg (110 lb) accessible from inside and outside



Provisional drawing of Ruschmeyer R 95 *(Jane's/Paul Jackson)*

1995

SYSTEMS: Generator and battery, electrohydraulic actuation for flaps, pitot heater and night lighting

AVIONICS: *Comms:* Four-point intercom with selectable hi-fi entertainment

Instrumentation: VFR, optional IFR and autopilot

DIMENSIONS, EXTERNAL:

Wing span	9.50 m (31 ft 2 in)
Wing aspect ratio	6.97
Length overall	7.93 m (26 ft 0¼ in)
Propeller diameter	1.88 m (6 ft 2 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.86 m (9 ft 4½ in)
Width	1.14 m (3 ft 9 in)
Height	1.24 m (4 ft 0¾ in)
Baggage compartment volume	0.80 m³ (28.25 cu ft)

AREAS:

Wings, gross	12.94 m² (139.3 sq ft)

WEIGHTS AND LOADINGS:

Standard weight empty	898 kg (1,980 lb)
Max useful load	452 kg (996 lb)
Max fuel weight: standard	173 kg (381 lb)
long range	274 kg (604 lb)
Max T-O and landing weight	1,350 kg (2,976 lb)
Max wing loading	104.3 kg/m² (21.36 lb/sq ft)
Max power loading	7.87 kg/kW (12.94 lb/hp)

PERFORMANCE:

Max level speed at 3,050 m (10,000 ft) 174 kts (322 km/h, 200 mph)

Stalling speed:	
flaps and gear up	67 kts (124 km/h, 77 mph)
flaps and gear down	58 kts (108 km/h, 67 mph)
Max rate of climb at S/L	347 m (1,140 ft)/min
Service ceiling	4,895 m (16,060 ft)
T-O run	260 m (853 ft)
T-O to 15 m (50 ft)	520 m (1,706 ft)
Landing from 15 m (50 ft)	480 m (1,575 ft)
Landing run	325 m (1,067 ft)

Range:

75% power, 165 kts (306 km/h, 190 mph) at 2,440 m (8,000 ft) 744 n miles (1,378 km, 856 miles)

45% power, 120 kts (222 km/h, 138 mph) at 915 m (3,000 ft) 1,479 n miles (2,740 km, 1,703 miles)

38% power, 114 kts (211 km/h, 131 mph) 1,004 n miles (1,860 km, 1,156 miles)

Certificated g limits +3.8/−1.52

UPDATED

Ruschmeyer R 90-230 FG with fixed landing gear

1995

RUSCHMEYER R 90-420 AT

TYPE: Touring aircraft

PROGRAMME: Proof-of-concept prototype (D-EERO converted from R 90-230) powered by 313 kW (420 shp) Allison 250-B17 turboprop, made first flight 2 November 1993. If market develops, production could be started in 1997

UPDATED

Ruschmeyer R 90-420 AT prototype

1995

RUSCHMEYER R 95

TYPE: Six-seat light transport

PROGRAMME: Revealed May 1994, stretched version of R 90-420 AT, first flight planned 1999

COSTS: Estimated programme cost, DM30 million up to JAR 23 certification

DESIGN FEATURES: Development of R 90 features and technologies.

POWER PLANT: One 358 kW (480 shp) Allison 250-B20 turboprop

ACCOMMODATION: Pilot and five passengers.

WEIGHTS AND LOADINGS:

Weight empty	1,230 kg (2,712 lb)
Max T-O weight	2,000 kg (4,409 lb)

PERFORMANCE (estimated):

Max level speed	259 kts (480 km/h, 298 mph)
Max cruising speed	238 kts (440 km/h, 273 mph)
Max rate of climb at S/L	400 m (1,312 ft)/min

NEW ENTRY

SCHEIBE

SCHEIBE FLUGZEUGBAU GmbH

August Pfalz-Strasse 23, D-85221 Dachau, or PO Box 1829, D-85208 Dachau
Telephone: 49 (8131) 7 20 83/84
Fax: 49 (8131) 69 85
CHAIRMAN: Dipl Ing Egon Scheibe
ENGINEERING DIRECTOR: Ing Matthias Nahrlich
MARKETING DIRECTOR: Ing Werner Hoffman

Scheibe has produced hundreds of gliders and motor gliders. Current motor glider production comprises the steel tube and wood SF 25C Falke and SF 25 Rotax Falke. Completing development is the SF 36 R.

UPDATED

SCHEIBE SF 36 R

TYPE: Two-seat motor glider.

PROGRAMME: Prototype D-KITP. First deliveries planned for August 1995.

COSTS: Forecast price of standard aircraft DM169,800.

DESIGN FEATURES: Designed to FAR Pt 23 and JAR Pt 22; can be used for training and touring; can be dismantled by three or four people in five to 10 minutes and transported in a modified glider trailer. Wing in two pieces. Wortmann FX-61-184 aerofoil inboard and FX 60-126 outboard. Gliding performance similar to that of SF 25E Super Falke.

FLYING CONTROLS: Conventional mechanical with fixed tailplane and damped elevator. Schempp-Hirth type airbrakes in upper surface of wing to adjust glide angle.

STRUCTURE: All CFRP.

LANDING GEAR: Tailwheel type with flexible CFRP main legs and steerable tailwheel linked to rudder.

POWER PLANT: One 59.7 kW (80 hp) Rotax 912A flat-four engine turning at 5,800 rpm, with built-in reduction gear producing 2,500 propeller rpm; electric starter and 12 V alternator standard. Hydraulically feathering propeller. Fuel capacity 70 litres (18.5 US gallons, 15.4 Imp gallons).

ACCOMMODATION: Two seats side by side; adjustable rudder pedals; baggage compartment, cabin heating standard; access over leading- or trailing-edges.

SYSTEMS: 12 V electrical system.

AVIONICS: Optional.

DIMENSIONS, EXTERNAL:

Wing span	16.30 m (53 ft 5¾ in)
Wing aspect ratio	17.03
Length overall	7.20 m (23 ft 7½ in)

AREAS:

Wings, gross	15.60 m² (167.9 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's weight empty	approx 515 kg (1,135 lb)
Max T-O weight	715 kg (1,576 lb)
Average wing loading	42 kg/m² (8.6 lb/sq ft)
Max power loading	12.0 kg/kW (19.7 lb/hp)

PERFORMANCE, POWERED:

Max level speed	113 kts (210 km/h; 130 mph)
Max cruising speed	97 kts (180 km/h; 112 mph)
Stalling speed	40 kts (75 km/h; 47 mph)
Max rate of climb	240 m (787 ft)/min
T-O run	approx 200 m (656 ft)
Range	approx 540 n miles (1,000 km; 621 miles)

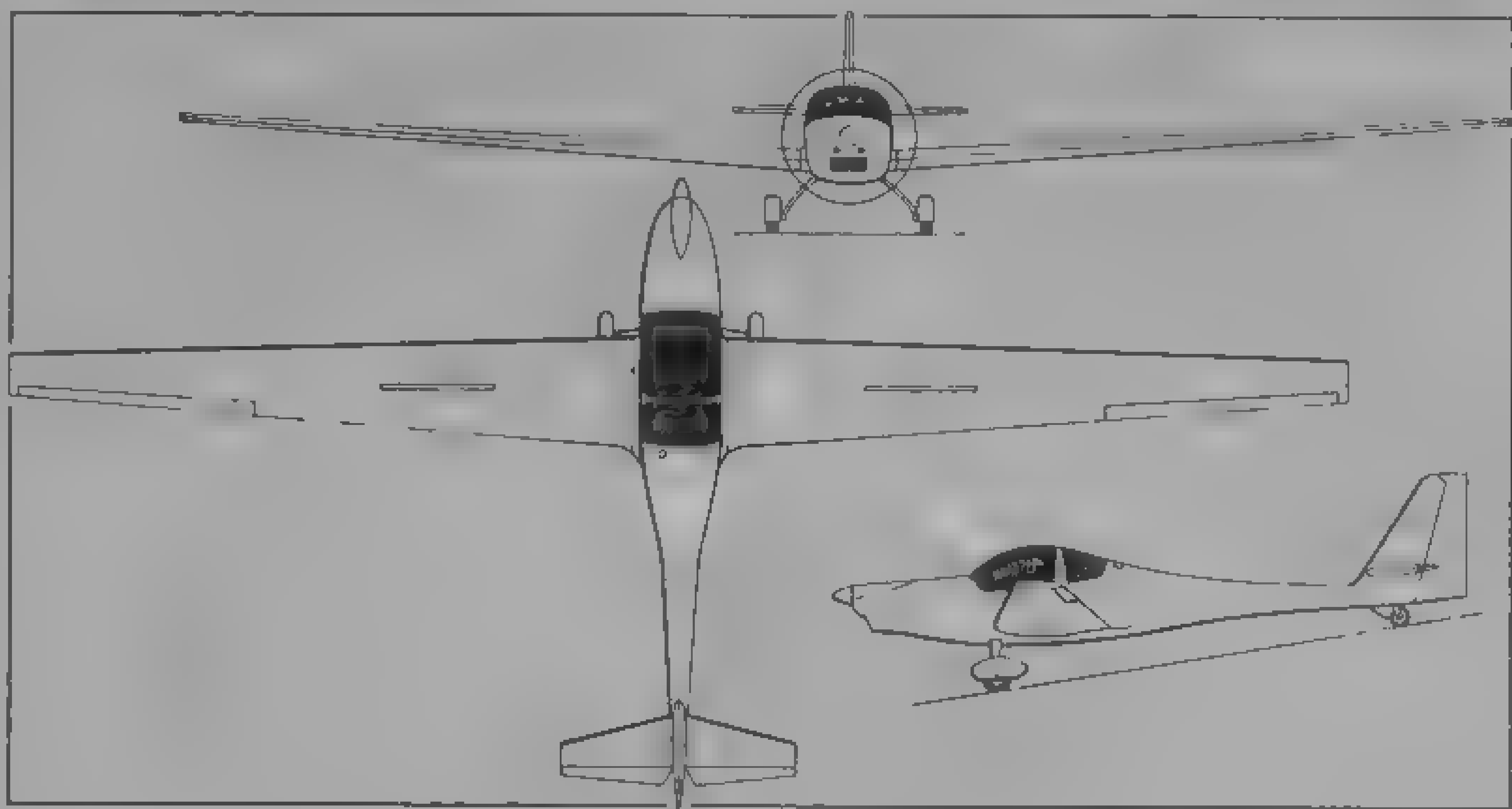
PERFORMANCE, UNPOWERED:

Best glide ratio at 51 kts (95 km/h; 59 mph)	29
Min rate of sink	approx 1.10 m (3.6 ft)/s

UPDATED

Scheibe SF 36 R two-seat motor glider

1994



Scheibe SF 36 R motor glider *(Jane's/Mike Keep)*

1994

SCHEIBE SF 25 C FALKE 2000, FALKE 1700 and ROTAX FALKE

TYPE: Two-seat motor glider.

PROGRAMME: In production.

CURRENT VERSIONS: **Falke 1700**: Powered by Limbach 1700 engine.

Falke 2000: Standard aircraft powered by Limbach L 2000 EA flat-four engine; monowheel landing gear or conventional tailwheel with two mainwheels available. *Details refer to this version.*

Rotax Falke: Has essentially the same performance, but is powered by a water-cooled Rotax 912A flat-four engine driving propeller at 2,500 rpm; nosewheel landing gear optional. Most production now of this version.

CUSTOMERS: Over 580 Falkes delivered, including 50 of Rotax version. 20 built in 1994 (19 Rotax, one 1700).

COSTS: Standard price with Limbach 2000 engine and monowheel landing gear, DM131,210; Rotax engine DM9,200 extra; nosewheel landing gear DM8,600 extra.

DESIGN FEATURES: Docile aerofoil with moderate aspect ratio, designed for safe and simple handling; aircraft can be easily dismantled and transported by trailer.

FLYING CONTROLS: Conventional, airbrakes in wing allow adjustment of descent path.

STRUCTURE: Steel tube and fabric fuselage, wooden wing.

LANDING GEAR: Standard landing gear is central monowheel, outriggers under wings, and tailwheel; two-wheel main landing gear with steerable tailwheel, and tricycle landing gear (only with Rotax engine), are optional.

POWER PLANT: Choice three engines: a 48.5 kW Limbach SL 1700 EA I; a 59.7 kW (80 hp) Limbach L 2000 EA driving the propeller at 3,450 rpm; or a 59.7 kW (80 hp) Rotax 912 A with water-cooled cylinder heads, running at 5,800 rpm and turning the propeller at 2,500 rpm. All engines have electric starter and alternator, propeller feathering optional. Standard fuel tankage is 55 litres (14.5 US gallons, 12.0 Imp gallons), optional fuel tankage 80 litres (21.1 US gallons, 17.6 Imp gallons).

ACCOMMODATION: Side by side seating, optional large cockpit opening, instrument panel space for radio.

SYSTEMS: 12 V electrical system.

AVIONICS: Choice of optional nav/com radios.

DIMENSIONS, EXTERNAL:

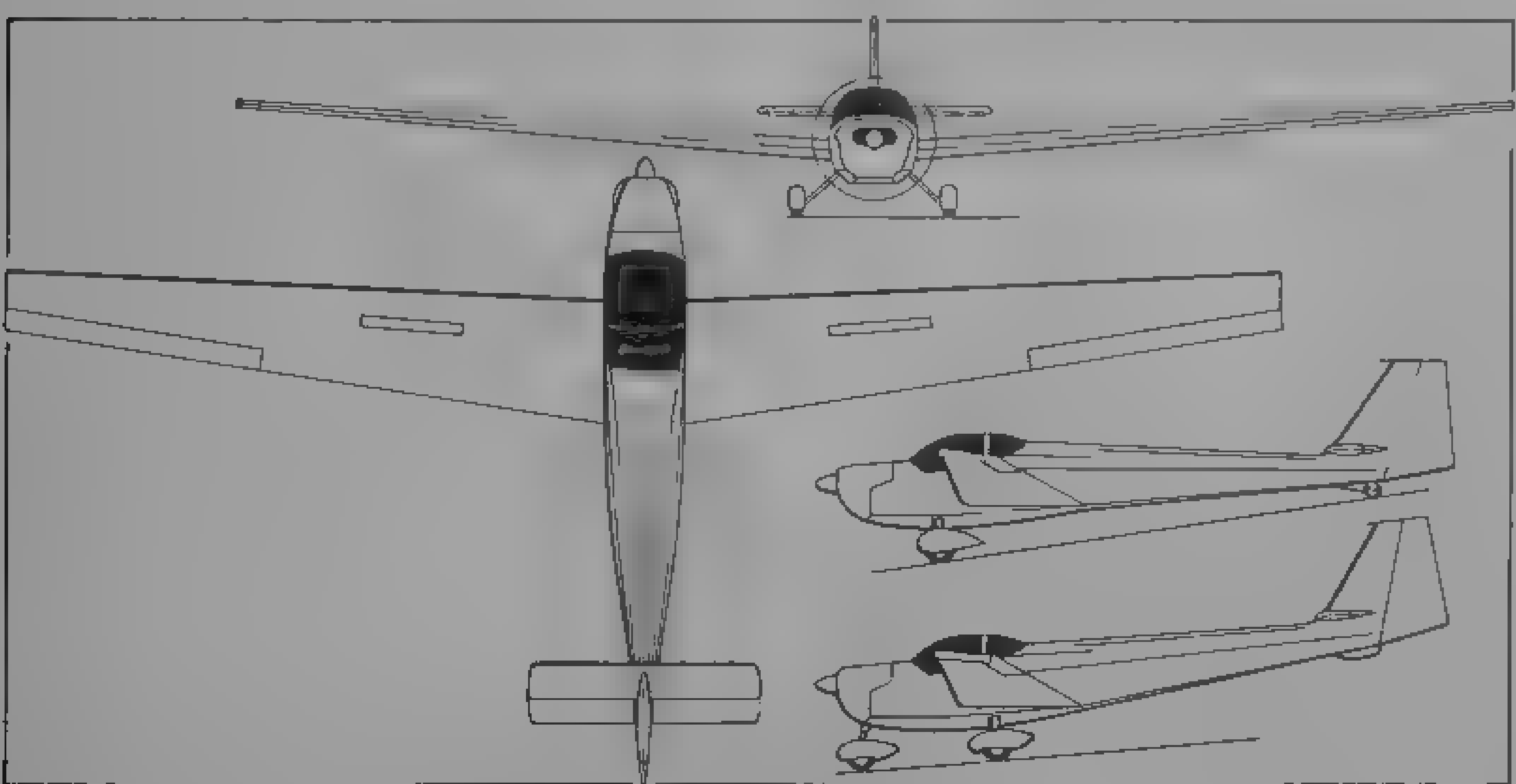
Wing span	15.30 m (50 ft 2¼ in)
Wing aspect ratio	12.86
Length overall	7.60 m (24 ft 11¼ in)

AREAS:

Wings, gross	18.20 m² (195.9 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's weight empty	approx 435 kg (959 lb)
Max T-O weight	650 kg (1,433 lb)
Max wing loading	33.5 kg/m² (6.9 lb/sq ft)
Max power loading	10.9 kg/kW (17.9 lb/hp)



Scheibe SF 25 C Falke powered by Rotax 912A engine, with second side view (lower) of Rotax-powered Falke with nosewheel landing gear *(Jane's/Mike Keep)*

1994

PERFORMANCE, POWERED (Rotax engine)

Max level speed	102 kts (190 km/h, 118 mph)
Max cruising speed,	97 kts (180 km/h, 112 mph)
Stalling speed	35 kts (65 km/h, 40 mph)
Max rate of climb at S/L	240 m (787 ft)/min
T-O run	100 m (328 ft)
Range, under power	377 n miles (700 km, 435 miles)
Endurance	4-5 h

PERFORMANCE, UNPOWERED

Best glide ratio	23-24
Min rate of sink	1.00 m (3.28 ft)/s

UPDATED

Scheibe SF 25 C Rotax Falke with optional tricycle landing gear

1994

Prototype of the Scheibe SF 40

1995

SCHEIBE SF 40

TYPE: Two-seat ultra-lightweight aircraft

PROGRAMME: Prototype first flew 1995, deliveries 1995

DESIGN FEATURES: Wings of constant chord, approximately 5° forward sweep

FLYING CONTROLS: Conventional mechanical ailerons, elevator and rudder

STRUCTURE: General construction of wood and fabric, some glassfibre.

LANDING GEAR: Tailwheel type, two strut braced mainwheels

POWER PLANT: One 44.7 kW (60 hp) Sauer four stroke driving a two-blade propeller. Fuel capacity 32 litres (8.5 US gallons; 7.0 Imp gallons)

ACCOMMODATION: Two side by side seats; rear-hinged canopy

SYSTEMS: Electrical system, engine-driven alternator, 12 V 30 Ah battery

AVIONICS: Customer specified

DIMENSIONS, EXTERNAL

Wing span	10.80 m (35 ft 5¼ in)
Wing aspect ratio	8.70

AREAS

Wings, gross	13.40 m² (144.2 sq ft)

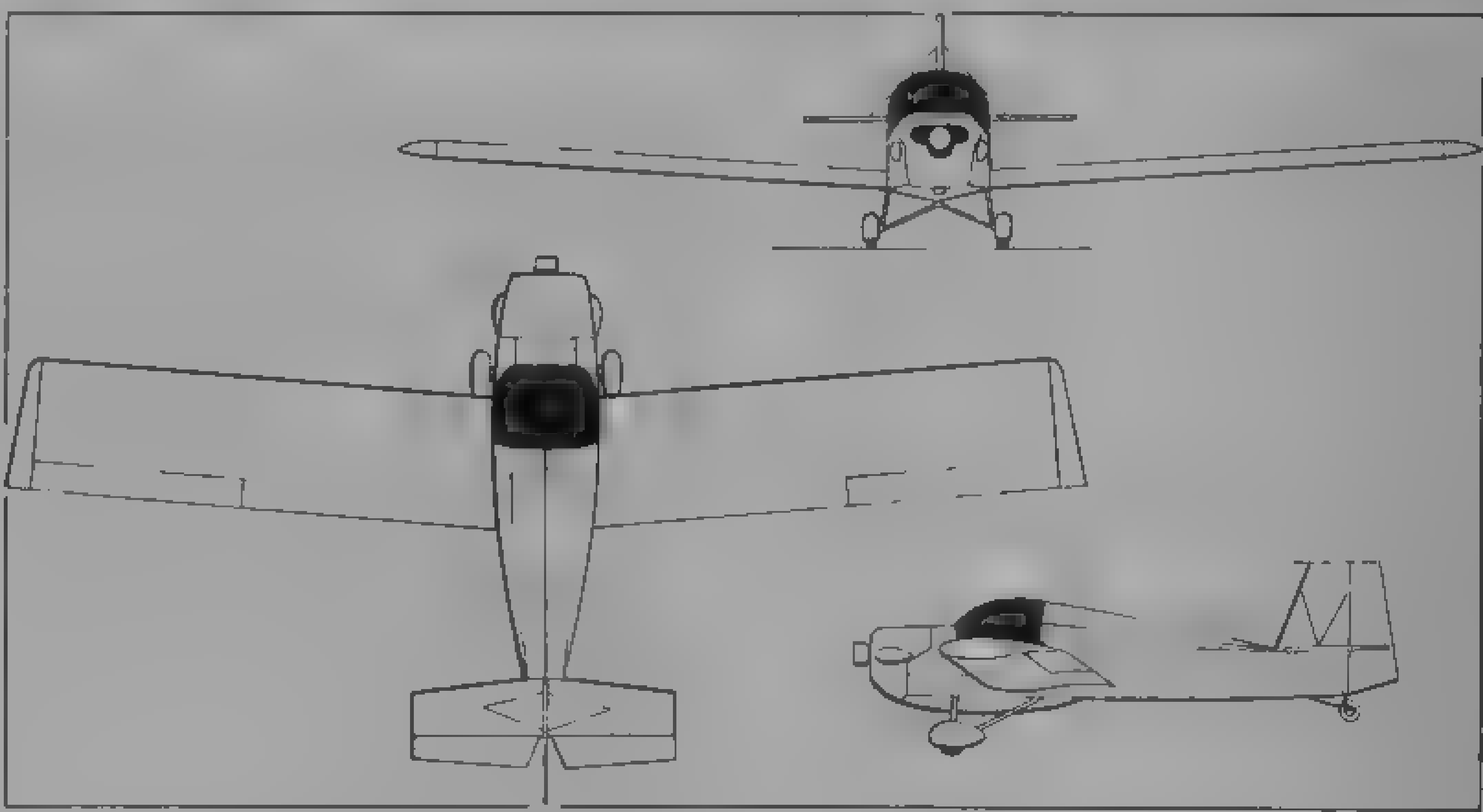
WEIGHTS AND LOADINGS

Weight empty	220 kg (485 lb)
Max payload	170 kg (374 lb)
Max T-O weight	400 kg (881 lb)
Max wing loading	29.9 kg/m² (6.1 lb/sq ft)
Max power loading	8.95 kg/kW (14.70 lb/hp)

PERFORMANCE (at max T-O weight, ISA)

Max cruising speed	81 kts (150 km/h, 93 mph)
Stalling speed, power off	29 kts (55 km/h, 34 mph)
T-O run	100 m (328 ft)
Range with max internal fuel	270 n miles (500 km, 310 miles)
Endurance with max internal fuel	3 h 30 min

NEW ENTRY



Scheibe SF 40 ultra-lightweight aircraft *(Jane's/James Goulding)*

1995

STEMME

STEMME GmbH & Co KG

Gustav Meyer Allee 25, D-13355 Berlin (Wedding)

Telephone: 49 (30) 463 40 71

Fax: 49 (30) 469 46 49

WORKS: Flugplatz Strausberg, D-15344 Strausberg

Telephone: 49 (3341) 31 11 70

Fax: 49 (3341) 31 11 73

PRESIDENT: Dr Reiner Stemme

TECHNICAL DIRECTOR: Dipl Ing Gottfried Freudenberger

SALES DIRECTOR: Dipl Ing Sebastian Loewer

Flight test and operations moved to Strausberg in 1991 factory area 1,200 m² (12,916 sq ft), 30 employees

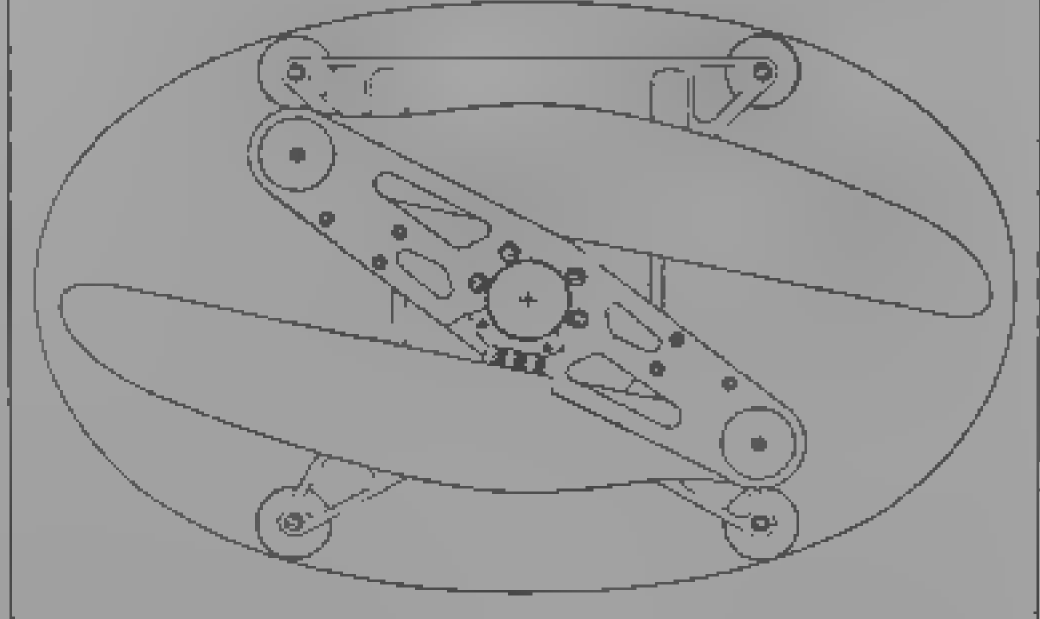
VERIFIED

STEMME S10

TYPE: Two-seat high-performance motor glider

PROGRAMME: Company formed in 1985, prototype (D-KKST) flown 6 July 1986, first flight of second prototype (D-KCHS) with definitive wing 2 June 1987; S10VC surveillance and observation platform introduced in 1989, designed to JAR 22. Certificated in Germany 31 December 1990, in UK 29 October 1991 and in USA 8 July 1992. Production of S10 suspended March 1994, resumed late 1994 with S10V

CURRENT VERSIONS: **S10:** Standard motor glider, *subject of following description*



Stemme retractable propeller in stowed position

1995

S10VC: Surveillance/observation version with underwing sensor pods for pollution control and resources investigation. One used by Greenpeace

S10V: Variable-pitch propeller; demonstrator (D-KGCX) completed mid-1994 as conversion of S10; one other converted; production as standard version from 1994, six new built by January 1995. (S10V has engineering designation S14.)

CUSTOMERS: Owners in Australia, Austria, Belgium, Canada, France, Germany, South Africa, Switzerland, UK and USA. By January 1995, 72 sold and 61 of all types (including prototypes) built, eight being S10Vs

COSTS: Standard aircraft DM239,000 without tax

DESIGN FEATURES: Wing has Horstmann & Quast HQ41 aerofoil, behaviour tuned for both low and high airspeeds and docility during tight turns, wing not affected by bug accretion or water droplets, dihedral 1°. Outer wings can be folded by one person for taxying and hangarage; wing sections carried in gantries inside trailer so that one person can fit centre and outer sections straight from trailer to fuselage

FLYING CONTROLS: Conventional, with flap/aileron linkage for manoeuvrability and docility at low airspeeds, Schempp-Hirth type airbrakes in outer ends of centre wing

STRUCTURE: CFRP wings in three sections detachable from fuselage, CFRP rear fuselage and tail mounted to steel tube centre frame carrying wing, engine and landing gear, nose section, of CFRP structure with Kevlar safety lining, mounted at front of centre frame. Engine fully accessible and horizontal firewall separates engine from wing and flying controls

LANDING GEAR: Retractable tailwheel type, electric actuation with mechanical standby; disc brakes; steerable tailwheel, large mainwheel tyres optional

POWER PLANT: One air-cooled 69.4 kW (93 hp) Limbach L 2400 EB1 D flat four engine mounted in the centre fuselage steel tube frame aft of cockpit, cooling by adjustable ram air intake; 1.9 m (6 ft 2¾ in) CFRP extension shaft in Kevlar tunnel drives folding nose-mounted propeller through flexible coupling, sliding spline joint and five-belt 1.18:1 reduction gear, engine starting in flight takes 4 seconds; nosecone is moved forward and spring-folded

blades emerge through peripheral slot under centrifugal force; centrifugal clutch protects against overspeed, damps starting shocks and allows propeller to slow down independently of engine on shutdown. Two-position variable-pitch propeller on S10V

Fuel in two 45 litre (11.9 US gallon, 9.9 Imp gallon) fuel tanks in outer ends of centre wing; 60 litre (15.8 US gallon, 13.2 Imp gallon) tanks optional

ACCOMMODATION: Two pilots side by side; dual controls standard, seats adjustable for position and rake; canopy hinged at forward end and held open by gas struts. heating provided by engine cooling air

SYSTEMS: 12 V 26 Ah battery and generator, 35 Ah battery optional, full night lighting and landing light optional.

AVIONICS: *Comms:* Intercom, VHF radio and transponder optional.

DIMENSIONS, EXTERNAL:

Wing span	23.00 m (75 ft 5¼ in)
Wing aspect ratio	28.29
Length overall	8.42 m (27 ft 7½ in)
Height over tailplane	1.79 m (5 ft 10½ in)
Wheel track	1.15 m (3 ft 9¼ in)
Wheelbase	5.40 m (17 ft 8½ in)
Fuselage ground clearance at mainwheels	0.72 m (2 ft 4¼ in)

DIMENSIONS, INTERNAL:

Cockpit: Width	1.16 m (3 ft 9½ in)
Height	0.93 m (3 ft 0½ in)

AREAS:

Wings, gross	18.70 m² (201.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	640 kg (1,411 lb)
Max T-O weight	850 kg (1,874 lb)
Max wing loading	45.3 kg/m² (9.3 lb/sq ft)
Max power loading	12.3 kg/kW (12.3 lb/hp)

PERFORMANCE, POWERED (at max T-O weight except where indicated):

Never-exceed speed (V_{NE}), smooth air	146 kts (270 km/h, 168 mph)
Manoeuvring speed (V_A)	97 kts (180 km/h, 112 mph)
Cruising speed: fixed-pitch propeller	89 kts (165 km/h, 102 mph)
variable-pitch propeller	121 kts (225 km/h, 139 mph)
Stalling speed	42 kts (78 km/h, 48 mph)
Max rate of climb at S/L: fixed-pitch propeller	183 m (600 ft)/min
variable-pitch propeller	228 m (750 ft)/min
T-O run: on concrete	200 m (656 ft)
on grass	300 m (984 ft)
Range: with 90 l (21 US gallons, 17.6 Imp gallons), variable-pitch propeller, continuous power	863 n miles (1,600 km, 995 miles)
with max fuel and sawtooth climb/glide profile	2,160 n miles (4,000 km, 2,485 miles)

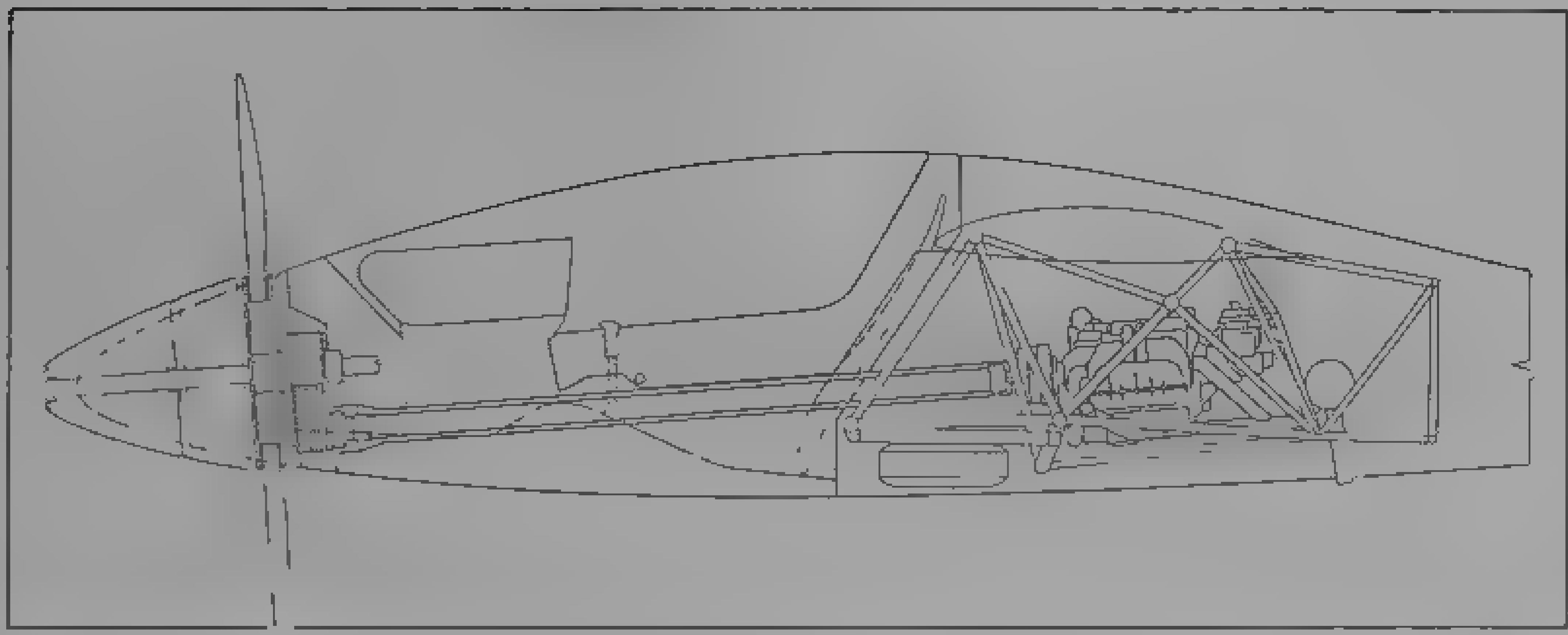
PERFORMANCE, UNPOWERED:

Best glide ratio at 57 kts (106 km/h, 66 mph)	50
Min rate of sink	0.57 m (1.87 ft)/s

OPERATIONAL NOISE LEVEL:

To German light aircraft rules	57.3 dBA

UPDATED

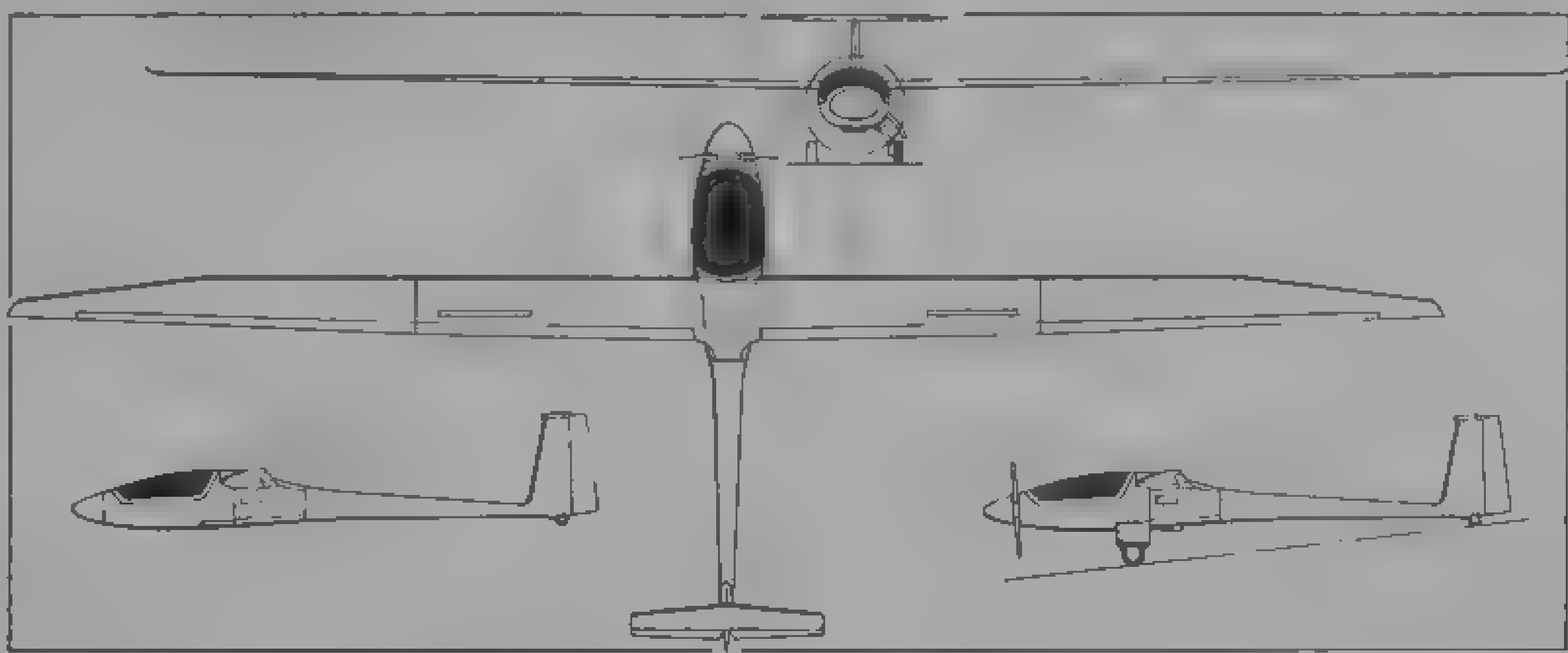


Stemme S10 engine, driveshaft and propeller layout

1995

Stemme S10 motor glider operated by Gepard Sensor Technologies Systems with surveillance pods under wings

1995



Stemme S10 showing additional side view (left) with landing gear and propeller retracted *(Jane's/Mike Keep)*

1994

GREECE

HAI

HELLENIC AEROSPACE INDUSTRY LTD

Details of HAI's substantial overhaul and subcontracting activities appear in *Jane's Aircraft Upgrades*

UPDATED

HUNGARY

DAC

DANUBIAN AIRCRAFT COMPANY (Dunai Repulogépyár Rt)

PO Box 305, H-1369 Budapest 5
Telephone: 36 (24) 366313
Fax: 36 (24) 365310
Telex: 225614
CHIEF ADVISER TO GENERAL DIRECTOR: József Oravecz
DEPUTY DIRECTOR OF MARKETING: Zoltán Erdokurti

DAC began as manufacturer of fighters, evolving to become largest helicopter repair and overhaul facility in Central Europe; is now a Mil Brooke centre, with direct links to Mil helicopter plant in Moscow, and the only certificated Mil service centre in the Balkans (mainly Mi-2/8/17/24); also service centre for McDonnell Douglas MD 500. Located on Tokol airfield, 20 km (12.4 miles) from Budapest; facilities include 38,000 m² (409,028 sq ft) of covered space, workforce of more than 800 in 1993, including some 500 engineers and systems/avionics specialists.

Currently developing modified version of Hummingbird derivative of Sikorsky S-52 four-seat helicopter (see under VAT in US section) for Eastern/Central European market. Had completed and flown one example by September 1993

UPDATED

GAK

GANZAVIA Kft

PO Box 62, H-1475 Budapest
Telephone: 36 (1) 210 11 50
Fax: 36 (1) 133 77 83
WORKS: Kőbányai út 21, H-1087 Budapest
MANAGING DIRECTOR: Miklos Deak

Ganzavia created by GANZ Machinery Works Holding Ltd (Ganz Gépgyár Holding) for production of the GAK-22 Dinó; predecessor company MAVAG manufactured fighter and training aircraft during Second World War

NEW ENTRY

GANZAVIA GAK-22 DINÓ

TYPE: Two-seat light sporting and general purpose biplane

PROGRAMME: Proof-of-concept aircraft HA-XAD (see 1987-88 *Jane's*). Dinó design started late 1986 and prototype construction early 1987; prototype (HA-XBP) made first flight October 1993; some modifications described in 1990-91 *Jane's*; prototype displayed at May 1994 Berlin ILA 94; completed over 200 flights and about 65 hours' flying by early 1995 towards FAR/JAR Pt 23 (Aerobatic category) certification. Second prototype under construction with a more comfortable cabin and fuel tanks of greater capacity in wings. Four-seat version to fly mid-1996

COSTS: Basic aircraft DM148,000 in early 1995

DESIGN FEATURES: Designed by Gyula Kovács and Artur Pfeilmayer; biplane with cantilevered wings without interplane struts, lower wing mounted forward of upper wing; conventional tail surfaces, tapered box-shaped fuselage. Possible applications include training, aerobatics, aerial photography, glider towing and agricultural work. NACA wing aerofoil sections 23018 at root, 23012 at tip; incidence 4° on upper wing, 3° lower wing; washout 1° 12' (both wings); tips swept back 30° on leading-edges

FLYING CONTROLS: Near full-span flaperons on lower wings only, interconnected with one-piece elevator; upward movement of elevator produces downward movement of flaperons; all controls operated by pushrods, port elevator has trim tab, no moving surfaces on upper wing

STRUCTURE: Welded steel tube fuselage, duralumin covered at front and fabric covered at rear; aluminium alloy wings, flaperons and tail unit; glassfibre engine cowling, wingtips, elevator tips and rudder tips; wing has constant chord and single spar

LANDING GEAR: Fixed tricycle type with cantilever self-sprung main legs and elastomerically sprung nosewheel leg. Wheel spats optional

POWER PLANT: One 85.8 kW (115 hp) Textron Lycoming O-235-H2C flat-four engine, driving a Mühlbauer two-blade fixed-pitch propeller. Alternative engines of up to 134.2 kW (180 hp) such as Textron Lycoming AEIO-360-B. Variable-pitch propeller as customer option. Single fuel tank in fuselage, capacity 80 litres (21.1 US gallons; 17.6 Imp gallons); second Dinó has wing tanks increasing total capacity to 120 litres (31.7 US gallons; 26.4 Imp gallons)

ACCOMMODATION: Two persons side by side in fully enclosed cabin, dual controls. Canopy hinged at front and opens upwards. Baggage space aft of seats

SYSTEMS: Electrical system 12 V 30 Ah battery, alternator fit appropriate to engine

AVIONICS: Customer specified

DIMENSIONS, EXTERNAL:

Wing span, each	7.70 m (25 ft 3 in)
Wing stagger	1.09 m (3 ft 7 in)
Wing aspect ratio	4.22
Length overall	6.10 m (20 ft 0¼ in)
Height overall	2.60 m (8 ft 6½ in)
Wheel track	2.50 m (8 ft 2½ in)
Propeller diameter	1.80 m (5 ft 10¾ in)

AREAS:

Wings, gross	14.04 m² (151.1 sq ft)

WEIGHTS AND LOADINGS:

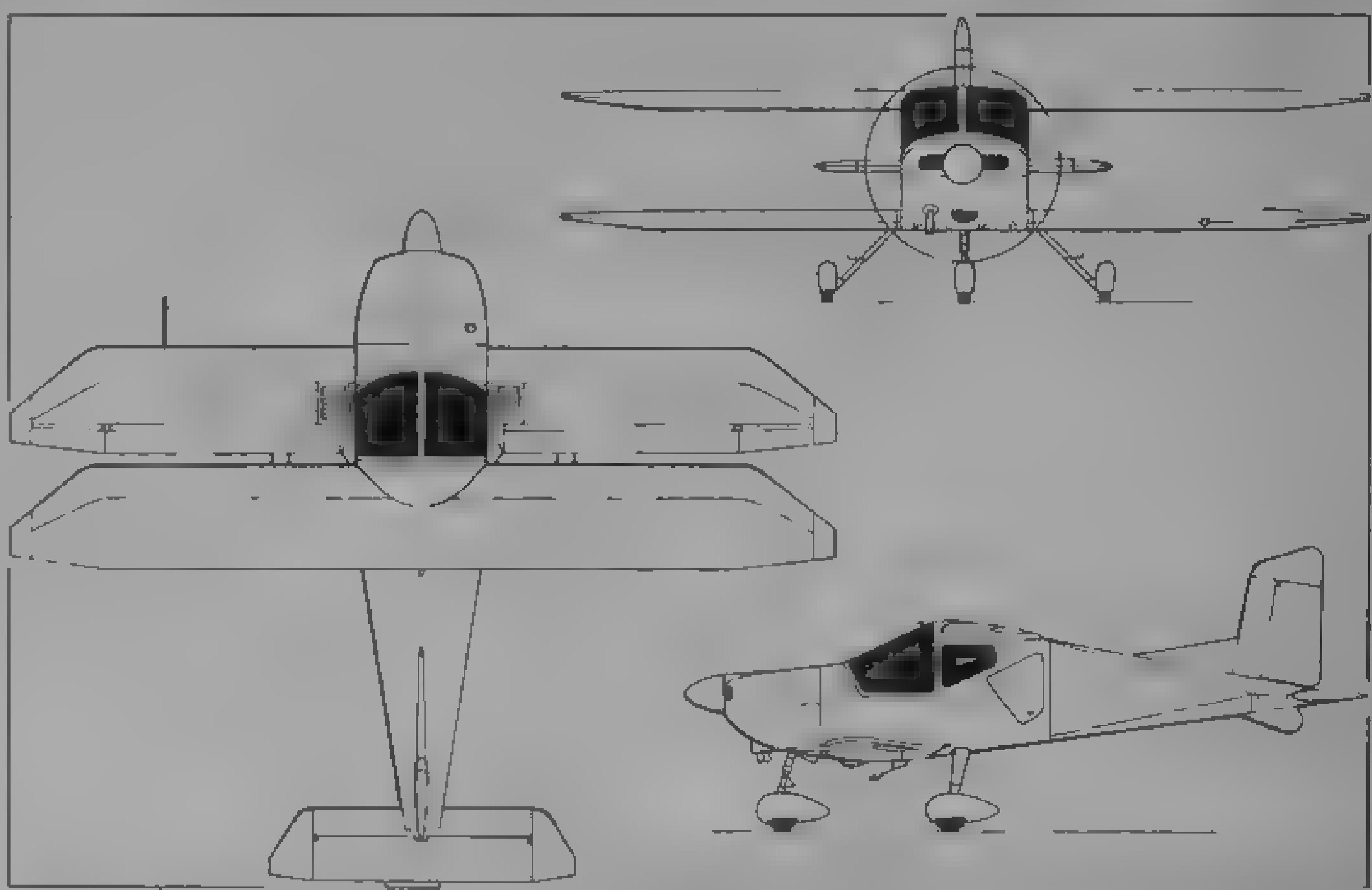
Weight empty	430 kg (948 lb)
Max payload	60 kg (132 lb)
Max T-O weight	720 kg (1,587 lb)
Max wing loading	51.3 kg/m² (10.5 lb/sq ft)
Max power loading (85.8 kW, 115 hp engine)	8.40 kg/kW (13.80 lb/hp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (V_{NE})	135 kts (250 km/h; 155 mph)
Max level speed	105 kts (195 km/h; 121 mph)
Max cruising speed	97 kts (180 km/h; 112 mph)
Econ cruising speed	94 kts (175 km/h; 109 mph)
Stalling speed, power off	44 kts (80 km/h; 50 mph)
T-O run	235 m (771 ft)
Service ceiling	3,200 m (10,500 ft)
Range with max internal fuel	378 n miles (700 km; 435 miles)

NEW ENTRY

Ganzavia GAK-22 Dinó prototype showing the pronounced wing stagger
1995


Ganzavia GAK-22 Dinó *(Jane's/James Goulding)*
1995

Ganzavia GAK-22 Dinó prototype. Note no control surfaces on top wing
1995

INDIA

ADA

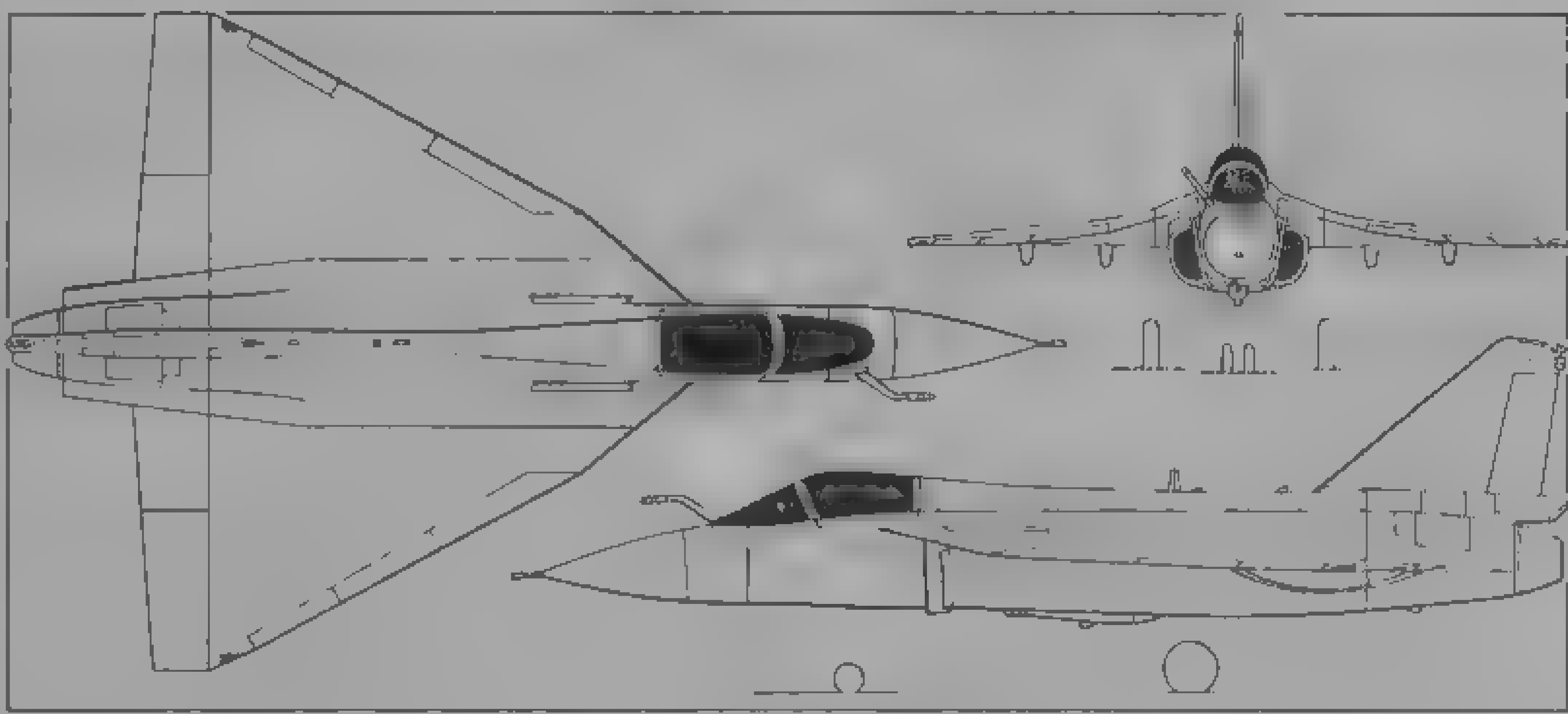
AERONAUTICAL DEVELOPMENT AGENCY

PO Box 1718, Vimanapura Post Office, Bangalore 560 017
Telephone: 91 (80) 562060
Fax: 91 (80) 569445
Telex: 0845 8114 ADA IN
LCA PROGRAMME DIRECTOR: Dr K Harinarayana
SENIOR MANAGER INFORMATION TECHNOLOGY:
T N Prakash

VERIFIED

Full-scale mockup of the LCA at Avia India air show in late 1993 *(Denis Hughes)*

1994



Provisional drawing of the ADA Light Combat Aircraft *(Jane's/Mike Keep)*

1991

LIGHT COMBAT AIRCRAFT (LCA)

TYPE: All-weather air superiority fighter and light close air support aircraft.

PROGRAMME: Development approved by Indian government 1983 as MiG-21/Ajeet replacement; project definition begun Spring 1987, completed late 1988; basic design finalised 1990; prototype construction by HAL started mid-1991, roll-out due mid-1995; first flights expected 1996 and 1997 and IOC 2008-10; two prototypes each to be powered by F404-GE-F2J3 afterburning turbofan; indigenous 83.4 kN (18,740 lb st) GTX-35VS Kaveri being developed, with assistance from SNECMA (France), for production aircraft; naval version also planned. International cost-sharing collaboration invited late 1993, but not yet achieved; discussing possible avionics assistance with Israel in early 1995.

CUSTOMERS: Indian Air Force (reported requirement for up to 200).

COSTS: Two prototypes funded with Rs15,000 million ($872 million) (1990). Total development costs, including engine, exceeded Rs35,000 million ($1.1 billion) by end of 1994.

DESIGN FEATURES: Advanced materials planned to achieve minimum weight; full quadruplex fly-by-wire control to confer agility with wide range of external stores; shoulder-mounted delta wings with compound sweep on leading-edges, large twist from inboard to outboard leading-edges, fixed-geometry intakes.

FLYING CONTROLS: Two-segment trailing-edge elevons and three-section leading-edge slats, vortex-shedding inboard leading-edges with inboard slots to form vortices over wingroot and fin; Lockheed Martin Electronics Sector quadruplex fly-by-wire AFCS; HOTAS controls.

STRUCTURE: Materials to include aluminium-lithium alloy, carbonfibre composites and titanium alloys; CFRP wing, fin and rudder.

LANDING GEAR: Hydraulically retractable tricycle type. Single mainwheels, twin-wheel nose unit.

POWER PLANT: One 80.5 kN (18,100 lb st) General Electric F404-F2J3 afterburning turbofan in prototypes. Indian GTRE GTX-35VS Kaveri turbofan, with Dowty/Smiths FADEC, under development for production aircraft. In-flight refuelling probe on starboard side of front fuselage. Provision for up to five 800 litre (211 US gallon; 176 Imp gallon) external fuel tanks.

ACCOMMODATION: Pilot only, on zero/zero ejection seat. Development will include two-seat training version.

SYSTEMS: Hydraulic system for powered flying controls, brakes and landing gear; electrical system for fly-by-wire and avionics power supply, environmental control system.

AVIONICS: *Comms:* V/UHF and UHF radios and datalink. IFF transponder/interrogator.
Radar: Hindustan Aeronautics multimode radar.
Flight: INS, Tacan, radio altimeter.
Instrumentation: NVG-compatible displays include collimated HUD with holographic combiner and left- and right-hand multifunction colour CRTs.
Mission: Avionics architecture centred round powerful computer with three MIL-STD-1553B databuses. FLIR.
Self-defence: RWR, jammer, chaff/flare dispenser.

ARMAMENT: Internally mounted GSh-23 twin-barrel 23 mm gun, with 220 rounds. Seven external stores stations (three under each wing and one under fuselage) for wide range of short/medium-range missiles and other ordnance.

DIMENSIONS, EXTERNAL:

Wing span	8.20 m (26 ft 10¾ in)
Wing aspect ratio	1.79
Length overall	13.20 m (43 ft 3¾ in)
Height overall	4.40 m (14 ft 5¼ in)

AREAS:

Wings, gross	approx 37.50 m² (403.6 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	approx 5,500 kg (12,125 lb)
Max external stores load	more than 4,000 kg (8,818 lb)
T-O weight (clean)	8,500 kg (18,740 lb)
Wing loading (clean)	approx 226.7 kg/m² (46.4 lb/sq ft)
Power loading (prototypes, clean)	105.6 kg/kN (1.03 lb/lb st)

PERFORMANCE (estimated):

Max level speed at altitude	Mach 1.6
Service ceiling	above 15,240 m (50,000 ft)
g limits	+9/−3.5

UPDATED

BHEL

BHARAT HEAVY ELECTRICALS LTD

BHEL House, Siri Fort, New Delhi 110 049
Telephone: 91 (11) 6493437
CHAIRMAN: A. Gavisiddappa
WORKS: Heavy Electrical Equipment Plant, Ranipur, Hardwar 249 403, Uttar Pradesh
Telephone: 91 (133) 426080 and 426457
Fax: 91 (133) 426462
Telex: 0599 206, 207 and 212
EXECUTIVE DIRECTOR: B R Gulati
PROJECT MANAGER, AVIATION: H W Bhatnagar

BHEL approved for manufacture of light aircraft by Indian Ministry of Industry in March 1991 and by Indian Directorate General of Civil Aviation in May 1991.

VERIFIED

BHEL LT-1 SWATI

TYPE: Two-seat civil light trainer; additionally suitable for sport flying, surveillance, photography and short hauls.

PROGRAMME: Designed and developed by Technical Centre of Directorate General of Civil Aviation, India; first flight 17 November 1990, technical certificate issued 1991 by Indian Institute of Technology, Kanpur, type certification awarded January 1992, first production batch (four aircraft) delivered March 1993. No information received since one aircraft lost in crash 3 June 1993, halting deliveries pending investigation. See 1994-95 *Jane's* for description and illustration.

UPDATED

HAL

HINDUSTAN AERONAUTICS LIMITED

CORPORATE OFFICE: PO Box 5150, 15/1 Cubbon Road, Bangalore 560 001
Telephone: 91 (80) 2256901
Fax: 91 (80) 2258758
Telex: 845 2266 HAL IN
CHAIRMAN: R N Sharma
DIRECTOR, CORPORATE PLANNING: S. N Sachindran
CHIEF MANAGER, PUBLIC RELATIONS: Cdr M Nirmal

Formed 1 October 1964, has 12 manufacturing divisions at seven locations (Bangalore, Nasik, Koraput, Hyderabad, Kanpur, Lucknow and Korwa), plus Design Complex, total workforce approximately 36,000 in January 1995. Hyderabad Division manufactures avionics for all aircraft produced by HAL, plus air route surveillance and precision approach radars; Lucknow Division produces landing gears and other accessories under licence from manufacturers in France, Russia and the UK; Korwa manufactures inertial navigation and nav/attack systems.

UPDATED

DESIGN COMPLEX

Post Bag 1789, Bangalore 560 017
Telephone: 91 (80) 565201, 561020 and 570457
Fax: 91 (80) 5593096
Telex: 845 8083
GENERAL MANAGER: Dr C. R. Ramanujachar

Comprises Aircraft, Engine and Helicopter Design Bureaux; earlier designs have included HT 2, Pushpak, Krishak, Basant, HF-24 Marut, Kiran, HPT 32 and HTT-34. Most recent designs are ALH, first flown 1992, and HTT-35; effort also being given to design, development and prototype manufacture of LCA (see ADA entry in this section).

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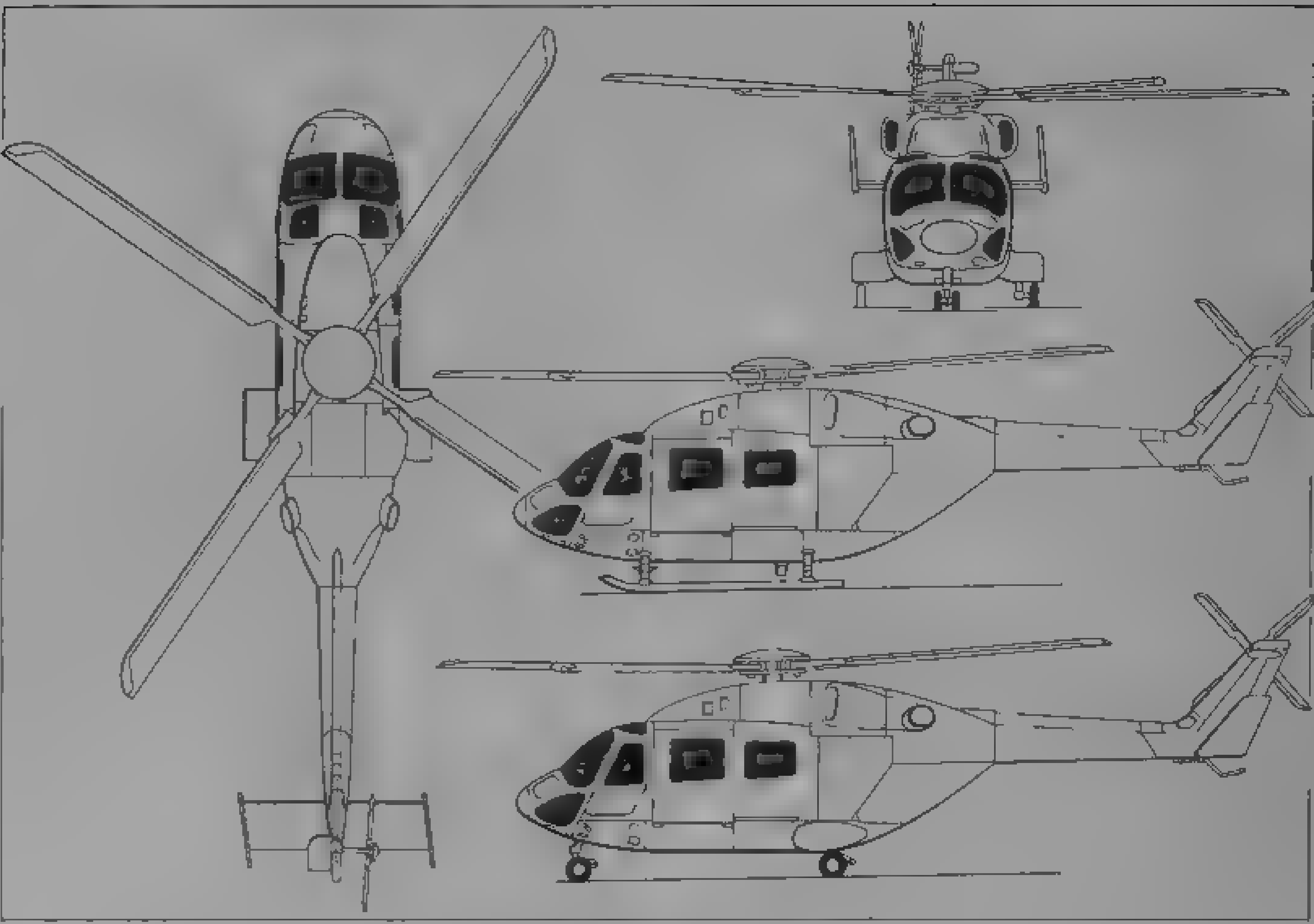


Naval version of the HAL Advanced Light Helicopter, with additional side view (centre) of air force/army variant (*Jane's/Mike Keep*)

1993

HAL ADVANCED LIGHT HELICOPTER (ALH)

TYPE: Multirole twin-turbine light helicopter.

PROGRAMME: Agreement signed with MBB July 1984 to support design, development and production; design started November 1984; ground test vehicle runs began April 1991; four flying prototypes (two basic, one air force/army, one naval); first prototype (Z 3182) rolled out 29 June 1992, first flight 20 August and 'official' first flight 30 August 1992; not then fitted with ARIS; second prototype (Z 3183) made its first flight 18 April 1993, third in 1994, fourth (naval prototype) scheduled to fly in first half of 1995, with CTS 800 engines.

CURRENT VERSIONS: **Air force/army**: Skid gear, crashworthy fuel tanks, bulletproof supply tanks, IR and flame suppression; night attack capability; roles to include attack and SAR.

Naval: Retractable tricycle gear, harpoon decklock, foldable tailboom, pressure refuelling, fairings on fuselage sides to house mainwheels, flotation gear and batteries.

Civil: Roles to include passenger and utility transport, commuter/offshore executive, rescue/emergency medical service and law enforcement.

LAH (Light Attack Helicopter): Projected gunship version with tandem two-seat cockpit, gun turret, missile aiming system, weapon pylons and tailwheel landing gear.

CUSTOMERS: Indian government requirement for 250 or more for armed forces and Coast Guard to replace Chetaks/Cheetahs, but no firm contracts yet placed.

COSTS: Unit price of basic aircraft approximately $4 million (1992).

DESIGN FEATURES: Four-blade hingeless main rotor with advanced aerofoils and sweptback tips; Eurocopter FEL (fibre elastomer) rotor head, with blades held between pair of cruciform CFRP starplates; manual blade folding and rotor brake standard; integrated drive system transmission; four-blade bearingless crossbeam tail rotor on starboard side of fin; fixed tailplane; sweptback endplate fins offset to port; vibration damping by ARIS (anti-resonance isolation system), comprising four isolator elements between main gearbox and fuselage. Folding tailboom on naval variant.

Two views of the first prototype HAL Advanced Light Helicopter

1994

Main rotor blade section DMH 4 (DMH 3 outboard); tail rotor blade section S 102C (S 102E at tip). Rotor speeds 314 rpm (main), 1,564 rpm (tail).

FLYING CONTROLS: Integrated dynamic management by four-axis AFCS (actuators have manual as well as AFCS input), constant-speed rpm control, assisted by collective anticipator (part of FADEC and stability augmentation system acting through AFCS).

STRUCTURE: Main and tail rotor blades and rotor hub glassfibre/carbonfibre, Kevlar nosecone, crew/passenger doors, cowling, upper rear tailboom and most of tail unit, carbonfibre lower rear tailboom and fin centre panels; Kevlar/carbonfibre cockpit section; light alloy sandwich centre cabin and remainder of tailboom.

LANDING GEAR: Non-retractable metal skid gear standard for air force/army version. Hydraulically retractable tricycle gear on naval variant, with twin nosewheels and single mainwheels, latter retracting into fairings on fuselage sides which also house flotation gear and batteries; rearward-retracting nose unit, harpoon decklock system. Spring skid under rear of tailboom on all versions, to protect tail rotor. FPT Industries (UK) Kevlar inflatable flotation bags for prototypes, usable with both skid and wheel gear.

POWER PLANT: First three prototypes each powered by two Turbomeca TM 333 2B turboshafts, with full authority digital electronic control (FADEC), rated at 746 kW (1,000 shp) for T-O, 788 kW (1,057 shp) maximum contingency and 663 kW (889 shp) maximum continuous. LHTEC CTS 800 selected late 1994 as alternative power plant, to be test-flown in fourth prototype 1995.

Transmission ratings (two engines) 1,240 kW (1,663 shp) for 5 minutes for T-O and 1,070 kW (1,435 shp) maximum continuous. OEI ratings 800 kW (1,073 shp) for 30 seconds (super contingency), 700 kW (939 shp) for 2½ minutes, 620 kW (831 shp) for 30 minutes and 535 kW (717 shp) maximum continuous. Transmission input from both engines combined through spiral bevel gears to collector gear on stub-shaft. ARIS system gives 6° of freedom damping. Power take-off from main and auxiliary gearboxes for transmission driven accessories.

Total usable fuel, in self-sealing crashworthy underfloor tanks (three main and two supply), 1,400 litres (370 US gallons; 308 Imp gallons). Pressure refuelling in naval version.

ACCOMMODATION: Flight crew of two, on crashworthy seats in military/naval versions. Main cabin seats 10 persons as standard, 14 in high density configuration. Crew door and rearward-sliding passenger door on each side, clamshell cargo doors at rear of passenger cabin.

SYSTEMS: DC electrical power from two independent subsystems, each with a 6 kW starter/generator, with battery back-up for 15 emergency operations. AC power, also from two independent subsystems, each with a 5/10 kVA alternator. Three hydraulic systems (pressure 207 bars, 3,000 lb/sq in, maximum flow rate 25 litres, 6.6 US gallons, 5.5 Imp gallons/min): systems 1 and 2 for main and tail rotor flight control actuators, system 3 for landing gear, wheel brakes, decklock harpoon (naval variant) and optional equipment. Oxygen system.

AVIONICS: *Comms*: V/UHF, HF/SSB and standby UHF com radio, IFF and intercom.

Radar: Weather radar optional.

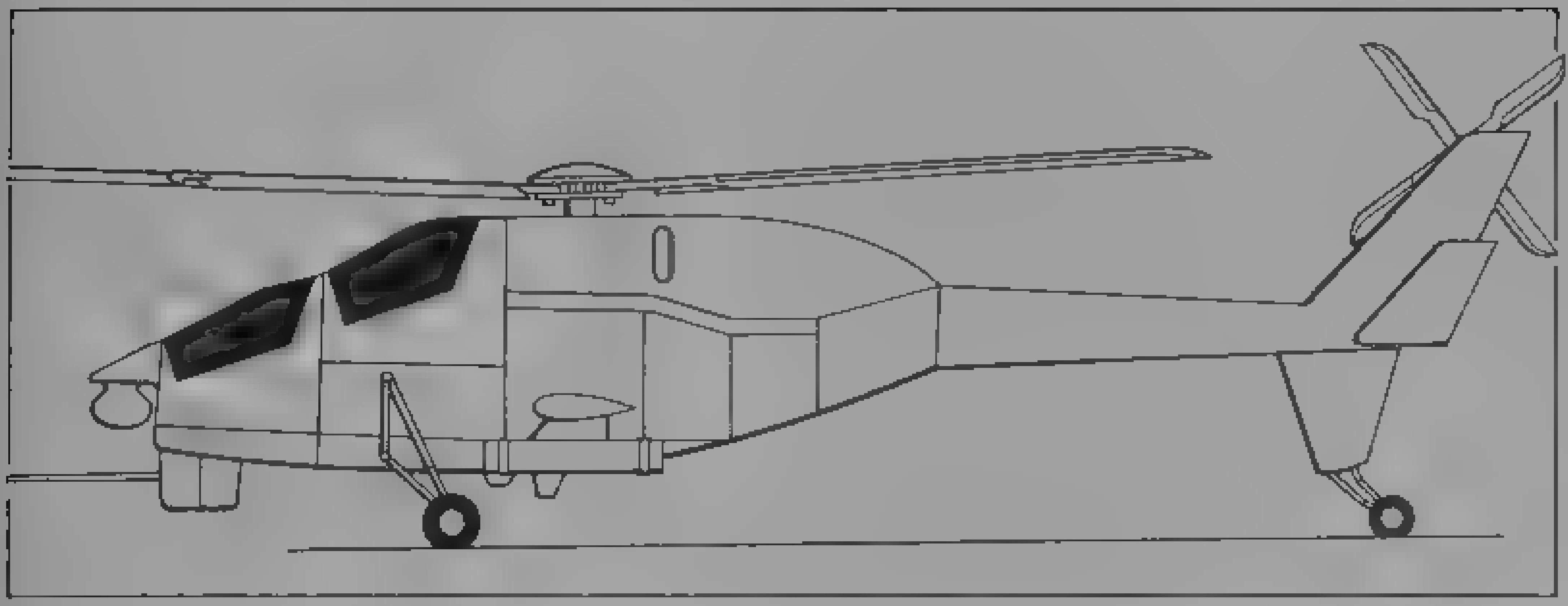
Flight: SFIM four-axis AFCS, Doppler navigation system, TAS system, ADF, radio altimeter, heading reference standard, Omega nav system optional.

EQUIPMENT: Depending on mission, can include two stretchers, external rescue hoist and 1,500 kg (3,307 lb) capacity cargo sling.

ARMAMENT: Cabin-side pylons for two torpedoes/depth charges or four anti-ship missiles on naval variant; on army/air force variant, these can be fitted with two anti-tank guided missiles, two pods of 68 mm rockets or two air-to-air missiles. Army/air force variant can also be equipped with ventral 20 mm gun turret or sling for carriage of land mines.

DIMENSIONS, EXTERNAL:

Main rotor diameter	13.20 m (43 ft 3¾ in)
Main rotor blade chord:	
main portion	0.50 m (1 ft 7¾ in)
at tip	0.167 m (6.6 in)
Tail rotor diameter	2.55 m (8 ft 4½ in)
Length:	
overall, both rotors turning	15.87 m (52 ft 0¾ in)
fuselage, tail rotor turning	12.89 m (42 ft 3¾ in)



Provisional drawing of HAL's proposed light attack helicopter *(Jane's/Mike Keep)*
1991

Height overall, tail rotor turning
  naval version 4.81 m (15 ft 9½ in)
  army/air force version 4.98 m (16 ft 4 in)
Height to top of main rotor head 3.93 m (12 ft 10¾ in)
Fuselage: Max width 2.00 m (6 ft 6¾ in)
Tail unit span (over fins) 3.19 m (10 ft 5½ in)
Wheel track (naval version) 2.80 m (9 ft 2¼ in)
Wheelbase (naval version) 4.37 m (14 ft 4 in)
Skid track (army/air force version) 2.60 m (8 ft 6½ in)

DIMENSIONS, INTERNAL:
Cabin, excl flight deck: Max width 1.97 m (6 ft 5½ in)
  Max height 1.42 m (4 ft 8 in)
  Volume 7.33 m³ (258.9 cu ft)
Cargo compartment volume 2.16 m³ (76.28 cu ft)

AREAS:
Main rotor disc 136.85 m² (1,473.0 sq ft)
Tail rotor disc 5.11 m² (55.0 sq ft)
Main fin 2.126 m² (22.88 sq ft)
Tailplane 2.40 m² (25.83 sq ft)

WEIGHTS AND LOADINGS (A: army/air force version, B: naval variant):
Weight empty, equipped: A, B 2,500 kg (5,511 lb)
Max fuel weight: A 1,040 kg (2,293 lb)
  B 1,100 kg (2,425 lb)
Max sling load: A 1,000 kg (2,205 lb)
  B 1,500 kg (3,307 lb)
Max T-O weight: A 4,000 kg (8,818 lb)
  B 5,000 kg (11,023 lb)
Max disc loading: A 29.23 kg/m² (5.99 lb/sq ft)
  B 36.54 kg/m² (7.48 lb/sq ft)

PERFORMANCE (at 4,000 kg, 8,818 lb AUW, at S/L, ISA):
Never-exceed speed (VNE) 178 kts (330 km/h; 205 mph)
Max level speed 156 kts (290 km/h; 180 mph)
Max cruising speed 132 kts (245 km/h; 152 mph)
Max rate of climb 720 m (2,362 ft)/min
Service ceiling 6,000 m (19,685 ft)
Hovering ceiling IGE above 3,000 m (9,850 ft)
Range: with max fuel, 20 min reserves
  431 n miles (800 km; 497 miles)
  with 700 kg (1,543 lb) payload
  216 n miles (400 km; 249 miles)
Endurance, 20 min reserves 4 h

UPDATED

HAL HTT-35

TYPE: Two-seat military trainer.

PROGRAMME: Revealed publicly at Avia India show December 1993; meets Indian Air Force Air Staff Target 208 and intended to replace both piston-engined Deepak and Kiran jet trainer from late 1990s; FSD go-ahead still awaited in Spring 1995.

DESIGN FEATURES: Typical non-swept, low-wing design with stepped cockpits; estimated fatigue life 7,000 hours. Intended for pilot screening, primary, basic and partial advanced (including weapon) training. Wing has 5° 40′ dihedral from roots, 2° root incidence and 2° 51′ washout.

FLYING CONTROLS: Primary surfaces manual/mechanical; elevator and rudder trim tabs. Hydraulically actuated wing flaps.

STRUCTURE: All-metal.

LANDING GEAR: Hydraulically retractable tricycle type; oleo-pneumatic shock absorber in each unit. Inward-retracting mainwheels are size 19 × 6.25-9, with hydraulic disc brakes. Rearward-retracting nosewheel is size 5.00-5; tyre pressure 6.20 bars (90 lb/sq in) in all units.

POWER PLANT: Two options available, and may be tested in separate prototypes: one AlliedSignal TPE331-12D turboprop, flat rated at 820 kW (1,100 shp), or Pratt & Whitney Canada PT6A-62, flat rated at 708 kW (950 shp). Hartzell four-blade constant-speed fully feathering propeller in each case. Fuel in integral tank in each wing plus supply tank in centre-fuselage. Fuel system to permit 30 seconds of inverted flight.

ACCOMMODATION: Crew of two in tandem, rear (instructor's) seat raised. Dual controls standard. Lightweight ejection seats, which can be ejected in sequence by command from rear cockpit or by individual operation. Separate, jettisonable clamshell canopy over each cockpit.

SYSTEMS: Hydraulic system for landing gear and flap actuation, powered by engine-driven pump; accumulator for emergency operation. Main electrical system (28 V DC) powered by engine-driven starter/generator, with 40 Ah Ni/Cd battery for secondary power and two solid-state static inverters (main and standby) for AC power.

AVIONICS: *Comms:* V/UHF main and UHF standby com transceivers.
Flight: ADF.
Instrumentation: Duplicated flight and engine instruments.

ARMAMENT: Hardpoint under each wing for practice bomb carriers, gun pods or rocket pods, each stressed for 250 kg (551 lb) load.

DIMENSIONS, EXTERNAL:
Wing span 10.40 m (34 ft 1½ in)
Wing aspect ratio 6.01
Length overall 9.527 m (31 ft 3 in)
Height overall 3.86 m (12 ft 8 in)
Wheel track 3.20 m (10 ft 6 in)
Wheelbase 2.825 m (9 ft 3¼ in)
Propeller diameter 2.39 m (7 ft 10 in)

AREAS:
Wings, gross 18.00 m² (193.75 sq ft)
Ailerons (total) 1.842 m² (19.83 sq ft)
Trailing-edge flaps (total) 2.319 m² (24.96 sq ft)
Fin, incl dorsal fin 2.00 m² (21.53 sq ft)
Rudder, incl tab 0.719 m² (7.74 sq ft)
Tailplane 3.50 m² (37.67 sq ft)
Elevators (total, incl tabs) 1.259 m² (13.55 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 1,742 kg (3,840 lb)
Fuel weight (usable) 450 kg (992 lb)
T-O weight, clean 2,325 kg (5,126 lb)
Max T-O weight with external stores 2,825 kg (6,228 lb)
Max wing loading: clean 129.2 kg/m² (26.45 lb/sq ft)
  with external stores 156.9 kg/m² (32.14 lb/sq ft)
Max power loading, with external stores:
  TPE331-12D engine 3.45 kg/kW (5.66 lb/shp)
  PT6A-62 engine 3.99 kg/kW (6.55 lb/shp)

PERFORMANCE (estimated):
Design diving speed 297 kts (550 km/h; 341 mph)
Max level speed: at S/L 254 kts (470 km/h; 292 mph)
  at 3,050 m (10,000 ft) 271 kts (502 km/h; 312 mph)
  at 6,100 m (20,000 ft) 270 kts (500 km/h; 311 mph)
Stalling speed: clean 76 kts (140 km/h; 87 mph)
  in approach configuration 69 kts (127 km/h; 79 mph)
Max rate of climb at S/L 1,220 m (4,003 ft)/min
Time to 4,500 m (14,760 ft) 4 min 36 s
Operating altitude 6,000 m (19,680 ft)
Service ceiling above 9,000 m (29,520 ft)
T-O to 15 m (50 ft) 260 m (853 ft)
Landing from 15 m (50 ft) 578 m (1,897 ft)
Range on internal fuel
  686 n miles (1,270 km; 789 miles)
Endurance on internal fuel 4 h
g limits +6/−3

UPDATED

Model of the HAL HTT-35 turboprop trainer *(Kenneth Munson)*
1994

BANGALORE COMPLEX

Post Bag 1785, Bangalore 560 017
Telephone: 91 (80) 5265201/5261020
Telex: 845 2234
MANAGING DIRECTOR: Dr C. G. Krishnadas Nair

Aircraft Division
Post Bag 1788, Bangalore 560 017
Telephone: 91 (80) 5273920
Fax: 91 (80) 5593956
Telex: 845 2234 HALM IN
GENERAL MANAGER: V. M. Akolkar

Helicopter Division
Post Bag 1790, Bangalore 560 017
Telephone: 91 (80) 5262924/5268602
Fax: 91 (80) 5584717
Telex: 845 2764
GENERAL MANAGER: U. D. Paradkar

Bangalore Complex includes Aircraft Division, Helicopter Division, Aerospace Division, Engine Division, Overhaul Division, Services Division, Foundry and Forge Division and Flight Operations.

Programmes include Jaguar International and Adour engine, prototypes of ADA LCA (which see), Chetak (Alouette) and Cheetah (Lama) helicopters, Artouste IIIB and AlliedSignal engines; repair and overhaul of aircraft and aero-engines; subcontract work for leading aerospace companies such as BAe, Aerospatiale, Boeing, Dornier, Latécoère and Fokker. In discussions early 1995 with Samsung Aerospace (see under KCAD in International section) to participate in projected 100/120-seat 'Asian Airbus'.

UPDATED

HAL (SEPECAT) JAGUAR INTERNATIONAL

Indian Air Force name: Shamsher (Assault Sword)

TYPE: Single-seat tactical attack aircraft and two-seat operational trainer.

PROGRAMME: Forty Jaguar Internationals with Adour Mk 804 engines delivered from UK; 45 more with Adour Mk 811s assembled in India from 1979; further 31 manufactured under licence in India (first delivery early 1988); further 15 ordered 1993 and due to begin production 1995; agreement with BAe signed mid-1993 to market Jaguar in Oman and to overhaul and repair that country's Jaguars.

CURRENT VERSIONS: **Jaguar B:** Two-seat trainer version.

Jaguar S: Standard single-seat attack version, *description applies to this model, except where indicated.*

Maritime Jaguar: Jaguars of IAF No. 6 Squadron, assigned to anti-shipping role, have Thomson-CSF Agave radar, interfaced with DARIN nav/attack system and Sea Eagle anti-shipping missiles; first modified aircraft delivered January 1986, eight delivered by end of 1992; four more to follow.

CUSTOMERS: Indian Air Force (131), comprising 116 single-seat and 15 two-seat combat-capable trainers. Basic strike version equips Nos. 5 and 14 Squadrons at Ambala, and

Jaguar International of No. 14 ('Bulls') Squadron, Indian Air Force, with overwing Magic AAMs *(Peter Steinemann)*

1993

Maritime Jaguar of No. 6 Squadron, Indian Air Force, with nose-mounted Agave radar *(Denis Hughes)*

1994

Nos. 16 and 27 Squadrons at Gorakhpur. Anti-shipping version equips No. 6 Squadron at Poona

DESIGN FEATURES: As British Jaguars (see International section of 1985-86 *Jane's*).

POWER PLANT: Two HAL built Rolls-Royce Turbomeca Adour Mk 811 turbofans, each rated at 25.0 kN (5,620 lb st) dry and 37.4 kN (8,400 lb st) with afterburning. Fixed geometry air intake on each side of fuselage aft of cockpit. Fuel in six tanks, one in each wing and four in fuselage. Total internal fuel capacity 4,200 litres (1,110 US gallons, 924 Imp gallons). Armour protection for critical fuel system components. Provision for carrying three auxiliary drop tanks, each of 1,200 litres (317 US gallons, 264 Imp gallons) capacity, on fuselage and inboard wing pylons. Provision for in-flight refuelling, with retractable probe forward of cockpit on starboard side

ACCOMMODATION (single-seater): Enclosed cockpit for pilot, with rearward-hinged canopy and Martin-Baker IN9B zero/zero ejection seat. Windscreen bulletproof against 7.5 mm rifle fire.

ACCOMMODATION (trainer): Crew of two in tandem on Martin-Baker IN9B Mk II zero/zero ejection seats. Individual rearward-hinged canopies. Rear seat 38 cm (15 in) higher than front seat. Bulletproof windscreen, as in single-seat version.

SYSTEMS: As detailed in 1985-86 *Jane's*

AVIONICS: HAL-manufactured DARIN (display attack and ranging inertial navigation) nav/attack system, incorporating INS, HUDWAC, COMED, interconnected MIL-STD-1553B dual-redundant databus and interfaced with LRMTS

Comms: Main (20-channel) V/UHF, standby UHF and HF/SSB transceivers. IFF-400 AM transponder

Radar: Thomson-CSF Agave in Maritime version interfaced with DARIN system

Flight: SAGEM Uliss 82 INS, HAL ADF and radar altimeter

Instrumentation: Smiths HUDWAC (head-up display and weapon aiming computer); GMAv COMED 2045 (combined map and electronic display)

Mission: Laser ranger and marked target seeker (LRMTS)

Self-defence: RWR, active and passive ECM

ARMAMENT: Two 30 mm Aden guns in lower fuselage aft of cockpit in single-seater, with 150 rds/gun, single Aden on port side in two-seater. One stores attachment on fuselage centreline and two under each wing. Centreline and inboard wing points can each carry up to 1,134 kg (2,500 lb) of weapons, outboard underwing points up to 567 kg (1,250 lb) each. Typical alternative loads include one air-to-surface missile and two 1,200 litre (317 US gallon; 264 Imp gallon) drop tanks; eight 1,000 lb bombs; various combinations of free-fall, laser-guided, retarded or cluster bombs, overwing R 550 Magic missiles; air-to-surface rockets, or a reconnaissance camera pack. Maritime Jaguars equipped with one or two Sea Eagle anti-shipping missiles

DIMENSIONS, EXTERNAL:

Wing span	8.69 m (28 ft 6 in)
Wing aspect ratio	3.12
Length overall, incl probe:	
single-seat	16.83 m (55 ft 2½ in)
two-seat	17.53 m (57 ft 6¼ in)
Height overall	4.89 m (16 ft 0¼ in)
Wheel track	2.41 m (7 ft 11 in)
Wheelbase	5.69 m (18 ft 8 in)

AREAS:

Wings, gross	24.18 m² (260.27 sq ft)

WEIGHTS AND LOADINGS:

Typical weight empty	7,000 kg (15,432 lb)
Max external stores load (incl overwing)	4,763 kg (10,500 lb)
Normal T-O weight (single-seater, with full internal fuel and ammunition for built-in cannon)	10,954 kg (24,149 lb)
Max T-O weight with external stores	15,700 kg (34,612 lb)
Max wing loading	649.3 kg/m² (133 lb/sq ft)
Max power loading	209.9 kg/kN (2.06 lb/lb st)

PERFORMANCE:

Max level speed at S/L	Mach 0.98 (648 kts; 1,200 km/h, 745 mph)
Max level speed above 6,000 m (19,685 ft)	Mach 1.5 (907 kts; 1,680 km/h, 1,044 mph)
Landing speed	115 kts (213 km/h; 132 mph)
Service ceiling	13,715 m (45,000 ft)
T-O run: clean	565 m (1,855 ft)
with four 1,000 lb bombs	880 m (2,890 ft)
with eight 1,000 lb bombs	1,250 m (4,100 ft)
T-O to 15 m (50 ft) with typical tactical load	940 m (3,085 ft)
Landing from 15 m (50 ft) with typical tactical load	785 m (2,575 ft)
Landing run:	
normal weight, with brake-chute	470 m (1,540 ft)
normal weight, without brake-chute	680 m (2,230 ft)
overload weight, with brake-chute	670 m (2,200 ft)
Typical attack radius, internal fuel only:	
hi-lo-hi	460 n miles (852 km; 530 miles)
lo-lo-lo	290 n miles (537 km; 334 miles)
Typical attack radius with external fuel:	
hi-lo-hi	760 n miles (1,408 km; 875 miles)
lo-lo-lo	495 n miles (917 km; 570 miles)
Range with max external fuel	1,400 n miles (2,593 km; 1,611 miles)
g limits	+8.6 (+12 ultimate)/−3

UPDATED

HAL CHEETAH

TYPE: Turbine-powered general purpose helicopter (licence-built Aerospatiale SA 315B Lama)

PROGRAMME: Design begun in France for Indian armed forces late 1968, first flight 17 March 1969, French certification 30 September 1970; FAA certification 25 February 1972, production by HAL (now only production source) for Indian armed forces started 1972 and continuing.

CUSTOMERS: Total 407 French built Lamas delivered (production ended), Helibras (which see) assembled seven in Brazil (named Gavião), HAL had delivered a total of 238 by 31 March 1994. Two sold to Namibia later that year

DESIGN FEATURES: Three-blade main and tail rotors, articulated main rotor hub; hydraulic drag dampers and interblade restraint cables, rotor brake standard, blades can be folded, main rotor rpm 353, tail rotor rpm 2,001, main blade section NACA 63A (constant chord)

FLYING CONTROLS: Fully powered hydraulic with adjustable friction damper on stick in place of cyclic trim, fixed-shaft engine runs at constant speed with transmission; power adjustment by means of fuel flow variation, fixed tailplane, freewheel for autorotation

STRUCTURE: Light metal cabin structure; steel tube truss centre section and tailboom, main rotor blades have aluminium alloy spar and skin wrapped round Moltoprene block filling, stainless steel leading-edge strip, tail rotor blades hollow aluminium alloy sheet aerofoil with leading-edge protective strip

LANDING GEAR: Skid type, with removable wheels for ground manoeuvring. Pneumatic floats for normal operation from water, and emergency flotation gear, inflatable in the air, are available.

POWER PLANT: One 640 kW (858 shp) HAL built Turbomeca Artouste IIIB turboshaft, derated to 404 kW (542 shp). Fuel tank in fuselage centre-section, with capacity of 575 litres (152 US gallons, 126.5 Imp gallons), of which 573 litres (151.5 US gallons, 126 Imp gallons) are usable. Oil capacity 7 litres (1.85 US gallons, 1.55 Imp gallons

ACCOMMODATION: Glazed cabin seats pilot and co-pilot or passenger side by side in front and three passengers behind. Jettisonable door on each side. Provision for external sling for loads of up to 1,000 kg (2,204 lb). Can be equipped for rescue (hoist capacity 160 kg, 352 lb), liaison, observation, training, agricultural, photographic and other duties. As an ambulance, can accommodate two stretchers and a medical attendant. Cabin heating optional

SYSTEMS: Single hydraulic system. Electrical system includes engine starter/generator, 36 Ah battery and external power socket. Oxygen system optional

DIMENSIONS, EXTERNAL:

Main rotor diameter	11.02 m (36 ft 1¾ in)
Tail rotor diameter	1.91 m (6 ft 3¼ in)
Distance between rotor centres	6.435 m (21 ft 1½ in)
Main rotor blade chord (constant)	0.35 m (13.8 in)

Indian Army HAL Cheetah (licence-built SA 315B Lama)

1995

Length	
overall, both rotors turning	12.91 m (42 ft 4¼ in)
fuselage	10.23 m (33 ft 6¾ in)
Height overall	3.09 m (10 ft 1¾ in)
Skid track	2.38 m (7 ft 9¾ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	2.10 m (6 ft 10¾ in)
Max width	1.40 m (4 ft 7 in)
Max height	1.28 m (4 ft 2¼ in)
Volume	3.10 m³ (109.5 cu ft)
AREAS:	
Main rotor disc	95.38 m² (1,026.7 sq ft)
Tail rotor disc	2.87 m² (30.84 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	995 kg (2,193 lb)
Max T-O weight: normal	1,750 kg (3,858 lb)
with externally slung cargo	1,850 kg (4,078 lb)
with agricultural spray kit	1,950 kg (4,299 lb)
Max disc loading: normal	18.35 kg/m² (3.76 lb/sq ft)
with externally slung cargo	19.40 kg/m² (3.97 lb/sq ft)
with agricultural spray kit	20.44 kg/m² (4.19 lb/sq ft)
PERFORMANCE (at max normal T-O weight at S/L):	
Never-exceed speed (VNE)	113 kts (210 km/h; 130 mph)
Max cruising speed	103 kts (192 km/h; 119 mph)
Max rate of climb	330 m (1,080 ft)/min
Service ceiling	6,400 m (21,000 ft)
Range with max fuel	296 n miles (550 km; 341 miles)
Endurance	3 h 30 min

UPDATED

HAL CHETAK

TYPE: Turbine-powered general purpose helicopter (licence-built Aerospatiale SA 316B Alouette III).

PROGRAMME: First flight (original French Alouette III) 28 February 1959; remains in production only in India.

CURRENT VERSIONS: **Basic military**: VUC-201A V/UHF com, ARC-610A ADF, TFAP 6F intercom and cargo sling standard. Role equipment for observation, troop or cargo transport and logistic support can include missile launchers, sand filters, Doppler nav system, rescue hoist, flotation gear, and gun mounting in cabin doorway. For anti-tank missions, can be equipped with gyrostabilised roof-mounted monocular sight, guns and air-to-surface wire-guided missiles.

Naval version: Avionics for ASW or other maritime roles can include VGR-101R VHF receiver, UHS 190A UHF homing, CG-512-3 gyromagnetic compass, 4286-V8 artificial horizon, RAM-700A radar altimeter, Doppler nav system and autopilot. Other system and equipment options include windscreen wiper, nosewheel castor lock, mainwheel axle cover, hydraulic harpoon decklock, emergency flotation gear, MAD, search and rescue cabin layout, rescue hoist, cargo sling, and floor hatch blanking plate. Armament can include torpedoes, guns and air-to-surface missiles.

Coastguard: Standard avionics as listed for basic military version; optional avionics include RDR 1400C weather radar, CG-512-3 gyromagnetic compass, Litton LTN 211 (or similar) Omega nav system, RAM-700A or equivalent radar altimeter, VGR 101R VHF receiver, 4286-V8 artificial horizon and autopilot. Other options include rescue hoist, searchlight, camera installation, fuel jettison system, hydraulic harpoon decklock, nosewheel castor lock, windscreen wiper, battery temperature warning system, mainwheel axle covers, NVGs and sea rescue modifications.

Passenger transport: Civil version for pilot and up to six passengers (five in VIP configuration). Equipped as standard with COM-105A, V/UHF com radio, VHF/FM ARC-610A ADF, TFAP 6F intercom, battery temperature warning system, first aid kit, fire extinguisher, fire axe and carpet. VIP version has cabin soundproofing (including upholstery), passenger foot step assembly, and two ventilation fans.

CUSTOMERS: More than 1,450 produced in France; ICA Brasov (now IAR) produced 200 in Romania; HAL output had totalled 329 by 31 March 1994. Two sold to Namibia later that year.

DESIGN FEATURES: Three-blade main and tail rotors; articulated main rotor hub has hydraulic drag dampers plus interblade restraint cables; constant chord blades can be folded; rotor brake standard.

FLYING CONTROLS: Hydraulic fully powered controls; cyclic trimming by means of adjustable friction damper on stick; fixed-shaft engine runs at constant speed with transmission; power adjustment by means of fuel flow variation; fixed tailplane with endplate fins.

STRUCTURE: Steel tube centre-fuselage covered with fairings, semi-monocoque tailboom, all metal blades.

LANDING GEAR: Non-retractable tricycle type, manufactured under Messier Bugatti licence. Hydraulic shock absorption. Nosewheel is fully castoring. Provision for skis or emergency pontoon landing gear.

POWER PLANT: One 649 kW (870 shp) HAL built Turbomeca Artouste IIIB turboshaft, derated to 410 kW (550 shp) for maximum continuous operation. Fuel in single tank in fuselage centre-section, with capacity of 575 litres (152 US gallons; 126.5 Imp gallons), of which 573 litres (151 US gallons; 126 Imp gallons) are usable.

ACCOMMODATION: Normal accommodation for pilot and six persons, with three seats in front and four-person folding seat at rear of cabin. Two baggage holds in centre-section on each side of welded structure and enclosed by centre-section fairings. Provision for carrying two stretchers athwartships at rear of cabin, and two other persons, in addition to pilot. All passenger seats removable to enable aircraft to be used for freight carrying. Can also be adapted for cropspraying or aerial survey roles. Provision for external sling for loads of up to 750 kg (1,650 lb). One forward opening door on each side, immediately in front of two rearward-sliding doors. Dual controls and cabin heating optional.

AVIONICS: See under Current Versions.

ARMAMENT: In assault role, can be equipped with wide range of weapons. A 7.62 mm machine gun (with 1,000 rds) can be mounted athwartships on tripod behind pilot's seat, firing to starboard, either through small window in sliding door or through open doorway with door locked open. Rear seat is removed to allow gun mounting to be installed. In this configuration, maximum accommodation is for pilot, co-pilot, gunner and one passenger, although normally only pilot and gunner carried. Alternatively, a 20 mm gun (with 480 rds) can be carried on open turret-type mounting on port side of cabin. For this installation all seats except that of pilot are removed, as is port side cabin door, and crew consists of pilot and gunner. Instead of these guns, aircraft can be equipped with two or four wire-guided missiles on external jettisonable launching rails, gyrostabilised sight, or 68 mm rocket pods.

DIMENSIONS, EXTERNAL:	
Main rotor diameter	11.02 m (36 ft 1¾ in)
Main rotor blade chord (each)	0.35 m (13.8 in)
Tail rotor diameter	1.912 m (6 ft 3¼ in)
Spraybar span (agricultural version)	10.00 m (32 ft 9¾ in)
Length: overall, rotors turning	12.84 m (42 ft 1½ in)
fuselage, tail rotor turning	10.17 m (33 ft 4½ in)
Width overall, blades folded	2.60 m (8 ft 6¼ in)
Height to top of rotor head	2.97 m (9 ft 9 in)
Wheel track	2.602 m (8 ft 6½ in)
AREAS:	
Main rotor disc	95.38 m² (1,026.6 sq ft)
Tail rotor disc	2.87 m² (30.9 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, standard	1,230 kg (2,711 lb)
Max T-O weight	2,200 kg (4,850 lb)
Max disc loading	23.07 kg/m² (4.72 lb/sq ft)
PERFORMANCE (standard version at max T-O weight):	
Never-exceed speed (VNE) at S/L	113 kts (210 km/h; 130 mph)
Max cruising speed at S/L	100 kts (185 km/h; 115 mph)
Max rate of climb at S/L	260 m (850 ft)/min
Service ceiling	3,250 m (10,675 ft)
Hovering ceiling: IGE	2,850 m (9,350 ft)
OGE	1,500 m (4,920 ft)
Range with max fuel at S/L	257 n miles (477 km; 296 miles)
Endurance	3 h

UPDATED

HAL Chetak (licence-built Alouette III)

1995

ACCESSORIES COMPLEX

PO Box HAL, Lucknow
Telephone: 91 (522) 384347
Fax: 91 (522) 383973
MANAGING DIRECTOR: H. C. Kholay

Comprises Lucknow, Hyderabad, Kanpur and Korwa Divisions.

UPDATED

KANPUR DIVISION

Post Bag 225, Kanpur 208 008
Telephone: 91 (512) 42488 and 44021/5
Fax: 91 (512) 350505
Telex: 325 243 HALK IN
GENERAL MANAGER: A. P. Arya

UPDATED

HAL (HAWKER SIDDELEY) HS 748

Development of airborne surveillance, warning and control (ASWAC) version of Kanpur built HS 748s started 1985, testbed flown 5 November 1990 with empty 4.8 m (15 ft 9 in) diameter rotodome produced by DASA (MBB), which would provide technical assistance in any eventual production; run by Indian Defence Research and Development Organisation as ADE sponsored ASP (Airborne Surveillance Platform) programme, avionics designed by Indian Electronics and Radar Development Establishment, manufacture by BEL (Bharat Electronics Ltd); foreign participation in radar design expected. Flight testing continued in 1994.

UPDATED

HAL (DORNIER) 228

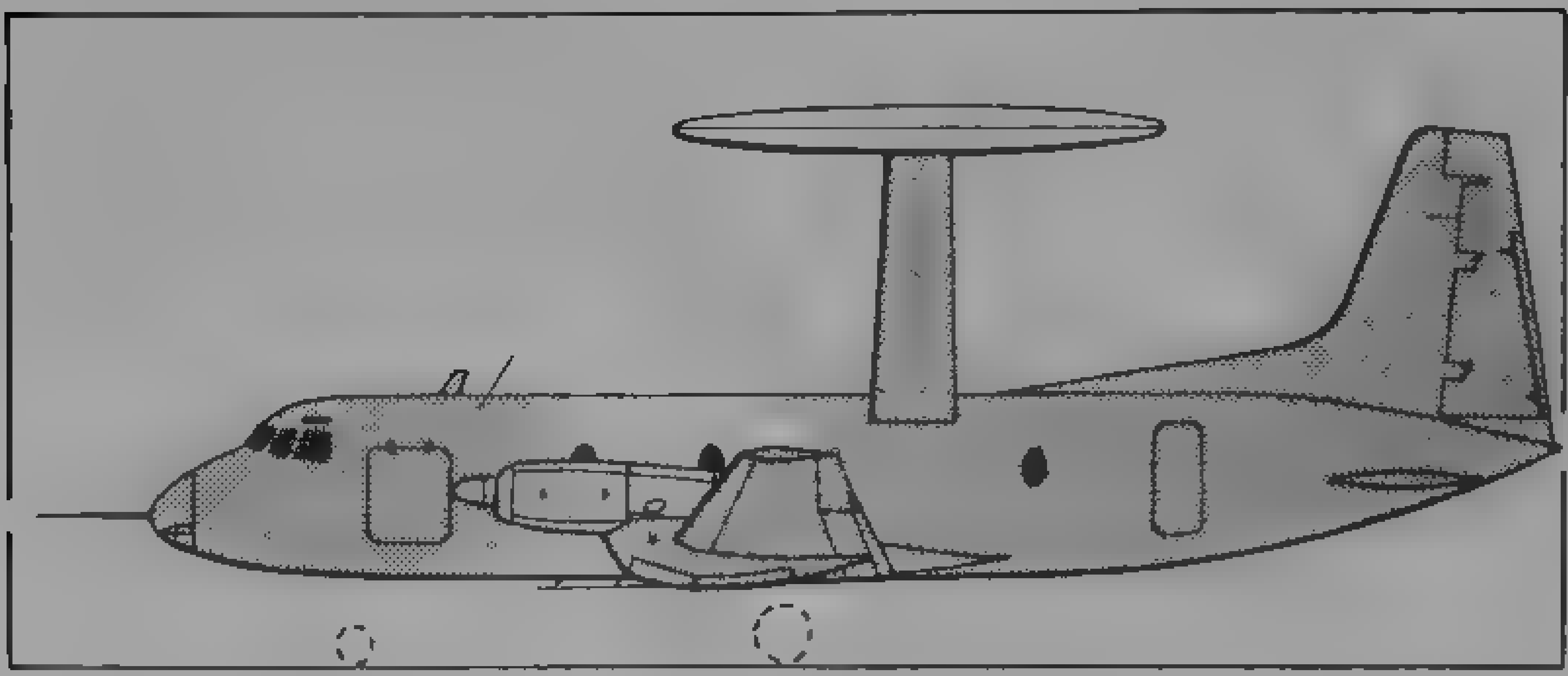
TYPE: Multirole civil/military turboprop twin.

PROGRAMME: Contract for licence manufacture of up to 150 Dornier 228s over 10 years signed 29 November 1983, some aircraft supplied complete from Germany; first flight Kanpur built aircraft 31 January 1986.

CURRENT VERSIONS: **Regional Airliner**: Ten HAL built 228-201s delivered to Vayudoot by January 1994.

Maritime Surveillance: Thirty-three 228-101s for Indian Coast Guard (after three from Germany); deliveries started 1987; in service with Nos 744 and 750 Squadrons at Daman and Madras, for coastal, environmental and anti-smuggling patrol, 360° Marec 2 search radar under fuselage (replaced in 22 aircraft by Super Marec), Litton Omega navigation system, Matra infra-red/ultra-violet linescanner for pollution detection, search and rescue liferafts, 1 Mcd searchlight, side-mounted loudhailer, marine markers, and provision for two Micronair underwing spraypods to combat oil spills, sliding main cabin door for airdropping six- or 10-man liferafts. Normal crew two pilots, radar operator and observer. Optional armament includes two underwing 7.62 mm twin-gun machine gun pods or air-to-surface missiles.

Anti-ship: Indian Navy plans to acquire 27 specially equipped Dornier 228-201s with anti-ship missiles and Super Marec radar (10 radars ordered 1993-94).



Drawing of HAL's prototype ASWAC conversion of the Hawker Siddeley 748 (*Jane's/Derek Ballington*) *1995*

Utility transport: Indian Air Force acquiring 25 228 201s, deliveries started 1987; Nos 41 and 59 Squadrons, carry 21 field-equipped troops on inward-facing folding seats, large roller door at rear, port side.

Executive/Air taxi. Various configurations including six- or 10-seat executive or 15 passenger air taxi, with cabin attendant, and galley/wardrobe/toilet; built-in APU for air conditioning and lighting in flight or on ground.

CUSTOMERS: See Current Versions; total 58 delivered from HAL production line by March 1994, one export order from Mauritius 1990.

UPDATED

SYSTEMS: Hydraulic system for brakes only. Electrical system (28 V DC earth return type) powered by 70 A alternator, with SAFT 24 V Ni/Cd standby battery. No air conditioning, pneumatic, de-icing or oxygen systems.

AVIONICS: *Comms:* HAL (Hyderabad Division) COM-150 main UHF and COM-104A standby VHF com.

DIMENSIONS, EXTERNAL:

Wing span	9 50 m (31 ft 2 in)
Wing chord: at root	2 24 m (7 ft 4¼ in)
at tip	0 92 m (3 ft 0¼ in)
Wing aspect ratio	6 02
Length overall	7 72 m (25 ft 4 in)
Fuselage: Max width	1 25 m (4 ft 1¼ in)
Height overall	2 88 m (9 ft 5½ in)
Tailplane span	3.60 m (11 ft 9¾ in)
Wheel track	3 45 m (11 ft 4 in)
Wheelbase	2 10 m (6 ft 10¾ in)
Propeller diameter	2 03 m (6 ft 8 in)
Propeller ground clearance (static)	0 23 m (9 in)

AREAS:

Wings, gross	15 00 m² (161.5 sq ft)
Ailerons (total)	1.04 m² (11 19 sq ft)
Trailing-edge flaps (total)	1 82 m² (19 59 sq ft)
Vertical tail surfaces (above fuselage reference line)	2 06 m² (22.17 sq ft)
Rudder (aft of hinge line), incl tabs	0 869 m² (9 35 sq ft)
Tailplane	3.024 m² (32.55 sq ft)
Elevator (aft of hinge line), incl tabs	1 34 m² (14.42 sq ft)

WEIGHTS AND LOADINGS:

Basic weight empty	890 kg (1,962 lb)
Fuel and oil (guaranteed min)	164 kg (361 lb)
Max T-O and landing weight	1,250 kg (2,756 lb)
Max wing loading	83 33 kg/m² (17.07 lb/sq ft)
Max power loading	6.44 kg/kW (10 60 lb/hp)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (VNE) (structural)	240 kts (445 km/h; 276 mph)
Max level speed at S/L	143 kts (265 km/h, 164 mph) IAS
Max cruising speed at 3,050 m (10,000 ft)	115 kts (213 km/h, 132 mph)
Econ cruising speed	95 kts (176 km/h, 109 mph)
Stalling speed, 20° flap, engine idling	60 kts (110 km/h, 69 mph)
Max rate of climb at S/L	335 m (1,100 ft)/min
Service ceiling	5,500 m (18 045 ft)
T-O run	345 m (1,132 ft)
T-O to 15 m (50 ft)	545 m (1,788 ft)
Landing from 15 m (50 ft)	487 m (1,598 ft)
Landing run	220 m (720 ft)
Range at 3,050 m (10,000 ft) at econ cruise power	401 n miles (744 km, 462 miles)
g limits	+6/−3

HAL HPT-32 DEEPAK

TYPE: Two-seat *ab initio* and basic trainer and multirole aircraft.

PROGRAMME: First flight (X2157) 6 January 1977, first flight of first production aircraft (third built) 31 July 1981, production started late 1987/early 1988, domestic DGCA civil certification received 25 November 199

CUSTOMERS: Indian Air Force and Navy initial orders for 88 and one for Agricultural Aviation; all 89 delivered; follow-on batch of 10 delivered 1993-94.

DESIGN FEATURES: Roles include instrument, aerobatic and night flying training, glider or target towing, weapon training and light strike, SAR, supply dropping and reconnaissance, as well as primary and basic training. Tapered straight wing, section NACA 64A-212, dihedral 5° from roots, incidence 2° 30′ at root.

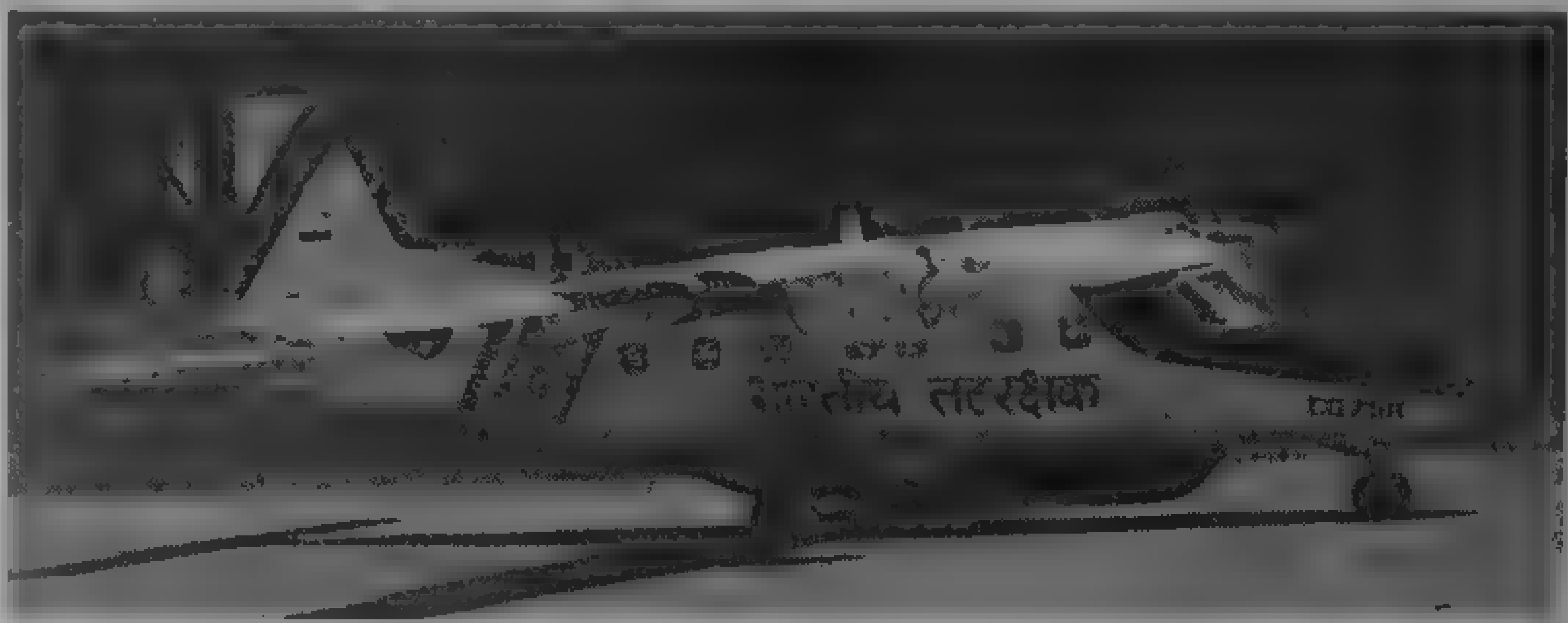
FLYING CONTROLS: Conventional mechanical, one-piece elevator has geared tab in port half and trim tab in starboard half, rudder trim tab, geared tab and ground adjustable tab in each aileron, plain flaps.

STRUCTURE: Fail-safe all-metal stressed skin structure.

LANDING GEAR: Non-retractable tricycle type, with HAL oleo-pneumatic shock-absorber in each unit. Dunlop UK single mainwheels and nosewheel. Dunlop UK mainwheel tyres size 446 × 151 × 166 mm, pressure 3.10 bars (45 lb/sq in); Dunlop India nosewheel tyre, size 361 × 126 × 127 mm, pressure 2 41 bars (35 lb/sq in). Dunlop UK air-cooled hydraulic disc brakes on mainwheels. Minimum ground turning radius 6 50 m (21 ft 4 in).

POWER PLANT: One 194 kW (260 hp) Textron Lycoming AEIO-540-D4B5 flat-six engine, driving a Hartzell two-blade constant-speed metal propeller. Total of 220 litres (58 1 US gallons 48.4 Imp gallons) of fuel in four flexible tanks (two in each wing), plus a 9 litre (2 4 US gallon; 2 Imp gallon) metal collector tank in fuselage. Total fuel capacity 229 litres (60 5 US gallons, 50 4 Imp gallons). Overwing refuelling points. Oil capacity 13 6 litres (3 6 US gallons, 3 Imp gallons).

ACCOMMODATION: Side by side seats for two persons under rearward-sliding jettisonable framed canopy. Seats adjustable in height by 127 mm (5 in). Full dual controls, and adjustable rudder pedals, for instructor and pupil. Cockpit ventilated.



HAL built Dornier 228-101 of the Indian Coast Guard *1995*

HAL HPT 32 two-seat basic trainer of the Indian Air Force *1995*

MiG COMPLEX

PO Box 5150; 15/1 Cubbon Road, Bangalore 560 001
Telephone: 91 (80) 2263839 and 2269803
Fax: 91 (80) 2268758 and 577533
Telex: 845 2266 HAL IN

MANAGING DIRECTOR: H K L. Anand

Complex originally contained Nasik, Koraput and Hyderabad Divisions of HAL, respectively building airframes, engines and avionics of MiG-21 under licence. Indian MiG 21 production phased out 1986-87 as production of MiG-27M increased. See *Jane's Aircraft Upgrades* for details of Indian Air Force MiG-21 upgrade programme.

UPDATED

NASIK DIVISION

Ojhar Township Post Office, Nasik 422 207, Maharashtra
Telephone: 91 (253) 78117 and (2533) 75433
Fax: 91 (2533) 75825
Telex: 0752 241

GENERAL MANAGER: N R Mohanty

VERIFIED

HAL (MIKOYAN) MiG-27M

Indian name: Bahadur (Valiant)
NATO reporting name: Flogger-J

TYPE: Variable-sweep attack fighter.

PROGRAMME: HAL began licence assembly of MiG-27M 1984, first aircraft rolled out October 1984; Indian components included from 1988, entered IAF service 11 January 1986; plan for mid-life update and continuation of production to more than 200.

CURRENT VERSIONS: **MiG-27M.** Current aircraft, as Russian Flogger-J (see 1994-95 *Jane's*).

Mid-life update: IAF considering avionics upgrade.

CUSTOMERS: MiG-27M joined MiG-23s and -27s supplied direct from USSR, 125 completed by early 1994; original

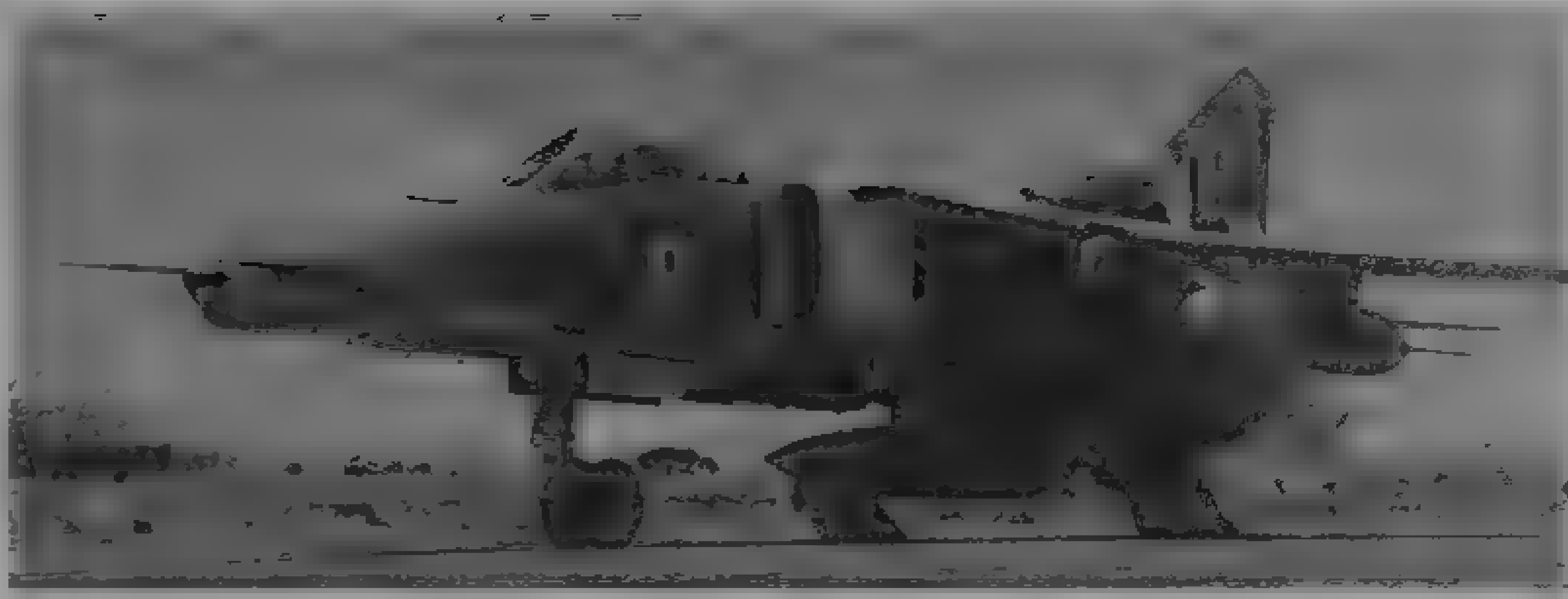
165 now to be final total, following abandonment of plans to produce over 200; but only one aircraft (instead of planned 17) completed in 1993-94 due to hiatus in supply of Russian/CIS components. Currently equips six of planned eight IAF squadrons (Nos. 2, 9, 18, 22, 31 and 222).

DESIGN FEATURES: Shoulder wing variable-geometry configuration, sweep variable manually in flight or on ground through 56°, with recommended settings of 18° 40', 47° 40' and 74° 40' (given in manuals and on pilot's panel as 16°, 45° and 72° respectively); two hydraulic wing sweep motors driven separately by main and control booster systems; if one system fails, wing sweep system remains effective at 50 per cent normal angular velocity, rear fuselage detachable between wing and tailplane for engine servicing, lower portion of large ventral fin hinged to fold to starboard when landing gear extended, for ground clearance; leading-edge sweepback 72° on fixed wing panels, 57° on horizontal tail surfaces, 65° on fin

FLYING CONTROLS: Hydraulically actuated; full-span single-slotted trailing-edge flaps, each in three sections, outboard sections operable independently when wings fully swept no ailerons, two-section upper surface spoilers/lift dumpers, forward of two mid-flap sections each side, operate differentially in conjunction with horizontal tail surfaces (except when disengaged at 72° sweep), and collectively for improved runway adherence and braking after touchdown; leading-edge flap on outboard two-thirds of each main (variable-geometry) panel, coupled to trailing-edge flaps, all-moving horizontal tail surfaces operate differentially and symmetrically for aileron and elevator function respectively, ground adjustable tab on each horizontal surface; rudder actuated by hydraulic booster with spring artificial feel; four door type airbrakes, two on each side of rear fuselage, above and below horizontal tail surface

STRUCTURE: All-metal, two main spars and auxiliary centre spar in each wing extended chord (dogtooth) on outer panels visible when wings swept; fixed triangular inboard wing panels (gloves); primary structural component formed by wing centre-section and No. 2 fuel tank, made integrally of welded VNS-2 steel alloy panels, housing engine air intake duct and carrying wing glove boxes and main landing gear attachments; basically circular section semi-monocoque fuselage, flattened each side of cockpit lateral air intake trunks blend into circular detachable rear fuselage; splitter plate, with boundary layer bleeds, forms inboard face of each intake, two rectangular auxiliary intake doors in each trunk, under inboard wing leading-edge, are sucked open to increase intake area at take-off and low airspeeds; pressure relief vents under rear fuselage; fin and forward portion of horizontal surfaces conventional light alloy structures; rudder and rear of horizontal surfaces have honeycomb core

LANDING GEAR: Hydraulically retractable tricycle type, with levered-suspension legs, single wheel on each main unit and steerable self-centring twin-wheel nose unit, main wheel tyres size 830 × 300 mm, pressure 10.8 ± 0.5 bars (156 ± 7 lb/sq in); nosewheel tyres size 520 × 125 mm pressure 7.85 ± 0.5 bars (114 ± 7 lb/sq in); main units retract inward into rear of air intake trunks; main fairings to enclose these units attached to legs, small inboard fairing for each wheel bay hinged to fuselage belly. Nose unit, with shimmy damper, and with mudguard over each wheel, retracts rearward. Mainwheel hydraulic disc brakes and anti-skid units. PT-10370-65 brake-chute, area 21 m² (226 sq ft) in cylindrical fairing at base of rudder with split conic doors


HAL built Indian Air Force MiG-27M attack fighter
1995

POWER PLANT: One Soyuz/Khachaturov R-29B-300 turbojet, rated at 78.45 kN (17,635 lb st) dry and 112.8 kN (25,353 lb st) with maximum afterburning; fixed air intakes and two-position (on/off) afterburner nozzle consistent with primary requirement of transonic speed at low altitude; internal fuel capacity 5,400 litres (1,426 US gallons, 1,188 Imp gallons); provision for up to three 790 litre (209 US gallon, 174 Imp gallon) external tanks

ACCOMMODATION: Pilot only, on KM-1 or KM-1M (zero height/70 to 675 knots; 130 to 1,250 km/h, 80 to 775 mph) ejection seat in air conditioned and pressurised cockpit, under small hydraulically actuated rearward-hinged canopy. Bulletproof windscreen

AVIONICS: *Comms:* SO-69 transponder; SRO-1P IFF, RI-65 16-item vocal warning system

Flight: SAU-1 automatic flight control system, INS SUA-1 angle of attack indicator; RV-5R/RV-10 radio altimeters

Mission: PrNK-23M nav/attack system. Fone range finder; bullet-shaped antenna above each glove pylon associated with missile guidance

Self-defence: SPS-141 infra-red jammer; SG-1 radar warning receiver

EQUIPMENT: Flare dispenser, in form of short fence, on fuselage each side of dorsal fin

ARMAMENT: One 30 mm six-barrel GSh-6-30 gun in fuselage belly pack with 260 rounds, bomb/JATO rack each side of rear fuselage; five other pylons for external stores, 4,000 kg (8,818 lb) of weapons, including tactical nuclear bombs, R-3S (K-13T, NATO AA-2D 'Atoll-D') and R-60T (AA-8 'Aphid') air-to-air missiles, Kh-23 (AS-7 'Kerry') radio command guided air-to-surface missiles, 240 mm S-24 rockets, UB-32 or UB-16 packs of 57 mm rockets, twenty-two 50 or 100 kg, nine 250 kg or eight 500 kg bombs, or napalm containers

DIMENSIONS, EXTERNAL:
Wing span: fully spread 13.965 m (45 ft 10 in)
fully swept 7.779 m (25 ft 6¼ in)
Length overall 17.076 m (56 ft 0¼ in)
Height overall 5.00 m (16 ft 5 in)
Tailplane span 5.75 m (18 ft 10¼ in)
Wheel track 2.728 m (8 ft 11½ in)
Wheelbase 5.991 m (19 ft 8 in)

AREAS:
Wings, gross: spread 37.35 m² (402.0 sq ft)
swept 34.16 m² (367.7 sq ft)
Horizontal tail surfaces 6.88 m² (74.06 sq ft)
Trailing-edge flaps (total) 5.90 m² (63.51 sq ft)
Spoilers (total) 1.20 m² (12.92 sq ft)

WEIGHTS AND LOADINGS (A: MiG-27, B: MiG-27K):
Weight empty: A 11,908 kg (26,252 lb)
Max internal fuel: A 4,560 kg (10,053 lb)
Max external stores 4,000 kg (8,818 lb)
Normal T-O weight: A 18,100 kg (39,905 lb)
Max T-O weight from unprepared surface
B 18,107 kg (39,920 lb)
Max T-O weight: A 20,300 kg (44,750 lb)
B 20,670 kg (45,570 lb)
Max landing weight: B 17,000 kg (37,475 lb)
Max wing loading:
A, spread 544.7 kg/m² (111.3 lb/sq ft)
A, swept 594.3 kg/m² (121.7 lb/sq ft)
B, spread 553.4 kg/m² (113.4 lb/sq ft)
B, swept 605.1 kg/m² (123.9 lb/sq ft)
Max power loading: A 180.0 kg/kN (1.76 lb/lb st)
B 183.25 kg/kN (1.80 lb/lb st)

PERFORMANCE (basic MiG-27):
Max level speed, clean, at 8,000 m (26,250 ft)
Mach 1.7 (1,017 kts, 1,885 km/h, 1,170 mph)
at S/L Mach 1.1 (728 kts, 1,350 km/h; 839 mph)
Landing speed
140-146 kts (260-270 km/h, 162-168 mph)
Max rate of climb at S/L 12,000 m (39,370 ft)/min
Service ceiling 14,000 m (45,900 ft)
T-O run 950 m (3,120 ft)
Landing run: with brake-chute 900 m (2,950 ft)
without brake-chute 1,300 m (4,265 ft)
Combat radius (lo-lo-lo) with 7% reserves
with two Kh-29 missiles
121 n miles (225 km, 140 miles)
with two Kh-29 missiles and three 790 l external tanks 291 n miles (540 km, 335 miles)
g limit +7.0

UPDATED

NAL

NATIONAL AEROSPACE LABORATORIES

PO Bag 1779, Kodihalli, Bangalore 560 017
Telephone: 91 (80) 570584/565579/571112
Fax: 91 (80) 5593942/560862/560670
DIRECTOR: Dr K. N. Raju
HEAD OF FLIGHT EXPERIMENTS DIVISION: Prof R. B. Damania

UPDATED


NALLA-2 Hansa prototype two-seat civil trainer
1995

NAL/TAAL NALLA-2 HANSA

TYPE: Side by side two-seat civil trainer (NALLA = NAL Light Aircraft).

PROGRAMME: Design started mid-1989; construction of first prototype began December 1991, and this aircraft (VT-XIW) made first flight 17 November 1993. Manufacture of initial production aircraft began August 1993, first flight due mid-1995. Prototype has Indian DGCA Experimental category type certificate; production version to be certificated to FAR Pt 23.

COSTS: Programme development Rs12 million (1992); standard aircraft estimated at Rs2.5 million (1995).

DESIGN FEATURES: Docile handling qualities for *ab initio* training; robust construction and low acquisition/operating cost, low-wing monoplane with circular-section waisted fuselage; outer wings tapered on leading-edges, with unswept trailing-edge, sweptback fin and rudder, conventional unswept, straight tapered horizontal tail surfaces.

Laminar-section wing (Wortmann FX-60-177, thickness/chord ratio 17.7 per cent); dihedral 4° from roots, incidence 0°; tip washout 2°

FLYING CONTROLS: Frise ailerons (100 per cent internal mass balance); horn balanced plain elevators and large rudder all actuated mechanically by push/pull rods, pitch trim by electrically operated tab in port elevator. No flaps

STRUCTURE: Built entirely of composites (CFRP/GFRP reinforced epoxy) with hand lay-up and room temperature curing. Solid foam core wing and tail surfaces with single GFRP spars; auxiliary spar in wing to take landing gear loads. Moulded fuselage with PVC foam core; mouldless construction for wings and tail.

Following description refers to first prototype.

LANDING GEAR: Non-retractable tricycle type, with cantilever steel spring mainwheel legs and castoring (±100°) nosewheel. Cleveland wheels and mainwheel hydraulic disc brakes; tyre sizes 6.00-6 (main), 5.00-5 (nose). Minimum ground turning radius 2.54 m (8 ft 4 in)

POWER PLANT: One Teledyne Continental O-200 flat four engine in prototype (74.6 kW; 100 hp at 2,750 rpm). Sensenich two-blade fixed-pitch wooden propeller. Single composites fuel tank aft of cockpit, capacity 110 litres (29 US gallons; 24.2 Imp gallons). Single gravity refuelling point on top of fuselage.

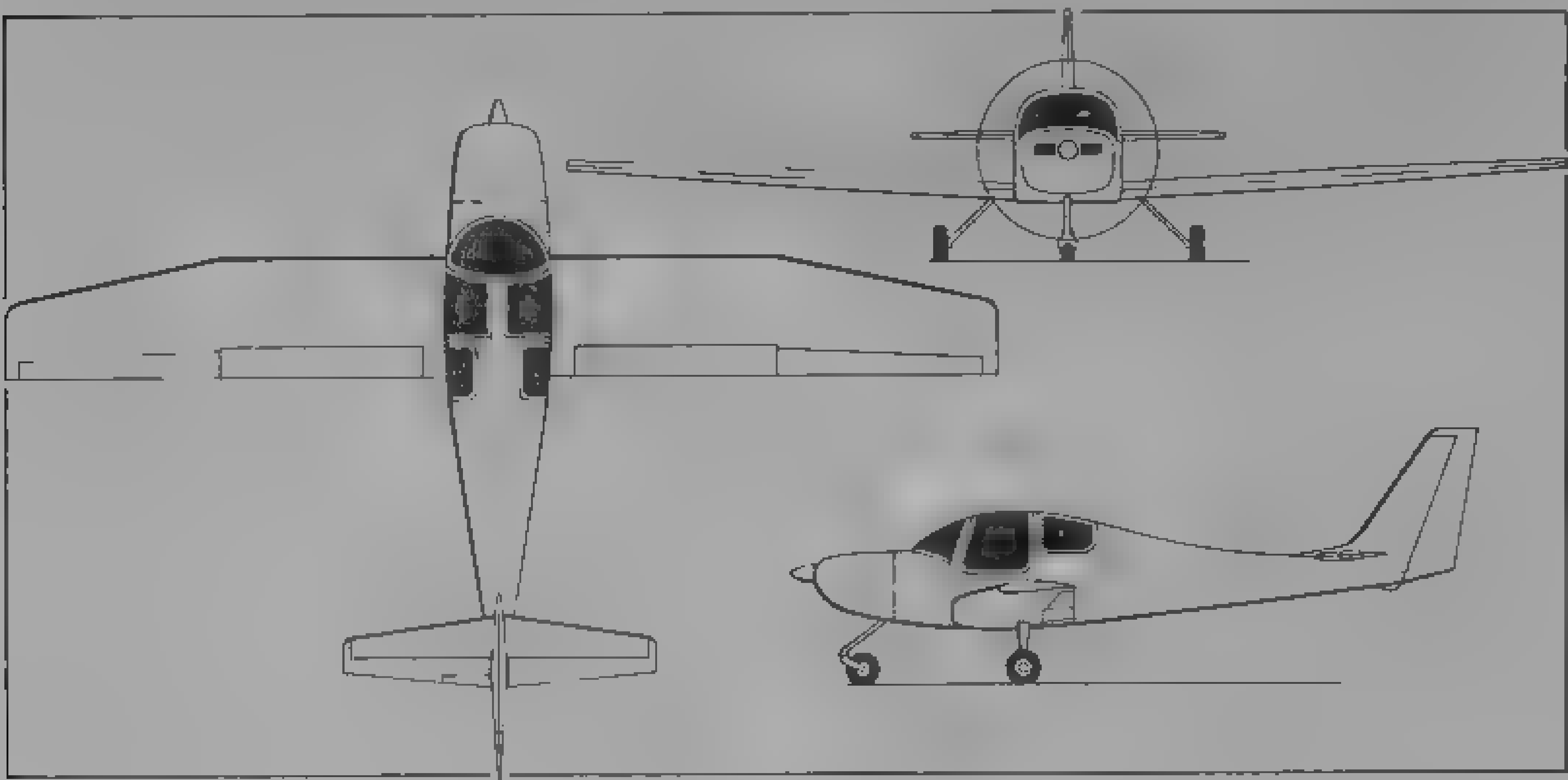
Production version to have 93 kW (125 hp) Teledyne Continental IO-240 flat four

ACCOMMODATION: Two seats side by side; dual controls standard. Upward-opening gull-wing doors

SYSTEMS: Manual (toe-operated) hydraulic mainwheel brakes. Electrical system powered by 12 V alternator and sealed lead acid battery

AVIONICS: *Comms*: Bendix/King KX 125 combined com/nav unit with concealed foil antennae. ACK Technologies E-01 ELT

Instrumentation: Conventional VFR



NAL/TAAL Hansa in production configuration *(Jane's/Mike Keep)* *1994*

DIMENSIONS, EXTERNAL:

Wing span	9.91 m (32 ft 6¼ in)
Wing chord: constant portion	1.48 m (4 ft 10¼ in)
at tip	0.86 m (2 ft 9¾ in)
Wing aspect ratio	7.76
Length overall	7.00 m (22 ft 11½ in)
Height overall	2.60 m (8 ft 6½ in)
Tailplane span	3.30 m (10 ft 10 in)
Wheel track	3.70 m (12 ft 1¾ in)
Wheelbase	1.74 m (5 ft 8½ in)
Propeller diameter	1.753 m (5 ft 9 in)
Propeller ground clearance	0.24 m (9½ in)

AREAS:

Wings, gross	12.66 m² (136.3 sq ft)
Ailerons (total)	0.97 m² (10.44 sq ft)
Fin	1.35 m² (14.53 sq ft)
Rudder	0.60 m² (6.46 sq ft)
Tailplane	1.93 m² (20.77 sq ft)
Elevators (total)	0.80 m² (8.61 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	600 kg (1,323 lb)
Max fuel weight	80 kg (176 lb)
Max T-O and landing weight	800 kg (1,763 lb)
Max wing loading	63.2 kg/m² (12.94 lb/sq ft)
Max power loading	10.73 kg/kW (17.64 lb/hp)

PERFORMANCE (estimated, at max T-O weight, ISA):

Never-exceed speed	136 kts (251 km/h; 156 mph)
Max level speed at S/L	103 kts (191 km/h; 118 mph)
Stalling speed	51 kts (95 km/h; 59 mph)
Max rate of climb at S/L	180 m (590 ft)/min
Service ceiling	3,660 m (12,000 ft)
T-O run	275 m (900 ft)
T-O to 15 m (50 ft)	427 m (1,400 ft)
Landing from 15 m (50 ft)	366 m (1,200 ft)
Landing run	244 m (800 ft)
Range with max fuel, no reserves	434 n miles (804 km; 500 miles)

UPDATED

OTHER AIRCRAFT

For details of **M-102 Duet/Saras** 9/14-passenger twin-turboprop business and commuter transport, see Myasishchev/NAL entry in the International section

NEW ENTRY

TAAL

TANEJA AEROSPACE AND AVIATION LTD

305 Mota Chambers, 9 Cunningham Road, Bangalore 560 052
Telephone: 91 (80) 2260751 and 2268619
Fax: 91 (80) 2263214
Telex: 845 8624
CHAIRMAN: B. R. Taneja
DIRECTOR AND CEO: Wg Cdr Dinesh Kumar (Retd)
DIRECTOR OF PROJECTS: Salil Taneja
CHIEF OF MARKETING: Sqn Ldr A. V. Nerurkar (Retd)

TAAL is part of Indian Seamless Metal Tubes Group; has modern plant at Hosur, near Bangalore, with 1,300 m (4,265 ft) captive runway, hangars, laboratories, paint shops and other facilities for aircraft overhaul and manufacture. Entered into technical agreement Spring 1992 with Aercosmos of Milan to produce Partenavia P.68C/TC, P.68 Observer and AP.68TP-600 Viator light twins (see Italian section) in India; installed capacity of plant is 24 aircraft per year. TAAL programme aimed at meeting growing demand for this category of aircraft within India, and to tap export potential to neighbouring countries in south-east Asia. First TAAL built aircraft (VT-TAA, a P.68 Observer 2) made its first flight 17 March 1994. One P.68 delivered late 1994 (of six sold), next five due for delivery by end of March 1995. Sales of 12 more being negotiated in early 1995.

TAAL also has agreement with NAL (National Aerospace Laboratories, see previous entry) for manufacture of NALLA-2 Hansa light trainer in new composites shop being set up at Hosur plant.

UPDATED

INDONESIA

IPTN

PT. INDUSTRI PESAWAT TERBANG NUSANTARA (Nusantara Aircraft Industries Ltd)

PO Box 1562 BD, Jalan Pajajaran 154, Bandung 40174
Telephone: 62 (22) 633900 and 633911
Fax: 62 (22) 633912
Telex: 28295 IPTN BD IA
HEAD OFFICE: PO Box 3752 JKT, 14th Floor, Bumi Daya Plaza Building, Jalan Imam Bonjol 61, Jakarta 10310
Telephone: 62 (21) 3103833
Fax: 62 (21) 3100081
Telex: 61246 IPTN JK IA
PRESIDENT DIRECTOR: Prof Dr Ing B. J. Habibie
SENIOR VICE-PRESIDENTS:
Hari Laksono (Commercial) (General Manager, PT IPTN)
Eddy Susilo (Production)
Sudjana Sapiie (Engineering and Technology)
EXECUTIVE VICE-PRESIDENT, SALES AND MARKETING:
Heru Santoso
VICE-PRESIDENT, N-250 PROGRAMME: Djoko Sartono
VICE-PRESIDENT, CN-235 PROGRAMME: Herri Poernomo
VICE-PRESIDENT, FIXED WING: Faqih Zuhdi
VICE-PRESIDENT, ROTARY WING: Bambang Wahyudi
PRESS RELATIONS MANAGER: Soleh Affandi
US SUBSIDIARY: **IPTN North America Inc**, 1035 Andover Park West, Suite B, Tukwila, Seattle, Washington 98188-7681
Telephone: 1 (206) 575 6507
Fax: 1 (206) 575 0318

Originally formed by Indonesian government as PT Industri Pesawat Terbang Nurtanio (Nurtanio Aircraft Industry Ltd) 23 August 1976 to centralise all aerospace facilities in one company, capital formed by combining assets of Pertamina Advanced Technology and Aeronautical Division and Nurtanio Aircraft Industry (LIPNUR; see 1977-78 *Jane's*); present name adopted late 1985. Workforce 15,800 in early 1995; factory area 70 ha (173 acres) including 600,000 m² (6,458,340 sq ft) covered area.

Fixed Wing Division currently co-manufactures CN-235 with CASA (see Airtech in International section), produces CASA C-212 Aviocar (see under Spain) under licence, and is developing indigenous N-250-100 regional airliner. Agreement 19 June 1991 with BAe to collaborate on production and assembly of Hawks for Indonesian Air Force; discussions with BAe have included possibility of transferring Jetstream 31 production to Indonesia.

Rotary Wing Division is responsible for licence production of Eurocopter BO 105 and Super Puma (as NBO-105 and NAS-332 respectively), and Bell 412 (as NBell-412). New agreement with Bell Spring 1995 will increase production of 412HP and extend IPTN range to include Bell 407T and 430.

Weapon System Division in Menang Tasikmalaya, West Java (plus smaller plant at Batu Poron, Madura), develops and produces weaponry for IPTN military aircraft.

Subcontract work includes production of components for Boeing 737 and 767, Fokker 100 (first of 280 shipsets delivered 15 April 1993) and Lockheed Fort Worth F-16; surveillance improvement programme under way on three Boeing 737 Surveillers of Indonesian Air Force; 1,393 m² (15,000 sq ft) maintenance centre can maintain, overhaul and repair Allison 250, P&W JT8D, RR Dart RDa.7, AlliedSignal LTS101 and TPE331 and General Electric CT7 engines, plus some components of Allison T56 and RR Spey; repair and overhaul of CFM56, Allison AE 2100 and RR Tay to start in 1995.

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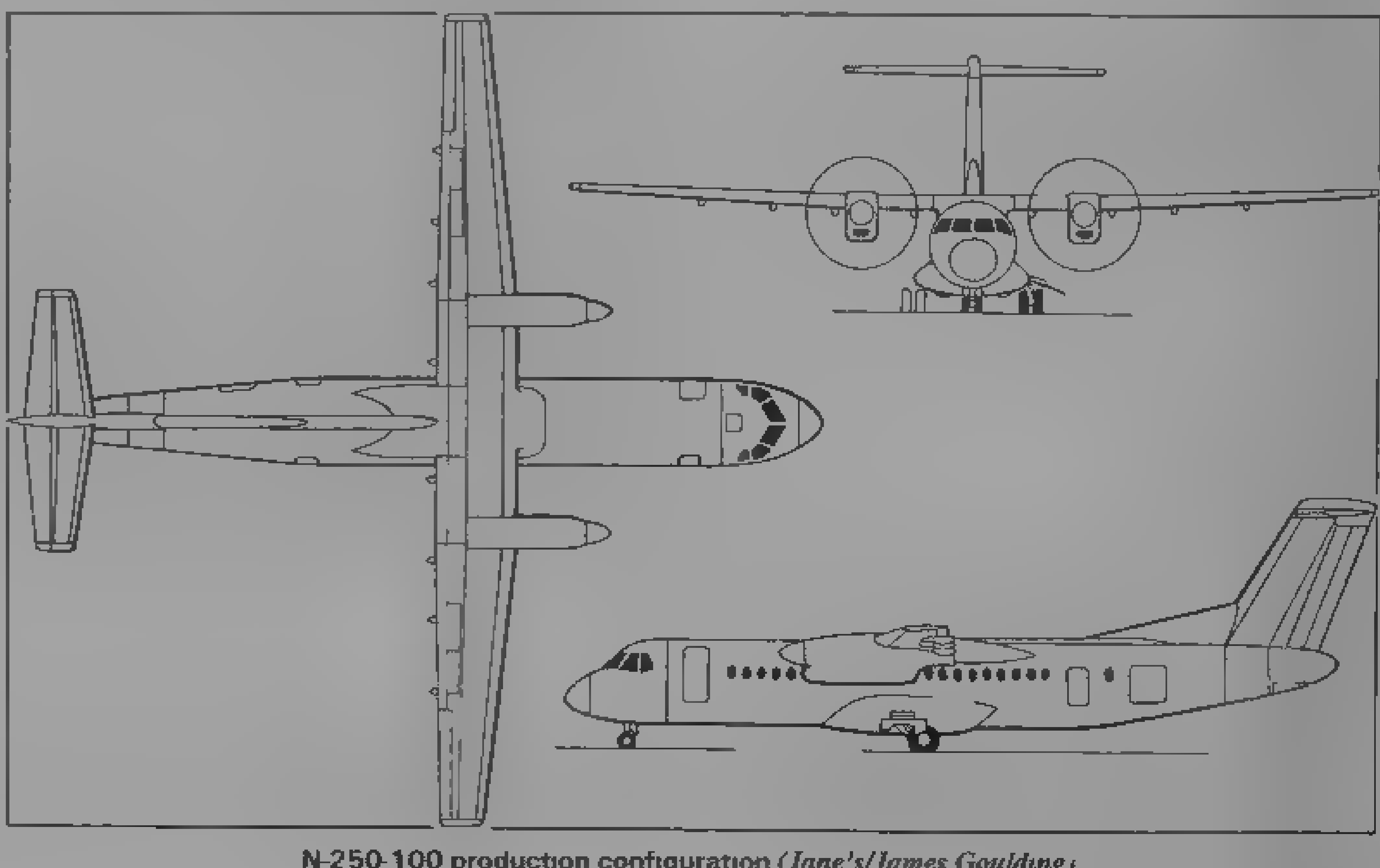


N-250-100 production configuration *(Jane's/James Goulding)* *1995*

The IPTN N-250 prototype, rolled out to public view on 10 November 1994

1995

IPTN N-250-100

TYPE: Twin-turboprop, pressurised 64/68-passenger regional transport

PROGRAMME: Project (Indonesia's first fully indigenously designed transport) announced at Paris Air Show June 1989; first metal cut August 1992, decided mid-1993 to launch with N-250-100 as 64/68 seat sized model instead of originally planned 50/54-seat N-250 (though first prototype to remain configured as 50-seater); this prototype (PK-XNG) rolled out 10 November 1994, first flight 10 August 1995, then three N-250-100 development aircraft (plus two static test), first of which planned to roll out in February 1996; first flight by a production aircraft planned for mid-1996; domestic and FAA certification and service entry (Indonesian regional airlines) mid-1997. Site being sought for possible second assembly line in USA.

CURRENT VERSIONS: **N-250**: First prototype only.

N-250-100: Production version, *description applies to this version except where indicated*. Fuselage 1.524 m (5 ft 0 in) longer than N-250 by 0.508 m (1 ft 8 in) insert forward and 1.016 m (3 ft 4 in) aft of wing; shorter engine nacelles. Passenger, cargo and combi versions to be offered.

CUSTOMERS: Orders by January 1995 from Merpati (five), Sempati (six), Bouraq (five) and Gulfstream International Airlines (10); options held at that date by Merpati (95), Sempati (10), Bouraq (60) and FFV (24). Total orders and options thus 26 + 189 = 215.

COSTS: Estimated $650 million (1994) for R&D up to certification. Standard aircraft priced (early 1995) at $14 million.

DESIGN FEATURES: Larger fuselage cross-section and longer cabin than CN-235, but no rear loading ramp; high wing has constant chord centre-section (thickness/chord ratio 17 per cent) and tapered outer panels (13 per cent thickness/chord ratio at tip); sweptback vertical tail surfaces with large dorsal fin; non-swept T tailplane; double-hinged rudder.

Wing is of modified NASA MD2 (root) and MD3 (tip) aerofoil sections, set at 2° incidence and having 3° dihedral and 3° twist on outboard panels.

FLYING CONTROLS: Lucas/Liebherr fully powered fly-by-wire control of flaps, ailerons, roll spoilers, elevators and rudder; standby fly-by-wire for rudder, mechanically signalled standby for ailerons and elevators. Fixed tailplane. Long span, fixed vane double-slotted Fowler flaps, with two-segment spoiler forward of each outer flap. Roll spoilers also function as ground spoilers.

STRUCTURE: Includes composites sandwich for flaps, spoilers, ailerons, elevators, rudder, wing/fin/tailplane tips and leading-edges, wingroot fairings, dorsal fin, tailcone, cowlings, radome and landing gear doors.

LANDING GEAR: Messier-ERAM hydraulically retractable tricycle type, with twin wheels and oleo-pneumatic shock absorbers on each unit. Main units retract into fairings on fuselage sides, nosewheel forward; nose unit has Lucas 'fly-by-wire' steering (±65°). Mainwheel tyres size 37 × 11.75 (16/14 ply rating), pressure 6.96 bars (101 lb/sq in); nosewheel tyres size H21 × 7.25 (8/12 ply rating), pressure 4.96 bars (72 lb/sq in). Dunlop steel disc brakes with digital anti-skid system.

POWER PLANT: Two 2,386 kW (3,200 shp) Allison AE 2100C turboprops, each driving a Dowty R384 six-blade propeller. Engines have Lucas Aerospace FADEC. All fuel in wings, inboard and outboard of nacelles. EICAS monitoring. Pressure refuelling point in starboard mainwheel fairing, plus overwing gravity point for each tank. Oil capacity 4.77 litres (1.26 US gallons, 1.05 Imp gallons).

ACCOMMODATION (N-250-100): Flight deck crew of two. Seating (four-abreast with central aisle) for 62 or 64 tourist class passengers at 81 cm (32 in) pitch, 68 at 76 cm (30 in) pitch, or 60 at 81 cm (32 in) with optional increase in cargo. One or two cabin attendants. Storage compartment at front of cabin on port side. Galley at front and toilet at rear of cabin, both on starboard side. Passenger airstair door at front on port side; service doors at front and rear on starboard side. Type III emergency exit at rear on port side. Large baggage compartment aft of main cabin, with door on starboard side. Additional bulk storage in underfloor compartment, also with external access.

SYSTEMS: Dual Hamilton Standard R90-3WR environmental control systems, pressurised by engine bleed air and APU (maximum pressure differential 0.41 bar; 6.0 lb/sq in). Three hydraulic systems, each at 207 bars (3,000 lb/sq in) pressure. Electrical system has a 40 kVA dual-channel, variable-speed, constant-frequency engine-driven generator to provide 115/200 V three-phase AC power at 400 Hz, with two transformer-rectifier units and two 43 Ah Ni/Cd batteries for 28 V DC normal and emergency power respectively. Rubber boot de-icing of wing, fin and tailplane leading-edges, Westland hot-air anti-icing system with FOD duct for engine intakes. Sundstrand APS-1000 APU. Flight Refuelling fuel management system.

AVIONICS: *Comms*: Two VHF 422, one HF 9000 and one TDR 94D (all Collins) standard, Avtech intercom and PA system, Antex ELT, Loral solid-state CVR. Third VHF 422 and Selcal optional.

Radar: Collins WXR 840 weather radar (TWR 850 optional).

Flight: Dual Collins AHS 85 AHRS, ADF 462, VOR 432 and ADC 850 air data systems, single Collins DME 442 and ALT 55B, Collins FCC 4004 AFCS, SFIM solid state FDR, Sundstrand Mk V GPWS. Second DME 442 and ALT 55B, and TCAS, optional.

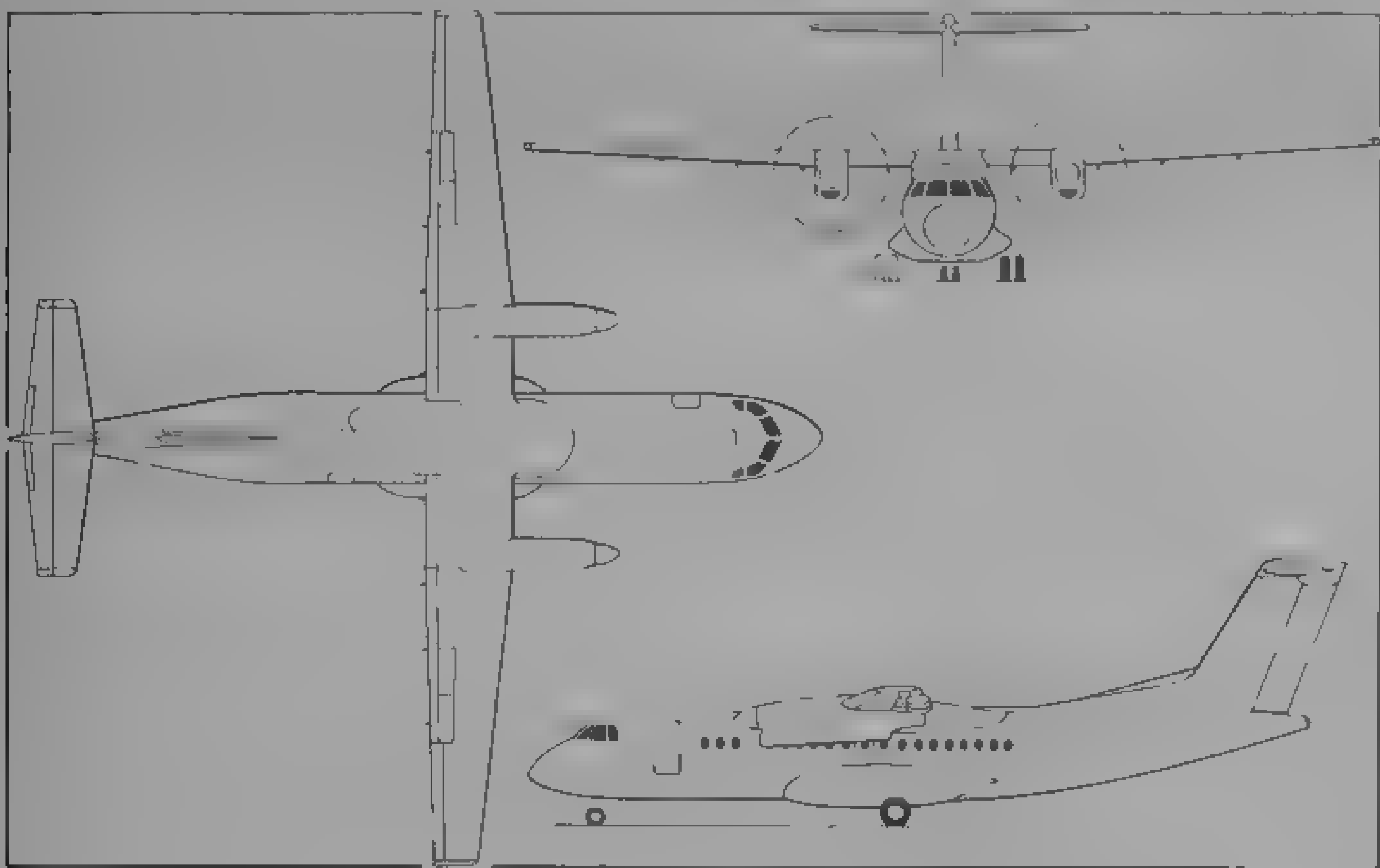
Instrumentation: Collins Pro Line IV EFIS (four CRTs, and EICAS (one CRT); sixth CRT for GPS optional.

DIMENSIONS, EXTERNAL (N-250 and N-250-100, except where indicated):

Wing span	28.00 m (91 ft 10¼ in)
Wing chord: at root	2.80 m (9 ft 2¼ in)
at tip	1.45 m (4 ft 9 in)
Wing aspect ratio	12.06
Length overall: 250	26.629 m (87 ft 4½ in)
250-100	28.153 m (92 ft 4¼ in)
Fuselage length: 250	25.25 m (82 ft 10 in)
250-100	26.774 m (87 ft 10 in)
Fuselage max diameter	2.90 m (9 ft 6¼ in)
Height overall	8.785 m (28 ft 9¾ in)
Tailplane span	9.04 m (29 ft 8 in)
Wheel track (c/l of shock struts)	4.10 m (13 ft 5¼ in)
Wheelbase: 250	9.745 m (31 ft 11⅝ in)
250-100	10.253 m (33 ft 7⅝ in)
Propeller diameter	3.81 m (12 ft 6 in)
Distance between propeller centres	7.67 m (25 ft 2 in)
Passenger door (fwd, port): Height	1.75 m (5 ft 9 in)
Width	0.78 m (2 ft 6¾ in)
Height to sill	1.635 m (5 ft 4½ in)
Service doors (fwd and rear, stbd, each):	
Height	1.397 m (4 ft 7 in)
Width	0.61 m (2 ft 0 in)
Height to sill	1.635 m (5 ft 4½ in)
Baggage door (rear, stbd): Height	1.36 m (4 ft 5½ in)
Width	1.12 m (3 ft 8 in)
Height to sill	1.76 m (5 ft 9¼ in)
Emergency exit (rear, port): Height	0.915 m (3 ft 0 in)
Width	0.61 m (2 ft 0 in)

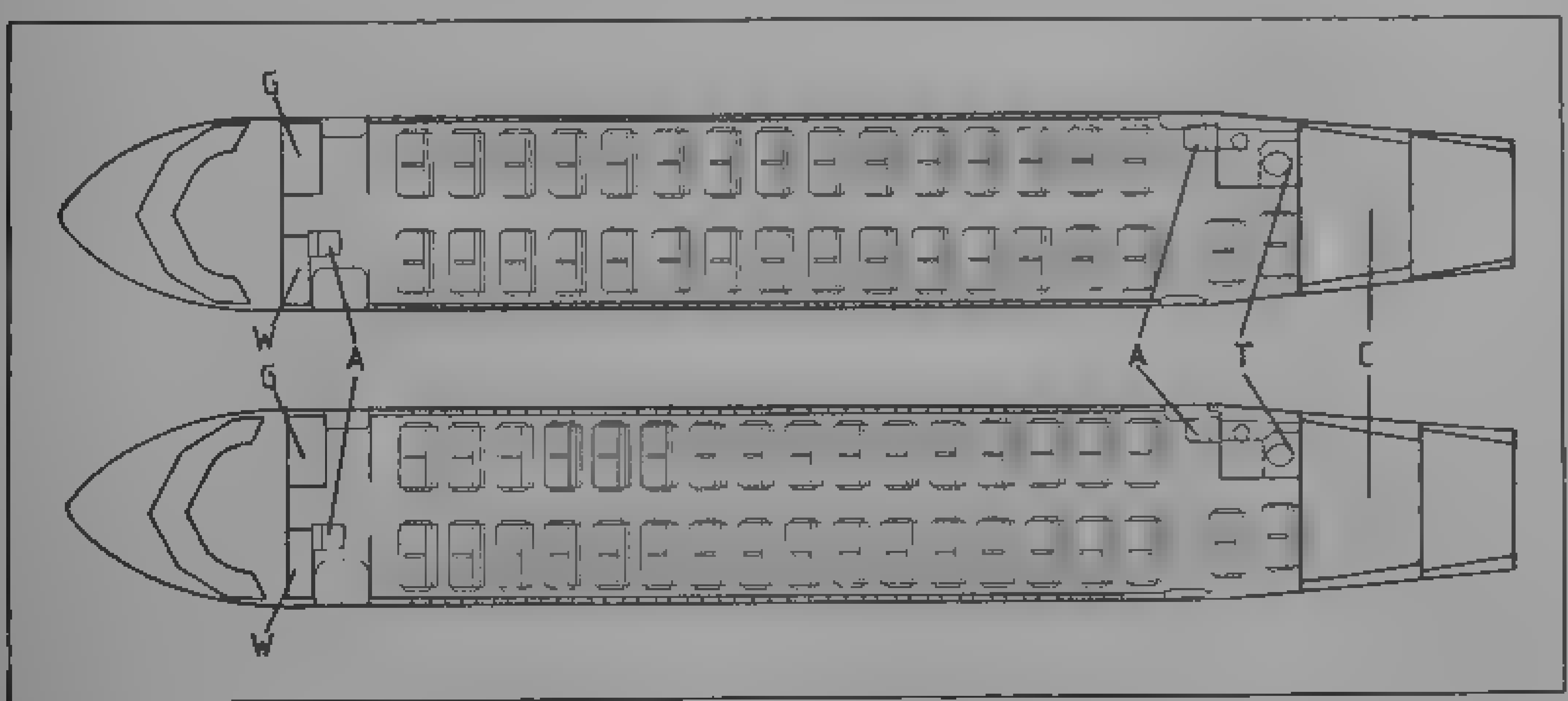
DIMENSIONS, INTERNAL:

Cabin: Length	13.23 m (43 ft 5 in)
Max width	2.70 m (8 ft 10¼ in)
Width at floor	2.41 m (7 ft 10¾ in)
Max height	1.925 m (6 ft 3¾ in)
Main baggage compartment	11.05 m³ (390.2 cu ft)
Underfloor bulk storage	0.60 m³ (21.2 cu ft)



The short-fuselage 50-seat N-250 prototype (*Jane's/Cliff Minney*)

1995



N-250-100 typical 64-seat (top) and 68-seat layouts

A: attendant's seat, C: cargo, G: galley, T: toilet, W: wardrobe

1995

AREAS

Wings, gross	65 00 m² (699 7 sq ft)
Vertical tail surfaces (total	14 722 m² (158 47 sq ft)
Horizontal tail surfaces (total)	16 31 m² (175 56 sq ft)

WEIGHTS AND LOADINGS

Typical operating weight empty,	
250	13,665 kg (30 126 lb)
250-100	15,700 kg (34,612 lb)
Max fuel weight 250, 250-100	4,200 kg (9,259 lb)
Max payload: 250	6,000 kg (13,227 lb)
250-100	6 200 kg (13,668 lb)
Max ramp weight 250	22,100 kg (48,722 lb)
250-100	24,900 kg (54,895 lb)
Max T-O weight: 250	22,000 kg (48,501 lb)
250-100	24,800 kg (54,674 lb)
Max landing weight 250	21,800 kg (48,060 lb)
250-100	24,600 kg (54 233 lb)
Max zero-fuel weight 250	19 665 kg (43,353 lb)
250-100	21 900 kg (48 281 lb)
Max wing loading 250	338.5 kg/m² (69 3 lb/sq ft)
250-100	381 5 kg/m² (78 1 lb/sq ft)
Max power loading 250	4 61 kg/kW (7 58 lb/shp)
250-100	5 20 kg/kW (8 54 lb/shp)

PERFORMANCE (N 250, estimated

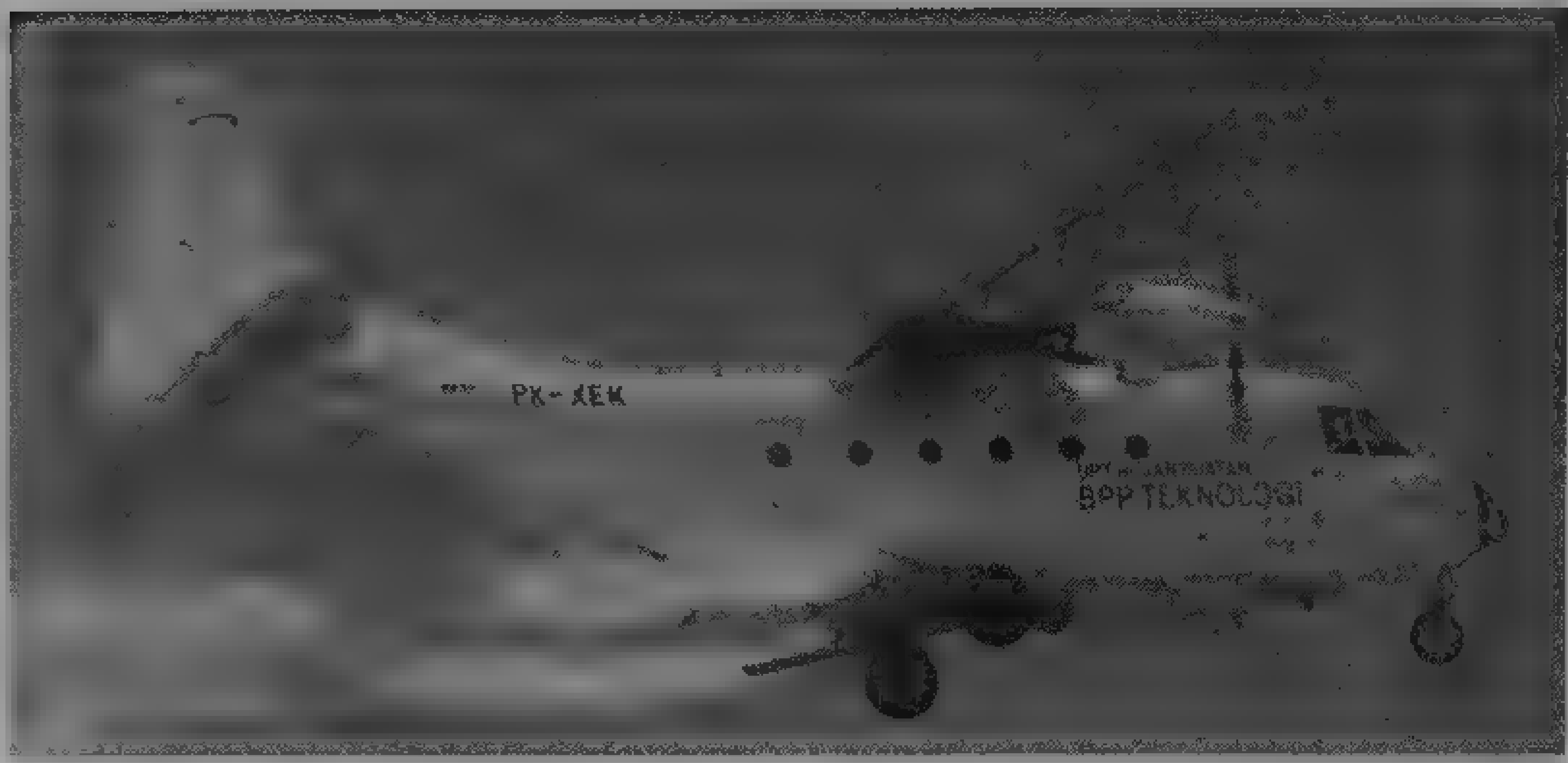
Max cruising speed at 7 620 m (25 000 ft) ISA	330 kts (611 km/h, 380 mph)
Econ cruising speed at 6 100 m (20,000 ft)	300 kts (556 km/h, 345 mph)
Stalling speed, power off	
flaps up	105 kts (195 km/h, 121 mph) EAS
20° flap	90 kts (167 km/h, 104 mph) EAS
Max rate of climb at S/L	600 m (1,968 ft)/min
Rate of climb at S/L, OEI	240 m (787 ft)/min
Service ceiling	7,620 m (25,000 ft)
Service ceiling OEI	5,180 m (17,000 ft)
T-O and landing balanced field length at S/L, ISA + 20°C	1,220 m (4,000 ft)
Range with max payload	686 n miles (1,270 km, 789 miles)
Max range with 50 passengers	
basic	800 n miles (1,481 km, 920 miles)
optional	1,100 n miles (2,037 km, 1,266 miles)

UPDATED

IPTN (CASA) NC-212-200 AVIOCAR

Aviocar manufactured under licence in Indonesia as NC-212 since 1976, IPTN produced 29 NC-212-100 before switching to NC-212-200 Roles include civil passenger and cargo (including quick-change VIP), LAPES (low-altitude parachute extraction system) airdropping, military transport, SAR, maritime patrol, medevac, photographic, survey and rain-making. See table for customer deliveries

UPDATED



Rain-making NC-212-200 operated by BPP Teknologi

1995

IPTN (EUROCOPTER) NBO-105

Manufactured under licence from MBB (now Eurocopter) as NBO-105 since 1976; only rotors and transmission now supplied from Germany, originally **NBO-105CB**, but stretched **NBO-105S** introduced from 101st aircraft onwards, **NBO-105MPDS** (multipurpose delivery system) can carry 50 to 81 mm unguided rockets, single or twin 0.30 in or 0 50 in machine gun pods, and reconnaissance or FLIR pods. Also available in **FAC** (forward air control) version See table for customer deliveries

UPDATED

Search and rescue NBO-105 of the Indonesian Air Force

1993

IPTN AIRCRAFT DELIVERIES
(at 1 January 1995)

Country	Operator	* CN-235	NC-212	NBO-105	NSA-330	NAS-332	NBell-412	NBK-117	Total
Indonesia	Airfast		2				2		4
	Air Force	6	10		7				23
	Army		4	22			4		30
	Asahi Mantrust		6						6
	Bakrie Brothers			1					1
	Borsumey Wehrı			1					1
	Bouraq Airlines		3						3
	BPP Teknologi		6						6
	Deraya Air Charter		4						4
	Dirgantara Air Service		2						2
	Forestry Dept			10					10
	Freeport						2		2
	Gatari						2		2
	Gudang Garam			2				1	3
	Gunung Madu			2					2
	Immigration Directorate			1					1
	Merpati Nusantara Airlines	15	22						37
	Navy		11	7		4	4		26
	Pelita Air Service		13	36	4	4			57
	Pilot Training Curug		3	5					8
	PLN/National Electric Co						1		1
	Police			16					16
	Sabang Merauke Air Charter		4						4
	Sampoerna			1					1
	SAR			2					2
	State Secretary					2		2	4
	Transindo						1		1
	Transportation Dept			1					1
	Trigana						2		2
	Sub-totals	**21**	**90**	**107**	**11**	**10**	**18**	**3**	**260**
Malaysia	Air Force					1			1
Thailand	Agricultural Dept		5						5
UAE	Air Force	7							7
USA	Guahan Airways (Guam)		2						2
	Totals	**28**	**97**	**107**	**11**	**11**	**18**	**3**	**275**

* For full CN-235 customer list see under Airtech in International section

IPTN (EUROCOPTER) NAS 332 SUPER PUMA

Assembly of 11 AS 330J Pumas began 1981, switched to AS 332C and L Super Puma in early 1983, first NAS 332 for Pelita Air Service rolled out 22 April 1983; deliveries include four as commando and general purpose transports for Indonesian Navy. Available configurations include **ASW/MA** (anti submarine warfare/maritime attack). See table for customer deliveries

UPDATED

IPTN (BELL) NBELL-412

Licence agreement for Bell 412 (see Canadian section) signed November 1982, covers 100 helicopters, production started 1984 first flight April 1986. NBell-412HP now 40 per cent Indonesian manufactured. FN Herstal **EMA** (external mounting assembly) for 7 62 and 12 7 mm gun pods and 70 mm rocket pods, already certificated for Canadian and Italian Agusta built Bell 412s, qualified for NBell-412 and fitted to several helicopters. **CAS** (close air support) configuration also available. See table for customer deliveries

UPDATED

IPTN built NBell-412 twin-turboshaft helicopter

1995

OTHER AIRCRAFT

See under Airtech in International section for details of CASA-IPTN **CN-235** twin-turboprop military and civil transport.

NEW ENTRY

INTERNATIONAL PROGRAMMES

AERMACCHI/DASA

PARTICIPATING COMPANIES:
Aermacchi: see under Italy
Daimler-Benz Aerospace: see under Germany

Development of the AT-2000 advanced jet trainer was suspended in 1994, see 1994-95 *Jane's* for basic data

UPDATED

AIRBUS

AIRBUS INDUSTRIE

1 Rond Point Maurice Bellonte, F-31707 Blagnac Cedex, France
Telephone: 33 61 93 33 33
Fax: 33 61 93 37 92
Telex: AIRBU 530526 F
PARIS OFFICE: 12bis avenue Bosquet, F-75007 Paris, France
Telephone: 33 (1) 45 51 40 95
CHAIRMAN OF SUPERVISORY BOARD: Edzard Reuter
VICE-PRESIDENT OF SUPERVISORY BOARD: Louis Gallois
MANAGING DIRECTOR: Jean Pierson
COO: Volker von Tein
SENIOR VICE-PRESIDENT COMMERCIAL: John Leahy
SENIOR VICE-PRESIDENT INDUSTRIAL AND PROGRAMMES: Rolf Feddersen
GENERAL MANAGER PRESS AND INFORMATION SERVICES: Barbara Kracht
AIRFRAME PRIME CONTRACTORS:
Aerospatiale: see under France
Daimler-Benz Aerospace Airbus: see under Germany
British Aerospace Airbus: see under UK
CASA: see under Spain

Airbus Industrie set up December 1970 as Groupement d'Intérêt Economique to manage development, manufacture, marketing and support of A300; this management now extends to A300-600, A310, A319, A320, A321, A330, A340 and A3XX

Airbus Industrie responsible for all work on these programmes by partner companies and has about 2,700 employees, including workers at its spare parts centre in Hamburg and its US subsidiary; about 35,000 more are directly employed on Airbus work within its four partners. Aerospatiale has 37 9 per cent interest in Airbus Industrie, Daimler-Benz Aerospace Airbus 37 9 per cent, British Aerospace Airbus 20 per cent, CASA 4.2 per cent. Fokker is an associate in A300 and A310 and Belairbus (Belgian consortium) in A310, A320, A330 and A340. Alenia of Italy manufactures front fuselage plug for A321

Airbus Industrie deliveries declined from 163 in 1991 to 157 in 1992, 138 in 1993 and 123 in 1994. Cancellations by end of 1993 appeared to total 28. New orders totalled 125 in 1994 compared with 38 in 1993. First A340 delivered to Air France in March 1993 was 1,000th Airbus airliner. Total order backlog at end 1994, not including subsequent changes, was 615, valued at $51 8 billion. Planned output is 138 aircraft in 1995 and 154 in 1996

Subsidiaries include Aeroformation, Airbus Industrie of North America, Airbus Finance Company (AFC) formed in 1994, Airbus Training Centre (Miami) and Airbus Industrie China. Airbus Industrie's training centre in Toulouse, previously a subsidiary known as Aeroformation, and the main spares centre, formerly Airspares Hamburg, have been integrated within the consortium's Customer Services Directorate

In March 1994, Airbus signed an agreement with Indonesia's IPTN to assist in flight testing of N-250-100 turboprop transport (see under Indonesia) between end 1994 and certification in 1997

Airbus Industrie joined its four member companies in March 1993 in studying Very Large Commercial Transport (see UHCA/VLCT/NLA in this section) with Boeing. Agreement of 1995 provides for Airbus Industrie to manufacture EuroFLA military transport (which see).

Refer also to SATIC (later in this section) for A300-600ST Super Transporter

UPDATED

TOTALS OF AIRBUS AIRLINERS
At 30 June 1995

	A300	A310	A319	A320	A321	A330	A340	Totals
Firm orders	474	259	81	666	157	115	144	1,896
Delivered	441	250	—	504	27	28	62	1,312
Operating	429	247	—	500	27	28	61	1,292
AIRBUS ORDERS and DELIVERIES in 1994								
Firm orders	—	—	42	33	20	—	30	125
Delivered	23	2	—	48	16	9	25	123
AIRBUS ORDERS and DELIVERIES, January-March 1995								
Firm orders (net)	2	2	30	8	9	(−3)	(−1)	47
Delivered	10	2	—	23	11	18	15	79

AIRBUS A300-600

TYPE: Large-capacity wide-bodied medium/long range commercial airliner

PROGRAMME: Launched May 1969, initial variants were A300B1 (first flight 28 October 1972, service entry May 1974: see 1971-72 *Jane's* for details), A300B2 and A300B4 (248 built: see 1984-85 and previous editions); A300-600 go-ahead December 1980; first flight (F-WZLR) 8 July 1983, certificated (with JT9D-7R4H1 engines) 9 March 1984, first delivery (to Saudia) 26 March 1984

Improved version with CF6-80C2 engines and other changes (see Current Versions) made first flight 20 March 1985. French certification for Cat IIIb take-offs and landings 26 March 1985, first delivery of improved version (to Thai Airways) 26 September 1985. Extended range A300-600R (then known as -600ER) made first flight 9 December 1987, receiving European and FAA certification 10 and 28 March 1988 respectively, deliveries (to American Airlines) beginning 20 April 1988. A300-600 powered by GE CF6-80C2A5 with FADEC granted full 180 minutes ETOPS April 1994

CURRENT VERSIONS: **A300-600**: Advanced version of A300B4-200, major production version since early 1984. Passenger and freight capacity increased by fitting rear fuselage of A310 with pressure bulkhead moved aft; wings have simple Fowler flaps and increased trailing-edge camber; forward-facing two-person flight deck with EFIS, new digital avionics; new braking control system; new APU, simplified systems; weight saving by use of composites for some secondary structural components, payload/range performance and fuel economy improved by comprehensive drag clean up

Improved version: Introduced 1985. Has CF6-80C2 or PW4000 as engine options, carbon brakes, wingtip fences and 'New World' flight deck, basic equipment of aircraft delivered from late 1991 further improved by incorporating standard options. *Detailed description applies to this version except where indicated*

A300-600R: Extended range version of A300-600, differing mainly in having fuel trim tank in tailplane and higher maximum T-O weight

A300-600 Convertible: Convertible passenger/cargo version, described separately

A300-600 Freighter: Non passenger version, described separately

MRTT: Multirole tanker/transport conversions of early A300, A300-600, A310 and A340. See separate entry

Airbus Super Transporter: A300-600R conversion as Super Guppy replacement, see under SATIC later in this section

CUSTOMERS: See table above

DESIGN FEATURES: Mid mounted wings with 10 5 per cent thickness/chord ratio, 28° sweepback at quarter-chord, and (since 1985) tip fences; circular-section pressurised fuselage, all-swept tail unit

FLYING CONTROLS: Each wing has three-segment, two-position (T-O/landing) leading-edge slats (no cutout over engine pylon), small Krueger flap at leading-edge wingroot, three cambered tabless flaps on trailing-edge, all-speed aileron between inboard flap and outer pair, and seven spoilers forward of flaps on each wing; flaps occupy 84 per cent of trailing-edge, increasing wing chord by 25 per cent when fully extended, ailerons deflect 9° 2' downward automatically when flaps are deployed all 14 spoilers used as lift dumpers, outboard 10 for roll control and inboard 10 as airbrakes, variable incidence tailplane. Ailerons/elevators/rudder fully powered by hydraulic servos (three per surface), controlled mechanically, secondary surfaces (spoilers/flaps/slats) fully powered hydraulically with electrical control, tailplane by two independent hydraulic motors electrically controlled with additional mechanical input, preselection of spoiler/lift dump lever permits automatic extension of lift dumpers on touchdown, flaps and slats have similar drive mechanisms, each powered by twin motors driving ball screwjacks on each surface with built in protection against asymmetric operation

STRUCTURE: Two-spar main wing box, integral with fuselage and incorporating fail-safe principles; third spar across inboard sections; semi-monocoque fuselage (frames and

Airbus A300-600R twin-turbofan extended-range airliner in the insignia of Iran Air

1995

open Z-section stringers), with integrally machined skin panels in high-stress areas, primary structure is of high strength, damage tolerant aluminium alloy, with steel or titanium for some critical fuselage components, honeycomb panels or selected glassfibre laminates for secondary structures, metal slats, flaps and ailerons. CFRP fins replaced aluminium alloy unit from 1988, secondary structure composites include AFRP for flap track fairings, rear wing/body fairings, cooling air inlet fairings and radome, GFRP for wing upper surface panels above mainwheel bays, fin leading/trailing-edges, fin-tip, fin/fuselage fairings, tailplane trailing-edges, elevator leading-edges, tailplane and elevator tips and elevator actuator access panel; carbon reinforced GFRP for elevators and rudder. CFRP for spoilers, outer flap deflector doors and fin box; all CFRP moving surfaces have aluminium or titanium trailing-edges. Nosewheel doors and mainwheel leg fairing doors also of CFRP. Nose gear is structurally identical to that of B2/B4/A310, main gear is generally reinforced with a new hinge arm and a new pitch damper hydraulic and electrical installation. Nacelles have CFRP cowling panels and are subcontracted to Rohr (California); pylon fairings are of AFRP.

Aerospatiale builds nose (including flight deck), lower centre-fuselage, four inboard spoilers, wing/body fairings and engine pylons, Daimler-Benz Aerospace Airbus builds forward fuselage (flight deck to wing box), upper centre fuselage, rear fuselage (including tailcone), vertical tail, 10 outboard spoilers and some cabin doors, it also equips wings and installs interiors and seats, BAe designed wings and builds wing box, CASA manufactures horizontal tail, port and starboard forward passenger doors and main wheel/nosewheel doors; Fokker produces wingtips, ailerons, flaps, slats and main gear leg fairings. Large, fully equipped and inspected airframe sections shipped by Super Guppy to Aerospatiale at Toulouse for final assembly and painting, aircraft then being flown to Hamburg for outfitting and returned to Toulouse for final customer acceptance.

LANDING GEAR: Hydraulically retractable tricycle type, of Messier-Bugatti design, with Messier-Bugatti/Liebherr/Dowty shock absorbers and wheels standard. twin-wheel nose unit retracts forward, main units inward into fuselage; free-fall extension, has four-wheel main bogies, interchangeable left with right. Standard bogie size is 927 × 1,397 mm (36½ × 55 in); wider bogie of 978 × 1,524 mm (38½ × 60 in) is optional. Mainwheel tyres size 49 × 17-20 (standard) or 49 × 19-20 (wide bogie), with respective pressures of 12.4 and 11.1 bars (180 and 161 lb/sq in). Nosewheel tyres size 40 × 14-16, pressure 9.4 bars (136 lb/sq in). Steering angles 65°/95°. Messier-Bugatti/Liebherr/Dowty hydraulic disc brakes standard on all mainwheels. Normal braking powered by 'green' hydraulic system, controlled electrically through two master valves and monitored by a brake system control box to provide anti-skid protection. Standby braking (powered automatically by 'yellow' hydraulic system if normal 'green' system supply fails) controlled through a dual metering valve; anti-skid protection is ensured through same box as normal system, with emergency pressure supplied to brakes by accumulators charged from 'yellow' system. Automatic braking system optional. Bendix or Goodrich wheels and brakes available optionally. Minimum ground turning radius (effective, aft CG) 22.00 m (72 ft 2¼ in) about nosewheel, 34.75 m (114 ft 0 in) about wingtips.

POWER PLANT: Two turbofans in underwing pods. A300-600 was launched with 249 kN (56,000 lb st) Pratt & Whitney JT9D-7R4H1 and currently available with 249 kN (56,000 lb st) Pratt & Whitney PW4156 or 262.4 kN (59,000 lb st) General Electric CF6-80C2A1. A300-600R is offered with 273.6 kN (61,500 lb st) CF6-80C2A5 or 258 kN (58,000 lb st) PW4158. CF6-80C2A5 and PW4158 also available as options on A300-600. Fuel in two integral tanks in each wing, and fifth integral tank in wing centre section, giving standard usable capacity of 62,000 litres (16,379 US gallons; 13,638 Imp gallons). Additional 6,150 litre (1,625 US gallon; 1,353 Imp gallon) fuel/trim tank in tailplane (-600R only) increases this total to 68,150 litres (18,004 US gallons; 14,991 Imp gallons). Optional extra fuel cell in aft cargo hold can increase total to 75,350 litres (19,906 US gallons, 16,575 Imp gallons) in -600R. Two standard refuelling points beneath starboard wing; similar pair optional under port wing.

ACCOMMODATION: Crew of two on flight deck, plus two observers' seats. Passenger seating in main cabin in six-, seven-, eight- or nine-abreast layout with two aisles, typical mixed class layout has 266 seats (26 first class and 240 economy), six/eight-abreast at 96/86 cm (40/32 in) seat pitch with two galleys and two toilets forward, one galley and two toilets in mid-cabin, and one galley and two toilets at rear; typical economy class layout for 289 passengers eight-abreast at 86 cm (34 in) pitch. Maximum capacity (subject to certification) 375 passengers. Closed overhead baggage lockers on each side (total capacity 10.48 m³, 370 cu ft) and in double-sided central 'super-bin' installation (total capacity 14.50 m³, 512 cu ft), giving 0.03 to 0.09 m³ (1.2 to 3.2 cu ft) per passenger in typical economy layout.

Two outward parallel-opening Type A plug type passenger doors ahead of wing on each side, and one on each side at rear. Type I emergency exit on each side aft of wing. Underfloor baggage/cargo holds fore and aft of wings, with doors on starboard side, forward hold can accommodate 12 LD3 containers, or four 2.24 × 3.17 m (88 × 125 in) pallets or, optionally, 2.43 × 3.17 m (96 × 125 in) pallets, or engine modules, rear hold can accommodate 10 LD3 containers, additional bulk loading of freight provided for in an extreme rear compartment with usable volume of 17.3 m³ (611 cu ft); alternatively, rear hold can carry 11 LD3 containers, with bulk cargo capacity reduced to 9.0 m³ (318 cu ft), bulk cargo compartment can be used to transport livestock. Entire accommodation is pressurised, including freight, baggage and avionics compartments.

SYSTEMS: Air supply for air conditioning system taken from engine bleed and/or APU via two high pressure points; conditioned air can also be supplied direct to cabin by two low pressure ground connections, ram air inlet for fresh air ventilation when packs not in use. Pressure control system (maximum differential 0.574 bar, 8.32 lb/sq in) consists of two identical, independent, automatic systems (one active, one standby), automatic switchover from one to other after each flight and in case of active system failure, in each system, pressure controlled by two electric outflow valves, function depending on preprogrammed cabin pressure altitude and rate of change of cabin pressure, aircraft altitude, and preselected landing airfield elevation. Automatic pre-pressurisation of cabin before take-off, to prevent noticeable pressure fluctuation during take-off. Modular box system provides passenger oxygen to all installation areas.

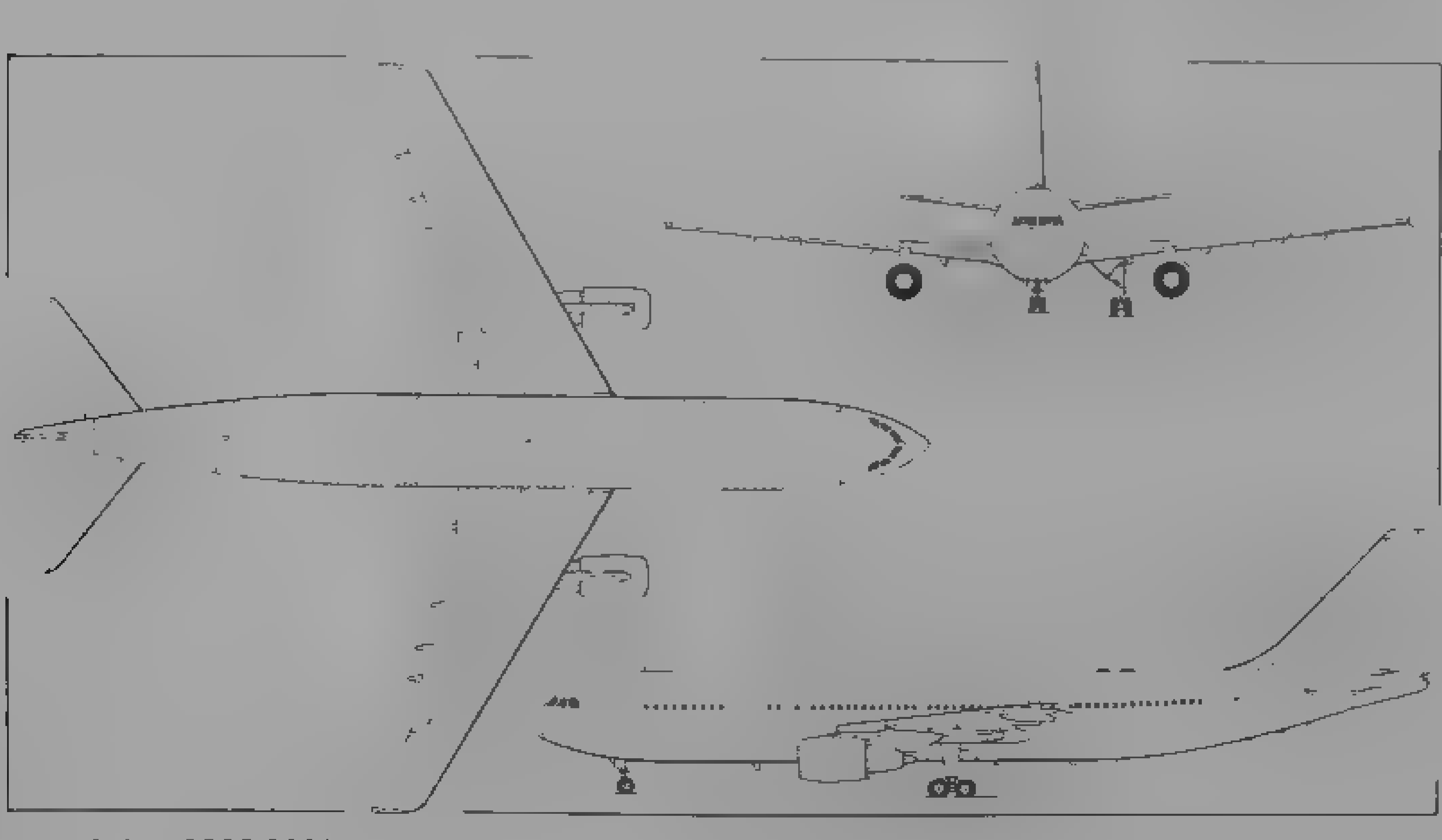
Hydraulic system comprises three fully independent circuits, operating simultaneously, each system includes reservoir of direct air/fluid contact type, pressurised at 3.5 bars (51 lb/sq in), fire resistant phosphate ester type fluid, nominal output flow 136 litres (35.9 US gallons, 30 Imp gallons)/min delivered at 207 bars (3,000 lb/sq in) pressure; 'blue' and 'yellow' systems have one pump each, 'green' system has two pumps. The three circuits provide triplex power for primary flying controls, if any circuit fails, full control of aircraft is retained without any necessity for action by crew. All three circuits supply ailerons, rudder and elevators, 'blue' circuit additionally supplies spoiler 7, spoiler/airbrake 4, airbrake 1, yaw damper and slats, 'green' circuit additionally supplies spoiler 6, flaps, Krueger flaps, slats, landing gear, wheel brakes, steering, tailplane trim, artificial feel, and roll/pitch/yaw autopilot, 'yellow' circuit additionally supplies spoiler 5, spoiler/airbrake 3, airbrake 2, flaps, wheel brakes, cargo doors, artificial feel, yaw damper, tailplane trim, and roll/pitch/yaw autopilot. Ram air turbine pump provides standby hydraulic power should both engines become inoperative.

Main electrical power supplied under normal flight conditions by two integrated drive generators, one on each engine; third (auxiliary) generator, driven by APU, can replace either of main generators, having same electromagnetic components but not constant-speed drive, each generator rated at 90 kVA, with overload ratings of 112.5 kVA for 5 minutes and 150 kVA for 5 seconds, APU generator driven at constant speed through gearbox. Three unregulated transformer-rectifier units (TRUs) supply 28 V DC power. Three 25 Ah Ni/Cd batteries used for emergency supply and APU starting, emergency electrical power taken from main aircraft batteries and emergency static inverter, providing single-phase 115 V 400 Hz output for flight instruments, navigation, communications and lighting when power not available from normal sources.

Hot air anti-icing of engines, engine air intakes, and outer segments of leading-edge slats, electrical heating for anti-icing flight deck front windscreens, demisting flight deck side windows, and for sensors, pitot probes and static ports, and waste water drain masts.

AlliedSignal GTCP 331-250F APU in tailcone, exhausting upward; installation incorporates APU noise attenuation. Self-contained fire protection system, and firewall panels protect main structure from an APU fire. APU provides bleed air to pneumatic system, and drives auxiliary AC generator during ground and in-flight operation; APU drives 90 kVA oilspray-cooled generator, and supplies bleed air for main engine start or air conditioning system. For current deliveries of A300-600, APU has improved relight capability, and can be started throughout flight envelope.

For new A300-600s and -600Rs, two optional modifications offered for compliance with full extended range twin-engined operations (ETOPS) requirements



Airbus A300-600R wide-bodied transport (two GE CF6-80C2 turbofans) *(Jane's/Dennis Punnett)*

1986

hydraulically driven fourth generator and increased cargo hold fire suppression capability. ETOPS kit qualified for aircraft with CF6-80C2 and JT9D-7R series engines, and since mid 1988 for those with PW 4000 series.

AVIONICS: *Comms.* Standard communications radios include two VHF, with provision for a third, two HF, two transponders, one Selcal, interphone and passenger address systems, ground crew call system and cockpit voice recorder. Provision for Mode S transponders.

Radar: Weather radar standard, with provision for second.

Flight: Radio navigation avionics include two VOR, two ILS, two DME, one ADF, two marker beacon receivers and two radio altimeters, TCAS and GPWS. Most other avionics are to customer requirements, only those relating to the instrument landing system (Bendix/King or Collins ILS and Collins or TRT radio altimeter) being selected and supplied by the manufacturer. Two Honeywell digital air data computers standard, basic digital AFCS has dual flight control computers (FCCs) for flight director and autopilot functions (for Cat. III automatic landings), single thrust control computer (TCC) for speed and thrust control, and two flight augmentation computers (FACs) to provide yaw damping, electric pitch trim, and flight envelope monitoring and protection. Options include second FCC (for Cat. III automatic landing); second TCC, two flight management computers (FMCs) and two control display units for full flight management system. Basic aircraft also fitted with ARINC 717 data recording system with digital flight data acquisition unit, digital flight data recorder and three-axis linear accelerometer; optional additional level of windshear protection is available.

Instrumentation: Six identical and interchangeable CRT electronic displays (four electronic flight instrument system and two electronic centralised aircraft monitor), plus digitised electromechanical instruments with liquid crystal displays.

DIMENSIONS, EXTERNAL:
- Wing span: 44.84 m (147 ft 1 in)
- Wing aspect ratio: 7.73
- Length overall: 54.08 m (177 ft 5 in)
- Fuselage: Length: 53.30 m (174 ft 10¼ in)
  - Max diameter: 5.64 m (18 ft 6 in)
- Height overall: 16.53 m (54 ft 3 in)
- Tailplane span: 16.26 m (53 ft 4 in)
- Wheel track: 9.60 m (31 ft 6 in)
- Wheelbase (c/l of shock-absorbers): 18.60 m (61 ft 0 in)
- Passenger doors (each): Height: 1.93 m (6 ft 4 in)
  - Width: 1.07 m (3 ft 6 in)
  - Height to sill: forward: 4.60 m (15 ft 1 in)
    - centre: 4.80 m (15 ft 9 in)
    - rear: 5.50 m (18 ft 0½ in)
- Emergency exits (each): Height: 1.60 m (5 ft 3 in)
  - Width: 0.61 m (2 ft 0 in)
  - Height to sill: 4.87 m (15 ft 10 in)
- Underfloor cargo door (forward):
  - Height: 1.71 m (5 ft 7½ in)
  - Width: 2.69 m (8 ft 10 in)
  - Height to sill: 3.07 m (10 ft 1 in)
- Underfloor cargo door (rear):
  - Height: 1.71 m (5 ft 7½ in)
  - Width: 1.81 m (5 ft 11¼ in)
  - Height to sill: 3.41 m (11 ft 2¼ in)
- Underfloor cargo door (extreme rear):
  - Height (projected): 0.95 m (3 ft 1 in)
  - Width: 0.95 m (3 ft 1 in)
  - Height to sill: 3.56 m (11 ft 8 in)

DIMENSIONS, INTERNAL:
- Cabin, excl flight deck: Length: 40.21 m (131 ft 11 in)
  - Max width: 5.28 m (17 ft 4 in)
  - Max height: 2.54 m (8 ft 4 in)
- Underfloor cargo hold:
  - Length, forward: 10.60 m (34 ft 9¼ in)
    - rear: 7.95 m (26 ft 1 in)
    - extreme rear: 3.40 m (11 ft 2 in)
  - Max height: 1.76 m (5 ft 9 in)
  - Max width: 4.20 m (13 ft 9¼ in)
- Underfloor cargo hold volume:
  - forward: 75.1 m³ (2,652 cu ft)
  - rear: 55.0 m³ (1,942 cu ft)
  - extreme rear: 17.3 m³ (611 cu ft)

AREAS:
- Wings, gross: 260.0 m² (2,798.6 sq ft)
- Leading-edge slats (total): 30.30 m² (326.15 sq ft)
- Krueger flaps (total): 1.115 m² (12.00 sq ft)
- Trailing-edge flaps (total): 47.30 m² (509.13 sq ft)
- All-speed ailerons (total): 7.06 m² (75.99 sq ft)
- Spoilers (total): 5.396 m² (58.08 sq ft)
- Airbrakes (total): 12.59 m² (135.52 sq ft)
- Fin: 45.20 m² (486.53 sq ft)
- Rudder: 13.57 m² (146.07 sq ft)
- Tailplane: 44.80 m² (482.22 sq ft)
- Elevator (total): 19.20 m² (206.67 sq ft)

*WEIGHTS AND LOADINGS (A: CF6-80C2A1/A5 engines, B: PW4156/4158 engines, both in 266-seat configuration):
- Manufacturer's weight empty:
  - A (600): 79,210 kg (174,630 lb)
  - A (600R): 79,403 kg (175,055 lb)
  - B (600): 79,151 kg (174,500 lb)
  - B (600R): 79,318 kg (174,865 lb)
- Operating weight empty:
  - A (600): 90,115 kg (198,665 lb)
  - A (600R): 90,339 kg (199,165 lb)
  - B (600): 90,067 kg (198,565 lb)
  - B (600R): 90,265 kg (199,000 lb)
- Max payload (structural): A (600): 39,885 kg (87,931 lb)
  - A (600R): 39,661 kg (87,437 lb)
  - B (600): 39,993 kg (88,169 lb)
  - B (600R): 39,735 kg (87,600 lb)
- Underfloor cargo capacity (A and B):
  - containerised: 68,400 kg (150,795 lb)
  - bulk: 2,766 kg (6,100 lb)
- Max usable fuel:
  - 600: standard: 49,786 kg (109,760 lb)
  - 600R: standard: 54,721 kg (120,640 lb)
    - with optional cargo hold tank: 58,618 kg (129,230 lb)
- Max T-O weight (A and B):
  - 600: 165,000 kg (363,765 lb)
  - 600R (standard): 170,500 kg (375,885 lb)
  - 600R (option): 171,700 kg (378,535 lb)
- Max ramp weight (A and B):
  - 600: 165,900 kg (365,745 lb)
  - 600R (standard): 171,400 kg (377,870 lb)
  - 600R (option): 172,600 kg (380,520 lb)
- Max landing weight (A and B):
  - 600: 138,000 kg (304,240 lb)
  - 600R (standard): 140,000 kg (308,645 lb)
- Max zero-fuel weight (A and B):
  - 600, 600R (standard): 130,000 kg (286,600 lb)
- Max wing loading: 600: 635 kg/m² (130.0 lb/sq ft)
  - 600R (standard): 656 kg/m² (134.4 lb/sq ft)

* *Production aircraft from late 1991 onward. See 1989-90 and previous editions for earlier versions*

PERFORMANCE (at max T-O weight except where indicated, A and B as for Weights and Loadings):
- Max operating speed (V_{MO}) from S/L to 8,140 m (26,700 ft): 335 kts (621 km/h; 386 mph) CAS
- Max operating Mach number (M_{MO}) above 8,140 m (26,700 ft): 0.82
- Max cruising speed at 7,620 m (25,000 ft): 480 kts (890 km/h; 553 mph)
- Max cruising speed at 9,150 m (30,000 ft): Mach 0.82 (484 kts, 897 km/h; 557 mph)
- Typical long-range cruising speed at 9,450 m (31,000 ft): Mach 0.80 (472 kts, 875 km/h; 543 mph)
- Approach speed: 600: 135 kts (249 km/h; 155 mph)
  - 600R: 136 kts (251 km/h; 156 mph)
- Max operating altitude: 12,200 m (40,000 ft)
- Runway ACN for flexible runway, category B:
  - standard bogie and tyres: 600: 56
    - 600R: 59
    - 600R (option): 60
  - optional bogie and tyres: 600: 52
    - 600R: 55
    - 600R (option): 56
- T-O field length at S/L, ISA + 15°C:
  - 600: A: 2,280 m (7,480 ft)
    - B: 2,190 m (7,185 ft)
  - 600R: A (C2A5 engines): 2,290 m (7,520 ft)
    - B (PW4158 engines): 2,240 m (7,350 ft)
- Landing field length: 600: 1,536 m (5,040 ft)
  - 600R: 1,555 m (5,100 ft)
- Range (1991 and subsequent deliveries) at typical airline OWE with 266 passengers and baggage, reserves for 200 n miles (370 km; 230 miles): 600, GE engines: 3,700 n miles (6,852 km; 4,257 miles)
  - 600, PW engines: 3,650 n miles (6,759 km; 4,200 miles)
  - 600R, GE/PW engines, standard fuel: 4,050 n miles (7,500 km; 4,660 miles)
  - 600R, GE/PW engines, optional fuel: 4,150 n miles (7,685 km; 4,775 miles)

OPERATIONAL NOISE LEVELS (A300-600R, ICAO Annex 16, Chapter 3):
- T-O: A: 91.1 EPNdB (96.3 limit)
  - B: 92.2 EPNdB (96.3 limit)
- Sideline: A: 98.6 EPNdB (99.9 limit)
  - B: 97.7 EPNdB (99.9 limit)
- Approach: A: 99.8 EPNdB (103.3 limit)
  - B: 101.7 EPNdB (103.3 limit)

UPDATED

AIRBUS A300-600 CONVERTIBLE and A300-600 FREIGHTER

TYPE: Specialised versions of A300-600.

PROGRAMME: First flight of A300-600F 2 December 1993; A300-600F powered by GE CF6-80C2A5 with FADEC was first A300-600 version to operate with full 180 minutes ETOPS in May 1994.

CURRENT VERSIONS: **Convertible:** For all-passenger or mixed passenger/cargo configuration. Typical options include accommodation (in mainly eight-abreast seating) for maximum 375 passengers (subject to certification) on the upper deck, or 145 passengers (seven/eight-abreast) plus six 2.44 × 3.17 m (96 × 125 in) pallets, or 83 passengers plus nine 96 × 125 in pallets, up to twenty 2.24 × 3.17 m (88 × 125 in) pallets, or five 88 × 125 in plus nine 96 × 125 in pallets.

Freighter: For freighting only; no passenger systems provided, various systems options give airlines ability to adapt basic aircraft to specific freight requirements. Airbus offers conversion with port-side forward freight door.

CUSTOMERS: Federal Express became A300-600 Freighter launch customer July 1991 with order for 25, of which seven delivered by February 1995, commitments for 50 more.

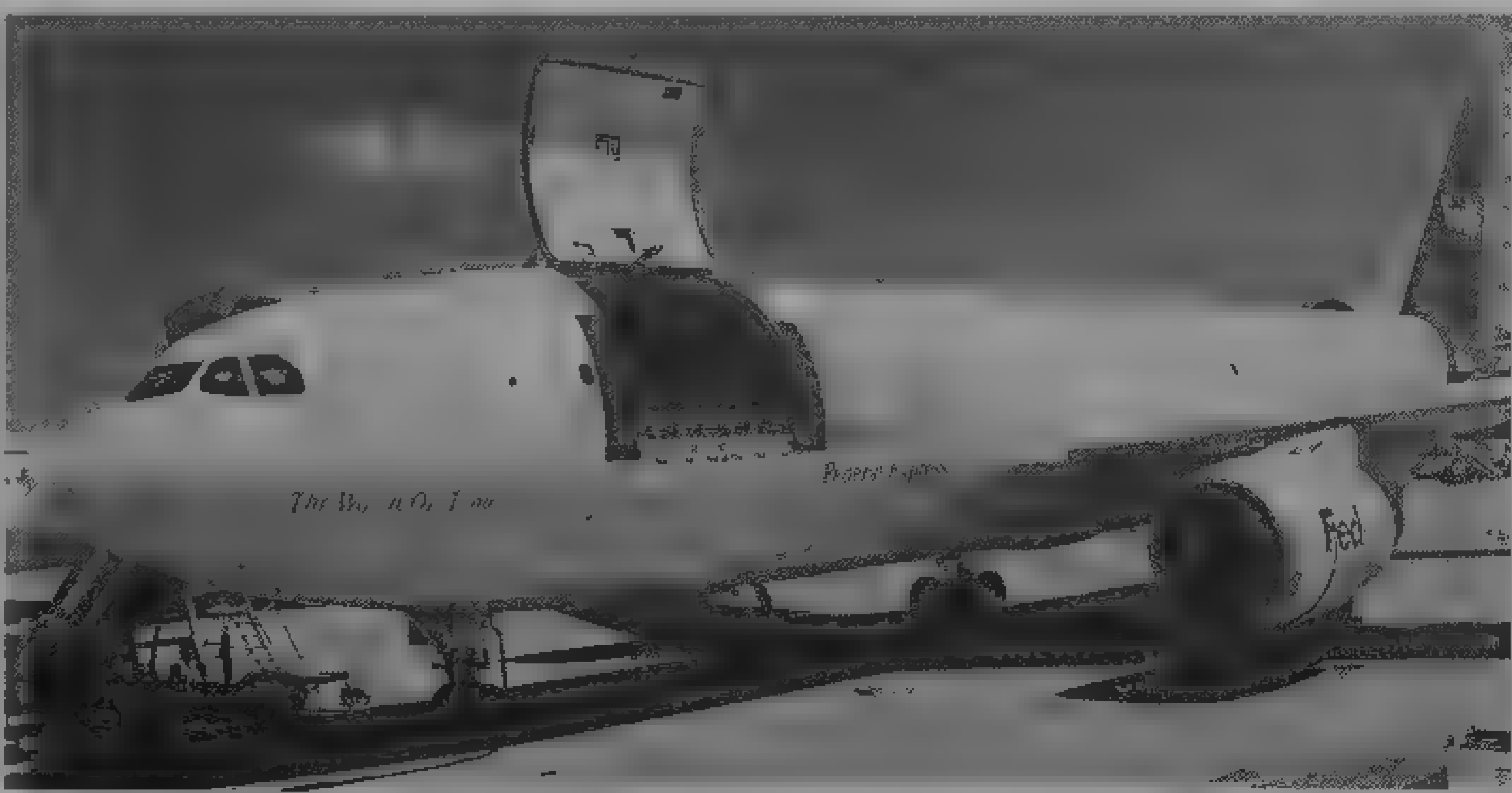
STRUCTURE: Generally similar to A300-600. Main differences are large forward port-side upper deck cargo door, reinforced cabin floor, smoke detection system in main cabin, upper deck cargo door is on opposite side to door of forward underfloor hold, allowing simultaneous loading or unloading at all positions.

POWER PLANT: Options as for A300-600R, first example was first Airbus aircraft powered by GE CF6-80C2A5 with FADEC.

DIMENSIONS, EXTERNAL: As A300-600R, plus:
- Upper deck cargo door (fwd, port):
  - Height (projected): 2.57 m (8 ft 5¼ in)
  - Width: 3.58 m (11 ft 9 in)
  - Height to sill: 4.91 m (16 ft 1 in)

DIMENSIONS, INTERNAL:
- Cabin upper deck usable for cargo:
  - Length: 33.45 m (109 ft 9 in)
  - Min height: 2.01 m (6 ft 7 in)
  - Max height:
    - ceiling trim panels in place: 2.22 m (7 ft 3¼ in)
    - without ceiling trim panels: 2.44 m (8 ft 0 in)
  - Volume: 192-203 m³ (6,780-7,169 cu ft)

WEIGHTS AND LOADINGS (basic Convertible: A with CF6-80C2A5 engines, B with PW4158 engines):
- Manufacturer's weight empty:
  - A, passenger mode: 81,900 kg (180,560 lb)
  - B, passenger mode: 81,820 kg (180,380 lb)
  - A, freight mode: 81,640 kg (179,985 lb)
  - B, freight mode: 81,560 kg (179,810 lb)
- Operating weight empty:
  - A, passenger mode: 92,160 kg (203,180 lb)
  - B, passenger mode: 92,100 kg (203,045 lb)
  - A, freight mode: 83,470 kg (184,020 lb)
  - B, freight mode: 83,410 kg (183,885 lb)
- Max payload (structural):
  - A, passenger mode: 37,840 kg (83,423 lb)
  - B, passenger mode: 37,900 kg (83,555 lb)
  - A, freight mode: 46,530 kg (102,580 lb)
  - B, freight mode: 46,590 kg (102,710 lb)



Open freight door of FedEx parcels transport A300

1995

A300-600 Freighter of Federal Express

1995

Max T-O weight, A, B	170,500 kg (375,900 lb)
Max landing weight, A, B	140,000 kg (308,650 lb)
Max zero-fuel weight, A, B	130,000 kg (286,600 lb)

WEIGHTS AND LOADINGS (basic Freighter variant of -600R):

Manufacturer's weight empty	
A	77,947 kg (171,840 lb)
B	77,874 kg (171,680 lb)
Operating weight empty: A	78,854 kg (173,840 lb)
B	78,781 kg (173,680 lb)
Max payload (structural)	
A, range mode	51,146 kg (112,760 lb)
B, range mode	51,220 kg (112,920 lb)
A, payload mode	54,946 kg (121,130 lb)
B, payload mode	55,017 kg (121,290 lb)
Max T-O weight: A, B	
range mode	170,500 kg (375,900 lb)
payload mode	165,100 kg (363,980 lb)
Max landing weight: A, B	
range mode	140,000 kg (308,650 lb)
payload mode	140,600 kg (309,970 lb)
Max zero-fuel weight: A, B	
range mode	130,000 kg (286,600 lb)
payload mode	133,800 kg (294,980 lb)

PERFORMANCE:

Range with max (structural) payload, allowances for 30 min hold at 460 m (1,500 ft) and 200 n mile (370 km, 230 mile) diversion: A, B, range mode
2,650 n miles (4,908 km, 3,050 miles)
A, B, payload mode
1,900 n miles (3,519 km, 2,186 miles)

UPDATED

AIRBUS A310

Canadian Forces designation: CC-150 Polaris

TYPE: Large-capacity wide-bodied medium/extended-range transport.

PROGRAMME: Launched July 1978; first flight (F-WZLH) 3 April 1982, initial French/German certification 11 March 1983; first deliveries (Lufthansa and Swissair) 29 March 1983, entering service 12 and 21 April respectively; JAR Cat IIIa certification (France/Germany) September 1983, UK certification January 1984, JAR Cat. IIIb November 1984; FAA type approval early 1985. First flight of extended-range A310-300 8 July 1985 (certificated with JT9D-7R4E engines 5 December 1985, delivered to launch customer Swissair 17 December), wingtip fences introduced as standard on A310-200 from Spring 1986 (first delivery Thai Airways, 7 May); certification/delivery of A310-300 with CF6-80C2 engines April 1986, with PW4152s June 1987. Russian State Aviation Register certification October 1991 (first Western built aircraft to achieve this status).

CURRENT VERSIONS: **A310-200** Basic passenger version, *to which detailed description mainly applies*.

A310-200C Convertible version of A310-200, first delivery (Martinair) 29 November 1984.

A310-200F Freighter version.

A310-300 Extended-range passenger version, second member of Airbus family to introduce delta-shaped wingtip fences as standard. Extra range provided by increased basic maximum T-O weight (150,000 kg, 330,695 lb) and greater fuel capacity (higher maximum T-O weights optional), standard extra fuel capacity is in tailplane, allowing in-flight CG control for improved fuel efficiency. For extra long range, one or two ACTs (additional centre tanks) can be installed in part of cargo hold, modification certified November 1987 (first customer Wardair of Canada).

Canadian Forces operate six A310-300s. German Luftwaffe three and French Air Force two; last named have ETOPS for 180 minutes. Details of projected military versions appear at the end of the Airbus entry.

CUSTOMERS: See order tables preceding A300-600 entry.

DESIGN FEATURES: Retains same fuselage cross-section as A300, but with cabin 11 frames shorter and overall fuselage 13 frames shorter than A300B2/B4-100 and -200, new advanced-technology wings of reduced span and area; new and smaller horizontal tail surfaces, common pylons able to support all types of GE and PW engines offered; advanced digital two-man cockpit, landing gear modified to cater for size and weight changes. Wings have 28° sweepback at quarter-chord, root incidence 5° 3′, dihedral 11° 8′ (inboard) and 4° 3′ (outboard) at trailing-edge, and thickness/chord ratios of 15.2 (root), 11.8 (at trailing-edge kink) and 10.8 per cent (tip).

FLYING CONTROLS: Wing leading-edge movable surfaces as for A300-600; trailing-edges each have single Fowler flap outboard, vaned Fowler flap inboard lateral control by inboard all-speed aileron and fly-by-wire outboard spoilers, without outboard ailerons, all 14 spoilers used as lift dumpers, inner eight also as airbrakes, fly-by-wire spoiler panels controlled by two independent computer systems with different software to ensure redundancy and operational safety. Tail control surfaces as for A300-600.

STRUCTURE: Mainly of high-strength aluminium alloy except for outer shrouds (structure in place of low-speed ailerons), spoilers, wing leading-edge lower access panels and outer deflector doors, nosewheel doors, mainwheel leg fairing doors, engine cowling panels, elevators and fin box, which are all of CFRP; A310 was first production airliner to have carbon fin box, starting with A310-300 for Swissair in December 1985, flap track fairings, flap access doors, rear wing/body fairings, pylon fairings, nose radome, cooling air inlet fairings and tailplane trailing-edges made of AFRP; wing leading-edge top panels, panel aft of rear spar, upper surface skin panels above mainwheel bays, forward wing/body fairings, glide slope antenna cover, fin leading/trailing-edges, fin and tailplane tips (GFRP), and rudder (CFRP/GFRP). Wing box is two-spar multirib metal structure, with top and bottom load-carrying skins. Undertail bumper beneath rear fuselage, to protect structure against excessive nose-up attitude during T-O and landing.

Manufacturing breakdown differs in detail from that of A300-600: Aerospatiale builds nose section (including flight deck), lower centre-fuselage and wing box, rear wing/body fairings, engine pylons and airbrakes, and is responsible for final assembly; Daimler-Benz Aerospace Airbus builds forward fuselage, upper centre-fuselage, rear fuselage and associated doors, tailcone, fin and rudder, flaps and spoilers, and fits control surfaces and equipment to main wing structure produced by BAe; CASA's contribution includes horizontal tail surfaces, nose-gear and mainwheel doors, and forward passenger doors; Fokker manufactures main landing gear leg doors, wingtips, all-speed ailerons and flap track fairings, wing leading-edge slats and forward wing/fuselage fairings produced by Belgian Belairbus consortium.

LANDING GEAR: Hydraulically retractable tricycle type. Twin-wheel steerable nose unit (steering angle 65°/95°) as for A300. Main gear by Messier-Bugatti, each bogie having two tandem-mounted twin-wheel units. Retraction as for A300-600. Standard tyre sizes: main, 46 × 16-20, pressure 11.2 bars (163 lb/sq in); nose, 40 × 14-16, pressure 9.0 bars (131 lb/sq in). Two options for low-pressure tyres on main units: (1) size 49 × 17-20, pressure 9.8 bars (143 lb/sq in); (2) size 49 × 19-20, pressure 8.9 bars (129 lb/sq in). Messier-Bugatti brakes and anti-skid units standard, Bendix type optional on A310-200. Carbon brakes standard since 1986. Minimum ground turning radius (effective, aft CG) 18.75 m (61 ft 6 in) about nosewheel, 33.00 m (108 ft 3¼ in) about wingtips.

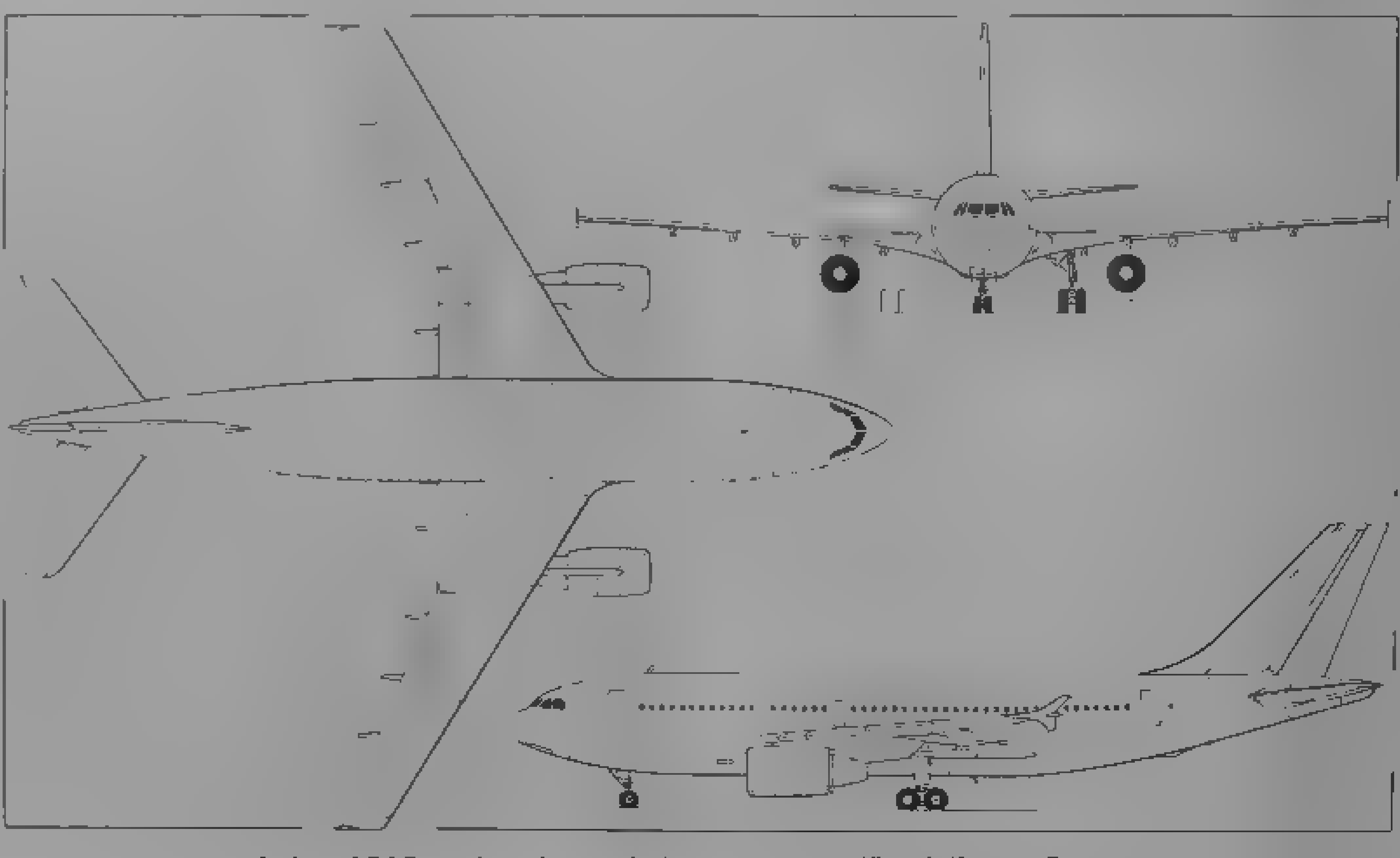
POWER PLANT: Launched with two 213.5 kN (48,000 lb st) Pratt & Whitney JT9D-7R4D1 or 222.4 kN (50,000 lb st) General Electric CF6-80A3 turbofans; currently available with 238 kN (53,500 lb st) CF6-80C2A2, or 231.2 kN (52,000 lb st) Pratt & Whitney PW4152. Available from late 1991 with 262.4 kN (59,000 lb st) CF6-80C2A8 or 249.1 kN (56,000 lb st) PW4156A. Total usable fuel capacity 55,000 litres (14,530 US gallons; 12,098 Imp gallons) in A310-200. Increased to 61,100 litres (16,141 US gallons, 13,440 Imp gallons) in A310-300 by additional fuel in tailplane trim tank. Further 7,200 litres (1,902 US gallons, 1,584 Imp gallons) can be carried in each, of up to two, additional centre tanks (ACT) in forward part of aft cargo hold. Two refuelling points, one beneath each wing outboard of engine.

ACCOMMODATION: Crew of two on flight deck, provision for third and fourth crew seats. Cabin, with six-, seven-, eight- or nine-abreast seating, normally for 210 to 250 passengers, although certificated for up to 280; typical two-class layout for 220 passengers (20 first class, six-abreast at 101.6 cm, 40 in seat pitch, plus 200 economy class mainly eight abreast at 81.3 cm, 32 in pitch); maximum capacity for 280 passengers nine-abreast in high-density configuration at pitch of 76 cm (30 in). Standard layout has two galleys and toilet at forward end of cabin, plus two galleys and four toilets at rear, depending on customer requirements, second toilet can be added forward, and toilets and galleys can be located at forward end at class divider position. Overhead baggage stowage as for A300-600, rising to 0.09 m³ (3.2 cu ft) per passenger in typical economy layout. Four passenger doors, one forward and one aft on each side, oversize Type I emergency exit over wing on each side. Underfloor baggage/cargo holds fore and aft of wings, each with door on starboard side; forward hold accommodates eight LD3 containers or three 2.24 × 3.17 m (88 × 125 in) standard or three 2.44 × 3.17 m (96 × 125 in) optional pallets, rear hold accommodates six LD3 containers, with optional seventh LD3 or LD1 position, LD3 containers can be carried two-abreast, and/or standard pallets installed crosswise.

SYSTEMS: AlliedSignal GTCP 331-250 APU. Air conditioning system, powered by compressed air from engines, APU or a ground supply unit, two separate packs; air is distributed to flight deck, three separate cabin zones, electrical and electronic equipment, avionics bay and bulk cargo compartment, ventilation of forward cargo compartments optional. Pressurisation system has maximum normal differential of 0.57 bar (8.25 lb/sq in). Air supply for wing ice protection, engine starting and thrust reverser system bled from various stages of engine compressors, or supplied by APU or ground supply unit.

Hydraulic system (three fully independent circuits operating at 207 bars; 3,000 lb/sq in): details as described for A300-600.

Electrical system, similar to that of A300-600, consists of a three-phase 115/200 V 400 Hz constant frequency AC system and a 28 V DC system, two 90 kVA engine-driven brushless generators for normal single-channel operation, with automatic transfer of busbars in the event of a



Airbus A310 medium/extended-range airliner *(Jane's/Dennis Punnett)*

1993

generator failure, each has overload rating of 135 kVA for 5 minutes and 180 kVA for 5 seconds, third (identical) AC generator, directly driven at constant speed by APU, can be used during ground operations, and also in flight to compensate for loss of one or both engine-driven generators; current production A310s have APU with improved relight capability, which can be started and operated throughout the flight envelope. Any one generator can provide sufficient power to operate all equipment and systems necessary for indefinite period of safe flight. DC power is generated via three 150 A transformer rectifiers; three Ni/Cd batteries.

Flight crew oxygen system fed from rechargeable pressure bottle of 2,166 litres (76.5 cu ft) capacity; standard options are second 76.5 cu ft bottle, a 3,256 litre (115 cu ft) bottle, and an external filling connection, emergency oxygen sets for passengers and cabin attendants. Anti-icing of outer wing leading-edge slats and engine air intakes by hot air bled from engines, and of pitot probes, static ports and plates, and sensors, by electric heating.

For current production A310s, an ETOPS (extended range twin-engined operations) modification kit, as for the A300-600, is available.

AVIONICS: As described for A300-600.

DIMENSIONS, EXTERNAL:

Wing span	43.89 m (144 ft 0 in)
Wing chord: at root	8.38 m (27 ft 6 in)
at tip	2.18 m (7 ft 1¾ in)
Wing aspect ratio	8.80
Length overall	46.66 m (153 ft 1 in)
Fuselage: Length	45.13 m (148 ft 0¾ in)
Max diameter	5.64 m (18 ft 6 in)
Height overall	15.80 m (51 ft 10 in)
Tailplane span	16.26 m (53 ft 4¼ in)
Wheel track	9.60 m (31 ft 6 in)
Wheelbase (c/l of shock-absorbers)	15.21 m (49 ft 10¾ in)
Passenger door (forward, port): Height	1.93 m (6 ft 4 in)
Width	1.07 m (3 ft 6 in)
Height to sill at OWE	4.54 m (14 ft 10¾ in)
Passenger door (rear, port): Height	1.93 m (6 ft 4 in)
Width	1.07 m (3 ft 6 in)
Height to sill at OWE	4.85 m (15 ft 11 in)
Servicing doors (forward and rear, stbd)	as corresponding passenger doors
Upper deck cargo door (A310C/F)	as A300-600F
Emergency exits (overwing, port and stbd, each): Height	1.39 m (4 ft 6¾ in)
Width	0.67 m (2 ft 2½ in)
Underfloor cargo door (forward): Height	1.71 m (5 ft 7¼ in)
Width	2.69 m (8 ft 10 in)
Height to sill at OWE	2.611 m (8 ft 6¾ in)
Underfloor cargo door (rear): Height	1.71 m (5 ft 7¼ in)
Width	1.81 m (5 ft 11¼ in)
Height to sill at OWE	2.72 m (8 ft 11 in)
Underfloor cargo door (aft bulk hold): Height	0.95 m (3 ft 1½ in)
Width	0.95 m (3 ft 1½ in)
Height to sill at OWE	2.751 m (9 ft 0¼ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	33.24 m (109 ft 0¾ in)
Max width	5.28 m (17 ft 4 in)
Max height	2.33 m (7 ft 7¾ in)
Volume	210.0 m³ (7,416.1 cu ft)
Forward cargo hold: Length	7.63 m (25 ft 0½ in)
Max width	4.18 m (13 ft 8½ in)
Height	1.71 m (5 ft 7¼ in)
Volume	50.3 m³ (1,776.3 cu ft)
Rear cargo hold: Length	5.033 m (16 ft 6¼ in)
Max width	4.17 m (13 ft 8¼ in)
Height	1.67 m (5 ft 5¾ in)
Volume	34.5 m³ (1,218.4 cu ft)
Aft bulk hold: Volume	17.3 m³ (610.9 cu ft)
Total overall cargo volume	102.1 m³ (3,605.6 cu ft)

AREAS:

Wings, gross	219.0 m² (2,357.3 sq ft)
Leading-edge slats (total)	28.54 m² (307.20 sq ft)
Trailing-edge flaps (total)	36.68 m² (394.82 sq ft)
Ailerons (total)	6.86 m² (73.84 sq ft)
Spoilers (total)	7.36 m² (79.22 sq ft)
Airbrakes (total)	6.16 m² (66.31 sq ft)

Vertical and horizontal tail surfaces as A300-600

WEIGHTS AND LOADINGS (220-seat configuration. C2: CF6-80C2A2 engines, P2: PW4152s, C8: CF6-80C2A8s, P6: PW4156As):

Manufacturer's weight empty: 200 C2	71,660 kg (157,975 lb)
P2	71,601 kg (157,850 lb)
300 C2	71,840 kg (158,380 lb)
P2	71,781 kg (158,250 lb)
C8	72,050 kg (158,840 lb)
P6	71,965 kg (158,655 lb)
Operating weight empty*: 200 C2	80,142 kg (176,685 lb)
P2	80,125 kg (176,645 lb)
300 C2	80,344 kg (177,130 lb)
P2	80,842 kg (178,225 lb)
C8	80,868 kg (178,285 lb)
P6	80,801 kg (178,135 lb)

Airbus A310 twin-turbofan airliner operated by Aerolineas Argentinas *1995*

Max payload: 200 C2	32,860 kg (72,443 lb)
P2	32,880 kg (72,490 lb)
300 C8	32,117 kg (70,805 lb)
P6	32,158 kg (70,896 lb)
* Max usable fuel: 200	44,100 kg (97,224 lb)
300	49,039 kg (108,110 lb)
Max T-O weight: 200	142,000 kg (313,050 lb)
300	150,000 kg (330,675 lb)
options (300)	153,000 kg (337,300 lb)
	or 157,000 kg (346,125 lb)
	or 164,000 kg (361,550 lb)
Max landing weight: 200, 300	123,000 kg (271,150 lb)
options (200 and 300)	124,000 kg (273,375 lb)
Max zero-fuel weight: 200, 300	113,000 kg (249,120 lb)
options (200 and 300)	114,000 kg (251,325 lb)

* *optional additional tank in aft cargo hold adds 5,779 kg (12,740 lb) of fuel and increases OWE/reduces max payload by 842 kg (1,856 lb). Two additional tanks add 11,560 kg (25,485 lb) of fuel and increase OWE/reduce max payload by 1,620 kg (3,571 lb)*

PERFORMANCE (at basic max T-O weight except where indicated, engines as under Weights and Loadings):

Typical long-range cruising speed at 9,450-12,500 m (31,000-41,000 ft): C2, P2, C8, P6	Mach 0.80
Approach speed at max landing weight: C2, P2, C8, P6	135 kts (250 km/h; 155 mph)
T-O field length at S/L, ISA + 15°C: 200 C2	1,860 m (6,100 ft)
P2	1,799 m (5,900 ft)
300 C2 (at 150 tonne MTOW)	2,408 m (7,900 ft)
P2 (at 150 tonne MTOW)	2,225 m (7,300 ft)
C8 (at 164 tonne MTOW)	2,560 m (8,400 ft)
P6 (at 164 tonne MTOW)	2,400 m (7,875 ft)
Landing field length at S/L, at max landing weight (200 and 300): C2	1,479 m (4,850 ft)
P2	1,555 m (5,100 ft)
Runway ACN for flexible runway, category B standard tyres: 200	43
300	49
optional tyres: 200	41
300	47

Range (1991 and subsequent deliveries) at typical airline OWE with 220 passengers and baggage, international reserves for 200 n mile (370 km; 230 mile) diversion:

200, GE engines	3,600 n miles (6,667 km; 4,142 miles)
200, PW engines	3,650 n miles (6,759 km; 4,200 miles)
300, GE engines	4,300 n miles (7,963 km; 4,948 miles)
300, PW engines	4,350 n miles (8,056 km; 5,005 miles)
300, option, at T-O weight 157,000 kg (346,125 lb): GE engines	4,750 n miles (8,797 km; 5,466 miles)
PW engines	4,800 n miles (8,889 km; 5,523 miles)
300, option, at T-O weight 164,000 kg (361,560 lb): GE engines	5,150 n miles (9,537 km; 5,926 miles)
PW engines	5,200 n miles (9,630 km; 5,984 miles)

OPERATIONAL NOISE LEVELS (ICAO Annex 16, Chapter 3):

T-O: 200 C2	89.6 EPNdB (95.3 limit)
300 C2	91.2 EPNdB (95.6 limit)
Sideline: 200 C2	96.4 EPNdB (99.2 limit)
300 C2	96.3 EPNdB (99.4 limit)
Approach: 200, 300 C2	98.6 EPNdB (102.9 limit)

UPDATED

AIRBUS A320

TYPE: Twin-turbofan short/medium-range airliner.

PROGRAMME: Launched 2 March 1984, four-aircraft development programme (first flight 22 February 1987 by F-WWAI); JAR (UK/French/German/Dutch certification of A320-100 with CFM56-5 engines, for two-crew operation, awarded 26 February 1988, first deliveries (Air France and British Airways) 28 and 31 March 1988 respectively; JAR certification of A320-200 with CFM56-5s received 8 November 1988, followed by FAA type approval for both models 15 December 1988; certification with V2500 engines (first flown 28 July 1988) received 20 April (JAR) and 6 July 1989 (FAA), deliveries with this power plant (to Adria Airways) beginning 18 May 1989; FAA approved common type rating on A320 and A321 without further training in early 1994, 500th A320 delivered, 20 January 1995, to United Airlines.

CURRENT VERSIONS: **A320**: Initial version (21 ordered), details in 1987-88 *Jane's*. Superseded by A320-200.

A320-200: Now called simply **A320**. Standard version from third quarter 1988, differs from initial A320 in having wingtip fences, wing centre-section fuel tank and higher maximum T-O weights. *Detailed description applies to this version.*

A320 research: A320 used for riblet research 1989-91.

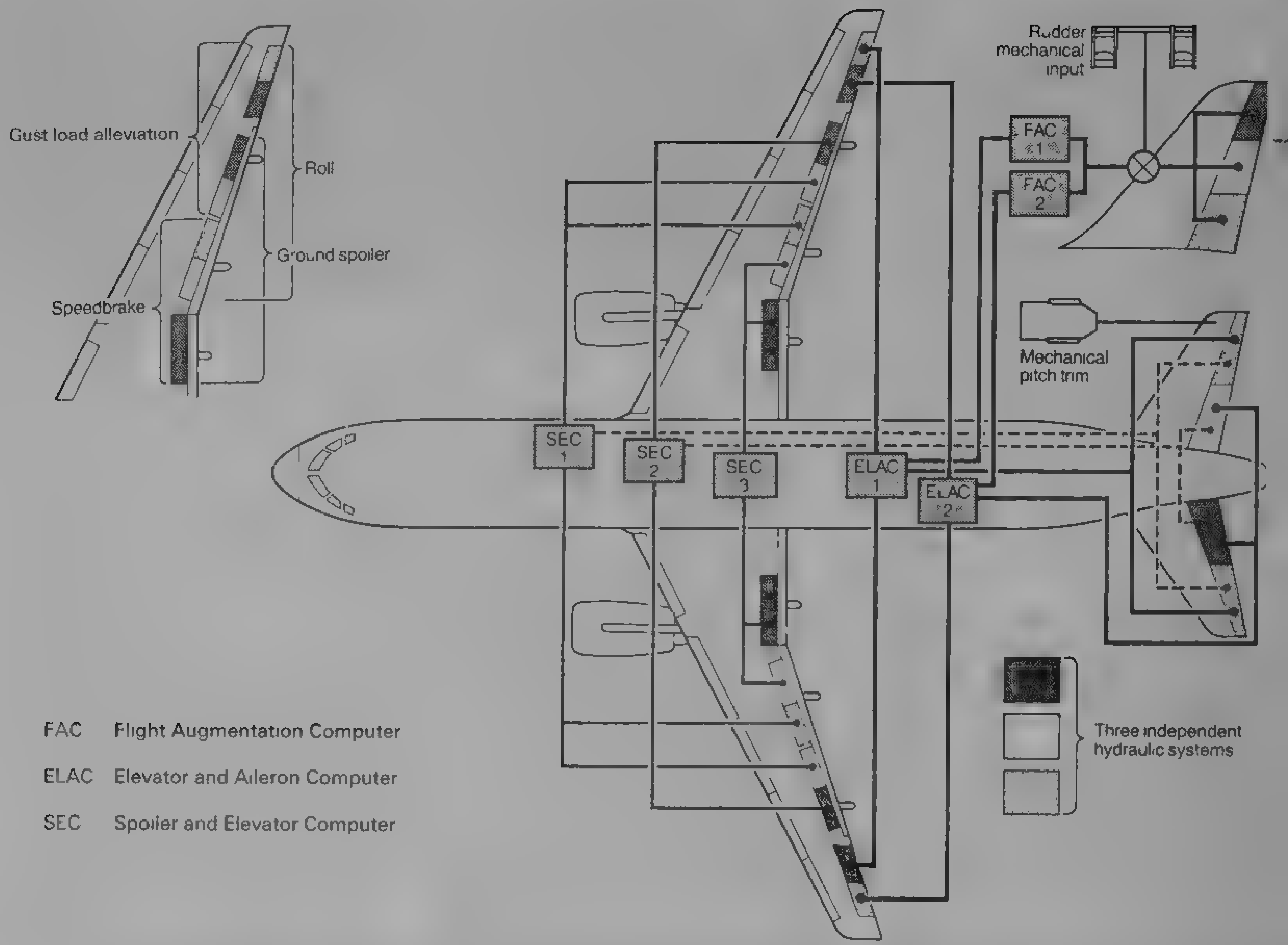
A319: Shortened version of A320, described separately.

A321-100 and -200: Stretched versions of A320, described separately.

CUSTOMERS: See table preceding A300-600 entry.

DESIGN FEATURES: First subsonic commercial aircraft to have composites for major primary structures, and centralised

The 500th Airbus A320 delivery: United Airlines, January 1995 *1995*



Architecture of the Airbus A320 electrical flight control system The fly-by-wire slats and flaps are independently controlled and not part of the primary system Inputs to ELACs and SECs come from the air data inertial reference system, the sidesticks and the flight guidance computer. See Flying Controls heading in A320 entry

1993

Airbus A320 flight deck with sidestick controllers outboard and six-screen EFIS

1993

maintenance system, advanced-technology wings have 25° sweepback at quarter-chord, 5° 6′ 36″ dihedral, and incorporate gust load alleviation system, plus experience from A310 and significant commonality with other Airbus Industrie aircraft where cost-effective, 6° tailplane dihedral

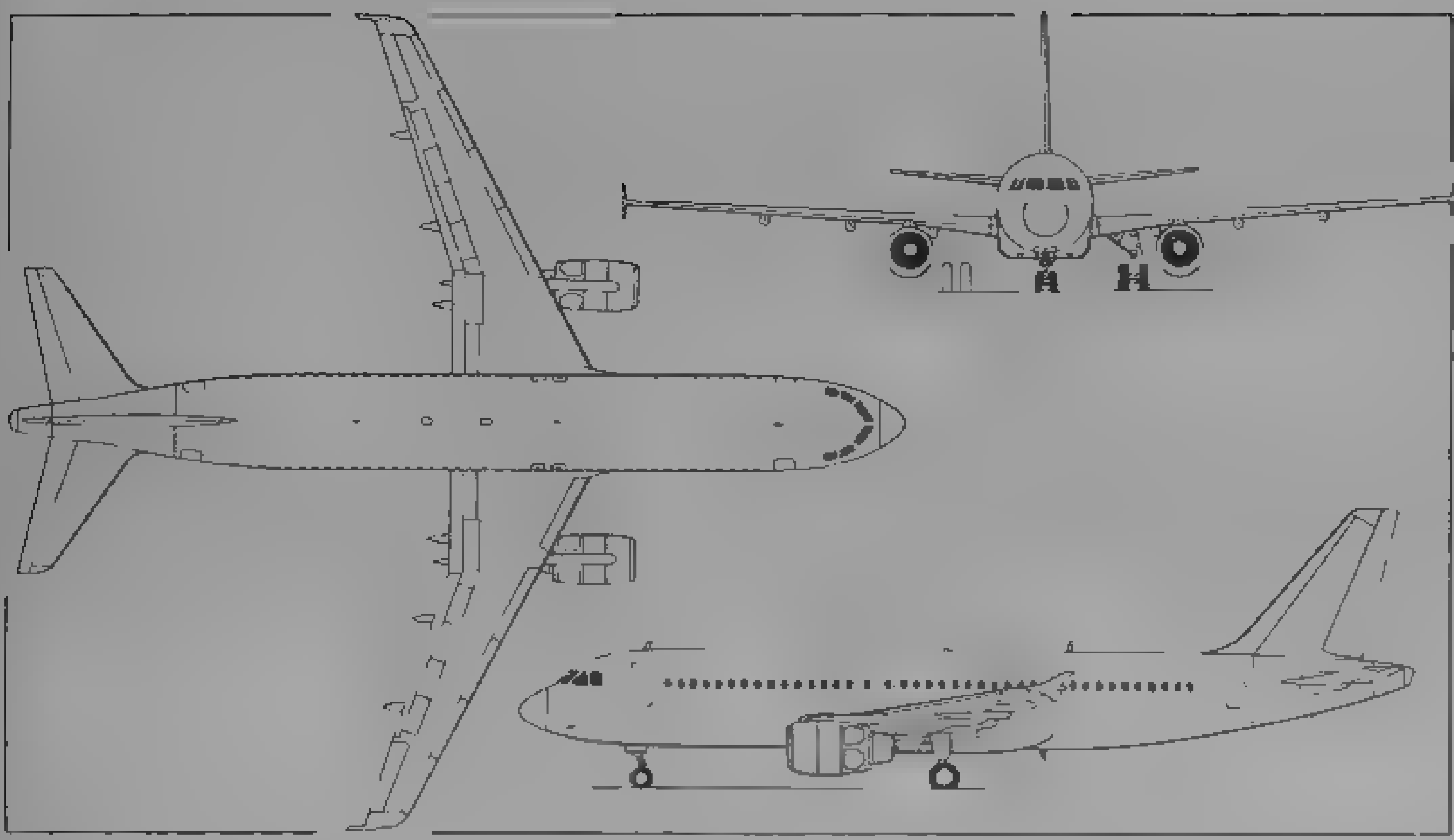
FLYING CONTROLS A320 is first subsonic commercial aircraft equipped for fly-by-wire (FBW) control throughout entire normal flight regime, and first to have sidestick controller (one for each pilot) instead of control column and aileron wheel. Thomson-CSF/SFENA digital FBW system features five main computers and operates, via electrical signalling and hydraulic jacks, all primary and secondary flight controls, pilot's pitch and roll commands are applied through sidestick controller via two different types of computer; these have redundant architecture to provide safety levels at least as high as those of mechanical systems they replace; system incorporates flight envelope protection features to a degree that cannot be achieved with conventional mechanical control systems, and its computers will not allow aircraft's structural and aerodynamic limitations to be exceeded, even if pilot holds sidestick fully forward it is impossible to go beyond aircraft's maximum operating speed (V_{MO}) for more than a few seconds, if pilot holds sidestick fully back, aircraft is controlled to an 'alpha floor' angle of attack, a safe airspeed above stall and throttles opened automatically to ensure positive climb. Nor is it possible to exceed g limits while manoeuvring If a bank angle of more than 30° is commanded with the sidestick, the bank angle is automatically returned to 30° when pressure is released

Fly-by-wire system controls, ailerons, elevators, spoilers, flaps and leading-edge slats, rudder movement and tailplane trim connected to FBW system, but also signalled mechanically when used to provide final back-up pitch and yaw control, which suffices for basic instrument flying Each wing has five-segment leading-edge slats (one inboard, four outboard of engine pylon), two-segment Fowler trailing-edge flaps, and five-segment spoilers forward of flaps, all 10 spoilers used as lift dumpers, inner six as airbrakes, outer eight and ailerons for roll control and outer four and ailerons for gust alleviation, slat and flap controls by Liebherr and Lucas

STRUCTURE. Generally similar to A310, but with AFRP for fuselage belly fairing skins, GFRP for fin leading-edge and fin/fuselage fairing, CFRP for wing fixed leading/trailing-edge bottom access panels and deflectors, trailing-edge flaps and flap track fairings, spoilers, ailerons, fin (except leading-edge), rudder, tailplane, elevators, nosewheel/mainwheel doors, and main gear leg fairing doors. A320 was first airliner to go into production with CFRP tailplane

Aerospatiale builds entire front fuselage (forward of wing leading-edge), cabin rear doors, nosewheel doors, centre wing box and engine pylons, and is responsible for final assembly; centre and rear fuselage, tailcone, wing flaps, fin, rudder and commercial furnishing undertaken by Daimler Benz Aerospace Airbus, British Aerospace builds main wings, including ailerons, spoilers and wingtips, and main landing gear leg fairings, Belgian consortium Belairbus produces leading-edge slats, CASA responsible for tailplane, elevators, mainwheel doors, and sheet metal work for parts of rear fuselage.

LANDING GEAR Hydraulically retractable tricycle type, with twin wheels and oleo-pneumatic shock-absorber on each unit (four-wheel main-gear bogies, for low-strength



Airbus A320 twin-turbofan single-aisle 150/179-seat airliner *(Jane's/Dennis Punnett)*

1993

runways, optional). Dowty main units retract inward into wing/body fairing, steerable Messier-Bugatti nose unit retracts forward; nosewheel steering angle ±75° (effective turning angle ±70°). Radial tyres standard, size 45 × 16-R20 on main gear and 30 × 8.8-R15 on nose gear; optional tyres for main gear are 49 × 17R20 or 49 × 19R20 radials, or 46 × 16-20 or 49 × 19-20 crossplies, and for nose gear 30 × 8.8-15 crossplies; tyres for main-gear bogie option are either 915 × 300R16 radials or 36 × 11-16 crossplies. Carbon brakes standard. Minimum width of pavement for 180° turn 23.1 m (75 ft 9¼ in).

POWER PLANT: Two 104.5 to 111.2 kN (23,500 to 25,000 lb st) class CFM International CFM56-5A1 turbofans for first aircraft delivery in Spring 1988, with 111.2 kN (25,000 lb st) IAE V2500-A1 engines available for aircraft delivered from May 1989 and 117.9 kN (26,500 lb st) CFM56-5A3 from November 1990; 117.9 kN (26,500 lb st) CFM56-5B4 and 111.2 kN (25,000 lb st) IAE V2525-A5 available from 1994. Nacelles by Rohr Industries; thrust reversers by Hispano-Suiza for CFM56 engines, by IAE for V2500s. Dual-channel FADEC system standard on each engine. For A320-200, standard fuel capacity in wing and wing centre-section tanks is 23,859 litres (6,303 US gallons, 5,248 Imp gallons); for A320-100, standard fuel capacity without centre-section tank is 15,843 litres (4,185 US gallons, 3,485 Imp gallons).

ACCOMMODATION: Standard crew of two on flight deck, with one (optionally two) forward-facing folding seats for additional crew members, seats for four cabin attendants. Single-aisle main cabin has seating for up to 179 passengers, depending upon layout, with locations at front and rear of cabin for galley(s) and toilet(s); typical two-class layout has 12 seats four-abreast at 91.5 cm (36 in) pitch in 'super first' and 138 six-abreast at 81 cm (32 in) pitch economy class; alternative 152 six-abreast seats (84 business + 68 economy) at 86 and 78 cm (34 and 31 in) pitch respectively; single class economy layout could offer 164 seats at 81 cm (32 in) pitch, or up to 179 in high density configuration. Compared with existing single-aisle aircraft, fuselage cross-section is significantly increased, permitting use of wider triple seats to provide higher standards of passenger comfort; five-abreast business class seating provides standard equal to that offered as first class on major competitive aircraft. In addition, wider aisle permits quicker turnrounds. Overhead stowage space superior to that available on existing aircraft of similar capacity, and provides ample carry-on baggage space; best use of underseat space for baggage is provided by improved seat design and optimised positioning of seat rails. Passenger doors at front and rear of cabin on port side, forward one having optional integral airstairs, service door opposite each of these on starboard side. Two overwing emergency exits each side. Fuselage double-bubble cross-section provides increased baggage/cargo hold volume and working height, and ability to carry containers derived from standard interline LD3 type. As base is same as that of LD3, all existing wide-body aircraft and ground handling equipment can accept these containers without modification. Forward and rear underfloor baggage/cargo holds, plus overhead lockers; with 164 seats, overhead stowage space per seat is 0.056 m³ (2.0 cu ft). Mechanised cargo loading system will allow up to seven LD3 based containers to be carried in freight holds (three forward and four aft).

SYSTEMS: Liebherr/ABG-Semca air conditioning, Hamilton Standard/Nord-Micro pressurisation, Sundstrand electrical system, and new and more efficient AlliedSignal APU. Primary electrical system powered by two Sundstrand 90 kVA constant frequency generators, providing 115/200 V three-phase AC at 400 Hz; third generator of same type, directly driven at constant speed by APU, can be used during ground operations and, if required, during flight.

AVIONICS: *Flight*: Fully equipped ARINC 700 digital avionics including advanced digital automatic flight control and flight management systems; AFCS integrates functions of SFENA autopilot and Honeywell FMS, Honeywell air data and inertial reference system.

Instrumentation: Each pilot has two Thomson-CSF/VDO electronic flight instrumentation system (EFIS) displays (primary flight display and navigation display); PFD was first on an airliner to incorporate speed, altitude and heading. Between these two pairs of displays are two Thomson-CSF/VDO electronic centralised aircraft monitor (ECAM) displays developed from the ECAM systems on A310 and A300-600; upper display incorporates engine performance and warning, lower display carries warning and system synoptic diagrams.

DIMENSIONS, EXTERNAL:

Wing span	33.91 m (111 ft 3 in)
Wing aspect ratio	9.39
Length overall	37.57 m (123 ft 3 in)
Fuselage: Max width	3.95 m (12 ft 11½ in)
Max depth	4.14 m (13 ft 7 in)
Height overall	11.80 m (38 ft 8½ in)
Tailplane span	12.45 m (40 ft 10 in)
Wheel track (c/l of shock-struts)	7.59 m (24 ft 11 in)
Wheelbase	12.63 m (41 ft 5 in)
Passenger doors (port, forward and rear), each:	
Height	1.85 m (6 ft 1 in)
Width	0.81 m (2 ft 8 in)
Height to sill	3.415 m (11 ft 2½ in)
Service doors (stbd, forward and rear), each	as corresponding passenger doors
Overwing emergency exits (two port and two stbd), each:	
Height	1.02 m (3 ft 4¼ in)
Width	0.51 m (1 ft 8 in)
Underfloor baggage/cargo hold doors (stbd, forward and rear), each: Height	1.249 m (4 ft 1¼ in)
Width	1.82 m (5 ft 11½ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	27.38 m (89 ft 10 in)
Max width	3.696 m (12 ft 1½ in)
Max height	2.22 m (7 ft 4 in)
Baggage/cargo hold volume: front	13.28 m³ (469 cu ft)
rear	25.48 m³ (900 cu ft)

AREAS:

Wings, gross	122.4 m² (1,317.5 sq ft)
Leading-edge slats (total)	12.64 m² (136.1 sq ft)
Trailing-edge flaps (total)	21.10 m² (227.1 sq ft)
Ailerons (total)	2.74 m² (29.49 sq ft)
Spoilers (total)	8.64 m² (93.00 sq ft)
Airbrakes (total)	2.35 m² (25.30 sq ft)
Vertical tail surfaces (total)	21.5 m² (231.4 sq ft)
Horizontal tail surfaces (total)	31.0 m² (333.7 sq ft)

WEIGHTS AND LOADINGS (Typical 150-passenger configuration, A: CFM56-5A1 engines, B: V2500-A1s):

Operating weight empty: A	41,782 kg (92,113 lb)
B	42,069 kg (92,746 lb)
Max payload: A	19,220 kg (42,372 lb)
B	18,931 kg (41,735 lb)
Max fuel	19,159 kg (42,238 lb)
Max T-O weight: standard	73,500 kg (162,040 lb)
1st option	75,500 kg (166,445 lb)
2nd option	77,000 kg (169,755 lb)
Max landing weight	64,500 kg (142,195 lb)
Max zero-fuel weight	61,000 kg (134,480 lb)
Max wing loading:	
standard	600.5 kg/m² (123.0 lb/sq ft)
1st option	616.83 kg/m² (126.3 lb/sq ft)
2nd option	629.08 kg/m² (128.8 lb/sq ft)

PERFORMANCE (at max T-O weight except where indicated, engines A and B as for Weights and Loadings, C: CFM56-5A3/5B4, D: 77,000 kg; 169,756 lb max T-O weight):

T-O distance at S/L, ISA + 15°C: A	2,336 m (7,665 ft)
B	2,294 m (7,526 ft)
C	2,042 m (6,700 ft)
D	2,286 m (7,500 ft)
Landing distance at max landing weight:	
A, C	1,470 m (4,823 ft)
B	1,442 m (4,730 ft)
Runway ACN (flexible runway, category B):	
twin-wheel, standard 45 × 16R20 tyres	41
four-wheel bogie option, 36 × 11-16 Type VII or 900 × 300 R16	22

Range with 150 passengers and baggage in two-class layout, FAR domestic reserves and 200 n mile (370 km; 230 mile) diversion:

A, standard	2,650 n miles (4,907 km; 3,049 miles)
B, standard	2,700 n miles (5,000 km; 3,107 miles)
A, optional	2,800 n miles (5,185 km; 3,222 miles)
B, optional	2,900 n miles (5,370 km; 3,337 miles)
2nd option:	
A, C	2,850 n miles (5,278 km; 3,280 miles)
B	2,950 n miles (5,463 km; 3,395 miles)

OPERATIONAL NOISE LEVELS (ICAO Annex 16, Chapter 3; A, B and C as for performance):

T-O: A	88.0 EPNdB (91.5 limit)
B	86.6 EPNdB (91.5 limit)
C	86.5 EPNdB (91.5 limit)
Sideline: A	94.4 EPNdB (96.8 limit)
B	92.8 EPNdB (96.8 limit)
C	94.8 EPNdB (96.8 limit)
Approach: A	96.2 EPNdB (100.5 limit)
B	96.6 EPNdB (100.5 limit)
C	96.0 EPNdB (100.5 limit)

UPDATED

AIRBUS A319

TYPE: Short-fuselage A320.

PROGRAMME: Airbus Board officially authorised start of sales 22 May 1992; programme launched June 1993. Final assembly of first aircraft began 23 March 1995; first flight (with CFM56s) scheduled for September 1995, certification March 1996, service entry with Swissair April 1996; future developments could include corporate/VIP version with transatlantic or Europe-Middle East range capability.

CUSTOMERS: See table preceding A300-600 entry. ILFC first customer (14); other firm orders (April 1995): Air Inter (nine), Swissair (three); Air Canada (25); total 450 sales predicted.

COSTS: Total development cost estimated at $275 million, entirely financed by Airbus Industrie.

DESIGN FEATURES: Seven fuselage frames shorter than A320, giving overall length of 33.80 m (110 ft 11 in), but otherwise little changed. Seats 124 passengers in typical two-class layout, compared with 150 in A320 and 185 in A321; range of 2,700 n miles (5,000 km; 3,107 miles) claimed as longest in this category of airliner; common pilot type rating planned with A320 and A321.

FLYING CONTROLS: Same flight deck and flying control system as A320.

STRUCTURE: As A320. Aircraft to be assembled in Germany by Daimler Benz Aerospace Airbus, which already assembles the stretched A321; partner workshares

Artist's impression of the Airbus A319 in Swissair markings. A319 will enter service in April 1996

1994

Airbus A321 of Swissair

1995

rearranged to maintain overall workshare balance between France and Germany

POWER PLANT: Two CFMI CFM56-5A4 or IAE V2522-A5 turbofans, each giving 97.9 kN (22,000 lb st) or two CFMI CFM56-5A5 or IAE V2524-A5, each giving 104.5 kN (23,500 lb st). Maximum fuel capacity 23,860 litres (6,303 US gallons; 5,248 Imp gallons)

WEIGHTS AND LOADINGS:

Typical operating weight empty	40,125 kg (88,460 lb)
Max payload	16,875 kg (37,203 lb)
Max T-O weight:	
CFM56-5A4 or V2522-A5	64,000 kg (141,095 lb)
CFM56-5A5 or V2524-A5	68,000 kg (149,910 lb)
Max landing weight	61,000 kg (134,480 lb)

PERFORMANCE (estimated, A: with CFM56-5A4 or V2522-A5; B: with CFM56-5A5 or V2524-A5):

T-O distance, S/L, ISA+15°C: A	1,829 m (6,000 ft)
B	1,951 m (6,400 ft)
Landing distance: A, B	1,356 m (4,450 ft)

Range with 124 passengers and baggage, FAR domestic reserves and 200 n mile (370 km; 230 mile) diversion:

A, at T-O weight 64,000 kg (141,095 lb)
1,900 n miles (3,518 km; 2,186 miles)

B, at T-O weight 68,000 kg (149,914 lb)
2,650 n miles (4,907 km; 3,049 miles)

UPDATED

AIRBUS A321

TYPE: Stretched version of A320.

PROGRAMME: Announced 22 May and launched 24 November 1989; four development aircraft, first flight with V2530 lead engine 11 March 1993 (F-WWIA); second aircraft with alternative CFM56-5B engine in May 1993; V2530-powered version received European JAA certification 17 December 1993; CFM56-5B2-powered version certificated by JAA 15 February 1994; CFM56-5B1 certificated by JAA 27 May 1994; first delivery (to Lufthansa) January 1994. In service with Lufthansa March 1994. A321 powered by CFM56-5Bs passed cold weather trials in Kiruna January 1994; first delivery with alternative engine (to Alitalia) 22 March 1994. FAA certification with CFM engines expected in Autumn 1995. JAA approval for Cat IIIb automatic landings achieved in December 1994.

CURRENT VERSIONS: **A321**: Initial version, *as described below*.

A321-200: Extended range version, launched April 1995; features reinforced structure, higher thrust versions of existing engines and additional centre tank (ACT) capacity 2,900 litres (766 US gallons; 638 Imp gallons) which increase maximum T-O weight to 88,995 kg (196,200 lb) and range by 250 to 400 n miles (463 to 740 km; 287 to 460 miles). A321-200 expected to have increased market appeal on North American domestic routes, charter routes between Northern and Southern Europe, and on scheduled routes between Europe and Middle East.

CUSTOMERS: See table ahead of A300-600 entry.

DESIGN FEATURES: Compared with A320, A321 has 4.27 m (14 ft 0 in) fuselage plug immediately forward of wing and 2.67 m (8 ft 9 in) plug immediately aft; overwing emergency exits replaced by exits in plugs, pairs of wing fuel tanks unified and system simplified; other changes include local structural reinforcement of existing assemblies, slightly extended wing trailing-edge with double-slotted flaps, uprated landing gear and higher T-O weights.

STRUCTURE: As for A320 except for airframe changes noted under Design Features; front fuselage plug by Alenia, rear one by BAe; final assembly and outfitting by Deutsche Aerospace Airbus at Hamburg.

LANDING GEAR: Uprated, with 22 in wheel rims, 1,270 × 455R22 mainwheel tyres and increased energy brakes; wheels and brakes by Aircraft Braking Systems.

POWER PLANT: Two CFM56-5B1 or IAE V2530-A5 turbofans, each rated at 133.4 kN (30,000 lb st); CFM56-5B2 engines of 137.9 kN (31,000 lb st) available as an option. Fuel capacity 23,700 litres (6,261 US gallons; 5,213 Imp gallons)

ACCOMMODATION: Typically offers 24 per cent more seats and 40 per cent more hold volume than A320; examples are 185 passengers in two-class layout (16 first class at 91 cm, 36 in seat pitch and 169 economy class at 81 cm, 32 in), or 200 passengers in all-economy configuration. Each fuselage plug incorporates one pair of emergency exits, replacing single overwing pair of A320.

SYSTEMS: Choice of AlliedSignal GTCP 36-300 or APIC APS 3200 APU; full commonality with A320 installation.

DIMENSIONS, EXTERNAL:

Wing span	34.09 m (111 ft 10 in)
Length overall	44.51 m (146 ft 0 in)
Height overall	11.81 m (38 ft 9 in)
Passenger and service doors (port/stbd, forward and rear)	as for A320
Emergency exits (forward stbd and rear port/stbd, each):	
Height	1.52 m (5 ft 0 in)
Width	0.76 m (2 ft 6 in)
Emergency exit (forward port, usable also as passenger door): Height	1.85 m (6 ft 1 in)
Width	0.76 m (2 ft 6 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	34.39 m (112 ft 10 in)
Baggage/cargo hold volume:	
front	23.02 m³ (813 cu ft)
rear	29.02 m³ (1,025 cu ft)

WEIGHTS AND LOADINGS (Typical 185-passenger layout: C1: CFM56-5B1, V: V2530-A5, C2: CFM56-5B2):

Operating weight empty: C1, C2	47,852 kg (105,495 lb)
V	47,966 kg (105,745 lb)
Max payload: C1, C2	21,648 kg (47,725 lb)
V	21,534 kg (47,474 lb)
Max fuel: C1, V, C2	19,031 kg (41,956 lb)
Max T-O weight: standard	83,000 kg (182,980 lb)
option	85,000 kg (187,390 lb)
Max landing weight: standard	73,500 kg (162,035 lb)
option	74,500 kg (164,240 lb)
Max zero-fuel weight: standard	69,500 kg (153,220 lb)
option	70,500 kg (155,425 lb)
Max wing loading	694.4 kg/m² (142.2 lb/sq ft)

PERFORMANCE (estimated):

T-O distance at max T-O weight, S/L, ISA +15°C:	
C1	2,339 m (7,674 ft)
V	2,328 m (7,638 ft)
C2	2,276 m (7,468 ft)
Landing distance at max landing weight:	
C1, V, C2	1,587 m (5,208 ft)
Runway ACN (flexible runway, category B):	
standard	48

Range with 185 passengers and baggage at typical airline OWE, FAR domestic reserves and 200 n mile (370 km; 230 mile) diversion: C1, C2:

standard	2,200 n miles (4,074 km; 2,531 miles)
optional	2,300 n miles (4,259 km; 2,646 miles)
V: standard	2,250 n miles (4,167 km; 2,589 miles)
optional	2,350 n miles (4,352 km; 2,704 miles)

OPERATIONAL NOISE LEVELS (ICAO Annex 16, Chapter 3, estimated):

T-O: C1	87.4 EPNdB (92.1 limit)
V	85.4 EPNdB (92.1 limit)
Sideline: C1	94.5 EPNdB (97.2 limit)
V	94.5 EPNdB (97.2 limit)
Approach: C1	95.2 EPNdB (100.9 limit)
V	95.4 EPNdB (100.9 limit)

UPDATED

AIRBUS A340

TYPE: Large-capacity wide-bodied medium/long-range airliner.

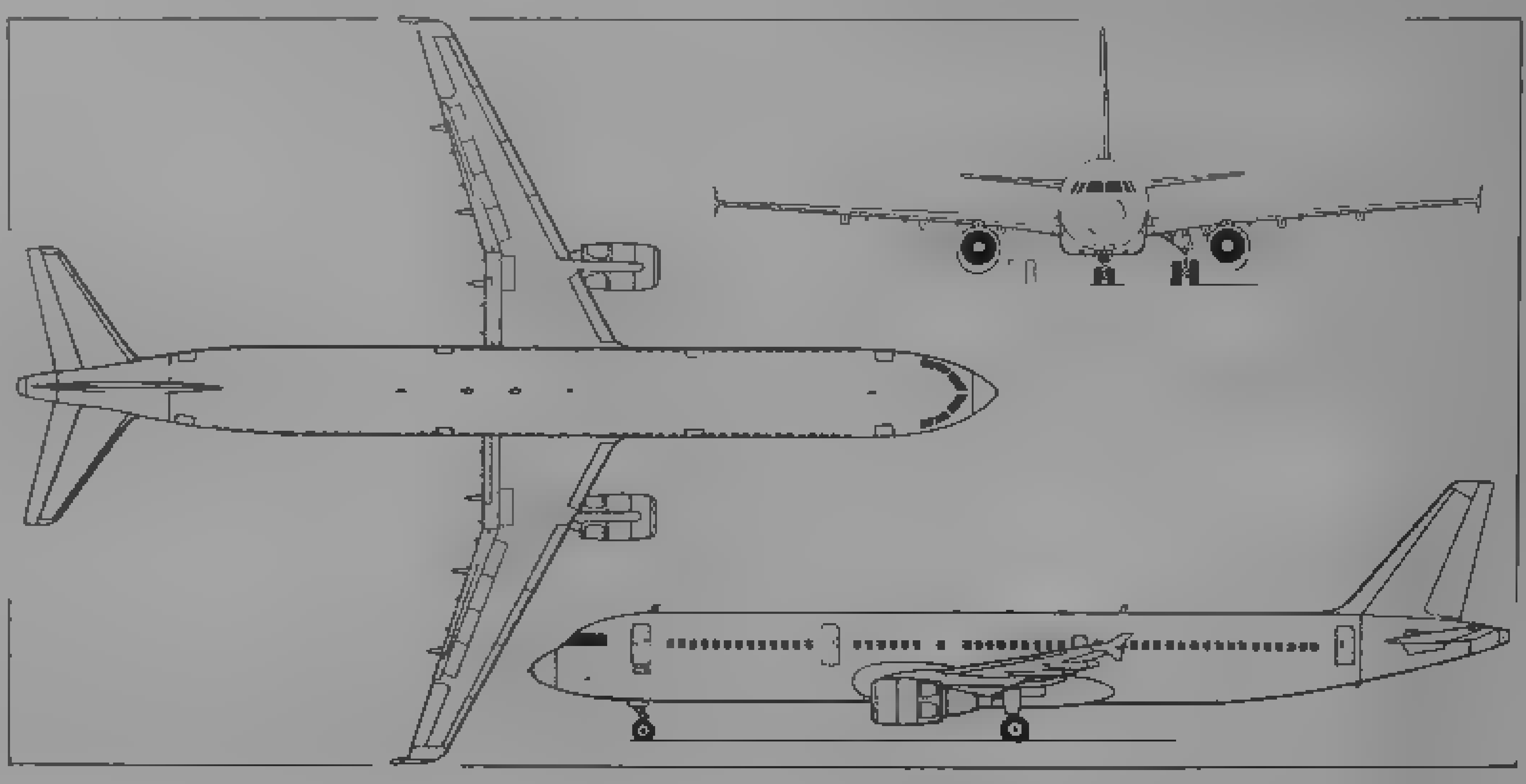
PROGRAMME: Launched 5 June 1987 as combined programme with A330, differing mainly in number of engines and in engine-related systems; first six aircraft were four A340-300s and two -200s; first flight 25 October 1991 (A340-300); A340-200 and -300 certificated simultaneously by 18 European joint airworthiness authorities (JAA) on 22 December 1992. A340-300 and -200 entered service with Air France and Lufthansa March 1993; both received FAA certification 27 May 1993. A340/A330 certificated by JAA for GPS satellite navigation January 1994; successful trials conducted at Toulouse in October 1994 using differential global positioning (DGPS) for fully automatic landings, including roll-out. By end of 1994, A340 fleet had logged 127,000 flight hours in 17,700 sorties.

A330 and A340 were first airliners created with 100 per cent computer-aided design (CAD).

CURRENT VERSIONS: **A340-300**: Four-engined higher capacity version, carrying up to 375 passengers (standard) or 440 (optional) and powered initially by CFM56-5C2 turbofans.

Longer-range version of A340-300, previously referred to as A340-300X, able to carry typical load of 295 passengers over distances of 7,150 n miles (13,242 km; 8,228 miles), powered by 151.2 kN (34,000 lb st) CFM56-5C4 turbofans, maximum T-O weight 271,000 kg (597,450 lb). Stronger landing gear, and engine refinements added to achieve range. Option for 1996 delivery onward.

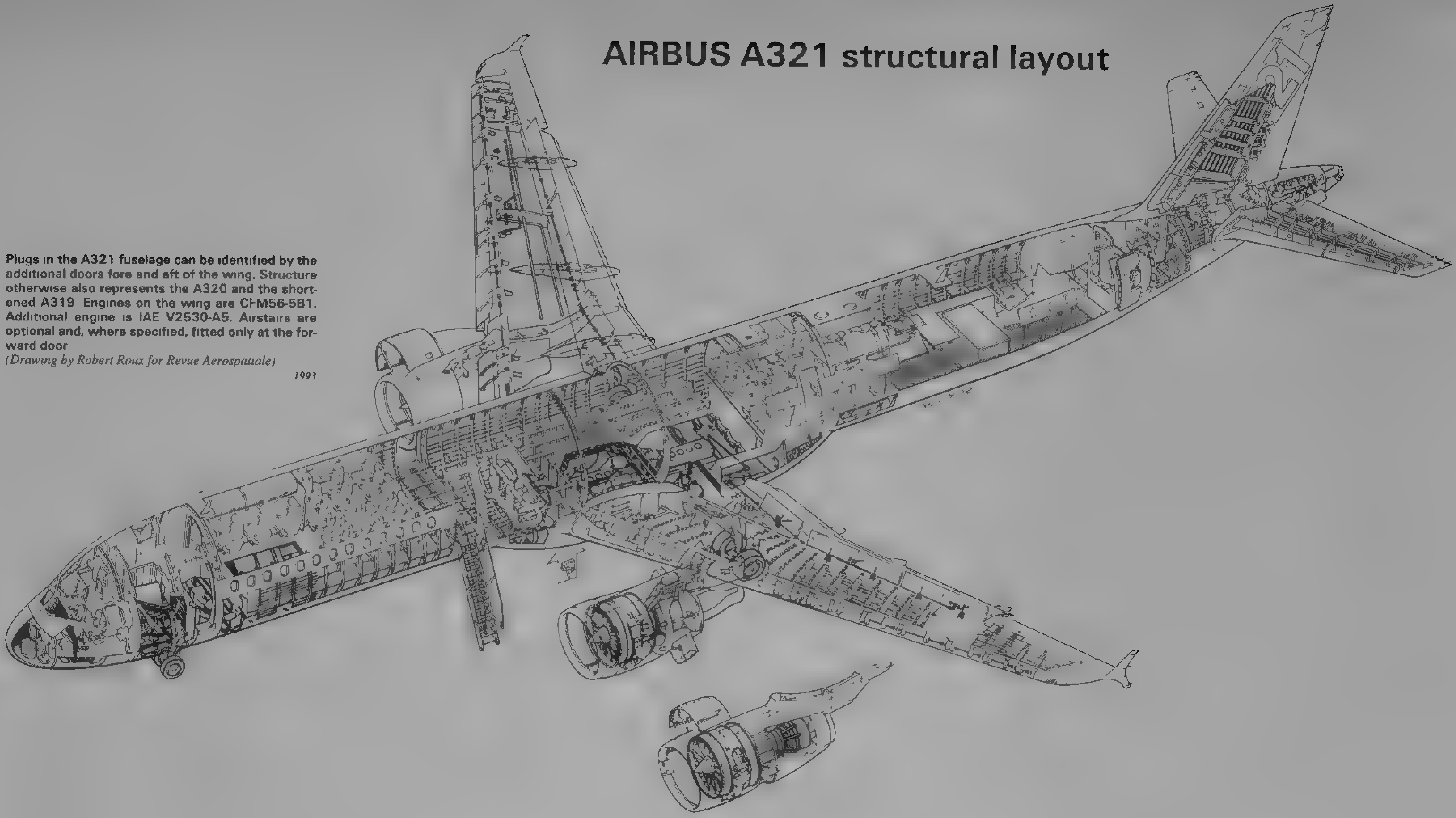
A340-200: Short-fuselage, longer range version of A340-300, with same initial power plant, exit limited seating capacity 303 or 263 in three classes, 26 LD3s or nine standard pallets under floor; first flight (F-WWBA) 1 April 1992; entered service March 1993.



A321 stretched development of the Airbus A320 *(Jane's/Dennis Punnett)*

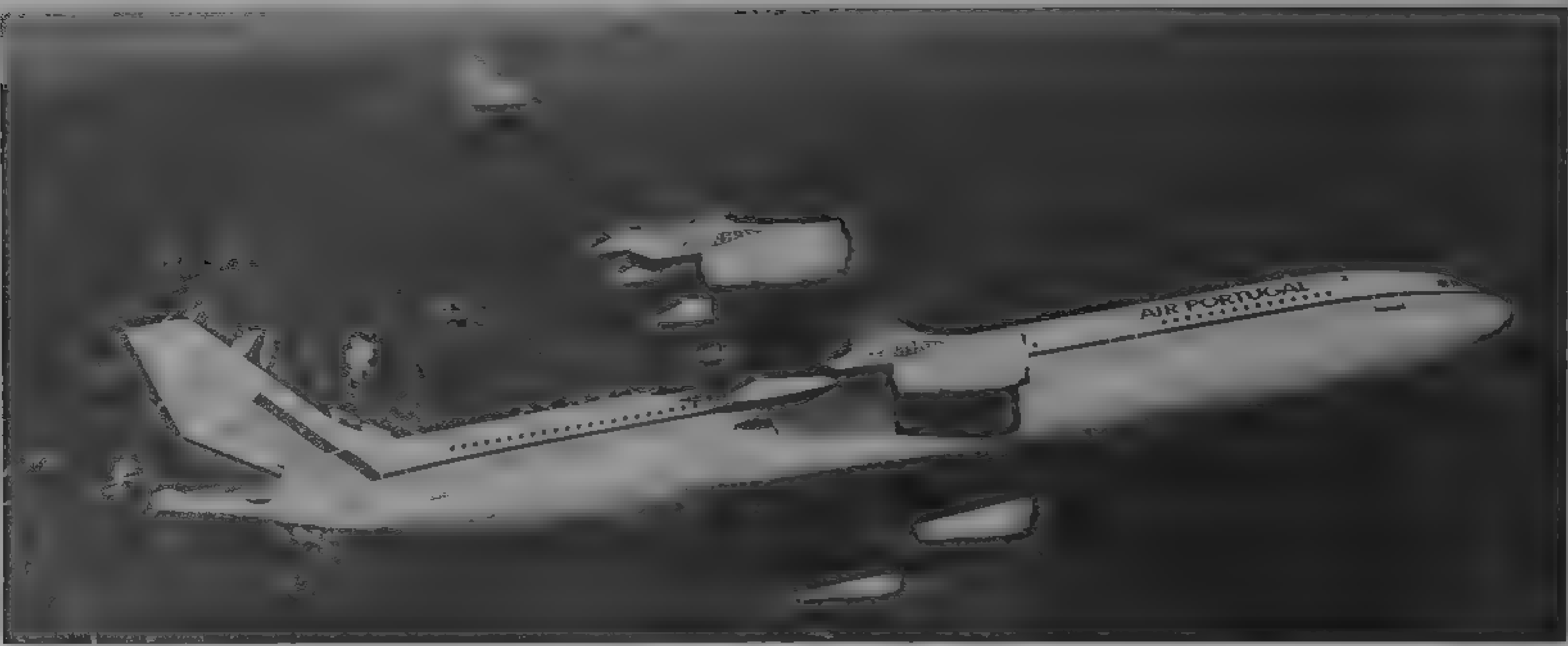
1995

AIRBUS A321 structural layout



Plugs in the A321 fuselage can be identified by the additional doors fore and aft of the wing. Structure otherwise also represents the A320 and the shortened A319. Engines on the wing are CFM56-5B1. Additional engine is IAE V2530-A5. Airstairs are optional and, where specified, fitted only at the forward door
(Drawing by Robert Roux for Revue Aerospatiale)
1993

Airbus A321 cutaway drawing, showing the two different engines initially available



Airbus A340 of TAP Air Portugal

1995

A340 AARGOS. From late 1995, testbed A340 No. 1 will be offered to atmospheric scientists [illegible] of the impac[illegible] [illegible] Airborne Atmo-spheric Research Global Observation System (AARGOS) programme. five airline-operated A340s also routi[illegible] gathering ozone and water vapour data under Measure-ment of Ozone on Airbus In-Service Aircraft (MOZAIC) programme

A340-8000: Possible advanced version of A340-200 with additional fuel under cabin floor, sl[illegible] CFM56-5C engines and higher max [illegible] could carry 260 three-class passengers [illegible] (14,816 km; 9,206 miles), potentially [illegible]

A340-8000 Alternative: As immediately above, but with one more underfloor fuel tank, first class sleeping [illegible] floor; could carry 140 passen-gers for 8,500 n miles (15,742 km; 9,781 miles), making possible high-comfort non-stop service from Europe to Australia

A340-300 Stretch. Possible version for transporting some 50 more passengers over same or greater distances as A340-300

A340-300 Advanced Possible version; new engines in 177.9 kN (40,000 lb st) class; transporting full A340-300 passenger load over same distances as A340-200

A340-200 Advanced: Possible version, engines as immediately above, endurance of more than 20 hours with full passenger load, affording "virtually one-stop around-the-world"

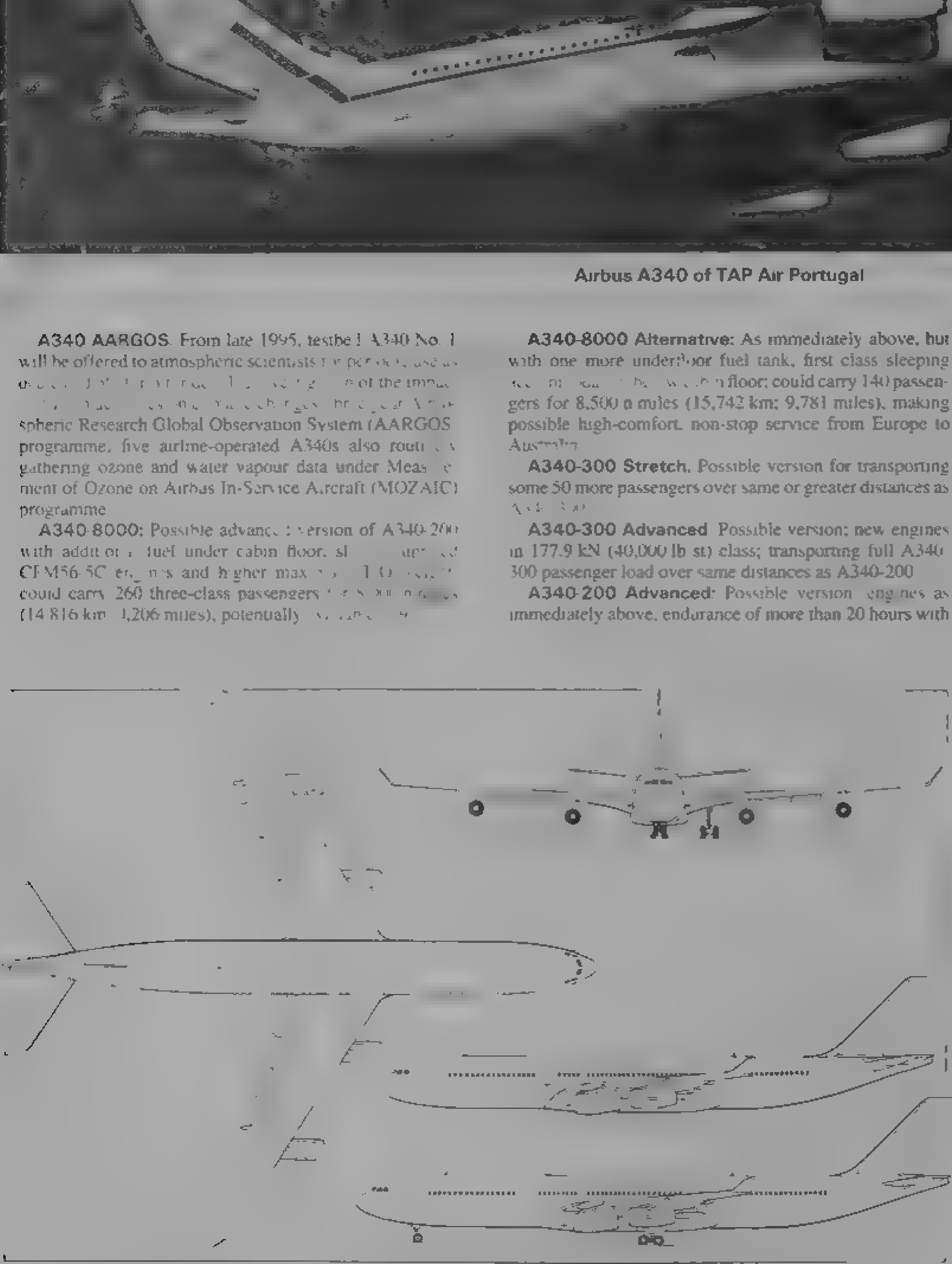
CUSTOMERS: See table preceding A300-600 entry

DESIGN FEATURES: A340 capitalises on commonality with A330 (identical wing/cockpit/tail unit and same basic fuselage) to create aircraft for different markets, and also has much in common (for example, existing Airbus wide-body fuselage cross-sections, A310/A300-600 fin, advanced versions of A320 cockpit and systems) with rest of Airbus range; FAA has approved cross-crew qualifi-cation for A320, A321, A330 and A340. New design wing (by BAe), approximately 40 per cent larger than that of A300-600, has 30° sweepback and winglets

FLYING CONTROLS: In A330/A340 electronic flight control sys-tem (EFCS), roll axis is controlled by two individual out-board ailerons and five outboard spoiler panels on each wing; pitch axis control is by trimmable tailplane and sep-arate left and right elevators, tailplane can also be mechan-ically controlled from flight deck, but fly-by-wire computer inputs are superimposed; single rudder is directly linked to rudder pedals, with dual yaw damping inputs superimposed. High-lift devices consist of full-span slats, flaps and aileron droop; speed braking and lift dump-ing by raising all six spoilers on each wing and raising all ailerons. Slats and flaps controlled outside main fly-by-wire complex by duplicated slat and flap control computers (SFCC). See diagram

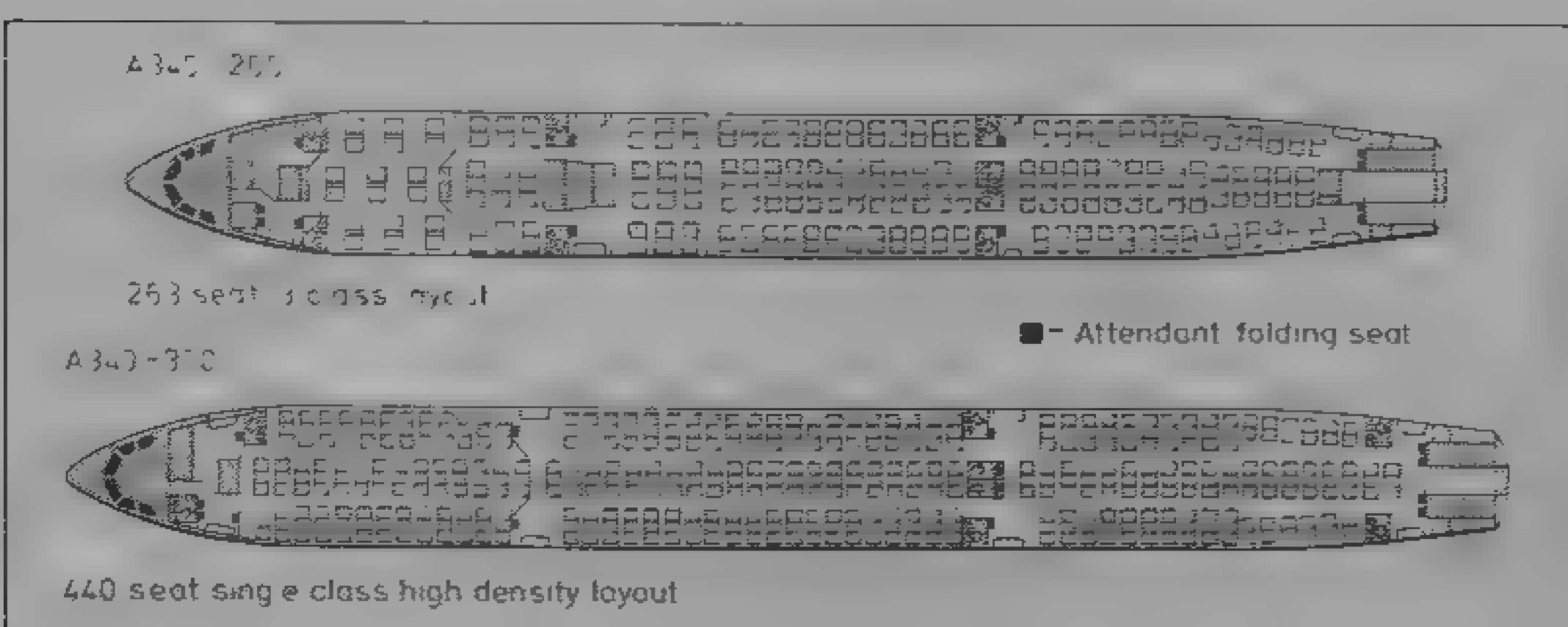
Control surface actuation by three hydraulic systems (green, yellow, blue); two powered control units (PCU) at each aileron and elevator are controlled either by primary or secondary flight control computers; single actuators at spoiler panels controlled by primary or secondary flight control computers, dual PCUs for fly-by-wire tailplane trimming, and for centrally located flap and slat actuators, three PCUs at rudder

Fly-by-wire computers include three flight control pri-mary computers (FCPC) and two flight control secondary computers (FCSC); each computer has two processors with different software; primary and secondary computers have different architecture and hardware, power supplies and signalling lanes are segregated, system provides stall protection, overspeed protection and manoeuvre protec-tion as in the A320, but the A330/340 computer arrange-ment maintains the protections for longer in the face of failures of sensors and inputs. FCPC and FCSC all operate continuously and provide comparator function to active channels, but only one in active control at any one control surface; reconfiguration logic can provide alternative



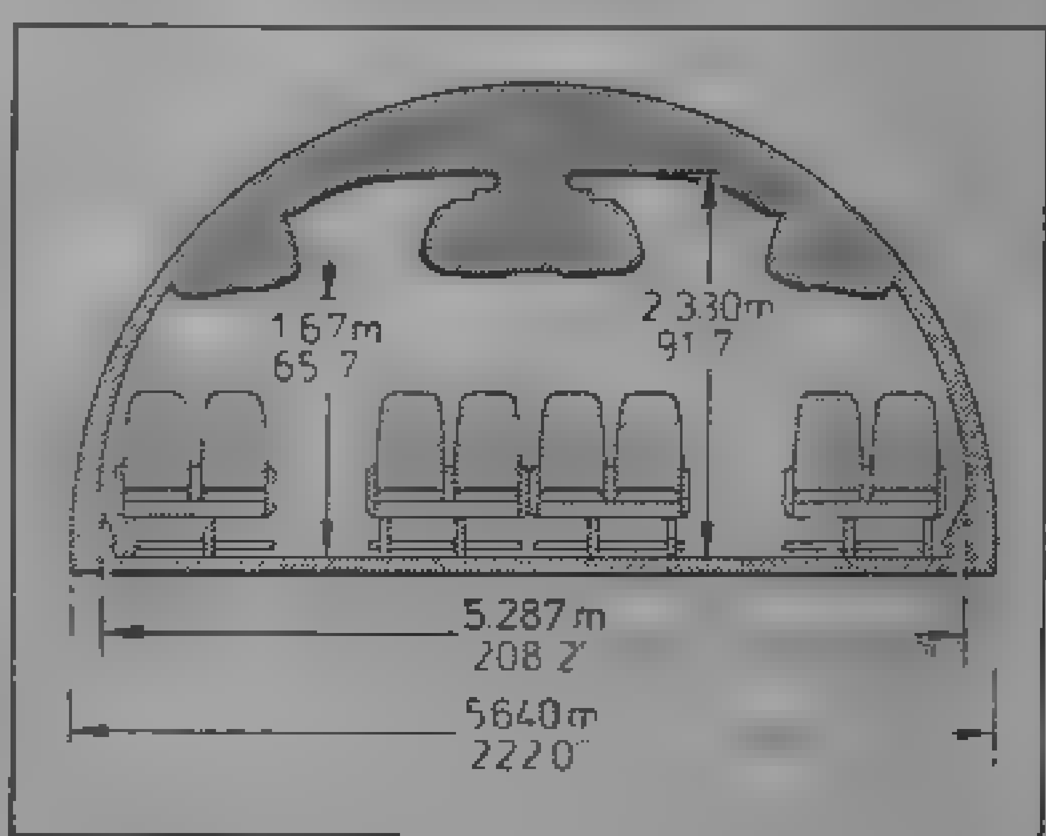
Airbus A340-300 four-turbofan long-range airliner, with additional side view (upper) of A340-200 *(Jane's/Dennis Punnett)*

1986



Cabin layouts for Airbus A340-200 and A340-300 *(Jane's/Mike Keep)*

1993



Airbus A330/340 passenger cabin cross-section *(Jane's/Mike Keep)*

1994

control after failures: different normal and alternative control laws apply fly by wire basically as a g demand in pitch and rate demand in roll, plus complex manoeuvre limitations; if all three inertial systems fail (removing attitude information), system reverts to direct mode in which control surface angle is directly related to sidestick position, ultimate control mode is direct control of rudder and tailplane angle from rudder pedals and manual trim wheel, which is sufficient for accurate basic instrument flight

Pilots have sidestick controllers and normal rudder pedals. EFIS instrumentation consists of duplicated primary flight displays (PFD), navigation displays (ND) and electronic centralised aircraft monitors (ECAM); three display management computers with separate EFIS and ECAM channels, can each control all six displays in their four possible formats, flight path control by duplicated flight management and guidance and envelope computers (FMGEC); they control every phase of flight including course, attitude, engine thrust and flight planning using information from GPS and inertial systems, point of no return calculations made automatically for long-range flights in A340/A330. Control system data is collected for maintenance purposes by two flight control data concentrator (FCDC) computers.

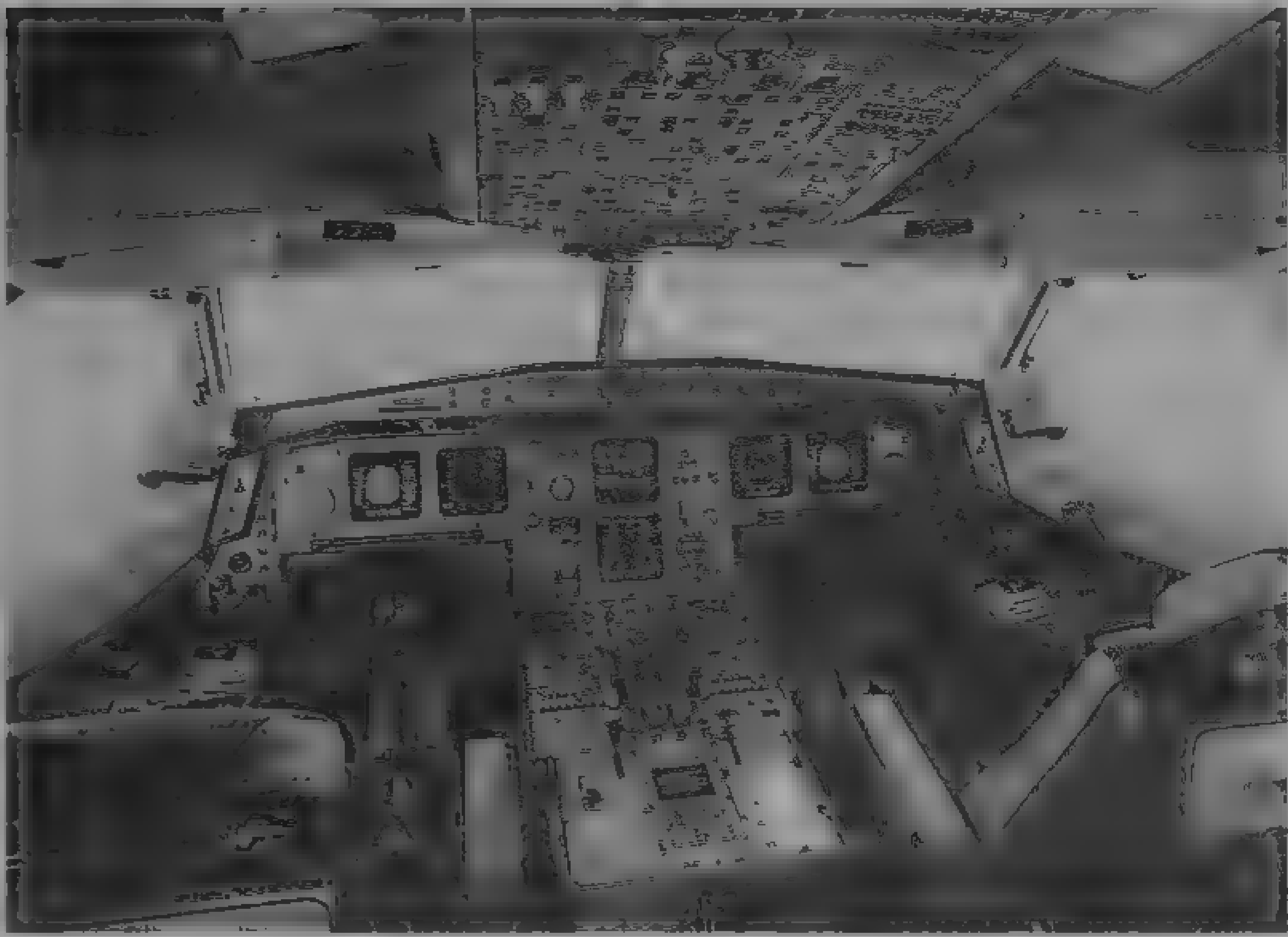
In normal flight, bank angle limited to 33° hands-off (autopilot control) and 67° with full stick displacement, airspeeds limited to 305 knots (565 km/h; 350 mph) and Mach 0.82 under automatic flight control, if stick is held fully forward, the nose is automatically raised when airspeed reaches VMO + 15 knots (28 km/h, 17 mph), if nose is raised equivalent protections apply, 'alpha max' (13° clean and 19° with flap), slightly below maximum lift coefficient, is the greatest achievable with sidestick, 'alpha floor' is the angle of attack beyond which throttles progressively open to go-around power and airspeed is finally held steady just above stall, even if stick is continuously held back, alpha protection applied at 'normal' and 'hard' modes according to alpha rate: below protection speed (V_{PROT}) of 142 knots (263 km/h, 163 mph) automatic and manual trimming stops, outer ailerons remain centred at over 200 knots (371 km/h; 230 mph); if a spoiler panel fails, the symmetrical opposite panel stops operating, if rudder yaw damping fails, pairs of spoiler panels are used instead; minimum-speed marker on PFD adjusts to changing aircraft configuration, airbrake and pitch rate, fuel automatically transferred between wing and tailplane tanks to minimise trim drag when cruising above 7,620 m (25,000 ft)

Engines controlled by setting throttle levers to marks on quadrant, such as climb (CLB), maximum continuous and flexible take-off (Flex T-O); digital engine control makes detailed settings appropriate to altitude and temperature

During landing and take-off, nosewheel steering by rudder pedals, automatically disengages above 100 knots (185 km/h; 115 mph) demands for more than 4°/s nose-up pitch restrained near ground; maximum airspeeds for flaps and slats signalled on airspeed scale, trim automatically cancels effect of flaps, landing gear and airspeed, ailerons droop with full flap selection and deflect 25° up with spoilers in lift dump after touchdown; thrust reverser failure automatically countered by cancelling symmetrical opposite reverser, voice warning demands throttle closure at 6 m (20 ft) during landing flare [illegible] when throttles closed at touchdown on touch-and-go [illegible] trim automatically reset for take-off when Flex T-O power selected, engine failure in flight compensated automatically, with wings held level, slight heading drift and spoiler panels sucked down to avoid unnecessary drag

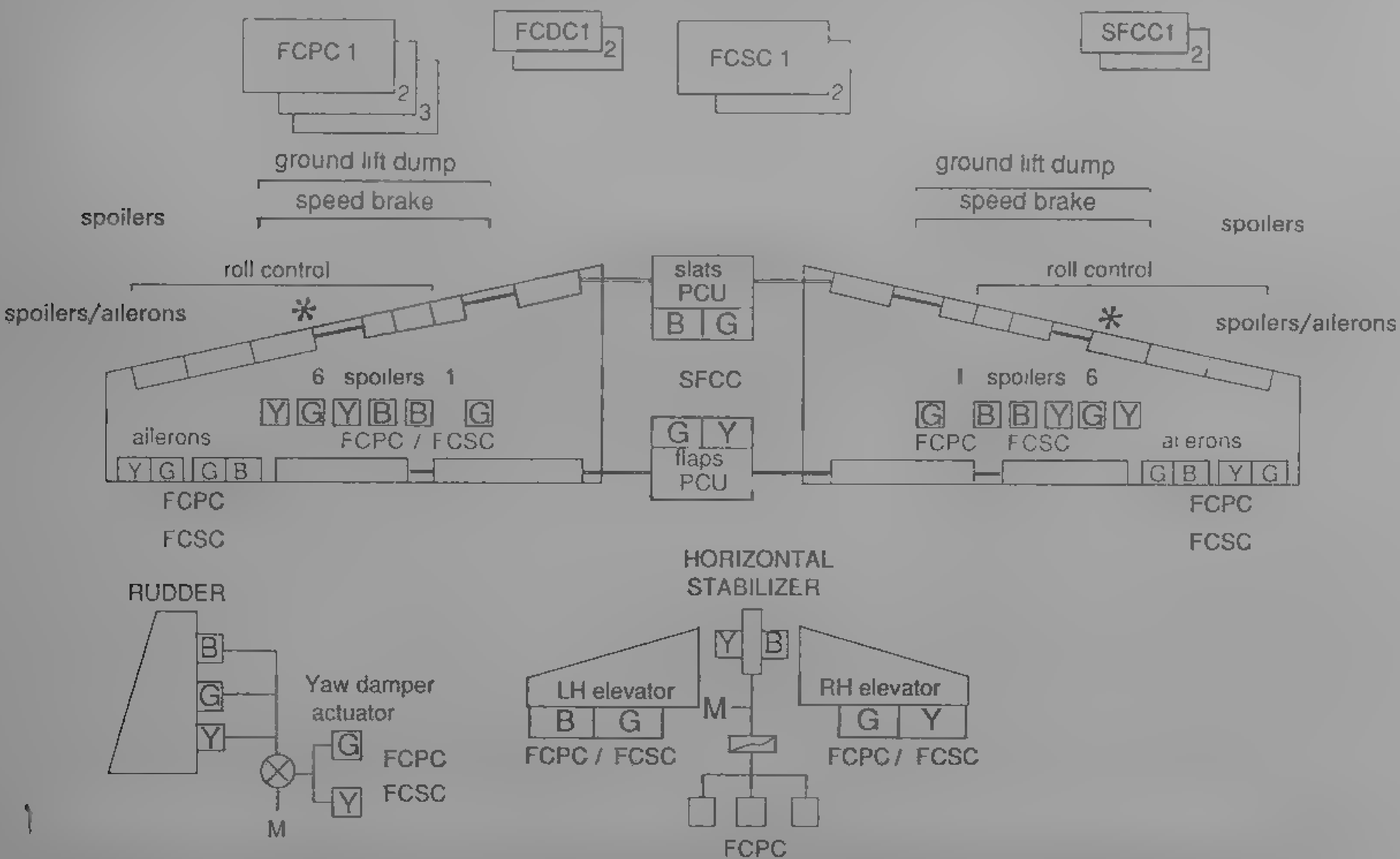
STRUCTURE: A330 and A340 wings almost identical except latter strengthened in area of outboard engine pylon with appropriate modification of leading-edge slats 4 and 5 main three-spar wing box and leading/trailing-edge ribs and fittings of aluminium alloy, with Al-Li for some secondary structures; steel or titanium slat supports, approximately 13 per cent (by weight) of wings is of CFRP, GFRP or AFRP, including outer flaps and flap track fairings, ailerons, spoilers, leading/trailing-edge fixed surface panels and wing-lets; common fuselage for all initial versions except in overall length (A340-300 same size as A330 and longest, A340-200 eight frames shorter), construction generally similar to that of A310 and A300-600 except centre section to accept new wing, tail unit (common to all versions) utilises same CFRP fin as A300-600 and A310 new tailplane incorporates trim fuel tank and has CFRP outer main boxes bridged by aluminium alloy centre-section

Work-sharing along lines similar to those for A310 and A300-600, with percentages similar to those held in consortium. Aerospatiale thus responsible for cockpit, engine



Flight decks of the A330 and A340 (illustrated) are almost identical and very similar to the A320. The FAA has approved cross-qualification of pilots

1995



Layout of the Airbus A330/A340 fly-by-wire system, showing the application of the three hydraulic systems blue, yellow and green (B, Y, G), to the various surfaces and computers three flight control primary computers, two flight control data concentrator computers two flight control secondary computers and two slat and flap control computers M stands for direct mechanical control and PCU for powered control unit See Flying Controls heading in A340 entry

1994

pylons, part of centre fuselage, and final assembly and outfitting at Toulouse; British Aerospace (with Textron Aerostructures, USA, as subcontractor) for wings, Daimler Benz Aerospace Airbus for most of fuselage, fin and interior; CASA for tailplane, Belgian consortium Belairbus for leading-edge slats and slat tracks

LANDING GEAR: Main (four-wheel bogie) and twin-wheel nose units identical on all A330/340 versions. A340 has additional twin-wheel auxiliary unit on fuselage centreline amidships. Goodyear tyres on all units. Landing gear and surrounding structure reinforced for extended-range A340-300

POWER PLANT: Four 138.8 kN (31,200 lb st) CFM56-5C2 turbofans initially; 144.6 kN (32,500 lb st) CFM56-5C3 and 151.2 kN (34,000 lb st) CFM56-5C4 engines available as options. Maximum fuel capacity (-200 and -300) 138 600 litres (36,614 US gallons; 30,488 Imp gallons)

ACCOMMODATION: Crew of two on flight deck (all versions), flight deck can be supplied with humidified air. Passenger seating typically six-abreast in first class, seven abreast in business class and eight-abreast in economy (nine-abreast optional), all with twin aisles, two-class configurations seat 335 passengers in A340-300, and 303 passengers in A340-200; more typically, a three-class layout seats 295 in A340-300 and 263 in the A340-200. Underfloor cargo holds house up to 32 LD3 containers or 11 standard 2.24 × 3.17 m (88 × 125 in) pallets in A340-300, and 26 LD3s or 9 pallets in A340-200; front and rear cargo holds have doors wide enough to accept 2.44 × 3.17 m (96 × 125 in) pallets, all versions have a 19.68 m³ (695 cu ft) bulk cargo hold aft of the rear cargo hold

DIMENSIONS, EXTERNAL:

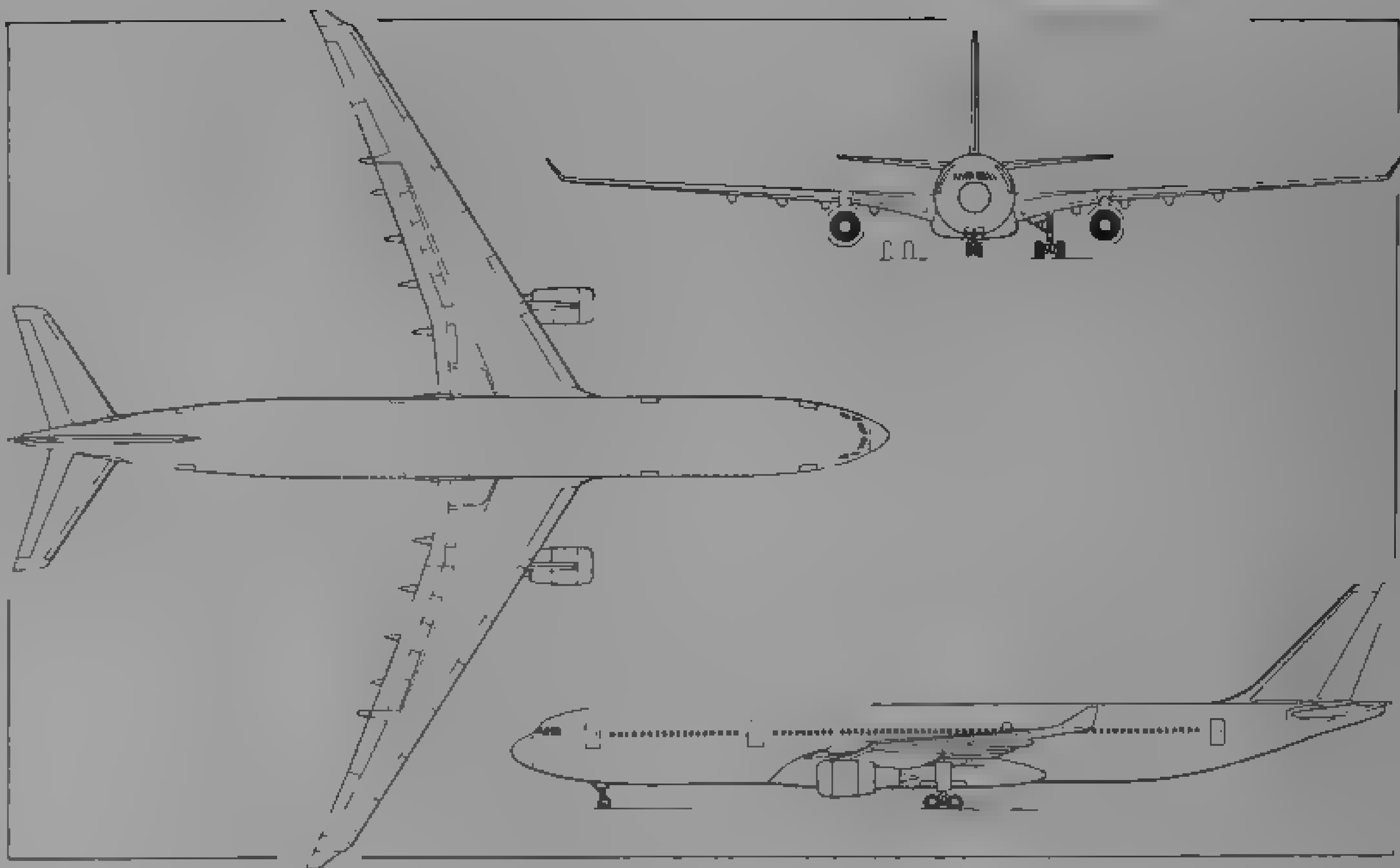
Wing span (all versions)	60.30 m (197 ft 10 in)
Wing aspect ratio (all versions)	10.01
Length overall: A340-200	59.39 m (194 ft 10 in)
A340-300	63.65 m (208 ft 10 in)
Fuselage: Max diameter (all versions)	5.64 m (18 ft 6 in)
Height overall (all versions)	16.74 m (54 ft 11 in)
Wheel track (all versions)	10.49 m (34 ft 5 in)

AREAS:

Wings, gross (all versions)	363.1 m² (3,908.4 sq ft)

WEIGHTS AND LOADINGS:

Typical airline operating weight empty:	
A340-200	123,085 kg (271,350 lb)
A340-300: standard	126,873 kg (279,700 lb)
longer range version	129,806 kg (286,175 lb)
Max payload: A340-200	45,915 kg (101,225 lb)
A340-300: standard	47,127 kg (103,900 lb)
longer range version	48,194 kg (106,250 lb)
Max T-O weight:	
A340-200, -300 standard	257,000 kg (566,575 lb)
A340-300: optional	260,000 kg (573,200 lb)
longer range version	271,000 kg (597,450 lb)
Max landing weight: A340-200	181,000 kg (399,025 lb)
A340-300: standard	186,000 kg (410,050 lb)
optional	188,000 kg (414,450 lb)
longer range version	190,000 kg (418,875 lb)
Max zero-fuel weight:	
A340-200	169,000 kg (372,575 lb)
A340-300: standard	174,000 kg (383,600 lb)
longer range version	178,000 kg (392,425 lb)
Max wing loading	746.4 kg/m² (152.9 lb/sq ft)
Max power loading (CFM56-5C2)	488.11 kg/kN (4.78 lb/lb st)



Airbus A330 twin-turbofan airliner, developed in parallel with the A340 *(Jane's/Dennis Punnett)*

1986

PERFORMANCE (estimated, definitions as for Weights and Loadings):

Max operating Mach number (M_{MO})	0.86
Typical operating Mach number	0.82
Range at typical OWE:	
A340-200 with 263 passengers and baggage, international allowances and 200 n mile (370 km, 230 mile) diversion	7,450 n miles (13,806 km; 8,573 miles)
A340-300 with 295 passengers and baggage, allowances as above: standard	6,700 n miles (12,416 km; 7,710 miles)
longer range version	7,200 n miles (13,343 km; 8,285 miles)

OPERATIONAL NOISE LEVELS (estimated):

T-O, fly-over	95.0 EPNdB
Sideline	94.7 EPNdB
Approach	97.2 EPNdB

UPDATED

AIRBUS A330

TYPE: Wide-body, medium/long-range twin-engined airliner

PROGRAMME: Developed simultaneously with four-engined A340; launched 5 June 1987, first flight (F-WWKA) with GE engines 2 November 1992, first R R Trent 700-powered A330 flew 31 January 1994; simultaneous European and US certification with initial GE CF6-80E1 engines received October 1993; first delivery (Air Inter) December 1993, entered service January 1994, certification with PW4164/4168 obtained 2 June 1994, A330 powered by GE CF6-80E1 with FADEC granted 120 minutes ETOPS approved May 1994, Aer Lingus flew first ETOPS services across the Atlantic in May 1994; A330 powered by PW4164/4168 granted 90 minutes ETOPS approval November 1994, certification with R R Trent achieved 22 December 1994, 90 minutes ETOPS approval granted prior to first delivery, to Cathay Pacific Airways, 24 February 1995

All main structural and systems information common to both A330 and A340 are listed in A340 entry. Differences in A330 given here

CURRENT VERSIONS: **A330-300**: Seating capacity as for A340-300; 335 passengers standard, 440 passengers maximum. Payload increase of 7,000 kg (15,432 lb) offered for standard A330-300 in October 1993

Longer-range version: Previously A330-300X, higher gross weight to allow typical 335 passengers to be carried 4,850 n miles (8,982 km; 5,581 miles), compared with 4,500 n miles (8,334 km, 5,178 miles) for basic A330-300, maximum T-O weight 217,000 kg (478,402 lb) available for end 1995 delivery

A330 'Downward Extension': Studies under way in 1994 for lower-capacity variants of A330, ranging from eight-frame reduction using A330-200 fuselage, to 17-frame reduction giving same passenger capacity as A300-600, optimum A300M10 configuration involves 10-frame reduction, affording carriage of 240 passengers in three classes over same range as Boeing 767-300ER, but with far higher payload capacity

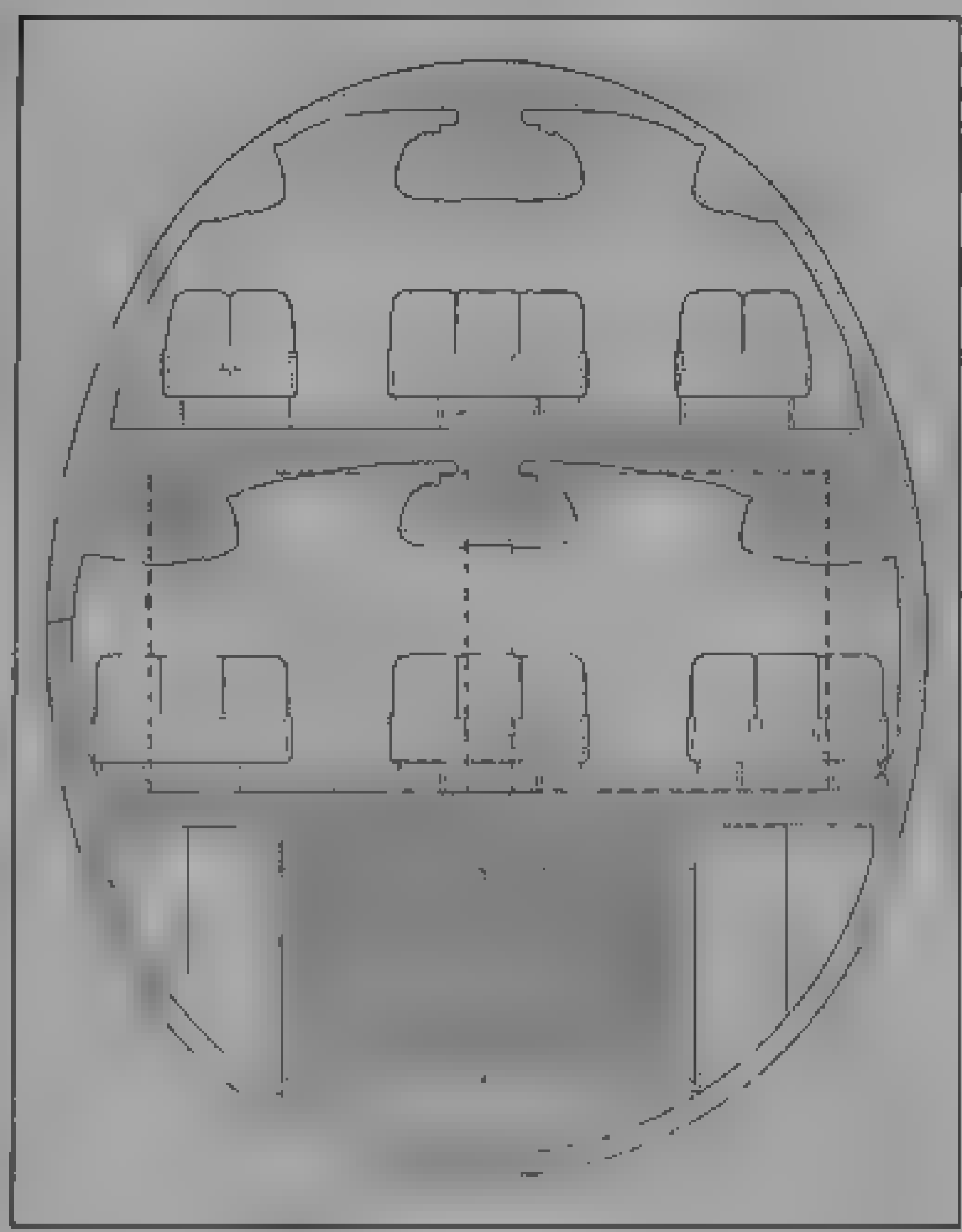
A330 Super Stretch: Study for version of A330 carrying additional passengers in fully furnished forward freight compartment with windows; to give a Boeing 747 passenger load over shorter range, but at far lower direct operating cost

Gulf Air is the first Middle East airline to operate the Airbus A340

1995

Airbus A330 of the German carrier LTU

1995



Airbus A3XX fuselage cross-section showing 2 44 m (8 ft 0 in) square freight containers as alternative load on lower passenger deck External height 8 53 m (27 ft 11¾ in), width 6 77 m (22 ft 2½ in)

1995

POWER PLANT: First deliveries with two 300 3 kN (67,500 lb st) GE CF6-80E1A2 turbofans, alternative engines, using common pylon and mount, P&W PW4164/4168 or R-R Trent 768/772. Longer-range version powered by PW4164/4168 or Trent 768/772. Fuel capacity 97,170 litres (25 670 US gallons, 21,374 Imp gallons).

DIMENSIONS, EXTERNAL

Length overall	63 65 m (208 ft 10 in)

WEIGHTS AND LOADINGS (A330-300 basic versions, CS with CF6-80E1A2, PS with PW4164/4168, TS with Trent 768/772. A330-300 longer-range versions, CL with CF6-80E1A2, PL with PW4164/4168, TL with Trent 768/772):

Typical airline operating weight empty:	
CS	120,285 kg (265,175 lb)
PS	120,851 kg (266,425 lb)
TS	120,012 kg (264,575 lb)
CL	120,617 kg (265,925 lb)
PL	121,183 kg (267,150 lb)
TL	120,344 kg (265,325 lb)
Max payload: CS	46,715 kg (102,985 lb)
PS	46,149 kg (101,740 lb)
TS	46,988 kg (103,390 lb)
CL	48,383 kg (106,665 lb)
PL	47,817 kg (105,415 lb)
TL	48,656 kg (107,265 lb)
Max T-O weight: CS, PS, TS	212 000 kg (467,375 lb)
CL, PL, TL	217,000 kg (478,400 lb)
Max landing weight:	
CS, PS, TS	174,000 kg (383 600 lb)
optional	177,000 kg (390,200 lb)
CL, PL, TL	179,000 kg (394,625 lb)
Max zero-fuel weight:	
CS, PS, TS	164,000 kg (361,550 lb)
optional weight	167,000 kg (368,150 lb)
CL, PL, TL	169,000 kg (372,575 lb)

PERFORMANCE

Range at typical OWE, with allowances for 200 n mile (370 km, 230 mile) diversion and international reserves:

A330-300 with 335 passengers and baggage:

CS, TS	4,500 n miles (8,334 km; 5,178 miles)
PS	4,450 n miles (8,241 km; 5,120 miles)
CL, TL	4,850 n miles (8,982 km; 5,581 miles)
PL	4,800 n miles (8,889 km; 5,523 miles)

OPERATIONAL NOISE LEVELS (A330-300, estimated):

T-O, flyover	92.2 EPNdB
Sideline	97.8 EPNdB
Approach	101 EPNdB

UPDATED

AIRBUS A3XX

TYPE: High-capacity airliner

PROGRAMME: Engineering work began in early June 1994, Ultra-High Capacity Airliner/Very Large Commercial Transport; intended to carry between 530 and 800 passengers, company declined to wait for completion of joint international study by Boeing, Aerospatiale, British Aerospace and Daimler-Benz Aerospace (with Airbus Industrie as an observer) which was due to be completed in mid 1995.

Market forecast suggests 40 per cent of expenditure on airliners over next 20 years will be on airliners of Boeing 747 size, or larger. A3XX is Airbus 'insurance' against Boeing domination of market if international VLCT programme is not launched.

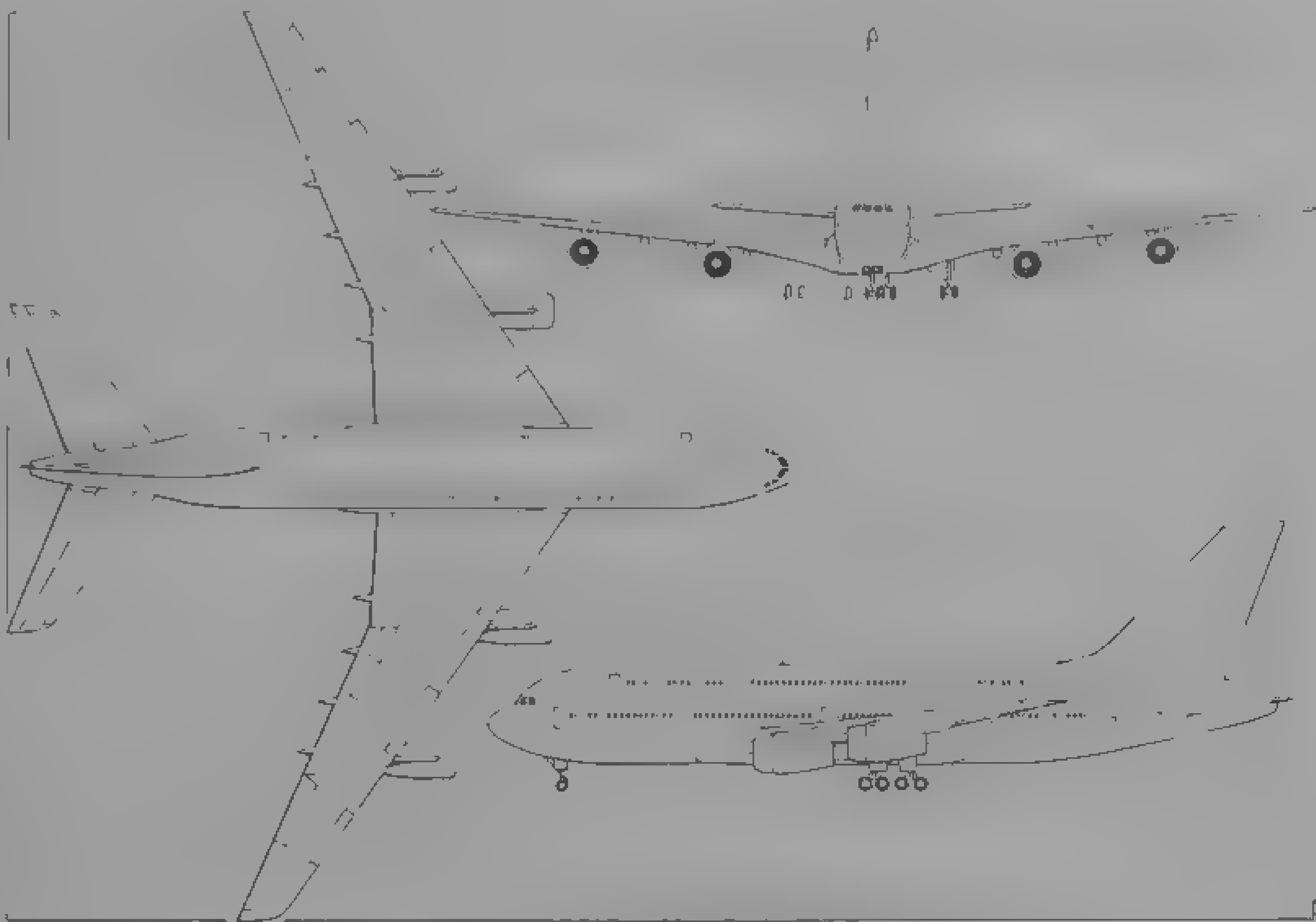
Airbus A3XX ground work includes consultation with potential customers in Far East, Europe and USA, some airlines may require A3XX before 2003, which is planned service entry date.

DESIGN FEATURES: First version of Airbus UHCA, designated A3XX-100, is conventional in external appearance, but requires new developments in structures, materials, landing gear design and aerodynamics. Power plant drawn from existing range of engines installed in A330 (GE CF6-80E1, P&W PW4168 or RR Trent 700).

Fuselage is vertically orientated oval three-deck arrangement, rather than horizontal double bubble originally favoured; configuration also responsible for more modest propulsion requirement. 'Vertical ovoid' fuselage accommodates nine passengers abreast on main deck and seven-abreast on upper deck at A320 standards of comfort, option for increase to 10 and eight. Seating ranges from 530 or 570 (depending on seat spacing) in three-class layout to 854 in single-class, high-density Japanese domestic layout.

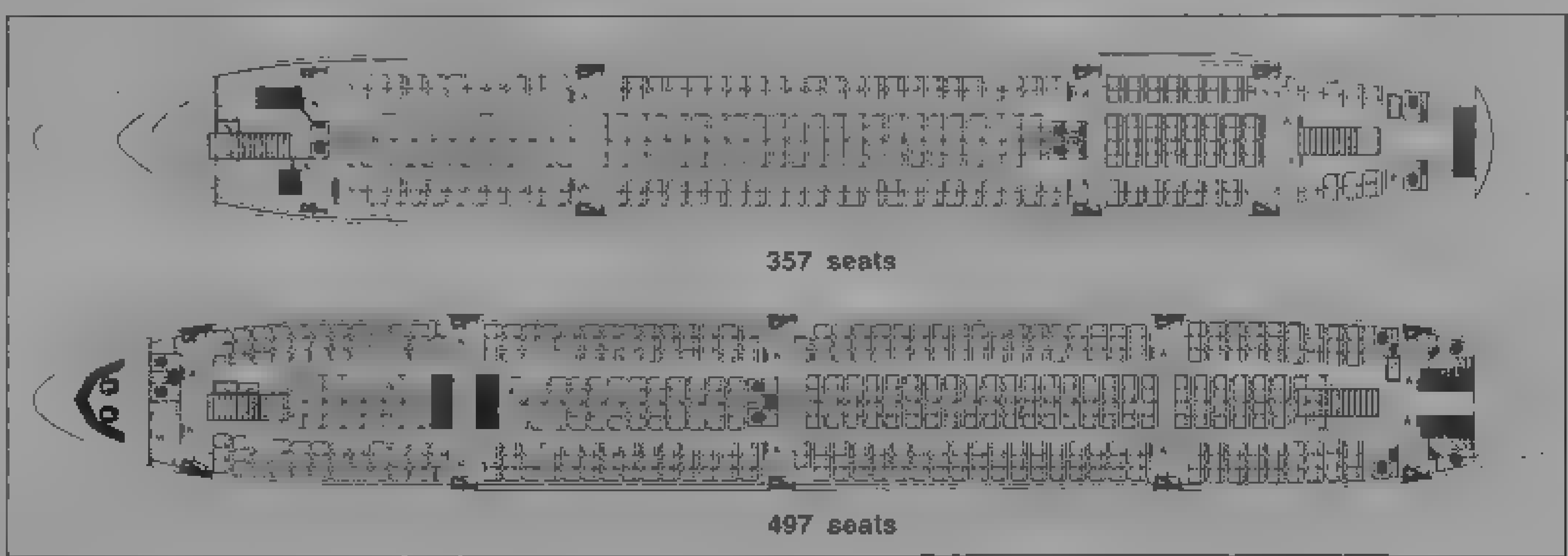
Lower deck accommodates normal range of cargo containers (30 LD3 in A3XX-100, 36 LD3 in A3XX-200) or pallets (10 in A3XX-100, 12 in A3XX-200) and 15 m³ (530 cu ft) of bulk freight, main deck is large enough to accommodate two 2 44 x 2 44 m (8 ft 0 in x 8 ft 0 in) containers side by side in a freighter version.

Maximum take-off weight of 471,000 kg (1,038,000 lb), exceeding that of Boeing 747-400, allows



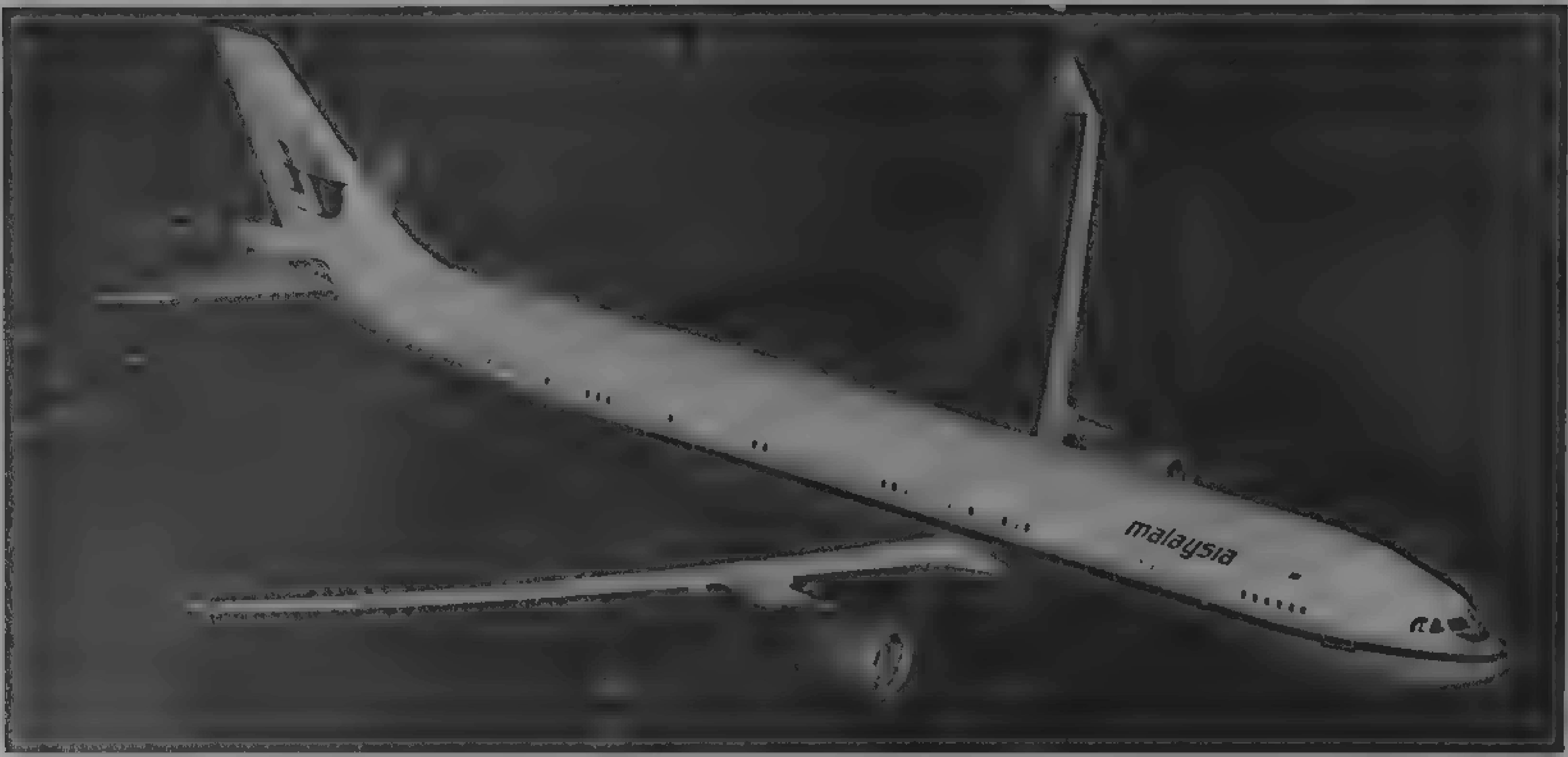
Airbus A3XX Ultra-High Capacity Airliner project (*Jane's/Keith Fretwell*)

1994



Upper and lower decks of projected A3XX configured for 854 passengers

1995



Airbus A330 of Malaysia Airlines

1995

[illegible]00 n miles (13,705 km; 8,515 miles) with full passenger load. Direct operating costs of A3XX required to be at [illegible] t 15 to 20 per cent lower than those of nearest exis[illegible] ompet[illegible] A3XX 200 would feature a stretch of 6.5 m (2[illegible] ft 4 in) to increase seating to between 630 and 680 in three-class layout and to 1,000 in high-density [illegible]

[illegible]

W[illegible] n (all versions) [illegible]

Length overall: A3XX-100 69.70 m (228 ft 8 in)
  A3XX-200 76.20 m (250 ft 0 in)
Fuselage: Max diameter 8.53 m (27 ft 11¾ in)
  Max width 6.77 m (22 ft 2½ in)
Height overall 22.80 m (74 ft 9½ in)

WEIGHTS AND LOADINGS:
Operating weight empty:
  A3XX-100 241,000 kg (531,3[illegible] lb)
  A3XX-200 260,000 kg (573,200 lb)
Max zero-fuel weight:
  A3XX-100 321,000 kg (707,675 lb)
  A3XX-200 350,000 kg (771,600 lb)
Max T-O weight: A3XX-100 471,000 kg (1,038,375 lb)
  A3XX-200 515,000 kg (1,135,375 lb)

UPDATED

Computer-generated image of Airbus A3XX with London buses for scale

1995

AIRBUS MILITARY DERIVATIVES

Some A300s and A310s purchased for operation by several air forces. Airbus Industrie proposing future specific military versions as under:

NEW ENTRY

MULTI ROLE TANKER TRANSPORT (MRTT)

TYPE: Military derivatives of A300, A300-600 and A310.

PROGRAMME: Canadian Forces, German Luftwaffe, French and Thai air forces already operate A310s variously fitted for VIP, troop and/or freight transport. Airbus has delegated development and marketing of flight refuelling versions to its major partners, using either pre-owned or new aircraft. A340 may also be adapted as tanker later. Deliveries possible by late 1990s.

DESIGN FEATURES: Conversions offer greater refuelling and transport capability than earlier airliners in combination with modern aircraft with better lifetime costs and longer life expectancy; possible roles include tanker with boom and hose-reel transfer systems, cargo and personnel transports which can be combined with refuelling, medevac, airborne command post and reconnaissance/airborne warning. Airbus conversions offer payloads from 35,000 to 50,000 kg (77,161 to 110,231 lb), full payload trans-Atlantic range, long on-station time, combined boom and hosereel transfer capability, standard Airbus forward port-side freight door (projected height 2.57 m; 8 ft 5¼ in, width 3.58 m, 11 ft 9 in); quick-change main deck layout, probe or receptacle fuel receiver capability; commonality with existing airliners and same worldwide support resources, predictable spares requirements and longer remaining airframe life. About 100 civil operators on all five continents are flying A300/310, and first-generation Airbus airliners are now becoming available on market; military rendezvous and self-protection systems can be fitted; main deck can be converted with palletised seating for up to 270 passengers in under 24 hours; up to 28,000 kg (61,729 lb) of additional fuel can be carried in tanks in underfloor cargo compartments.

POWER PLANT: MRTT 300 powered by GE CF6-50C2, MRTT 300-600 powered by GE CF6-80C2A5; MRTT 310 powered by GE CF6-80C2A2

DIMENSIONS, INTERNAL (300: MRTT 300, 600: MRTT 300-600R, 310: MRTT 310)

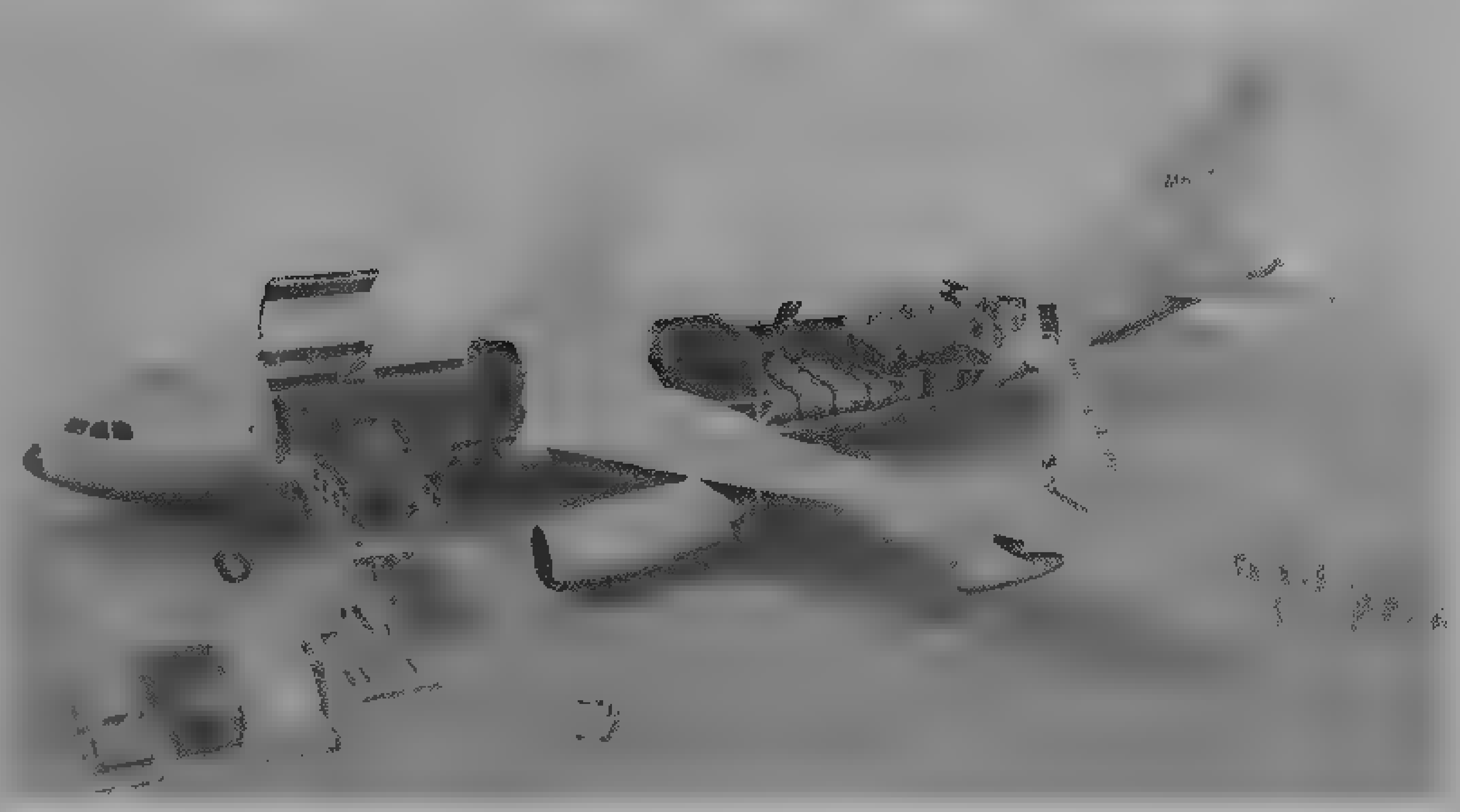
Usable cabin length: 300	36.96 m (121 ft 3 in)
600	40.70 m (133 ft 6 in)
310	43.90 m (144 ft 0 in)
Cabin height: all	2.28 m (7 ft 5¾ in)
Max cabin width: all	5.29 m (17 ft 4¼ in)
Underfloor freight hold volume:	
300	107 m³ (3,778.7 cu ft)
600	138 m³ (4,873.43 cu ft)
310	80 m³ (2,825.2 cu ft)

WEIGHTS AND LOADINGS

Operating weight empty: 300	88,410 kg (194,910 lb)
600	89,650 kg (197,645 lb)
310	80,830 kg (178,200 lb)
Max normal fuel capacity: 300	48,350 kg (106,595 lb)
600	53,290 kg (117,485 lb)
310	47,940 kg (105,690 lb)
Additional fuel: all	28,240 kg (62,258 lb)
Max T-O weight: 300	165,000 kg (363,750 lb)
600 normal	170,500 kg (375,875 lb)
600 optional	171,700 kg (378,525 lb)
310 normal	157,000 kg (346,125 lb)
310 optional	164,000 kg (361,550 lb)

PERFORMANCE:

Refuelling speed:
- all, boom: 240-320 kts (444-592 km/h, 276-368 mph)
- all, hose and drogue: 220-320 kts (407-592 km/h, 253-368 mph)



Cutaway drawing of Airbus MRTT

1995

Max range, standard fuel:

300	3,700 n miles (6,852 km; 4,258 miles)
600	4,150 n miles (7,685 km; 4,775 miles)
310	4,800 n miles (8,889 km; 5,523 miles)

Max range, using transferable fuel:

300, 600	5,400 n miles (10,000 km; 6,214 miles)
310	7,200 n miles (13,334 km; 8,285 miles)

UPDATED

AIRTECH

AIRCRAFT TECHNOLOGY INDUSTRIES

PRESIDENT: Prof Dr-Ing B J Habibie (IPTN)

VICE-PRESIDENT: Javier Alvarez Vara (CASA)

PARTICIPATING COMPANIES:

CASA: see under Spain

IPTN: see under Indonesia

Airtech formed by CASA and IPTN to develop CN-235 twin-turboprop transport; design and production shared 50-50.

VERIFIED

AIRTECH (CASA/IPTN) CN-235

Spanish Air Force designations: T.19A (VIP) and T.19B

TYPE: Twin-turboprop military and civil transport.

PROGRAMME: Preliminary design began January 1980, prototype construction May 1981, one prototype completed in each country, with simultaneous roll-outs 10 September 1983; first flights 11 November 1983 (by CASA's ECT-100) and 30 December 1983 (IPTN's PK-XNC). Spanish and Indonesian certification 20 June 1986, first flight of production aircraft 19 August 1986. FAA type approval (FAR Pts 25 and 121) 3 December 1986; deliveries began 15 December 1986 from IPTN line and 4 February 1987 from CASA; entered service (with Merpati Nusantara Airlines) 1 March 1988; licence agreement with TAI (see Turkish section) announced January 1990, initially to assemble and later to manufacture locally 50 of 52 ordered; first flight of Turkish assembled aircraft 24 September 1992, first delivery 13 November 1992. JAR 25 type approval October 1993.

CURRENT VERSIONS: **CN-235 Series 10**: Initial production version (15 built by each company), with CT7-7A engines; described in 1986-87 and earlier *Jane's*.

CN-235 Series 100/110: Generally as Series 10, but CT7-9C engines in new composite nacelles; replaced Series 10 in 1988 from 31st production aircraft. Series 110 is Indonesian built, with improved electrical, warning and environmental systems to comply with JAR Pt 25; certification achieved July 1995. *Detailed description applies to this version except where indicated.*

CN-235 Series 200/220: Structural reinforcements to cater for higher operating weights, aerodynamic improvements to wing leading-edges and rudder, reduced field length requirements and much-increased range with maximum payload; certificated by FAA March 1992. Series 220 is Indonesian built, with improvements similar to Srs 110; certification expected mid-1996.

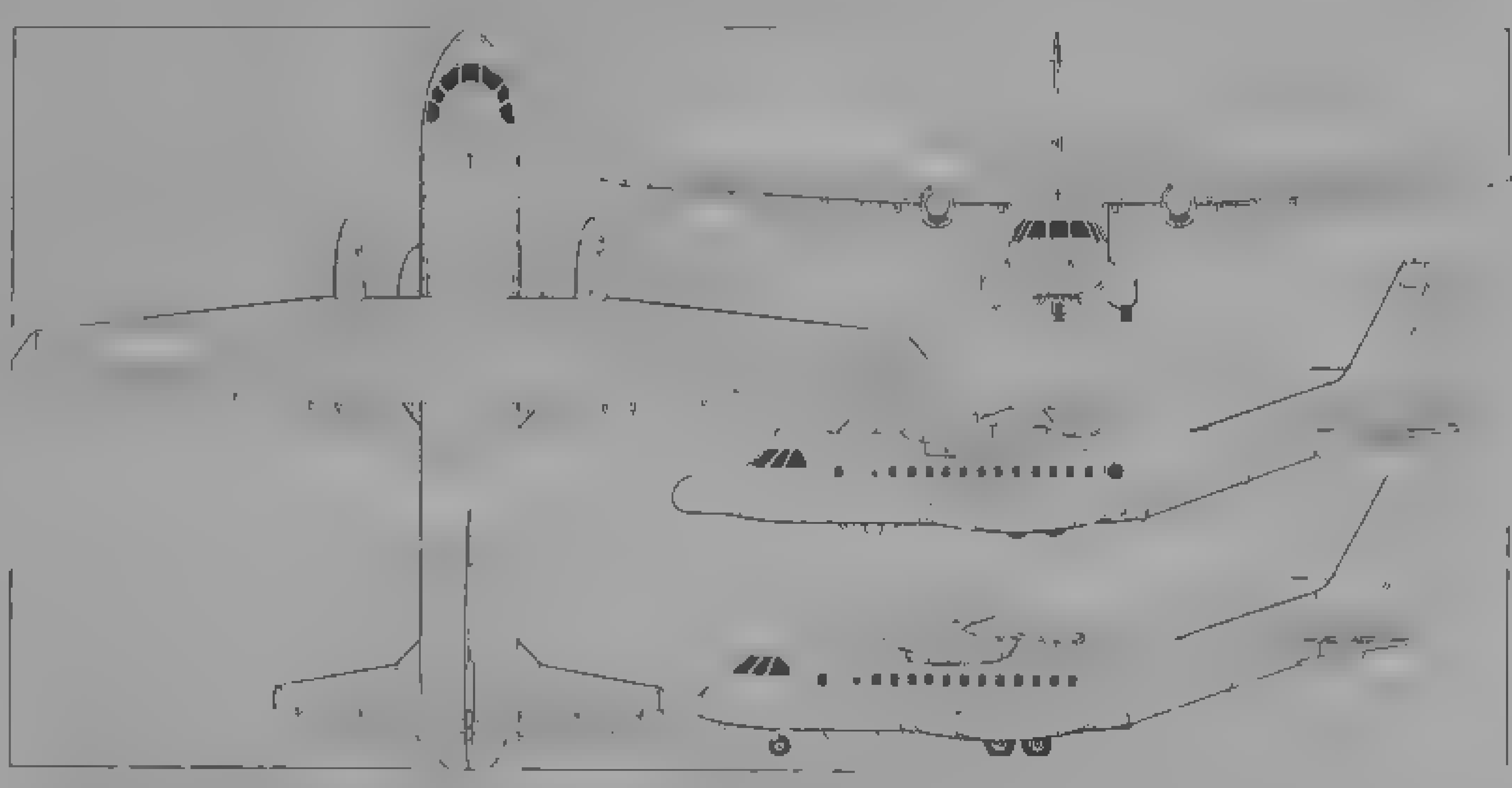
CN-235 Series 330 Phoenix: Indonesian built; initially offered to Royal Australian Air Force with new Honeywell avionics (MIL-STD-1553 databus, GPS/INS and autopilot) and ARL-2002 electronic warfare self-protection system, Hawker de Havilland having design authority for modifications.

CN-235 M: Other military transport versions.

CN-235 MP Persuader and CN-235 MPA: Maritime patrol versions, described separately.

CN-235 QC: Quick-change cargo/passenger version, certificated by Spanish DGAC May 1992.

CUSTOMERS: Total orders 210 (44 civil, 166 military and other) by January 1995, of which 119 then delivered. See table.



Airtech (CASA/IPTN) CN-235 twin-turboprop multipurpose transport, with additional side view (centre) of CN-235 MPA (*Jane's/Dennis Punnett*)

1993

DESIGN FEATURES: Optimised for short-haul operations, enabling it to fly four 860 n mile (1,593 km; 990 mile) stage lengths (with reserves) before refuelling and to operate from paved runways or unprepared strips; high-mounted NACA 65_3-218 aerofoil wing with no-dihedral constant chord centre-section, tapered outer panels have 3° dihedral and 3° 51′ 36″ sweepback at quarter-chord; pressurised fuselage (including baggage compartment) of flattened circular cross-section, with upswept rear end incorporating cargo ramp/door; sweptback fin (with dorsal fin) and rudder; low-set non-swept fixed incidence tailplane and elevators; two small ventral fins; vortex generators on rudder and elevator leading-edges.

FLYING CONTROLS: Ailerons, elevators and rudder statically and dynamically balanced, with mechanical actuation (duplicated for ailerons); mechanical servo tab and electric trim tab in each aileron, rudder and starboard elevator, trim tab only in port elevator; single-slotted inboard and outboard trailing-edge flaps (each pair interchangeable port/starboard), actuated hydraulically by Dowty irreversible jacks.

STRUCTURE: Conventional semi-monocoque, mainly of aluminium alloys with chemically milled skins; composites (mainly glassfibre or glassfibre/Nomex honeycomb sandwich, with some carbonfibre and Kevlar) for leading/trailing-edges of wing/tail moving surfaces, wing/fuselage and main landing gear fairings, wing/fin/tailplane tips, engine nacelles, ventral fins and nose radome. Propeller blades are of glassfibre, with metal spar and urethane foam core. CASA builds wing centre-section, inboard flaps, forward and centre fuselage, engine nacelles; IPTN builds outer wings, outboard flaps, ailerons, rear fuselage and tail unit; both manufacturers use numerical control machinery extensively. Final assembly line in each country. Part of tail unit built by ENAER Chile under subcontract from CASA. TAI (Turkey) to assemble under licence initially, progressing gradually to local manufacture of 50 aircraft for Turkish Air Force.

LANDING GEAR: Messier-Bugatti retractable tricycle type with levered suspension, suitable for operation from semi-prepared runways. Electrically controlled hydraulic extension/retraction, with mechanical back-up for emergency extension. Oleo-pneumatic shock absorber in each unit. Each main unit comprises two wheels in tandem, retracting rearward into fairing on side of fuselage. Mainwheels semi-exposed when retracted. Single steerable nosewheel (±48°) retracts forward into unpressurised bay under flight deck. Dunlop 28 × 9.00-12 (12 ply rating) tubeless mainwheel tyres standard, pressure 5.17 bars (75 lb/sq in) on civil version, 5.58 bars (81 lb/sq in) on military version; low pressure mainwheel tyres optional, size 11.00-12/10, pressure 3.45 bars (50 lb/sq in). Dunlop 24 × 7.7 (10/12 ply rating) tubeless nosewheel tyre, pressure 5.65 bars (82 lb/sq in) on civil version, 6.07 bars (88 lb/sq in) on military version. Dunlop hydraulic differential disc brakes. Dunlop anti-skid units on main gear. Chilean Army aircraft used in Antarctic have wheel/ski gear. Minimum ground turning radius 9.50 m (31 ft 2 in) about nosewheel, 18.98 m (62 ft 3¼ in) about wingtip.

POWER PLANT: Two General Electric CT7-9C turboprops, each flat rated at 1,305 kW (1,750 shp) (S/L, to 41°C) for take-off and 1,394.5 kW (1,870 shp) up to 31°C with automatic power reserve. Hamilton Standard 14RF-21 four-blade constant-speed propellers with full feathering and reverse pitch capability. Fuel in two 1,042 litre (275 US gallon; 229 Imp gallon) integral main tanks in wing centre-section and two 1,592 litre (421 US gallon; 350 Imp gallon) integral outer-wing auxiliary tanks; total fuel capacity 5,264 litres (1,392 US gallons; 1,158 Imp gallons), of which 5,128 litres (1,355 US gallons, 1,128 Imp gallons) are usable. Single pressure refuelling point in starboard main landing gear fairing; gravity filling point in top of each tank. Propeller braking permits No. 2 engine to be used as on-ground APU. Oil capacity 13.97 litres (3.69 US gallons; 3.07 Imp gallons).

Airtech CN-235 M of the Indonesian Air Force on a LAPES mission

1995

ACCOMMODATION: Crew of two on flight deck, plus cabin attendant (civil version) or third crew member (military version). Accommodation in commuter version for up to 44 passengers in four-abreast seating, at 76 cm (30 in) pitch, with 22 seats each side of central aisle. Toilet, galley and overhead luggage bins standard. Pressurised baggage compartment at rear of cabin, aft of movable bulkhead, additional stowage in rear ramp area and in overhead lockers. Can also be equipped as mixed passenger/cargo combi (for example, 19 passengers and two LD3 containers), or for all-cargo operation, with roller loading system, carrying four standard LD3 containers, five LD2s, or two 2.24 × 3.18 m (88 × 125 in) and one 2.24 × 2.03 m (88 × 80 in) pallets, or for military duties, carrying up to 48 troops or 46 paratroops. Other options include layouts for aeromedical (24 stretchers and four medical attendants), ASW/maritime patrol (with 360° search radar and Exocet missiles or Mk 46 torpedoes), electronic warfare, geophysical survey or aerial photographic duties.

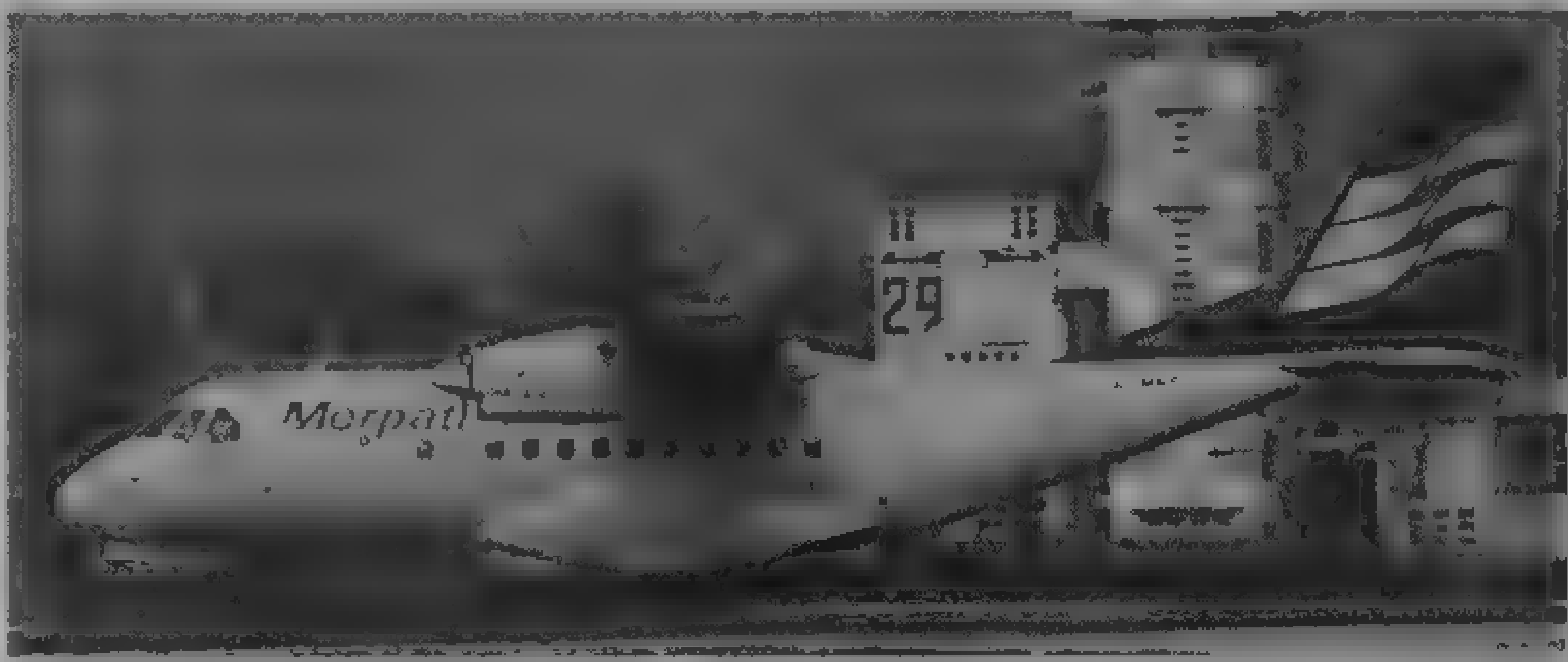
Main passenger door, outward and forward-opening with integral stairs, aft of wing on port side, serving also as a Type I emergency exit. Type III emergency exit facing this door on starboard side. Crew/service downward-opening door (forward, starboard) has built in stairs, and serves also as a Type I emergency exit, or as passenger door in combi version, second Type III exit opposite this door on port side. Wide ventral door/cargo ramp in underside of upswept rear fuselage, for loading of bulky cargo. Accommodation fully air conditioned and pressurised.

SYSTEMS: Hamilton Standard air conditioning system, using engine compressor bleed air. AiResearch electropneumatic pressurisation system (maximum differential 0.25 bar; 3.6 lb/sq in) giving cabin environment of 2,440 m (8,000 ft) up to operating altitude of 5,485 m (18,000 ft). Hydraulic system, operating at nominal pressure of 207 bars (3,000 lb/sq in), comprises two engine-driven, variable displacement axial electric pumps, a self-pressurising standby mechanical pump, and a modular unit incorporating connectors, filters and valves, system is employed for actuation of wing flaps, landing gear extension/retraction, wheel brakes, emergency and parking brakes, nosewheel steering, cargo ramp and door, and propeller braking. Accumulator for back up braking system. 28 V DC primary electrical system powered by two 400 A Auxilec engine-driven starter/generators, with two 24 V 37 Ah Ni/Cd batteries for engine starting and 30 minutes (minimum) emergency power for essential services. Constant frequency single-phase AC power (115/26 V) provided at 400 Hz by three 600 VA static inverters (two for normal operation plus one standby), two three-phase engine-driven alternators for 115/200 V variable frequency AC power. Fixed oxygen installation for crew of three (single cylinder at 124 bars, 1,800 lb/sq in pressure), three portable units and individual masks for passengers. Pneumatic boot anti-icing of wing (outboard of engine nacelles), fin and tailplane leading-edges. Electric anti-icing of propellers, engine air intakes, flight deck windscreen, pitot tubes and angle of attack indicators. No APU: starboard engine, with propeller braking, can be used to fulfil this function. Hand type fire extinguishers on flight deck (one) and in passenger cabin (two), smoke detector in baggage compartment. Engine fire detection and extinguishing system.

AVIONICS (civil): *Comms*: Two Collins VHF-22B com radios, one Avtech DADS crew interphone, Collins TDR-90 ATC transponder, Fairchild A 100A cockpit voice recorder, Avtech PACIS PA system, Dorne & Margolin ELT 8.1 emergency transmitter. Optional second TDR-90; optional HF-230 radio.

Radar: Collins WXR 300 weather radar.

Flight: Two Collins VIR-32 VOR/ILS/marker beacon receivers, Collins DME-42, Collins ADF 60A, two Collins 332D-11T vertical gyros, two Collins MCS-65 directional gyros, two Collins ADI-85A, two Collins HSI 85, two Collins RMI-36, Collins APS-65 autopilot/



Airtech CN-235 twin-turboprop civil transport operated by Merpati of Indonesia

1995

CN-235 PRODUCTION
(At 1 January 1995)

Customer	Qty	First order	First aircraft	First delivery	Delivered 1 Jan 1995	Mfr
Civil version						
Mandala Airlines (Indonesia)	3		—	—	0	IPTN
Merpati Nusantara (Indonesia)	15		PK MNA	15 Dec 1986	15[1]	IPTN
	16[9]	Apr 1994	—	—	0	IPTN
Austral (Argentina)	2	19 Dec 1989	EC-FAE	1993	2	CASA
Binter Canarias (Spain)	4[1]	10 Jun 1988	EC-EMO	22 Dec 1988	4	CASA
Binter Mediterraneo (Spain)	4[2]	19 Dec 1989	EC-FAD	4 Sep 1990	3	CASA
Military version						
Brunei Air Wing	3[3]		—	—	0	IPTN
Indonesian armed forces	24		A 2301	12 Jan 1993	6	IPTN
Malaysian Air Force	6[7]		—	—	0	IPTN
Abu Dhabi Air Force	7		810	31 Aug 1993	7	IPTN
Botswana Defence Force	2[1]	10 Jun 1986	OG-1	21 Dec 1987	2	CASA
Chilean Army	3	12 Feb 1989	E-216	31 Aug 1989	3	CASA
Ecuadorian Army	1	6 Jun 1989	AEE-502	6 Jun 1989	1	CASA
Ecuadorian Navy	1	27 Jul 1988	ANE-204	13 Jun 1989	1	CASA
French Air Force	8[8]	11 Apr 1990	043	28 Feb 1991	8	CASA
Gabon Air Forces	1	26 Feb 1990	TR KJE	19 Mar 1991	1	CASA
Irish Air Corps	1	3 Apr 1991	250	10 Apr 1991	1	CASA
	2[3]	3 Apr 1991	252	8 Dec 1994	2	CASA
Moroccan Air Force	7[10]	19 Sep 1989	CN-AMA	27 Sep 1990	7	CASA
Oman Police	2	15 Feb 1992	A40-CU	14 Jan 1993	2	CASA
Panama National Guard	1[1]	19 Mar 1987	SAN 265	13 Sep 1988	1	CASA
Papua New Guinea DF	2	26 Oct 1991	P2-0501	15 Nov 1991	2	CASA
Saudi Air Force	4[1]	5 Feb 1984	118	9 Feb 1987	4	CASA
South African AF (ex Bophuthatswana)	1[1]	29 May 1990	T-330	6 Jan 1991	1	CASA
South Korea AF	12	19 Aug 1992	078	13 Nov 1993	12	CASA
Spanish Air Force	2[4]	16 Nov 1988	T.19-01	7 Dec 1988	2	CASA
	18	28 Dec 1990	T.19-03	1 Feb 1991	18	CASA
	6[3]			—	0	CASA
Turkish Air Force	52[6]	11 Dec 1990	51	25 Jan 1992	14	CASA
Sub-totals	**210**				**119**	
Demo/trials	3[5]		EC-016		3	CASA
	2		PK XNC		2	IPTN
Totals	**215**				**124**	

[1] Series 10
[2] Series 200
[3] Maritime patrol
[4] VIP version
[5] Includes one 100QC
[6] 50 built in Turkey by TAI
[7] Option on further 12
[8] Option of further seven
[9] Series 220
[10] Includes one VIP version

Note: All are Series 100/110 unless indicated otherwise

flight director; Collins ALT-55B radio altimeter; two Collins 345A-7 rate of turn sensors, SFENA H 301 APM standby attitude director indicator; Sundstrand Mk II GPWS, and Fairchild/Teledyne flight data recorder. Options include second DME-42 and ADF-60A, Collins RNS-325 radar nav, Litton LTN 72R inertial nav or Global GNS 500A Omega navigation system.

Instrumentation: Collins EFIS-85B five-tube CRT system standard.

AVIONICS (military) (Indonesian aircraft): *Comms:* Collins AN/ARC-182 VHF/UHF, Collins HF 9000 HF, IFF.

Flight: Collins VIR-32 VHF nav; Litton LTN92 GPS aided INS, Collins DF 206A ADF; Collins AN/APS 65F autopilot, GPWS.

Instrumentation: Collins EFIS-85B(14) EFIS (four or five screens). IPTN developing cockpit lighting system compatible with night vision goggles.

EQUIPMENT: Navigation lights, anti-collision strobe lights, 600 W landing light in front end of each main landing gear fairing, taxi lights, ice inspection lights, emergency door lights, flight deck and flight deck emergency lights, cabin and baggage compartment lights, individual passenger reading lights, and instrument panel white lighting, all standard.

ARMAMENT (military version): Three attachment points under each wing. Weapons can include McDonnell Douglas Harpoon anti-ship missiles. Indonesian MPA version (which see) can be fitted with two Mk 46 torpedoes or AM 39 Exocet anti-shipping missiles.

DIMENSIONS, EXTERNAL:

Wing span	25.81 m (84 ft 8 in)
Wing chord: at root	3.00 m (9 ft 10 in)
at tip	1.20 m (3 ft 11¼ in)
Wing aspect ratio	10.16
Length overall	21.40 m (70 ft 2½ in)
Fuselage: Max width	2.90 m (9 ft 6 in)
Max depth	2.615 m (8 ft 7 in)
Height overall	8.177 m (26 ft 10 in)
Tailplane span	10.60 m (34 ft 9¼ in)
Wheel track (c/l of mainwheels)	3.90 m (12 ft 9½ in)
Wheelbase	6.92 m (22 ft 8½ in)
Propeller diameter	3.35 m (11 ft 0 in)
Propeller ground clearance	1.66 m (5 ft 5¼ in)
Distance between propeller centres	7.00 m (22 ft 11½ in)
Passenger door (port, rear) and service door (stbd, fwd):	
Height	1.70 m (5 ft 7 in)
Width	0.73 m (2 ft 4¾ in)
Height to sill	1.22 m (4 ft 0 in)
Paratroop doors (port and stbd, rear, each):	
Height	1.75 m (5 ft 9 in)
Width	0.90 m (2 ft 11½ in)
Height to sill	1.22 m (4 ft 0 in)
Ventral upper door (rear): Length	2.366 m (7 ft 9¼ in)
Width	2.349 m (7 ft 8½ in)
Height to sill	1.22 m (4 ft 0 in)
Ventral ramp/door (rear): Length	3.042 m (9 ft 11¾ in)
Width	2.349 m (7 ft 8½ in)
Height to sill	1.22 m (4 ft 0 in)
Type III emergency exits (port, fwd, and stbd, rear):	
Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL (C: CASA built, N: IPTN built):

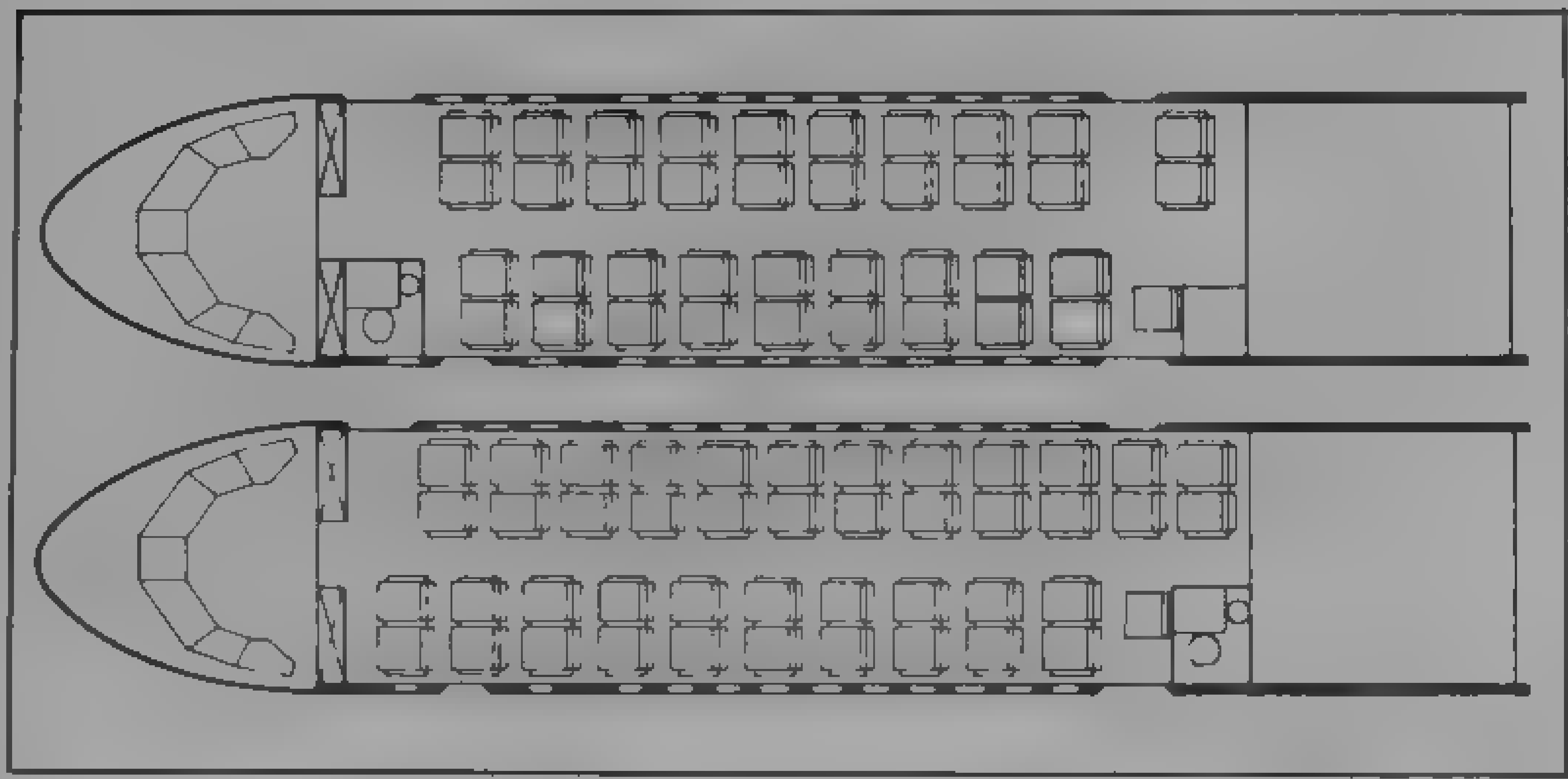
Cabin, excl flight deck: Length: C	9.65 m (31 ft 8 in)
N	9.98 m (32 ft 9 in)
Max width	2.70 m (8 ft 10½ in)
Width at floor	2.366 m (7 ft 9 in)
Max height: C	1.88 m (6 ft 2 in)
N	1.85 m (6 ft 0¾ in)
Floor area	22.822 m² (245.65 sq ft)
Volume: C	43.24 m³ (1,527.0 cu ft)
N	41.76 m³ (1,474.8 cu ft)
Baggage compartment volume:	
ramp	5.30 m³ (187.2 cu ft)
overhead bins	1.68 m³ (59.3 cu ft)

AREAS:

Wings, gross	59.10 m² (636.1 sq ft)
Ailerons (total, incl tabs)	3.07 m² (33.06 sq ft)
Trailing-edge flaps (total)	10.87 m² (117.0 sq ft)
Fin, incl dorsal fin	11.38 m² (122.49 sq ft)
Rudder, incl tabs	3.32 m² (35.74 sq ft)
Tailplane	25.40 m² (273.4 sq ft)
Elevators (total, incl tabs)	4.25 m² (45.75 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty:	
passenger version	9,800 kg (21,605 lb)
cargo and military versions	8,800 kg (19,400 lb)
Max fuel	4,230 kg (9,325 lb)
Max payload: passenger version:	
Srs 100	4,000 kg (8,818 lb)
Srs 200	4,300 kg (9,480 lb)
cargo and military versions	6,000 kg (13,227 lb)
Max weapon load (CN-235 M)	3,500 kg (7,716 lb)
Max T-O weight: civil: Srs 100	15,100 kg (33,289 lb)
Srs 200	15,800 kg (34,833 lb)
military	16,500 kg (36,376 lb)
Max landing weight: civil:	
Srs 100	14,900 kg (32,849 lb)
Srs 200	15,600 kg (34,392 lb)
military	16,500 kg (36,376 lb)



CN-235 in typical configurations for 38 (top) and 44 passengers

1995

CN-235 MPA testbed produced by IPTN

1995

One of two CN-235 MP Persuaders of the Irish Air Corps

1995

Flight deck of French Air Force CN-235 M (*Paul Jackson*)

1995

Max zero-fuel weight, civil 14,100 kg (31,085 lb)
military 15,400 kg (33,951 lb)
Cabin floor loading: cargo and military versions
1,504 kg/m² (308.0 lb/sq ft)
Max wing loading: civil
Srs 100 255.5 kg/m² (52.36 lb/sq ft)
Srs 200 267.3 kg/m² (54.75 lb/sq ft)
military 279.2 kg/m² (57.18 lb/sq ft)
Max power loading (without APR): civil:
Srs 100 5.78 kg/kW (9.51 lb/shp)
Srs 200 6.05 kg/kW (9.95 lb/shp)
military 6.32 kg/kW (10.39 lb/shp)

PERFORMANCE (civil versions at max T-O weight, ISA, except where indicated):
Max operating speed at S/L
240 kts (445 km/h; 276 mph) IAS
Max cruising speed at 4,575 m (15,000 ft)
248 kts (460 km/h; 286 mph)
Stalling speed at S/L:
flaps up 100 kts (186 km/h; 116 mph) IAS
flaps down 84 kts (156 km/h; 97 mph) IAS
Max rate of climb at S/L 465 m (1,527 ft)/min
Rate of climb at S/L, OEI 128 m (420 ft)/min
Service ceiling 7,620 m (25,000 ft)
Service ceiling, OEI 4,500 m (14,775 ft)
T-O run: Srs 100 1,217 m (3,993 ft)
Srs 200 1,051 m (3,450 ft)
T-O balanced field length at S/L:
Srs 100 1,406 m (4,615 ft)
Srs 200 1,275 m (4,185 ft)
Srs 200 at AUW of 14,646 kg (32,290 lb)
1,139 m (3,737 ft)
Landing from 15 m (50 ft) at S/L:
Srs 100 1,276 m (4,187 ft)
Srs 200 670 m (2,200 ft)
Range at 5,485 m (18,000 ft), reserves for 87 n mile (161 km; 100 mile) diversion and 45 min hold:
Srs 100 with max payload
450 n miles (834 km; 518 miles)
Srs 200 with max payload
957 n miles (1,773 km; 1,102 miles)
Srs 100 with max fuel
2,110 n miles (3,908 km; 2,428 miles)
Srs 200 with max fuel
1,974 n miles (3,656 km; 2,272 miles)

PERFORMANCE (CN-235 M at max T-O weight, ISA, except where indicated):
As for civil versions except:
Max rate of climb at S/L 579 m (1,900 ft)/min
Rate of climb at S/L, OEI 156 m (512 ft)/min
Service ceiling 8,110 m (26,600 ft)
Service ceiling, OEI 4,800 m (15,750 ft)
T-O to 15 m (50 ft) (CFL): Srs 100 1,290 m (4,235 ft)
Srs 200 1,165 m (3,825 ft)
Landing from 15 m (50 ft): Srs 100 772 m (2,530 ft)
Srs 200 652 m (2,140 ft)
Landing run, with propeller reversal:
Srs 100 398 m (1,306 ft)
Srs 200 400 m (1,313 ft)
Range at 6,100 m (20,000 ft), long-range cruising speed, reserves for 45 min hold: Srs 100 with max payload
810 n miles (1,501 km; 932 miles)
Srs 200 with max payload
825 n miles (1,528 km; 950 miles)
Srs 100 with 3,550 kg (7,826 lb) payload
2,350 n miles (4,352 km; 2,704 miles)
Srs 200 with 3,550 kg (7,826 lb) payload
2,400 n miles (4,445 km; 2,762 miles)

OPERATIONAL NOISE LEVELS (civil versions):
T-O 84.0 EPNdB
Approach 87.0 EPNdB
Sideline 86.0 EPNdB

UPDATED

AIRTECH CN-235 MP PERSUADER and CN-235 MPA

TYPE: Maritime patrol versions of CN-235.

CURRENT VERSIONS: **CN-235 MP Persuader**: CASA version; different avionics to Indonesian MPA.

CN-235 MPA: Developed by IPTN, available either with lengthened nose housing radar and IFF, or with normal CN-235 nose, plus belly radar. CN-235 prototype PK-XNC serving as testbed. Provision for quick-change configuration for general transport, communications or other duties. Maximum T-O weight 15,400 kg (33,951 lb), endurance more than 8 hours.

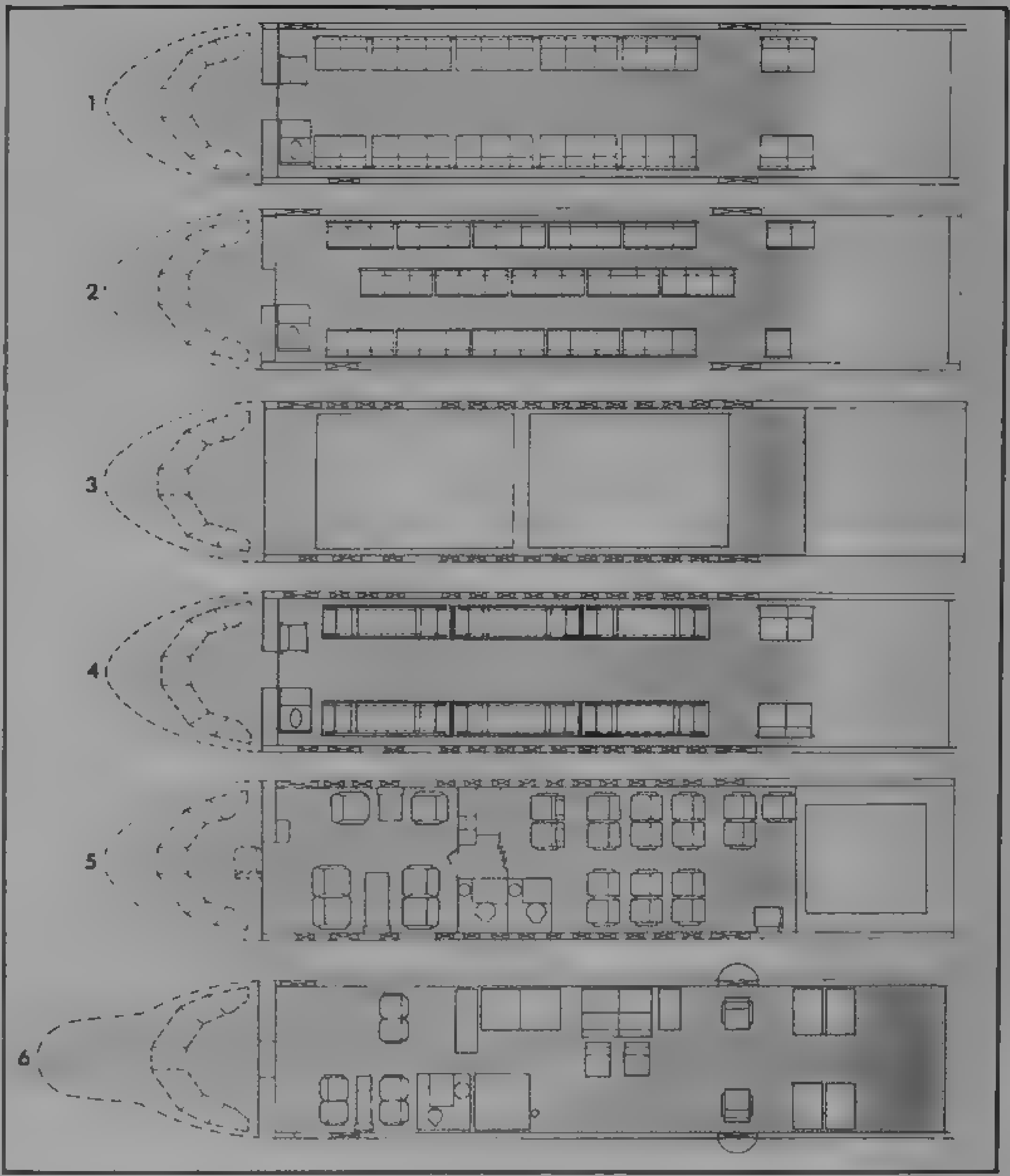
AVIONICS (Persuader): *Radar*: Litton APS-504(V)5.

Mission: FLIR-2000HP undernose-mounted night vision system and Litton AN/ALR 85(V) ESM system, fully integrated via a central tactical processor with reconfigurable consoles.

AVIONICS (CN-235 MPA): *Radar*: Litton APS-504(V)5, or Texas Instruments AN/APS-134 (LW) or Thompson Ocean Master 100.

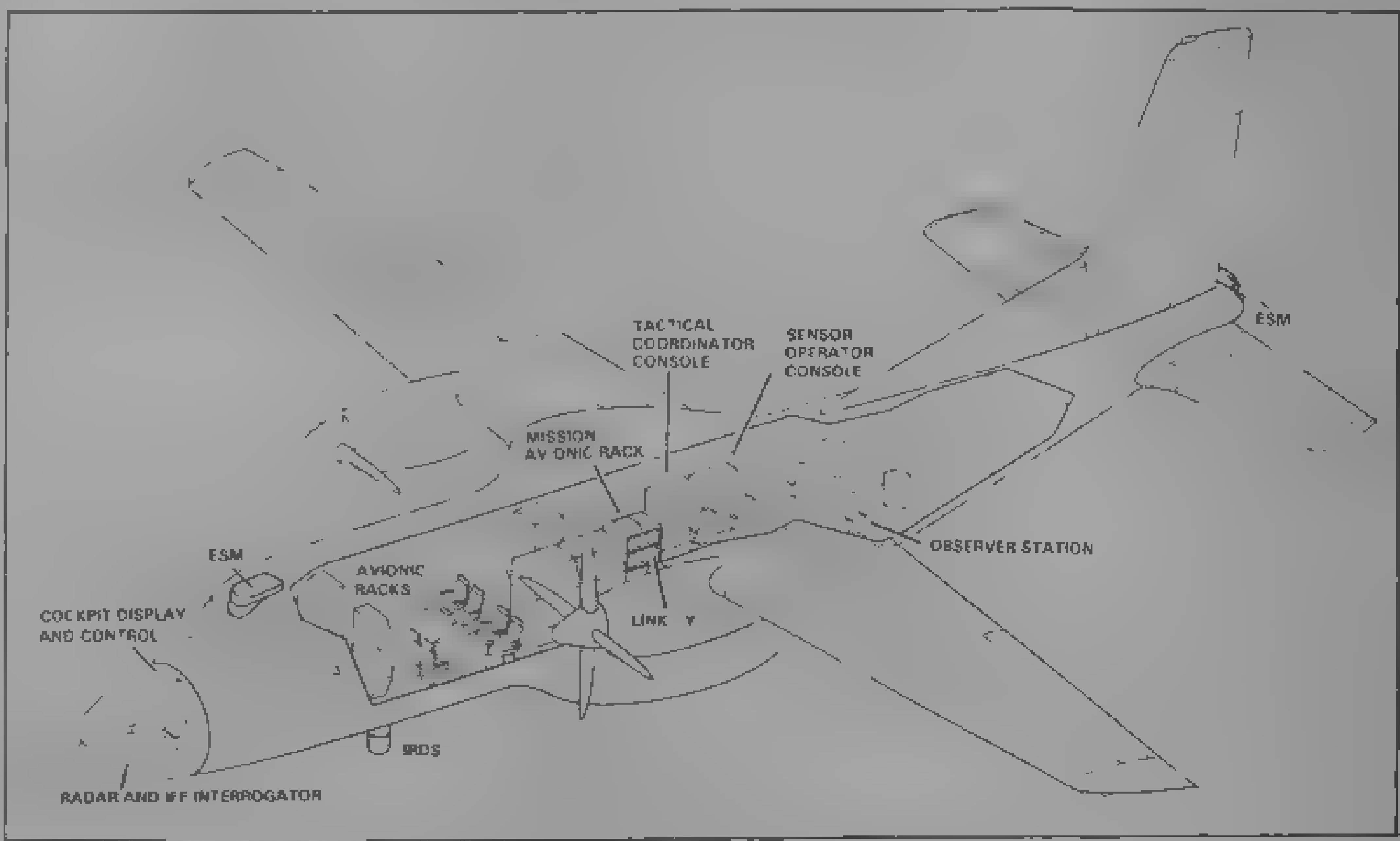
Flight: Litton LN92 ring laser gyro INS; Trimble TNL 7900 Omega/GPS.

Mission: Argo data processing and display system with multifunction consoles, GEC-Marconi SG-300, or Argo Systems AR-700 or Litton AN/ALR 93(V)4 ESM. FLIR Systems AN/AAQ-21 Safire or GEC-Marconi MRT FLIR. Cossor 3500 IFF interrogator. (Trials aircraft originally equipped with APS-504 and Ocean Master; SG-300. Reconfigured by 1994 with AN/APS-134, MRT, AR-700, LN92 and TNL 7900. Further alternatives available at customer's option.)



CN-235 M configured for (1) paratroop transport; (2) troop transport; (3) cargo transport on standard pallets; (4) medical evacuation with 18 stretchers and five attendants; (5) VIP communications; and (6) maritime patrol

1995



Interior arrangement of the IPTN CN-235 MPA maritime patrol aircraft

1994

WEIGHTS AND LOADINGS (representative):
Max fuel weight 4,000 kg (8,818 lb)
Max T-O weight 15,400 kg (33,951 lb)
Max zero-fuel weight 13,600 kg (29,982 lb)
Max landing weight 15,200 kg (33,510 lb)

UPDATED

AMX

AMX INTERNATIONAL

c/o Alenia, Via Faustiniana, I-00131 Rome, Italy
Telephone: 39 (6) 52291
Fax: 39 (6) 52293094

PRESIDENT: Dott Ing Giovanni Gazzaniga (Alenia)

VICE-PRESIDENTS
F Grandi (Aermacchi)
R Pesce (Embraer)

PUBLIC RELATIONS
Flavio R Piditti (Alenia, Turin)

PARTICIPATING COMPANIES
Alenia: see under Italy
Aermacchi: see under Italy
Embraer: see under Brazil

VERIFIED

AMX

Brazilian Air Force designations: A-1 and A-1B

TYPE: Single-seat close air support, battlefield interdiction and reconnaissance aircraft, with secondary capability for offensive counter-air.

PROGRAMME: Resulted from 1977 Italian Air Force specification for small tactical fighter-bomber (see 1987-88 and previous *Jane's* for early background), original Aeritalia/Aermacchi partnership joined by Embraer July 1980; seven single-seat prototypes built (first flight 15 May 1984; further details in 1987-88 and earlier editions); production of first 30 (Italy 21, Brazil nine), and design of two-seater began mid-1986; first production aircraft rolled out at Turin 29 March 1988, making first flight 11 May; second contract (Italy 59, Brazil 25, including six and three two-seaters respectively) placed 1988, deliveries to Italian Air Force (six for Reparto Sperimentale di Volo at Pratica di Mare) began April 1989; production A-1 for Brazilian Air Force (s/n 5500) made first flight 12 August 1989, deliveries (two to 1° Esquadrão of 16° Grupo de Aviação at Santa Cruz, following from 17 October 1989; in-flight refuelling test programme completed (by Embraer) August/September 1989; first flight by first (of three) two-seat AMX-T 14 March 1990 (MM55024), followed by second on 16 July; first flight of Embraer two-seater (serial number 5650), 14 August 1991; third production lot authorised early 1992, first two-seater for Brazilian Air Force (5650) delivered 7 May 1992. Series production for Italy, Brazil and prospective export customers expected to continue through the 1990s. Italian single-seat production temporarily halted following delivery on 1 February 1993 of 72nd aircraft (MM7160), resumed late 1994, when first production AMX Ts delivered to 14° Gruppo/2° Stormo at Rivolto.

CURRENT VERSIONS: **Single-seater:** Intended to replace G91R/Y and F-104G/S in Italian Air Force (eight squadrons) and EMB-326GB Xavante in Brazilian Air Force for close support/interdiction/reconnaissance, sharing counter air duties with IDS Tornado (Italy) and F-5E/Mirage 50 (Brazil), in service with 2°, 3° and 51° Stormi (Italy) and 16° Grupo (Brazil). Brazilian Air Force aircraft (designated **A-1**) differ primarily in avionics and weapon delivery systems, and have two 30 mm guns instead of Italian version's single multibarrel 20 mm weapon. *Detailed description applies to single-seater except where indicated.*

Two-seater: Second cockpit accommodated by removing forward fuselage fuel tank and relocating environmental control system, dual controls, canopy, integration of rear cockpit GEC Marconi HUD monitor, and oxygen systems, designed/redesigned by Embraer, intended both as **AMX-T** operational trainer and, suitably equipped, for such roles as EW, reconnaissance and maritime attack. Brazilian designation **A-1B**.

CUSTOMERS: Total of 192 (136 Italy/56 Brazil, including 26 and 11 two-seaters) on firm order (see table). Total 19 including two Brazilian built in 1994, deliveries by January 1995 totalled 120, comprising 92 Italian (including six AMX-T) and 28 Brazilian (including four AMX-T).

AMX REQUIREMENTS

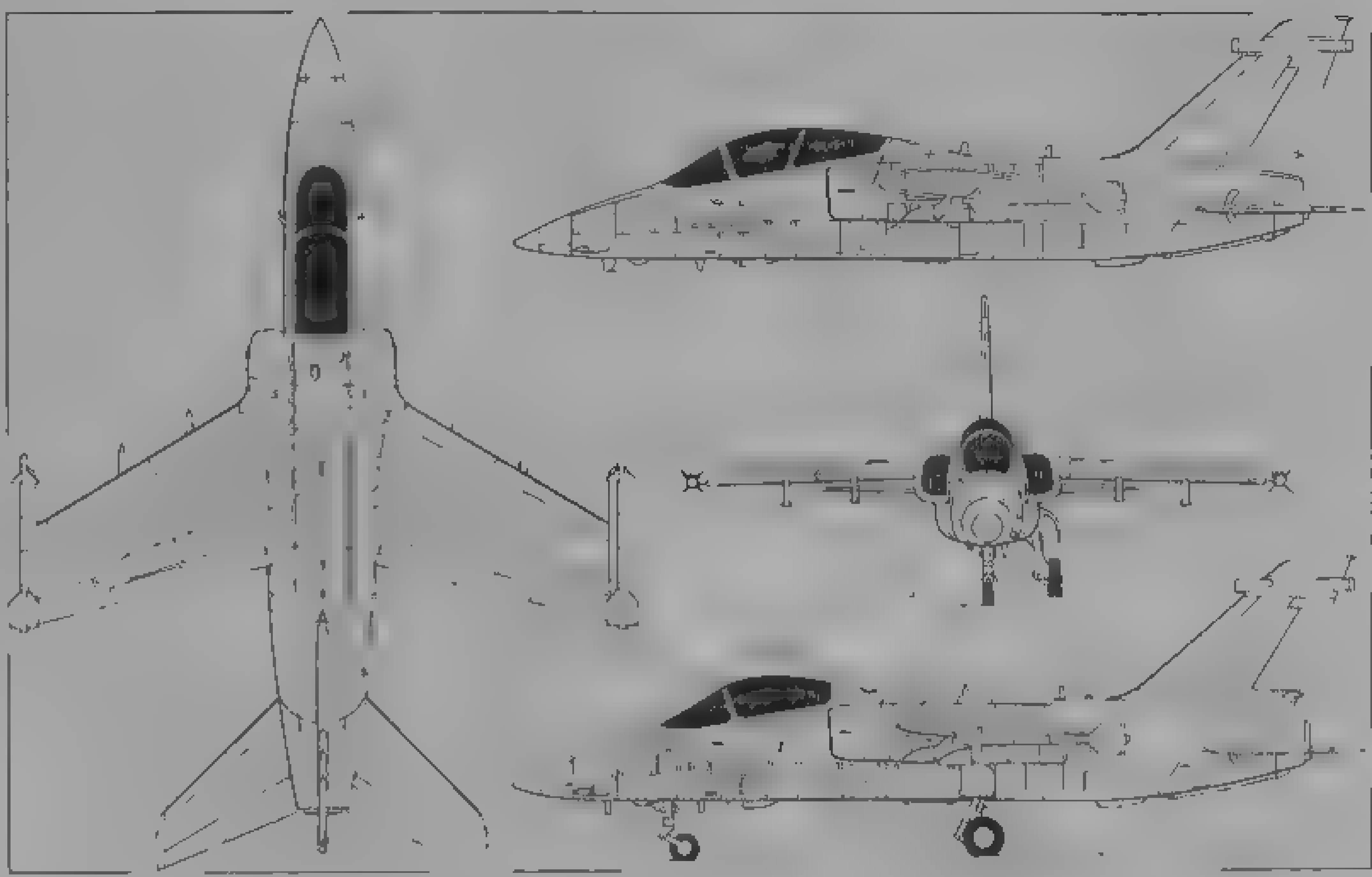
	Italy		Brazil		
Batch	**AMX**	**AMX-T**	**AMX**	**AMX-T**	**Total**
1	19	2	8	1	30
2	53	6	22	3	84
3	38	18	15	7	78
Subtotal	**110**	**26**	**45**	**11**	**192**
4	35	16	15	4	70
5	42	9	19	0	70
Total	**187**	**51**	**79**	**15**	**332**

Note: Batches 1-3 only funded. Full requirements unlikely to be met.

DESIGN FEATURES: Intended for high-subsonic/very low altitude day/night missions, in poor visibility and, if necessary, from poorly equipped or partially damaged runways; wing sweepback 31° on leading-edges, 27° 30′ at quarter-chord; thickness/chord ratio 12 per cent.

Single-seat AMX of the 16° Grupo, Brazilian Air Force

1995



Alenia/Aermacchi/Embraer AMX, in production for the air forces of Italy and Brazil, upper side view shows two-seater *(Jane's/Dennis Punnett)*

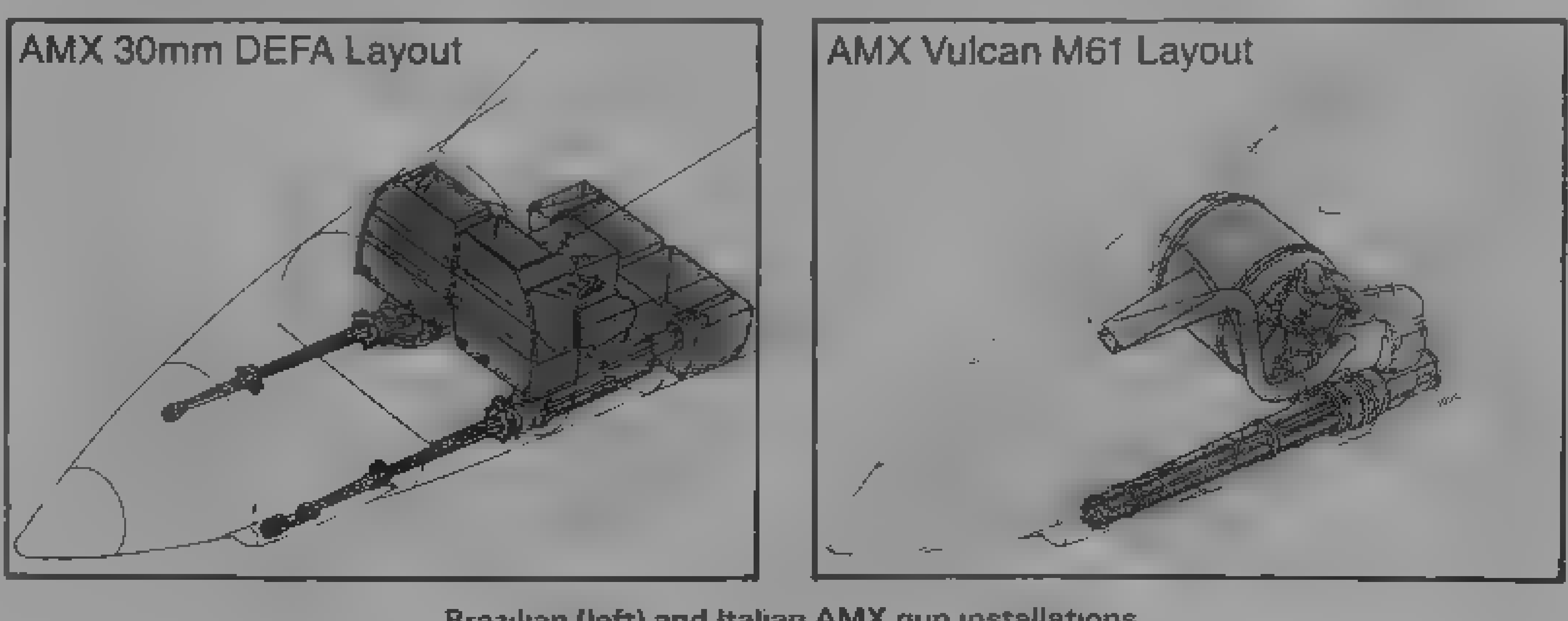
1991

FLYING CONTROLS: Hydraulically actuated ailerons and elevators; leading-edge slats and Fowler double-slotted trailing-edge flaps (each two-segment on each wing) actuated electrohydraulically; pair of hydraulically actuated spoilers forward of each flap pair, deployable separately in inboard and outboard pairs, fly-by-wire control of spoilers, rudder and variable incidence tailplane by Alenia/GEC-Marconi flight control computer; ailerons, elevators, rudder have manual reversion for fly-home capability even with both hydraulic systems inoperative; spoilers serve also as airbrakes/lift dumpers.

STRUCTURE: Mainly aluminium alloy except for carbonfibre fin and elevators, shoulder mounted wings, each with three-point attachment to fuselage, have three-spar torsion box with integrally stiffened skins; oval-section semi-monocoque fuselage, with rear portion (including tailplane) detachable for engine access; work split gives programme leader Alenia 46.7 per cent (centre-fuselage, nose radome, tail surfaces, ailerons and spoilers); Aermacchi has 23.6 per cent (forward fuselage including gun and avionics integration, canopy, tailcone) and Embraer 29.7 per cent (air intakes, wings, leading-edge slats, flaps, wing pylons, external fuel tanks and reconnaissance pallets), single-sourced production, with final assembly lines in Italy and Brazil.

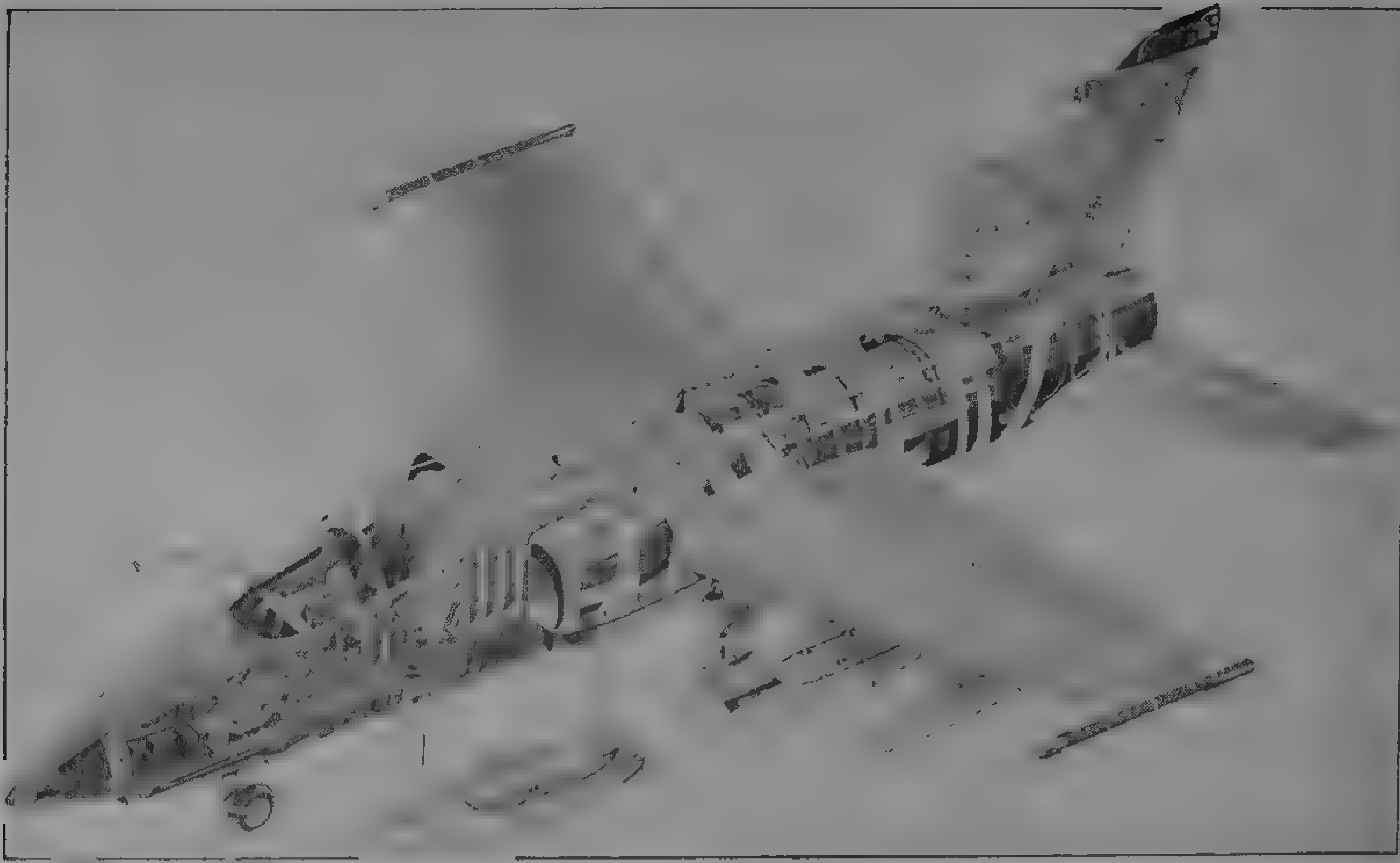
LANDING GEAR: Hydraulically retractable tricycle type, of Messier Bugatti levered suspension design, built in Italy by Magnaghi (nose unit) and in France by ERAM (main units). Single wheel and oleo-pneumatic shock-absorber on each unit. Nose unit retracts forward, main units retract forward and inward, turning through approximately 90° to lie almost flat in underside of engine air intake trunks. Nosewheel hydraulically steerable (±60°), self-centring and fitted with anti-shimmy device. Mainwheel tyres size 670 × 210-12, pressure 9.65 bars (140 lb/sq in); nosewheel tyre size 18 × 5.5-8, pressure 10.7 bars (155 lb/sq in). Hydraulic brakes and fully modulated anti-skid system. No brake-chute. Runway arrester hook. Minimum ground turning radius 7.53 m (24 ft 8½ in).

POWER PLANT: One 49.1 kN (11,030 lb st) Rolls-Royce Spey Mk 807 non-afterburning turbofan, built under licence in Italy by Fiat, Piaggio and Alfa Romeo Avio, in association with Companhia Eletro-Mecânica (CELMA) in Brazil. Self-sealing, compartmented, rubber fuselage bag tanks and two integral wing tanks with combined capacity of 3,500 litres (924.6 US gallons, 770 Imp gallons). Auxiliary



Brazilian (left) and Italian AMX gun installations

1993



Structural cutaway of the Italo-Brazilian AMX

1993

fuel tanks of up to 1,100 litres (290 US gallons; 242 Imp gallons) capacity can be carried on each inboard underwing pylon, and up to 580 litres (153 US gallons, 128 Imp gallons) on each outboard pylon. Single-point pressure or gravity refuelling of internal and external tanks. In-flight refuelling capability (probe and drogue system)

ACCOMMODATION: Pilot only, on Martin-Baker Mk 10L zero/zero ejection seat. 18° downward view over nose. One-piece wraparound windscreen, one-piece hinged canopy opening sideways to starboard. Cockpit pressurised and air-conditioned. Tandem two-seat combat trainer/special missions version also in production

SYSTEMS: Microtecnica environmental control system (ECS) provides air conditioning of cockpit, avionics and reconnaissance pallets, cockpit pressurisation, air intake and inlet guide vane anti-icing, windscreen demisting and anti-g systems. Duplicated redundant hydraulic systems, driven by engine gearbox, operate at pressure of 207 bars (3,000 lb/sq in) for actuation of primary flight control system, flaps, spoilers, landing gear, wheel brakes, anti-skid system, nosewheel steering and gun operation. Primary electrical system AC power (115/200 V at fixed frequency of 400 Hz) supplied by two 30 kVA IDG generators, with two transformer-rectifier units for conversion to 28 V DC, 36 Ah Ni/Cd battery for emergency use, to provide power for essential systems in the event of primary and secondary electrical system failure. Aeroeletrônica (Brazil) external power control unit. Fiat FA 150 Argo APU for engine starting. APU-driven electrical generator for ground operation. Liquid oxygen system

AVIONICS: All avionics/equipment packages pallet-mounted and positioned for rapid access. Modular design and space provisions within aircraft permit retrofitting of alternative avionics

Comms: UHF and VHF com, and IFF

Radar: Pointer ranging radar in Italian AMXs is I-band set modified from Elta (Israel) EL/M-2001B and built in Italy by FIAR. Brazilian aircraft have Tecnasa/SMA SCP-01 radar

Flight: Litton Italia INS, with standby AHRS and Tacan for Italian Air Force. VOR/ILS for Brazil. Data processing, with Microtecnica air data computer. GEC-Marconi MED 2067 video monitor display in rear cockpit of two-seater, for use by instructor/navigator as HUD monitor

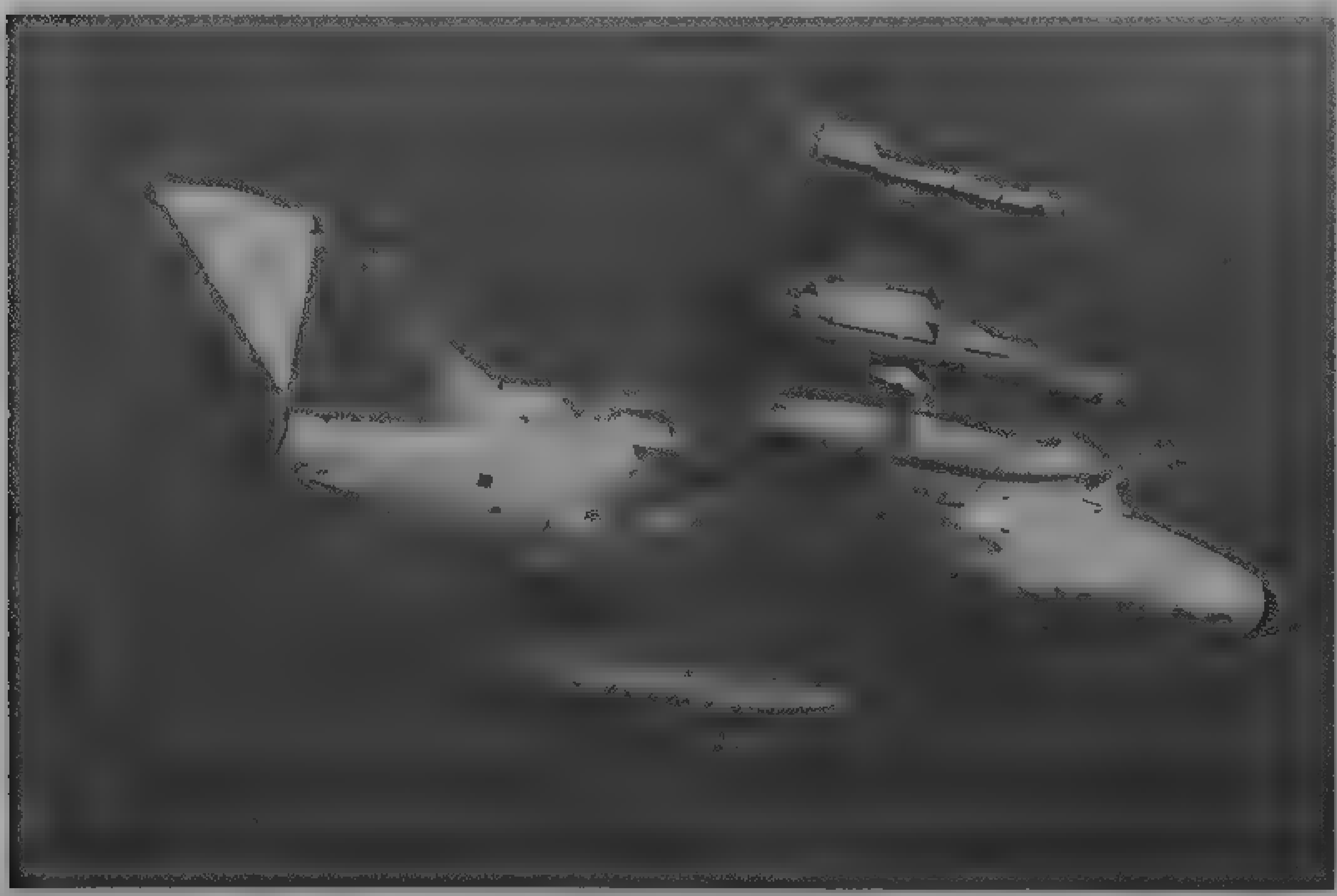
Instrumentation: Alenia computer-based weapon aiming and delivery, incorporating radar and Alenia stores management system; digital data displays (OMI/Alenia head-up, Alenia multifunction head-down, and weapons/nav selector). Provision for night vision goggles.

Mission: FLIR

Self defence: Elettronica active and passive ECM including fin-mounted radar warning receiver

EQUIPMENT: For reconnaissance missions, any one of three interchangeable Aeroeletrônica (Brazil) pallet-mounted photographic systems can be carried installed internally in forward fuselage; external infra-red/electro-optical pod can be carried on centreline pylon. Each system is fully compatible with aircraft, and does not affect operational capability, aircraft can therefore carry out reconnaissance missions without effect upon normal nav/attack and self-defence capabilities. Camera bay in lower starboard side of fuselage, forward of mainwheel bay

ARMAMENT: One M61A1 multibarrel 20 mm cannon, with 350 rounds, in port side of lower forward fuselage of aircraft for Italian Air Force (one 30 mm DEFA 554 cannon on each side in aircraft for Brazilian Air Force). Single stores attachment point on fuselage centreline, plus two attachments under each wing, and wingtip rails for two AIM-9L Sidewinder or similar infra-red air-to-air missiles (MAA 1 Piranha on Brazilian aircraft). Fuselage and inboard underwing points each stressed for loads of up to 907 kg (2,000 lb), outboard underwing points stressed for 454 kg (1,000 lb) each. Triple carriers can be fitted to inboard underwing pylons, twin carriers to all five stations. Total external stores load 3 800 kg (8,377 lb). Attack weapons can include free-fall or retarded Mk 82/83/84 bombs, laser-guided bombs, cluster bombs, air-to-surface missiles (including area denial, anti-radiation and anti-shipping weapons), electro-optical precision-guided munitions and rocket launchers. Exocet firing trials conducted 1991, Marte trials 1994



Second production Italian AMX T (MM55027) in maritime attack configuration with Marte missiles, plus wingtip Sidewinders

1995

DIMENSIONS, EXTERNAL

Wing span	
excl wingtip missiles and rails	8 874 m (29 ft 1½ in)
over missiles	9 97 m (32 ft 8½ in)
Wing aspect ratio	3.75
Wing taper ratio	0 5
Length, overall	13 23 m (43 ft 5 in)
fuselage	12.55 m (41 ft 2 in)
Height overall	4 55 m (14 ft 11¼ in)
Tailplane span	5 20 m (17 ft 0¾ in)
Wheel track	2 15 m (7 ft 0¾ in)
Wheelbase	4.70 m (15 ft 5 in)

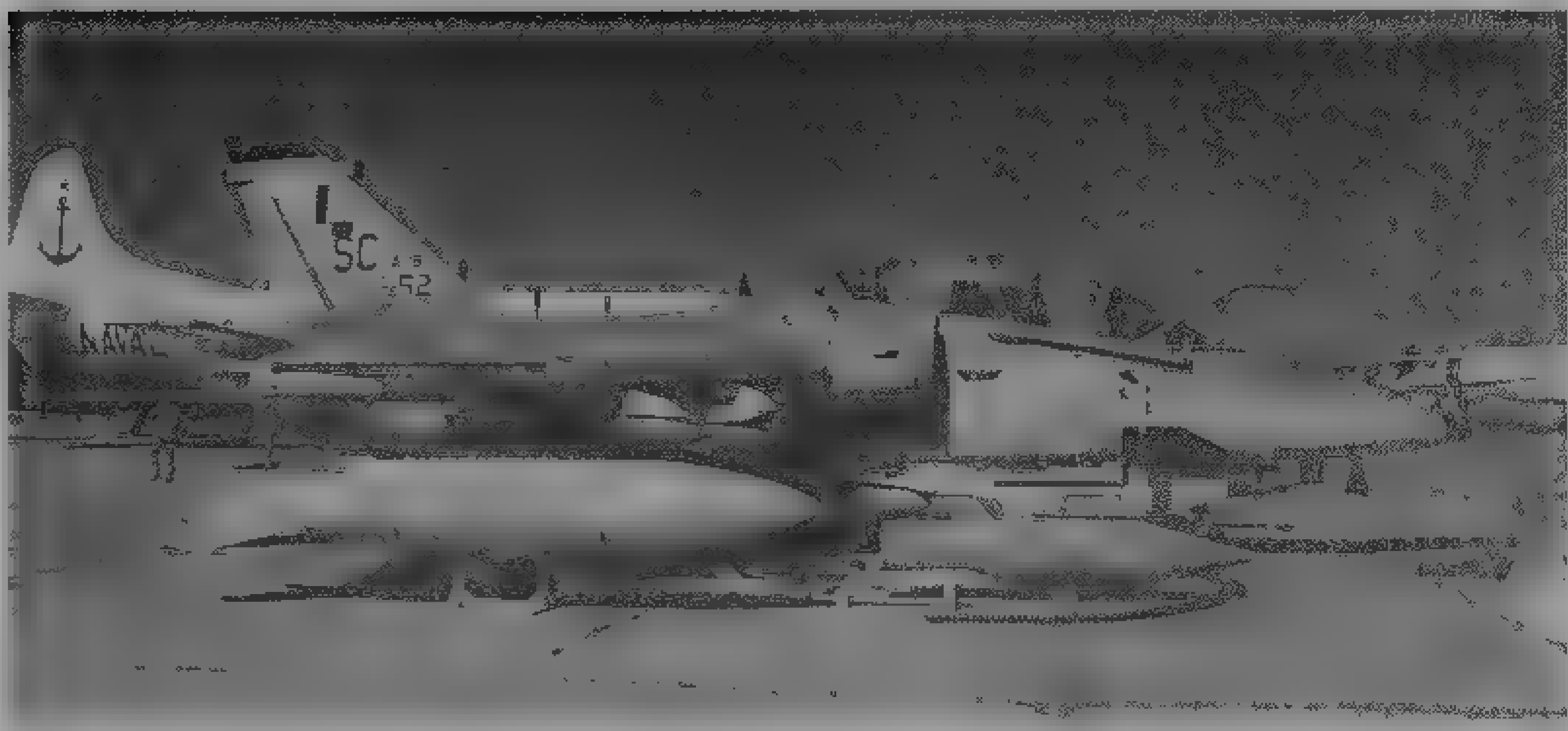
AREAS

Wings, gross	21 00 m² (226 04 sq ft)
Ailerons (total)	0 88 m² (9.47 sq ft)
Trailing-edge flaps (total)	3 86 m² (41 55 sq ft)

Leading-edge slats (total) 2 066 m² (22 24 sq ft)
Spoilers (total) 1 30 m² (13 99 sq ft)
Fin (exposed) 4.265 m² (45.91 sq ft)
Rudder 0 833 m² (8 97 sq ft)
Tailplane (total exposed) 5 10 m² (54 90 sq ft)
Elevators (total) 1 00 m² (10 76 sq ft)

WEIGHTS AND LOADINGS (all versions)
Operational weight empty 6,730 kg (14,837 lb)
Max fuel weight internal 2,790 kg (6,151 lb)
external 1 726 kg (3,805 lb)
Max external stores load 3 800 kg (8,377 lb)
T O weight (clean) 9 694 kg (21,371 lb)
Typical mission T-O weight 10,750 kg (23,700 lb)
Max T-O weight 13 000 kg (28,660 lb)
Normal landing weight 7 000 kg (15,432 lb)
Combat wing loading (clean)
457 1 kg/m² (93 62 lb/sq ft)
Max wing loading 619 05 kg/m² (126 79 lb/sq ft)
Max power loading 265 14 kg/kN (2 60 lb/lb st)

PERFORMANCE (A at typical mission weight of 10,750 kg, 23 700 lb with 907 kg, 2,000 lb of external stores, B at max T O weight with 2,721 kg, 6 000 lb of external stores, ISA in both cases)
Max level speed at S/L Mach 0 84
at 9,150 m (30,000 ft) Mach 0 86
Max rate of climb at S/L 3,124 m (10,250 ft)/min
Service ceiling 13,000 m (42,650 ft)
T-O run at S/L A 631 m (2 070 ft)
B 982 m (3,220 ft)
T O to 15 m (50 ft) at S/L B 1,442 m (4,730 ft)
Landing from 15 m (50 ft) at S/L, B 753 m (2,470 ft)



Brazilian A-1B (AMX-T) two-seat operational trainer *(Embraer/Mario Vinagre)*

1995

Landing run at S/L 464 m (1,520 ft)
Attack radius, allowances for 5 min combat over target and 10% fuel reserves
lo-lo-lo: A 300 n miles (556 km, 345 miles)
B 285 n miles (528 km; 328 miles)
hi-lo-hi A 480 n miles (889 km, 553 miles)
B 500 n miles (926 km, 576 miles)
Ferry range with two 1,000 litre (264 US gallon, 220 Imp gallon) drop tanks, 10% reserves
1,800 n miles (3,333 km, 2,071 miles)
g limits +7 33/–3

UPDATED

ATR

AVIONS DE TRANSPORT REGIONAL

1 Allee Pierre Nadot, F-31712 Blagnac Cedex, France
Telephone: 33 61 93 11 11
Fax: 33 61 30 07 40 or 93 13 16
Telex. 533 984 F/GIE ATR

CHAIRMAN OF THE BOARD (alternate)
Louis Gallois (Aerospatiale)
Fausto Cereti (Alenia)
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Henri-Paul Puel (Aerospatiale)
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SENIOR VICE-PRESIDENT, NEW PROJECTS
Philippe Leboue
VICE-PRESIDENT SALES ENGINEERING Alain Fontaine
COMMUNICATIONS MANAGER: Mlle E. Broge
PARTICIPATING COMPANIES:
Aerospatiale see under France
Alenia. see under Italy

First Aerospatiale/Aeritalia agreement July 1980; ATR programme started 4 November 1981 Groupement d'Intéret Economique (50/50 joint management company) formally established 5 February 1982 to develop ATR series of transport aircraft. Assembly or licenced production by Xian Aircraft in a new factory at Shenzhen, near Hong Kong, under discussion Xian already produces components for ATR

ATR marketing and support office opened in Washington 15 July 1986, ATR airline support centre in Singapore opened 18 November 1988, ATR Training Centre opened 1 July 1989 By early 1995, 265 ATR 42 and 115 ATR 72 operating with 60 customers, 32 sold and 48 produced during 1994, combined 42/72 production rate 4 4 per month in early 1995

In January 1995, Aerospatiale, Alenia and British Aerospace announced intended creation of Aero International Regional (AIR) joint venture, to be owned in equal proportions by the three parties, covers both turboprops and regional jets Venture will begin 1 January 1996 by merging marketing, sales and customer support activities of ATR Avro and Jetstream (see UK section) into single integrated organisation offering full range of regional aircraft will lead all-new product developments

ATR, Avro and Jetstream each to maintain appropriate industrial and financial capabilities to support their respective programmes, including improvements In addition, partners to study means to greater industrial integration Joint venture activities undertaken in France, Italy and UK, headquarters in Toulouse

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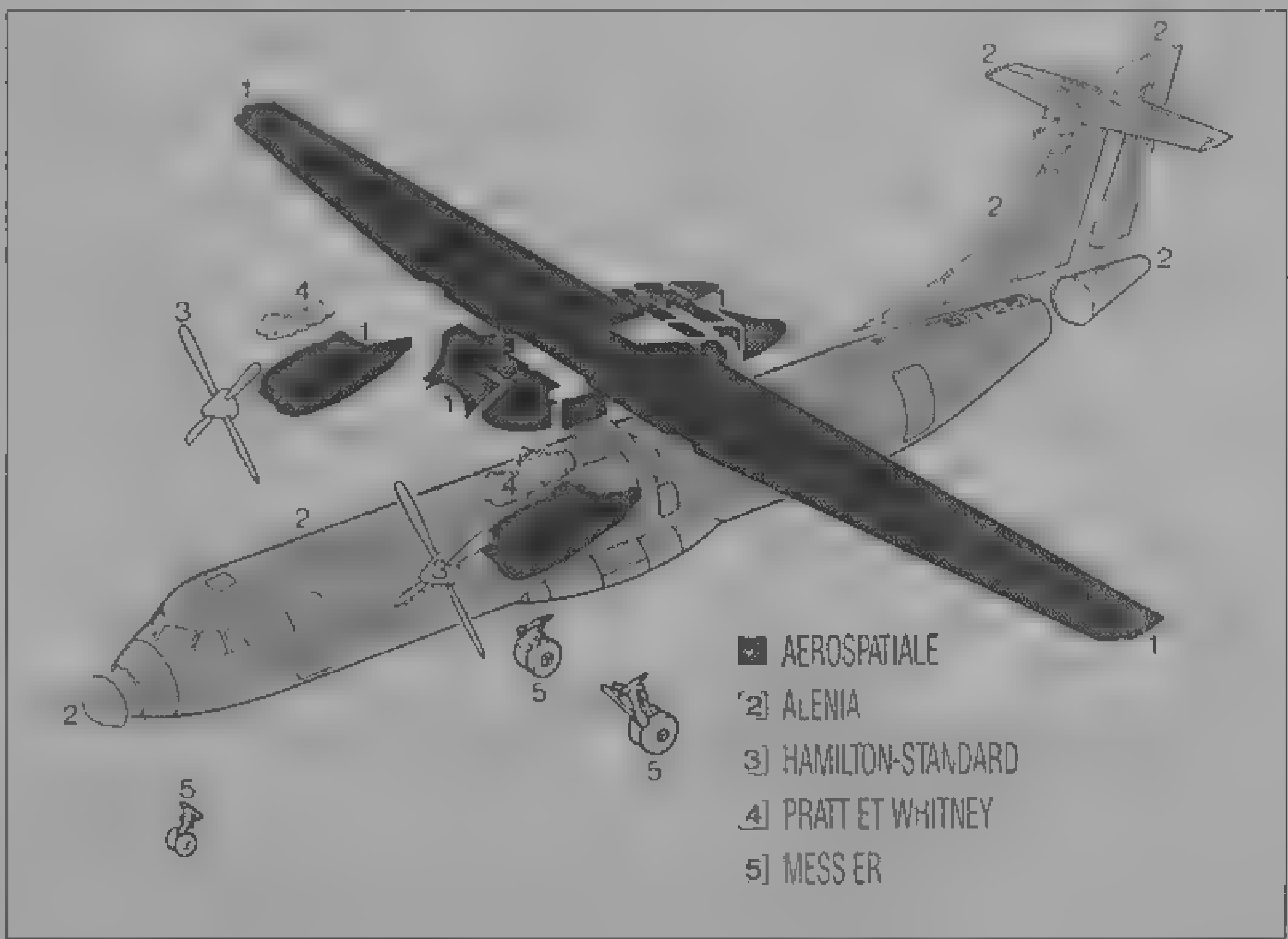


Manufacturers of the ATR airframe

1995

ATR 42

TYPE. Twin-turboprop regional transport

PROGRAMME Joint launch by Aerospatiale and Aeritalia (now Alenia) in October 1981 following June 1981 selection of P&WC PW120 turboprop as basic power plant, first flights of two prototypes 16 August 1984 (F-WEGA) and 31 October 1984 (F-WEGB); first flight production aircraft 30 April 1985, simultaneous certification to JAR 25 by France and Italy 24 September 1985, followed by USA (FAR 25) 25 October 1985, Germany 12 February 1988, UK 31 October 1989, deliveries began 3 December 1984.

CURRENT VERSIONS. **ATR 42 300** Initial production version, with higher maximum T O weight and better payload/range than prototypes. *Description applies to this version except where indicated*

ATR 42 320 Identical to 42-300 except for optional PW121 engines for improved hot/high performance, OWE increased/payload decreased by 5 kg (11 lb)

ATR 42 400. P&WC PW121A engines with six-blade propellers. first flight 12 July 1995, two ordered for CSA

ATR 42 500 Powered by P&WC PW127 as ATR 72 210. *Described separately*

ATR 42 Cargo. Quick-change (1 hour) interior to hold nine containers with 4,000 kg (8,818 lb) payload

ATR 42 F Military/paramilitary freighter with modified interior, reinforced cabin floor, port-side cargo/airdrop door can be opened in flight, can carry 3,800 kg (8,377 lb) of cargo or 42 passengers over 1 250 n miles (2,315 km 1,438 miles). One delivered to Gabon 1989

ATR Calibration: Navaid calibration version

ATR 42L: Freighter with lateral cargo door

CUSTOMERS. Total 290 firm orders by 12 June 1995, of which 277 then delivered

COSTS: Reported unit price of ATR 42-300 $11 4 million

DESIGN FEATURES. Designed to JAR 25/FAR 25; wing section Aerospatiale RA-XXX-43 (NACA 43 series derivative); thickness/chord ratio 18 per cent at root. 13 per cent at tip. constant chord, no-dihedral centre-section with 2° incidence at root, outer panels 3° 6′ sweepback at quarter-chord and 2° 30′ dihedral. Fuselage (including baggage/cargo compartments) pressurised. Sweptback vertical and non-swept horizontal (T) tail surfaces Dispatch reliability February 1994 was 98 9 per cent, fleet leader then had flown 16,568 hours, maximum landings by one aircraft 21,103

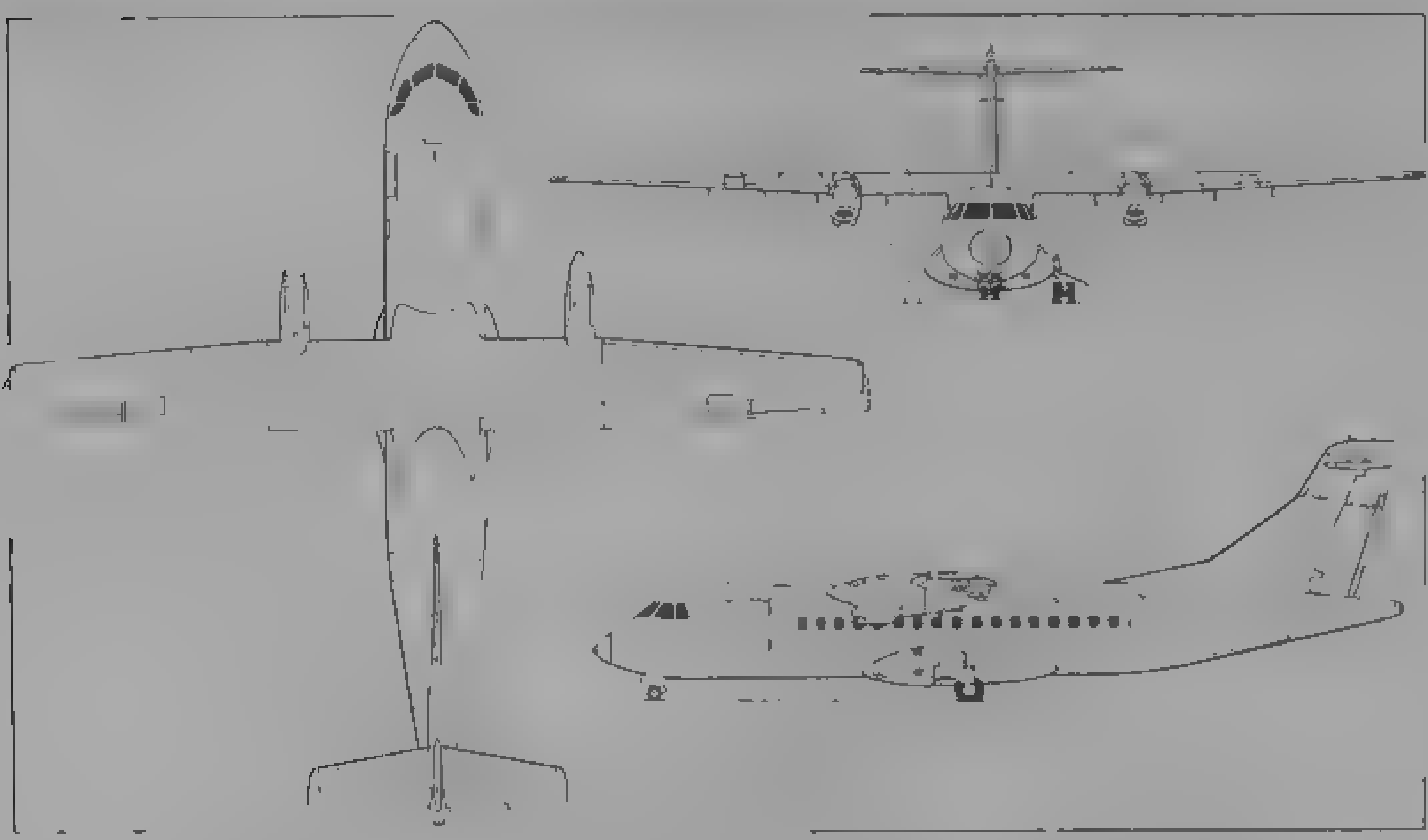
FLYING CONTROLS Mechanically actuated, lateral control by ailerons and single spoiler surface ahead of each outer flap, ailerons each have electrically actuated trim tab fixed incidence tailplane, horn balanced rudder and elevators, each with electrically actuated trim tab; two-segment double-slotted flaps on offset hinges with Ratier Figeac hydraulic actuators

STRUCTURE. Two-spar fail safe wings, mainly of aluminium alloy, with leading edges of Kevlar/Nomex sandwich, wing top skin panels aft of rear spar are of Kevlar/Nomex with carbon reinforcement; flaps and ailerons have aluminium ribs and spars, with skins of carbonfibre/Nomex and carbon/epoxy respectively, fuselage is fail-safe stressed skin, mainly of light alloy except for Kevlar/Nomex sandwich nosecone, tailcone, wing/body fairings nosewheel doors and main landing gear fairings, fin (attached to rearmost fuselage frame) and tailplane mainly of aluminium alloy CFRP/Nomex sandwich rudder and elevators, dorsal fin of Kevlar/Nomex and GFRP Nomex sandwich, engine cowlings of CFRP/Nomex and Kevlar/Nomex sandwich, reinforced with CFRP in nose and underside, propeller blades have metal spars and GFRP/polyurethane skins

Aerospatiale responsible for design and construction of wings and engine nacelles, flight deck and cabin layout, installation of power plant, flying controls, electrical and de-icing systems, and final assembly and flight testing of

ATR 42 of Lao Aviation

1994



Aerospatiale/Alenia ATR 42 twin-turboprop regional transport (*Jane's/Dennis Punnett*)

1983

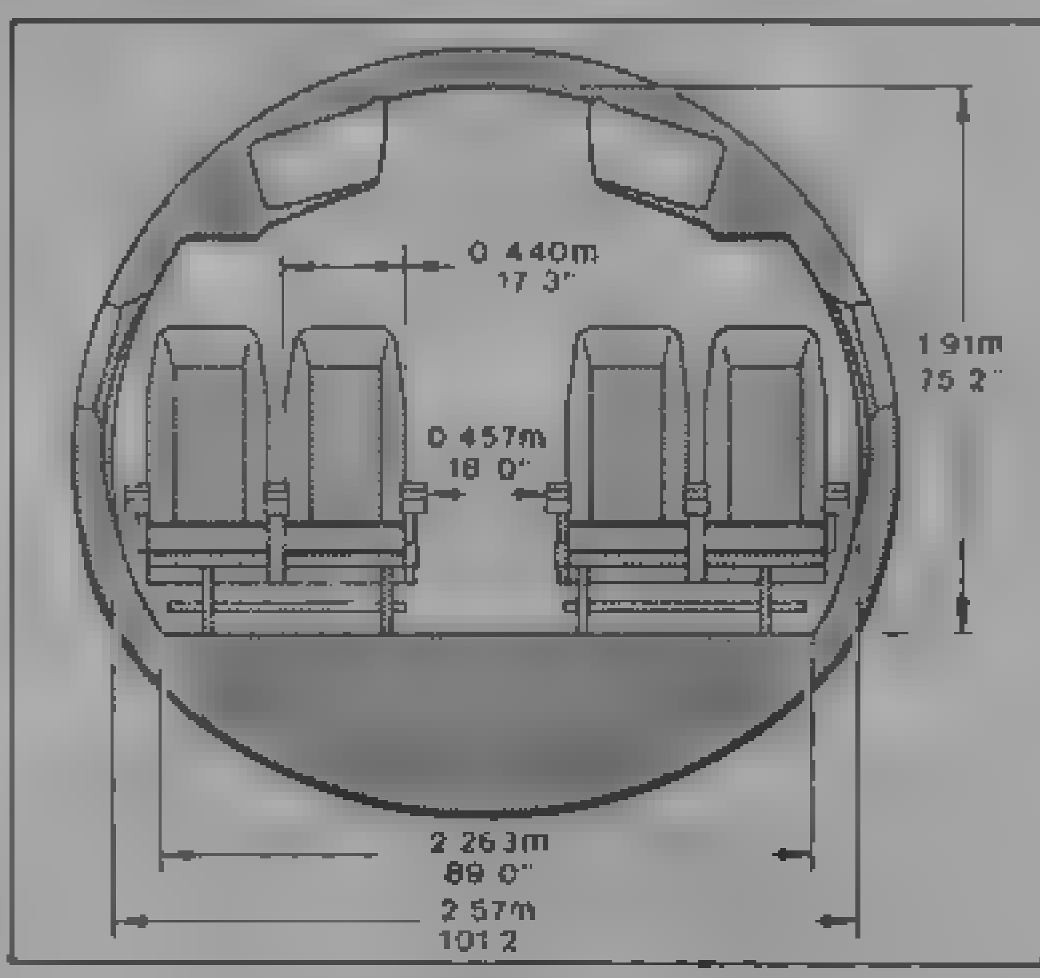
civil passenger versions, Alenia builds fuselage and tail unit, installs landing gear hydraulic system, air conditioning and pressurisation systems. ATR 42/72 manufactured at St Nazaire and Nantes (France), Pomigliano d'Arco and Capodichino (Italy), and assembled in Toulouse

LANDING GEAR: Hydraulically retractable tricycle type, of Messier-Bugatti/Magnaghi/Nardi trailing-arm design, with twin wheels and oleo-pneumatic shock-absorber on each unit. Nose unit retracts forward, main units inward into fuselage and large underfuselage fairing. Goodyear multiple-disc mainwheel brakes and Hydro-Aire anti-skid units. Goodyear mainwheels and tubeless tyres, size 32 × 8.8-10PR, pressure 7.17 bars (104 lb/sq in). Low-pressure tyres optional. Goodyear nosewheels and tubeless tyres, size 450 × 190-5TL, pressure 4.14 bars (60 lb/sq in). Minimum ground turning radius 17.08 m (56 ft 0¼ in)

POWER PLANT: Two Pratt & Whitney Canada PW120 turboprops in 42-300, each flat rated at 1,342 kW (1,800 shp) for normal operation and 1,492 kW (2,000 shp) OEI and driving a Hamilton Standard 14SF four-blade constant-speed fully feathering and reversible-pitch propeller. Power plant for ATR 42-320 is two PW121s, each flat rated at 1,417 kW (1,900 shp) for normal operation and 1,567 kW (2,100 shp) OEI. Fuel in two integral tanks in spar box, total capacity 5,700 litres (1,506 US gallons; 1,254 Imp gallons). Single pressure refuelling point in starboard wing leading-edge. Gravity refuelling points in wing upper surface. Oil capacity 40 litres (10.6 US gallons, 8.8 Imp gallons)

ACCOMMODATION: Crew of two on flight deck; folding seat for observer. Seating for 42 passengers at 81 cm (32 in) pitch; or 46, 48 or 50 passengers at 76 cm (30 in) pitch, four-abreast layout with central aisle. Passenger door, with integral steps, at rear of cabin on port side. Main baggage/cargo compartment between flight deck and passenger cabin, with access from inside cabin and separate loading door on port side; toilet, galley, wardrobe and seat for cabin attendant at rear of passenger cabin, with service door on starboard side, rear baggage/cargo compartment aft of passenger cabin; additional baggage space provided by overhead bins and underseat stowage. Entire accommodation, including flight deck and baggage/cargo compartments, pressurised and air conditioned. Emergency exit via rear passenger and service doors, and by window exits on each side at front of cabin

SYSTEMS: AiResearch air conditioning and Softair pressurisation systems, utilising engine bleed air. Pressurisation system (nominal differential 0.41 bar; 6.0 lb/sq in) provides cabin altitude of 2,040 m (6,695 ft) at flight altitudes



Fuselage cross-section of ATR 42/72/82
(*Jane's/Mike Keep*)

1993

of up to 7,620 m (25,000 ft). Two independent hydraulic systems, each at pressure of 207 bars (3,000 lb/sq in), driven by electrically operated Abex pump and separated by interconnecting valve controlled from flight deck, system flow rate 7.9 litres (2.09 US gallons, 1.74 Imp gallons)/min; one system actuates wing flaps, spoilers, propeller brake, emergency wheel braking and nosewheel steering, second system for landing gear and normal braking. Kléber-Colombes pneumatic system for de-icing of outer wing leading-edges, tailplane leading-edges and engine air intakes; optional de-icing of inner wing leading-edge and fin for severe conditions, noses of aileron and elevator horns have full-time electric anti-icing. Main electrical system is 28 V DC, supplied by two Auxilec 12 kW engine-driven starter/generators and two Ni/Cd batteries (43 Ah and 15 Ah), with two solid state static inverters for 115/26 V single-phase AC supply; 115/200 V three-phase supply from two 20 kVA frequency wild engine-driven alternators for anti-icing of windscreen, flight deck side windows, stall warning and airspeed indicator pitots, propeller blades and control surface horns. Eros/Puritan oxygen system. Instead of APU, starboard propeller braked and engine run to give DC and 400 Hz power, air conditioning and hydraulic pressure

AVIONICS: Bendix/King Gold Crown III comm/nav equipment standard, Collins Pro Line II optional

Comms: CVR, PA system

Radar: Honeywell P-800 weather radar

Flight: Honeywell DFZ 600 AFCS, AZ-800 ADCs; AH 600 AHRS with avionics standard communication bus, GPWS, digital FDR, DME, Honeywell FMZ-800 flight management system and dual GPS receivers installed in four Continental Airlines ATR 42s to allow autonomous approaches

Instrumentation: EZ-820 electronic flight instrument system

DIMENSIONS, EXTERNAL

Wing span	24.57 m (80 ft 7½ in)
Wing chord: at root	2.57 m (8 ft 5¼ in)
at tip	1.41 m (4 ft 7½ in)
Wing aspect ratio	11.08
Length overall	22.67 m (74 ft 4½ in)
Fuselage: Max width	2.865 m (9 ft 4¾ in)
Height overall	7.586 m (24 ft 10¾ in)
Elevator span	7.31 m (23 ft 11¾ in)
Wheel track (c/l of shock-struts)	4.10 m (13 ft 5¼ in)
Wheelbase	8.78 m (28 ft 9¾ in)
Propeller diameter	3.96 m (13 ft 0 in)
Distance between propeller centres	8.10 m (26 ft 7 in)
Propeller fuselage clearance	0.82 m (2 ft 8¼ in)
Propeller ground clearance	1.10 m (3 ft 7¼ in)
Passenger door (rear, port): Height	1.75 m (5 ft 9 in)
Width	0.75 m (2 ft 5½ in)
Height to sill (at OWE)	1.375 m (4 ft 6¼ in)
Service door (rear, stbd): Height	1.22 m (4 ft 0 in)
Width	0.61 m (2 ft 0 in)
Height to sill	1.375 m (4 ft 6¼ in)
Cargo/baggage door (fwd, port)	
Height	1.53 m (5 ft 0¼ in)
Width	1.275 m (4 ft 2¼ in)
Height to sill (at OWE)	1.15 m (3 ft 9¼ in)
Emergency exits (fwd, each): Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)
Crew emergency hatch (flight deck roof)	
Length	0.51 m (1 ft 8 in)
Width	0.483 m (1 ft 7 in)

DIMENSIONS, INTERNAL

Cabin: Length (excl flight deck, incl toilet and baggage compartments)	14.66 m (48 ft 1¼ in)
Max width	2.57 m (8 ft 5¼ in)
Max width at floor	2.263 m (7 ft 5¼ in)
Max height	1.91 m (6 ft 3¼ in)
Floor area	31.0 m² (333.7 sq ft)
Volume	58.0 m³ (2,048.25 cu ft)
Baggage/cargo compartment volume	
front (42-46 passengers)	6.0 m³ (211.9 cu ft)
front (48 passengers)	4.8 m³ (169.5 cu ft)
front (50 passengers)	3.6 m³ (127.1 cu ft)
rear	4.8 m³ (169.5 cu ft)
overhead bins	1.5 m³ (53.0 cu ft)

AREAS

Wings, gross	54.50 m² (586.6 sq ft)
Ailerons (total)	3.12 m² (33.58 sq ft)
Flaps (total)	11.00 m² (118.40 sq ft)
Spoilers (total)	1.12 m² (12.06 sq ft)
Fin, excl dorsal fin	12.48 m² (134.33 sq ft)
Rudder, incl tab	4.00 m² (43.05 sq ft)
Tailplane	11.73 m² (126.26 sq ft)
Elevators (total, incl tabs)	3.92 m² (42.19 sq ft)

WEIGHTS AND LOADINGS

Operating weight empty (incl FAR 121 equipment):	
42-300	10,285 kg (22,674 lb)
42-320	10,290 kg (22,685 lb)
Max fuel weight	4,500 kg (9,920 lb)
Max payload: 42-300	4,915 kg (10,835 lb)
42-320	4,910 kg (10,824 lb)
Max T-O weight	16,700 kg (36,817 lb)
Max ramp weight	16,720 kg (36,860 lb)
Max zero-fuel weight	15,200 kg (33,510 lb)
Max landing weight	16,400 kg (36,156 lb)
Max wing loading	306.4 kg/m² (62.79 lb/sq ft)
Max power loading: 42-300	6.22 kg/kW (10.23 lb/shp)
42-320	5.90 kg/kW (9.69 lb/shp)

PERFORMANCE (42-300 at max T-O weight, to FAR Pt 25, incl Amendment 42, ISA, except where indicated)

Never-exceed speed (V_{NE})	Mach 0.55 (250 kts; 463 km/h, 287 mph CAS)
Max cruising speed at 5,180 m (17,000 ft), gross weight of 16,200 kg (35,715 lb)	265 kts (490 km/h, 305 mph)
Econ cruising speed at 7,620 m (25,000 ft)	243 kts (450 km/h, 279 mph)
Stalling speed: flaps up	104 kts (193 km/h, 120 mph)
30° flap	81 kts (151 km/h, 94 mph)
Max rate of climb at S/L, gross weight of 15,000 kg (33,069 lb)	640 m (2,100 ft)/min
Rate of climb at S/L, OEI, gross weight as above	191 m (625 ft)/min
Max operating altitude	7,620 m (25,000 ft)
Service ceiling, OEI, at 97% of max T-O weight and ISA + 10°C	2,315 m (7,595 ft)
T-O balanced field length	
at S/L, ISA	1,090 m (3,576 ft)
at 915 m (3,000 ft), ISA + 10°C	1,300 m (4,265 ft)
Landing field length at S/L at max landing weight	1,030 m (3,380 ft)

Internal layout of ATR 42 with baggage space forward as well as aft and airstairs at rear door

1993

Runway LCN at max T-O weight
rigid pavement, 200 cm radius of relative stiffness
standard tyres 19
low-pressure tyres 16
76 cm flexible pavement, standard tyres 20
83 cm flexible pavement, low pressure tyres 16
Max range with 46 passengers, reserves for 87 n mile (161 km 100 mile) diversion and 45 min hold
1,050 n miles (1,944 km; 1,208 miles)
Range with max fuel, reserves as above
max cruising speed
2 420 n miles (4,482 km, 2,785 miles)
long-range cruising speed
2,720 n miles (5,037 km, 3,130 miles)

PERFORMANCE (42-320, conditions as above): As for 42-300 except
Max cruising speed at 5,180 m (17,000 ft), gross weight of 16,200 kg (35,715 lb) 269 kts (498 km/h, 310 mph)
Service ceiling, OEI, at 97% of max T-O weight, ISA + 10°C 3 140 m (10,300 ft)
T-O balanced field length
at S/L, ISA 1,040 m (3,412 ft)
at 915 m (3,000 ft), ISA + 10°C 1,235 m (4,052 ft)

OPERATIONAL NOISE LEVELS
T-O 82 8 EPNdB
Approach 96 7 EPNdB
Sideline 83.7 EPNdB

UPDATED

ATR 42 500

TYPE: Uprated ATR 42 with 'new look' interior

PROGRAMME: Announced at Paris Air Show 1993; will become baseline version of ATR 42, first flight F-WWEZ (c/n 443) 16 September 1994; certification April 1995 deliveries mid-1995. Being developed in parallel with ATR 72-210

CUSTOMERS: Initial customers include Aeromar (two, plus options for three more), Air Dolomiti (two) and American Eagle (10 options), total market estimated at 300 to 400.

COSTS: Development cost $50 million; sale price $12 2 million (1994).

DESIGN FEATURES: More powerful engines (see below), reinforced wings to allow greatly increased cruising speed of 304 knots (563 km/h, 350 mph) and higher weights, could depart at maximum gross weight from Denver, Colorado, in 30°C (86°F) ambient, all systems improvements of ATR 72, including flight management computers, to be incorporated, cockpit, elevators and fin taken from ATR 72-210; strengthened landing gear; electrically operated main doors, reinforced fuselage and wing centre-section

POWER PLANT: Two Pratt & Whitney Canada PW127E turboprops (as ATR 72), derated from 2,051 kW (2,750 shp) to the 1,790 kW (2,400 shp) of the PW124, giving high power reserve, ATR 72-210 nacelles; six-blade Ratier-Figeac/Hamilton Standard 568F propellers with new electronic control giving faster response and better synchrophasing (as planned for ATR 72-210 in 1996); fuel capacity unchanged

ACCOMMODATION: Seating for 46 to 50 passengers at 76 cm (30 in) pitch, completely new interior with new ceiling and sidewalls, indirect lighting, more sound damping and active sound control; call buttons and reading lights relocated; overhead bins lengthened to 2 m (6 ft 6¾ in) to accommodate skis, golf clubs and fishing equipment carried as hand baggage Baggage volume increased by 30 per cent Dowty/Noise Cancellation Technologies active noise control (ANC) system tested by ATR and offered for ATR 42-500; installed in second ATR 42-500 (c/n 445, first flight 28 November 1994), system includes a tachometer on each engine and 48 microphones and 24 loudspeakers distributed along cabin overheads and sidewalls; results in 16 dB reduction in noise from turbulent air flow and 12 dB reduction in overall noise. In parallel, prototype and second ATR 42 500 have structural acoustic treatment comprising reinforcement of seven fuselage frames adjacent propeller plane; dynamic vibration absorbers in this area, and internal aluminium skin damping material forward and aft of wing.

SYSTEMS: New systems transferred from ATR 72.

WEIGHTS AND LOADINGS
Operating weight empty 10,980 kg (24,207 lb)
Max payload 5,620 kg (12,390 lb)
Max T-O weight 18,500 kg (40,785 lb)
Max power loading (with power reserve)
4 51 kg/kW (7 42 lb/shp)

PERFORMANCE
Cruising speed 304 kts (563 km/h, 350 mph)
T-O distance
ISA +20°C at 915 m (3,000 ft) 1,400 m (4,593 ft)
ISA, S/L for 300 n mile (556 km, 345 mile) stage with 48 passengers 960 m (3,149 ft)
Landing field length
S/L at landing weight after 300 n mile (556 km, 345 mile) sector 970 m (3,182 ft)
S/L at max landing weight 1,160 m (3 805 ft)
Time to climb to 5,180 m (17,000 ft) 9 2 min
Service ceiling OEI, ISA +10°C, 97% max T-O weight 5 485 m (18 000 ft)
Max range 1 000 n miles (1 852 km 1 151 miles)

UPDATED

First ATR 42-500 (F-WWEZ), flown 16 September 1994

1995

ATR 52C

TYPE: Proposed rear-loading military/civil cargo version of ATR 72-210

PROGRAMME: Announced April 1992, launch customers still awaited, but Australia, India, Malaysia, South Africa and Thailand seen as most likely to buy and share cost of development of tail loading system

CUSTOMERS: Market originally estimated at 400 aircraft

COSTS: Development cost estimated at $150 million (1995)

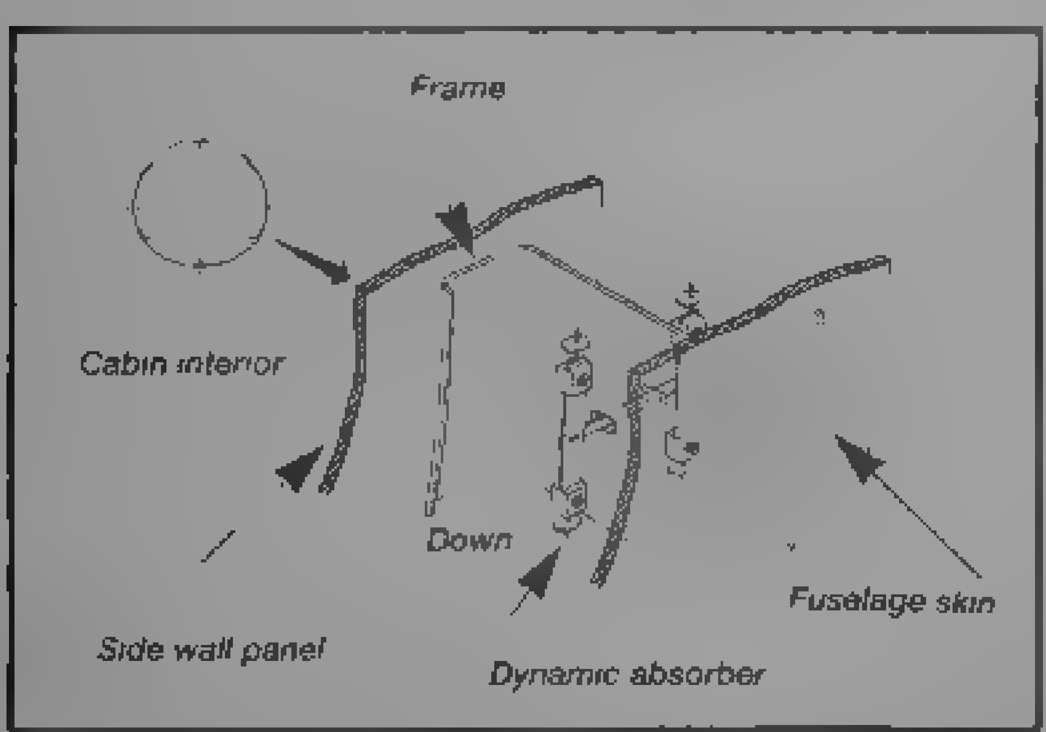
DESIGN FEATURES: ATR 72-210 wings, fuselage and tail surfaces except for rear-loading feature and 3 176 m (10 ft 5 in) shorter fuselage, location of shortening depends on weight of rear-loading feature

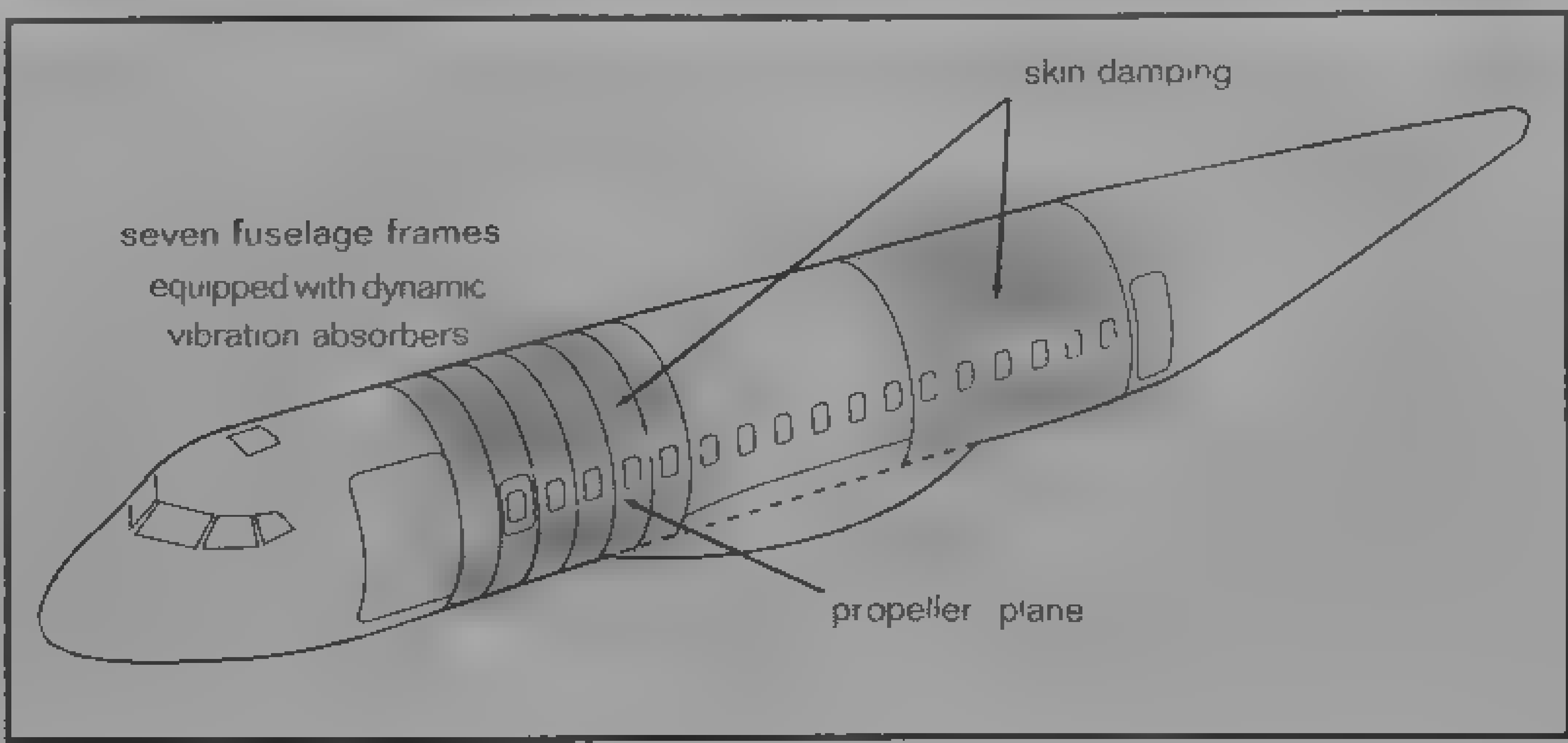
FLYING CONTROLS: As ATR 72

STRUCTURE: As ATR 72, rear-loading doors may be petal or ramp type, strengthened cargo floor

LANDING GEAR: Same as ATR 72

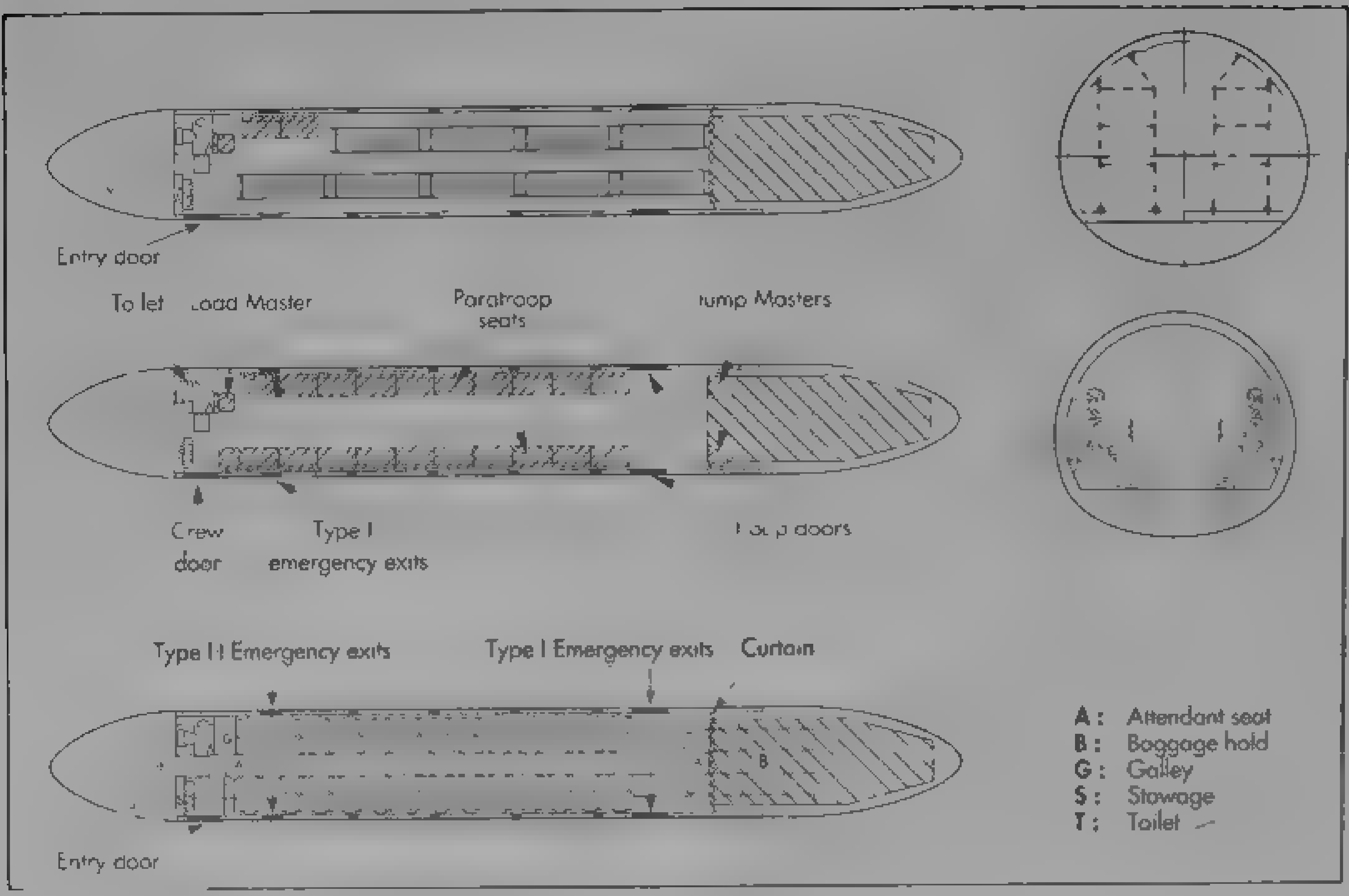
POWER PLANT: Two Pratt & Whitney Canada PW127 turboprops, normal take-off power 1,849 kW (2,480 shp), OEI power 2,058 kW (2,760 shp), driving Hamilton Standard/Ratier Figeac 247F composite-blade propellers. Fuel system as ATR 72-210





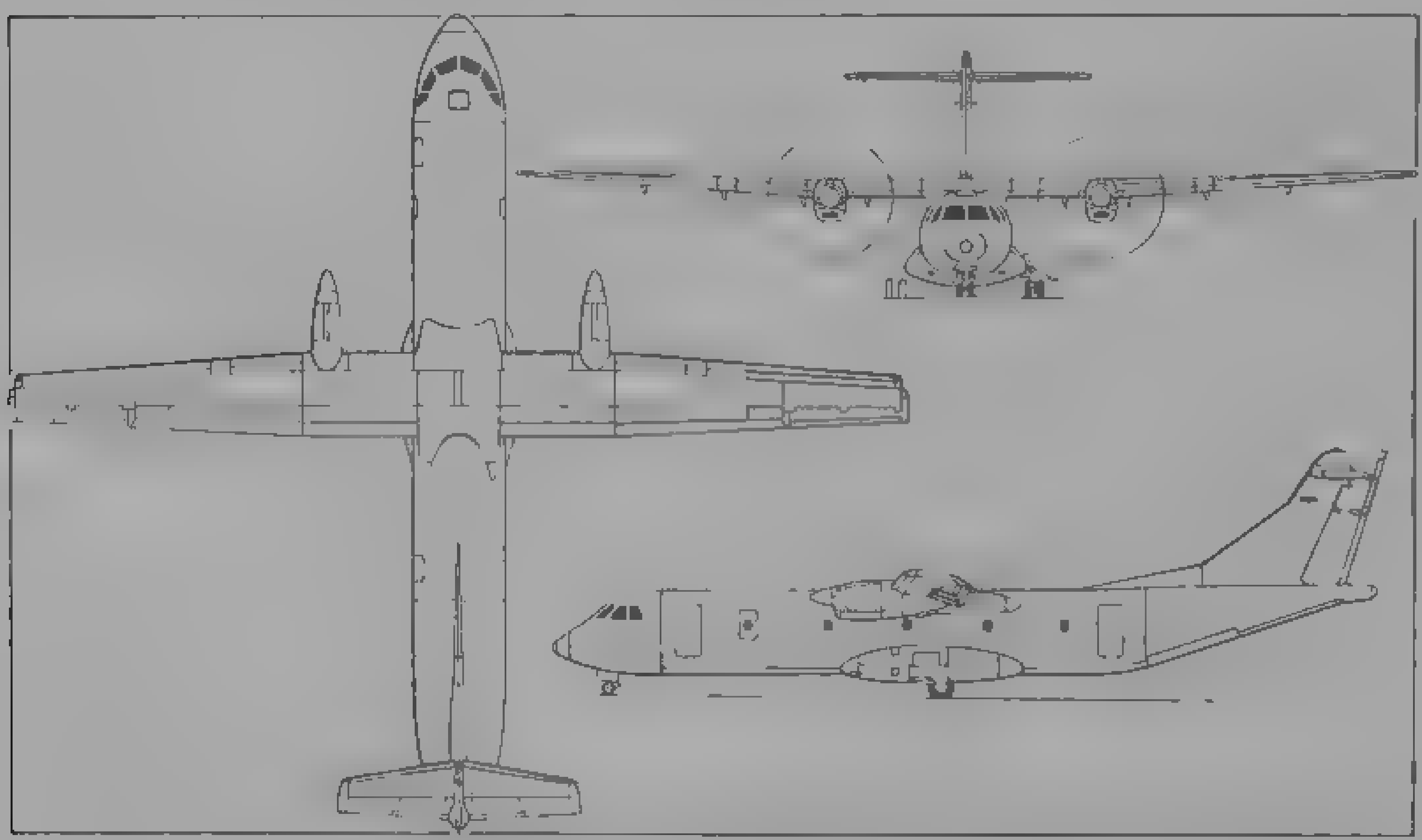
Noise reduction measures in the ATR 42 500 include skin damping material (right) and dynamic vibration absorbers (above)

1995



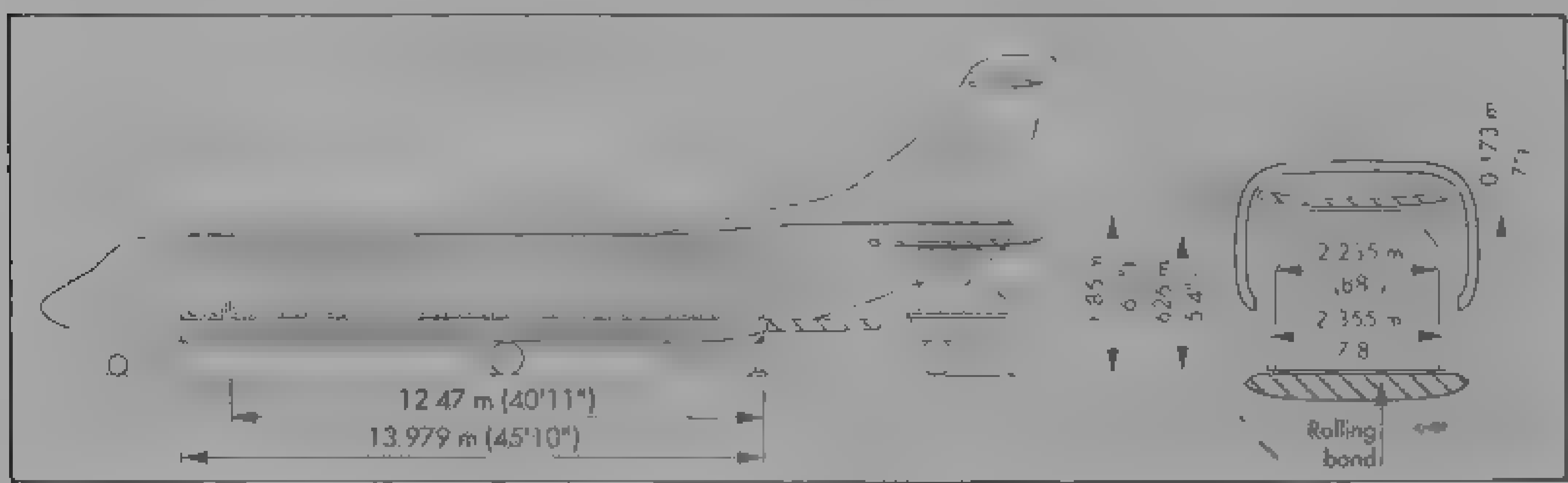
Possible floor configuration of military ATR 52C

1995



Proposed ATR 52C military freighter *(Jane's/Mike Keep)*

1994



Cargo hold of ATR 52C rear-loading military transport

1994

ATR 72 of Vietnam Airlines

1995

ACCOMMODATION Two-man flight deck with roof escape hatch, main cargo floor, excluding small service and seating area at front and loading ramp at rear, can accommodate four 2 24 × 3.18 m (88 × 125 in) pallets or six LD3 containers end-to-end along cabin centreline or three 2.24 × 2 74 m (88 × 108 in) pallets and one LD3, cargo restraint net at forward end of cabin, four roller tracks down main cargo floor; forward crew door to port and passenger door at rear to port, four cabin windows each side, front units are Type III emergency exits, medevac version has three tiers of four stretchers down each sidewall (24 total), plus toilet, separate washbasin, two personnel seats and folding table at front of cabin, passenger layout allows 54 seats four-abreast at 76 cm (30 in) pitch, plus attendant folding seat and toilet

SYSTEMS: As in ATR 72-210

AVIONICS. As in ATR 72 210

DIMENSIONS, EXTERNAL

Wing span	27 05 m (88 ft 9 in)
Length of fuselage	24.46 m (80 ft 3 in)
Height overall	8.37 m (27 ft 5½ in)
Tailplane span	7 31 m (23 ft 11¾ in)
Wheel track	4.10 m (13 ft 5½ in)
Wheelbase	9.64 m (31 ft 7½ in)
Propeller diameter	3 96 m (13 ft 0 in)
Crew door (port, fwd). Height	1 75 m (5 ft 8⅞ in)
Width	0.82 m (2 ft 8¼ in)
Passenger doors (both sides, rear)	
Height	1 80 m (5 ft 11 in)
Width	0 90 m (2 ft 11½ in)

DIMENSIONS, INTERNAL

Cargo deck Length, excl ramp	13 98 m (45 ft 10¼ in)
Height under rear door	2 02 m (6 ft 7½ in)

WEIGHTS AND LOADINGS

Operating weight empty	11,839 kg (26,100 lb)
Max payload	7,761 kg (17,110 lb)
Max fuel weight	5,000 kg (11,023 lb)
Mission equipment allowance	400 kg (882 lb)
Max T-O weight normal	22,000 kg (48,502 lb)
tactical	19,550 kg (43,100 lb)
Max zero-fuel weight	20,000 kg (44,092 lb)
Max landing weight normal	21,350 kg (47,069 lb)
tactical	19,400 kg (42,769 lb)

PERFORMANCE (estimated)

Balanced T-O field length, FAR 25	1,380 m (4,528 ft)
Tactical T-O run	515 m (1,690 ft)
Landing run	350 m (1,149 ft)
Landing field length, FAR 25	1,140 (3,741 ft)

Range with 5,000 kg (11,023 lb) payload
798 n miles (1,480 km, 919 miles)

UPDATED

ATR 72

TYPE: Twin-turboprop regional transport

PROGRAMME Announced at 1985 Paris Air Show, launched 15 January 1986, three development aircraft built, first flights 27 October 1988 (F-WWEY), 20 December 1988 (F-WWEZ, c/n 108) and April 1989 (OH KRA, c/n 126), French and US certification 25 September and 15 November 1989 respectively; deliveries, to Kar Air of Finland, began 27 October 1989 (OH-KRB). Average dispatch reliability 99 2 per cent by February 1994

CURRENT VERSIONS: **ATR 72-200**: Current production version, also cargo version, capable of carrying 13 small containers. *Description applies to this version except where indicated*

ATR 72-210: Improved hot/high performance version with PW127 engines rated at 1 849 kW (2,480 shp) and Hamilton Standard 247F propellers with composites blades on steel hubs, ATPCS power 2,059 kW (2,760 shp), carries 7 to 19 more passengers than standard ATR 72 in WAT-limited conditions, French and US certification 15 and 18 December 1992 German on 24 February 1993, first delivery December 1992, 60 ordered by American airlines, eight by Eurowings

ATR-72A. Fitted with Hamilton Standard/Ratier-Figeac 568F propellers, as ATR 42 500, to be introduced in 1996

ATR 52C: Rear-loading cargo version, *described separately*

CUSTOMERS. Total 163 ATR 72 ordered by 12 June 1995, of which 149 then delivered

DESIGN FEATURES: Stretched version of ATR 42 (which see) with more power, more fuel, greater wing span/area, and longer fuselage for up to 74 passengers

FLYING CONTROLS: As for ATR 42 but vortex generators ahead of ailerons and aileron horn balances shielded by wingtip extensions, vortex generators under leading-edge of elevators

STRUCTURE: Generally as for ATR 42, but new wings outboard of engine nacelles have CFRP front and rear spars, self-stiffening CFRP skin panels and light alloy ribs, resulting in weight saving of 120 kg (265 lb); sweepback on outer panels 2° 18′ at quarter-chord.

LANDING GEAR: Improved main units, with Dunlop wheels (tyres size 34 × 10R-16, pressure 7.86 bars, 114 lb/sq in) and structural carbon brakes, nose gear as ATR 42. Minimum ground turning radius 19 76 m (64 ft 10 in)

POWER PLANT: Two Pratt & Whitney Canada PW124B turboprops, each rated at 1,611 kW (2,160 shp) for normal take-off and 1,790 kW (2,400 shp) with ATPCS. Hamilton Standard 14SF-11 four-blade propellers. each new outer wing spar box forms additional 637 litre (168 US gallon, 140 Imp gallon) fuel tank, pressure refuelling point in starboard main landing gear fairing

ACCOMMODATION: As ATR 42 but seating for 64, 66, 70 or (high density) 74 passengers, at respective seat pitches of 81, 79, 76, 76 cm (32, 31, 30, 30 in), plus second cabin attendant's seat. Single baggage compartment at rear of cabin; one or two at front, depending on seating layout and type of port forward door fitted. This can be a passenger or cargo door, with a service door opposite on starboard side. Service door on each side at rear, that on port side replaced by a passenger door when cargo door is fitted at front. Two additional emergency exits (one each side); both rear doors also serve as emergency exits. All doors are of plug type. Increased capacity air conditioning system

AVIONICS: More advanced avionics of ATR 72-210 now being transferred into ATR 42-500.

DIMENSIONS, EXTERNAL: As ATR 42 except

Wing span	27.05 m (88 ft 9 in)
Wing chord at tip	1.59 m (5 ft 2⅝ in)
Wing aspect ratio	12.00
Length overall	27.166 m (89 ft 1¼ in)
Height overall	7.65 m (25 ft 1¼ in)
Wheelbase	10.77 m (35 ft 4 in)
Passenger door (fwd, port): Height	1.75 m (5 ft 9 in)
Width	0.82 m (2 ft 8¼ in)
Height to sill	1.12 m (3 ft 8 in)
Alternative cargo door (fwd, port):	
Height	1.53 m (5 ft 0¼ in)
Width	1.275 m (4 ft 2⅛ in)
Height to sill	1.12 m (3 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin: Length (excl flight deck, incl toilet and baggage compartments)	19.21 m (63 ft 0¼ in)
Cross-section	as for ATR 42
Floor area	41.7 m² (449 sq ft)
Volume	76.0 m³ (2,684 cu ft)
Baggage/cargo compartment volume (with front passenger door): front (64-66 passengers)	3.9 m³ (137.7 cu ft)
front (66 passengers with front cargo door)	5.8 m³ (204.8 cu ft)
front (74 passengers)	1.6 m³ (56.5 cu ft)
rear	4.8 m³ (169.5 cu ft)

AREAS: As ATR 42 except:

Wings, gross	61.0 m² (656.6 sq ft)
Ailerons (total)	3.75 m² (40.36 sq ft)
Flaps (total)	12.28 m² (132.18 sq ft)
Spoilers (total)	1.34 m² (14.42 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty	12,500 kg (27,558 lb)
Max fuel weight	5,000 kg (11,023 lb)
Max payload	7,200 kg (15,873 lb)
Max T-O weight	21,500 kg (47,400 lb)
Max ramp weight	21,530 kg (47,465 lb)
Max zero-fuel weight	19,700 kg (43,430 lb)
Max landing weight	21,350 kg (47,068 lb)
Max wing loading	352.5 kg/m² (72.20 lb/sq ft)
Max power loading	6.01 kg/kW (9.88 lb/shp)

PERFORMANCE (ATR 72-200, at max T-O weight except where indicated):

Max cruising speed at 4,575 m (15,000 ft)	284 kts (526 km/h, 327 mph)
Econ cruising speed at 7,010 m (23,000 ft), at 95% max T-O weight	248 kts (460 km/h, 286 mph)
Max operating altitude	7,620 m (25,000 ft)
Service ceiling, OEI, at 97% max T-O weight and ISA + 10°C	2,680 m (8,800 ft)
T-O balanced field length: at S/L, ISA	1,408 m (4,620 ft)
at 915 m (3,000 ft), ISA + 10°C, at 97% MTOW	1,570 m (5,150 ft)
Landing field length at S/L, ISA, at MLW	1,210 m (3,970 ft)
Still air range (ISA), reserves for 87 n mile (161 km, 100 mile) diversion and 45 min continued cruise: max optional payload	645 n miles (1,195 km; 742 miles)
66 passengers	1,200 n miles (2,222 km, 1,381 miles)
max fuel and zero payload	2,100 n miles (3,889 km; 2,416 miles)

PERFORMANCE (ATR 72-210): Mainly as ATR 72-200 except:

Max cruising speed	280 kts (519 km/h, 322 mph)
Service ceiling, OEI, ISA + 10°C, 97% MTOW	4,330 m (14,200 ft)
T-O balanced field length: at S/L, ISA	1,205 m (3,953 ft)
at 915 m (3,000 ft), ISA + 10°, at T-O weight of 20,500 kg (45,195 lb)	1,280 m (4,200 ft)
Landing field length at S/L, ISA at MLW	1,043 m (3,420 ft)

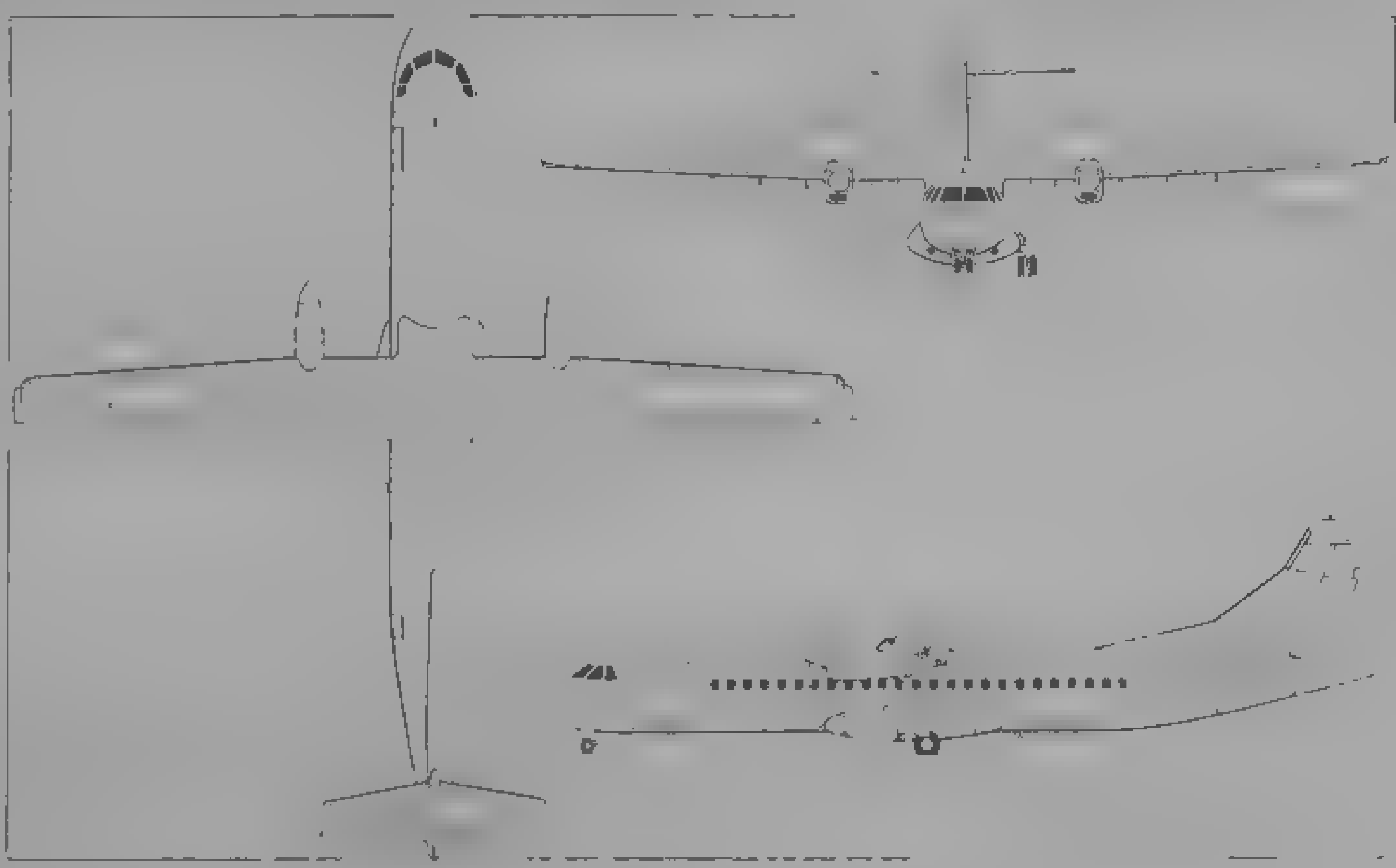
UPDATED

ATR 82

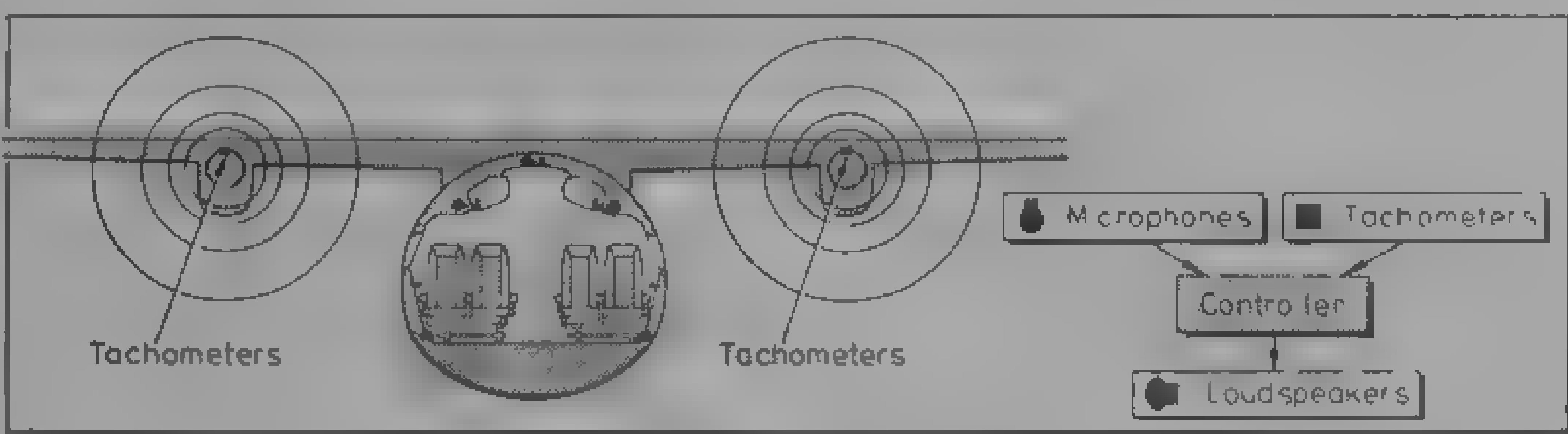
TYPE: Stretched ATR 72

PROGRAMME: Technical and market studies completed end 1994, formal launch dependent on launch customer and

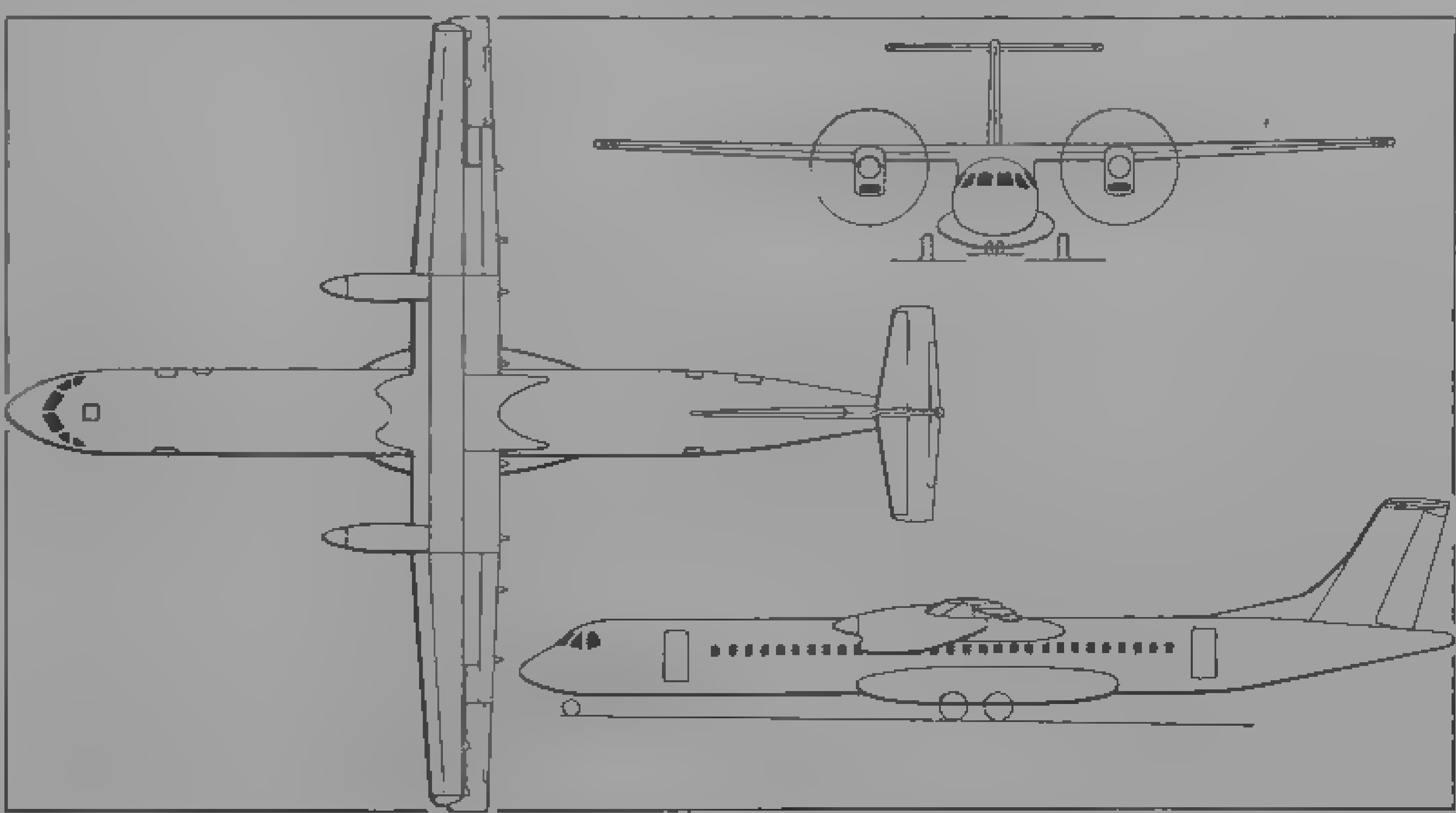
ATR 72-200 cargo version of TAT (France), demonstrating its 13 container freight capacity *1993*



ATR 72-200 (two Pratt & Whitney Canada PW124B turboprops) *(Jane's/Dennis Punnett)* *1993*



Drawing shows positioning of tachometers and paired microphones and loudspeakers of active sound control being introduced in ATR 42/72. The system includes 48 microphones and 24 loudspeakers *(Jane's/Mike Keep)* *1994*



ATR 82, stretched version of ATR 72 *(Jane's/Mike Keep)* *1994*

adequate finance, expected 1995. First delivery 43 months after order. Potential market for 300 ATR 82s.

DESIGN FEATURES: Existing fuselage strengthened and stretched to accommodate 80 passengers at 81 cm (32 in) pitch with equal or increased baggage volume, maximum 84 seats, optional second toilet; wing enlarged and strengthened; landing gear modified.

COSTS: Estimated development cost $500 to $600 million, unit cost $18 million (1995 estimate).

POWER PLANT: Two 3,356 kW (4,500 shp) class turboprops, contenders comprise General Electric GLC38, Allison AE 2100G and AlliedSignal LF-502. Propellers approximately 4.00 m (13 ft) diameter, six or eight blades.

DIMENSIONS, EXTERNAL:

Wing span	27.05 m (88 ft 9 in)
Length overall	31.80 m (104 ft 4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	28.85 m (94 ft 7¾ in)
Max width	2.57 m (8 ft 5¼ in)
Height	1.91 m (6 ft 3¼ in)

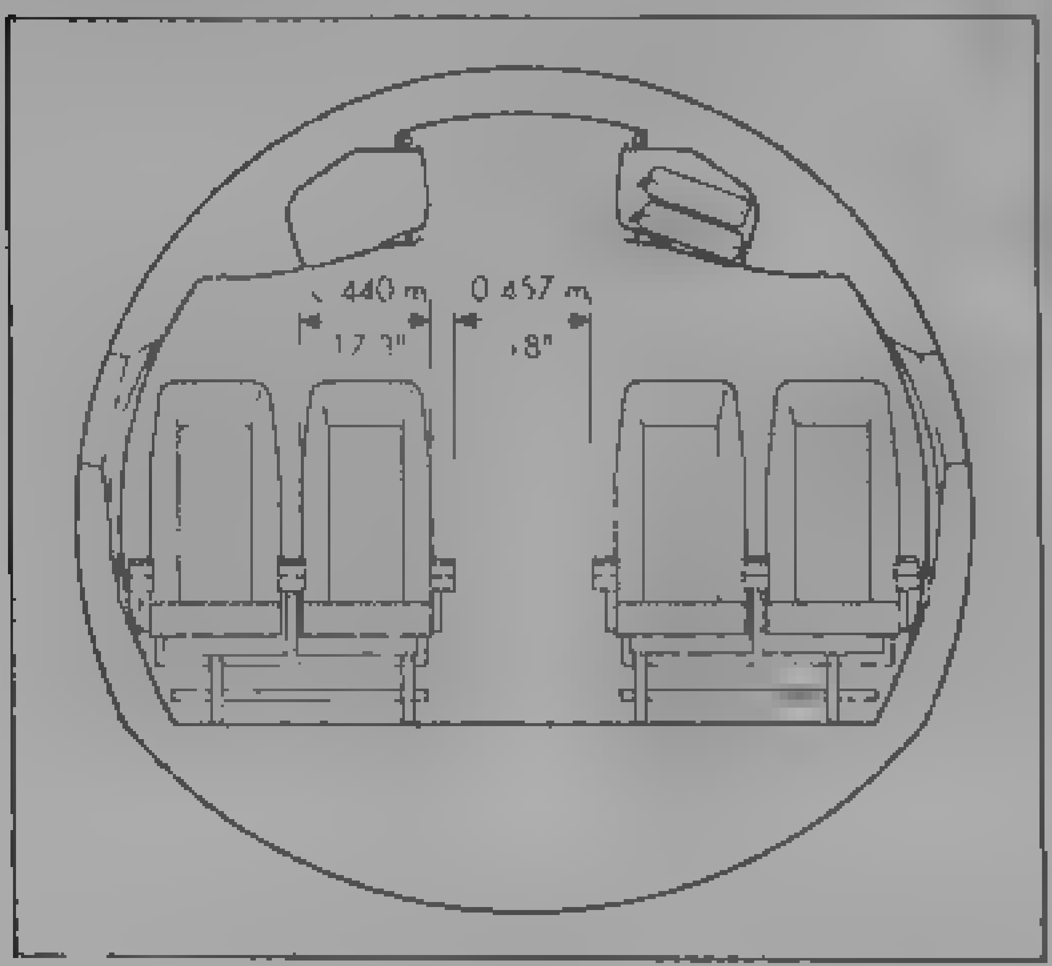
WEIGHTS AND LOADINGS:

Operating weight empty	18,406 kg (40,578 lb)
Max payload	10,306 kg (22,720 lb)
Max fuel weight	5,000 kg (11,023 lb)
Max T-O weight	31,060 kg (68,475 lb)

PERFORMANCE (estimated):

Max cruising speed	335 kts (620 km/h, 385 mph)
T-O distance	1,400 m (4,593 ft)
Landing distance	1,280 m (4,200 ft)
Range	1,000 n miles (1,852 km, 1,151 miles)

UPDATED

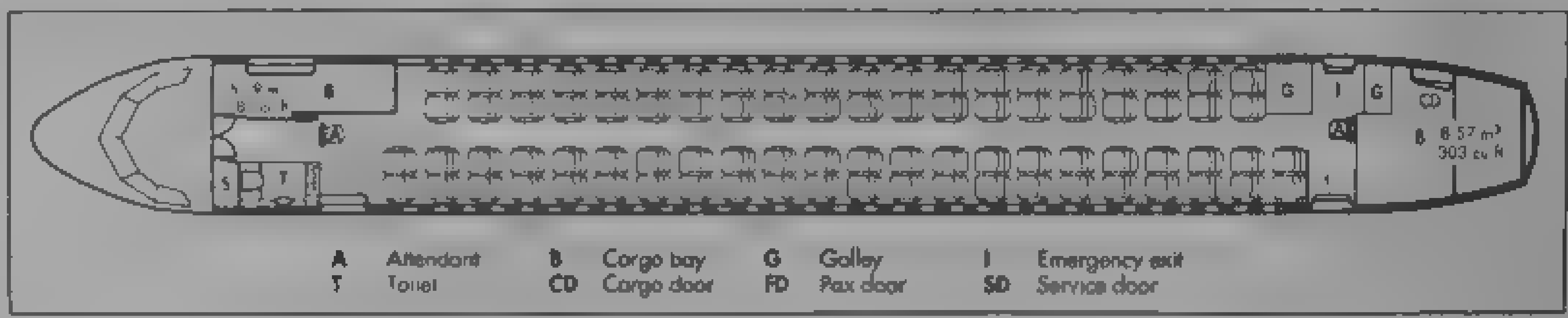


Cross-section of ATR 82 airliner

1995

Model of the proposed ATR 82

1995



Cabin configuration of ATR 82 for 84 seats at 79 cm (31 in) pitch

1995

AVIOTECHNICA

AVIOTECHNICA LTD

BULGARIA: PO Box 423, Trakia, 4000 Plovdiv
Telephone: 359 (32) 83 10 40
Fax: 359 (32) 83 10 80
PRESIDENT: D. Dobrev

RUSSIA: PO Box 32, K-45, 103045 Moscow

'Aviation Technique' founded 1983 by Bulgarian company VMZ Sopot as research, development and manufacturing subsidiary, including plant and Institute producing UAVs for countries in former Warsaw Pact. Company's primary objective was to manufacture tail surfaces, engine nacelles and landing gear for Ilyushin Il-114 airliner and components for Mi-17 and Mi-34 helicopters. Due to delays in Il-114 production, Aviotechnica Ltd created 1991 as new joint company with 51 per cent share held by Bulgarian companies VMZ-Sopot, Metalchim and Metalchim Trading, and 49 per cent by Russian companies Interavia and LMZ (Luchovitsy Mashinostroitelnii Zavod, manufacturer in MiG-29 programme).

First joint product of Aviotechnica Ltd is SL-90 Leshii (I-1) lightplane.

VERIFIED

Aviotechnica SL-90 Leshii (I-1) two/three-seat light aircraft

1993

AVIOTECHNICA SL-90 LESHII (I-1) (SPRITE)

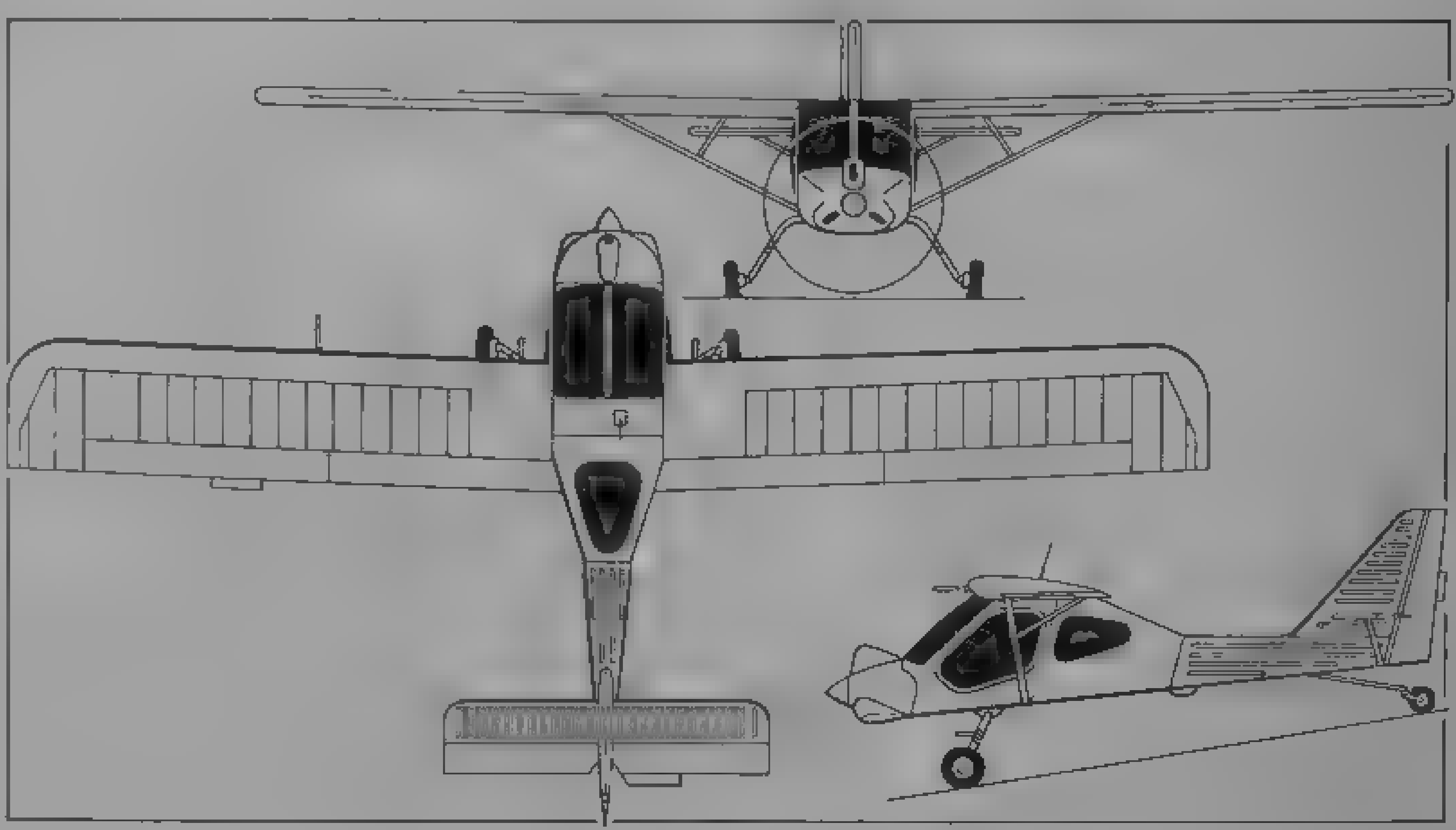
TYPE: Two/three-seat sport, touring, patrol, cartographic and agricultural light aircraft.

PROGRAMME: Construction started, as I-1, by Interavia (responsible for engineering documentation) in 1988, first three prototypes built by Interavia and Myasishchev EMZ (Experimentalnii Mashinostroitelnii Zavod) in Russia, with flight tests carried out at Mikhail Gromov Flight Test Institute near Moscow (first flight February 1990), certification is in accordance with FAR Pt 23 and Russian light aircraft standards, manufacture of preseries batch of 10 undertaken by LMZ (responsible for jigs, engineering documentation and component production), with final assembly at both LMZ and Aviotechnica, first flight of first series aircraft February 1993 in Bulgaria, example with non-standard engine and four-blade propeller demonstrated at MosAeroshow '93 (see 1994-95 *Jane's*, page 356), planned production programme involves 350 aircraft by LMZ and Aviotechnica.

CURRENT VERSIONS: To be available with choice of one standard or three optional engines (see Power Plant).

DESIGN FEATURES: Strut braced high-wing monoplane with extensively glazed cabin, braced tailplane and sweptback vertical tail. Constant chord wings with TsAGI R-III-15 aerofoil section, 3° sweepforward, 1° dihedral and 2° incidence.

FLYING CONTROLS: Conventional coupled mechanical, ground adjustable tab on port aileron, starboard elevator and rudder. Plain flaps.



Aviotechnica SL-90 Leshii light aircraft *(Jane's/Mike Keep)*

1993

STRUCTURE: Mixed-construction wing (duralumin frame with duralumin skin on forward portion, cotton fabric covering aft); all-metal (aluminium alloy) fuselage. Corrugated skin on rear fuselage, fin and tailplane. All-metal wing to be introduced on later aircraft.

LANDING GEAR: Non-retractable, with cantilever spring steel mainwheel legs and controllable/lockable tailwheel. Mainwheels size 400 × 150 mm, tailwheel 200 × 80 mm. Mainwheel brakes.

POWER PLANT: One 82 kW (110 hp) M-3 three-cylinder four-stroke radial engine standard, with Interavia VM-3 two-blade constant-speed wooden propeller. Helmeted cowl over each cylinder. Fuel capacity (two wing tanks) 140 litres (37 US gallons, 30.8 Imp gallons). Alternatives (already flight tested) are RPD-25 rotary engine (more than 89.5 kW, 120 hp), Textron Lycoming O-235 (85.75 kW, 115 hp) and Textron Lycoming O-320 (112 kW, 150 hp).

ACCOMMODATION: Two seats side by side. Space for more than 80 kg (176 lb) of baggage, or third person, aft of front seats. Door on each side for pilot/passenger; separate door for baggage compartment.

EQUIPMENT: Russian or other, to customer's requirements.

DIMENSIONS, EXTERNAL:	
Wing span	11.623 m (38 ft 1¾ in)
Wing chord, constant	1.262 m (4 ft 1½ in)
Wing aspect ratio	9.33
Length overall	6.40 m (21 ft 0 in)
Height overall	2.10 m (6 ft 10¾ in)
Tailplane span	3.30 m (10 ft 10 in)
Wheel track	2.30 m (7 ft 6½ in)
Wheelbase	3.63 m (11 ft 11 in)
Propeller diameter	1.85 m (6 ft 0¾ in)
Cabin doors, each: Height	0.95 m (3 ft 1½ in)
Max width	1.15 m (3 ft 9¼ in)
Baggage door: Max height	0.83 m (2 ft 8¾ in)
Max width	0.80 m (2 ft 7½ in)
DIMENSIONS, INTERNAL:	
Cabin: Max width	1.15 m (3 ft 9¼ in)
AREAS:	
Wings, gross	14.481 m² (155.9 sq ft)
Ailerons (total)	1.449 m² (15.60 sq ft)
Trailing-edge flaps (total)	1.542 m² (16.60 sq ft)
Fin	0.97 m² (10.44 sq ft)
Rudder	0.87 m² (9.36 sq ft)
Tailplane	1.44 m² (15.50 sq ft)
Elevators (total)	1.46 m² (15.72 sq ft)
WEIGHTS AND LOADINGS (M-3 engine):	
Weight empty	510 kg (1,124 lb)
Fuel weight	110 kg (242.5 lb)
Typical mission T-O weight	780 kg (1,720 lb)
Max T-O weight	840 kg (1,852 lb)
Max wing loading	58.01 kg/m² (11.88 lb/sq ft)
Max power loading	10.24 kg/kW (16.83 lb/hp)
PERFORMANCE (at max T-O weight, M-3 engine, except where indicated):	
Never-exceed speed (VNE)	121 kts (225 km/h; 140 mph)
Max level speed	103 kts (190 km/h; 118 mph)
Max cruising speed	86 kts (160 km/h; 99 mph)
Stalling speed	43 kts (80 km/h; 50 mph)
Max rate of climb at S/L	180 m (590 ft)/min
Service ceiling	4,000 m (13,125 ft)
T-O and landing run (grass)	200 m (657 ft)
g limits (metal wings/tailplane)	+6.3/−4

UPDATED

AVRO INTERNATIONAL AEROSPACE LTD — *see UK section*

CAWAC

CHENGDU ASIA WATER AIRCRAFT COMPANY

Chengdu, Sichuan, People's Republic of China

PRESIDENT: Luo Yiji

PARTICIPATING COMPANIES:

Lake Aircraft Inc: see under USA

Jingmen Aircraft Manufacturing Company, People's Republic of China

CAWAC formed 1993 as joint venture between Wenjiang Industrial Development Company of Sichuan, China Yonglin Scientific, Technical and Economic Development Company, and the FEC Company of the USA. It has been licensed to import up to 150 **Lake Turbo 270 Renegade** amphibians (see US section) into China, followed by kits for local assembly, and is eventually to manufacture this aircraft in China. It will collaborate with Lake Aircraft and Jingmen Aircraft in production, supply, marketing and customer support for these aircraft. First Renegade demonstration flight in China took place 20 February 1994 at Lake Longquan, Chengdu.

Future plans by CAWAC include development of six-, 10- and 30-seat amphibians. Chinese home market alone believed to require up to 800 of this type of aircraft.

VERIFIED

DAIMLER-BENZ AEROSPACE AIRBUS/TUPOLEV

PARTICIPATING COMPANIES:

Daimler-Benz Aerospace Airbus, see under Germany

Tupolev: see under Russia

UPDATED

DAIMLER-BENZ AEROSPACE AIRBUS/TUPOLEV CRYOPLANE

TYPE: Proof-of-concept airliner powered by cryogenic hydrogen or liquid natural gas.

PROGRAMME: Daimler-Benz Aerospace Airbus co-operating in German-Russian effort started in 1990 to investigate environmentally compatible airliner using fuel other than kerosene. Two-year feasibility study by Deutsche (now Daimler-Benz) Aerospace Airbus, completed in September 1992, concluded that liquid hydrogen is safer than natural gas, kinder to environment and more readily available over long term.

Following feasibility study, new three-year phase begun to develop critical technology and components such as tanks for liquid hydrogen storage at −253°C at 1.5 bars (21.75 lb/sq in), together with pumps and seals. This supported by German Ministry of Economics.

Participants in Cryoplane project, under leadership of Daimler-Benz Aerospace Airbus, include Tupolev, KKBM (formerly Kuznetsov), Daimler-Benz Aerospace, Munich, Linde, MAN Technologie, Messer Griesheim, Uhde, AlliedSignal Aerospace, Bodenseewerk, Liebherr, Deutsche Lufthansa, Berlin Airport Corporation and Hamburg's Max Planck Meteorological Institute. Since 1988, Tupolev has been testing a Tu-155 with one engine fuelled by hydrogen; it also operated on kerosene and liquid natural gas (LNG) (see 1990-91 *Jane's*). The Euro-Quebec Hydro-Hydrogen Pilot Project, begun Autumn 1993, is experimenting with modular combustion chamber elements to reduce nitrogen oxide emissions substantially below those of conventional propulsion systems.

Artist's impression of the production version of Daimler-Benz Aerospace Airbus Cryoplane based on an Airbus A310 experimentally fuelled with cryogenic hydrogen

1995

Demonstration phase, possibly based on modified Airbus A310, could start in about 2000. Liquid hydrogen requires four times as much tankage volume as kerosene, and best location for such tankage is faired into upper part of fuselage, as shown in artist's impression. Such a system could be in service by 2010. Airbus envisages production version as A310 lengthened by 11.00 m (36 ft 1 in), carrying 319 passengers up to 2,700 n miles (5,000 km; 3,106 miles). Cryoplane would cruise at 9,150 to 10,000 m (30,000 to 33,000 ft); water vapour emissions contribute less to greenhouse effect at such lower altitudes and formation of condensation trails of ice crystals, which aggravate greenhouse effect, can be minimised.

UPDATED

DASSAULT/DORNIER

PARTICIPATING COMPANIES:

Dassault Aviation, see under France

Dornier: see under Daimler-Benz Aerospace, Germany

Although Dassault continues to market the Alpha Jet, the aircraft remains out of production. Last detailed description in 1990-91 *Jane's*.

UPDATED

DE CHEVIGNY/WILSON

c/o Aéro Club de France, 6 rue Galilée, F-75016 Paris, France

VERIFIED

DE CHEVIGNY/WILSON EXPLORER

Planned second Explorer amphibian apparently not completed. Details and photograph in the 1994-95 *Jane's*.

UPDATED

EGRETT

PARTICIPATING COMPANIES

E-Systems Inc, Greenville Division, PO Box 6056
Greenville, Texas 75403-6056, USA
Telephone: 1 (903) 457 5561
Fax: 1 (903) 457 4413

Grob: see under Germany

AlliedSignal: see under USA in Engines section

Egrett name derived from those of original three companies collaborating in its development

UPDATED

G 520 EGRETT II and STRATO 1

TYPE: Multipurpose high-altitude surveillance and relay aircraft. (See also Grob Strato 2C in German section.)

PROGRAMME: Begun 1986 and revealed April 1987 as joint programme by E-Systems' Greenville Division (programme leader/systems integrator), Grob (airframe design and construction) and Garrett (engine); first flight (proof-of-concept Egrett I) 24 June 1987, five others since flown (see Current Versions), total over 2,000 flying hours by January 1995; US/German venture Telos GmbH (E-Systems, Grob, MBB and Elekluft) formed June 1990 for in-country logistics and maintenance support for Egrett/D-500 associated programmes but dissolved 1993; second D-500 outfitted for sigint 1991; two-seat trainer version flown 21 April 1993 and certificated by LBA and FAA December 1993 and September 1994.

CURRENT VERSIONS: **D-FGEI/N14ES**: Egrett I non-pressurised proof-of-concept (POC) aircraft, as described in 1991-92 and earlier *Jane's*; holds three world records in its class for time to height, height without payload, and height in level flight. No longer flying.

D-FGEE: D-500 preprototype for Egrett II, differing from Egrett I in having 5.00 m (16 ft 4¾ in) greater wing span (for improved endurance), pressurised cockpit, retractable main landing gear (to avoid masking underfuselage DF antenna), modified rear fuselage, and higher gross and payload weights; first flight 20 April 1989, certificated by LBA 22 March 1991 and FAA 13 September 1991. On 31 March 1994 established new Class C1 and height with payload world records for turboprop aircraft by lifting 1,000 kg (2,205 lb) to altitude of 15,552 m (51,023.6 ft).

D-FGEO: D-500 integration prototype for electronic systems evaluation and test, first flight 9 September 1990; generally similar to D-FGEE; total flying hours of D-FGEE and D-FGEO more than 1,100 by January 1995.

D-FDEM (G-520): E-Systems owned Egrett II demonstrator for various requirements, used to demonstrate multiple sensors including electro-optical/infra-red, radar, sigint, lidar, and communications relays. Detachable wingtips and bulged payload modules beneath wingroots; first flight 4 January 1991, operating 1993-95 in US Experimental category for demonstration and test purposes.

D-FGRO Strato 1 (G 520): Grob owned commercial demonstrator for environmental surveillance; fitted with winglets and commercial avionics, first flight 7 June 1991.

D-FDST (G-520T): Trainer version. E-Systems awarded $27.4 million FMS contract August 1991 for two-seat dual-control trainer, to be built and flight tested by Grob; first flight 21 April 1993, FAA certification 30 September 1994. Fuselage stretched by plugs forward and aft of wing to accommodate second, stepped, cockpit in tandem, greater fuel capacity than G-520 and small dimensional changes. Performance generally comparable to that of single-seaters except climb, endurance and range slightly reduced by added drag of cockpit modification. Mission payloads can be controlled from either cockpit.

CUSTOMERS: German government announced its intention March 1992 to order nine single-seat D-500s (sic) to fulfil Luftwaffe LAPAS I requirement. After entirely successful completion of FMS full-scale development programme (estimated cost $400 million) in 1993, German Ministry of Defence did not proceed into production contract because of defence cutbacks and changes in geopolitical environment.

Egrett currently being presented to a number of international customers with requirements for low life-cycle cost high-altitude surveillance or research.

DESIGN FEATURES: Capacious fuselage and very high-aspect ratio wings for HALE (high-altitude, long endurance) performance, capable of manned or unmanned operation. 12 bays in fuselage can accept various payloads to customer's requirements, in modular packages facilitating installation/servicing/removal; large fuselage bays provide easy access to payloads.

Laminar flow wing section (modified Eppler E 580), leading-edge sweepback 4°, thickness/chord ratio 16.1 per cent; elliptical tip section; dihedral 3°; incidence 2° at root; 0° twist.

FLYING CONTROLS: Primary surfaces manual/mechanical (pushrods), with cable-controlled elevator and rudder trim; split flaps on wing inboard trailing-edges.

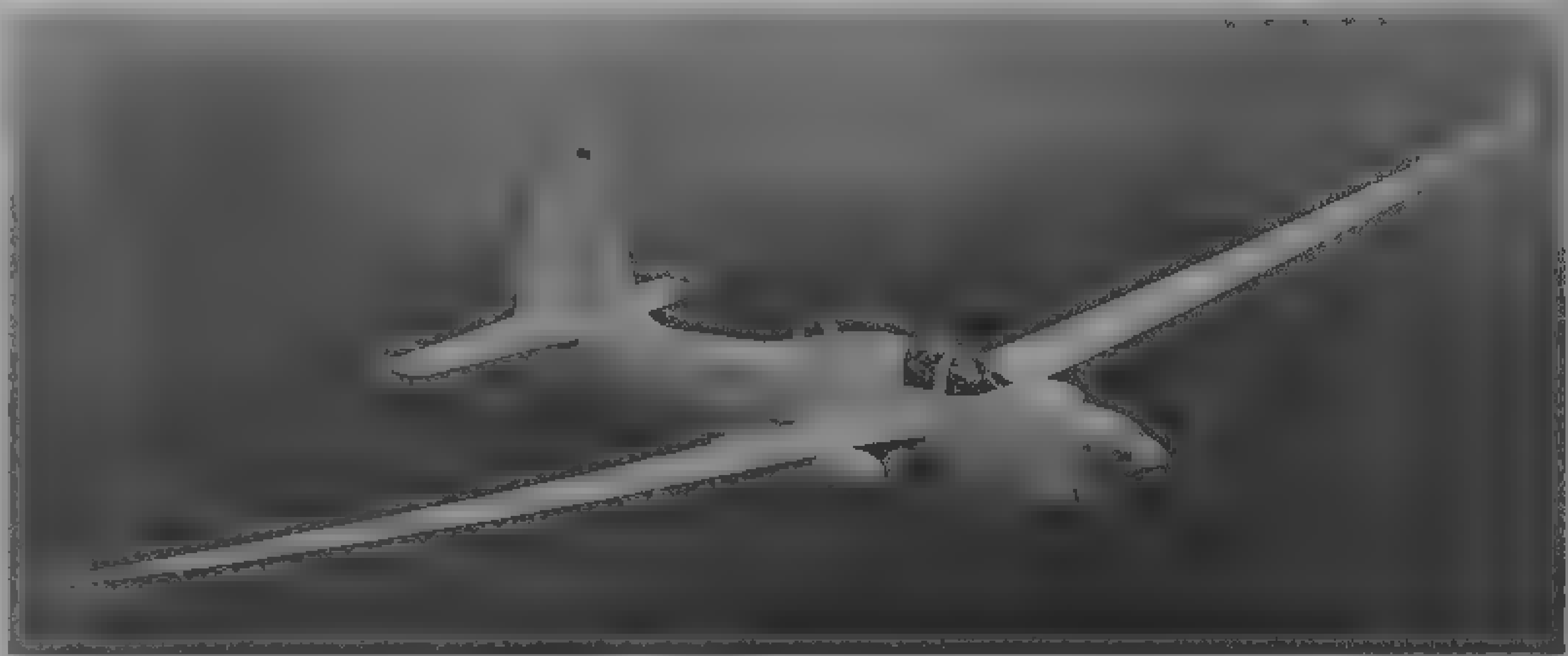
STRUCTURE: Single box spar in wing; load-bearing skins of honeycomb sandwich core construction throughout; airframe built largely of glassfibre and carbonfibre composites, for low radio/radar reflectivity; propeller blades also of composites.

LANDING GEAR: Electrohydraulically retractable tricycle type, with single wheel and oleo-pneumatic shock-absorber on each unit. Nose unit retracts rearward, main units forward into underwing pods. Mainwheel tyres size 17.5 × 5.75 in, pressure 12.41 bars (180 lb/sq in); nosewheel tyre size 18 × 4.4 in, pressure 6.62 bars (96 lb/sq in). Air-cooled hydraulic disc brakes. Nosewheel steerable ±55°. Minimum ground turning radius about nosewheel 8.70 m (28 ft 6½ in).

POWER PLANT: One AlliedSignal TPE331-14F-801L turboprop, flat rated at 559 kW (750 shp), driving a Hartzell HC-E4P-5/E11990K four-blade constant speed, fully feathering, reversible-pitch propeller. Integral fuel tank occupying almost whole of each wing leading-edge, combined capacity 1,117 litres (295 US gallons; 246 Imp gallons) standard, 1,382 litres (365 US gallons; 304 Imp gallons) optional; gravity fueling point in upper surface of each wing near tip. (D-FDEM fuel capacity 1,317 litres; 348 US gallons; 290 Imp gallons standard.) Oil capacity 11.4 litres (3 US gallons; 2.5 Imp gallons).

Grob G 520T tandem two-seat Egrett trainer

1995



The winglet-equipped Egrett II/Strato 1 commercial demonstrator

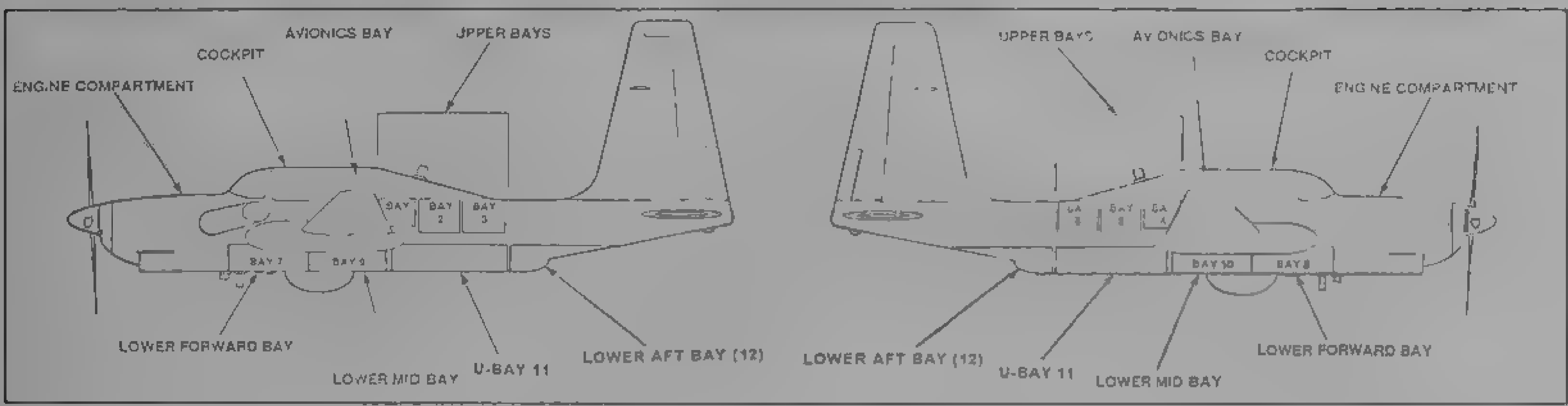
1995

Cockpit of the single-seat Egrett II

1995

G-520 Egrett II multisensor demonstrator with non-standard bulged lower forward and mid bays

1993



Disposition of payload bays in the single-seat Egrett II

1995

ACCOMMODATION: Single-seat pressurised cockpit. Canopy opens sideways to port. Cockpit is heated and ventilated or air conditioned, as required

SYSTEMS: AiResearch air cycle environmental control system (maximum pressure differential 0.41 bar; 6.0 lb/sq in) uses engine bleed air for cockpit heating, ventilation and air conditioning, and to condition avionics/equipment bays. Electrically driven hydraulic system for landing gear actuation and mainwheel brakes only.

Electrical DC power provided by 250 A engine-driven starter/generator and one (optionally two) 24 V 19 Ah lead-acid batteries, 10 kVA (optionally 30 or 40 kVA AC generator for 115/200 V three-phase AC at 400 Hz, in addition, one 250 VA 115/200 V AC inverter provides primary avionics power.

Liquid oxygen system, capacity 10 litres (610 cu in) (doubled in G-520T). Pneumatic boot de-icing of wing and tailplane leading-edges, electrically heated propeller blades and pitot ports; bleed air heated engine air inlet

AVIONICS: *Comms*: Bendix King VHF and UHF radios and ATC transponder with IFF capability

Flight: Bendix/King VHF nav, Tacan, marker beacon receiver

Instrumentation: Bendix/King IFR ADF, KFC 325 flight director and autopilot

EQUIPMENT: Basic G-520 has six payload compartments (1-6) in upper fuselage, aft of cockpit and adjacent avionics bay (see diagram), four additional payload bays (7-10) on each side of lower forward fuselage (two port, two starboard), a removable U-shaped bay (11) forming part of the lower centre fuselage, and a rear bay (12) behind the aft fuselage fairing. Avionics and equipment bays are ventilated and heated or cooled as required to maintain a temperature-controlled environment but are not pressurised

DIMENSIONS, EXTERNAL:

Wing span:	
520 (except FDEM), 520T	33.00 m (108 ft 3¼ in)
FDEM	31.50 m (103 ft 4¼ in)
Wing chord at root: 520, 520T	1.90 m (6 ft 2¾ in)
Wing aspect ratio: 520 (except FDEM), 520T	27.45
FDEM	25.57
Length overall: 520	12.00 m (39 ft 4½ in)
520T	13.67 m (44 ft 10¼ in)
Fuselage (520, 520T): Max width	1.04 m (3 ft 5 in)
Max depth: 520	1.93 m (6 ft 4 in)
520T	2.36 m (7 ft 9 in)
Height overall: 520	5.68 m (18 ft 7¾ in)
520T	5.66 m (18 ft 6¾ in)
Tailplane span: 520	6.40 m (21 ft 0 in)
520T	6.00 m (19 ft 8¼ in)
Wheel track: 520	
(except FDEM)	4.68 m (15 ft 4¼ in)
FDEM and 520T	4.57 m (15 ft 0 in)
Wheelbase: 520	3.71 m (12 ft 2 in)
520T	4.26 m (13 ft 11¼ in)
Propeller diameter: 520, 520T	3.05 m (10 ft 0 in)
Propeller ground clearance: 520, 520T	0.33 m (1 ft 1 in)

DIMENSIONS, INTERNAL (520):

Cockpit, excl avionics bays:	
Length	1.685 m (5 ft 6¼ in)
Max width	0.862 m (2 ft 10 in)
Max height	1.265 m (4 ft 1¾ in)
Floor area	1.45 m² (15.6 sq ft)
Volume	1.47 m³ (51.9 cu ft)

Installing payload items in the Egrett's removable U-bay

1993

Payload bays, approx
- 1, 4 (each) Length: 0.615 m (2 ft 0¼ in)
  - Width: 0.94 m (3 ft 1 in)
  - Height: 0.45 m (1 ft 5¾ in)
- 2, 5 (each) Length: 0.625 m (2 ft 0½ in)
  - Width: 0.94 m (3 ft 1 in)
  - Height (2): 0.54 m (1 ft 9¼ in)
  - Height (5): 0.415 m (1 ft 4¼ in)
- 3, 6 (each) Length: 0.645 m (2 ft 1½ in)
  - Width: 0.94 m (3 ft 1 in)
  - Height: 0.545 m (1 ft 9½ in)
- 7, 8 (each) Length: 1.45 m (4 ft 9 in)
  - Width: 0.25 m (9¾ in)
  - Height: 0.50 m (1 ft 7¾ in)
- 9, 10 (each) Length: 1.10 m (3 ft 7¼ in)
  - Width: 0.25 m (9¾ in)
  - Height: 0.50 m (1 ft 7¾ in)
- 11 Length: 1.95 m (6 ft 4¾ in)
  - Width: 0.80 m (2 ft 7½ in)
  - Height: 0.53 m (1 ft 8¾ in)
- 12 Length: 1.00 m (3 ft 3¼ in)
  - Width: 0.75 m (2 ft 5½ in)
  - Height: 0.53 m (1 ft 8¾ in)

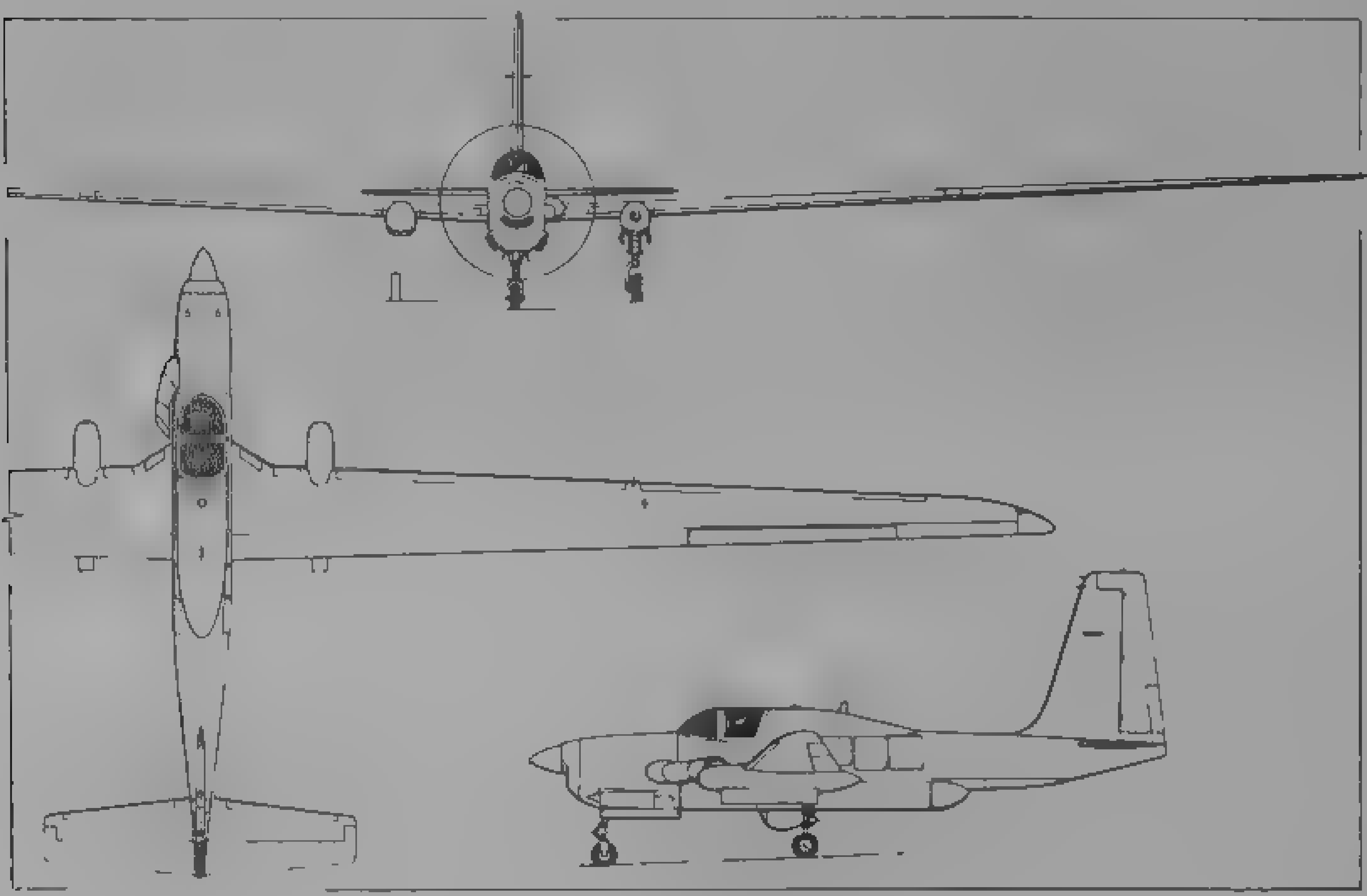
Avionics/payload bays:
- Combined volume: 6.37 m³ (225 cu ft)

AREAS
- Wings, gross
  - 520 (except FDEM), 520T: 39.68 m² (427.1 sq ft)
  - FDEM: 38.80 m² (417.6 sq ft)
- Ailerons (total): 1.51 m² (16.25 sq ft)
- Trailing-edge flaps (total): 3.19 m² (34.34 sq ft)
- Fin: 5.67 m² (61.03 sq ft)
- Rudder: 1.733 m² (18.65 sq ft)
- Tailplane: 520: 7.50 m² (80.73 sq ft)
  - 520T: 7.17 m² (77.18 sq ft)
- Elevators (total): 520: 2.34 m² (25.19 sq ft)
  - 520T: 2.20 m² (23.68 sq ft)

WEIGHTS AND LOADINGS
- Weight empty: 3,063 kg (6,754 lb)
- Max payload bay weight capacities:
  - 1, 4, 7, 8, 9, 10 (each): 68 kg (150 lb)
  - 2, 3, 5, 6 (each): 102 kg (225 lb)
  - 11: 238 kg (525 lb)
  - 12: 22 kg (49 lb)
- Max payload: 998 kg (2,200 lb)
- Max fuel load: standard: 907 kg (2,000 lb)
  - optional: 1,092 kg (2,407 lb)
- Max T-O weight: 4,700 kg (10,362 lb)
- Max landing weight: 520: 4,465 kg (9,843 lb)
  - 520T: 4,433 kg (9,773 lb)
- Max zero-fuel weight: 520: 4,077 kg (8,988 lb)
  - 520T: 4,234 kg (9,334 lb)
- Max wing loading: 520 (except FDEM), 520T: 118.46 kg/m² (24.26 lb/sq ft)
  - FDEM: 121.13 kg/m² (24.81 lb/sq ft)
- Max power loading: 8.41 kg/kW (13.82 lb/shp)

PERFORMANCE (at max T-O weight)
- Max operating speed up to 9,750 m (32,000 ft), and max cruising speed: 153 kts (284 km/h, 176 mph) IAS
- Econ cruising speed: 110 kts (204 km/h, 126 mph)
- Stalling speed, engine idling
  - flaps up: 66 kts (123 km/h; 76 mph)
  - flaps down: 60 kts (111 km/h 69 mph)
- Max rate of climb at S/L: 427 m (1,400 ft)/min
- Service ceiling: 16,000 m (52,495 ft)
- T-O run: 457 m (1,500 ft)
- T-O to 15 m (50 ft): 671 m (2,200 ft)
- Landing from 15 m (50 ft): 702 m (2,300 ft)
- Landing run: 397 m (1,300 ft)
- Range with max payload, max range power at 13,715 m (45,000 ft), reserves for 45 min at 3,050 m (10,000 ft) at max range power: 724 n miles (1,341 km, 833 miles)
- Range with max fuel: 2,475 n miles (4,584 km, 2,848 miles)
- Max endurance: 13 h
- g limits: flaps up: +3.28/−1.3
  - flaps down: +2

UPDATED



Egrett II high-altitude surveillance aircraft *(Jane's/Dennis Punnett)*

1995

EHI

EH INDUSTRIES LIMITED

PARTICIPATING COMPANIES
- **Agusta**: see under Italy
- **Westland**: see under UK

CO-CHAIRMEN
- Alan Jones
- Amedeo Caporaletti

MANAGING DIRECTOR: E. Striano

EH Industries formed June 1980 by Westland Helicopters and Agusta (50 per cent each) to undertake joint development of new anti-submarine warfare helicopter for Royal Navy and Italian Navy within an integrated programme under which naval, army and civil variants now being produced. Programme handled on behalf of both governments by UK Ministry of Defence; Westland has design leadership for commercial version, Agusta for rear-loading military/utility version, naval version being developed jointly for UK and Italian navies and export. IBM/Westland selected to manage Royal Navy programme in 1991. Canadian programme launched October 1992 and terminated 12 months later.

In March 1994 EHI teamed with McDonnell Douglas Helicopter Systems to offer minimally modified, US built EH 101 to US armed forces for Medium Lift Replacement Helicopter programme, complementing Bell/Boeing V-22 Osprey.

VERIFIED

EH INDUSTRIES EH 101

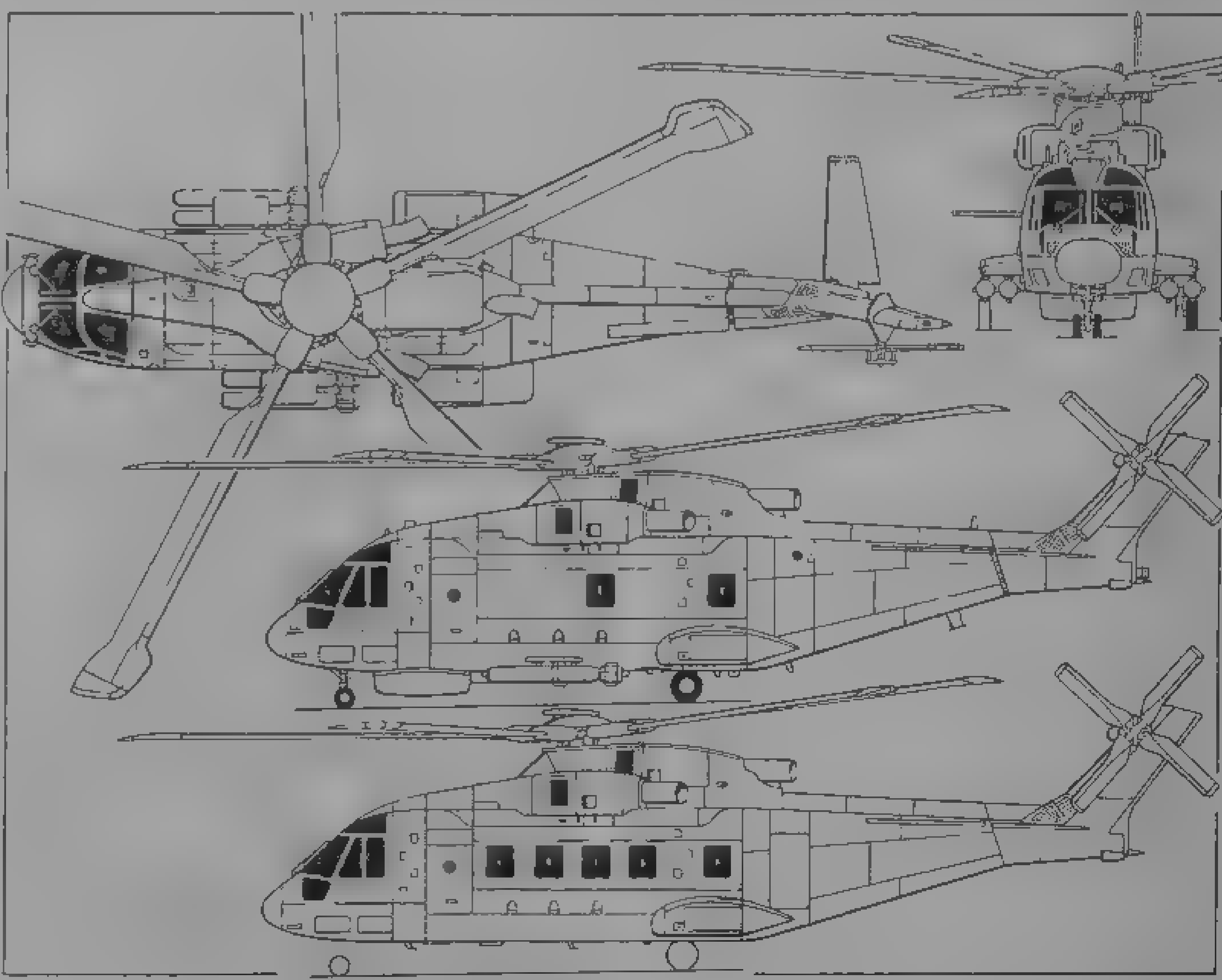
Royal Navy name: Merlin
Provisional RAF name: Griffon

TYPE: Three-engined multirole helicopter.

PROGRAMME: Stems from Westland WG 34 (see UK section of 1979-80 *Jane's*), selected by UK MoD as Sea King replacement late Summer 1978; broadly similar requirement by Italian Navy led to 1980 joint venture with Agusta; subsequent market research confirmed compatibility of basic EH 101 design with commercial payload/range and tactical transport/logistics requirements, resulting in decision to develop naval, civil and military variants based on common airframe.

Nine month project definition phase approved by UK/Italian governments 12 June 1981; full programme go-ahead announced 25 January 1984, design and development contract signed 7 March 1984; selected by Canadian government August 1987; Italian built iron bird ground test airframe followed by nine preproduction aircraft (PP1-9: see Current Versions); RTM 322 engines selected for RN Merlin June 1990; T700-GE-T6A engines selected for Italian Navy version September 1990; 4th UK/Italian government MoU signed 30 September 1991 (starting industrialisation phase); UK MoD commitment to 44 Merlins 9 October 1991; Canadian order for 50 (35 CH-148 and 15 CH-149) announced 24 July 1992; UK and Italian civil certification planned for late 1993, but delayed to 25 November 1994, when US FAA approval simultaneously achieved; service entry for naval version originally due early 1996, but now expected in 1999.

Flight testing halted following January 1993 loss of PP2, resumed 24 June 1993. $1 million study completed for US Marine Corps, 1993, assessing EH 101 as 30-troop or cargo transport as fall-back in event of Bell/Boeing MV-22 cancellation. First flight with RTM 322 engines, 6



Three-view of the naval EH 101, with additional side view (bottom) of the Heliliner *(Jane's/Mike Keep)*

1993

EH 101 third prototype with mast-mounted sensor for icing trials

1995

July 1993; two aircraft to fly total of 260 hours for development. Canadian requirement cut to 43 by deletion of seven CH-148s in August 1993 as cost-saving measure, but incoming government cancelled entire programme on 4 November 1993, despite award of substantial offsets to Canadian firms. UK government confirmed EH 101 as next RAF tactical transport helicopter on 1 December 1993, formal announcement of order for 22 made 9 March 1995.

CURRENT VERSIONS (general): **Srs 100/Naval**: Primary roles ASW, ASV, anti-ship surveillance/tracking, amphibious operations and SAR; other roles may include AEW, vertrep and ECM (deception, jamming and missile seduction); designed for fully autonomous all-weather operation from land bases, large and small vessels (including merchant ships) and oil rigs, and specifically from a 3,500 tonne frigate, with dimensions tailored to frigate hangar size. Capabilities include frigate launch and recovery in conditions up to Sea State 6 with ship on any heading and wind speed (from any direction) up to 50 knots (93 km/h; 57 mph), endurance and carrying capacity needed to meet expanding maritime tactical requirements of 21st Century, including ability to operate distantly for up to five hours with state of the art equipment and weapons. See under Italian Navy and Merlin headings below.

Srs 300 Heliliner: Commercial passenger version.

Utility: Army (**Srs 400**) and civil (**Srs 500**) versions with rear ramp; naval (**Srs 200**) version without ramp.

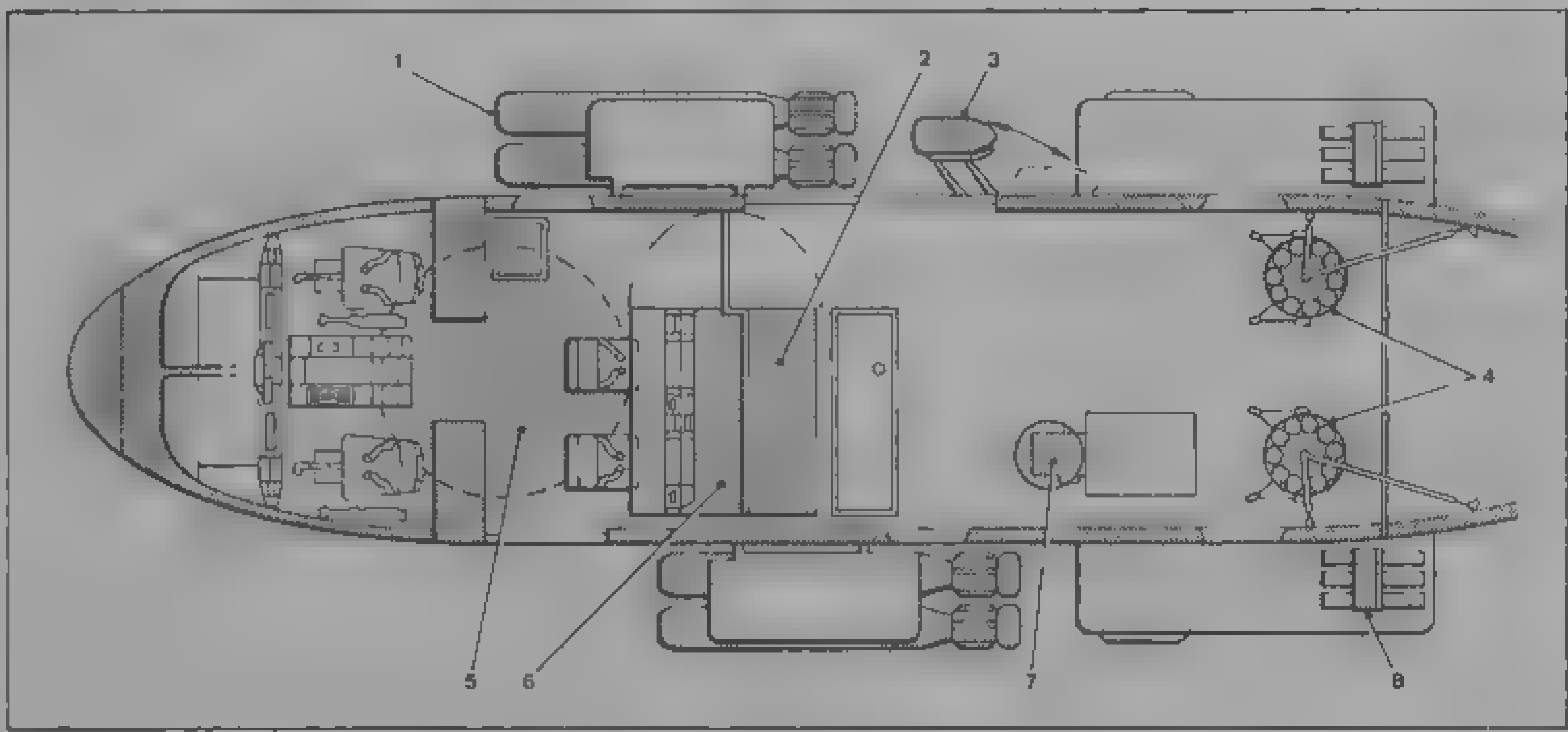
CURRENT VERSIONS (specific): **PP1**: Westland built first preproduction aircraft; first flight (ZF641) 9 October 1987, completed official test centre review 1991, over 375 hours flown by September 1992, at which time being refitted with T700-GE-T6A engines and 3,878 kW (5,200 shp) main gearbox. To Italy May 1995 for 21 hour trials programme.

PP2: Agusta built second preproduction aircraft, first flight 26 November 1987; deck trials aboard Italian Navy *N. Grecale* and *Maestrale* July 1990; was to lead work on achieving new maximum T-O weight of 14,288 kg (31,500 lb), and had been fitted with ACSR (see Design Features), but lost in crash in Italy, 21 January 1993, during noise measurement trials.

PP3: Westland built, first flight (G-EHIL) 30 September 1988, first civil-configured aircraft; has conducted rotor vibration trials and flights with 'soft link' engine mounting struts, icing trials at CFB Shearwater, Canada for five months from November 1993 (total 23 sorties); continuing programme also includes optimisation of ACSR, and weapon and development trials. Serialled ZH647 for weapons carriage in 1993.

PP4: Westland built, first flight (ZF644) 15 June 1989, general naval variant, overwater navigation equipment trials and AFCS development; flown with RTM 322 engines 6 July 1993, initiating two year programme of ground running and 160 flight hours. This to have been followed by 50 hours training RN aircrew for operational trials including hot-and-high (military) at Mesa, USA, 1995 but aircraft lost on 7 April 1995 after 463 hours in 385 sorties.

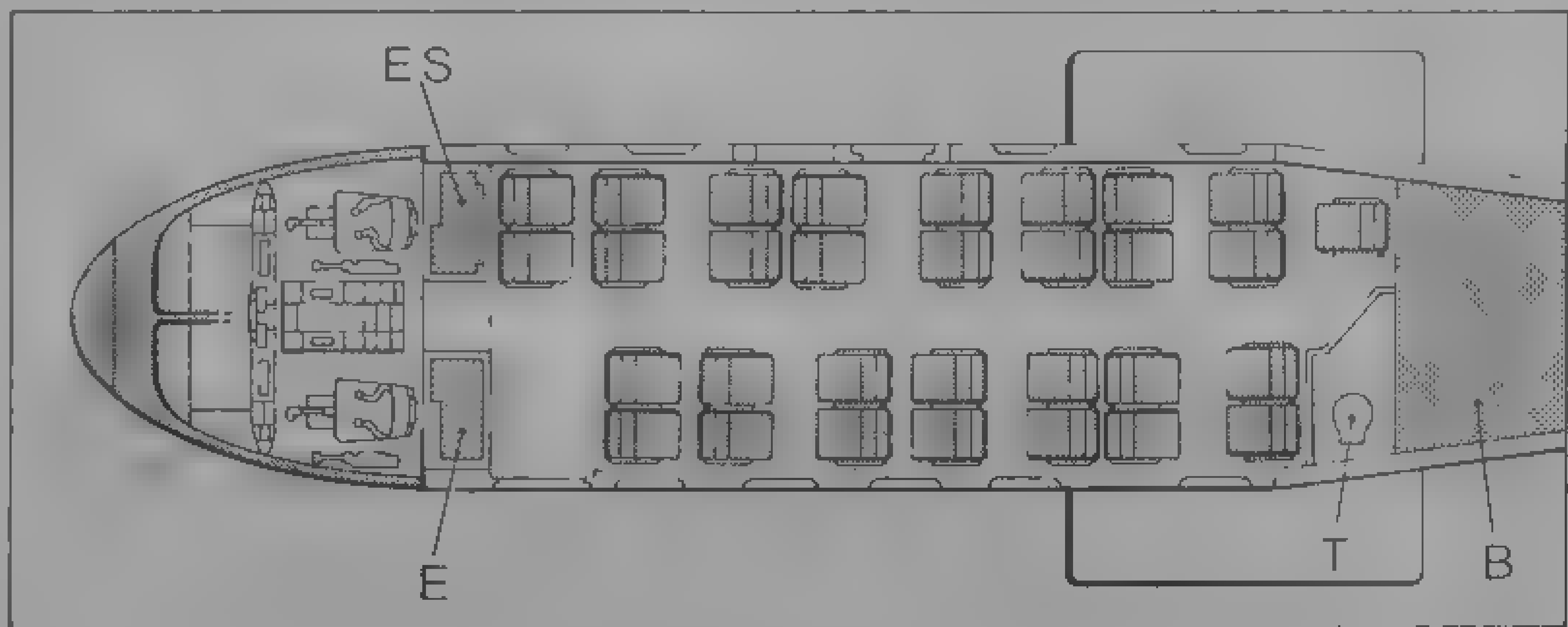
PP5: Westland built, dedicated Merlin development aircraft, first flight (ZF649) 24 October 1989; Type 23 frigate interface trials in HMS *Norfolk* (including decklock recovery handling, weapons handling, tail and blade folding) August 1991; sea-going trials in HMS *Iron Duke* (including overwater sonobuoy release) completed December 1992. Second RTM 322 testbed. Full Merlin avionics from 1997 for operational trials of datalink, sonar, digital map, colour displays and GPS; also ship-to-helicopter operations limits trials.



EH 101 typical ASW layout (*Jane's/Mike Keep*)

1: up to four homing torpedoes, 2: sensor processing, 3: retractable rescue hoist, 4: sonobuoy dispensers, 5: 360° radar, 6: mission console, 7: active dipping sonar, 8: flight stores carriers

1993



Heliliner 'Club 4' seating arrangement for 30 passengers (*Jane's/Mike Keep*)

E: avionics, B: baggage, S: stowage, T: toilet

1995

PP6: Agusta built, dedicated Italian Navy development aircraft, first flight 26 April 1989; sea-going trials in *Giuseppe Garibaldi* and *Andrea Doria* completed mid-October 1991; rotor downwash trials on behalf of Canadian Forces to assess acceptability for SAR role.

PP7: Agusta built, military utility development aircraft with rear loading ramp; first flight 18 December 1989; low-speed handling trials and tail rotor performance assessment 1992, fitted with ACSR 1992. Registered I-HIOI in November 1993.

PP8: Westland built, civil variant, first flight (G-OIOI) 24 April 1990; evaluations of ADF and DME, area nav, electronic instrumentation, civil AFCS and communications equipment, fitted with ACSR.

PP9: Agusta built; civil variant, final development aircraft (second with rear ramp); first flight (I-LIOI) 16 January 1991; extensive flight controls survey involving both ground and in-flight trials. Hot-and-high (civil) trials at Mesa, USA, 1995.

Civil Utility: For commercial operators requiring rear-loading facility, represented by PP9.

Heliliner: Commercial variant, main certification programme being flown by PP3, with PP8 as demonstrator, intended to offer 360 n mile (666 km; 414 mile) range, with full IFR reserves, carrying 30 passengers and baggage, flight crew of two, provision for cabin attendant, stand-up headroom, airline style seating, overhead baggage stowage, full environmental control, passenger entertainment, and provision for toilet and galley. Category A VTO performance, capable of offshore/oil rig operations or scheduled flights into city centres at high all-up weights under more rigorous future civil operating rules; rear loading ramp optional.

Italian Navy ASW: Development aircraft PP4 (basic)

EH 101 cutaway drawing

1995

and PP6; will operate from both shore bases and aircraft/helicopter carriers

Italian Navy AEW: Requirement revealed in 1994 for AEW helicopter; system unspecified

Merlin HAS. Mk 1: Royal Navy ASW version, for which PP4 (basic) and PP5 are development aircraft, will operate from Type 23 frigates, 'Invincible' class carriers, RFAs and other ships, and land bases. Of first seven production Merlins, RN01 and RN02 (to fly mid-1996) assigned to operational performance acceptance trials in Bahamas, 1998-99, and to assistance in sea trials, RN03 to A&AEE, Boscombe Down, for service release trials. RN04-RN07 to form Intensive Flight Trials Unit 1999. Deliveries three, seven, 11 and 12 in 1996-99. Also under consideration by potential customer in Middle East

Merlin upgrade: Under study, 1993, with improved sensors and processing equipment, plus uprated transmission for later versions of RTM 322. For retrofit, in addition to follow-on purchase

Military Utility: Tactical or logistic transport variant (represented by PP7) with rear-loading ramp, able to airlift 6 tons or up to 30 combat equipped troops. Tail- and rotor-folding Utility version under consideration, with role options including mine countermeasures, towing EDO Mk 106 sled

'Griffon HC Mk 1': Bid for RAF contract entered May 1994, revised cockpit layout for low-level operations, provision for pintle-mounted machine guns in side doors. Order for 22 announced 9 March 1995

'CH-X': Offered to USMC, chin gun turret

CH-148 Petrel and **CH-149 Chimo:** Intended Canadian versions, cancelled; see 1994-95 and previous *Jane's*

AW320 Cormorant: Adaptation of civil EH 101 offered to Canada in early 1995 for naval and SAR missions; deck landing capability, reduced cost achieved by reliance on mainly commercial avionics. GEC-Marconi Cormorant dipping sonar

CUSTOMERS: Total 66 for UK, comprising 44 Royal Navy Merlins and 22 RAF Griffons. Italian Navy expected to order 16, comprising eight ASW (and ASV) versions, four AEW versions and four marines tactical transports with blade- and tail-folding, option anticipated on further eight configuration unspecified. Long-range utility version for logistic and tactical support role also under consideration by Italy and proposed to US Marine Corps

Prototypes participating in 3,750 hour flight development programme, additional 6,000 hours to be flown by PP8 and PP9 from Brindisi (Italy) and Aberdeen (Scotland) to improve reliability and prove extended overhaul intervals

PP8 preproduction Heliliner 30-seat passenger helicopter

1995

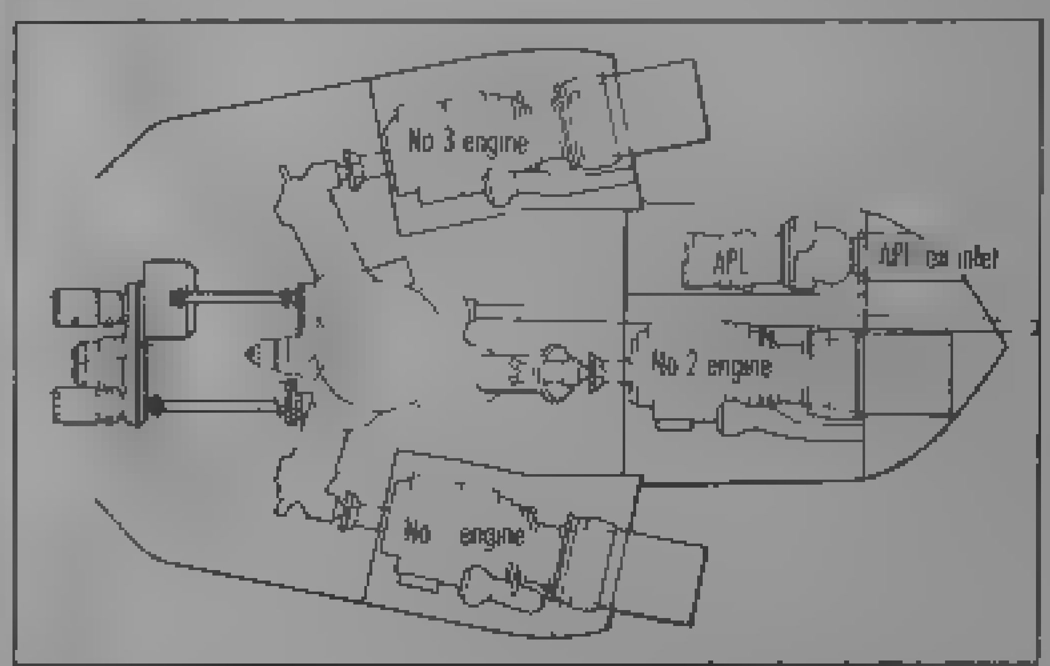
COSTS: Royal Navy £1.5 billion (1991) for 44 Merlin, RAF £500 million for 22 'Griffons'; Canada C$4.4 billion (1992) for 50 CH-148/149, to be reduced to C$2.0 to 2.5 billion for projected AW320 version. Production investment phase (design, tooling, maturity and product support) valued at £200 million (1993)

DESIGN FEATURES: Three-engine power margin, fail-safe/damage-tolerant airframe and rotating components, high system redundancy, onboard monitoring of engines/transmission/avionics/utility systems; airframe/power plant/rotor and transmission systems/flight controls/utility systems common to all variants, five-blade main rotor with multiple load path hub and elastomeric bearings; blades of advanced aerofoil section with BERP-derived high-speed tips; four-blade teetering tail rotor; transmission has minimum 30 minutes (60 minutes demonstrated) run-dry capacity; fuselage in four main modules (front and centre ones common to all variants, modified rear fuselage and slimmer tailboom on military utility variant to accommodate rear-loading ramp); automatic power folding of main rotor blades and tail rotor pylon on naval variant, with emergency manual back-up (tail section folds forward/downward, stowing starboard half of tailplane beneath rear fuselage). Folding version of utility (rear ramp) EH 101 has been designed. New active vibration cancelling system ACSR (active control of structural response) reduces vibration by 80 per cent at blade passing frequency

Airframe overhaul interval 1,000 hours on service-entry, eventual target 3,000 hours. Intended service life of 40,000 hours

FLYING CONTROLS: Dual redundant digital AFCS

STRUCTURE: Rotor head of composites surrounding a metal core; composite blades, fuselage mainly aluminium alloy, with bonded honeycomb main panels, composites for such complex shapes as forward fuselage, upper cowling panels, tailfin, tailplane and windscreen. Engine air intakes of Kevlar reinforced with aero-web honeycomb. Tail unit of



EH 101 power plant and APU configuration

1994

carbon epoxy and Kevlar epoxy skinned sandwich panels over central skeleton of metal- or foam-cored composites ribs and longerons; Kevlar-Nomex-Kevlar sandwich for leading-edge of tailfin. Single-sourced series production, with final assembly lines in Italy and UK.

LANDING GEAR: Hydraulically retractable tricycle type, with single mainwheels and steerable twin-wheel nose unit, designed and manufactured by AP Precision Hydraulics in association with Officine Meccaniche Aeronautiche. Main units retract into fairings on sides of fuselage. Goodrich wheels, tyres and brakes: main units have size 8.50-10 wheels with 24 × 7.7 tyres, unladen pressure 6.96 bars (101 lb/sq in); nosewheels have size 19.5 × 6.75 tyres, unladen pressure 8.83 bars (128 lb/sq in). Twin-mainwheel gear optional for all variants. FPT Industries emergency flotation bags.

POWER PLANT: Three Rolls-Royce Turbomeca RTM 322 turboshafts in Royal Navy Merlin (maximum contingency and intermediate contingency ratings 1,724 kW, 2,312 shp and 1,566 kW, 2,100 shp respectively); General Electric T700-GE-T6A turboshafts in Italian naval variant, rated at 1,278 kW (1,714 shp) maximum contingency, 1,254 kW (1,682 shp) intermediate and 1,071 kW (1,437 shp) maximum continuous at S/L, ISA. Engines for Italian naval variant will be assembled by Alfa Romeo Avio and Fiat. Commercial and utility variants powered by three General Electric CT7-6 turboshafts (CT7-6A in PP3) with ratings of 1,432 kW (1,920 shp) maximum and intermediate contingency, 1,230 kW (1,649 shp) maximum continuous.

Transmission rating in commercial variant 3,878 kW (5,200 shp) maximum T-O and maximum continuous; 2,863 kW (3,840 shp) maximum continuous with OEI.

Standard fuel in three tanks, each of 1,074 litres (276 US gallons; 230 Imp gallons) capacity, total 3,222 litres (851 US gallons, 709 Imp gallons). Each tank feeds separate engine, except on selection of emergency cross-feed; self-sealing optional. Additional fourth or fifth tanks (all same size) optional, maximum fuel capacity 5,370 litres (1,417 US gallons; 1,181 Imp gallons). Computerised fuel management system. Pressure refuelling point on starboard side, maximum transfer rate 682 litres (180 US gallons; 150 Imp gallons)/min; individual gravity refuelling positions on port side.

ACCOMMODATION: One or two pilots on flight deck (naval version will be capable of single-pilot operation; commercial variant will be certificated for two-pilot operation). ASW version will normally also carry observer and acoustic systems operator. Martin-Baker crew seats in naval version, able to withstand 10.7 m (35 ft)/s impact. Socea or Ipeco crew seats in commercial variant. Commercial version able to accommodate 30 passengers four-abreast at approximate seat pitch of 76 cm (30 in), plus cabin attendant, with toilet, galley and baggage facilities (including overhead bins). Offshore variant offers 'Club 4' grouped seating to facilitate rapid egress through windows in event of ditching. Military variant can accommodate up to 30 (seated) or 45 (non-seated) combat-equipped troops, 16 stretchers plus a medical team, palleted internal loads, or can carry externally slung loads of up to 5,443 kg (12,000 lb).

Main passenger door emergency exit at front on port side with additional emergency exits on starboard side and on each side of cabin at rear, above main landing gear sponson. Large sliding door at mid-cabin position on starboard side, with inset emergency exit. Commercial variant has baggage bay aft of cabin, with external access via door on port side. Cargo loading ramp/door at rear of cabin on military and utility versions. Cabin floor loading 976 kg/m² (200 lb/sq ft) on PP1.

SYSTEMS: Hamilton Standard/Microtecnica environmental control system. Dual redundant integrated hydraulic system, pressurised by three Vickers pumps each supplying fluid at 207 bars (3,000 lb/sq in) nominal working pressure, with flow rates of 55, 59 and 60 litres (14.5, 15.6 and 15.9 US gallons; 12.1, 13.0 and 13.2 Imp gallons)/min respectively. Hydraulic system reservoirs are of the piston load pressurised type, with a nominal pressure of 0.97 bar (14 lb/sq in).

Primary electrical system is 115/200 V three-phase AC, powered by two Lucas brushless, oilspray-cooled 45 kVA generators (90 kVA if Lucas Spraymat blade ice protection system fitted), with one driven by main gearbox and the other by accessory gearbox; plus a third, separately driven standby alternator. APU for main engine air-starting, and to provide electrical power, plus air for ECS, without running main engines or using external power supplies. Lucas Spraymat electric de-icing of main/tail blades standard on naval variant, optional on others. Dowty electric anti-icing of engine air intakes. Fire detection and suppression systems by Graviner and Walter Kidde respectively.

AVIONICS (military): Integrated systems based on two MIL-STD-1553B multiplex databuses that link basic aircraft management, avionics and mission systems.

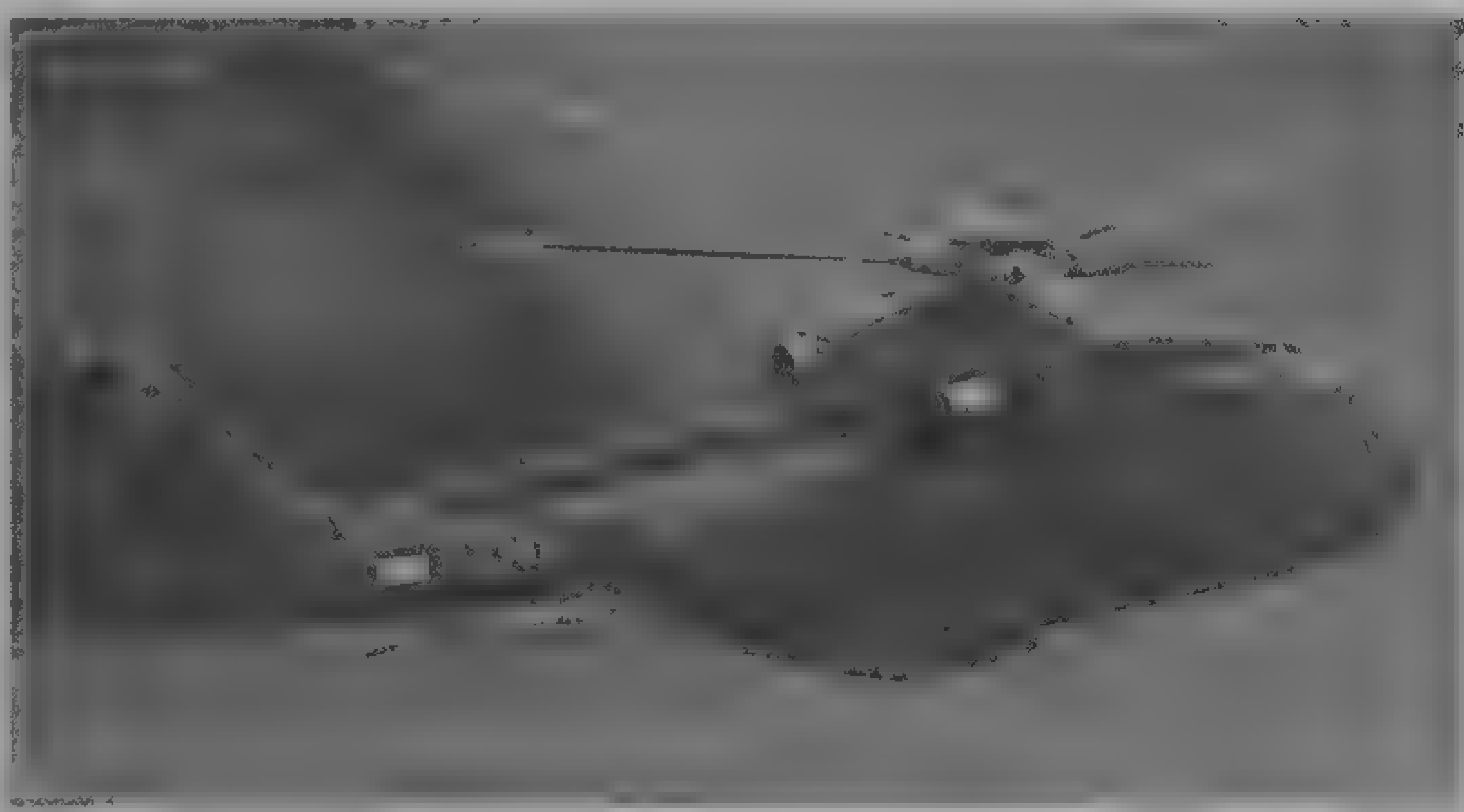
Comms: ASW version has Elmer HF (two), and GEC Marconi UHF (one) and AD 3400 V/UHF (two) com radios.

Radar: ASW version fitted with 360° search radar (GEC Marconi Blue Kestrel in UK's Merlin, Eleradas MM/APC-784 in Italian helicopters).

Flight: Smiths Industries OMI SEP 20 dual redundant digital AFCS is standard, providing fail-operational autostabilisation and four-axis autopilot modes (auto hover, auto transitions to/from hover standard on naval variants, optional on commercial and military variants). AFCS sensors on naval variant include British Aerospace LINS 300 ring laser gyro inertial reference unit (IRU) and Litton Italia LISA 4000 strapdown AHRS. IRU also provides self-contained navigation, with Racal Doppler 91E velocity sensor. Cossor Electronics GPS receiver selected for Royal Navy variant, Euronav GPS for Italian Navy aircraft. Other avionics on naval variants include Thomson-CSF AHV 16 radar altimeters (two), GEC-Marconi low airspeed sensing

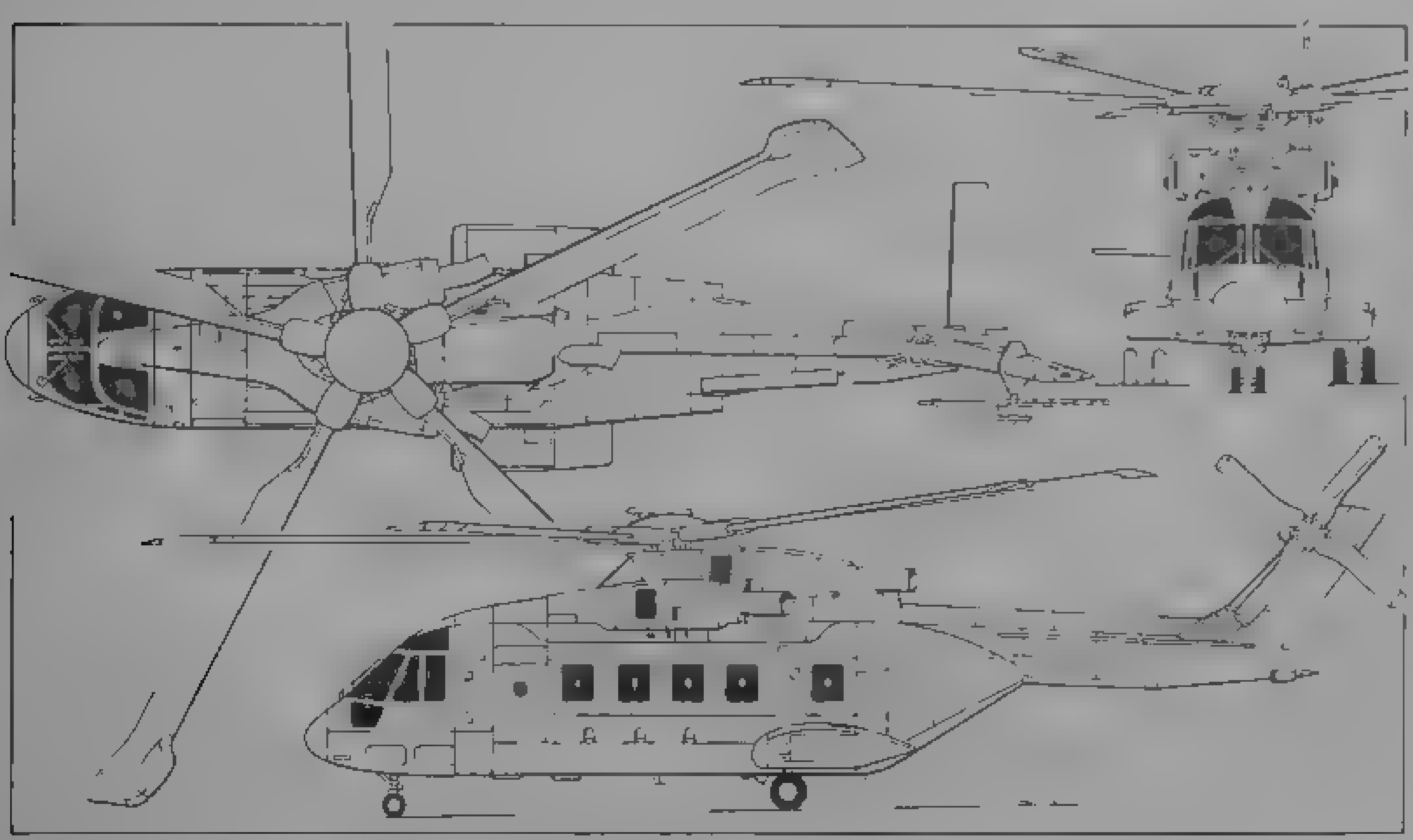
EH 101 in Royal Navy Merlin configuration

1995



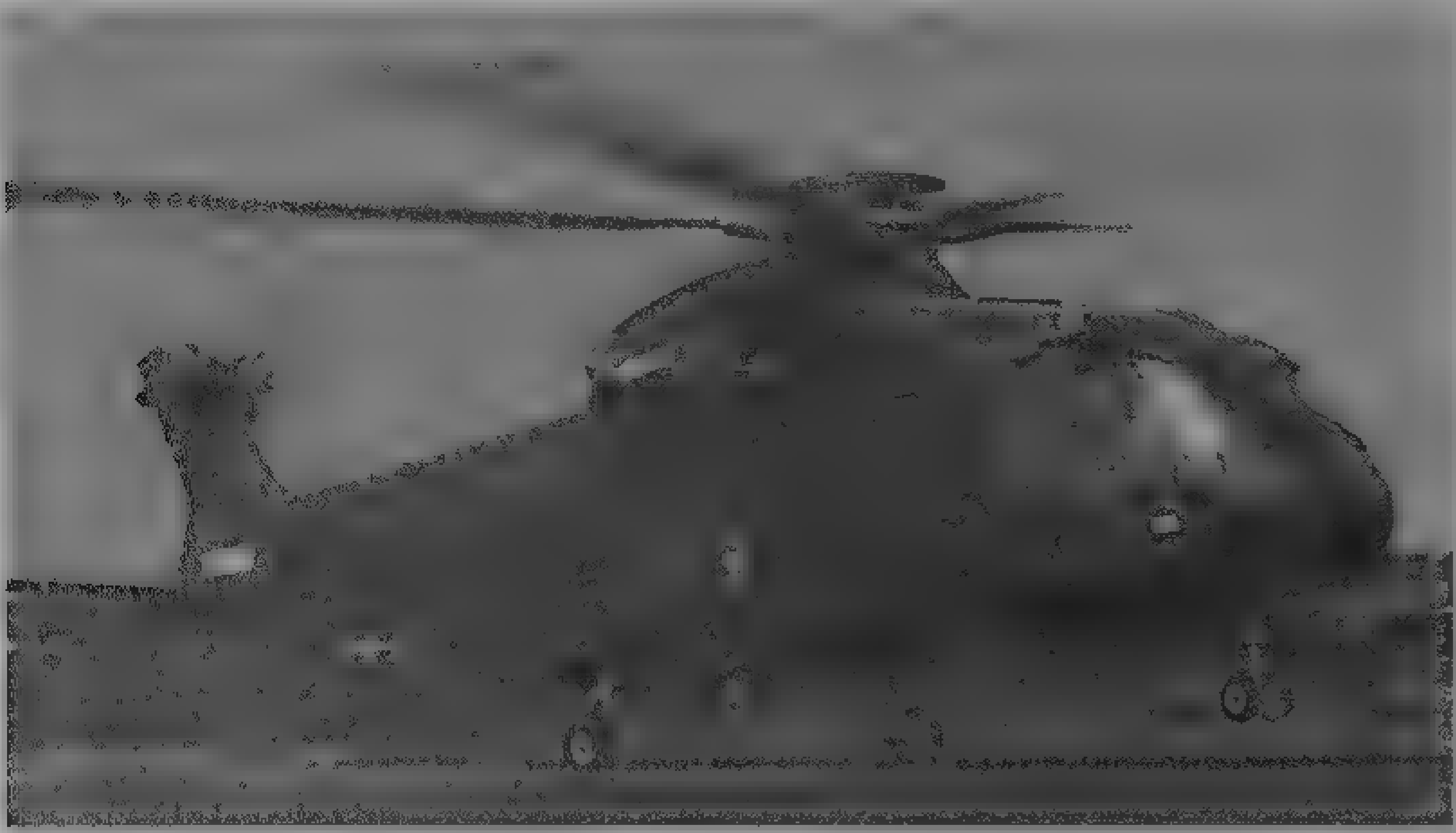
Italian built ninth development EH 101

1994



Utility version of the EH 101, showing modified rear fuselage with rear-loading ramp/door *(Jane's/Mike Keep)*

1993



EH 101 PP4 re-engined as the RTM 322 testbed *(Paul Jackson)*

1995

and air data system, and Alenia/GEC-Marconi aircraft management computer

Instrumentation: Litton pilot's mission display unit

Mission: On naval variant, main processing element of management system is a dual redundant aircraft management computer which carries out navigation, control and display management, performance computation and health and usage monitoring of principal systems (engines, drive systems, avionics and utilities); it also controls basic bus. Alenia/Racal cabin mission display unit. Surveillance radar (see above), plus dipping sonar (GEC-Thomson/Sintra folding lightweight acoustic system for helicopters, FLASH, in Merlin), advanced sonobuoy processing equipment and Racal Orange Reaper ESM. Alenia SL/ALR-735 ASM for Italy. GEC Marconi AQS-950 acoustic processing system, NGL mission recorder and sonobuoy/flare dispenser, and Chelton sonobuoy homers, in Merlin. Alenia AYK-204 processors (four) in Italian version. ASST (anti-ship surveillance and tracking) version will carry equipment for tactical surveillance and OTH (over the horizon) targeting, to locate and relay to a co-operating frigate the position of a target vessel, and for mid-course guidance of frigate's missiles. On missions involving patrol of an exclusive economic zone it can also, with suitable radar, monitor every hour all surface contacts within area of 77,700 km² (30,000 sq miles); can patrol an EEZ 400 × 200 n miles (740 × 370 km; 460 × 230 miles) twice in one sortie, and can effect boarding and inspection of surface vessels during fishing protection and anti-smuggling missions. AVIONICS (civil): Integrated avionics system of commercial variant based on ARINC 429 data transfer bus.

Comms: Racal intercom system, Collins or Bendix/King communications system

Radar: Honeywell or Bendix/King weather radar

Flight: Canadian Marconi CMA-900 flight management system for fuel flow, fuel quantity and specific range computations, tuning of nav/com radios, interfaces with electronic instrument systems, two-dimensional multisensor navigation, and built-in navigational database with update service. AFCS sensors on commercial variant include two Litton Italia LISA-4000 strapdown AHRS. Standard avionics include Penny and Giles air data system.

Instrumentation: Smiths Industries/OMI electronic instrument system (EIS) providing colour flight instrument, navigation and power systems displays. CMA-900 includes colour CRT display with graphics and alphanumeric capability

EQUIPMENT: ASW variants will have two sonobuoy dispensers, external rescue hoist and Fairey Hydraulics (Merlin) decklock. BAJ Ltd four-float emergency flotation gear

ARMAMENT (naval and military utility versions): Naval version able to carry up to four homing torpedoes (probably Marconi Sting Ray on Merlin, Eurotop or A244 on Italian version) or other weapons. ASV version designed to carry air-to-surface missiles (Marte Mk 2 for Italian Navy) and other weapons, for use as appropriate, from strikes against major units using sea-skimming anti-ship missiles to small arms deterrence of smugglers. Armament optional on military utility versions; options include chin turret for 12.7 mm machine gun and stub-wings for rocket pods

DIMENSIONS, EXTERNAL:

Main rotor diameter	18.59 m (61 ft 0 in)
Tail rotor diameter	4.01 m (13 ft 2 in)
Length	
overall, both rotors turning	22.81 m (74 ft 10 in)
main rotor and tail pylon folded (naval variant)	16.00 m (52 ft 6 in)
Width excl main rotor	4.52 m (14 ft 10 in)
main rotor and tail pylon folded (naval variant)	5.49 m (18 ft 0 in)
Height overall, both rotors turning	6.65 m (21 ft 10 in)
main rotor and tail pylon folded (naval variant)	5.21 m (17 ft 1 in)
Passenger door (fwd, port): Height	1.70 m (5 ft 7 in)
Width	0.91 m (3 ft 0 in)
Sliding cargo door (mid-cabin, stbd):	
Height	1.55 m (5 ft 1 in)
Width	1.83 m (6 ft 0 in)
Baggage compartment door (rear, port, Heliliner):	
Height	1.38 m (4 ft 6 in)
Width	0.55 m (1 ft 10 in)
Rear-loading ramp/door (rear, military/utility variant):	
Height	1.80 m (5 ft 10¾ in)
Width	2.11 m (6 ft 11 in)

DIMENSIONS, INTERNAL:

Cabin	
Length: naval variant	7.09 m (23 ft 3 in)
commercial/utility variant	6.50 m (21 ft 4 in)
Max width	2.49 m (8 ft 2 in)
Width at floor	2.26 m (7 ft 5 in)
Max height	1.83 m (6 ft 0 in)
Volume: naval variant	29.0 m³ (1,024 cu ft)
Heliliner	27.5 m³ (970 cu ft)
Baggage compartment volume (Heliliner)	3.82 m³ (135 cu ft)

AREAS:

Main rotor disc	271.51 m² (2,922.5 sq ft)
Tail rotor disc	12.65 m² (136.2 sq ft)

WEIGHTS AND LOADINGS (A: naval variant, B: Heliliner, C: military/utility variant):

Operating weight empty (estimated)	
A	10,500 kg (23,149 lb)
B (IFR offshore equipped)	9,300 kg (20,503 lb)
C	9,350 kg (20,613 lb)
Max fuel weight (four internal tanks, total)	
A (JP-5)	3,406 kg (7,509 lb)
B, C (JP-4)	3,360 kg (7,408 lb)
Max fuel weight (five internal tanks, total)	
B, C (JP-4)	4,200 kg (9,259 lb)
Disposable load/payload	
A (four torpedoes)	960 kg (2,116 lb)
B (30 passengers plus baggage)	2,850 kg (6,283 lb)
C (24 combat equipped troops)	3,120 kg (6,878 lb)
Max T-O weight: A, B, C	14,600 kg (32,188 lb)
Max disc loading: A, B, C	53.8 kg/m² (11.01 lb/sq ft)

PERFORMANCE:

Never-exceed speed (VNE) at S/L, ISA	167 kts (309 km/h; 192 mph) IAS
Average cruising speed	150 kts (278 km/h; 173 mph)
Best range cruising speed	140 kts (259 km/h; 161 mph)
Best endurance speed	90 kts (167 km/h; 104 mph)
Range (B):	
four tanks, offshore IFR equipped, with reserves	610 n miles (1,129 km; 702 miles)
five tanks, offshore IFR equipped, with reserves	750 n miles (1,389 km; 863 miles)
Ferry range, C (four tanks plus internal auxiliary tank)	1,130 n miles (2,093 km; 1,300 miles)

UPDATED

EMBRAER/FMA

Development of the Embraer/FMA CBA-123 Vector twin turboprop regional and corporate transport was terminated during 1994. For description see 1994-95 and earlier *Jane's*.

UPDATED

EUROCOPTER

EUROCOPTER SA

72 boulevard de Courcelles, F-75017 Paris, France
Telephone: 33 (1) 49 34 44 44
Fax: 33 (1) 49 34 44 47
Telex: 212836 F AISPA X

CHAIRMEN:
Jean François Bigay
Dr Siegfried Sobotta

DIRECTOR OF COMMUNICATIONS: X. Poupardin

Formed 16 January 1992 by merger of Aerospatiale and MBB (Daimler-Benz Aerospace) helicopter divisions. Share capital held on two levels: Eurocopter Holding SA owned 60 per cent by Aerospatiale and 40 per cent by Deutsche Aerospace, capital of Eurocopter SA held 75 per cent by Eurocopter Holding and 25 per cent by Aerospatiale. Eurocopter is ready for other companies to join.

In 1994 Eurocopter's turnover was FFr9 billion (12 per cent down on 1993). Eurocopter products cover 75 to 80 per cent of the range of helicopters in terms of size and capacity, but company intends to expand this to 95 per cent, particularly with co-operative development of Russian Mil Mi-38 (See Euromil entry, this section).

Workforce was reduced by 1,060 to 10,500 during 1993, and by a further 10 per cent during 1994. Eurocopter sold 133 civil and military helicopters, worth FFr7.3 billion (and delivered 149) in 1994, compared with 166 (and 159) in 1993.

All national and international subsidiaries and partially owned companies concerned with helicopters formerly belonging to Aerospatiale or Daimler-Benz Aerospace are now controlled by Eurocopter SA through Eurocopter Participations, which see.

Works are at La Courneuve (Paris) and Marignane (Marseille) in France and Ottobrunn (Munich) and Donauwörth in Germany.

UPDATED

EUROCOPTER TIGER GmbH

Gustav Heinemann Ring 135 (PO Box 838356), D-81700 Munich, Germany
Telephone: 49 (89) 638250-0
Fax: 49 (89) 638250-50

CHIEF EXECUTIVE OFFICERS:
Bernard Darrieus
Ingo Jaschke

Company formed 18 September 1985 to manage development and manufacture of Tiger/Tigre battlefield helicopter for French and German armies (see details later in this section); because it is working on a single government contract, Eurocopter Tiger is not a full member of Eurocopter; executive authority for programme is DFHB (Deutsch Französisches Hubschrauberburo) in Koblenz; procurement agency is German government BWB (Bundesamt für Wehrtechnik und Beschaffung).

UPDATED

EUROCOPTER PARTICIPATIONS

PO Box 13, F-13725 Marignane, France
DIRECTOR: Philippe Harache

Company formed January 1993 as subsidiary of Eurocopter SA to manage 16 Eurocopter subsidiaries outside France and Germany, including the principal ones listed below. Others are Samaero (Singapore), Helibras (Brazil), Eurocopter de Mexico, Lansav (South Africa), MBB Helicopter Systems (UK), and Helicopteros Espana. Partly owned are MBB Kutlutas Helikopterleri (Turkey), Euroaircraft Services (Malaysia), MBB Helicopter and Transport (Nigeria), Philippine Helicopter Services, Eurocopter International Belgium and Eurocopter do Brasil.

VERIFIED

EUROCOPTER DEUTSCHLAND

D-81663 Munich, Germany
Telephone: 49 (89) 6000 04
Fax: 49 (89) 6000 9033
CHAIRMAN: Dr Siegfried Sobotta
PUBLIC RELATIONS EXECUTIVE: Christina Gotzhein

Industrial concern in charge of development, production and product support of current and future products originating in German part of group.

Launched **Hubschrauber 2010** project early 1995 as four year study into concepts for civil helicopter to enter service in second decade of next century; half of required DM120 million ($80 million) provided by German government, targets include halving of operating costs (partly through 30 per cent reduction in fuel consumption), 20 per cent cut in empty weight, increased cruising speeds up to 190 knots (352 km/h, 219 mph) and noise levels 10 EPNdB below current ICAO limit.

UPDATED

Artist's impression of possible 21st Century helicopter benefiting from Hubschrauber 2010 research
1995

EUROCOPTER FRANCE

PO Box 13, F-13725 Marignane, France
Telephone: 33 42 85 85 85
Fax: 33 42 85 85 00
Telex: 410975 F
PRESIDENT DIRECTOR GENERAL: Jean-François Bigay

Industrial concern in charge of development, production and product support of current and future products originating in French part of group. Formed groupement d'intérêt économique with Canadair in mid-1994 to service Canadair water bombers of the French Sécurité Civile, GIE called Canadair Eurocopter Réparation Bombardier à Eau (CEREBRE).

VERIFIED

EUROCOPTER INTERNATIONAL

20 avenue Marcel-Cachin, F-93123 La Courneuve Cedex, France
Telephone: 33 (1) 49 34 40 00
Fax: 33 (1) 49 34 45 10
Telex: 212836 F AISPA X
CHAIRMAN: Jean P. Bernadet
DEPUTY CHAIRMAN: Werner Reinl

Wholly owned subsidiary of Eurocopter SA, formed 6 May 1991, responsible for marketing all group helicopters.

UPDATED

AMERICAN EUROCOPTER CORPORATION

2701 Forum Drive, Grand Prairie, Texas 75052-7099, USA
Telephone: 1 (214) 641 0000
Fax: 1 (214) 641 3761
CHAIRMAN: Guy Essautier
CEO: David Smith

Combines former MBB Helicopter of West Chester, Pennsylvania, and Aerospatiale Helicopters of Grand Prairie, Texas, both of which have modification and assembly facilities as well as sales activities. MBB site now concentrating on support. Aerospatiale Helicopters had agreement with LTV (now Vought Aircraft) to propose AS 565 Panther to US Army as utility transport. In 1993, AS 350BA competed for US Army New Training Helicopter order subsequently won by Bell TH-67 Creek.

UPDATED

EUROCOPTER CANADA LTD

PO Box 250, 1100 Gilmore Road East, Fort Erie, Ontario L2A 5M9, Canada
Telephone: 1 (416) 871 7772
Fax: 1 (416) 871 3320
PRESIDENT AND CHIEF EXECUTIVE OFFICER: Willy Heidbuechel
VICE-PRESIDENT AND CHIEF OPERATIONS MANAGER: Michael D. Lavoy

Formerly MBB Helicopter Canada, producer and design authority for Eurocopter BO 105 LS (see details under Canada); completes and sells BO 105 CBS and BK 117 in Canada, partner in EC 135 (BO 108), development of which is partly financed by Canadian government.

UPDATED

EUROCOPTER SERVICE JAPAN

Owned by Eurocopter SA (51 per cent), Nozaki (24.5 per cent) and Sony Trading (24.5 per cent); 410 Eurocopter helicopters of various types, a large proportion of Japanese civil helicopter fleet, and 75 Eurocopter/Kawasaki BK 117s, in service; company supports, modifies and sells them.

[redacted]

EUROCOPTER INTERNATIONAL PACIFIC

PO Box 51, Bankstown, NSW 2200, Australia
Telephone: 61 (2) 794 9900
Fax: 61 (2) 791 0195

Sales and support company for Eurocopter products and programmes.

VERIFIED

EUROCOPTER TIGER/TIGRE

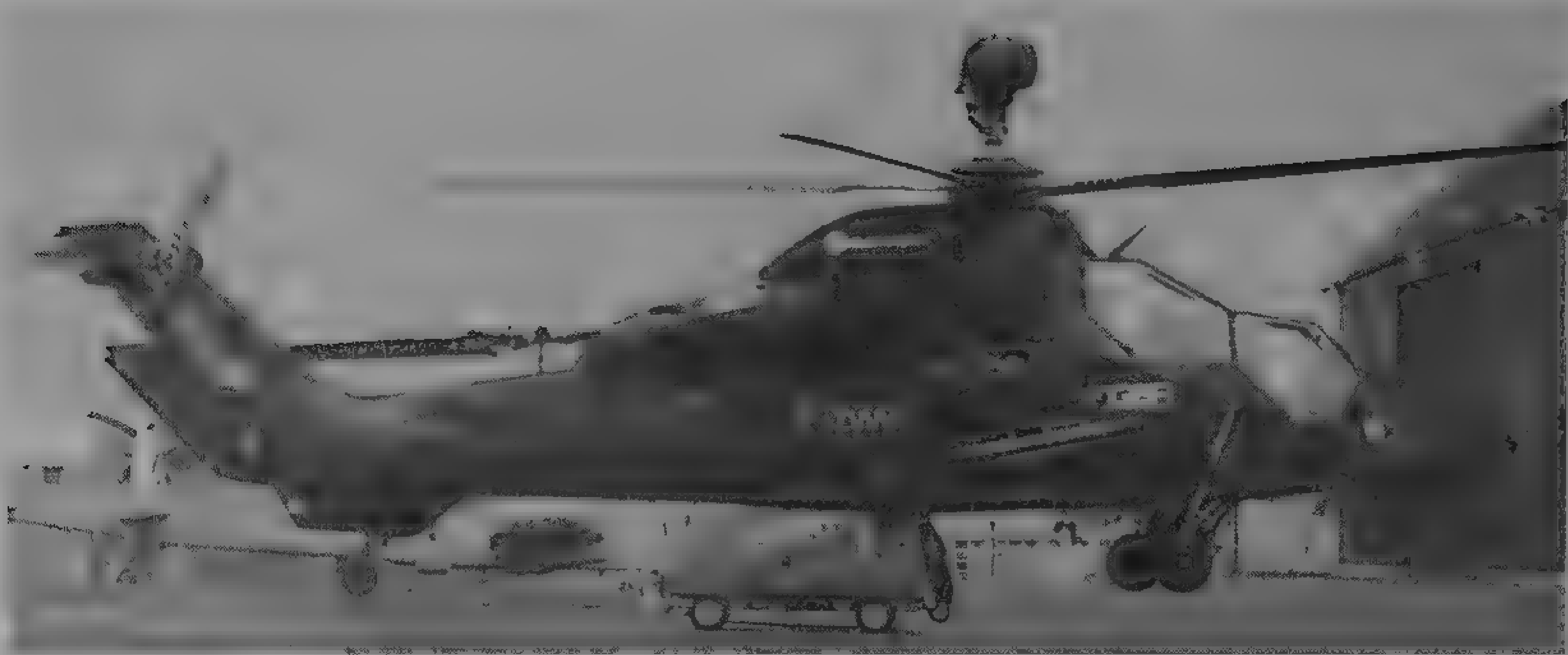
TYPE: Twin-engined anti-tank and ground support helicopter.

PROGRAMME: Original 1984 French/German MoU to develop common new anti-tank helicopter amended 13 November 1987, FSD approved 8 December 1987, main development contract awarded 30 November 1989, when name Tiger (Germany)/Tigre (France) adopted; five development aircraft planned, including three unarmed aerodynamic prototypes to be used also for core avionics testing (PT1, 2 and 3), one (PT4) in HAP (initially called Gerfaut) configuration and one (PT5) as UHU/HAC prototype; PT1 rolled out 4 February 1991, first flight 27 April 1991; four flying by December 1994, further details below, total 720 hours flown by April 1995. Germany confirmed purchase of full 212 required, 1994, having considered cut to 138. Industrialisation phase brought forward by two years to 1995 to strengthen export prospects, first deliveries in 1999 to France (approximately 10) and for export.

Joint team at Marignane to flight test basic helicopter, update avionics during trials, and test HAP variant, similar team at Ottobrunn to qualify basic avionics. Euromep mission equipment package, and integrate weapons system. Rotor downwash problems resulted in trial forward positioning of horizontal stabiliser; by mid-1994 definitive solution adopted of reversion to original position, but halving area.

CURRENT VERSIONS (general): **Tigre HAP**: Hélicoptère d'Appui et de Protection; name Gerfaut dropped late 1993; escort and fire support version for French Army, for delivery from 1999, armed with 30 mm Giat AM-30781 automatic cannon in undernose turret, with 150 to 450 rds ammunition, four Mistral air-to-air missiles and two pods each with twenty-two 68 mm unguided SNEB rockets delivering armour-piercing darts, mounted on stub-wings or 12-round rocket pod instead of each pair of Mistrals making total of 68 rockets, roof mounted TV, FLIR, laser rangefinder and direct view optics sensors, image intensifiers integrated in helmets.

UHU: Unterstutzungs Hubschrauber, German Army anti-tank and support helicopter for delivery from 2000, replaces PAH-2 Tiger, underwing pylons for up to eight HOT 2 or Trigat missiles, four Stinger self-defence



Eurocopter Tiger PT1 prototype (F-ZWWW) with mast-mounted sight and tailplane mounted in definitive rearward location *(Paul Jackson)*

1994

missiles, unguided rockets, gun pod and extended self-defence system, mast-mounted TV/FLIR/laser ranger sight for gunner; nose-mounted FLIR for piloting.

Tigre HAC Hélicoptère Anti-Char: anti-tank variant for French Army, for delivery from 1999; wing pylons for up to eight HOT 2 or Trigat missiles (or four HOT 2 and four Trigat) inboard, four Mistral air-to-air missiles outboard; same mast-mounted sight and pilot FLIR system as UHU.

Export: Combines features of French and German versions; offered (unsuccessfully) to UK and Netherlands.

CURRENT VERSIONS (specific): **PT1/F-ZWWW:** Aerodynamic prototype, basic avionics, first flight 27 April 1991. Successively fitted with aerodynamic mockups of mast-mounted and roof-mounted sights, nose-mounted gun and weapon containers. Total 423 hours to 15 December 1994.

PT2/F-ZWWY: HAP aerodynamic configuration, full core avionics, rolled out 9 November 1992, first flight 22 April 1993. Total 164 hours to 15 December 1994. To receive HAP systems, May 1995.

PT3/F-ZWWT: Full core avionics (including navigation and autopilot); first flight 19 November 1993. Total 40 hours to 15 December 1994. To receive UHU systems, February 1997.

PT4/F-ZWWU: HAP avionics (including roof sight and HUD; first Tiger with live weapons system); first flight 15 December 1994. Sighting system trials early 1995. Giat cannon trials (15 sorties) completed at Toulon, April 1995; full testing began at CEV Cazaux, September 1995. Mistral AAM trials 1996.

PT5: Full UHU avionics; first flight due in early 1996.

CUSTOMERS: Original requirement was for 427 (France 75 HAP and 140 HAC, Germany 212 PAH-2); UHU version substituted for PAH-2s in 1993. French order amended by 1994 to 115 HAP and 100 HAC; also under consideration by Spain. Eurocopter teamed with BAe Defence Dynamics Division for £2.5 billion UK Army competition for 91 combat helicopters; UK considered full membership of Eurocopter Tiger programme, achieving 100 per cent offset; Tiger rejected in favour of AH-64D Apache, July 1995. Exports of 300 Tigers thought possible.

COSTS: Tiger current development cost reported DM2.2 billion.

DESIGN FEATURES: FEL (fibre elastomer) main rotor designed for simplicity, manoeuvrability and damage tolerance; has infinite life except for inspection of elastomeric elements at more than 2,500 hour intervals; hub consists of titanium centrepiece (including duct for mast-mounted sight) with composites starplates bolted above and below; flap and lead/lag motions of blades allowed by elastic bending of neck region and pitch change by elastic part of elastomeric bearings; lead/lag damping by solid-state visco-elastic damper struts faired into trailing-edge of each blade root; equivalent flapping hinge offset of 10.5 per cent gives high control power; SARIB passive vibration damping system between transmission and airframe; three-blade Spheriflex tail rotor has composite blades with fork roots; built-in ram air engine exhaust suppressors.

FLYING CONTROLS: All versions have pilot in front, gunner in rear with full dual controls; both crew members can perform all tasks and weapon operation except that anti-tank missile firing only available to gunner; each crew member has two colour multifunction displays and one central control and display unit; autopilot is part of basic avionics system (see under Avionics heading); fully powered hydraulic flying controls by SAMM/Liebherr, Labinal/Electrometal servo trim; definitive horizontal tail is surface of reduced size mounted aft beneath tail rotor.

STRUCTURE: 80 per cent CFRP, block and sandwich and Kevlar sandwich, 6 per cent titanium and 11 per cent aluminium; airframe structure protected against lightning and EMP by embedded copper/bronze grid and copper bonding foil; stub wings of aluminium spars with CFRP ribs and skins; titanium engine deck may be replaced by GFRP; airframe tolerates crash impacts at 10.5 m/s (34.4 ft/s) and meets MIL-STD-1290 crashworthiness standards; titanium main rotor hub centrepiece and tail rotor Spheriflex integral hub/mast; blade spars filament wound GFRP, CFRP skins and subsidiary spars and foam filling.

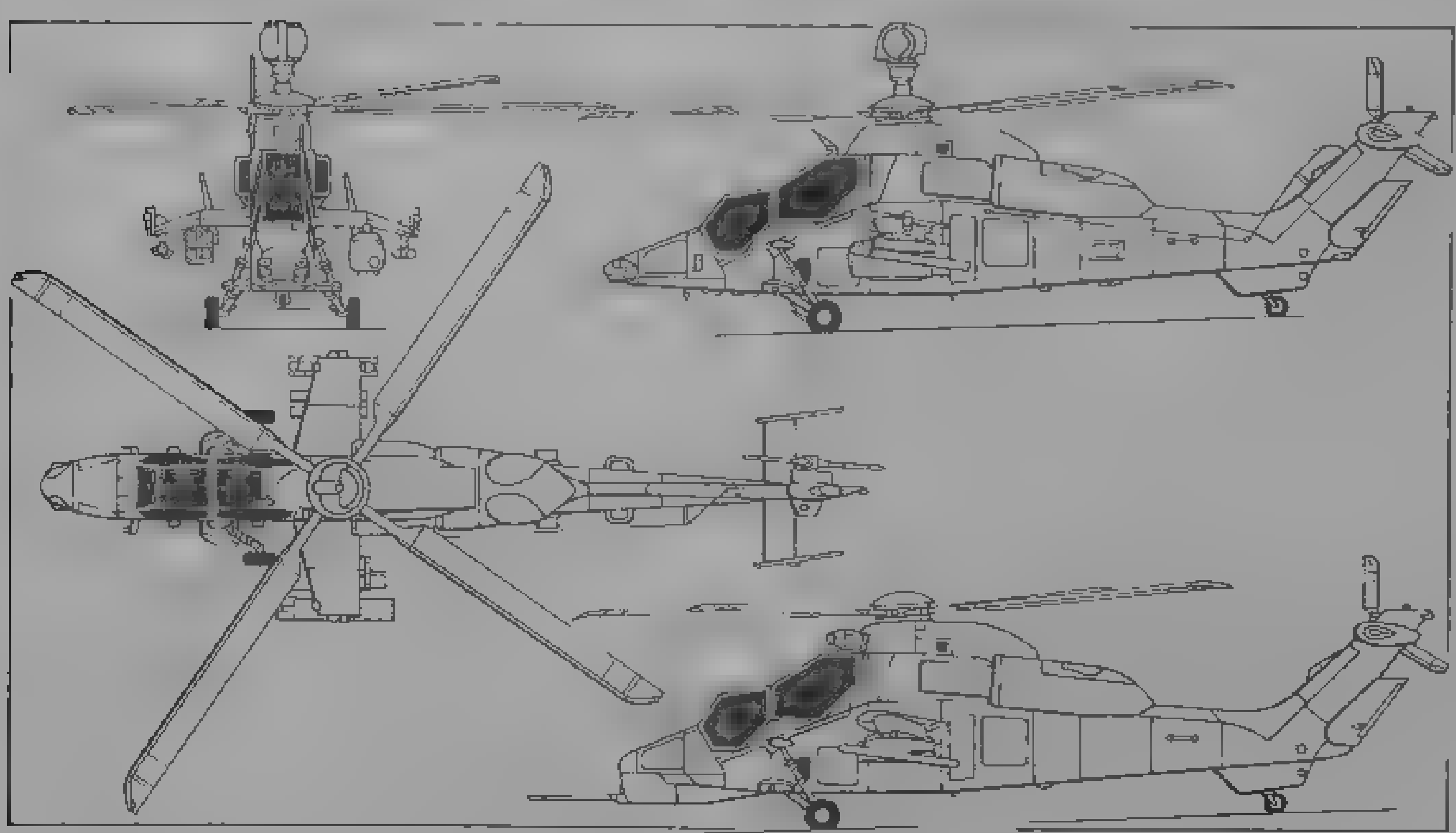
Eurocopter France responsible for transmission, tail rotor, centre-fuselage (including engine installation), aerodynamics, fuel and electrical systems, weight control, maintainability, reliability and survivability. Eurocopter Deutschland for main rotor, flight control and hydraulic systems, front and rear fuselage (including cockpits), prototype assembly, flight characteristics and performance, stress and vibration testing and simulation.

LANDING GEAR: Non-retractable tailwheel type, with single wheel on each unit. Designed to absorb impacts of up to 6 m (20 ft)/s. Main gear by Messier-Bugatti, tail gear by Liebherr Aerotechnik.

POWER PLANT: Two MTU/Rolls-Royce/Turbomeca MTR 390 turboshafts, mounted side by side above centre-fuselage (engine first flown in Panther testbed 14 February 1991).

Agility demonstration by Eurocopter Tiger/Tigre *(Paul Jackson)*

1995



Eurocopter Tiger and HAC helicopter with additional side view (bottom) of the French HAP escort and support version *(Jane's/Mike Keep)*

1989

Eurocopter prototype in HAP configuration with dummy roof mounted STRIX sight, 30 mm gun in nose and rockets and Mistral missiles on pylons. Tailplane has since been moved aft to original location

1994

power ratings are maximum T-O 958 kW (1,285 shp), super emergency 1,160 kW (1,556 shp), maximum continuous 873 kW (1,171 shp), self-sealing crashworthy fuel tanks, with explosion suppression, total capacity 1,360 litres (359 US gallons, 299 Imp gallons). Gearbox has specified 30 minutes' dry running capability (demonstrated 65 minutes, November 1994

ACCOMMODATION: Crew of two in tandem, with pilot in front and weapons system operator at rear, armoured, impact absorbing seats, stepped cockpits, with flat-plate transparencies

SYSTEMS: Redundant hydraulic, electrical and fuel systems

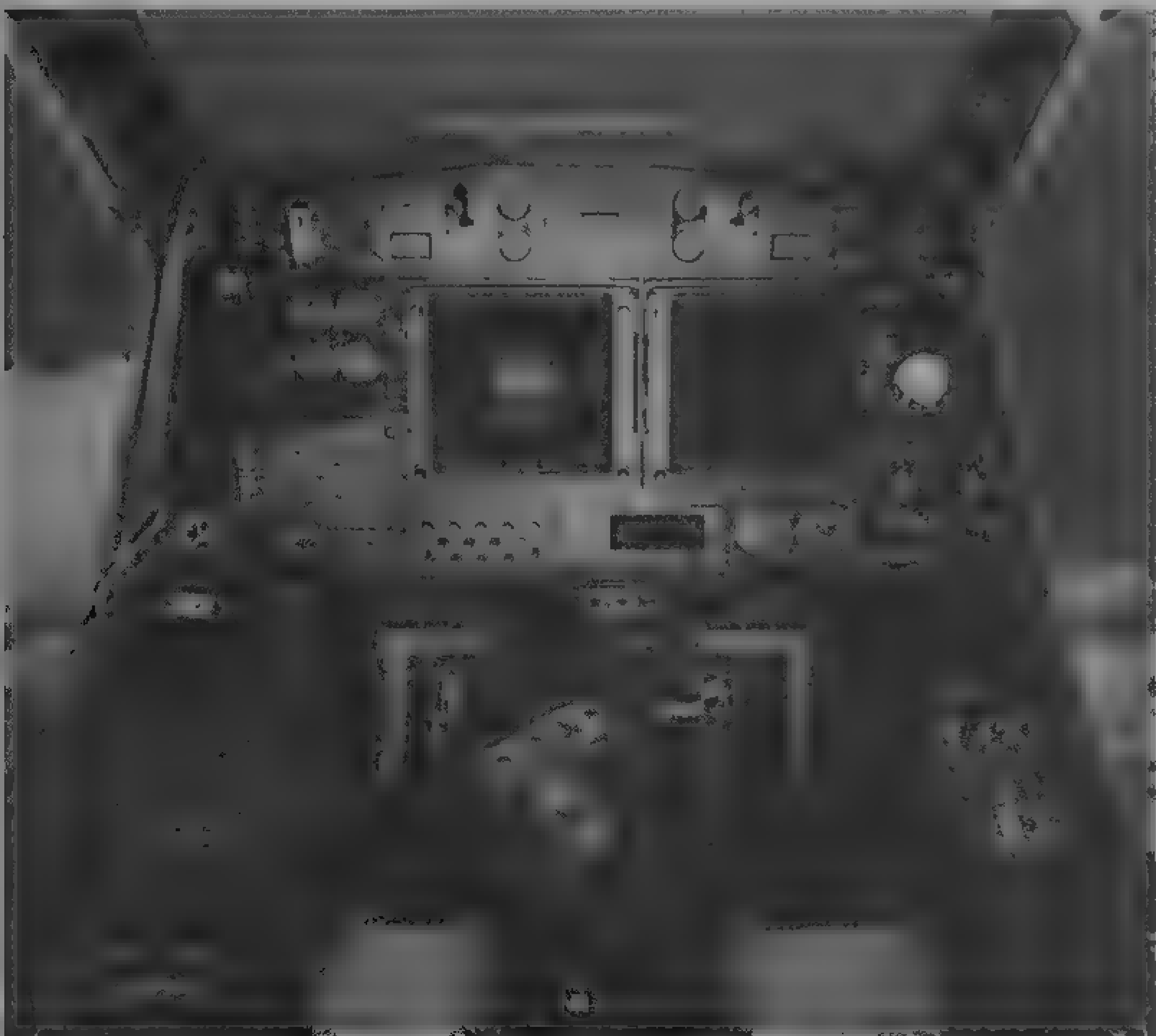
AVIONICS: *Basic or core avionics* common to all three versions include bus/display system, com radio (French and German systems vary), autonomous nav system and radio/Doppler navaids, electronic countermeasures (including laser warning) and automatic flight control system, all connected to and controlled through redundant MIL-STD-1553B data highways

Flight: Navigation system, by Sextant Avionique, Teldix and DASA, is fully redundant, system contains two Sextant PIXYZ three-axis ring laser gyro units, two air data computers, two magnetic sensors, one Teldix/Canadian Marconi CMA 2012 Doppler radar, radio altimeter and GPS, volume of each laser unit is 3 Modular Concept Units (⅜ Air Transport Rack), each weighs 5.5 kg (12.1 lb), these sensors also provide signals for flight control, information display and guidance, integrated duplex AFCS by Sextant and Nord Micro, AFCS computers produced by Sextant Avionique, VDO-Luft and Litef

Instrumentation: Colour liquid crystal flight displays showing symbology and imagery (two per cockpit for flight and weapon/systems information) by Sextant and VDO-Luft, each crewman has central control/display unit for inputting all radio, electronic systems and navigation selections, digital map display system by Dornier and VDO-Luft, engine and systems data are fed into the data bus for in-flight indication and subsequent maintenance analysis

Mission: Euromep (European mission equipment package) includes SATEL (Aerospatiale/Pilkington Thorn Optronics/Eltro consortium) pilot vision subsystem (PVS), air-to-air subsystem (Stinger or Mistral), mast-mounted sight and missile subsystem and Euromep management system all connected to separate MIL-STD-1553B data highway, PVS has 40° field of view thermal imaging sensor steered by helmet position detector giving both crewmen day/night/bad weather vision, flight symbology and air-to-air aiming in helmet-mounted display, mast mounted sight, gunner sight electronics and gunner's head in target acquisition display and ATGW 3 subsystem connected by separate data highway, HOT 2 missile system also available. GEC-Marconi Avionics fully integrated day and night helmet ordered for German Tigers; French Tigres to have similar Sextant helmet mounted sights for both crewmen, Sextant Avionique HUD for pilot, armament control panel and fire control computer

HAP combat support mission equipment package includes SFIM/TRT STRIX gyrostabilised roof-mounted sight above rear cockpit, includes direct view optics with [illegible] tube television and IR channels and laser ranger/designator



Pilot's (front) cockpit of Tiger is centred on primary flight and navigation displays, with control and display panel on left console; autopilot controls are at lower left of main panel; 11 buttons and slew controls visible on cyclic stick and seven on collective lever thumb panel

1994

ARMAMENT: As listed under Current Versions

DIMENSIONS, EXTERNAL:

Main rotor diameter	13.00 m (42 ft 7¾ in)
Tail rotor diameter	2.70 m (8 ft 10¼ in)
Length of fuselage	14.00 m (45 ft 11¼ in)
Height: to top of rotor head	3.81 m (12 ft 6 in)
to top of tail rotor disc	4.32 m (14 ft 2 in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase	7.65 m (25 ft 1 in)

AREAS:

Main rotor disc	132.7 m² (1,428.7 sq ft)
Tail rotor disc	5.72 m² (61.63 sq ft)

WEIGHTS AND LOADINGS:

Basic weight empty	3,300 kg [illegible]
Mission T-O weight	[illegible]
Max overload T-O weight	6,000 kg [illegible]

Main rotor disc loading (max mission T-O weight)
43.70 kg/m² (8.95 lb/sq ft)
Power loading (max mission T-O weight, T-O power)
3.0 kg/kW (4.97 lb/shp)

PERFORMANCE (estimated, at AUW of 5,400 kg 11,905 lb):
Cruising speed
135-151 kts (250-280 km/h, 155-174 mph)
Max rate of climb at S/L more than 600 m (1,970 ft)/min
Hovering ceiling OGE more than 2,000 m (6,560 ft)
Endurance, incl 20 min reserves 2 h 50 min

UPDATED

EUROCOPTER AS 332 SUPER PUMA and AS 532 COUGAR Mk I

TYPE: Twin-turbine multirole helicopter.

PROGRAMME: Early history and versions listed in 1985-86 and earlier *Jane's*; first flight AS 332 Super Puma (F-WZJA) 13 September 1978, six prototypes, deliveries began mid-1981; present version powered by Turbomeca Makila 1A1 introduced 1986, military versions renamed Cougar in 1990; first AS 332L (stretched fuselage) certificated to French IFR Cat. II 7 July 1983 and delivered to Lufttransport of Norway, certificated for flight into known icing 29 June 1983, FAA Cat. II certification with SFIM CDV 85 P4 four-axis AFCS and FAR Pt 25 Appendix C known icing clearance. Mk I continues in production as long as orders (mainly making good attrition) continue.

CURRENT VERSIONS: Designation suffixes, U: military unarmed utility, A: armed, S: anti-ship/submarine, C: military court (short) fuselage, L: long fuselage, military or civil.

AS 332L1 Super Puma: Standard Mk I civil version with long fuselage and airline interior for 20 passengers. UK CAA IFR certification 21 April 1992, one delivered to British International Helicopters.

AS 532UC Cougar: Military Mk I short fuselage unarmed utility, seats up to 21 troops and two crew; cabin floor reinforced for 1,500 kg/m² (307 lb/sq ft).

AS 532UL Cougar: Military Mk I unarmed long fuselage version, cabin lengthened by 0.76 m (2 ft 6 in), extra fuel and two large windows in forward cabin plug, carries up to 25 troops and two crew. French Army version designated AS 532M.

AS 532AC Cougar: Armed AS 532UC (Mk I).

AS 532AL Cougar: Armed AS 532UL (Mk I).

AS 532SC Cougar: Naval short Mk I version with ASW/ASV equipment, folding tail rotor pylon and main rotor blades; deck harpoon device.

AS 532UL Horizon: Battlefield surveillance radar helicopter; flight trials of small Orphée radar under an AS 330B Puma started 1986, French Army wanted 20 AS 532 Cougar Mk II fitted with radar, dedicated ECM and data link (Orchidée programme) to be delivered in 1986, first flight of full scale AS 532/Orchidée June 1990, programme cancelled for budgetary reasons August 1990; prototype without datalink flew 24 missions in Gulf War February 1991 in Operation Horus, Horizon programme (Hélicoptère d'Observation Radar et d'Investigation sur Zone) with more effective operational concept and reduced development costs replaced Orchidée; development contract awarded to Eurocopter October 1992 for two AS 532UL Horizons with same radar capabilities and ECM as Orchidée, but in AS 532UL Mk I Cougar, with standard ECM and longer mission endurance; first flight Horizon with full radar 8 December 1992. First delivery early 1995, four onm four order.

AS 332L2 Super Puma Mk II: Stretched version with Spheriflex rotor heads. See separate entry.

French Air Force AS 332L1 Super Puma of Presidential flight *(Paul Jackson)*
1995

AS 532C Cougar naval variant, equipped with dipping sonar and torpedo
1995

AS 532U2/A2 Cougar Mk II: Stretched version with Spheriflex rotor heads. See separate entry.

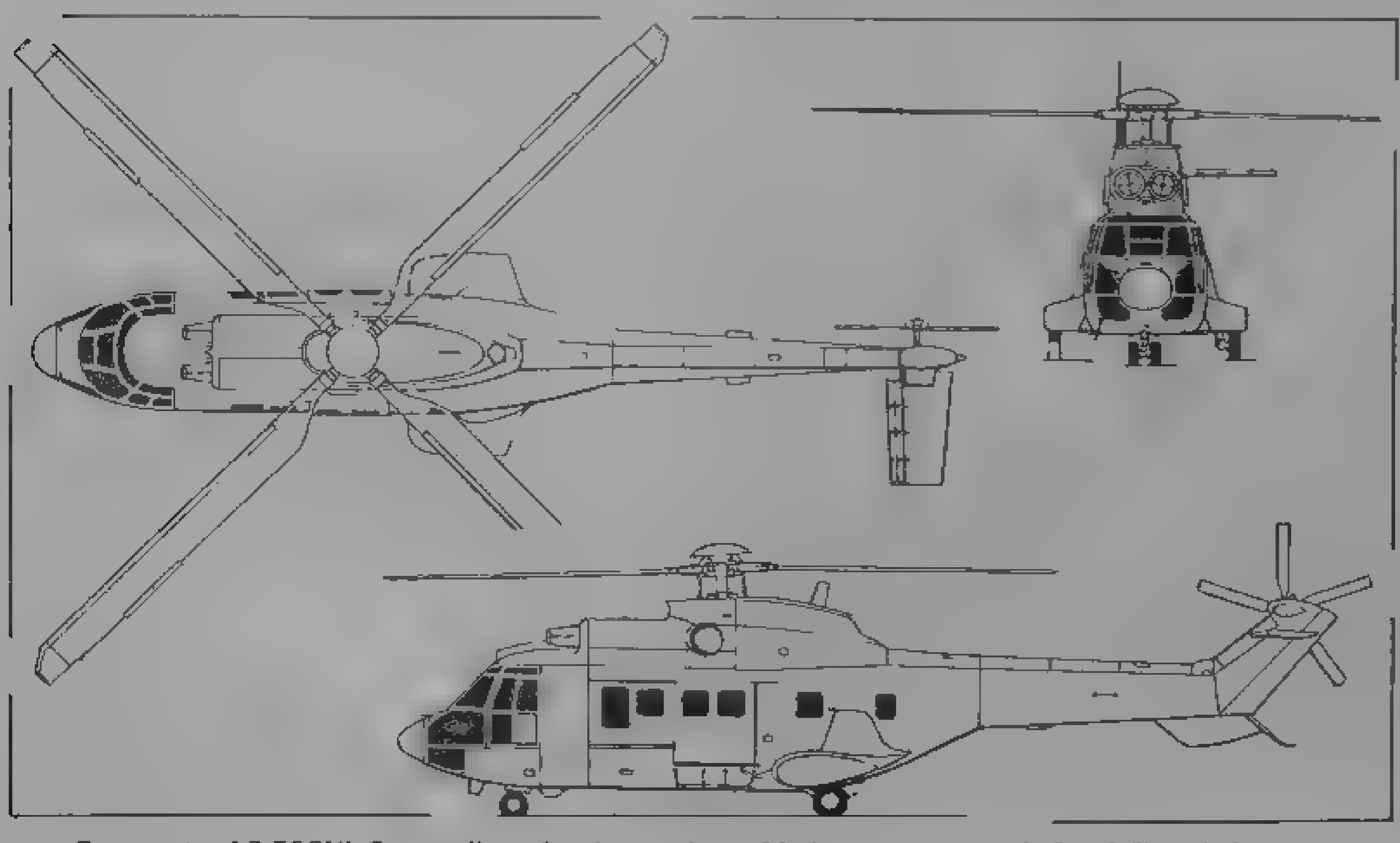
COSTS: Netherlands' 17 Cougars believed to cost Dfl450 million plus 120 per cent industrial offset.

CUSTOMERS: Total 456 AS 332/532s ordered from 42 countries (two-thirds of them military Cougars) by 1 January 1995 (at which time 397 delivered); more than 70 AS 332L1 Super Pumas in civil offshore oil industry support operations. French military orders include six for French Air Force (three for nuclear test facilities in Pacific and three for government VIP flying); French Army (ALAT) is replacing AS 330 Pumas with AS 532 Cougars; first 22 delivered to Force d'Action Rapide between late 1988 and end 1991.

Export customers include Abu Dhabi (eight including two VIP of which five to be upgraded with Exocet, sonar and torpedoes under 1995 contract), Brazil (16 including six AS 532SCs), Cameroon (one), Chile (army, two, navy, four AS 532SCs), China (six), Ecuador (eight including six army), Finland (three for border police), Gabon (one, Presidential Guard), Germany (three, border police), Indonesia (built under licence: see IPTN entry), Japan (three, army/VIP), Jordan (eight), South Korea (three army/VIP, one AS 332L1), Mexico (two VIP), Nepal (two, Royal Flight), Nigeria (two), Oman (two, Royal Flight), Panama (one VIP), Saudi Arabia (12 AS 532SCs), Singapore (22), Spain (10 SAR HD 21s, two VIP HT 21s, 18 army tactical transport HT 21s), Sweden (10 SAR), Switzerland (15 Cougars), Togo (one), Turkey (20 SA 532UL), Venezuela (eight), Zaire (one VIP). Bristow Helicopters acquired 31 examples of 19-passenger AS 332L (see 1993-94 *Jane's*) for offshore oil support.

DESIGN FEATURES: Four-blade fully articulated main rotor turning clockwise seen from above; five-blade tail rotor on starboard side of tailboom; engines mounted above cabin have rear drive into main transmission at 23,840 rpm, main rotor turns at 265 rpm, tail rotor at 1,278 rpm, various lateral sponsons available housing partly retracted main landing gear and combinations of additional fuel or pop-out floats, optional air conditioning system housed in casing on port forward flank of cabin; all civil versions certificated for IFR category A and B to FAR Pt 29.

FLYING CONTROLS: Dual fully powered hydraulic controls with full-time autostabilisation and yaw damping; machine remains flyable with autostabiliser switched off, cyclic trimming by stick friction adjustment; inverted slot on



Eurocopter AS 532UL Cougar (long fuselage military Mk I unarmed utility) *(Jane's/Dennis Punnett)*
1993

tailplane to maintain attitude holding effect at low climb speeds, large ventral fin, saucer fairing on rotor head to smooth wake of hub; four-axis SFIM 155 autopilot standard

STRUCTURE: Conventional light alloy airframe with some titanium; crashworthy fuel system, impact-absorbing landing gear and other features, main rotor blades of GFRP with CFRP stiffening and Moltoprene filler; elastomeric drag dampers

Some AS 332/532s built under licence by IPTN in Indonesia, some assembled by CASA in Spain and some equipped by F+W in Switzerland

LANDING GEAR: Retractable tricycle high energy absorbing design by Messier-Bugatti, all units retract rearward hydraulically, mainwheels into sponsons on sides of fuselage, dual-chamber oleo-pneumatic shock absorbers, twin wheel self centring nose unit, tyre size 466 × 176, pressure 7 0 bars (102 lb/sq in), single wheel on each main unit with tyre size 6.5 × 225-10 or 640 × 230-10, pressure 9 0 bars (130 lb/sq in); hydraulic differential disc brakes, controlled by foot pedals, lever operated parking brake; emergency pop-out flotation units can be mounted on main landing gear fairings and forward fuselage.

POWER PLANT: Two Turbomeca Makila 1A1 turboshafts, each with maximum contingency rating of 1,400 kW (1,877 shp) and maximum continuous rating of 1,184 kW (1,588 shp). Air intakes protected by a grille against ingestion of ice, snow and foreign objects, Centrisep multipurpose intake optional for flight into sandy areas

AS 532UC/AC have five flexible fuel tanks under cabin floor, with total usable capacity of 1,497 litres (395 US gallons, 329 Imp gallons); AS 532SC has total basic capacity of 2,141 litres (565 US gallons; 471 Imp gallons), AS 332L1/532UL/532AL have a basic fuel system of six flexible tanks with total capacity of 2,020 litres (533 US gallons, 444 Imp gallons) in the 332 and 2,003 litres (529 US gallons, 440 Imp gallons) in the 532; provision for additional 1,900 litres (502 US gallons, 418 Imp gallons) in four auxiliary ferry tanks installed in cabin; two external auxiliary tanks with total capacity of 650 litres (172 US gallons, 143 Imp gallons) standard on AS 532SC, optional on other versions: for long-range missions (mainly offshore) in AS 332L1, a special internal auxiliary tank can be fitted in cargo sling well, in addition to the two external tanks, to raise total usable fuel capacity to 2,994 litres (791 US gallons; 658 Imp gallons); refuelling point on starboard side of cabin; fuel system designed to avoid leakage following a crash, self-sealing tanks standard on military versions, optional on other versions; other options include a fuel dumping system and pressure refuelling.

ACCOMMODATION: One pilot (VFR) or two pilots side by side (IFR) on flight deck, with jump seat for third crew member or paratroop dispatcher; provision for composite light alloy/Kevlar armour for crew protection on military models, door on each side of flight deck and internal doorway connecting flight deck to cabin; dual controls, co-pilot instrumentation and crashworthy flight deck and cabin floors; maximum accommodation for 21 passengers in AS 532UC, 24 in AS 332L1 and 25 in AS 532UL, interiors available for VIP, air ambulance with six stretchers and 11 seated casualties/attendants, strengthened floor for cargo carrying, with lashing points; jettisonable sliding door on each side of main cabin or port side door with built-in steps and starboard side double door in VIP configuration, removable panel on underside of fuselage, at rear of main cabin, for longer loads, removable door with integral steps for access to baggage racks optional, hatch in floor below main rotor contains hook for slung loads up to 4,500 kg (9,920 lb) on internally mounted cargo sling, cabin and flight deck heated, ventilated and soundproofed, demisting, de-icing, washers and wipers for pilots' windscreens

SYSTEMS: Two independent hydraulic systems, supplied by self-regulating pumps driven by main gearbox. Each system supplies one set of powered flying controls, left-hand system also supplies autopilot, landing gear, rotor brake and wheel brakes, hydraulically actuated systems can be operated on ground from main gearbox (when a special disconnect system is installed to permit running of port engine with rotors stationary), or by external power through ground power receptacle. Emergency landing gear lowering by standby pump

Three-phase 200 V AC electrical power supplied by two 20 kVA 400 Hz alternators, driven by port side intermediate shaft from main gearbox and available on ground under same conditions as hydraulic ancillary systems, two 28 5 V DC transformer-rectifiers; main battery used for self-starting and emergency power in flight

AVIONICS: *Comms:* Optional equipment includes VHF, UHF, tactical HF and HF/SSB radio and intercom

Radar: Offshore models have nose-mounted radar, search and rescue version has nose-mounted Bendix/King RDR 1400 or chin-mounted Bendix/King 1500 search radar (as on Swedish Hkp 10s), naval ASW and ASV versions can have nose-mounted Thomson CSF Varan radar, linked to a tactical table in the cabin, and an Alcatel/Thomson Sintra HS 312 sonar station at rear of cabin

Flight: ADS, VOR/ILS, radio altimeter, GPS, VLF Omega, Decca navigator and flight log, Doppler, SFIM 155 autopilot, with provision for coupling to self-contained navigation and landing systems; search and rescue version

Eurocopter AS 532M1 Cougar of 4 Regiment, French Army *(Paul Jackson)*

1995

has Doppler, and Sextant Avionique Nadir or Decca self-contained navigation system (Nadir Mk 2 in French Army version), including navigation computer with SAR patterns, polar indicator, roller map display, hover indicator, route mileage indicator and groundspeed and drift indicator; SFIM CDV 155 autopilot coupler contains automatic nav track including search patterns, transitions and hover, multifunction video display shows radar and route images, SAR patterns and hover indication, Swedish Hkp 10s have Racal RAMS flight management system including GEC-Marconi AHRS, Decca Doppler and GPS

Instrumentation: Full IFR instrumentation optional

EQUIPMENT: Optional fixed or retractable rescue hoist (capacity 275 kg; 606 lb) starboard side; equipment for naval missions can include sonar, MAD and sonobuoys

ARMAMENT (optional): Typical alternatives for army/air force missions are two 20 mm guns or two 7 62 mm machine guns. Armament for naval missions includes two AM 39 Exocet missiles or two lightweight torpedoes

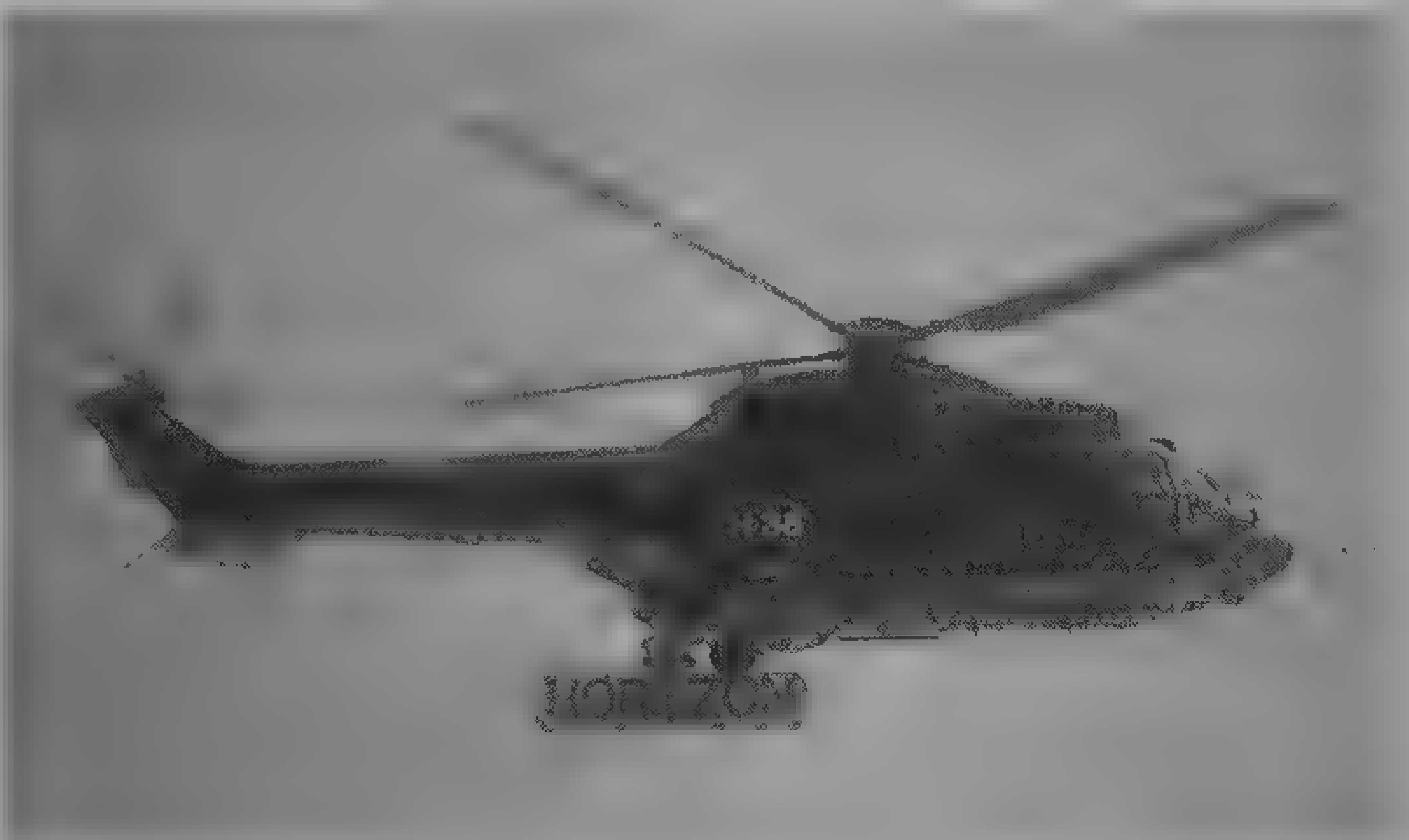
DIMENSIONS, EXTERNAL
- Main rotor diameter: 15 60 m (51 ft 2¼ in)
- Tail rotor diameter: 3 05 m (10 ft 0 in)
- Main rotor blade chord: 0 60 m (1 ft 11½ in)
- Length overall, rotors turning: 18 70 m (61 ft 4¼ in)
- fuselage incl tail rotor
  - AS 532UC/AC/SC: 15 53 m (50 ft 11½ in)
  - AS 332L1/532AL/UL: 16 29 m (53 ft 5½ in)
- Width, blades folded
  - AS 532UC/AC/AL/UL/332L1: 3 79 m (12 ft 5¼ in)
  - AS 532SC: 4 04 m (13 ft 3 in)
- Height overall: 4 92 m (16 ft 1¾ in)
  - blades and tail pylon folded
    - AS 532UC/AC/SC: 4 80 m (15 ft 9 in)
  - to top of rotor head: 4.60 m (15 ft 1 in)
- Wheel track: 3 00 m (9 ft 10 in)
- Wheelbase: AS 532UC/AC/SC: 4 49 m (14 ft 8¾ in)
  - AS 332L1/532AL/UL: 5 28 m (17 ft 4 in)
- Passenger cabin doors, each Height: 1 35 m (4 ft 5 in)
  - Width: 1 30 m (4 ft 3¼ in)
- Floor hatch, rear of cabin Length: 0 98 m (3 ft 2½ in)
  - Width: 0.70 m (2 ft 3½ in)

DIMENSIONS, INTERNAL
- Cabin Length, AS 532UC/AC/SC: 6 05 m (19 ft 10½ in)
  - AS 332L1/532AL/UL: 6 81 m (22 ft 4 in)
- Max width: 1 80 m (5 ft 10¾ in)
- Max height: 1 55 m (5 ft 1 in)
- Floor area: AS 532UC/AC/SC: 7.80 m² (84 sq ft)
  - AS 332L1/532AL/UL: 9 18 m² (98 8 sq ft)
- Usable volume
  - AS 532UC/AC/SC: 11.40 m³ (403 cu ft)
  - AS 332L1/532AL/UL: 13 30 m³ (469 5 cu ft)

AREAS
- Main rotor disc: 191.1 m² (2,057 4 sq ft)
- Tail rotor disc: 7 31 m² (78.64 sq ft)

WEIGHTS AND LOADINGS
- Weight empty (standard aircraft)
  - AS 532UC/AC: 4,330 kg (9,546 lb)
  - AS 532SC: 4,500 kg (9,920 lb)
  - AS 332L1/532AL/UL: 4,460 kg (9,832 lb)
- Max T-O weight
  - AS 532UC/AC/AL/UL/SC, internal load: 9,000 kg (19,841 lb)
  - AS 332L1, internal load: 8,600 kg (18,960 lb)
  - all versions, with slung load: 9,350 kg (20,615 lb)

PERFORMANCE (at max T-O weight)
- Never-exceed speed (VNE): 150 kts (278 km/h; 172 mph)
- Cruising speed at S/L
  - AS 532UC/AC/AL/UL: 141 kts (262 km/h, 163 mph)
  - AS 532SC: 130 kts (240 km/h 149 mph)
  - AS 332L1: 144 kts (266 km/h, 165 mph)
- Max rate of climb at S/L
  - AS 532UC/AC/AL/UL: 420 m (1,378 ft)/min
  - AS 532SC: 372 m (1,220 ft)/min
  - AS 332L1: 486 m (1,594 ft)/min
- Service ceiling: AS 332L1: 4 600 m (15 090 ft)
  - AS 532UC/AC/SC/AL/UL: 4,100 m (13,450 ft)
- Hovering ceiling IGE
  - AS 532AL/UL/AC/UC/SC: 2,800 m (9,185 ft)
  - AS 332L1: 3,250 m (10,663 ft)
- Hovering ceiling OGE
  - AS 532AL/UL/AC/UC/SC: 1 650 m (5,415 ft)
  - AS 332L1: 2,300 m (7,545 ft)



French Army AS 532UL Cougar fitted with Horizon system *(Paul Jackson)*

1995

Eurocopter AS 332L2 Super Puma Mk IIs of Norway's Helikopter Service

1994

R[illegible] standard tanks, no reserves
- [illegible] 334 n miles (618 km; 384 miles)
- [illegible] 470 n miles (870 km; 540 miles)
- AS 532AL/U1 455 n miles (842 km; 523 miles)

Range at S/L with external (two 338 l) and auxiliary (320 l) tanks, no reserves
- AS 532UC/AC 549 n miles (1,017 km; 632 miles)
- [illegible] [illegible] n miles (1,245 km; 773 miles)

UPDATED

EUROCOPTER AS 332L2 SUPER PUMA Mk II and AS 532 COUGAR Mk II

TYPE: Twin-turbine medium helicopter

PROGRAMME: First flight of development vehicle 6 February 1987, French certification 2 April 1992, UK BCAR 29 certification 16 November 1992, first delivery August 1993. Earlier AS 332L1 and 532U/A Cougar Mk I remain on production line for navies and attrition replacement

CURRENT VERSIONS: **AS 332L2 Super Puma Mk II**: Current production civil transport, innovations include Spheriflex rotor heads, super-emergency engine rating, EFIS flight deck and built-in health and usage monitoring system, duplex four-axis AFCS, and hydraulically powered standby electrics for two hours' operation after complete main generator failure

AS 332L2 Super Puma Mk II VIP: New eight to 15-passenger arrangement with attendant and fully equipped galley and toilet, two four-seat lounges, fine materials and fittings throughout; range with [illegible] tendant, 635 n miles (1,176 km; 730 miles). First delivery 28 August 1993

AS 532U2 Cougar Mk II: Unarmed military utility transport, longest member of Cougar family; carries 29 troops and two-man crew

AS 532A2 Cougar Mk II: Armed version, first order by French Air Force for combat SAR, 1995

CUSTOMERS: Launch civil customer Bristow Helicopters order for 20 in abeyance in late 1993, Helikopter Service ordered four firm AS 332L Mk II plus eight on option in May 1992. RNethAF ordered 17 AS 532U2s October 1993, Turkey ordered 20 AS 532U2s October 1993, Service Flight Corporation of Vietnam ordered two AS 332L2s in May 1994, first delivered in December 1994, second [illegible] delivery in May 1995

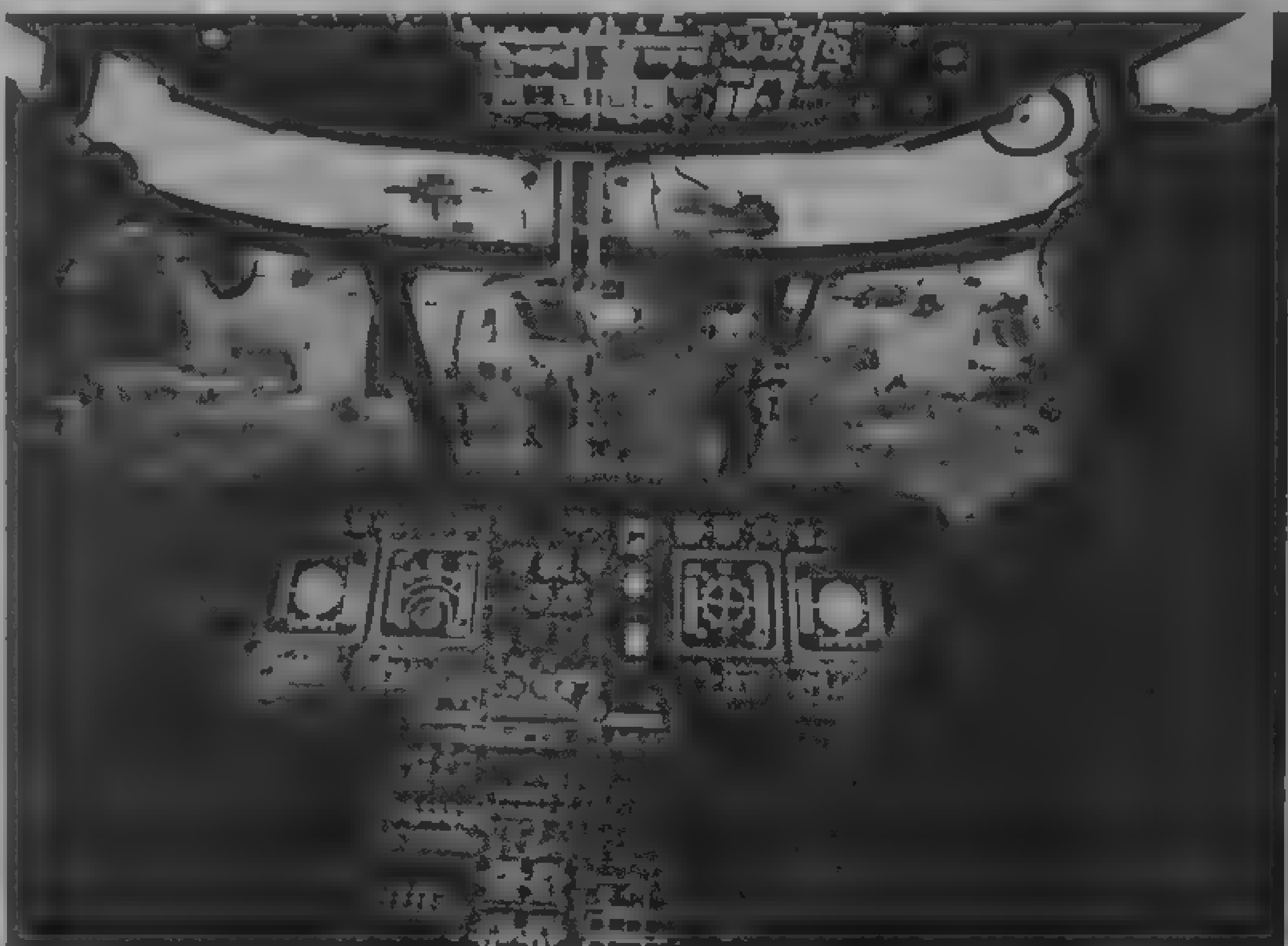
COSTS: 17 Netherlands AS 532U2 cost FFr1.4 billion, plus 120 per cent offset and technology offset over [illegible] years. 20 Turkish AS 532U2 cost $253 million, with 60 per cent offset mainly in aerospace industry

DESIGN FEATURES: Gross weight increased by 150 kg (331 lb) in 1993, composites plug in rear cabin area accommodates one extra row of seats and moves tail rotor rearwards. Spheriflex main and tail rotor heads with elastomeric spherical bearings and Kevlar retention bands, main rotor with longer blades having parabolic tips, standard enlarged composites sponsons can contain fuel, liferafts, air conditioning and pop-out floats

FLYING CONTROLS: Fully powered hydraulically actuated with SFIM 165 four-axis digital AFCS and coupler

STRUCTURE: Rear fuselage 55 cm (1 ft 9½ in) plug made of composites giving extra row of seats, large windows at rear of cabin, increased use of composites compared with Mk I, fuselage frames strengthened to retain same degree of crashworthiness

LANDING GEAR: Retractable tricycle high-impact absorbing landing gear, hydraulic retraction rearward, single mainwheels partially into sponsons and twin nosewheels into [illegible] centring nosewheels, mainwheel brakes



Flight deck of Eurocopter AS 532U2 Cougar Mk II showing EFIS flight instruments backed by integrated digital avionics, flight management system and duplex four-axis autopilot

1994

POWER PLANT: Two Turbomeca Makila 1A2 rear drive free turbines; maximum emergency power each (OEI 30 seconds), 1,573 kW (2,109 shp) 12 per cent higher than AS 332 Mk I intermediate emergency power (OEI two minutes) 1,467 kW (1,967 shp), take-off power 1,376 kW (1,845 shp), maximum continuous power 1,236 kW (1,657 shp) protective intake grilles standard, optional Centrisep multipurpose intakes for dusty conditions. Transmission ratings: twin-engined maximum 2,410 kW (3,229 hp), maximum from single engine 1,666 kW (2,232 hp), maximum transient 20 seconds 2,651 kW (3,552 hp), maximum continuous 1,555 kW (2,084 hp), transmission has extended run-dry capability

Standard fuel tankage under cabin floor 2,020 litres (535 US gallons, 444 Imp gallons), auxiliary tankage includes 324 litres (85 US gallons, 71.3 Imp gallons) in cargo hook well; sponson tanks each holding 325 litres (86 US gallons, 71.5 Imp gallons); 600 litres (159 US gallons, 132 Imp gallons) in cabin fuel tank, one to five internal ferry tanks each holding 475 litres (126 US gallons, 104.5 Imp gallons). Optional tankage (when crashproofing is fitted) 1,919 litres (507 US gallons, 422 Imp gallons); hook well tank 320 litres (84 US gallons; 70.4 Imp gallons); 325 litres (86 US gallons, 71.5 Imp gallons) in each sponson tank, crashproofing is standard in AS 532 and optional in 332, pressure refuelling optional

ACCOMMODATION: Single pilot in DGAC Category B civil operation, single pilot plus licensed crewman in Category A VFR, two pilots in IFR, military operation one pilot in VFR, two in IFR, civil transport 24 passengers and attendant in airline interior for 220 n miles (408 km, 253 miles) or 19 passengers at 81 cm (32 in) seat pitch for 350 n miles (648 km, 403 miles), military capacity, squad chief plus 28 troops, VIP version for eight to 15 passengers plus attendant, ambulance version holds 12 stretchers and four seated casualties plus attendant

SYSTEMS: Standard electrical system

AVIONICS: *Instrumentation:* Civil and military cockpits have EFIS consisting of four 15 × 15 cm (6 × 6 in) displays; military cockpit compatible with night vision goggles; civil and military IFR system offered, plus military communications radio, SAR system includes radar and FLIR coupled to display system as well as navigation computer with Doppler and GPS sensors, SAR system can include automatic search pattern, transition and hover hold.

EQUIPMENT: Pop-out floats, rescue winch, external sling

ARMAMENT: Armament choice as for AS 532A Cougar Mk I except for Exocet and two rocket pods

DIMENSIONS, EXTERNAL:

Main rotor diameter	16.20 m (53 ft 1½ in)
Tail rotor diameter	3.15 m (10 ft 4 in)
Length overall: rotors turning	19.50 m (63 ft 11 in)
main rotor folded	16.79 m (55 ft 0½ in)
Width: over sponsons	3.38 m (11 ft 1 in)
overall, main rotor folded	3.86 m (12 ft 8 in)
Height: overall, tail rotor turning	4.97 m (16 ft 4 in)
to top of rotor head	4.60 m (15 ft 1 in)
Tailplane span	2.17 m (7 ft 1½ in)
Wheel track	3.00 m (9 ft 10 in)
Wheelbase	5.28 m (17 ft 4 in)
Sliding cabin doors, each: Height	1.35 m (4 ft 5 in)
Width	1.30 m (4 ft 3¼ in)
Floor hatch: Length	0.98 m (3 ft 2¾ in)
Width	0.70 m (2 ft 3½ in)

DIMENSIONS, INTERNAL:

Cabin: Max length	7.87 m (25 ft 10 in)
Floor length	6.15 m (20 ft 2¼ in)
Max width	1.80 m (5 ft 10¼ in)
Max height	1.45 m (4 ft 9 in)

AREAS:

Main rotor disc	206.0 m² (2,217.4 sq ft)
Tail rotor disc	7.79 m² (83.88 sq ft)

Eurocopter AS 350B2 high-altitude Ecureuil of California operator Helistar Inc

1995

WEIGHTS AND LOADINGS:

Manufacturer's weight empty: L2	4,660 kg (10,274 lb)
U2	4,760 kg (10,493 lb)
Useful load: L2	4,640 kg (10,229 lb)
U2	4,990 kg (11,000 lb)
Standard fuel weight: L2	1,596 kg (3,519 lb)
U2, crashworthy tanks	1,548 kg (3,412 lb)
Max normal T-O weight: L2	9,300 kg (20,502 lb)
U2	9,750 kg (21,495 lb)
Max slung load: L2/U2	4,500 kg (9,920 lb)
Max flight weight with slung load,	
L2/U2	10,000 kg (22,046 lb)
Max disc loading, normal T-O weight	
L2	44.4 kg/m² (9.10 lb/sq ft)
U2	47.3 kg/m² (9.69 lb/sq ft)
Max two-engine transmission power loading	
L2	3.79 kg/kW (6.24 lb/shp)
U2	4.04 kg/kW (6.66 lb/shp)

PERFORMANCE:

Never-exceed speed (V_{NE})	
L2/U2	177 kts (327 km/h, 203 mph)
Fast cruising speed: L2	150 kts (277 km/h, 172 mph)
U2	147 kts (273 km/h, 170 mph)
Econ cruising speed: L2	133 kts (247 km/h, 154 mph)
U2	131 kts (242 km/h, 150 mph)
Rate of climb at 70 kts (130 km/h, 81 mph) at S/L:	
L2	441 m (1,447 ft)/min
U2	384 m (1,260 ft)/min
Service ceiling (45.7 m, 150 ft/min climb), ISA	
L2	5,180 m (16,995 ft)
U2	4,100 m (13,451 ft)
Hovering ceiling IGE, normal T-O weight, ISA, T-O power: L2	2,900 m (9,414 ft)
U2	2,540 m (8,333 ft)
Hovering ceiling OGE, normal T-O weight, ISA, T-O power: L2	2,250 m (7,382 ft)
U2	1,900 m (6,234 ft)
Hovering ceiling OGE, slung load weight, ISA, T-O power: L2/U2	380 m (1,247 ft)
Range, no reserves, standard fuel, econ cruise	
L2	460 n miles (851 km, 529 miles)
U2	430 n miles (796 km, 494 miles)
Range, no reserves, max fuel, econ cruise	
L2	805 n miles (1,491 km, 927 miles)
U2	635 n miles (1,176 km, 730 miles)
Endurance, standard fuel, at 70 kts (130 km/h, 81 mph)	
L2	4 h 54 min
U2	4 h 20 min

UPDATED

EUROCOPTER SA 342 GAZELLE

TYPE: Five-seat light utility helicopter

PROGRAMME: First flight 7 April 1967, powered by Astazou III fixed-shaft turbine, earlier versions detailed in 1979-80, 1984-85 and 1991-92 *Jane's*

CUSTOMERS: Total 1,255 SA 341/342 Gazelles ordered and delivered from French production to 40 countries and 29 armed forces. Production complete but available to order

UPDATED

EUROCOPTER AS 350 ECUREUIL/ASTAR and AS 550 FENNEC

Brazilian Air Force designations: CH-50 and TH-50 Esquilo

Brazilian Army designation: HA-1 Esquilo

Brazilian Navy designation: UH-12 Esquilo

TYPE: Five/six-seat light general purpose helicopter

PROGRAMME: First flight (F-WVKH) powered by Lycoming LTS101 turboshaft 27 June 1974, first flight second prototype (F-WVKI) powered by Turbomeca Arriel 14 February 1975, first production version was AS 350B powered by 478 kW (641 shp) Arriel 1B and certificated 27 October 1977, LTS101 powered AStar sold only in USA

CURRENT VERSIONS: **AS 350BA Ecureuil:** Powered by 478 kW (641 shp) Turbomeca Arriel 1B and fitted with large main rotor blades of AS 350B2 (see below), maximum T-O weight increased by 150 kg (331 lb); AS 350B can be upgraded to AS 350BA in field, replaced AS 350B during 1992; French VFR certification 1991; UK and US certifications 1992, Japanese 1993

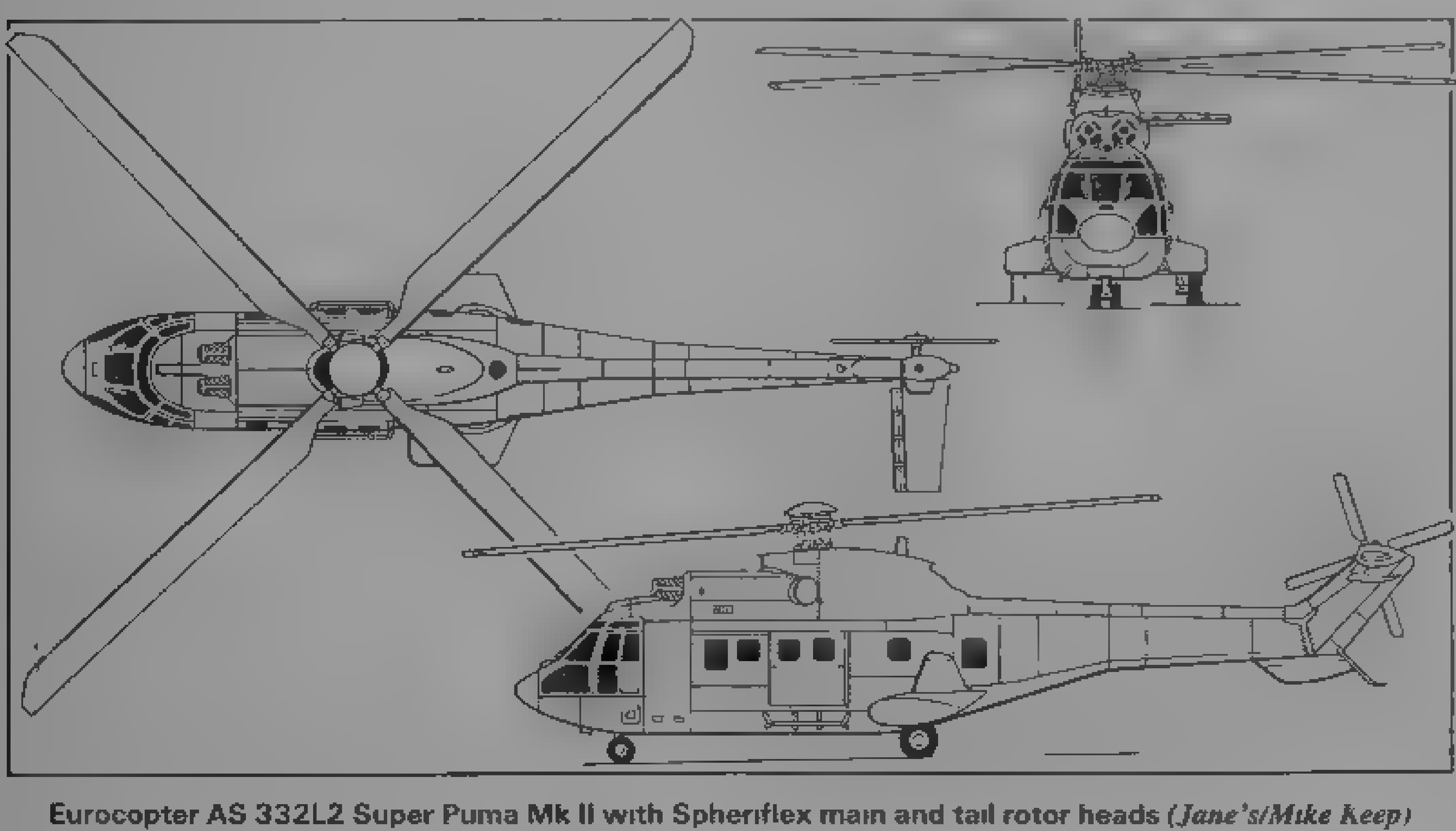
AS 350B2 Ecureuil: Powered by 546 kW (732 shp) Arriel 1D1 and with transmission uprated to 440 kW (590 shp); wide-chord new section main and tail rotor blades originally developed for AS 355 twin, certificated 26 April 1989; known as **SuperStar** in North America

AS 350B3 Ecureuil. New variant; 612 kW (820 shp) Arriel 2 and wide-chord tail rotor

AS 350D AStar: Version of 350B for North American market, LTS101 engine

AS 350 Firefighter: Conair system able to pick up water load in 30 seconds while hovering over water; demonstrated 1986, Isolair system demonstrated end 1992.

AS 550 Fennec: Military version of AS 350B2 powered by 546 kW (732 shp) Arriel 1D1, standard features include taller landing gear, sliding doors, NVG-compatible cockpit, reinforced airframe, provision for armoured seats, individual versions include utility **AS 550U2**, armed **AS 550A2**, missile-armed **AS 550C2**, unarmed naval **AS 550M2**, armed naval **AS 550S2** and Arriel 2 powered **AS 550A3** and anti-tank **AS 550C3**

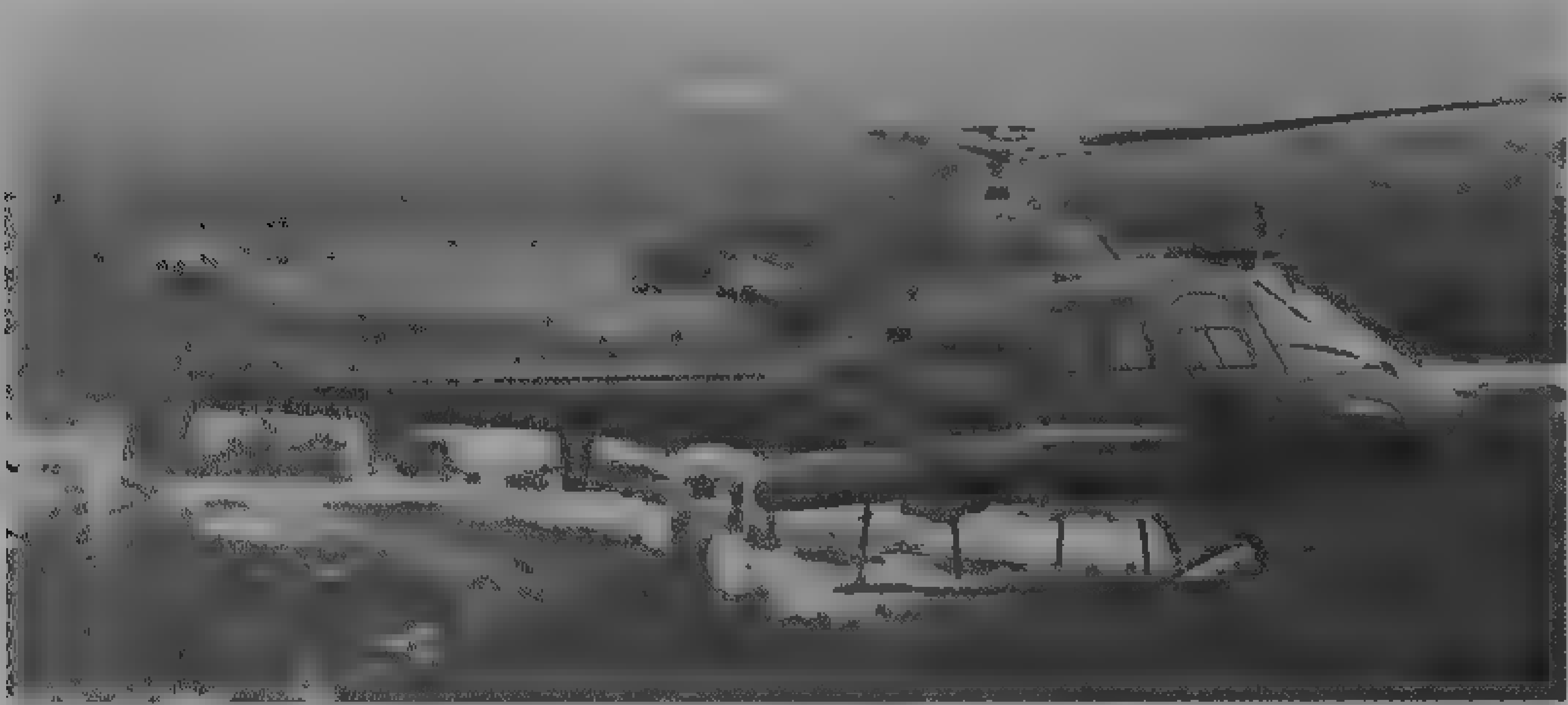


Eurocopter AS 332L2 Super Puma Mk II with Spheriflex main and tail rotor heads *(Jane's/Mike Keep)*

1991

Eurocopter AS 350BA exported to Japan

1995



Armed Eurocopter AS 550A3 single-engined Fennec with Arriel 2 engine

1995

CUSTOMERS: Total 1,850 AS 350s of all types ordered from 62 countries by 1 January 1995, 1,816 then delivered; 56 single-engined Ecureuil/Fennec ordered during 1994.

Military customers include Singapore armed forces (six), Australia (RAAF 18 for training, RAN six utility), Danish Army (12 AS 550C2 with ESCO HeliTOW system ordered 1987, delivered 1990), French Army ALAT (originally expressed need for up to 100 to replace Alouette IIs), French CEV (flight test centre). Built under licence by Helibras in Brazil (which see).

DESIGN FEATURES: Starflex bearingless glassfibre main rotor head; all versions now have lifting section composite main rotor blades. Main rotor turns at 394 rpm, tail rotor at 2,086 rpm.

FLYING CONTROLS: Single fully powered controls with accumulators to delay manual reversion following hydraulic failure until airspeed can be reduced; cyclic trim by adjustable stick friction; inverted aerofoil tailplane to adjust pitch attitude in climb, cruise and descent; saucer fairing on rotor head to smooth wake; swept fins above and below tail. Variety of autostabilisers and autopilots available (see Avionics).

STRUCTURE: Main rotor head and much of airframe of glassfibre and aramids; main rotor blades automatically manufactured in composites; self sealing composites fuel tank in military versions.

LANDING GEAR: Steel tube skid type. Taller version standard on military aircraft. Emergency flotation gear optional.

POWER PLANT: AS 350BA powered by one 478 kW (641 shp) Turbomeca Arriel 1B. AS 350B2/550 powered by one 546 kW (732 shp) Turbomeca Arriel 1D1. AS 350D powered by AlliedSignal LTS101 sold only in USA. Plastics fuel tank (self-sealing on AS 550) with capacity of 540 litres (142.6 US gallons; 119 Imp gallons).

ACCOMMODATION: Two individual bucket seats at front of cabin and four place rear bench standard, optional ambulance layout; large forward hinged door on each side of versions for civil use, optional sliding door at rear of cabin on port side (sliding doors standard on military version); baggage compartment aft of cabin, with full-width upward-hinged door on starboard side, top of baggage compartment reinforced to provide work platform on each side.

SYSTEMS: Hydraulic system includes four single-body servo units, operating at 40 bars (570 lb/sq in) pressure, and accumulators to delay reversion to manual control; electrical system includes a 4.5 kW engine-driven starter/generator, a 24 V 16 Ah Ni/Cd battery and a ground power receptacle; cabin air conditioning system optional.

AVIONICS: *Comms*: VHF/AM radios, HF/SSB transponder and ICS.

Flight: VOR/ILS, ADF, marker beacon receiver and DME. SFIM PA 85T31 (IFR), Honeywell HelCis or Collins APS-841H autopilot.

EQUIPMENT: Includes 907 kg (2,000 lb) capacity cargo sling (1,160 kg; 2,557 lb for AS 350B2/550), a 135 kg (297 lb) capacity electric hoist, a TV camera for aerial filming, and a 735 litre (194 US gallon; 161 Imp gallon) Simplex agricultural spraytank and boom system.

ARMAMENT (AS 550): Provision for wide range of weapons, including 20 mm Giat M621 gun, FN Herstal TMP twin 7.62 mm machine gun pods, Thomson Brandt 68.12 launchers for twelve 68 mm rockets, Forges de Zeebrugge launchers for seven 2.75 in rockets, and ESCO HeliTOW anti-tank missile system.

DIMENSIONS, EXTERNAL:

Main rotor diameter	10.69 m (35 ft 0¾ in)
Main rotor blade chord: AS 350BA/D	0.30 m (11¾ in)
AS 350B2/550	0.35 m (13¾ in)
Tail rotor diameter	1.86 m (6 ft 1¼ in)
Tail rotor blade chord: AS 350BA/D	0.185 m (7¼ in)
AS 350B2/550	0.205 m (8 in)
Length: overall, rotors turning	12.94 m (42 ft 5½ in)
fuselage	10.93 m (35 ft 10½ in)
Width: fuselage	1.80 m (5 ft 10¾ in)
overall, blades folded (that is, horizontal stabiliser span)	2.53 m (8 ft 3¾ in)
Height overall: AS 350BA/B2/D	3.14 m (10 ft 3½ in)
AS 550	3.34 m (10 ft 11½ in)
Skid track: AS 350BA/B2/D	2.17 m (7 ft 1½ in)
AS 550	2.28 m (7 ft 5¾ in)
Cabin doors (civil versions, standard, each):	
Height	1.15 m (3 ft 9¼ in)
Width	1.10 m (3 ft 7¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.42 m (7 ft 11¼ in)
Width at rear	1.65 m (5 ft 5 in)
Height	1.35 m (4 ft 5 in)
Baggage compartment volume	1.00 m³ (35.31 cu ft)

AREAS:

Main rotor disc	89.75 m² (966.1 sq ft)
Tail rotor disc	2.72 m² (29.25 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: AS 350BA	1,146 kg (2,526 lb)
AS 350B2	1,153 kg (2,542 lb)
AS 350D	1,123 kg (2,475 lb)
AS 550	1,220 kg (2,689 lb)
Max T-O weight: AS 350BA	2,100 kg (4,630 lb)
AS 350B2/550	2,250 kg (4,960 lb)
AS 350D	1,950 kg (4,300 lb)
Max weight with slung load:	
AS 350BA	2,250 kg (4,960 lb)
AS 350D	2,100 kg (4,630 lb)
Max disc loading: AS 350BA clean, D with slung load	23.40 kg/m² (4.79 lb/sq ft)
AS 350BA with slung load, AS 350B2/550 clean	25.07 kg/m² (5.13 lb/sq ft)

PERFORMANCE (AS 350BA/D at normal T-O weight, AS 350B2/550 at 2,200 kg; 4,850 lb):

Never-exceed speed (VNE) at S/L:	
AS 350BA/B2/550	155 kts (287 km/h; 178 mph)
AS 350D	147 kts (272 km/h; 169 mph)
Max cruising speed at S/L:	
AS 350BA	126 kts (234 km/h; 145 mph)
AS 350B2/550	133 kts (246 km/h; 153 mph)
AS 350D	124 kts (230 km/h; 143 mph)
Max rate of climb at S/L:	
AS 350BA	456 m (1,500 ft)/min
AS 350B2/550	534 m (1,750 ft)/min
Service ceiling: AS 350BA/B2/550	4,800 m (15,750 ft)
Hovering ceiling OGE: AS 350BA	1,980 m (6,500 ft)
AS 350B2/550	2,550 m (8,350 ft)
Range with max fuel at recommended cruising speed, no reserves:	
AS 350BA	394 n miles (730 km; 453 miles)
AS 350B2/550	360 n miles (666 km; 414 miles)

UPDATED

EUROCOPTER AS 355 ECUREUIL 2 TWINSTAR and AS 555 FENNEC

Brazilian Air Force designations: CH-55 and VH-55 Esquilo

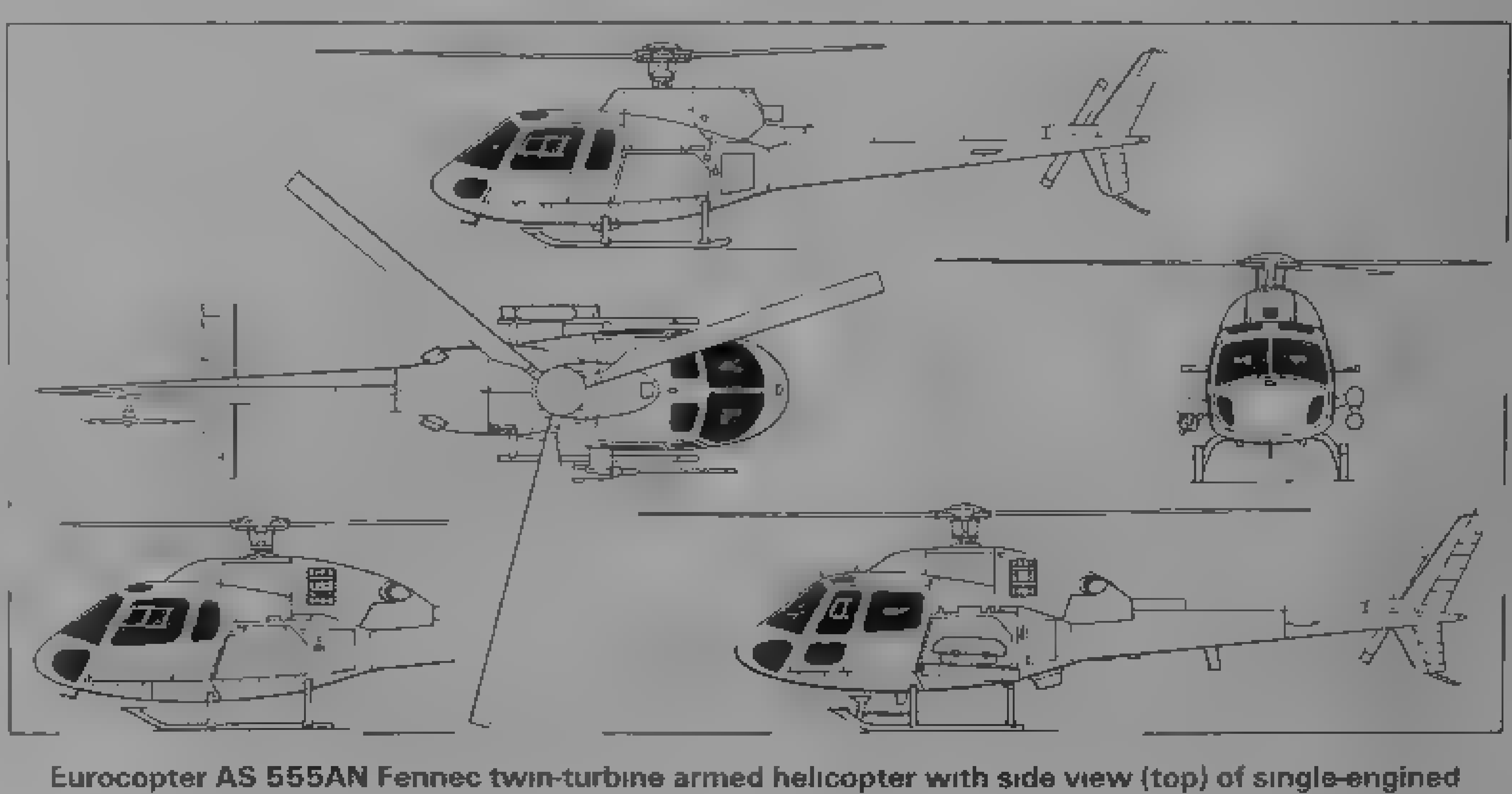
Brazilian Navy designation: UH-12B Esquilo

TYPE: Twin-turbine light general purpose helicopter.

PROGRAMME: First flight of first prototype (F-WZLA) 28 September 1979; details of early production AS 355E/F versions in 1984-85 *Jane's*; AS 355F superseded by AS 355F1 in January 1984; AS 355F2 certificated 10 December 1985; AS 355N powered by two Turbomeca TM 319 Arrius certificated in France in 1989, UK and USA in 1992; deliveries of this version began early 1992.

CURRENT VERSIONS: All current production AS 355 Ecureuil 2/555 Fennec are powered by two Turbomeca TM 319 Arrius turboshafts.

AS 355N Ecureuil 2: Current civil production version, adaptable for passengers, cargo, police, ambulance, slung



Eurocopter AS 555AN Fennec twin-turbine armed helicopter with side view (top) of single-engined AS 350BA Ecureuil and scrap view (bottom) of AS 355N civil twin *(Jane's/Dennis Punnett)*

1985

Eurocopter AS 355N of the Metropolitan Police Force, London

1995

loads, carrying harbour pilots, working on high tension cables and other missions, Category A OEI performance known as **TwinStar** in USA. *Details refer to this version except where stated*

AS 555UN Fennec: Military utility version and French Army ALAT IFR pilot trainer

AS 555AN Fennec: Armed version; later machines adapted for centreline-mounted 20 mm gun and pylon-mounted rockets

AS 555CN Fennec: Missile armed version, which was under development in 1992

AS 555MN Fennec: Naval unarmed version. Can carry a 360° chin-mounted radar

AS 555SN Fennec. Armed naval version for ASW and over-the-horizon targeting operating from ships of 600 tonnes upwards, armament includes one lightweight homing torpedo or the cannon and rockets of land-based versions, avionics include Bendix/King RDR-1500B 360° chin-mounted radar, Sextant Nadir 10 navigation system, Dassault Electronique RDN 85 Doppler and SFIM 85 T31 three-axis autopilot.

CUSTOMERS. Total 581 AS 355/555 ordered by 1 January 1995, at which time 551 delivered; 28 ordered in 1994; at least 96 powered by TM 319 Arrius. French Air Force ordered 52 Fennecs, first eight as AS 355F1s powered by Allison 250, flown by 67e Escadre d Hélicoptères at Villacoublay for communications and, with side-mounted Giat M61 20 mm gun pod, by ETOM 68 in Guyana, delivery of remaining 44 (AS 555AN powered by Arrius) began 19 January 1990; from 24th onwards, provision for centrally mounted 20 mm cannon and T 100 sight, plus Mistral missiles, French Army ordered 10 AS 555UNs for IFR training (delivery from February 1992); Brazilian Air Force has 13 AS 555s, 11 with armament designated CH-55 and two VIP transports designated VH 55, Brazilian Navy acquired 11 UH-12Bs; Brazilian AS 555s assembled by Helibras in Brazil (which see); three more navies ordered eight AS 555s in 1992, two in 1993 and four in 1994

DESIGN FEATURES: Starflex main rotor; two engine shafts drive into combiner gearbox containing freewheels, main rotor turns at 394 rpm and tail rotor at 2,086 rpm; otherwise substantially as AS 350

FLYING CONTROLS Powered, full dual flying controls without manual reversion, trim by adjustable stick friction, inverted aerofoil tailplane; swept fins above and below tailboom.

STRUCTURE Light metal tailboom and central fuselage structure, thermoformed plastics for cabin structure.

LANDING GEAR As for AS 350B2/550.

POWER PLANT Two Turbomeca TM 319 1A Arrius turboshafts, each rated at 357 kW (479 shp) for take-off and 302 kW (406 shp) maximum continuous; 379 kW (509 shp) 30 minutes OEI emergency, 407 kW (547 shp) 2.5 minutes OEI emergency; full authority digital engine control (FADEC) allows automatic sequenced starting of both engines, automatic top temperature and torque limiting and preselection of lower limits for practice OEI operation. Two integral fuel tanks, with total usable capacity of 730 litres (193 US gallons, 160 Imp gallons), in body structure

ACCOMMODATION As for single-engined Ecureuil and Fennec

SYSTEMS: As for AS 350B2/550, except two hydraulic pumps reservoirs and tandem powered flying control units and electric generators

AVIONICS Options include a second VHF/AM and radio altimeter; provision for IFR system, SFIM 85 T31 three-axis autopilot and CDV 85 T3 nav coupler

EQUIPMENT: Casualty installations, TV, FLIR, searchlight and winch available. See also current version descriptions

ARMAMENT (AS 555) Optional alternative weapons include Thomson Brandt or Forges de Zeebrugge rocket packs Matra or FN Herstal machine gun pods or a Giat M62 20 mm gun. Naval version carries one homing torpedo in ASW role, or SAR winch

DIMENSIONS EXTERNAL: As for AS 350B2/550

DIMENSIONS INTERNAL: As for AS 350B2/550

WEIGHTS AND LOADINGS

Weight empty 355N	1,382 kg (3,046 lb)
Max sling load 555N	1,134 kg (2,500 lb)
Max T-O weight	
555N, internal load	2,540 kg (5,600 lb)
555N, max sling load	2,600 kg (5,732 lb)

PERFORMANCE (AS 555N at max T-O weight, ISA)

Never-exceed speed (V_{NE})	150 kts (278 km/h, 172 mph)
Max cruising speed at S/L	121 kts (225 km/h, 140 mph)
Max rate of climb at S/L	408 m (1,340 ft)/min
Service ceiling	4,000 m (13,125 ft)
Hovering ceiling: IGE	2,600 m (8,530 ft)
OGE	1,550 m (5,085 ft)

Instrument panel of French Air Force AS 555AN Fennec *(Paul Jackson)*

1995

AS 555MN/SN Fennec naval helicopter with chin-mounted radar and pop-out floats

1994

Radius: SAR, two survivors
70 n miles (129 km; 80.5 m les)
Range with max fuel at S/L, no reserves
389 n miles (722 km; 448 miles)
Endurance, no reserves:
one torpedo, or cannon or rocket pods 2 h 20 min
cannon plus rockets 1 h 50 min

5.00-4, pressure 5.5 bars (80 lb/sq in); hydraulic disc brakes

POWER PLANT: Two Turbomeca Arriel 1C2 turboshafts, each rated at 551 kW (739 shp) for T-O and 471 kW (631 shp) maximum continuous, mounted side by side aft of transmission with stainless steel firewall between them. Standard fuel in four tanks under cabin floor and fifth tank in bottom of centre-fuselage, total capacity 1,135 litres (300 US gallons, 249.5 Imp gallons), provision for auxiliary tank in baggage compartment, with capacity of 180 litres (47.5 US gallons, 39.5 Imp gallons), or ferry tank in place of rear seats in cabin, capacity 475 litres (125.5 US gallons, 104.5 Imp gallons); refuelling point above landing gear door on port side. Oil capacity 14 litres (3.7 US gallons; 3.1 Imp gallons)

ACCOMMODATION: Standard accommodation for pilot and co-pilot or passenger in front, and two rows of four seats to rear; high density seating for one pilot and 12 passengers. VIP configurations for four to six persons in addition to pilot, three forward-opening doors on each side; freight hold aft of cabin rear bulkhead, with door on starboard side; cabin heated and ventilated

SYSTEMS: Air conditioning system optional. Duplicated hydraulic system, pressure 60 bars (870 lb/sq in). Electrical system includes two 4.8 kW starter/generators, one 24 V 27 Ah battery and two 250 VA 115 V 400 Hz inverters

AVIONICS: *Comms*: Optional transponder

Radar: Optional weather radar

Flight: SFIM 155 duplex autopilot, optional VOR, ILS, ADF, DME, GPS and SFIM CDV 85 autopilot coupler

Instrumentation: Two-pilot IFR instrument panel, optional EFIS

EQUIPMENT: Includes 1,600 kg (3,525 lb) capacity cargo hook, and 275 kg (606 lb) capacity hoist with 90 m (295 ft) cable

DIMENSIONS, EXTERNAL:

Main rotor diameter	11.94 m (39 ft 2 in)
Fenestron diameter	1.10 m (3 ft 7¼ in)
Main rotor blade chord: basic	0.385 m (1 ft 3¼ in)
outboard of tab	0.405 m (1 ft 4 in)
Length: overall, rotor turning	13.68 m (44 ft 10½ in)
fuselage	11.63 m (38 ft 2 in)
Width, rotor blades folded	3.21 m (10 ft 6⅜ in)
Height: to top of rotor head	3.52 m (11 ft 6½ in)
overall (tip of fin)	3.98 m (13 ft 0¾ in)

UPDATED

EUROCOPTER AS 365N2 DAUPHIN 2

US Coast Guard designation: HH-65A Dolphin

Israel Defence Force name: Dolpheen

TYPE: Twin-turbine commercial general purpose helicopter.

PROGRAMME: Certificated for VFR in France November 1989; 500th Dauphin (all versions) delivered in November 1991 was 83rd AS 365N2.

CURRENT VERSIONS: **AS 365N2 Dauphin 2**: Current production model. *Details below refer to this version.*

AS 366G1 (HH-65A Dolphin): US Coast Guard version (99 built, plus two ex-trials aircraft bought for evaluation by Israel as Dolpheen); trial installation of 895 kW (1,200 shp) LHTEC T800 turboshaft ordered February 1990 but abandoned November 1991 when LTS101 performance promised to improve; re-engining with French Arriels also declined. For description see 1991-92 and earlier *Jane's*.

AS 565UA/AA Panther: Army versions; described separately.

AS 565MA/SA Panther: Naval versions; described separately.

Ambulance/EMS: Flight crew of two plus two or four stretchers along cabin sides loaded through rear doors; up to four seats can replace stretchers on one side; doctor sits in middle with equipment; rear doors open through 180° instead of sliding.

Offshore support: Pilot plus up to 12 passengers, autopilot and navigation systems, pop-out floats.

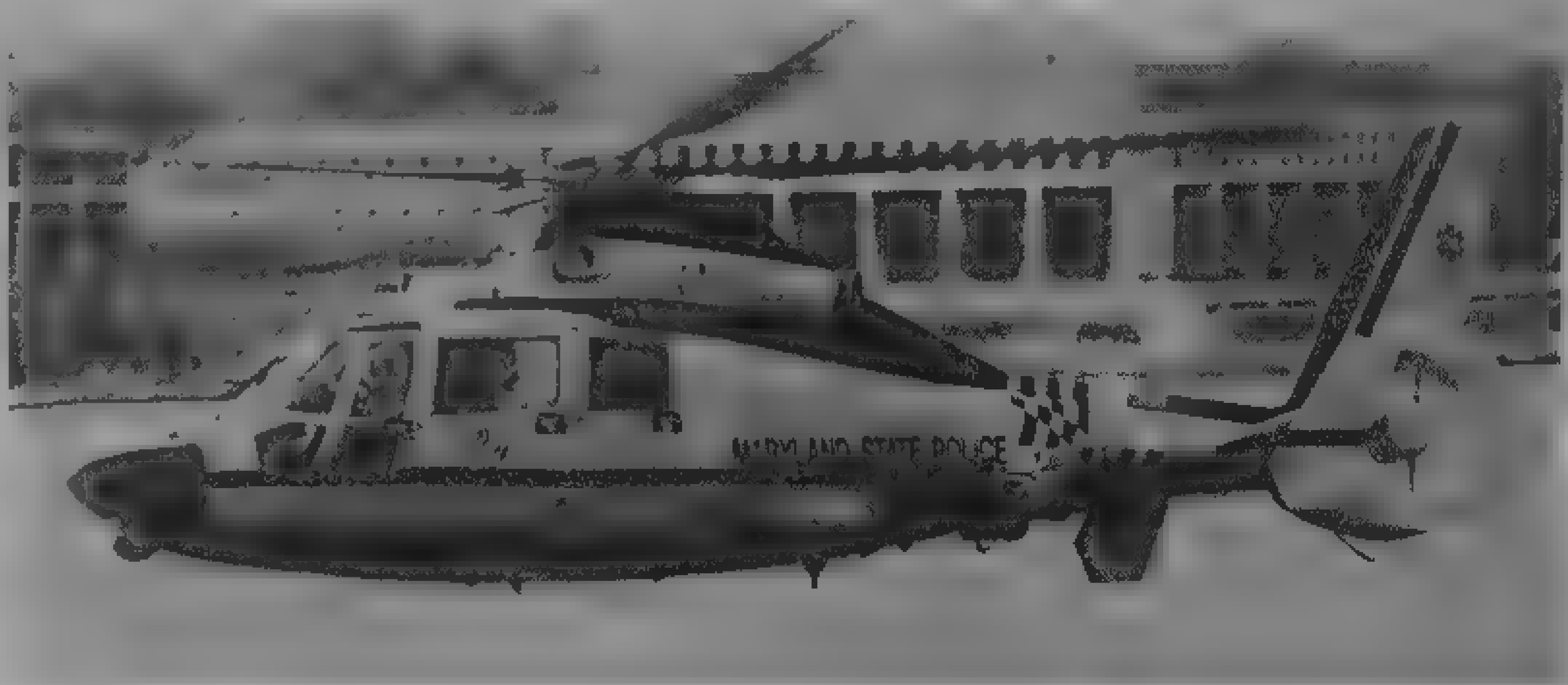
CUSTOMERS: Total 591 AS 365/366/565 ordered for civil and military use from 48 countries by 1 January 1995, of which 553 then delivered. 15 ordered in 1994; totals include 50 produced as Harbin Z-9/9A in China and 101 as HH-65A Dolphin US Coast Guard versions; Chinese production (which see) continuing as Z-9A-100.

DESIGN FEATURES: Starflex main rotor hub; 11-blade Fenestron; main rotor blades have quick disconnect pins for manual folding; ONERA OA 212 (thickness/chord ratio 12 per cent) at root to OA 207 (thickness/chord ratio 7 per cent) at tip; adjustment tab near tip; leading edge of tip swept at 45°; main rotor rpm 350, Fenestron rpm 3,665; rotor brake standard.

FLYING CONTROLS: Hydraulic dual fully powered, cyclic trim by adjustable stick friction damper; fixed tailplane, with endplate fins offset 10° to port. IFR systems available.

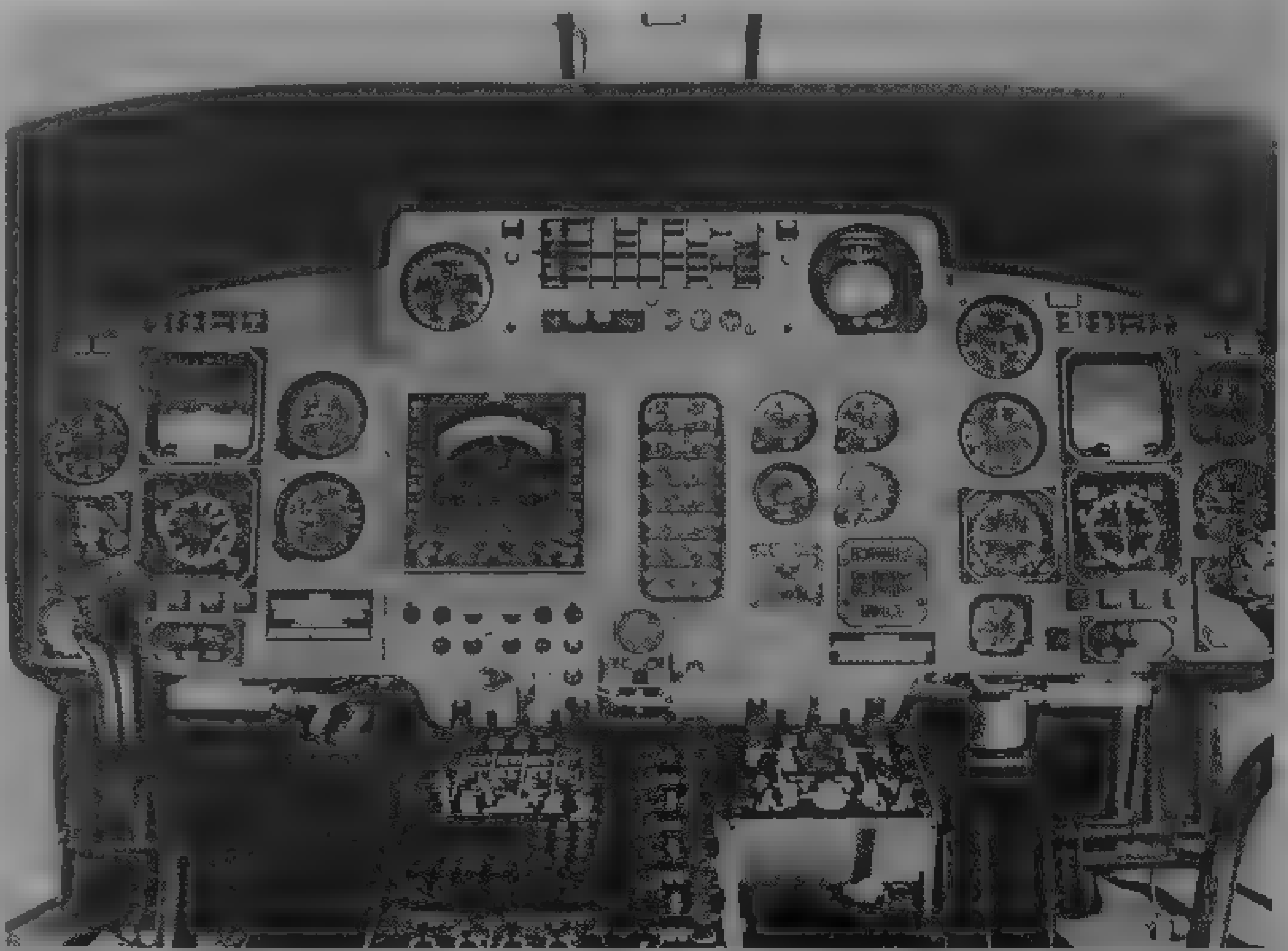
STRUCTURE: Mainly light alloy; machined frames fore and aft of transmission support; main rotor blades have CFRP spar and skins with Nomex honeycomb filling. Fenestron duct and fin of CFRP and Nomex/Rohacell sandwich; nose and power plant fairings of GFRP/Nomex sandwich; centre and rear fuselage assemblies, flight deck floor, roof, walls and bottom skin of fuel tank bays of light alloy/Nomex sandwich.

LANDING GEAR: Hydraulically retractable tricycle type, twin-wheel self centring nose unit retracts rearward, single wheel on each main unit; main legs retract into troughs in fuselage without cover doors; all three units have oleo-pneumatic shock absorber; mainwheel tyres size 15 × 6.00, pressure 8.6 bars (125 lb/sq in); nosewheel tyres size



Eurocopter AS 365N2 Dauphin of Maryland State Police, with radar and FLIR in nose, searchlight and hoist

1995



AS 365N2 Dauphin optional avionics. Collins Pro Line II-based EFIS plus Bendix/King RDR 1400C weather radar, Racal R-NAV2 and Trimble GPS

1995

Wheel track 1.90 m (6 ft 2¾ in)
Wheelbase 3.61 m (11 ft 10¼ in)
Main cabin door (fwd, each side):
Height 1.16 m (3 ft 9 in)
Width 1.14 m (3 ft 9 in)
Main cabin door (rear, each side):
Height 1.16 m (3 ft 9 in)
Width 0.87 m (2 ft 10 in)
Baggage compartment door (stbd):
Height 0.51 m (1 ft 8 in)
Width 0.73 m (2 ft 4¾ in)
DIMENSIONS, INTERNAL:
Cabin: Length 2.30 m (7 ft 6 in)
Max width 1.92 m (6 ft 3½ in)
Max height 1.40 m (4 ft 7 in)
Floor area 4.20 m² (45.20 sq ft)
Volume 5.00 m³ (176 cu ft)
Baggage compartment volume 1.00 m³ (35.3 cu ft)
AREAS:
Main rotor disc 111.9 m² (1,204.5 sq ft)
Fenestron disc 0.95 m² (10.23 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 2,256 kg (4,974 lb)
Max T-O weight:
internal or external load 4,250 kg (9,370 lb)
Max disc loading 37.9 kg/m² (7.78 lb/sq ft)
PERFORMANCE (at max T-O weight):
Never-exceed speed (VNE) at S/L
160 kts (296 km/h, 184 mph)
Max cruising speed at S/L 154 kts (285 km/h, 177 mph)
Econ cruising speed at S/L 140 kts (260 km/h; 161 mph)
Max rate of climb at S/L 420 m (1,379 ft)/min
Service ceiling 4,300 m (14,100 ft)
Hovering ceiling: IGE 2,550 m (8,365 ft)
OGE 1,800 m (5,905 ft)
Max range with standard fuel at S/L
484 n miles (897 km, 557 miles)
Endurance with standard fuel 4 h

UPDATED

EUROCOPTER AS 565 PANTHER (ARMY/AIR FORCE)

Brazilian Army designation: HM-1

TYPE: Unarmed and armed army/air force versions of AS 365N2 Dauphin 2.

PROGRAMME: First flight of AS 365M Panther (F-WZJV) 29 February 1984, first shown in production form 30 April 1986, armament integration and firing trials completed late 1986.

CURRENT VERSIONS: **AS 565UA**: Utility version; high-speed assault transport for eight to 10 troops with two crewmen over radius of 215 n miles (400 km, 248 miles); other roles include reconnaissance, aerial command post, electronic warfare, target designation, search and rescue, four-stretcher casevac and slung loads up to 1,600 kg (3,525 lb).

AS 565AA: Armed version; fuselage outriggers can carry two packs of 22 Thomson Brandt 68 mm rockets, two launchers for 19 Forges de Zeebrugge 2.75 in rockets, two Giat M621 20 mm gun pods with 180 rounds each, or four two-round packs of Mistral air-to-air missiles.

AS 565 Panther 800: Version fitted with two LHTEC T800s and IBM integrated avionics offered to US Army as UH-1H successor by Eurocopter and Vought Aircraft; first hover 24 March 1992, first flight 12 June; competition undecided.

CUSTOMERS: First order 36 AS 565AAs for Brazilian IBAvEx (Army Aviation Branch) at Taubaté delivered from 1989.

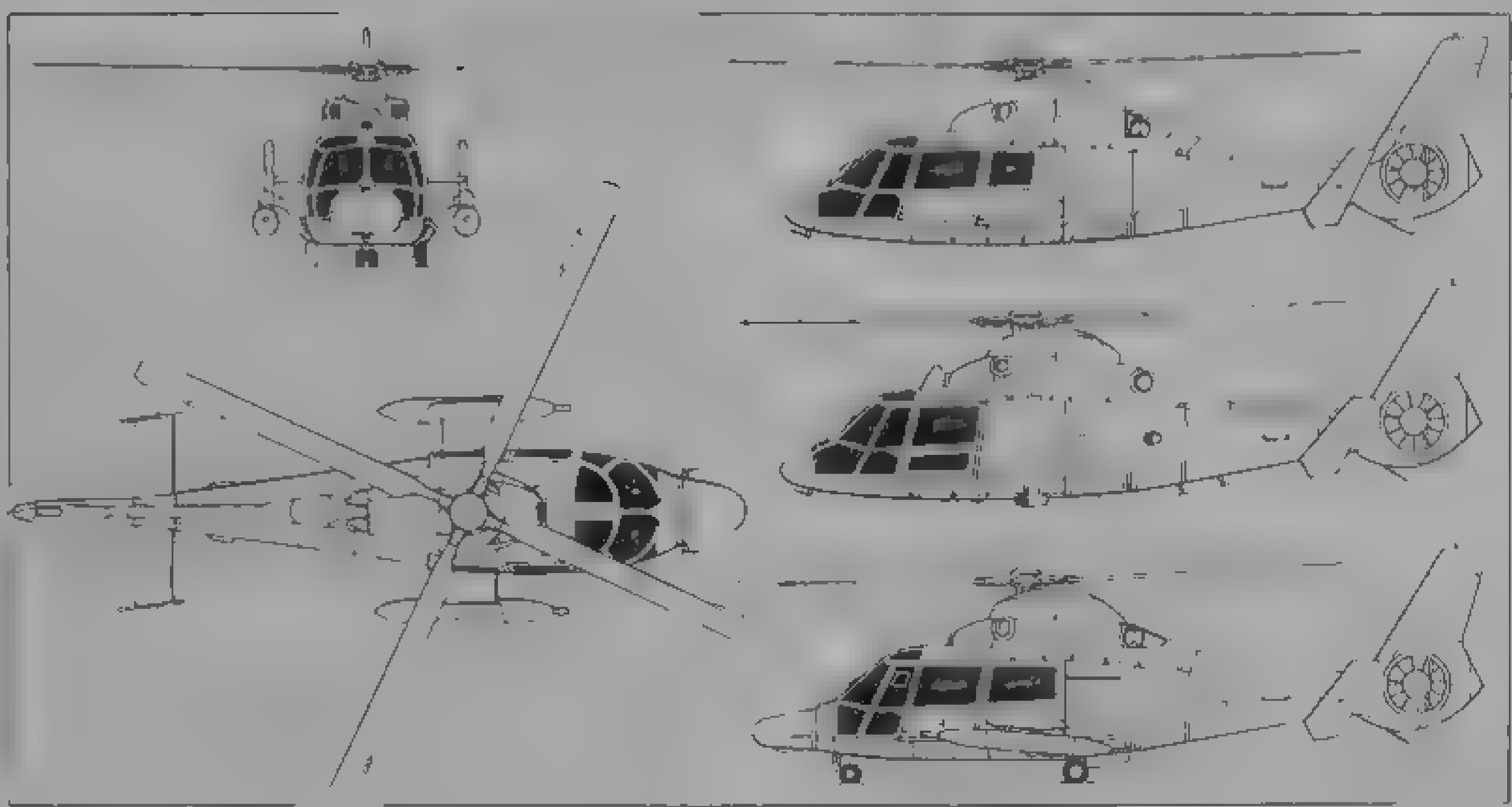
DESIGN FEATURES: As AS 365N2, but with greater use of composite materials and greater emphasis on survivability in combat areas; radar and IR signatures reduced by composites and special paints; noise signature low; powered control servos and engine controls armoured, cable cutters, run-dry transmission, crew seats tolerate 20 g; entire basic airframe designed to withstand vertical impact at 7 m (23 ft)/s at maximum T-O weight.

Eurocopter AS 365N2 Dauphin 2 of Mexican operator ASESA

1995

Eurocopter AS 565AA Panther for Brazilian Army

1994



Eurocopter AS 565AA Panther with side views (centre) of AS 366 HH-65A Dolphin and (top) AS 365N2 Dauphin (*Jane's/Dennis Punnett*)

1985

FLYING CONTROLS: As AS 365N2.

POWER PLANT: Two Turbomeca Arriel 1M1 turboshafts; maximum ratings (each) are contingency 584 kW (783 shp), take-off 558 kW (749 shp) and continuous 487 kW (653 shp). FADEC gives automatically sequenced engine starting, full protection from excess temperature and torque, anticipated engine acceleration and selectable torque/temperature limits for training. Fuel system withstands 14 m (46 ft)/s crash and tanks self-seal.

AVIONICS: *Comms*: Military communications radios.

Nav: Sextant Avionique self-contained navigation system.

Self defence: Optional Thomson-CSF TMV 011 Sherlock RWR, IR jammer and chaff/flare dispenser.

DIMENSIONS, EXTERNAL: As for AS 365N2, except:
Length of fuselage 12.11 m (39 ft 8¾ in)
WEIGHTS AND LOADINGS:
Weight empty 2,255 kg (4,971 lb)
Max sling load 1,600 kg (3,527 lb)
Max T-O weight, internal or external load
4,250 kg (9,369 lb)
PERFORMANCE (at average mission weight of 4,000 kg; 8,818 lb):
Never-exceed speed (VNE) 160 kts (296 km/h, 184 mph)
Max cruising speed at S/L 150 kts (278 km/h, 173 mph)
Max rate of climb at S/L 420 m (1,378 ft)/min
Hovering ceiling: IGE 2,600 m (8,531 ft)
OGE 1,850 m (6,070 ft)
Range with max standard fuel at S/L
472 n miles (875 km, 544 miles)

UPDATED

Vought Aircraft/Eurocopter Panther 800 powered by two LHTEC T800 turboshafts

1993

EUROCOPTER AS 565 PANTHER (NAVY)

Israel Defence Force name: Panter

TYPE: Naval derivative of AS 365N2 Dauphin 2

PROGRAMME: Launch order placed by Saudi Arabia 13 October 1980; first flight of modified AS 365N (c/n 5100) as prototype 22 February 1982; first flight production AS 365F (c/n 6014) equipped as SAR helicopter on 2 July 1982

CURRENT VERSIONS: **AS 565MA Panther**: Unarmed naval search and rescue and sea surveillance version, rescue hoist, sea search radar, self-contained navigation, automatic hover transition, searchlight and deck-landing harpoon optional.

AS 565SA Panther: Armed ASW and anti-ship version, ASW version has Sextant Avionique MAD or Thomson Sintra ASM HS 312 sonar and two homing torpedoes; four side-mounted AS 15TT radar-guided missiles in anti-ship role; SAR versions have nose-mounted Omera ORB 32 search radar; anti-ship versions have chin mounted, roll stabilised Agrion 15 radar

AS 565 Panter: Ordered by Israel Defence Force, April 1994, up to 20 required, search radar and navigation suite by Elbit, operation from Saar 5 frigates

CUSTOMERS: Saudi Arabia ordered four SAR/surveillance AS 565MAs and 20 anti-ship AS 565SAs with AS 15TT. Ireland ordered five for SAR with Bendix/King RDR 1500 radar, SFIM 155 autopilot, Sextant ONS 200A long-range navigation, Nadir Mk II nav computer, Dassault Electronique Cina B Doppler and five-screen EFIS; these can carry light weapons; French Navy ordered three AS 565F MA) 'Pédros' in 1988 for plane guard with carriers *Clémenceau* and *Foch*, 15 more AS 565MAs being delivered 1993-99, eventual requirement 40; seven, with AS 15TT ordered by Abu Dhabi, 1995

DESIGN FEATURES: Updated version of AS 365F shipborne Panther with enlarged 11-blade Fenestron for control during out-of-wind overwater hover, extended nose to house radar and additional avionics

FLYING CONTROLS: As AS 365N2, with SFIM CDV 155 flight director and coupler for naval operations

POWER PLANT: Two Turbomeca Arriel 1M1 turboshafts, each giving 558 kW (749 shp) for take-off and 487 kW (653 shp) continuously, standard fuel capacity 1,135 litres (300 US gallons, 250 Imp gallons), optional 180 litre (47 5 US gallon, 39 6 Imp gallon) auxiliary tank

ACCOMMODATION: Two-man crew, cabin can hold 10 passengers

DIMENSIONS, EXTERNAL: As for AS 565 Panther (army/air force) except
Width over missiles (565SA) 4 20 m (13 ft 9½ in)

WEIGHTS AND LOADINGS:
Weight empty 2,262 kg (4,987 lb)
Max sling load 1,600 kg (3,527 lb)
Max T-O weight, internal or external load 4,250 kg (9,370 lb)

PERFORMANCE (at average mission weight of 4,000 kg 8,818 lb):
Never-exceed speed (VNE) 160 kts (296 km/h, 184 mph)
Max cruising speed at S/L 148 kts (274 km/h, 170 mph)
Max rate of climb at S/L 420 m (1,380 ft)/min
Hovering ceiling IGE 2,600 m (8,530 ft)
OGE 1,860 m (6,102 ft)
Radius of action anti-shipping, with four missiles, 120 kts (222 km/h, 138 mph) cruising speed at 915 m (3,000 ft) ISA–20°C, 30 min reserves 135 n miles (250 km, 155 miles)
with two missiles 150 n miles (278 km; 173 miles)
SAR, ISA+20°C, 30 min reserves, carrying six survivors 130 n miles (241 km; 150 miles)
Range with max standard fuel at S/L 472 n miles (874 km, 543 miles)

UPDATED

French Navy Eurocopter AS 565MA Panther plane guard ('Pédro') helicopter *1993*

EUROCOPTER DAUPHIN X 380 DTP, AS 365X DGV and FBW

TYPE: Three experimental Dauphins testing future technology

PROGRAMME: First flight modified Dauphin X 380 DTP (Développement Technique Probatoire) (F-WDFK) 20 March 1989; first flight fly-by-wire Dauphin FBW (c/n 6001/F-WZJJ) 6 April 1989; first flight high speed AS 365X Dauphin Grande Vitesse (DGV) March 1991; set up Class E1e speed record of 200 knots (371 km, 230 mph) over 3 km triangular course 19 November 1991, also beat Class E1 world speed record

DESIGN FEATURES: DTP and DGV have five-blade Spheriflex rotor head with integrated hub/mast of filament-wound CFRP mounted by single bearing in transmission casing composites blades with drooped tapered tips; smaller Fenestron and aerodynamic rudder in fin, hub fully faired and blended with special low-drag engine/transmission fairing

FBW aircraft designed to investigate complex attitude control laws, trials with sidestick controller began April 1990

POWER PLANT: DTP powered by two Turbomeca Arriel 1C1 turboshafts; DGV powered by two special Arriel 1X with short-term capability for 660 kW (884 shp)

VERIFIED

EUROCOPTER BO 105

Swedish designation: Hkp 9

TYPE: Five/six-seat twin-turbine light helicopter

PROGRAMME: First flight of prototype 16 February 1967; production of 100 BO 105 M (VBH) and 212 BO 105 P (PAH-1) (see 1985-86 *Jane's* and current *Jane's Aircraft Upgrades*) completed 1984. Also assembled by Eurocopter Canada (see Canadian section) and IPTN (Indonesian section)

CURRENT VERSIONS: **BO 105 CBS**: Basic model with cabin stretched 0 25 m (10 in) in rear seat area, additional window aft of rear door; FAA certification to SFAR Pt 29-4 early 1983, production version prior to introduction of EC Super Five was BO 105 CBS-4. *Details here apply to BO 105 CBS-4, except where indicated.*

EC Super Five: Main production model since 1993 described separately

BO 105 LS: Hot and high variant powered by two Allison 250-C28C each rated at 410 kW (550 shp) for ½ minute, produced exclusively by Eurocopter Canada

CUSTOMERS: Total 1 329 BO 105s of all models delivered to 40 countries by 1 January 1995; 1,348 then on order, including 18 purchased in 1994, these include Mexican Navy (12), Spanish Army (70 including 18 armed reconnaissance, 14 observation and 28 anti-tank), Swedish Army (20 delivered by September 1988) and Swedish Air Force (four BO 105 CBS for IFR search and rescue)

DESIGN FEATURES: Four-blade main rotor with rigid titanium hub; only articulation is roller bearings for blade pitch change, all-composite blades of NACA 23012 section with drooped leading-edge and reflexed trailing-edge, 8° linear twist pendulous vibration damper near each blade root, main rotor brake standard, two blades can be folded two-blade semi-rigid tail rotor; main rotor rpm 424, tail rotor rpm 2,220

FLYING CONTROLS: Fully powered controls through hydraulic actuation pack mounted on transmission casing, very high control power and aerobatic capability, including claimed sustained inverted 1 g flight, IFR certification without autostabiliser

STRUCTURE: Light alloy structure with GFRP main and tail rotor blades and top fairing. Main production source is Eurocopter Deutschland factory at Donauworth, but Spanish models assembled by CASA, Indonesian models manufactured and assembled by IPTN and BO 105 LS manufactured exclusively by Eurocopter Canada (formerly MBB Helicopter Canada) in Ontario (which see).

LANDING GEAR: Skid type, with cross tubes designed for energy absorption by plastic deformation in event of heavy landing. Inflatable emergency floats can be attached to skids

POWER PLANT: Two 313 kW (420 shp) Allison 250-C20B turboshafts, each with a maximum continuous rating of 298 kW (400 shp). Bladder fuel tanks under cabin floor, usable capacity 570 litres (150 6 US gallons; 125 3 Imp gallons), fuelling point on port side of cabin, optional auxiliary tanks in freight compartment. Oil capacity engine 12 litres (3 2 US gallons, 2 6 Imp gallons), gearbox 11 6 litres (3.06 US gallons; 2.55 Imp gallons)

ACCOMMODATION: Pilot and co-pilot or passenger on individual longitudinally adjustable front seats with four point harnesses; optional dual controls. Bench seat at rear for three persons, removable for cargo and stretcher carrying. EMS versions available, entire rear fuselage aft of seats and under power plant available as freight and baggage space, with straight-in access through two clamshell doors at rear; two standard stretchers side by side in ambulance role, one forward-opening hinged and jettisonable door and one sliding door on each side of cabin; ram air and electrical ventilation system, heating system optional

SYSTEMS: Dual hydraulic systems, pressure 103 5 bars (1,500 lb/sq in), for powered main rotor controls, system flow rate 6 2 litres (1 64 US gallons, 1 36 Imp gallons)/min, bootstrap/fluid reservoir, pressurised at 1 7 bars (25 lb/sq in), electrical system powered by two 150 A 28 V DC starter/generators and a 24 V 25 Ah Ni/Cd battery external power socket

AVIONICS: Wide variety of avionics available including weather radar, Doppler and GPS navigation, 360° search radar, FLIR, TV broadcast and microwave datalink

EQUIPMENT: Standard equipment includes heated pitot, tie-down rings in cargo compartment, cabin and cargo compartment dome lights, position lights and collision warning lights, options include dual controls, heating system, windscreen wiper, rescue winch, landing light, searchlight, externally mounted loudspeaker, fuel dump valve, external load hook, settling protectors, snow skids, manual main rotor blade folding, emergency floats, NVG compatible cockpit, sand filters, and a wide range of EMS and VIP arrangements

DIMENSIONS, EXTERNAL:
Main rotor diameter 9 84 m (32 ft 3½ in)
Tail rotor diameter 1 90 m (6 ft 2¾ in)
Main rotor blade chord 0 27 m (10⅝ in)
Tail rotor blade chord 0 18 m (7 in)
Distance between rotor centres 5 95 m (19 ft 6¼ in)
Length: incl main and tail rotors 11 86 m (38 ft 11 in)
excl rotors 8 81 m (28 ft 11 in)
fuselage pod 4 55 m (14 ft 11 in)
Height to top of main rotor head 3 02 m (9 ft 11 in)
Width over skids, unladen 2 53 m (8 ft 3½ in)
laden 2 58 m (8 ft 5½ in)
Rear-loading doors. Height 0.64 m (2 ft 1 in)
Width 1 40 m (4 ft 7 in)

DIMENSIONS, INTERNAL:
Cabin, incl cargo compartment
Max width 1 40 m (4 ft 7 in)
Max height 1 25 m (4 ft 1 in)
Volume 4.80 m³ (169 cu ft)
Cargo compartment: Length 1.85 m (6 ft 0¾ in)
Max width 1 20 m (3 ft 11¼ in)
Max height 0 57 m (1 ft 10½ in)
Floor area 2.25 m² (24 2 sq ft)
Volume 1 30 m³ (45 9 cu ft)

AREAS:
Main rotor disc 76.05 m² (818 6 sq ft)
Tail rotor disc 2.835 m² (30 5 sq ft)

WEIGHTS AND LOADINGS:
Weight empty basic 1,301 kg (2,868 lb)
Standard fuel (usable) 456 kg (1,005 lb)
Max fuel, incl auxiliary tanks 776 kg (1,710 lb)
Max T-O weight 2,500 kg (5,511 lb)
Max disc loading 32.9 kg/m² (6.74 lb/sq ft)

PERFORMANCE (at max T-O weight):
Never-exceed speed (VNE) at S/L 131 kts (242 km/h, 150 mph)
Max cruising speed at S/L 129 kts (240 km/h, 149 mph)
Best range speed at S/L 110 kts (204 km/h; 127 mph)
Max rate of climb at S/L, max continuous power 444 m (1,457 ft)/min
Vertical rate of climb at S/L, T-O power 90 m (295 ft)/min
Max operating altitude
at 2,500 kg (5,511 lb) 3,050 m (10,000 ft)
at 2,300 kg (5,070 lb) 5,180 m (17,000 ft)
Hovering ceiling, T-O power: IGE 1,525 m (5,000 ft)
OGE 457 m (1,500 ft)
Range with standard fuel and max payload, no reserves
at S/L 300 n miles (555 km, 345 miles)
at 1,525 m (5,000 ft) 321 n miles (596 km, 370 miles)
Ferry range with auxiliary tanks, no reserves
at S/L 519 n miles (961 km, 597 miles)
at 1,525 m (5,000 ft) 550 n miles (1 020 km, 634 miles)

Endurance with standard fuel and max payload, no reserves: at S/L 3 h 24 min

UPDATED

EUROCOPTER EC SUPER FIVE

TYPE: Alternative high-performance version of BO 105 CBS 4

PROGRAMME: Derived from German Army PAH 1 upgrade programme; announced at Heli-Expo February 1993, certificated late 1993.

CUSTOMERS: Two to Bahrain Navy, 1994, with rescue hoist and nose-mounted 360° radar, two, equipped with rescue hoist, searchlights and auxiliary fuel tanks, ordered by Emercom of Russia (Ministry of the Russian Federation for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters) for delivery in Spring 1995

DESIGN FEATURES: New main rotor blades have parallel-chord DM-H4 aerofoil to 0 8 radius and tapered DM H3 to tip: rotor lift increased 150 kg (330 lb), giving 100 kg (220 lb) more payload for same maximum T-O weight, airframe vibration reduced to less than 0 1 *g*, improved stability

Improvements include Cat. A T-O weight in ISA + 20°C increased by 130 kg (287 lb), OGE hover ceiling at maximum T-O weight in ISA + 20°C increased by 500 m (1,640 ft); power required to hover OGE at S/L in ISA + 20°C reduced by 26 kW (35 shp), maximum weight in OGE hover, OEI with 2 5 minutes power in ISA + 20°C increased by 240 kg (529 lb), service ceiling OEI at maximum weight increased by 900 m (2,953 ft)

FLYING CONTROLS: As BO 105 CBS-4, dual controls standard.

POWER PLANT: As BO 105 CBS 4, but with scavenge oil filter increasing oil change interval to 200 hours; one-handed engine starting arrangement, transmission 30 minutes rating increased 10 per cent and 2 5 minutes rating up 15 per cent Fuel consumption reduced by up to 3 per cent

ACCOMMODATION: As BO 105 CBS-4

SYSTEMS: As BO 105 CBS-4, but with improved hydraulic system.

EQUIPMENT: Standard equipment includes second windscreen wiper, 250 W retractable landing light in nose, dual controls, single-hand starting device and scavenge oil filter Optional equipment otherwise as BO 105 CBS-4

PERFORMANCE (where different from BO 105 CBS-4 at average mission weight 2,300 kg, 5,070 lb):

Max cruising speed at S/L	132 kts (245 km/h, 152 mph)
Rate of climb, max continuous power at S/L	570 m (1,870 ft)/min
Service ceiling, OEI, 30 min power	1,707 m (5,600 ft)
Hovering ceiling, T-O power: IGE	3,200 m (10,500 ft)
OGE	2,430 m (7,970 ft)
Range at S/L	310 n miles (574 km, 357 miles)

UPDATED

EUROCOPTER EC 135

TYPE: Former BO 108, five/seven-seat twin turbine light helicopter

PROGRAMME: First flight of technology prototype BO 108 (D-HBOX) powered by two Allison 250-C20R turboshafts 15 October 1988 with conventional tail rotor, new all-composite bearingless tail rotor tested during 1990; Eurocopter announced in January 1991 that BO 108 was to succeed BO 105, first flight of second prototype (D-HBEC) powered by two Turbomeca TM 319-1B Arrius, 5 June 1991; production main and tail rotors flight tested during 1992 in preparation for certification programme, design revised late 1992 to increase maximum seating to seven: Advanced Fenestron adopted; two preproduction prototypes D-HECX and D-HECY made first flights respectively 15 February and 16 April 1994 powered by Turbomeca Arrius 2B and P&WC PW206B intended as production alternatives, design freeze expected early 1995, third preproduction prototype (D-HECZ) made first flight 28 November 1994, powered by Arrius 2B, and subsequently made type's US debut at HeliExpo '95 in Las Vegas in January 1995, total flight time of first three preproduction EC 135s was more than 220 hours at end of January 1995 VFR certification to JAR/FAA Part 27 with Category A provisions expected start 1996, IFR certification start 1997, deliveries to start first quarter 1996, initial production rate 30 per year, rising to 60

CURRENT VERSIONS: **EC 135B-1** Configuration of first and third prototypes

EC 135D-1 Configuration of second prototype

CUSTOMERS: Eurocopter expects to win 900 sales out of a world market for 1,350

COSTS: Operating cost 25 per cent lower than BO 105, development programme funded by Eurocopter Deutschland and Eurocopter Canada, suppliers and German Ministries of Economics and Research and Technology, unit cost $1 98 million (1995)

DESIGN FEATURES: Designed to FAR Pt 27 including Category A and European JARs; four blade FVW bearingless main rotor, as adopted for US Army RAH-66 armed scout helicopter; rotor rpm are variable; composites blades mounted on controlled flexibility composites arms giving flap, lag and pitch-change freedom; control demands transmitted from rods to root of blade by rigid CFRP pitch cuffs, main rotor blades have DM H3 and 4 aerofoils with non-linear twist and tapered transonic tips, main rotor axis tilted forward 5°, airframe drag 30 per cent lower than BO 105 by clean and compact external shape, cabin height retained by shallow transmission, vibration reduced by ARIS mounting between transmission and fuselage, all dynamically loaded components to have 3,000 hours MTBR or be maintained on-condition

Second BO 108 prototype had EFIS-based IFR system, fuselage stretched 15 cm (5 9 in) and interior cabin width extended by 10 cm (3 9 in); main rotor diameter extended to 10.20 m (33 ft 5½ in); for EC 135, tail rotor replaced in 1992 by New Generation Fenestron with 11 fixed flow straightening vanes in fan efflux designed to avoid momentum losses and improve fan figure of merit, vanes are swept relative to radius and fan has different number of blades to avoid shocks and reduce noise; fan blade tip speed is only 185 m (607 ft)/s, maximum T-O weight increased to 2,500 kg (5 511 lb)

FLYING CONTROLS: Conventional hydraulic fully powered controls with integrated electrical SAS servos, objective is single-pilot IFR with cost-effective stability augmentation

STRUCTURE: Airframe mainly Kevlar/CFRP sandwich composites except aluminium alloy sidewalls, pod lower module and cabin floor, tailboom and around cargo area, some titanium in engine bay, composites tailplane

LANDING GEAR: Skid type, inclined rearward by 1

POWER PLANT: Choice of production engines, two Turbomeca Arrius 2B (TM 319 2R) giving 342 kW (459 shp) each in ISA +20°C or two Pratt & Whitney Canada PW206B giving 332 kW (445 shp) each at ISA +20°C; both types of engine have FADEC. First prototype had two 335 5 kW (450 shp) class Allison 250-C20R-3 Fuel capacity 703 litres (186 US gallons, 155 Imp gallons)

ACCOMMODATION: Pilot, plus six passengers on crash-proof seats, forward-hinged doors for crew, sliding doors for passengers, rear passenger headroom may be increased by further reducing depth of transmission. Rear of pod has clamshell doors for bulky items/cargo; flights permissible with clamshell doors removed Unobstructed cabin interior

SYSTEMS: Redundant electrical supply systems to FAR Pt 27 standards Fully redundant dual hydraulic systems

AVIONICS: Sextant Avionique Nouvelle (AN) equipment

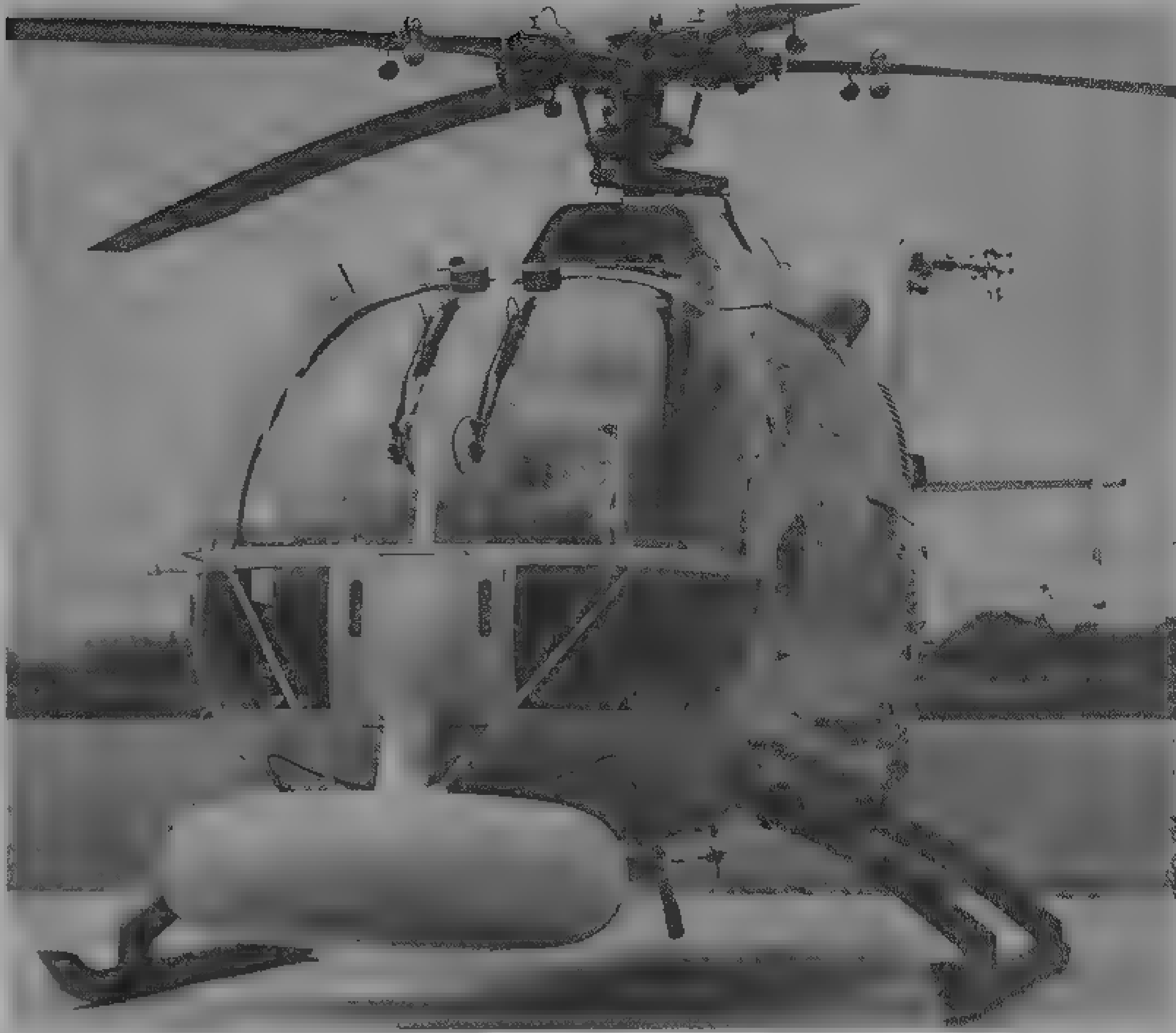
Radar: Provision for integrated weather radar

Flight: Air data computer; SFIM automatic flight control system (AFCS), GPS

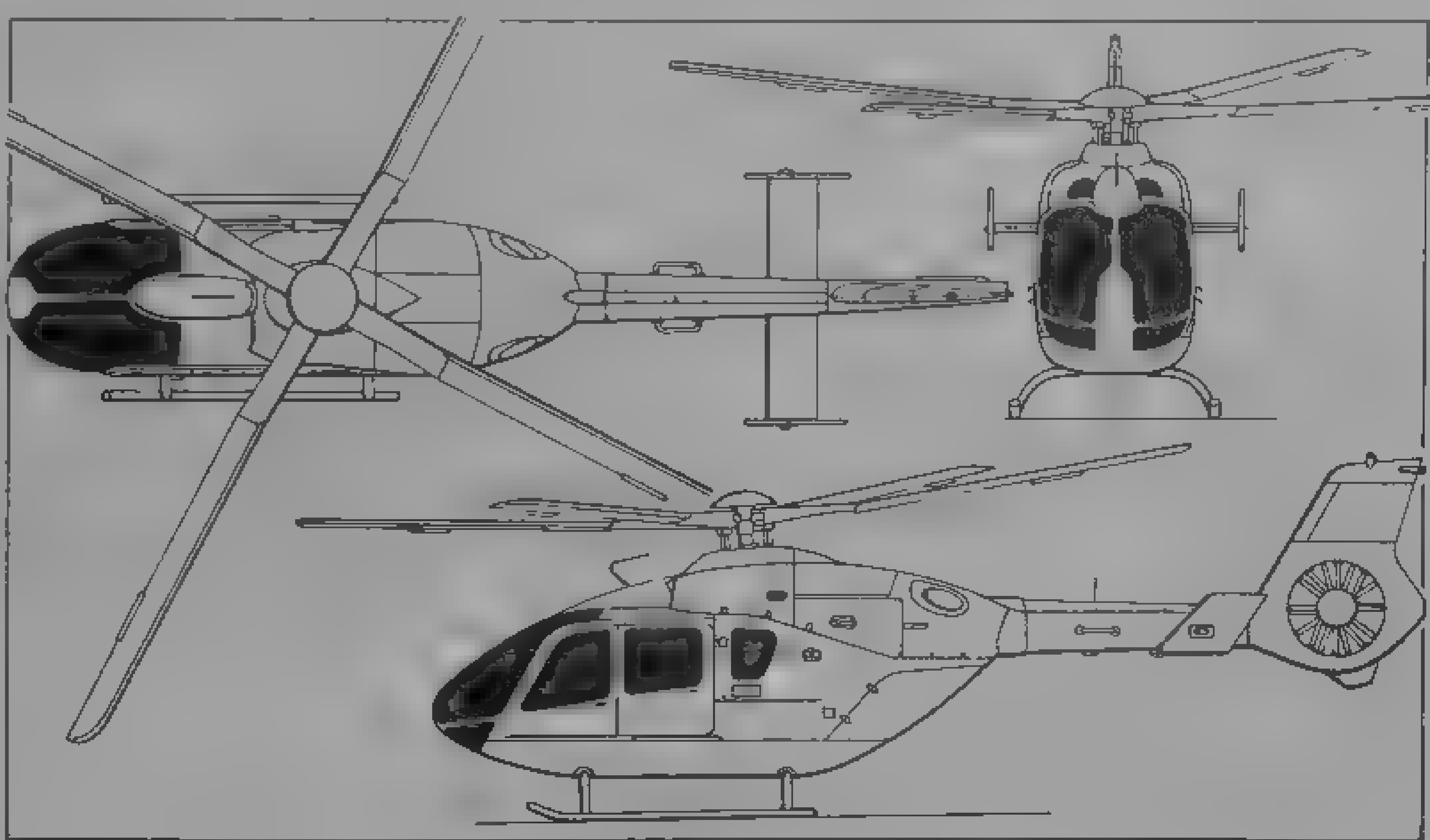
Instrumentation: Liquid crystal dual-screen vehicle and engine management displays

DIMENSIONS, EXTERNAL:

Main rotor diameter	10 20 m (33 ft 5½ in)
Fenestron diameter	1 00 m (3 ft 3¼ in)
Length: overall, rotor turning	12.13 m (39 ft 9½ in)
fuselage	10 16 m (33 ft 4 in)
Height overall	3 75 m (12 ft 3½ in)
Height to top of rotor head	3 23 m (10 ft 7¼ in)
Width without rotor blades	2 65 m (8 ft 8¼ in)
Width over skids	2 10 m (6 ft 10½ in)
Width of fuselage	1 56 m (5 ft 1½ in)



Eurocopter EC Super Five of Bahrain Navy, with RDR 1500B search radar for SAR *1995*



Eurocopter EC 135 seven-seat, twin-engined helicopter *(Jane's/Mike Keep)* *1994*

DIMENSIONS, INTERNAL:
Cabin volume (approx) 5.00 m³ (176.6 cu ft)
AREAS:
Main rotor disc 81.71 m² (879.5 sq ft)
Fenestron disc 2.84 m² (30.52 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 1,390 kg (3,064 lb)
Max fuel weight, standard 562 kg (1,239 lb)
Max T-O weight: normal 2,500 kg (5,511 lb)
with external load 2,700 kg (5,952 lb)
Max external load 1,200 kg (2,645 lb)
PERFORMANCE (at max T-O weight):
Never exceed speed (V_{NE}) 155 kts (287 km/h, 178 mph)
Max cruising speed at S/L 141 kts (261 km/h, 162 mph)
Max rate of climb at S/L 486 m (1,594 ft)/min
Service ceiling 6,100 m (20,000 ft)
Service ceiling, OEI 3,100 m (10,170 ft)
Hovering ceiling: IGE 4,750 m (15,585 ft)
OGE 3,750 m (12,305 ft)
Range at S/L, standard fuel 378 n miles (700 km; 425 miles)
Endurance at S/L, standard fuel 4 h 0 min

UPDATED

Second preproduction Eurocopter EC 135 during a test flight; note air flow straightening vanes in New Generation Fenestron

1995

EUROCOPTER EC 145 and EC 165

PROGRAMME: Studies continuing in early 1995 for two new helicopters in 4,000 to 5,000 kg (8,818 to 11,025 lb) class, to replace Eurocopter/Kawasaki BK 117 and AS 365N2 Dauphin 2; no launch decision before 1997.

NEW ENTRY

OTHER AIRCRAFT

Refer elsewhere in this section for **Eurocopter/CATIC/SA EC 120**, **Eurocopter/Kawasaki BK 117**, and **Euromil (Eurocopter/Mil/Kazan/Klimov) Mi-38**. Eurocopter also participates in **NH Industries NH 90** and **Eurofar** international programmes. The Aerospatiale **SA 315B Lama** remains in production by Hindustan Aeronautics and **Aerospatiale AS 330 Puma** by IAR SA; see Indian and Romanian sections respectively. **Atlas Oryx** (based on Puma/Super Puma airframe) is described in South African section. Refer to *Jane's Aircraft Upgrades* for BO 105M PAH-1A1 upgrades, other Pumas modified in South Africa and PT6B-engined Lama conversions by Rocky Mountain Helicopters in USA.

NEW ENTRY

EUROCOPTER/CATIC/SA

PARTICIPATING COMPANIES:
Eurocopter: see this section
CATIC: see under China
Singapore Aerospace: see under Singapore

VERIFIED

EC 120

TYPE: Formerly P120L, five-seat single-engined light helicopter.

PROGRAMME: Definition phase of original P120L launched 15 February 1990 as partnership of Eurocopter (programme leader, 61 per cent), CATIC (24 per cent) and Singapore Aerospace (15 per cent); redesigned with 500 kg (1,102 lb) lower gross weight and new engine and rotor and redesignated EC 120, January 1993; design definition completed mid-1993; assembly of first of three prototypes began at Eurocopter France at Marignane in early 1995, first flight 9 June 1995, first deliveries in second half 1997. Eurocopter responsible for rotor system/transmission/final assembly, flight test/certification, CATIC (through HAMC, which see under China) for fuselage, landing gear and fuel system, and SA for tailboom, fin structure and doors; final assembly in France or Germany. Joint design team working in Eurocopter France at Marignane.

CUSTOMERS: Estimated sales about 900 in first decade and 1,600 to 2,000 total.

COSTS: DM3 million ($1.98 million), 1995.

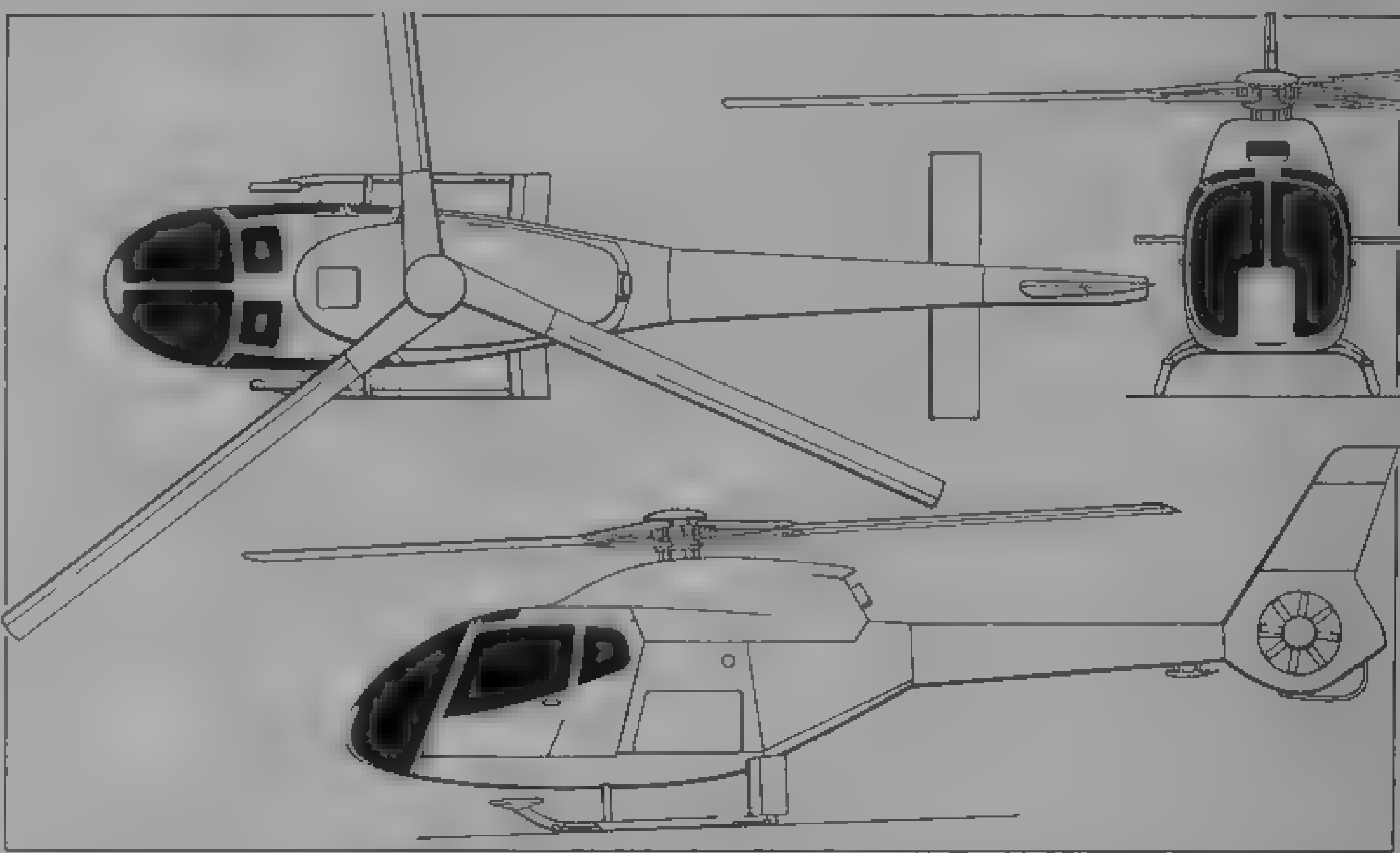
DESIGN FEATURES: Three-blade main rotor with Spheriflex hub integrated with main shaft and transmission; two-stage reduction gear; eight-blade New Generation Fenestron.

STRUCTURE: Composites for main and tail rotor blades, Spheriflex head and shaft made as single composites assembly; metal centre-fuselage; composites landing gear.

POWER PLANT: Turbomeca TM 319 Arrius 1B1 engine selected for first 300 EC 120s; power required is 373 kW (500 shp). Pratt & Whitney Canada PW200 likely to be optional on future model. Fuel capacity 400 litres (106 US gallons, 88 Imp gallons).

ACCOMMODATION: Pilot and four passengers.

DIMENSIONS, EXTERNAL:
Main rotor diameter 10.20 m (33 ft 5½ in)
Main rotor blade chord 0.26 m (10¼ in)
Fenestron diameter 0.75 m (2 ft 5½ in)
Fenestron blade chord 0.058 m (2¼ in)
Length overall, blades folded 11.54 m (37 ft 10¼ in)
Width, incl tailplane 2.40 m (7 ft 10½ in)
Height overall 3.27 m (10 ft 8¾ in)
Skid track 1.80 m (5 ft 10¾ in)
DIMENSIONS, INTERNAL:
Cabin: Length 1.80 m (5 ft 10¾ in)
Max width 1.50 m (4 ft 11 in)
Max height 1.31 m (4 ft 3½ in)
AREAS:
Main rotor disc 81.72 m² (879.3 sq ft)
Fenestron disc 0.44 m² (4.73 sq ft)
WEIGHTS AND LOADINGS:
Standard empty weight 850 kg (1,874 lb)
Max sling load 750 kg (1,653 lb)
Max useful load 700 kg (1,543 lb)
Max T-O weight 1,550 kg (3,417 lb)



Provisional three-view drawing of Eurocopter EC 120 single-engined five-seat light helicopter. New Generation Fenestron will have tangentially positioned fixed stator blades, as EC 135 *(Jane's/Mike Keep)*

1993

First flight of EC 120 light helicopter, 9 June 1995

1995

PERFORMANCE:
Max cruising speed 130 kts (240 km/h, 149 mph)
Hovering ceiling OGE: ISA 2,400 m (7,875 ft)
ISA + 20°C 1,200 m (3,940 ft)
Range approx 323 n miles (600 km, 372 miles)

UPDATED

EUROCOPTER/KAWASAKI

PARTICIPATING COMPANIES:
Eurocopter: see this section
Kawasaki: see under Japan

VERIFIED

EUROCOPTER/KAWASAKI BK 117

TYPE: Twin-turboshaft multipurpose helicopter

PROGRAMME: Developed jointly under agreement of 25 February 1977, four prototypes, first flight 13 June 1979, one preproduction aircraft, first flight 6 March 1981, first flights of production aircraft 24 December 1981 (JQ1001 in Japan) and 23 April 1982 (in Germany), certificated in Germany and Japan 9 and 17 December 1982 respectively, followed by US FAA 29 March 1983 (FAR Pt 29, Categories A and B, including Amendments 29-1 to 29-16); deliveries began early 1983. See 1991-92 and previous editions for earlier A series and B-1.

CURRENT VERSIONS: **BK 117 B-2**: Production model from 1992 powered by AlliedSignal LTS 101 (with BK 117 C-1 below), German LBA certification 17 January 1992, US FAA certification 7 December 1992; Japanese JCAB certification 18 March 1993. French DGAC certification 15 July 1993, maximum T-O weight increased to 3,350 kg (7,385 lb), payload increased by 150 kg (330 lb). Five built in Germany 1992 prior to discontinuation, production continues in Japan. *Details below apply to this version.*

BK 117 C-1: German version with new cockpit and Turbomeca Arriel 1E2 engines, first flight (F-WMBB) 6 April 1990; German LBA certification 17 January 1992; US FAA certification 7 December 1992, first delivery (to USA) December 1992, three delivered in 1992, four in 1993, five in 1994, French DGAC certification 15 July 1993. Performance similar to that of BK 117 B-2, payload increased 150 kg (330 lb); better hot and high performance. BK 117 C-1 improvement under way to increase OEI performance, includes higher transmission and engine OEI ratings, new tail rotor blades and variable rotor speed to improve tail rotor thrust and reduce external noise; German LBA certification achieved 28 April 1994, followed by US FAA certification 29 September 1994, French DGAC approval expected early 1995. *Performance differences listed after BK 117 B-2.*

NBK-117: Designation of aircraft licensed to be built by IPTN (see Indonesian section, 1991-92 *Jane's*) under November 1982 agreement with MBB.

All-composites testbed: One aircraft built by MBB for 3½ year German MoD research programme, 80 per cent of airframe in CFRP and 20 per cent in AFRP (Kevlar). First flight 27 April 1989, flight test programme completed July 1989.

BK 117 P5: Fly-by-wire control system first flown in Japan (JQ0003 P5) 2 October 1992, primary flight control system (PFCS) includes sidestick with triplex avionics for transmission and stability augmentation, selector for manual or autopilot flight; electronic control signals sent to triple servo valves on powered control units, PFCS is triplex; outer-loop flight control computer and sensor package are duplicated, collective lever and foot pedals also FBW, trial modes include relaxed static stability manoeuvre load control and direct force control, JQ0003 also has GPS with an electronic map display.

CUSTOMERS: Total of 251 delivered by MBB/Eurocopter by 1 January 1995 at which time orders totalled 255. Kawasaki total was 101 by 31 March 1994, Japanese production continues at low rate. Kawasaki agreed 1990 to supply CKD kits (about 30 over five year period) for local assembly in South Korea by Hyundai Precision Industry, nine kits delivered by end 1993. BK 117 delivered by Kawasaki to Sendai Fire Department November 1992 has GPS/digital map system indicating helicopter's three-dimensional position, flight direction and drift on map in colour liquid crystal display, all terrain higher than helicopter automatically shown red.

AlliedSignal-engined BK 117 B-2 of Samaritan Airevac

1995

COSTS: DM5 million ($3.33 million), 1995.

DESIGN FEATURES: System Bolkow four-blade main rotor head, almost identical to that of BO 105, main rotor blades similar to but larger than those of BO 105, with NACA 23012/23010 (modified) section, optional two-blade folding. Two-blade semi-rigid tail rotor with MBB S102E performance/noise optimised blade section, rotor rpm 383 (main), 2,169 (tail).

FLYING CONTROLS: Equipped as standard for single-pilot VFR operation, dual controls and dual VFR instrumentation optional, rotor brake and yaw CSAS standard on German built models, optional on Kawasaki aircraft, options include IFR instrumentation, two-axis (pitch/roll) CSAS and Honeywell SPZ-7100 dual digital AFCS. Mast moment indicator discourages excessive cyclic control inputs.

STRUCTURE: Main rotor has one-piece titanium hub with pitch-change bearings; fail-safe GFRP blades with stainless steel anti-erosion strip. Tail rotor, mounted on port side of central fin, has GFRP blades of high-impact resistance. Main fuselage pod and tailboom are aluminium alloy with single-curvature sheets and (on fuselage) bonded aluminium sandwich panels, secondary fuselage components are compound curvature shells of Kevlar sandwich. Engine deck, to which tailboom is integrally attached, forms cargo compartment roof and is of titanium adjacent engine bays. Detachable tailcone carries main fin/tail rotor support, and horizontal stabiliser with offset endplate fins.

MBB responsible for rotor systems, tailboom, tail unit, skid landing gear, hydraulic system, engine firewall and cowlings, powered controls and systems integration. Kawasaki for fuselage, transmission, fuel and electrical systems, and standard equipment. Components single-sourced and exchanged for separate assembly lines at Donauwörth and Gifu; some components and accessories interchangeable with those of BO 105 (which see), from which hydraulic powered control system is also adapted.

LANDING GEAR: Non-retractable tubular skid type, of aluminium construction. Skids are detachable from cross-tubes. Ground handling wheels standard. Emergency flotation gear, settling protectors and snow skids optional.

POWER PLANT: BK 117 B-2 has two AlliedSignal LTS 101-750B-1 turboshafts, each rated at 410 kW (550 shp) for take-off and maximum continuous power; OEI ratings are 548 kW (735 shp) for 2½ minutes and 523 kW (701 shp) for 30 minutes. BK 117 C-1 has two Turbomeca Arriel 1E2 turboshafts each rated at 550 kW (738 shp) for take-off, 516 kW (692 shp) maximum continuous and 574 kW (770 shp) for 2½ minutes OEI.

Kawasaki KB 03 main transmission rated at 736 kW (986 shp) for twin-engine T-O, 632 kW (848 shp) maximum continuous; for single-engine operation, 574 kW (770 shp) allowed for 2½ minutes, and 550 kW (738 shp) maximum continuous (see also BK 117 C-1 improvements).

Fuel in four flexible bladder tanks (forward and aft main tanks, with two supply tanks between), in compartments under cabin floor. Two independent fuel feed systems for engines and common main fuel tank. Total standard fuel capacity 708 litres (187 US gallons; 156 Imp gallons); single or twin internal auxiliary fuel tanks, each of 200 litres (53 US gallons, 44 Imp gallons) capacity, and two external auxiliary fuel tanks, each of 150 litres (40 US gallons, 33 Imp gallons), optional.

ACCOMMODATION: Pilot and up to six (executive version), seven (Eurocopter standard version) or nine passengers (Kawasaki standard version). High-density layouts available for up to 10 passengers in addition to pilot. Level floor throughout cockpit, cabin and cargo compartment. Jettisonable forward-hinged door on each side of cockpit, pilot's door having an openable window. Jettisonable rearward-sliding passenger door on each side of cabin, lockable in open position. Fixed steps on each side. Two hinged, clamshell doors at rear of cabin, providing straight-in access to cargo compartment. Rear cabin window on each side. Aircraft can be equipped for offshore support, medical evacuation (one or two stretchers side by side and up to six attendants), firefighting, search and rescue, law enforcement, cargo transport or other operations.

SYSTEMS: Ram air and electrical ventilation system. Fully redundant tandem hydraulic boost system (one operating and one standby), pressure 103.5 bars (1,500 lb/sq in), for flight controls. System flow rate 8.1 litres (2.14 US gallons; 1.78 Imp gallons)/min. Bootstrap/oil reservoir, pressure 1.7 bars (25 lb/sq in). Main DC electrical power from two 150 A 28 V starter/generators (one on each engine) and a 24 V 25 Ah Ni/Cd battery. AC power provided by inverter, second AC inverter optional, emergency busbar provides direct battery power to essential services, external DC power receptacle.

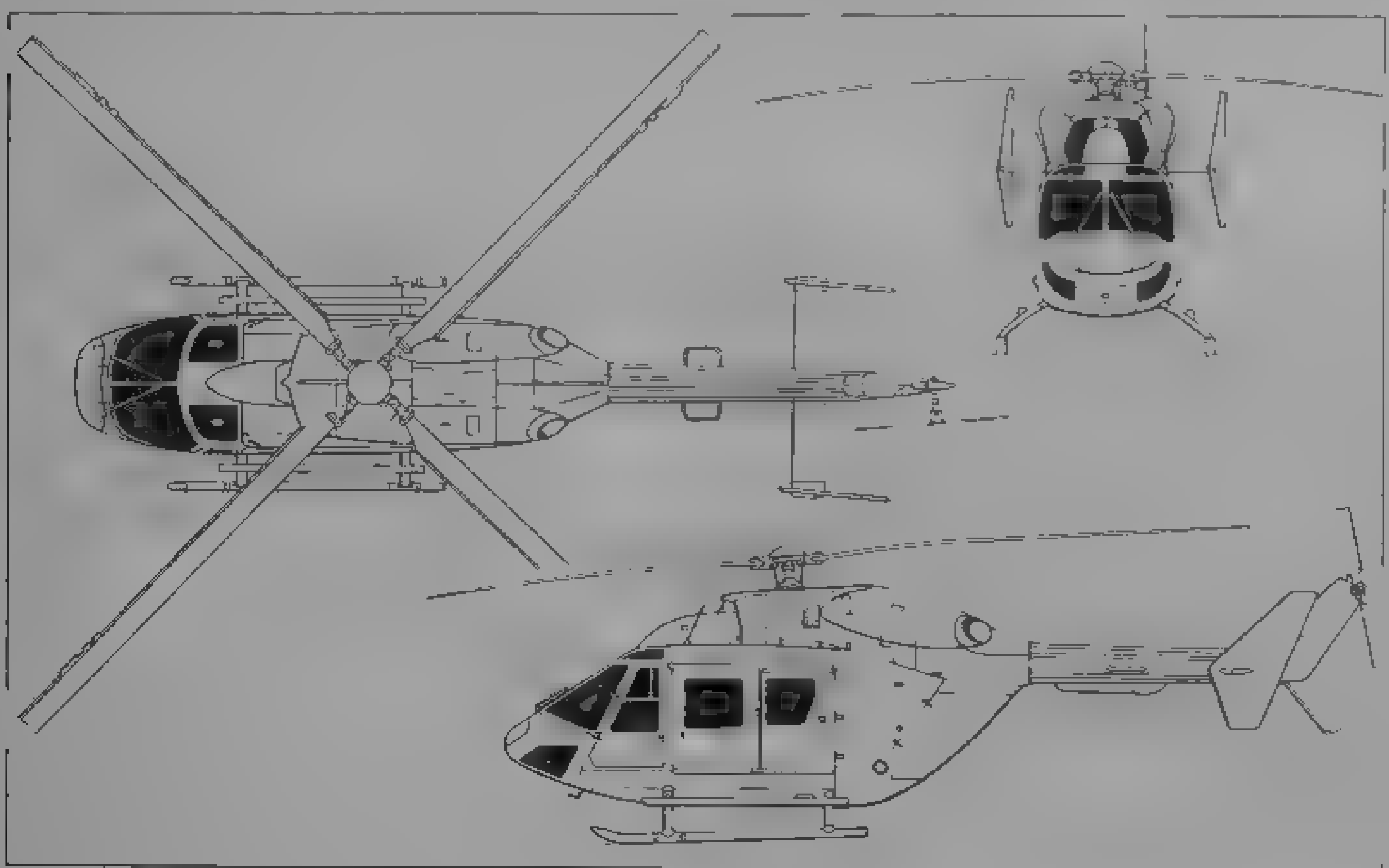
AVIONICS: *Comms*: VHF-AM/FM, UHF and HF radios to customer's requirements.

Flight: Long-range navaids optional.

Radar: Multirole radar optional.

Instrumentation: Basic instrumentation for single pilot VFR operation includes airspeed indicator with electrically heated pitot tube and static ports, encoding altimeter, instantaneous vertical speed indicator, 4 in artificial horizon, 3 in standby artificial horizon, HSI, (4 in and 3 in artificial horizons and HSI optional on Kawasaki built aircraft), gyro magnetic heading system, magnetic compass, ambient air temperature thermometer and clock.

EQUIPMENT: Standard basic equipment includes rotor brake, annunciator panel, master caution light, rotor rpm/engine fail warning control unit, fuel quantity indicator and low level sensor, outside air temperature indicator, engine and transmission oil pressure and temperature indicators, two exhaust temperature indicators, dual torque indicator, triple tachometer, two N1 tachometers, full internal and external lighting, ground handling wheels, pilot's and co-pilot's windscreen wipers, floor covering, interior panelling and sound insulation, ashtrays, map/document case, tiedown rings in cabin and cargo compartment, engine compartment fire warning indicator, engine fire extinguishing system, portable fire extinguisher, first aid kit, and single colour exterior paint scheme.



Eurocopter/Kawasaki BK 117 B-2 twin-turboshaft multipurpose helicopter (*Jane's/Dennis Punnett*)

1993

Optional equipment includes high-density seating arrangement, bleed air heating system, internal and external long range fuel tank, emergency flotation gear, settling protectors, snow skids, main rotor blade folding kit, dual pilot operation kit, stretcher installation, external cargo hook, rescue hoist, SX 16 remotely controlled searchlight, external loudspeaker, sand filter and kits for rescue, law enforcement and VIP transport

DIMENSIONS, EXTERNAL:
Main rotor diameter 11.00 m (36 ft 1 in)
Tail rotor diameter 1.96 m (6 ft 5 in)
Main rotor blade chord 0.32 m (1 ft 0½ in)
Length overall, both rotors turning 13.00 m (42 ft 8 in)
fuselage, tail rotor blades vertical 9.98 m (32 ft 9 in)
Fuselage: Max width 1.60 m (5 ft 3 in)
Height: overall, both rotors turning 3.85 m (12 ft 7½ in)
to top of main rotor head 3.36 m (11 ft 0¼ in)
Tailplane span (over endplate fins) 2.71 m (8 ft 10¾ in)
Tail rotor ground clearance 1.90 m (6 ft 2¾ in)
Width over skids 2.50 m (8 ft 2½ in)

DIMENSIONS, INTERNAL:
Combined cabin and cargo compartment
Max length 3.02 m (9 ft 11 in)
Width: max 1.49 m (4 ft 10½ in)
min 1.21 m (3 ft 11' in)
Height: max 1.28 m (4 ft 2½ in)
min 0.99 m (3 ft 3 in)
Useful floor area 3.70 m² (39.83 sq ft)
Volume 5.00 m³ (176.6 cu ft)

AREAS:
Main rotor blades (each) 1.76 m² (18.94 sq ft)
Tail rotor blades (each) 0.0975 m² (1.05 sq ft)
Main rotor disc 95.03 m² (1,022.9 sq ft)
Tail rotor disc 3.00 m² (32.24 sq ft)

WEIGHTS AND LOADINGS:
Basic weight empty 1,755 kg (3,869 lb)
Fuel, standard usable 558 kg (1,230 lb)
incl first auxiliary tank 718 kg (1,583 lb)
Max T-O weight, internal and external payload 3,350 kg (7,385 lb)
Max disc loading 35.25 kg/m² (7.22 lb/sq ft)
Max power loading 4.55 kg/kW (7.48 lb/shp)

PERFORMANCE (BK 117 B 2, ISA, A: at gross weight of 3,000 kg, 6,614 lb; B: at 3,200 kg, 7,055 lb; C: at 3,350 kg, 7,385 lb):
Never exceed speed (VNE) at S/L:
A 150 kts (278 km/h; 172 mph)
B, C 135 kts (250 km/h; 155 mph)
Max cruising speed at S/L:
A 136 kts (252 km/h; 156 mph)
B 134 kts (248 km/h; 154 mph)
C 133 kts (247 km/h; 153 mph)
Max forward rate of climb at S/L:
A 660 m (2,165 ft)/min
B 588 m (1,929 ft)/min
C 540 m (1,770 ft)/min
Max certificated operating altitude
A, B, C 5,490 m (18,000 ft)
Service ceiling, OEI, 30 m (100 ft)/min climb
A 3,170 m (10,400 ft)
B 2,590 m (8,495 ft)
C 1,890 m (6,200 ft)
Hovering ceiling IGE (zero wind)
A 3,690 m (12,105 ft)
B 3,050 m (10,005 ft)
C 2,530 m (8,300 ft)
Hovering ceiling IGE (17 kt, 32 km/h; 20 mph crosswind)
A 3,200 m (10,500 ft)
B 2,530 m (8,300 ft)
C 1,920 m (6,300 ft)
Hovering ceiling OGE: A 3,505 m (11,500 ft)
B 2,957 m (9,700 ft)
C 1,463 m (4,800 ft)
Range at S/L with standard fuel, no reserves 292 n miles (541 km; 335 miles)

PERFORMANCE (Main values for BK 117 C 1; A, B, C as above):
Never exceed speed (VNE) at S/L:
A 150 kts (278 km/h; 173 mph)
B 135 kts (250 km/h; 155 mph)
C 135 kts (250 km/h; 155 mph)
Max certificated operating altitude
A, B, C 5,490 m (18,000 ft)
Service ceiling, OEI, 30.5 m (100 ft)/min climb
A 3,290 m (10,795 ft)
B 2,715 m (8,905 ft)
C 2,025 m (6,645 ft)
Hovering ceiling, IGE, zero wind
A 3,690 m (12,105 m)
B 3,050 m (10,005 m)
C 2,530 m (8,300 m)
Hovering ceiling, IGE, (17 kt, 32 km/h, 20 mph) crosswind, A 3,200 m (10,500 ft)
B 2,530 m (8,300 ft)
C 1,920 m (6,300 ft)
Hovering ceiling, OGE: A 3,520 m (11,548 ft)
B 3,000 m (9,840 ft)
C 1,480 m (4,855 ft)

UPDATED

EUROFAR

EUROPEAN FUTURE ADVANCED ROTORCRAFT

PARTICIPATING COMPANIES:
Aerospatiale: see under France
Eurocopter France: see this section
Eurocopter Deutschland: see this section
Westland: see under UK

VERIFIED

EUROFAR

TYPE: Twin-turboshaft tilt-rotor transport.

PROGRAMME: Three year Phase 1 feasibility study completed end of 1991, including definition of a baseline aircraft; five year Phase 2 received support of European Eureka technology agency in 1992, covers the business case, operational studies, piloted simulations and preparation for demonstrator. CASA and Agusta withdrew from Eurofar Phase 2. First flight end of decade, flight testing completed last quarter 2002, production start 2004, first flight production aircraft 2006, certification possibly 2009. Shares in programme are Aerospatiale/Eurocopter France 46 per cent, Eurocopter Deutschland 22 per cent and Westland 32 per cent. Mil reported trying to join Eurofar programme in Autumn 1993.

Project continues as low priority; no known plan for construction of prototype, original timetable thus in doubt.

CUSTOMERS: 93 per cent of sales expected in regional airlines, 7 per cent in offshore oil industry; geographic distribution, 40 per cent in USA, 24 per cent in Europe, 21 per cent in Asia and 15 per cent elsewhere.

COSTS: Phase 2 expenditure ECU9 million, 50 per cent from governments through Eureka. Phase 1 cost ECU32 million.

DESIGN FEATURES: 30-passenger airliner, high forward-swept wing with partially tilting nacelles (stationary engines), four-blade rotors, T tail, cylindrical pressurised fuselage with APU, tricycle landing gear.

FLYING CONTROLS: Quadruplex fly-by-light electronic controls, automatic transition control.

STRUCTURE: CFRP/GFRP fuselage, wing and tail.

POWER PLANT: Two 3,200 kW (4,290 shp) maximum continuous power class turboshafts (modified PW300 foreseen).

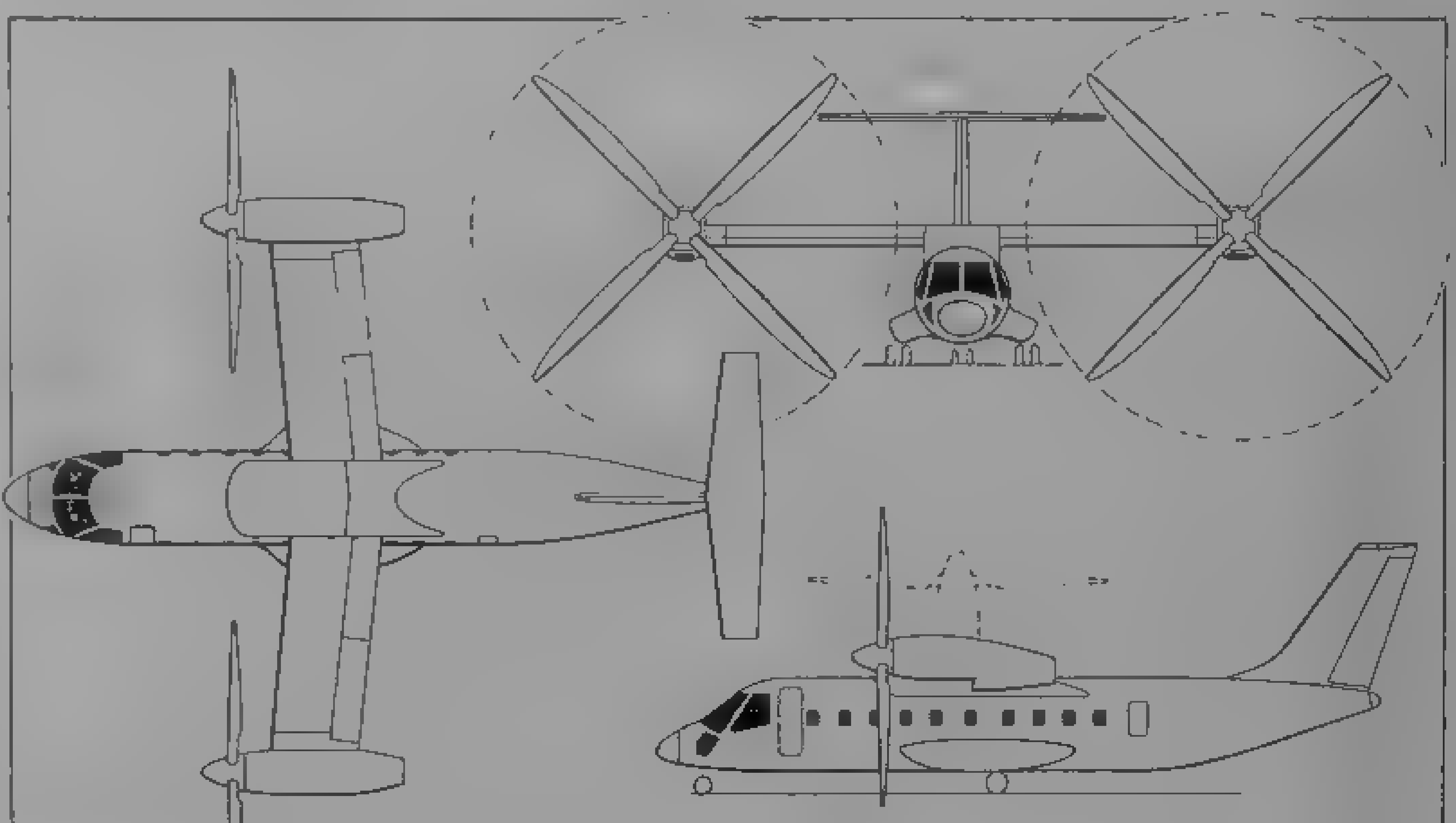
ACCOMMODATION: Two-pilot crew; 30 passengers, three-abreast seating at 83 cm (33 in) pitch with overhead stowage, toilet and galley.

DIMENSIONS, EXTERNAL:
Wing span between rotor centres 14.66 m (48 ft 1¼ in)
Rotor diameter, each 11.21 m (36 ft 9½ in)
Length overall 20.41 m (66 ft 11½ in)
Fuselage: Length 19.40 m (63 ft 7¾ in)
Diameter 2.48 m (8 ft 1½ in)
Height overall 6.645 m (21 ft 9½ in)

DIMENSIONS, INTERNAL:
Max height in aisle 1.83 m (6 ft 0 in)
Max width at shoulder level seated 2.23 m (7 ft 3¾ in)
Width of aisle 0.46 m (1 ft 6 in)
Seat width between armrests 0.43 m (1 ft 5 in)

WEIGHTS AND LOADINGS:
Max vertical T-O weight (Category A) 13,650 kg (30,093 lb)
Power/weight ratio (nominal) 2.13 kg/kW (6.57 lb/shp)

Eurofar civil tilt-rotor aircraft for the next century, as depicted by CATIA computer-aided design system *1993*



Possible configuration of 30-passenger Eurofar European tilt-rotor *(Jane's/Mike Keep)* *1993*

PERFORMANCE:
Cruising speed 335 kts (621 km/h; 385 mph)
Rate of climb 660 m (2,165 ft)/min
Hovering ceiling, both engines, OGE 3,050 m (10,000 ft)
Ceiling, OEI 1,250 m (4,100 ft)
Range 600 n miles (1,112 km; 690 miles)

UPDATED

EUROFIGHTER

EUROFIGHTER JAGDFLUGZEUG GmbH

Am Soldermoos 17, D-85399 Hallbergmoos, Munich, Germany
Telephone: 49 (811) 80-0
Fax: 49 (811) 80-1557
CHAIRMAN: Carlos Navarro
MANAGING DIRECTOR: William F McNaughton
MARKETING: Peter J Moore

Eurofighter GmbH formed to manage EFA (European Fighter Aircraft) programme June 1986, followed shortly after by Eurojet Turbo GmbH to manage engine programme. NEFMA (NATO European Fighter Management Agency) supervises EFA programme.

VERIFIED

EUROFIGHTER 2000 (EFA)

TYPE: Single-seat, highly agile STOL-capable fighter, optimised for air defence/air superiority; secondary capability for ground attack.

PROGRAMME: Outline staff target for common combat aircraft issued December 1983 by air chiefs of staff of France, Germany, Italy, Spain and UK; initial feasibility study launched July 1984; France withdrew July 1985, shareholdings then being readjusted to 33 per cent each to UK and Germany, 21 per cent Italy and 13 per cent Spain; project definition phase completed September 1986; definitive ESR-D (European Staff Requirement — Development) issued September 1987, giving military requirements in greater detail; definition refinement and risk reduction stage completed December 1987; main engine and weapons system development contracts signed 23 November 1988.

Programme halted 1992 by German demands for substantial cost reduction and studies of alternative proposals, which submitted in October 1992; Italy and Spain froze EFA work mid-October. Seven possible alternative configurations for New EFA (NEFA) offered to Germany, being permutations of single (three types) or twin engines, canards; and cranked wing. Only two of seven cheaper than EFA — both inferior to developments of MiG-29 and Su-27. Defence ministers' conference of 10 December 1992 relaunched aircraft as Eurofighter 2000, delaying service entry by three years, to 2000, and allowing Germany to incorporate off-shelf avionics (probably AN/APG-65 radar), lower standard of defensive aids and other deletions to effect 30 per cent price cut. Production commitment due by Italy, Spain and UK in 1995 and by Germany in 1996; deliveries to UK and Italy in 2000; Spain in 2001 and Germany in 2002. Intended four production lines likely to be reduced.

Eurofighter 2000 remained grounded throughout 1993 for exhaustive cross-checking of digital flight control system (DFCS); first flight eventually achieved 29 March 1994. Further difficulties resulted from German underfunding and demands for further cost-cuts. Political re-apportionment of work-shares to be attempted in 1995 following reduction of German requirement. Revised European Staff Requirement — Development signed by four air forces, 21 January 1994.

Planned eight development aircraft (no prototypes apart from BAe EAP — see 1991-92 and earlier *Jane's*) reduced to seven (DA1-7) early 1991 coincident with 11 per cent cut in intended flight test programme to 4,500 hours. Details of prototypes appear below. Eurofighter to clear full carefree-handling envelope by end 1995, including 9 *g* manoeuvring; interim (mid-1995) target is 750 knots (1,389 km/h; 863 mph), 35° AoA and 7 *g*. Second version of flight software completed February 1995 and airborne in second prototype, 17 May 1995.

Defensive aids subsystem contract awarded to EuroDASS 13 March 1992, but Germany and Spain initially declined to participate; may develop own equivalent systems. 'A' version of ECR 90 radar first flew in nose of modified BAe One-Eleven testbed (ZE433) at Bedford, 8 January 1993; 'C' version, to fly 1995, is first ECR 90 packaged to fit Eurofighter.

Fatigue test fuselage at Ottobrunn achieved 5,000 hours on 17 March 1995; target is 18,000 hours (equivalent to 6,000 hours of service use) by January 1997.

CURRENT VERSIONS (general): **Single-seater**: Standard version.

Two-seater: Combat-capable conversion trainer.

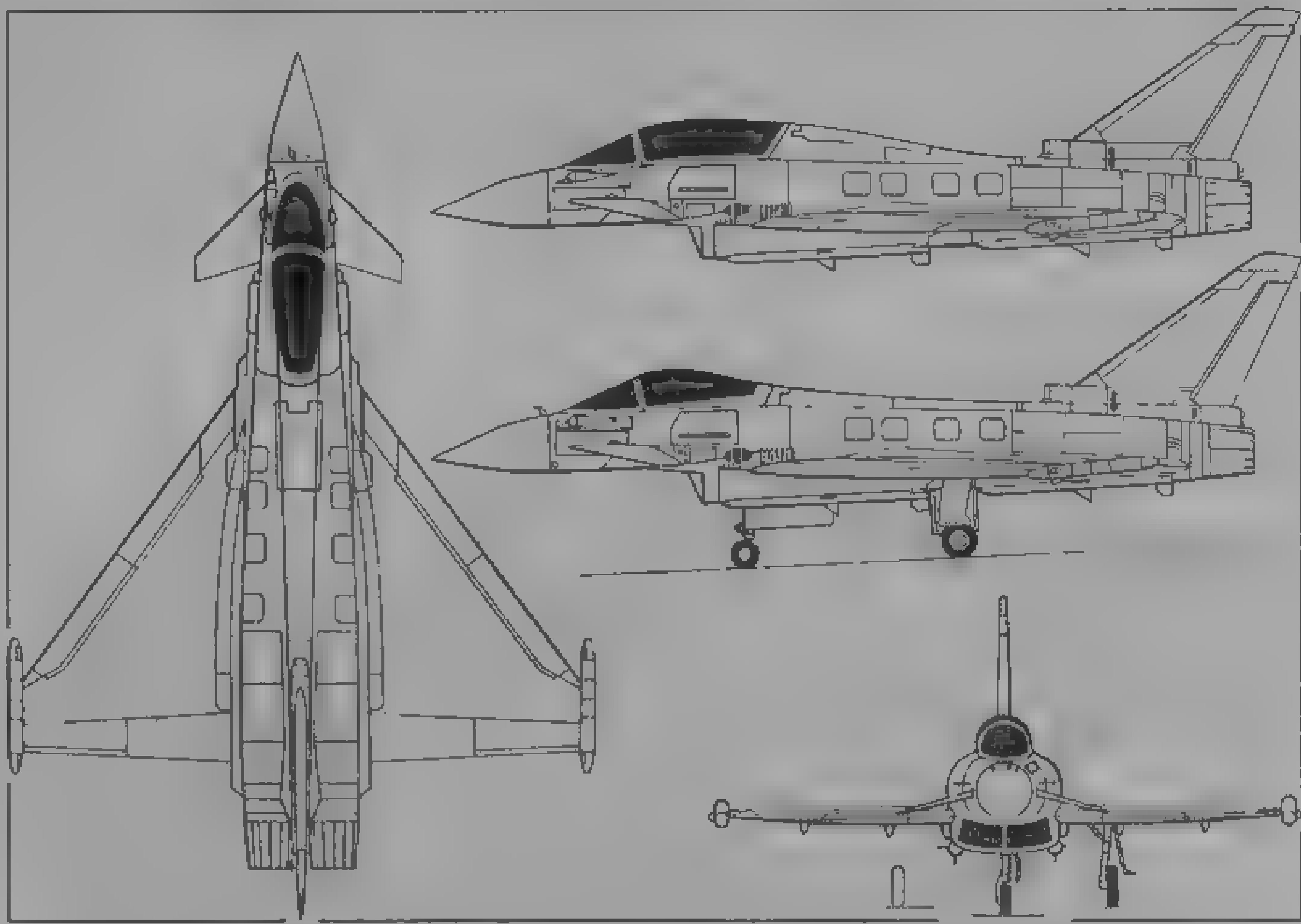
CURRENT VERSIONS (specific): **DA1/9829**: (DASA built at Ottobrunn, airframe No. 01, Luftwaffe serial number 9829) by road to Manching 11 May 1992; first flight, 27 March 1994; planned transfer to Warton for handling and envelope expansion trials (wearing UK serial number ZH586) cancelled, remained at Manching; eight sorties to June 1994, when grounded for FCS upgrade; reflown 1995.

DA2/ZH588: (BAe at Warton, airframe No. 02) first engine run 30 August 1992, first flight 6 April 1994, assigned to envelope expansion, nine sorties to June 1994, when grounded for FCS upgrade; reflown 17 May 1995.

DA3: (Alenia at Turin/Caselle, airframe No. 04) first with EJ200 power plants for engine trials (originally scheduled from March 1993 but postponed) and gun/weapon release trials.

Eurofighter 2000 DA4 two-seater being rolled out at BAe Warton factory in May 1994

1995



Single-seat version of Eurofighter 2000, with additional side view (top) of two-seat aircraft *(Jane's/James Goulding)*

1995

DA4/ZH590: (BAe, airframe No. 03) first two-seat and first with full avionics.

DA5: (DASA) construction begun 2 November 1992; first with ECR 90 radar; avionics and weapons trials.

DA6: (CASA at Seville) second two-seat; avionics development.

DA7: (Alenia); performance and weapons integration trials.

All originally to have flown before end 1994; target now end 1995. Further eight ground testing part-airframes.

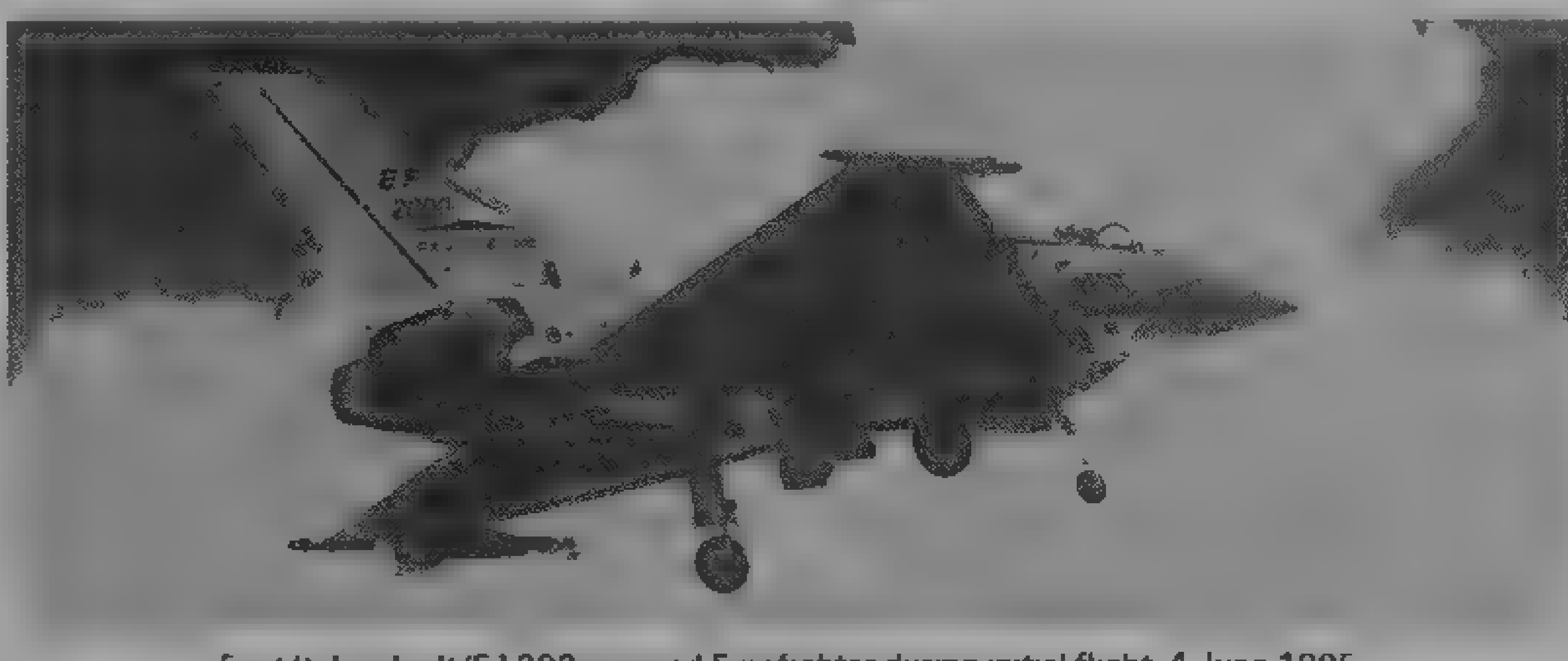
CUSTOMERS: Originally declared requirements for 765 (UK and Germany 250 each; Italy 165 and Spain 100). In January 1994, Spain announced firm requirement for 87; Germany believed planning 120 to 140; Italy, 130 including five squadrons of 14 each, plus OCU; and UK unchanged. All require some of two-seat version; export orders also anticipated. Planned first international batch is 30 aircraft including 26 two-seat trainers.

COSTS: £25 to 26.5 million, UK, 1992 unit cost. DM127 million, Germany early 1992, 10 year system price; reduced to DM89 million by late 1992 economies.

DESIGN FEATURES: Collaborative design by BAe, DASA, Alenia and CASA, incorporating some design and technology (including low detectability) from BAe EAP programme; low-wing, low-aspect ratio tail-less delta with 53° leading-edge sweepback; underfuselage box with side by side engine air intakes, each with fixed upper wedge/ramp and vari-cowl (variable position lower cowl lip) with Dowty actuators.

Intended service life, 6,000 hours or 30 years. Maintainability features include 9 mmh/fh and double engine change by four engineers in 45 minutes.

FLYING CONTROLS: Two-segment automatic slats on wing leading-edges, inboard and outboard flaperons on trailing-edges; all-moving foreplanes below windscreen, rudder, hydraulically actuated airbrake aft of canopy, forming part of dorsal spine. Liebherr primary flight control actuators. Full-authority quadruplex ACT (active control technology) digital fly-by-wire flight control system (team leader DASA) combines with mission adaptive configuring and aircraft's instability in pitch to provide required 'carefree' handling, gust alleviation and high sustained



First Italian built/EJ 200 engined Eurofighter during initial flight, 4 June 1995

1995

Eurofighter 2000 DA2 on its maiden flight from BAe Warton

1995

manoeuvrability throughout flight envelope, pitch and roll control via foreplane/flaperon ACT to provide artificial longitudinal stability; yaw control via rudder, no manual reversion, but DFCS incorporates 'panic button' for immediate return to straight-and level flight in emergency Ada language, apart from time-critical subroutines in Assembler STANAG 3838 NATO standard databus

STRUCTURE Fuselage, wings (including inboard flaperons), fin and rudder mainly of CFC (carbonfibre composites) except for foreplanes, outboard flaperons and exhaust nozzles (titanium); nose radome and fin-tip (GFRP), leading-edge slats, wingtip pods, fin leading-edge, rudder trailing-edge and major fairings (aluminium-lithium alloy); and canopy surround (magnesium alloy). CFC constitutes 70 per cent of surface area, with metal 15 per cent, GFRP 12 per cent and other materials 3 per cent Manufacture includes such advanced techniques as superplastic forming and diffusion bonding, CASA-led joint structures team, BAe responsible for front fuselage, foreplanes, starboard leading-edge slats and flaperons, plus (after 1994 transfer from DASA) fin and centreline pylon, DASA the centre-fuselage, Alenia the port wing, including all movable surfaces, Alenia/CASA the rear fuselage, and CASA/BAe the starboard wing, no duplication of tooling, final assembly line at each manufacturer's facility now in doubt, work-shares may be revised

Eurofighter 2000 cockpit

1995

Most subsystems developed by multination teams; in following description, for clarity, team leaders only are named

LANDING GEAR Dowty Aerospace retractable tricycle type Single-wheel main units retract inward into fuselage, nosewheel unit forward Nosewheel steering is subfunction of DFCS

POWER PLANT: First two development aircraft each powered by two Turbo-Union RB199-122 (Mk 104E) afterburning turbofans (each more than 71 2 kN; 16,000 lb st). DA3-DA7, retrofitted (1996) DA1 and DA2, and production aircraft, will have two Eurojet EJ200 advanced technology turbofans (each of approximately 60 kN; 13,490 lb st dry and 90 kN, 20,250 lb nominal thrust with afterburning), mounted side by side in rear fuselage with ventral intakes Staged EJ200 improvements available (but not funded) to 103 kN (23,155 lb st) and 117 kN (26,300 lb st). DASA digital engine control system Lucas Aerospace fuel management system Internal fuel capacity classified Provision for in-flight refuelling and up to three external fuel tanks two 1,000 litre (264 US gallon, 220 Imp gallon) and one 1,500 litre (396 US gallon, 330 Imp gallon) carried simultaneously

ACCOMMODATION: Pilot only, on Martin-Baker Mk 16A zero/zero ejection seat, Smiths Industries glareshields

SYSTEMS Normalair-Garrett environmental control system. Magnaghi hydraulic system. Lucas Aerospace electrical system, with GEC-Marconi/Bendix variable-speed constant frequency generator (Sundstrand unit in DA1 and DA2) and GEC-Marconi transformer-rectifier units Alenia-led utilities control system (UCS), controlled by microcomputer. AlliedSignal APU for engine starting, systems running and NBC filtering Microturbo UK air turbine starter motor

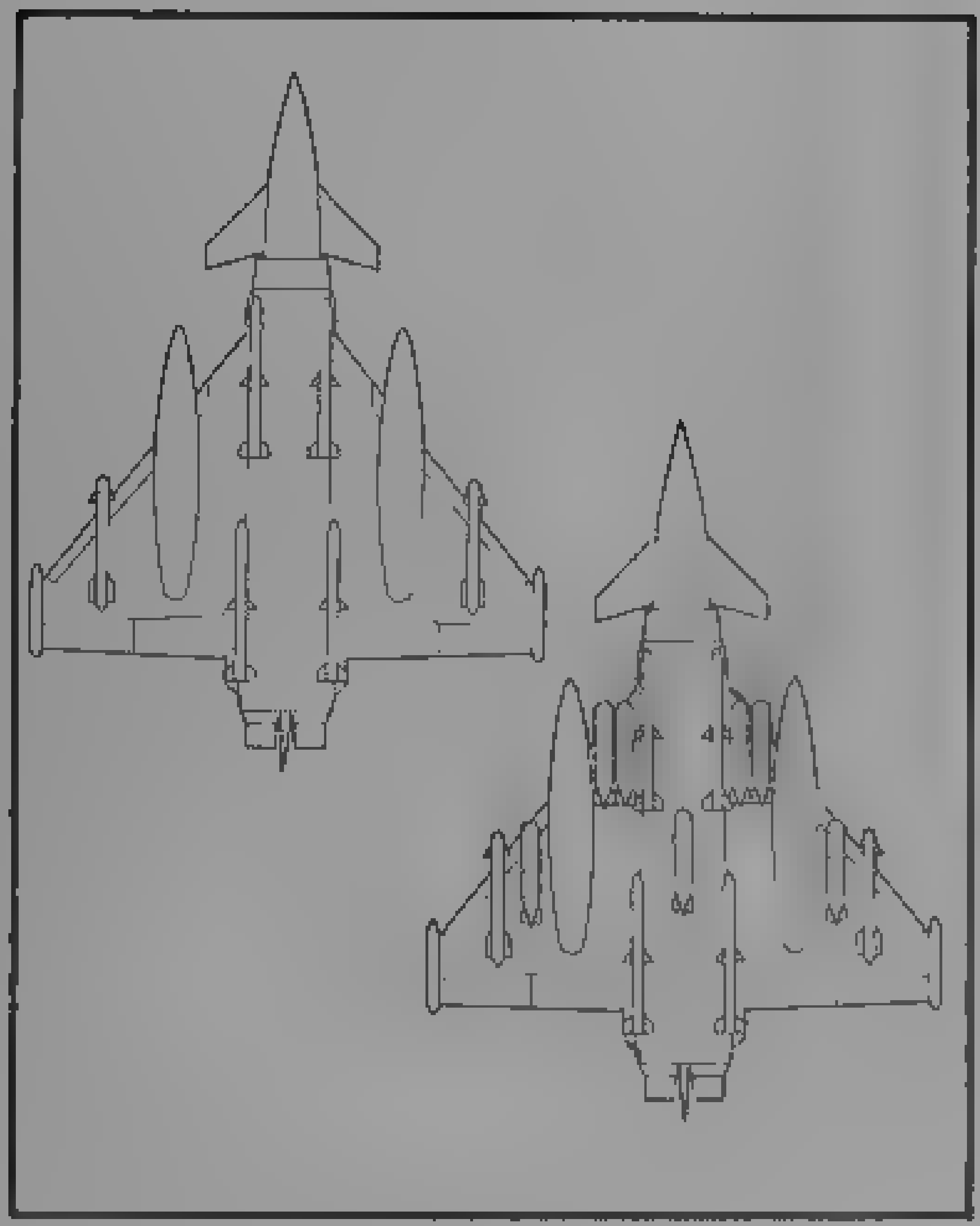
AVIONICS: BAe has overall team leadership for avionics development and integration All avionics, flight control and utilities control systems integrated through databus highways with appropriate redundancy levels, using fibre optics and microprocessors

Comms: Rohde & Schwarz Saturn VHF/UHF communications; Computing Devices video and voice recorder

Radar: GEC-Marconi ECR 90 multimode pulse Doppler radar

Flight GEC-Marconi (Elmer) crash survival memory unit

Instrumentation Special attention given to reducing pilot workload New cockpit techniques simplify safe and effective operation to limits of flight envelope while monitoring and managing aircraft and its operational systems, and detecting/identifying/attacking desired targets while remaining safe from enemy defences. This achieved through high level of system integration and automation, including HOTAS controls; GEC-Marconi wide-angle HUD able to display, in addition to other symbology FLIR pictures from sensor pod-mounted externally to port side of cockpit; helmet mounted sight (HMS), with direct voice

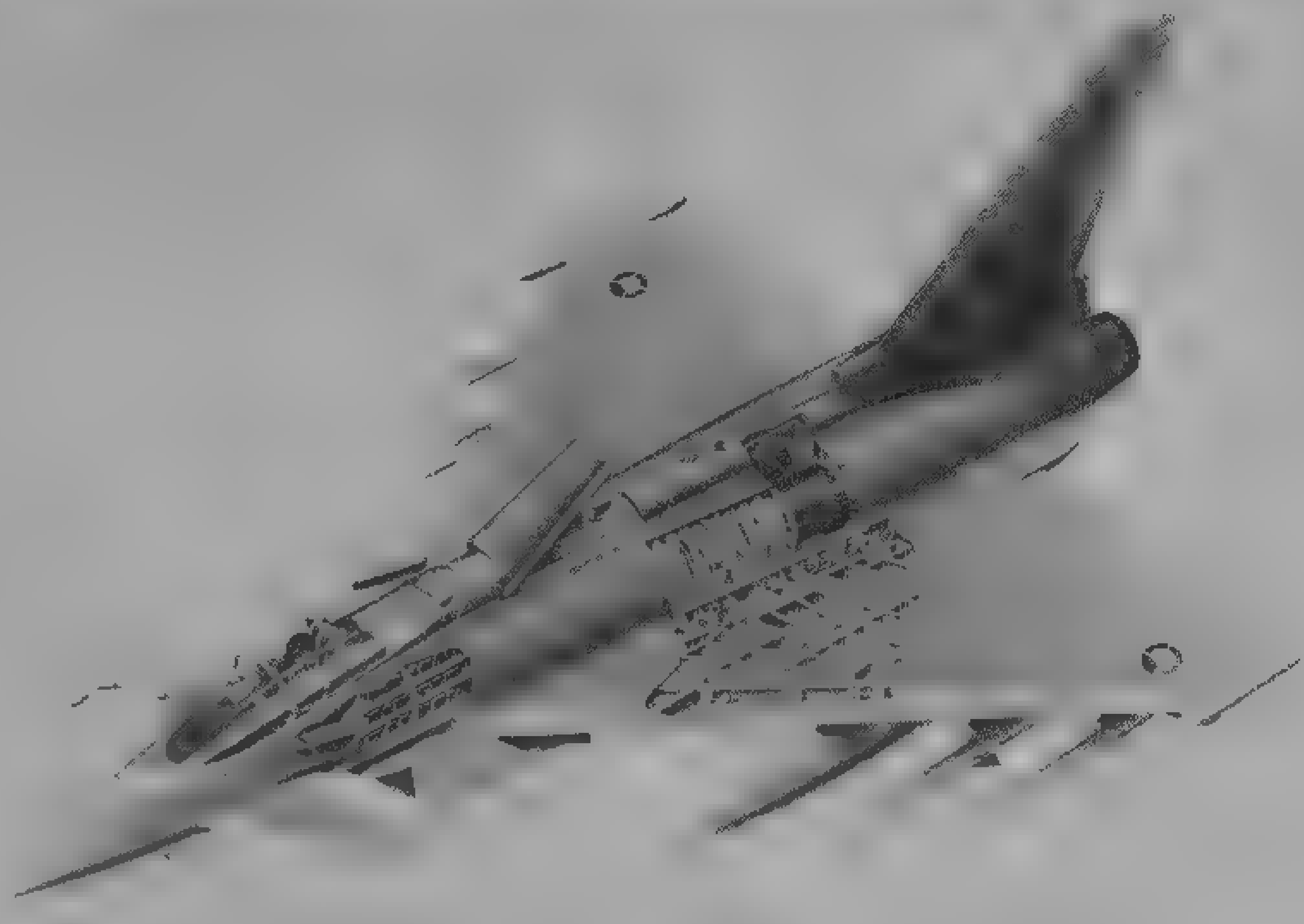


Eurofighter 2000 in air-to-air (left) and air-to-ground configurations

1994

Eurofighter 2000 DA1 on its maiden flight from Manching in March 1994

1994



Internal arrangement of wing structure, airbrake, avionics bay and refuelling boom of the Eurofighter 2000

1991

input (DVI) for appropriate functions, and three Smiths Industries multifunction head down (MFHD) colour CRT displays. Teldix cockpit interface unit.

Mission: Eurofirst (Pilkington-Thorn Optronics consortium) PIRATE (Passive Infra-Red Airborne Tracking Equipment) port side of windscreen.

Self-defence: Advanced integrated defensive aids sub-system (DASS), contracted to Euro-DASS consortium, led by GEC-Marconi Defence Systems, includes RWR and active jamming pod at each wingtip plus laser warning receiver, missile approach warning and towed decoys (Germany withdrew from DASS, but still requires RWR and MAW. Spain also withdrew, but intends to rejoin; UK and Spain are only nations to have LWR).

ARMAMENT: Interceptor will have internally mounted 27 mm Mauser gun on starboard side, plus mix of medium-range AIM-120 AMRAAM or Aspide and short-range air-to-air missiles carried externally. Four AIM-120s carried in underfuselage troughs. Short-range missiles carried on MI Aviation underwing ejector release units. Strengthened wing will, if necessary, be able to carry considerable load of air-to-surface weapons. Total of 13 external stores stations: five (including one wet) under fuselage and four (including one wet) under each wing.

DIMENSIONS, EXTERNAL:

Wing span over ECM pods	10.95 m (35 ft 11 in)
Wing aspect ratio	2.205
Length overall	15.96 m (52 ft 4¼ in)
Height overall	5.28 m (17 ft 3⅞ in)

AREAS:

Wings, gross	50.0 m² (538.2 sq ft)
Foreplanes	2.40 m² (25.83 sq ft)

WEIGHTS AND LOADINGS (approx):

Weight empty	9,999 kg (22,044 lb)
Internal fuel load	4,000 kg (8,818 lb)
External stores load (weapons and/or fuel)	6,500 kg (14,330 lb)
Max T-O weight	21,000 kg (46,297 lb)

PERFORMANCE (design):

Max level speed: Mach 2.2

T-O and landing distance with full internal fuel, two AIM-120s and two dogfight missiles, ISA + 15°C: 500 m (1,640 ft)

Combat radius: 250-300 n miles (463-556 km; 288-345 miles)

g limits with full internal fuel and two AIM-120s: +9/−3

UPDATED

EUROFLAG

EUROFLAG srl/AIRBUS MILITARY COMPANY

c/o Alenia, Via Faustiniana, I-00131 Rome, Italy
Telephone: 39 (6) 5229 2080
Fax: 39 (6) 5229 208

CHAIRMAN: Nino d'Angelo
GENERAL MANAGER: P. Felici

PARTICIPATING COMPANIES:

Aerospatiale: see under France
Alenia: see under Italy
British Aerospace: see under UK
CASA: see under Spain
Daimler-Benz Aerospace Airbus: see under Germany

Euroflag srl formed 17 June 1991, with headquarters in Alenia head office in Rome, to manage European FLA development. Aerospatiale, Alenia, British Aerospace, CASA and Daimler-Benz Aerospace Airbus have equal shares in Euroflag srl. MoUs established 1992 with Flabel (Sabca and Sonaca) of Belgium, OGMA of Portugal and TUSAŞ Aerospace Industries of Turkey to allow integrated participation in FLA programme. BAe and Flabel are industrial, not national, partners contributing their own funds, although UK government announced in December 1994 that membership to be upgraded to national participation in 1995.

Partners agreed in September 1994 to industrialise programme by transfer to their existing airliner production company; formal announcement 14 June 1995 that Airbus Military Company (AMC) to be established for FLA manufacture. Participating governments expected to leave work-share percentage decisions to industry.

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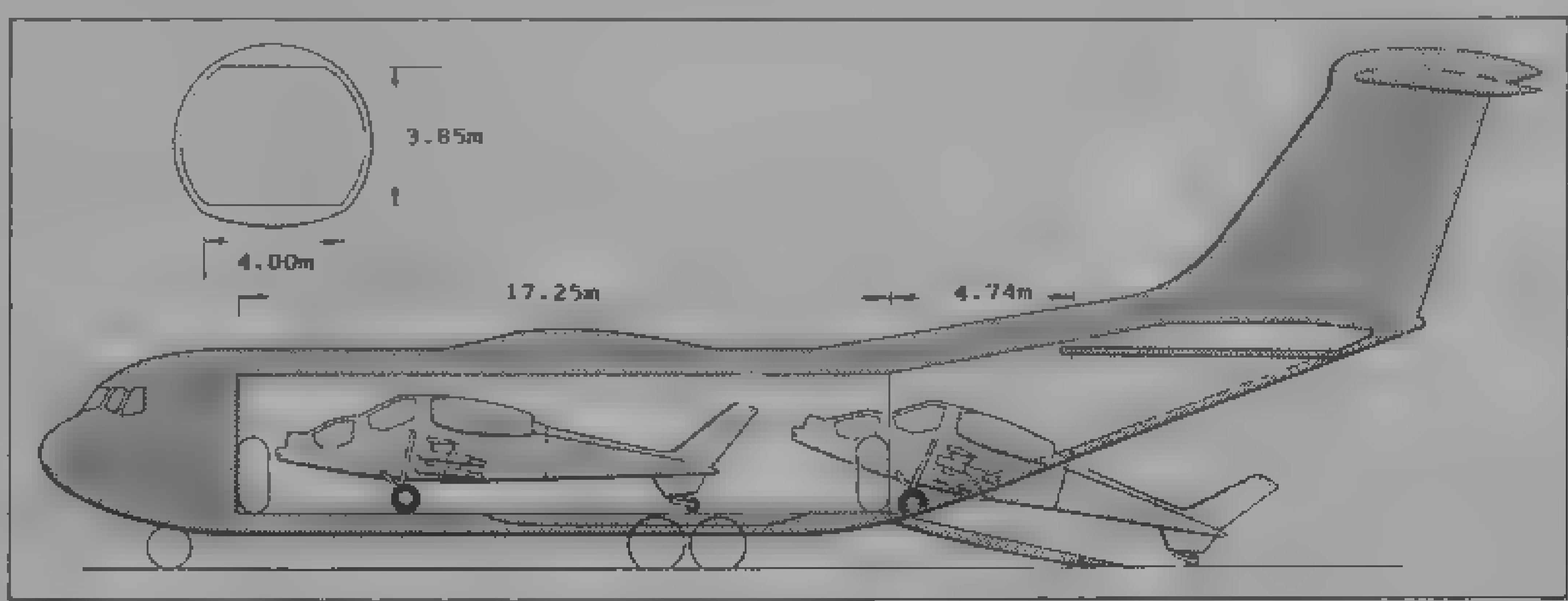

Euroflag Future Large Aircraft freight cabin dimensions *(Jane's/Mike Keep)*

1995

EUROFLAG FUTURE LARGE AIRCRAFT (FLA)

TYPE: Long range military tactical transport and tanker.

PROGRAMME: Original FIMA programme (see 1989-90 *Jane's*) replaced April 1989 by five-nation industry MoU to develop new technology transport to replace C-130 Hercules and C-160 Transall; Independent European Programme Group (IEPG) defined Outline European Staff Target (OEST) during 1991; Western European Union report in Autumn 1991 concluded Euroflag FLA should form core of future European military transport capability to support Rapid Reaction Corps; national armament directors of Belgium, France, Germany, Italy, Portugal, Spain and Turkey affirmed support for 12 month prefeasibility study completed by Euroflag in late 1992; UK Ministry of Defence declined involvement, but retained observer status; UK participation privately maintained by BAe and Shorts (10 per cent of BAe work); European Staff Target and inter governmental MoU signed by seven nations in 1993; full feasibility programme officially started October

Artist's impression of the turboprop-powered Euroflag Future Large Aircraft

1995

993, by which time cargo hold width and height increased from original 3.66 m (12 ft 0 in) and 3.55 m (11 ft 7¾ in), respectively), study finished mid-1995. Discussion of a 'close association' between Euroflag and Airbus Industrie began Autumn 1993 and formalised in June 1995.

FLA underwent profound change in April 1994 when turbofans deemed incapable of providing desired performance; aircraft recast with four turboprops of new design. Original timetable called for first flight in 2000 if full scale development phase starts in 1996, first deliveries in 2002; revised schedule is predevelopment phase from 1996, production-standard development from 1999, deliveries in 2003; initial WEU fleet size estimated at 300 aircraft.

CURRENT VERSIONS: Primarily for personnel/cargo transport and parachuting of men and equipment; derivatives will include air-refuelling tanker and possibly surveillance/reconnaissance, long-range maritime patrol and AEW. All data here may change during feasibility study. Three-point tanker carrying up to 40,000 kg (88,185 lb) of transferable fuel over 200 n mile (370 km, 230 mile) radius could take off from 1,525 m (5,000 ft) runway.

CUSTOMERS: Western European Union air forces of Belgium, France, Germany, Italy, Portugal, Spain, Turkey and UK probable. French requirement stated by Defence Ministry to be about 70 aircraft, early 1995; UK need is 40 to 50; exports expected, and attempts made early in 1995 to interest Japan; overall market estimated at 400 to 700 aircraft.

DESIGN FEATURES: High-wing, T tailed aircraft with rough field landing gear and much larger cabin/hold floor area and cross-section than C-130/C-160, permitting high payload factors with low-density cargo, vehicles or mixed passenger/cargo loads, and much greater payload/range; will have flight refuelling; operable all-weather and at night. Moving 375 tonnes (826,725 lb) of cargo over 3,780 n miles (7,000 km, 4,350 miles) in one lift would require 32 FLAs compared with 58 C-130Js.

STRUCTURE: Modern design/manufacturing techniques expected to afford major reductions in maintenance man-hour requirements and increases in aircraft availability/survivability.

POWER PLANT: Initial candidate engines include 6,711 kW (9,000 shp) M138 turboprop offered by SNECMA, MTU and Fiat Avio and based on SNECMA M88-2 core; BMW Rolls-Royce offering a turboprop development of the BR715 turbofan giving 6,711 to 8,948 kW (9,000 to 12,000 shp); Allison Engines AE 2100. Propeller partnerships sought among Dowty Aerospace, Ratier Figeac, Hispano Suiza and ZF Luftfahrttechnik. Ukraine's Progress is offering D-27 propfan. Fuel capacity 52,500 litres (13,870 US gallons; 11,548 Imp gallons).

ACCOMMODATION: Two-man flight deck; typical loads include MLRS, Bradley AFV, Super Puma, two PAH-2 Tigers, up to 126 paratroops or 62 troops and eight 2.74 × 2.24 m (108 × 88 in) pallets.

DIMENSIONS, EXTERNAL:
Wing span 40.50 m (132 ft 10½ in)
Length overall 40.60 m (133 ft 2½ in)
Height overall 12.90 m (42 ft 4 in)

DIMENSIONS, INTERNAL (provisional):
Hold: Length: incl ramp 22.00 m (72 ft 2 in)
excl ramp 17.25 m (56 ft 7¼ in)
Floor width, continuous 4.00 m (13 ft 1½ in)
Floor to ceiling height, continuous 3.85 m (12 ft 7½ in)
Ramp length 4.74 m (15 ft 6¾ in)
Floor area: incl ramp 89.0 m² (958.0 sq ft)
excl ramp 69.0 m² (742.7 sq ft)
Volume: incl ramp 342.0 m³ (12,077 cu ft)
excl ramp 265.0 m³ (9,359 cu ft)

WEIGHTS AND LOADINGS:
Max payload 25,000 kg (55,115 lb)
Max T-O weight 104,600 kg (230,603 lb)
Operating weight empty 55,000 kg (121,254 lb)

PERFORMANCE:
Cruising Mach number Mach 0.68
Soft field landing and T-O less than 914 m (3,000 ft)
Range, with 20,000 kg (44,092 lb) payload up to 3,000 n miles (5,556 km, 3,452 miles)

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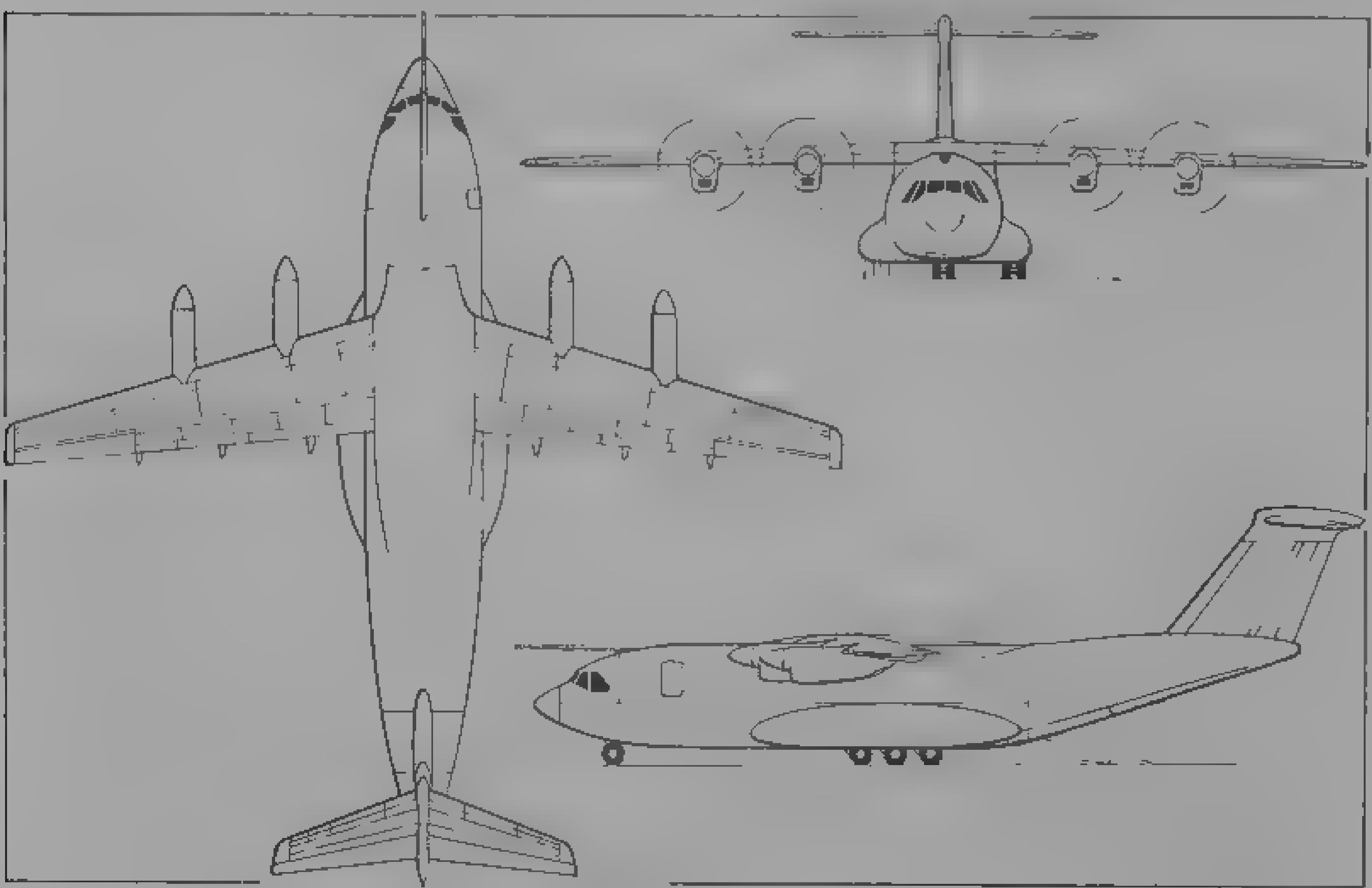

FLA configuration in 1994 after fuselage cross-sectional area increased and power plant change to turboprops *(Jane's/James Goulding)*

1995

EUROMIL

PARTICIPATING COMPANIES:
Eurocopter SA: see this section
Mil: see under Russia
Kazan: Mil's production centre in Kazakhstan
Klimov: see under Aero Engines, Russia

UPDATED

EUROMIL Mi-38

TYPE: Medium transport helicopter.

PROGRAMME: Agreement signed in Moscow 29 September 1994 between Eurocopter, Mil Moscow Helicopter Plant, Kazan Helicopter Production Plant (KVPO) and Klimov Corporation to form equal share joint venture company covering joint development and production of 30-passenger Mi-38 helicopter. Eurocopter plans to use Mi-38 to extend its range of products upwards; expects to invest about $100 million in programme. First deliveries 1999.

Mil (see Russian section for Mi-38 description) will handle development; Eurocopter to lead in flight deck, avionic system and passenger accommodation and responsible for preparation for export from Russia; Klimov in charge of engine development, industrialisation and production; Kazan will manufacture helicopter for domestic market.

UPDATED

EUROPATROL

PARTICIPATING COMPANIES
Alenia: see under Italy
British Aerospace: see under UK
Dassault Aviation: see under France
Daimler-Benz Aerospace: see under Germany
CASA: see under Spain
Fokker: see under Netherlands

Grouping formed by above manufacturers in late Summer 1992 to move towards development of a European maritime patrol aircraft and mission system for the next century. Initial objectives are to work towards a common requirement, approach governments and encourage Western European Armaments Group (WEAG) to formulate an Outline European Staff Target (OEST). Existing, updated or new aircraft would be considered and the mission system would be suitable for retrofitting in existing aircraft. BAe Nimrod, Dassault Atlantique 2 and Lockheed P-3 Orion offered as possible existing aircraft. Studies continuing at low priority in 1995.

UPDATED

HONDA/MSU

PARTICIPATING ORGANISATIONS
Honda R & D Company Ltd, Wako Research Centre, 1-4-1 Chuo Wako-shi, Saitama 351-01, Japan
Telephone: 81 (48) 462 5301
Fax: 81 (48) 462 5080
PRESIDENT: N Kawamoto
PROJECT LEADER: Haruo Nakayama
Mississippi State University, Raspet Flight Research Laboratory, Department of Aerospace Engineering, Drawer A, Mississippi 39762, USA
Fax: 1 (601) 325 3864

As part of its R & D programmes for future technologies applicable to transportation vehicles, Honda R & D conducting joint programme with Mississippi State University's Raspet Flight Research Laboratory to design, fabricate and test a small jet research aircraft to explore aerospace technologies.

UPDATED

HONDA/MSU MH-02

No further examples of this research aircraft are to be built.

Details, photograph and drawing in the 1994-95 and earlier *Jane's*.

UPDATED

IAR/AEDECO

PARTICIPATING COMPANIES
IAR: see under Romania
AEDECO: see under France

IAR/AEDECO NOGA VI

TYPE: Twin-turbofan small business jet.

PROGRAMME: Announced late 1993; two prototypes planned, plus two airframes for static and fatigue test; first flight forecast for mid-1997, FAR Pts 23 and 25 certification mid-1998. Other partners may be sought. Name is Romanian for Venus.

COSTS: Target price $2.2 million, development programme approximately $40 million (1994).

DESIGN FEATURES: Sweptback low wing with NACA aerofoil section, rear-mounted engines, T tail. AEDECO Managing Director is former designer with Dassault Aviation.

FLYING CONTROLS: Hydraulic actuation for primary control surfaces.

STRUCTURE: Mainly conventional aluminium alloy stressed skin.

LANDING GEAR: Retractable tricycle type; inward-retracting single mainwheels, single nosewheel.

POWER PLANT: Two 8.45 kN (1,900 lb st) Williams-Rolls FJ44 turbofans, pylon-mounted on sides of rear fuselage. Three fuel tanks: one in fuselage and one in each wing.

ACCOMMODATION: Six to eight persons, including pilot.

AVIONICS: Of Western origin, to be decided.

DIMENSIONS, EXTERNAL:
Wing span 11.50 m (37 ft 8¾ in)
Wing chord: at root 2.16 m (7 ft 1 in)
at tip 0.80 m (2 ft 7½ in)
Wing aspect ratio 7.71
Length overall 12.75 m (41 ft 10 in)
Fuselage: Max diameter 1.65 m (5 ft 5 in)
Height overall 4.42 m (14 ft 6 in)

DIMENSIONS, INTERNAL:
Cabin, excl flight deck: Length 3.75 m (12 ft 3½ in)
Max width 1.50 m (4 ft 11 in)
Max height 1.42 m (4 ft 8 in)

AREAS:
Wings, gross 17.15 m² (184.6 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 2,364 kg (5,218 lb)
Max fuel weight 1,260 kg (2,778 lb)
Max payload 743 kg (1,638 lb)
Max T-O weight 4,286 kg (9,450 lb)
Max wing loading 249.9 kg/m² (23.2 lb/sq ft)
Max power loading 507.22 kg/kN (4.97 lb/lb st)

PERFORMANCE (estimated, at max T-O weight):
Max operating Mach number (MMO) 0.82
Max operating speed 470 kts (870 km/h; 540 mph)
Max cruising speed Mach 0.78 (435 kts; 806 km/h; 501 mph)
Long-range cruising speed Mach 0.72 (413 kts; 765 km/h; 475 mph)
Max rate of climb at S/L, ISA+15°C 1,158 m (3,800 ft)/min
Max operating altitude 12,500 m (41,000 ft)
T-O field length 912 m (2,993 ft)
FAR Pt 25 balanced field length 1,181 m (3,875 ft)
Landing distance 818 m (2,684 ft)
Range with six passengers, allowance for taxi, T-O, climb from S/L to 12,500 m (41,000 ft), cruise at Mach 0.72, descent to S/L and land, 45 min reserves:
at Mach 0.78 1,500 n miles (2,780 km; 1,727 miles)
at Mach 0.72 1,700 n miles (3,150 km; 1,957 miles)

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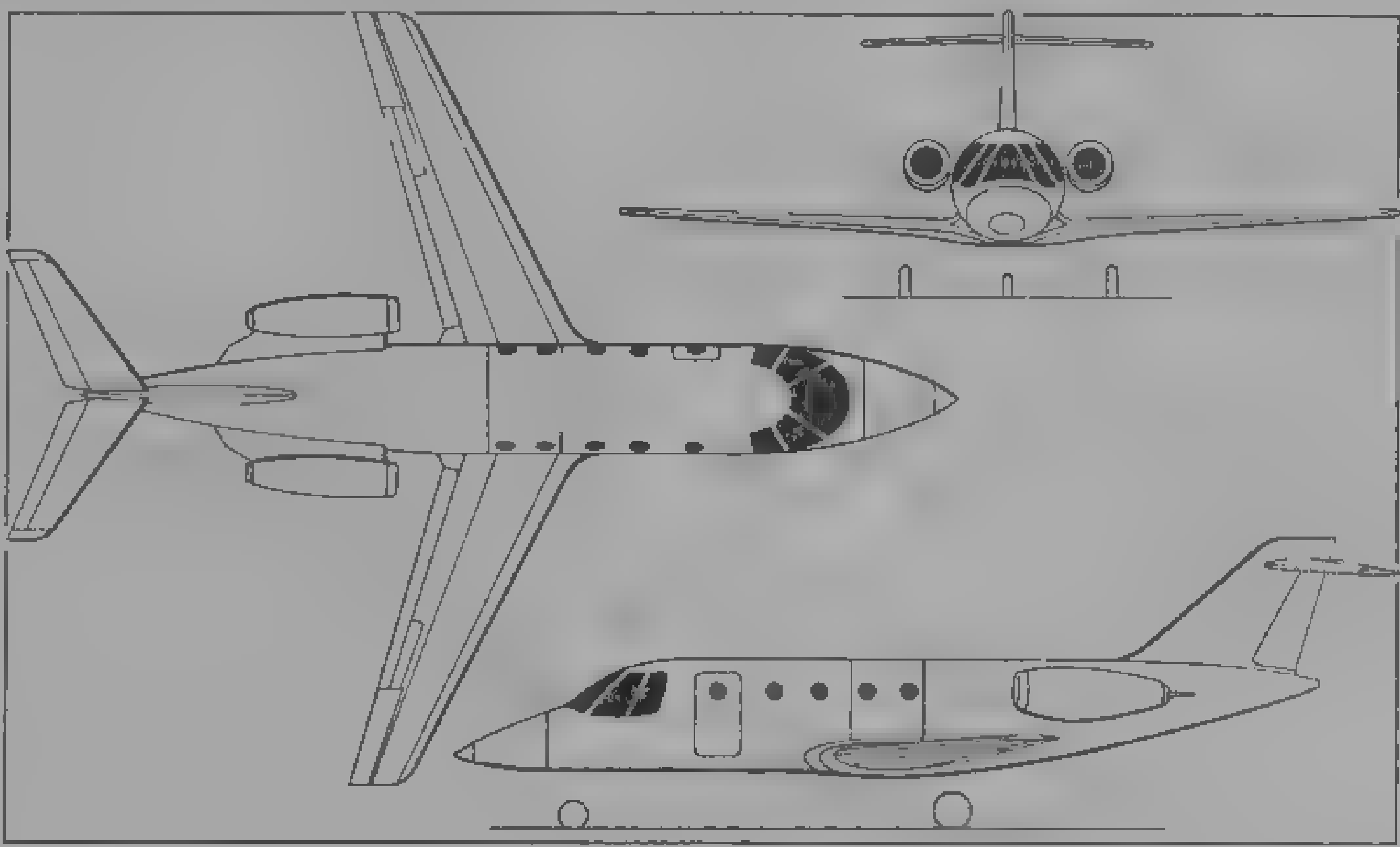


IAR/AEDECO Noga VI six/eight-seat business transport *(Jane's/Mike Keep)*
1994

KCAD/AVIC/DASA/FOKKER

PARTICIPATING COMPANIES
Samsung: (for KCAD) see under Korea, South
AVIC: see under China
DASA: see under Germany
Fokker: see under Netherlands

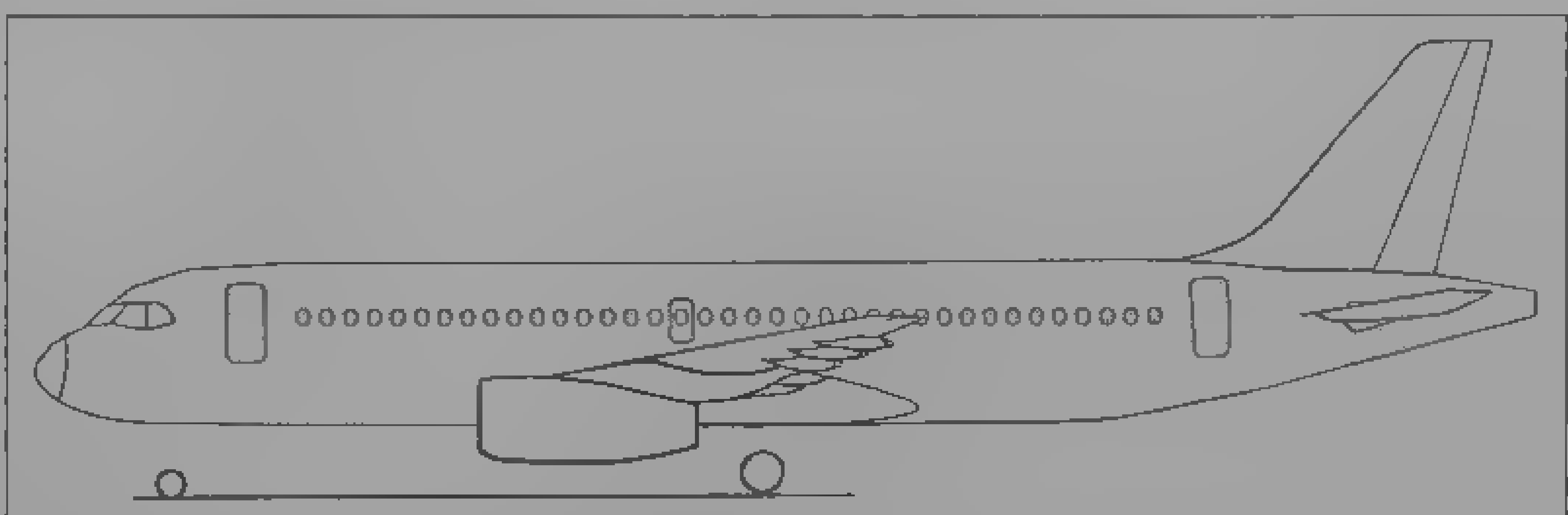
NEW ENTRY

100/120-SEAT REGIONAL TRANSPORT

PROGRAMME: Five-year feasibility study for a 100-passenger commuter transport funded by Korean government in 1993; model of 100/120-seat aircraft displayed in February 1994 showed close similarity to ATR family. Samsung leads Korean Commercial Aircraft Development (KCAD) consortium (other members Daewoo, Hyundai and Korean Air); Chinese and Korean governments signed collaboration MoU October 1994. DASA Airbus signed MoUs with AVIC (China) in December 1994 and Samsung in March 1995. Replacement MoU for new, one year feasibility study signed 15 May 1995, adding Fokker and transferring attention to twin-turbofan design, having high compatibility with single-aisle Airbuses. HAL of India may participate.

Initial design parameters include maximum T-O weight of 54,600 kg (120,370 lb), and range of up to 2,600 n miles (4,815 km; 2,992 miles) in special ER version. Two engines, each of 89 to 107 kN (20,000 to 24,000 lb st).

NEW ENTRY



By 1995, Euro-Asian transport studies had turned from high-wing turboprop to low-wing turbofan
1995

MCDONNELL DOUGLAS/BAe

PARTICIPATING COMPANIES
McDonnell Douglas, see under USA
British Aerospace, see under UK
VICE-PRESIDENT AND GENERAL MANAGER, AV-8
Patrick J. Finneran Jr

Companies initially associated through US procurement of BAe Harrier; relationship developed with US Navy selection of BAe Hawk, joint work now being undertaken on advanced STOVL combat aircraft

UPDATED

MCDONNELL DOUGLAS/BRITISH AEROSPACE HARRIER II

US Marine Corps designations: AV-8B and TAV-8B
RAF designations: Harrier GR. Mk 5, 5A and 7, and T Mk 10
Spanish Navy designation: VA.2 Matador II

TYPE: Single-seat V/STOL close support, battlefield interdiction, night attack and reconnaissance aircraft

PROGRAMME: Early background given in several previous editions, present collaborative programme began with two YAV-8B (converted AV-8A) aerodynamic prototypes (first flights 9 November 1978 and 19 February 1979) followed by four FSD aircraft (first flight 5 November 1981), first 12 pilot production AV-8Bs ordered FY82 (first flight 29 August 1983) deliveries to USMC beginning 12 January 1984, development programme for night attack version announced November 1984, first flights of RAF GR Mk 5 development aircraft 30 April (ZD318) and 31 July 1985 (ZD319), first USMC operational AV-8B squadron (VMA-331) achieved IOC August 1985, first flight of two-seat TAV-8B (No. 162747) 21 October 1986; first flight of night attack AV-8B prototype (162966) 26 June 1987, first GR Mk 5 for RAF (ZD324) handed over 1 July 1987, TAV-8B deliveries (to VMAT-203) began August 1987, EAV-8B deliveries to Spain 1987-88, production contract for new-build GR. Mk 7s placed April 1988, first flight of Pegasus 11-61 power plant (ZD402) 10 June 1989, first production night attack AV-8B (163853) delivered to VMA-214 on 15 September 1989; first flight of RAF GR Mk 7 (development aircraft, converted from GR Mk 5) 29 November 1989; 27 GR Mk 7s ordered April 1988 (later increased to 34), first flight of production Mk 7 (ZG471) May 1990. Production contract for T Mk 10 placed February 1990; first flight (ZH653) 7 April 1994, first delivery (ZH657 to No. 20(R) Squadron) 30 January 1995, first training mission (ZH658) 28 February 1995. See also separate entry for Harrier II Plus

CURRENT VERSIONS: **AV-8B Harrier II:** US Marine Corps single-seat close support version. **AV-8B Night Attack** version (FLIR bulge ahead of windscreen) from 167th AV-8B (163853) onwards (see Avionics paragraph), plus (from No. 182, 163874, and TAV-8B No. 16, 164120, in December 1990) uprated F402-RR-408 (Pegasus 11-61) engine. Production completed.

AV-8B Harrier II Plus: Radar equipped night attack version currently in production, described separately.

TAV-8B Harrier II: US Marine Corps two-seat operational trainer, with longer forward fuselage and 0.43 m (1 ft 5 in) taller vertical tail than AV-8B, two cockpits in tandem; two underwing stores stations only; BAe major subcontractor for this version.

VA.2 Matador II: Spanish Navy single-seat export version, manufacturers' designation **EAV-8B**.

Harrier GR. Mk 5: Royal Air Force single-seat battlefield air interdiction/close air support version. Two additional underwing stations, for Sidewinder missile carriage. All converted to Mk 7 by 1994.

Harrier GR. Mk 5A: Interim designation for 19 GR. Mk 5s prior to upgrade to full GR. Mk 7 standard. All converted to Mk 7 by late 1992.

Harrier GR. Mk 7: Royal Air Force single-seat night attack version, based on GR. Mk 5. New production between May 1990 (first flight of ZG471) and 2 June 1992 (last delivery: ZG862), conversions between 1990 and 1994.

Harrier T Mk 10: Royal Air Force operational trainer for GR. Mk 7, based on TAV-8B airframe with eight underwing pylons, FLIR and night vision equipment of GR. Mk 7. Current UK production version.

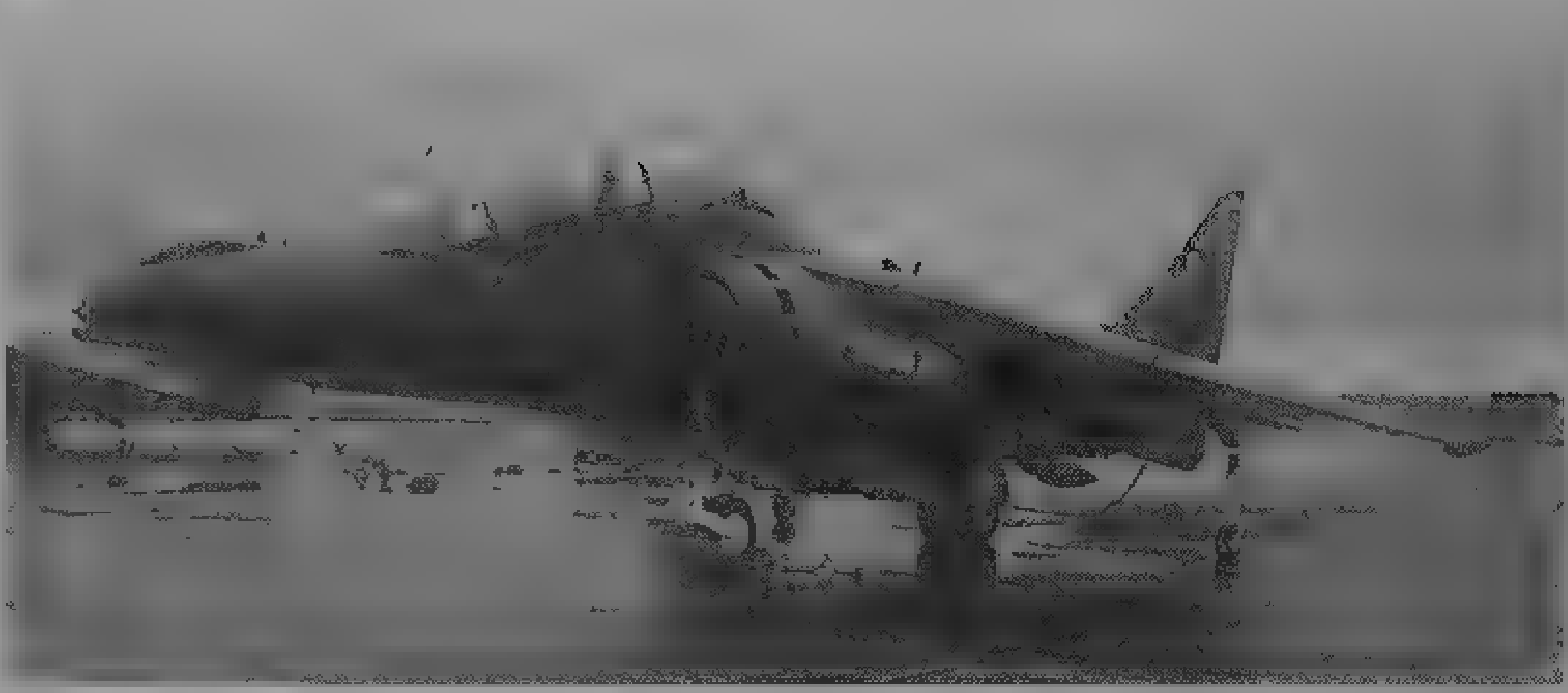
CUSTOMERS: US Marine Corps ordered total of 280 by FY91, including four FSDs (ordered FY79), 24 TAV-8Bs and 24 Harrier II Plus, target procurement of 300 AV-8Bs and 28 TAV-8Bs unlikely to be achieved but six ordered June 1992 to replace 1991 Gulf War losses and to be built in II Plus configuration. VMAT-203 received first AV-8B (161573) 12 January 1984 and first TAV-8B (162963) August 1987, also operated by VMA-211 (re-equipped 1990, second Night Attack squadron), VMA-214 (first with Night Attack version, initial aircraft, 163853, delivered 15 September 1989), VMA-223 (1 October 1987), VMA-231 (September 1985), VMA-311 (1989, third Night Attack unit, 1992), VMA-331 (commissioned 30 January 1985 as first operational unit but disbanded 30 September 1992), VMA-513 (January 1987, fourth Night Attack unit, 1992) and VMA-542 (1986; first Harrier II Plus unit 1993). Small-scale detachments, 1992-93 to Marines' composite squadrons (also with CH-46, AH-1W and UH-1N) for overseas voyages (for example, Somalia peace-keeping), AV-8B in HMM 262, 263 and 362, AV-8B Night Attack in HMM-161 and 361. Requirement to modify 73 'day attack' aircraft to Plus standard with new fuselage shells and power plant upgraded to -408 series, between FY94 and FY00.

McDonnell Douglas testbed AV-8B first flew 30 November 1994 with wingtip AIM-9 Sidewinder AAM installation, 1995 trials programme includes zero-scarf rear nozzles (matching front); improved under fuselage LID (lift improvement device), and ceramic matrix composite blast deflector, replacing titanium shields around rear fuselage. Phantom Works' research division also to gain TAV-8B in 1997 for trials of low-cost integrated flight- and propulsion-control system.

Royal Air Force ordered total of 109 by 1990, comprising two FSDs, 41 GR Mk 5s, 19 GR Mk 5As, 34 GR Mk 7s and 13 T Mk 10s (last mentioned ordered March 1990). First service flight of Mk 5 (ZD324) with No. 233 OCU, 30 March 1988, OCU redesignated No. 20 (Reserve) Squadron on 1 September 1992, deliveries to No. 1 Squadron from 23 November 1988 and unit redeclared to NATO on 2 November 1989; No. 1 re-equipped to GR. Mk 7 (rebuilt Mk 5As) and flew first sortie (ZD434) 2 June 1992, to No. 3 Squadron from 17 March 1989 (ZD401); Mk 5A delivered mainly to storage from 21 August 1990 (ZD432), first Mk 7 delivery to A&AEE, Boscombe Down, 5 June 1990 (ZG472), to Strike/Attack Operational Evaluation Unit (SAOEU) from 17 August 1990 (ZG473)—unit flew RAF's first NVG Harrier mission, 11 December 1990 and first NVG/GPS live bomb drop 19 February 1992; to No. 4 Squadron from 12 September 1990 (ZG473); re-equipped No. 3 Squadron from 30 November 1990 (ZG479). Single-seat deliveries completed (ZG862) 2 June 1992.

Contract for BAe upgrade of 58 (less any attrition) Mks 5/5A to Mk 7 awarded 2 November 1990; first ex-Mk 5 (ZD380) redelivered to RAF 21 December 1990, first ex-Mk 5A (ZD430) on 9 April 1991. No. 1 Squadron mainly equipped with ex Mk 5As, No. 20 Squadron (OCU) received first Mk 7 on 4 January 1993 and equipped with ex Mk 5s from late production. final Mk 7 conversions 1993-94, from early Mk 5s. INS modified to FIN 1075G (incorporating GPS) on one SAOEU aircraft and six of No. 1 Squadron, first squadron flight (ZD437) 19 November 1992; all SAOEU Harriers with GPS by 1994. Nos. 3 and 4 Squadrons (new production Mk 7s) provide detachment of eight grey-camouflaged Harriers to Turkey from April 1993 to patrol northern Iraq for UN, both units began conversion to night vision systems operational flying, Autumn 1994. First landing of an RAF Harrier II aboard an aircraft carrier was effected by GR Mk 7 ZG475 of SAOEU on HMS *Illustrious* at start of a three-aircraft deployment, 27 June 1994.

Spanish Navy received 12 Matador IIs for Novena Escuadrilla (Eslla 009) between 6 October 1987 and September 1988, operational aboard *Principe de Asturias*; eight new-build Harrier II Plus ordered, for which first rear fuselage delivered to CASA in December 1994 to launch local assembly, remaining 10 Matador IIs to be converted to Plus standard, procurement 20.



Harrier T Mk 10 ZH658 flew type's first training sortie at Wittering on 28 February 1995 *(Paul Jackson)*
1995

HARRIER II and II PLUS ORDERS (new build)

Customer		Single-seat	Trainer	First aircraft	Remarks
US Marines	FY79 order	4		161396	Prototypes
	FY82 order	12		161573	Pilot production
	FY83 order	21		162068	
	FY84 order	26	1	162721	
	FY85 order	30	2	162942	
	FY86 order	40	6	163176	
	FY87 order	36	6	163659	
	FY88 order	22	2	163862	
	FY89 order	20	4	164115	Incl 1 Plus, and 2 trainers to Italy
	FY90 order	21	3	164139	
	FY91 order	24		164548	All Plus, of which 3 to Italy
	FY92 order	6		165001	All Plus
Sub-totals		**262**	**24**		
Royal Air Force	Development	2		ZD318	Converted to Mk 7
	GR Mk 5	41**		ZD320	Converted to Mk 7
	GR Mk 5A	19		ZD430	Converted to Mk 7
	GR Mk 7	34		ZG471	
	T Mk 10		13	ZH653	
Sub-totals		**96***	**13***		
Spanish Navy	First order	12		163010	
	Second order	8‡		165028	All Plus
			1	165036	
Sub-totals		**20**	**1**		
Italian Navy		13†		165007	All Plus, excludes 3 AVs and 2 TAVs from USMC. Option on 8
Sub-total		**13**			
Grand totals		**391**	**38**		Options 8

Notes: Plus refers only to single-seat aircraft
* Assembled in UK: trainers at Warton, remainder at Dunsfold
† Assembled in Italy by Alenia
‡ Assembled in Spain by CASA
See Harrier II Plus entry for rebuild contracts

RAF Harrier GR. Mk 7 in overall grey camouflage for operations over Northern Iraq

1995

Italian Navy ordered a total of 18; two TAV-8Bs ordered May 1989 and 16 Harrier II Plus, of which first three ordered late 1991 (to come from USMC batch); option on eight; first delivery (two TAV-8Bs, MM55032-55033, to *Giuseppe Garibaldi*) 23 August 1991. See following entry.

Total firm orders (including II Plus) 429, of which 400 (MDC 298, BAe 102) delivered by January 1995.

COSTS: £200 million (1990 contract) for 13 T. Mk 10 aircraft. TAV-8B, $25 million (Spain 1992).

DESIGN FEATURES: Differences compared with Harrier GR. Mk 3/AV-8A (see under BAe in UK section of 1989-90 *Jane's*) include bigger wing and longer fuselage; use of graphite epoxy (carbonfibre) composite materials for wings and parts of fuselage and tail unit, adoption of supercritical wing section; addition of LIDS (lift improvement devices: larger strakes to replace gun/ammunition pods when armament not carried, plus retractable fence panel forward of pods) to augment lift for vertical take-off, larger wing trailing-edge flaps and drooped ailerons, redesigned forward fuselage and cockpit; redesigned engine air intakes to provide more VTO/STO thrust and more efficient cruise, two additional wing stores stations, wing outriggers relocated at mid-span to provide better ground manoeuvring capability, leading-edge root extensions (LERX) to enhance instantaneous turn rate and air combat capability; landing gear strengthened to cater for higher operating weights and greater external stores loads. Wing span and area increased by approximately 20 per cent and 14.5 per cent respectively compared with GR. Mk 3/AV-8A, leading-edge sweep reduced by 10°, thickness/chord ratios 11.5 per cent (root)/7.5 per cent (tip), marked anhedral on wings and variable incidence tailplane. Increased size ('100 per cent') LERX from 79th UK production aircraft (ZG506), being retrofitted to earlier Harriers.

FLYING CONTROLS: Hydraulic actuation (by Fairey irreversible jacks) of drooping ailerons and slab tailplane; rudder actuated mechanically, single slotted trailing-edge flaps with slot closure doors, manoeuvring at airspeeds below wing-borne flight by jet reaction control valves in nosecone and tailcone and at each wingtip and by thrust vectoring. LIDS 'box' traps air cushion bounced off ground by engine exhaust in VTOL modes, providing enough extra lift to enable aircraft to take off vertically at a gross weight equal to its maximum hovering gross weight, large forward-hinged airbrake beneath fuselage aft of rear main landing gear bay.

STRUCTURE: One-piece wing (including main multispar torsion box, ribs and skins), ailerons, flaps, LERX, outrigger pods and fairings, forward part of fuselage, LIDS, tailplane and rudder, are manufactured mainly from graphite epoxy (carbonfibre) and other composites; centre and rear fuselage, wing leading-edges (reinforced against bird strikes on RAF aircraft), wingtips, tailplane leading-edges and tips, and fin, are of aluminium alloy, titanium used for front and rear underfuselage heatshields and small area forward of windscreen.

McDonnell Douglas/BAe work split is 60/40 for AV-8B and EAV-8B, 50/50 for RAF aircraft. McDonnell Douglas builds entire wing, front and forward centre-fuselage (including nosecone, air intakes, heatshields, engine access doors and forward fuel tanks) and underfuselage fences/strakes, for all aircraft, plus tailplanes for USMC, Italian and Spanish aircraft, and assembles all USMC/Spanish fuselages. BAe builds rear centre and rear fuselage (including blast and heatshields, centre and rear fuel tanks, dorsal air intakes and tail bullets), fins and rudders, and the complete jet reaction control system, for all aircraft, plus tailplanes for RAF aircraft, and assembles all RAF fuselages, final assembly is by McDonnell Douglas for USMC, BAe for RAF, McDonnell Douglas, CASA or Alenia for Spain and Italy (see table).

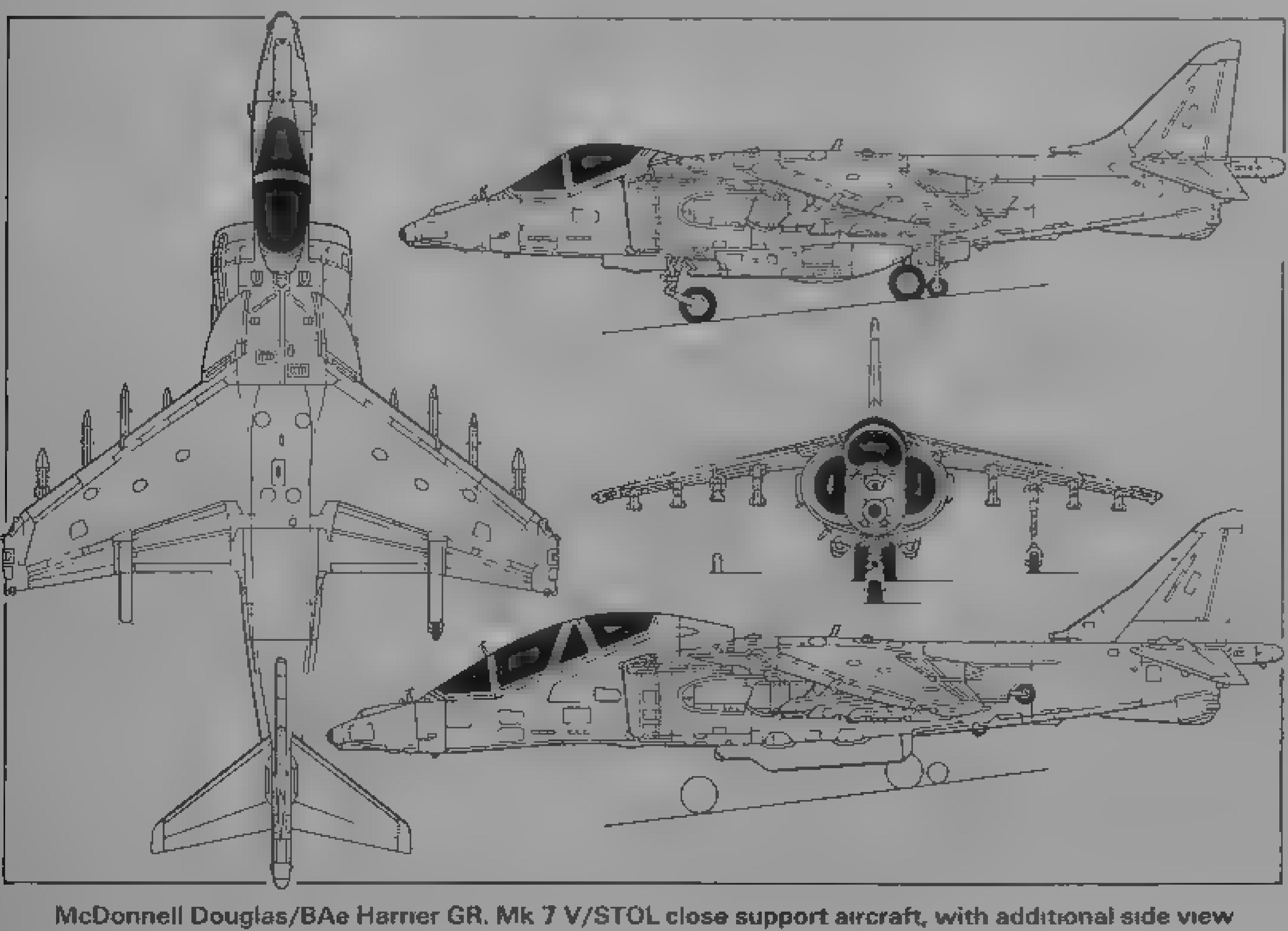
LANDING GEAR: Retractable bicycle type of Dowty design, permitting operation from rough unprepared surfaces of very low CBR (California Bearing Ratio). Hydraulic actuation, with nitrogen bottle for emergency extension. Single steerable nosewheel retracts forward, twin coupled mainwheels rearward, into fuselage. Small outrigger units, at approximately mid-span between flaps and ailerons, retract rearward into streamline pods. Telescopic oleo-pneumatic main and outrigger gear; levered suspension nosewheel leg. Dunlop wheels, tyres, multidisc carbon brakes and anti-skid system. Mainwheel tyres (size 26.0 × 7.75-13.00) and nosewheel tyre (size 26.0 × 8.75-11) all have pressure of 8.62 bars (125 lb/sq in). Outrigger tyres are size 13.5 × 6.00-4.00, pressure 10.34 bars (150 lb/sq in). McDonnell Douglas responsible for entire landing gear system.

POWER PLANT: One 105.87 kN (23,800 lb st) Rolls-Royce F402-RR-408 (Pegasus 11-61) vectored thrust turbofan in AV-8B (95.42 kN; 21,450 lb st F402-RR-406A/Pegasus 11-21 in aircraft delivered before December 1990), one 95.63 kN (21,500 lb st) Pegasus Mk 105 in Harrier GR. Mk 5/7, Mk 152-42 in Matador II. F402-RR-408 (see Harrier II Plus) retrofitted in both Italian TAV-8Bs, 1994. Redundant digital engine control system (DECS), with mechanical back-up, standard from March 1987. Zero-scarf front nozzles. Air intakes have an elliptical lip shape, leading-edges reinforced against bird strikes, and a single row of auxiliary intake doors. Access to engine accessories through top of fuselage, immediately ahead of wing.

Integral fuel tanks in wings, usable total 2,746 litres (725 US gallons; 604 Imp gallons) plus four fuselage tanks: front and rear, 609 litres (161 US gallons, 134 Imp gallons) each, port centre and starboard centre, 177 litres (47 US gallons, 39 Imp gallons) each. ('Front' tank is two separate, but equal size tanks.) Internal fuel 4,319 litres (1,140 US gallons, 950 Imp gallons) usable, 4,410 litres (1,164 US gallons, 970 Imp gallons) total in single-seat versions, 4,150 litres (1,096 US gallons, 913 Imp gallons) total in two-seat versions. Water injection tank with capacity of 225 kg (495 lb). Retractable bolt-on in-flight refuelling probe optional. Each of four inner underwing stations capable of carrying a 1,135 litre (300 US gallon; 250 Imp gallon) auxiliary fuel tank, total internal and external fuel 8,956 litres (2,365 US gallons, 1,970 Imp gallons).

ACCOMMODATION: Pilot only, on zero/zero ejection seat (UPC Stencel for USMC, Martin-Baker for RAF), in pressurised, heated and air conditioned cockpit. AV-8B cockpit raised approximately 30.5 cm (12 in) by comparison with AV-8A/YAV-8B, with redesigned one-piece wraparound windscreen (thicker on RAF aircraft than on those for USMC) and rearward-sliding bubble canopy, to improve all-round field of view. Windscreen de-icing. Windscreens and canopies for all aircraft manufactured by McDonnell Douglas.

SYSTEMS: No. 1 hydraulic system has flow rate of 43 litres (11.4 US gallons; 9.5 Imp gallons)/min, flow rate of No. 2 system is 26.5 litres (7.0 US gallons, 5.8 Imp gallons)/min. Reservoirs nitrogen pressurised at 2.76 to 5.52 bars (40 to 80 lb/sq in). Other systems include Westinghouse variable speed constant frequency (VSCF) solid-state electrical system, Lucas Mk 4 gas-turbine starter/APU, Clifton



McDonnell Douglas/BAe Harrier GR. Mk 7 V/STOL close support aircraft, with additional side view (bottom) of T. Mk 10 *(Jane's/Mike Keep)*

1992

Wingtip Sidewinder installation on company testbed AV-8B; 'Phantom Works' insignia on rear fuselage
1995

Precision onboard oxygen generating system (OBOGS), and Graviner Firewire fire detection system. Dorsal air-scoop at base of fin combined with engine bleed air for avionics bay cooling system.

AVIONICS: *Comms*: Collins RT 1250A/ARC-182 U/VHF com (GEC Marconi Avionics AD3500 ECM-resistant U/VHF AM/FM in RAF GR. Mk 7 aircraft, military designation ARI 23447 but ARC-182/ARI 23387 in GR. Mk 5), Bendix/King RT-1157/APX 100 IFF (Cossor IFF 4760 Mk 12/ARI 23389 transponder for RAF).

Flight: R-1379B/ARA-63 all-weather landing receiver (AV-8B only), RT 1159A/ARN-118 Tacan (ARI 23365 for RAF), RT-1015A/APN-194(V) radar altimeter (ARI 23388 for RAF GR. Mk 5 but RT1042A/ARI 23388 in GR Mk 7), Honeywell CV-3736/A com/nav/identification data converter, Litton AN/ASN-130A inertial navigation system (replaced by GEC-Marconi FIN 1075 or 1075G with RAF), A Research CP-1471/A digital air data computer. Retrofit of integrated GPS/Tacan authorised for USMC December 1994, for completion by June 1988. Flight controls that interface with reaction control system provided by Honeywell AN/ASW-46(V)2 stability augmentation and attitude hold system, now updated to high AoA capable configuration. RAF aircraft have an accident data recorder and (ordered July 1994) GEC-Marconi AVRS (airborne video recording system).

Instrumentation: Smiths Industries SU 128/A dual combining glass HUD and CP-1450/A display computer, IP-1318/A CRT Kaiser digital display indicator, and (RAF only) GEC-Marconi moving map display. Night attack version has Smiths Industries wide-angle HUD/HDD digital colour moving map display (Honeywell for USMC, GEC-Marconi for RAF) and pilot's NVGs (variant of GEC-Marconi Nite-Op) with compatible cockpit lighting.

Back-up mechanical instrumentation includes ASI, altimeter, AoA indicator, attitude indicator, cabin pressure altitude indicator, clock, flap position indicator, HSI, standby compass, turn and slip indicator, and vertical speed indicator.

Mission: Primary weapon delivery sensor system for AV-8B and GR. Mks 5/7 is Hughes Aircraft AN/ASB-19(V)2 or (V)3 Angle Rate Bombing Set, mounted in nose and comprising a dual-mode (TV and laser) target seeker/tracker. ARBS functions in conjunction with Unisys CP-1429/AYK-14(V) mission computer (built as Computing Devices ACCS 2000 for RAF), Smiths Industries AN/AYQ-13 stores management system, display computer, HUD and digital display indicator. Night attack versions equipped with GEC-Marconi nose-mounted FLIR. Vinten VICON 18 Srs 403 long-range optical reconnaissance pod evaluated for RAF 1991 and adopted 1993 as Srs 603, later 603GP(-1). VICON 57 multisensor pod evaluated in 1992 but aircraft policing northern Iraq (since 1993) employ VICON 18 or Harrier GR. Mk 3's optical pod. Contract placed 1994 for GEC-Marconi TIALD (thermal imaging airborne laser designator) pods.

Self-defence: Litton AN/ALR-67(V)2 fore/aft-looking RWR (AV-8B only), UK MoD AN/ARR-51 FLIR receiver, Goodyear AN/ALE-39 flare/chaff dispenser (upper and lower rear fuselage; current two dispensers to be increased to six) (Tracor AN/ALE-40 in RAF aircraft). Provision for Sanders AN/ALQ-164 defensive ECM pod on centreline pylon. GR. Mks 5/7 have GEC-Marconi Defence Systems ARI 23333 Zeus internal ECM system comprising advanced RWR and multimode jammer with Northrop Grumman RF transmitter, and Plessey PVS 2000 pulse Doppler missile approach warning (MAW) radar, mounted in tailboom, which automatically activates appropriate countermeasures upon detecting approach of enemy missiles; optical missile approach warner for retrofit to USMC aircraft.

RAF defensive aids include Bofors BOL 304 chaff dispenser in rear of Sidewinder launch rails (Phimat pod on port outer wing pylon, 1994, pending BOL availability). Italian Navy aircraft have Sanders AN/ALQ-164 electronic countermeasures, ordered March 1995.

EQUIPMENT: Anti-collision, approach, formation, in-flight refuelling, landing gear position, auxiliary exterior lights and console, instrument panel and other internal lighting.

ARMAMENT: Two underfuselage packs, mounting on port side a five-barrel 25 mm cannon based on General Electric GAU-12/U and 300-round container on starboard side, in AV-8B, or (RAF) two 25 mm Royal Ordnance Factories cannon with 100 rds/gun (derived from 30 mm Aden), operational clearance for Aden 25 still awaited, early 1995. Single 454 kg (1,000 lb) stores mount on fuselage centreline, between gun packs. Three stores stations under each wing on AV-8B, stressed for loads of up to 907 kg (2,000 lb) inboard, 454 kg (1,000 lb) on intermediate stations, and 286 kg (630 lb) outboard. Four inner wing stations are wet, permitting carriage of auxiliary fuel tanks; reduced manoeuvring limits apply when tanks mounted on intermediate stations. RAF aircraft have additional underwing station, for Sidewinder air-to-air missile, ahead of each outrigger wheel fairing. Harrier II Plus has provision for outrigger pylons (which not yet operationally cleared and would prevent multiple stores carriage on inboard and intermediate pylons).

Typical weapons include two or four AIM-9L Sidewinder, Magic or AGM-65E Maverick missiles, or up to six Sidewinders, up to sixteen 540 lb free-fall or retarded general purpose bombs, 12 BL 755 or similar cluster bombs, 1,000 lb free-fall or retarded bombs, 10 Paveway laser-guided bombs, eight fire bombs, 10 Matra 155 rocket pods (each with eighteen 68 mm SNEB rockets), or (in addition to underfuselage gun packs) two underwing gun pods. ML Aviation BRU-36/A bomb release units standard on all versions. RAF armoury expanded from early 1993 with CRV 7 rocket pods and CBU-87 cluster bombs. TAV-8B can carry six Mk 76 practice bombs or two LAU-68 rocket launchers for weapons training.

Cockpit of Harrier GR. Mk 7 displaying moving map (left) and FLIR (right) imagery on CRTs *(Paul Jackson)*
1993

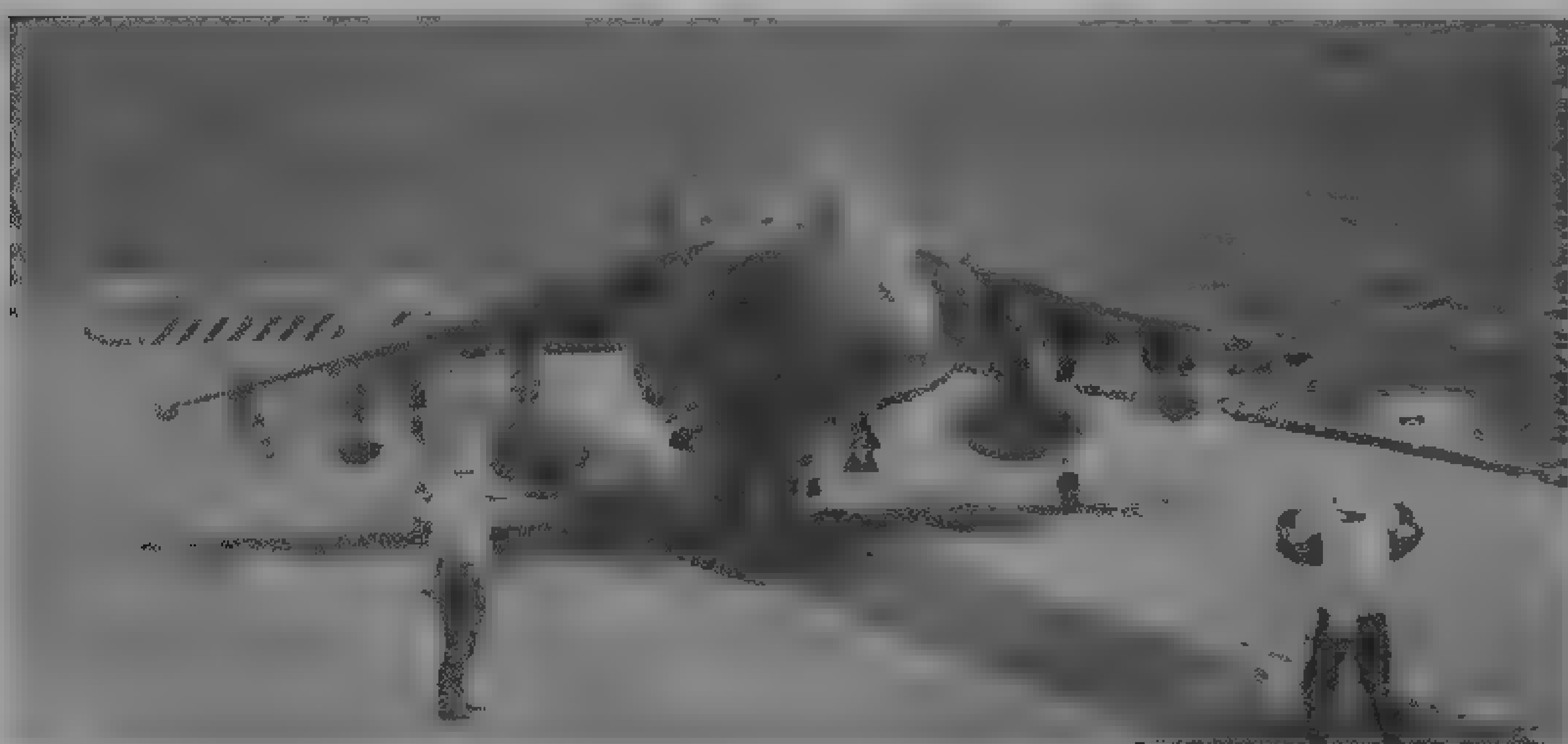
DIMENSIONS, EXTERNAL:
- Wing span: 9.25 m (30 ft 4 in)
- Wing aspect ratio: 4.00
- Length overall (flying attitude):
  - AV-8B: 14.12 m (46 ft 4 in)
  - TAV-8B: 15.32 m (50 ft 3 in)
  - GR. Mks 5/7: 14.36 m (47 ft 1½ in)
  - T. Mk 10: 15.79 m (51 ft 9½ in)
- Height overall: 3.55 m (11 ft 7¾ in)
- Tailplane span: 4.24 m (13 ft 11 in)
- Outrigger wheel track: 5.18 m (17 ft 0 in)

AREAS:
- Wings, excl LERX, gross: 21.37 m² (230.0 sq ft)
- LERX (total): Pegasus 11-21: 0.81 m² (8.7 sq ft)
  - Pegasus 11-61: 1.24 m² (13.4 sq ft)
  - '100 per cent': 1.39 m² (15.0 sq ft)
- Ailerons (total): 1.15 m² (12.4 sq ft)
- Trailing-edge flaps (total): 2.88 m² (31.0 sq ft)
- Ventral fixed strakes (total): 0.51 m² (5.5 sq ft)
- Ventral retractable fence (LIDs): 0.24 m² (2.6 sq ft)
- Ventral airbrake: 0.42 m² (4.5 sq ft)
- Fin: 2.47 m² (26.6 sq ft)
- Rudder, excl tab: 0.49 m² (5.3 sq ft)
- Tailplane: 4.51 m² (48.5 sq ft)

WEIGHTS AND LOADINGS (single-seaters, except where indicated):
- Operating weight empty (incl pilot and unused fuel):
  - AV-8B: 6,336 kg (13,968 lb)
  - GR. Mk 7: 7,050 kg (15,542 lb)
  - TAV-8B: 6,451 kg (14,223 lb)
- Max fuel: internal only*: 3,519 kg (7,759 lb)
  - internal and external*: 7,180 kg (15,829 lb)
- Max external stores: Pegasus 11-61: 6,003 kg (13,235 lb)
  - Pegasus 11-21/Mk 105†: 4,899 kg (10,800 lb)
- Max useful load (incl fuel, stores, weapons, ammunition, and water injection for engine):
  - VTO: approx 3,062 kg (6,750 lb)
  - STO: more than 7,710 kg (17,000 lb)
- Basic flight design gross weight for 7g operation: 10,410 kg (22,950 lb)
- Max T-O weight:
  - 435 m (1,427 ft) STO: 14,061 kg (31,000 lb)
  - S/L VTO, ISA:
    - AV-8B/Pegasus 11-61: 9,342 kg (20,595 lb)
    - GR. Mk 7: 8,700 kg (19,180 lb)
  - S/L VTO, 32°C: 8,142 kg (17,950 lb)
- Design max landing weight: 11,340 kg (25,000 lb)
- Max vertical landing weight: 9,043 kg (19,937 lb)

* *205 kg (453 lb) less in TAV-8B*
† *throughout full manoeuvring envelope*

PERFORMANCE:
- Max Mach number in level flight:
  - at S/L: 0.87 (575 kts, 1,065 km/h, 661 mph)
  - at altitude: 0.98
- STOL T-O run at max T-O weight:
  - ISA: 435 m (1,427 ft)
  - 32°C: 518 m (1,700 ft)
- Operational radius with external loads shown:
  - short T-O (366 m, 1,200 ft), 12 Mk 82 Snakeye bombs, internal fuel, 1 h loiter: 90 n miles (167 km; 103 miles)
  - hi-lo-hi, short T-O (366 m; 1,200 ft), seven Mk 82 Snakeye bombs, two 300 US gallon external fuel tanks, no loiter: 594 n miles (1,101 km, 684 miles)



RAF Harrier GR. Mk 7 preparing to launch from HMS *Illustrious* during two weeks of trials, 27 June to 8 July 1994 *(Paul Jackson)*
1994

deck launch intercept mission, two AIM 9 missiles and two external fuel tanks
627 n miles (1,162 km; 722 miles)
Unrefuelled ferry range, with four 300 US gallon external tanks:
tanks retained 1,638 n miles (3,035 km; 1,886 miles)
tanks dropped 1,965 n miles (3,641 km; 2,263 miles)
Combat air patrol endurance at 100 n miles (185 km, 115 miles) from base 3 h
g limits +8/ 3

UPDATED

MCDONNELL DOUGLAS/BRITISH AEROSPACE HARRIER II PLUS

TYPE: Enhanced capability derivative of AV 8B.

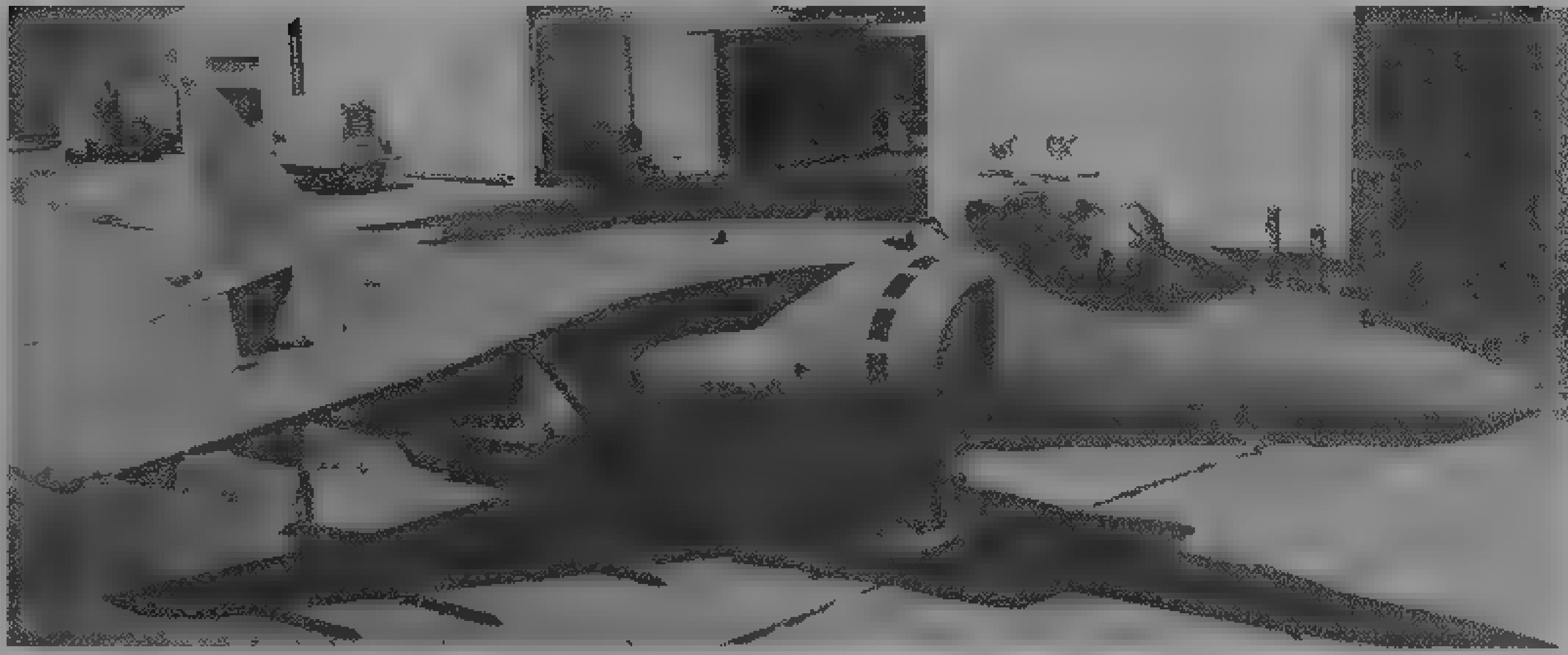
PROGRAMME: Intention to develop radar-equipped version of AV-8B announced as McDonnell Douglas/BAe private venture June 1987, radar integration efforts (with Hughes Aircraft) started 1988, trinational MoU (USA/Italy/Spain) of 28 September 1990 approved joint funding to develop and integrate AN/APG-65 radar, US Navy contract of 3 December 1990 authorised development of prototype and completion to Harrier II Plus standard of 24 AV 8Bs ordered in FY90-91; production MoU signed by USA/Italy/Spain March December 1992, prototype (AV-8B No 205, 164129) first flight 22 September 1992, deliveries to USMC from April 1993 (164548 to Naval Air Warfare Center); to finish June 1995. Harrier consortium adds Hughes (for radar), Alenia (Italy) and CASA (Spain); Italy and Spain each have 15 per cent share.

CUSTOMERS: US Marine Corps (27 including six replacements for AV-8Bs lost in 1991 Gulf War); orders from Italian Navy (16, with option for eight more) and Spanish Navy (eight ordered March 1993, for final assembly by CASA and delivery from 1996; plus 11 conversions). First USMC squadron aircraft (164551) delivered to VMA-542, first operational squadron, at Cherry Point, North Carolina, 8 July 1993, others to VMA-223 by December 1993 and VMA-231 by May 1994; each squadron operating six Plus aircraft alongside dozen 'day' AV-8Bs. Initial three Italian aircraft diverted from USMC contract, first (MM7199) delivered Cherry Point NAS 20 April 1994, three handed over to Grupo Aereo Imbarcati 10 June 1994, arrived Italy December 1994; deployed operationally, January 1995, covering UN withdrawal from Somalia. Balance of 13 authorised November 1992 (plus option on eight more) for final assembly by Alenia in Italy by 1997, assembly of first begun late 1994. USMC planning remanufacturing 73 'day' AV 8Bs to Harrier II Plus standard to permit complete conversion of VMA-542, VMA-223 and VMA-231. Initial four conversions funded in FY94 (contract May 1994), first aircraft is 162728, which will re-emerge re-serialled 165305 (see table). Refer also to AV 8B entry.

HARRIER II PLUS REBUILDS

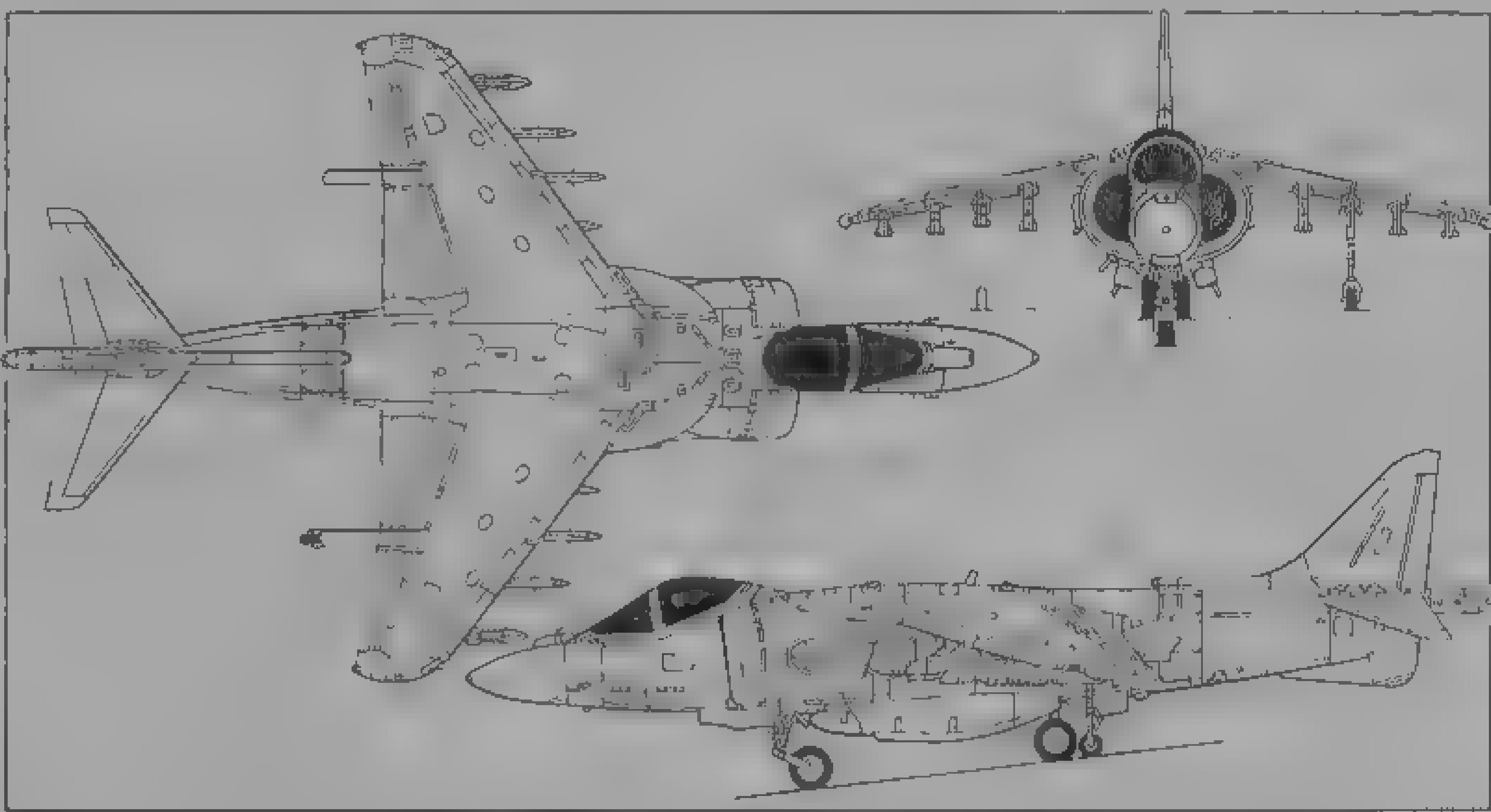
Funded	Qty	First aircraft
FY94	4	165305
FY95	4	165309
FY96	4*	
FY97	12*	
FY98	12*	
FY99	12*	
FY00	12*	
FY01	13*	
Total	**73**	

* Not yet authorised



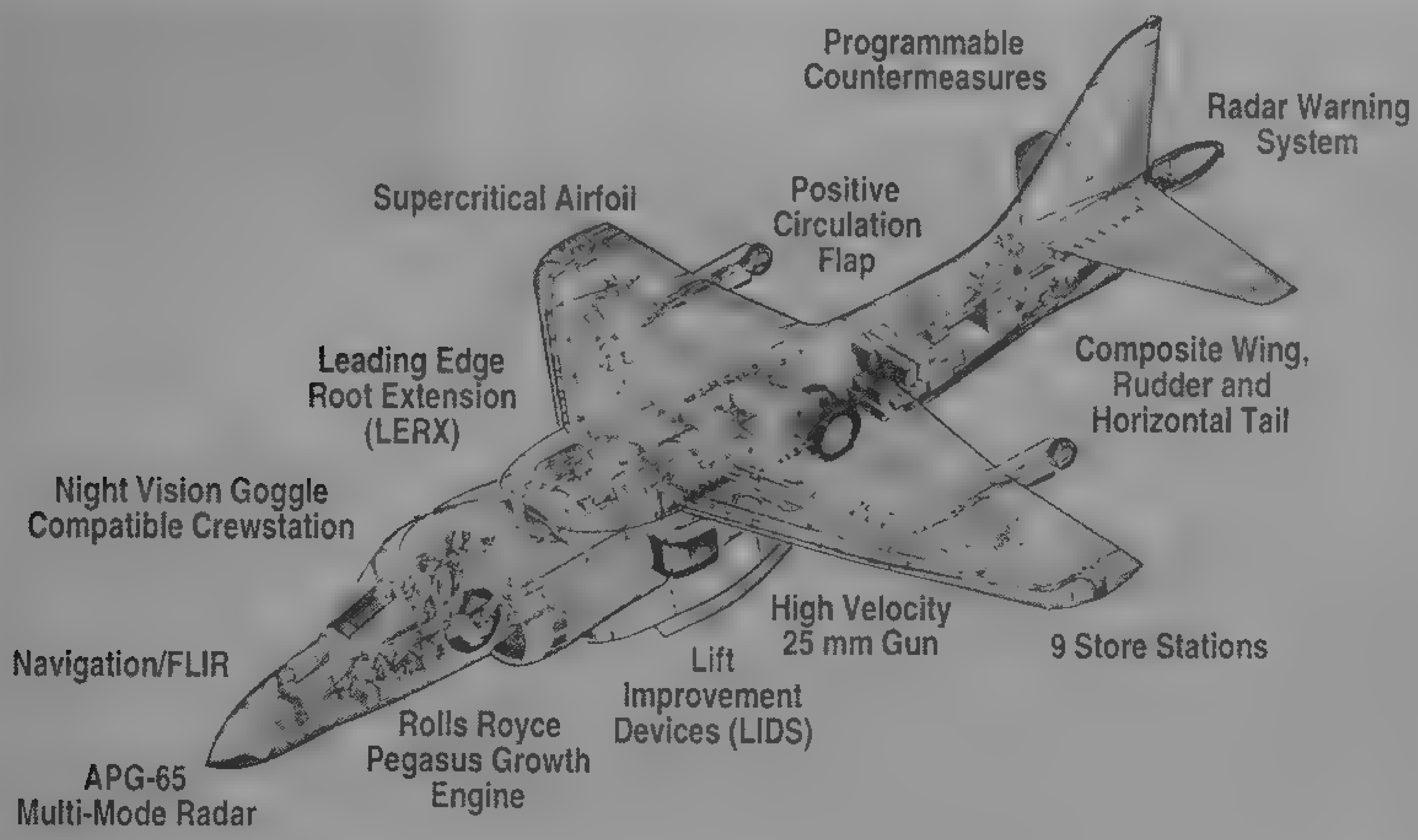
Italy's first AV-8B Plus, received on 20 April 1994

1994



McDonnell Douglas/BAe Harrier II Plus radar-equipped version of AV-8B (*Jane's/Mike Keep*)

1992



Cutaway of Harrier II Plus, showing radar installation and other features

1993

COSTS: $181.5 million (December 1990 contract) for development and production of 24 for USMC. $150 million for first four rebuilds (1994); $170 million for four rebuilds in FY96 funding.

DESIGN FEATURES: Generally as for Night Attack AV-8B with F402-RR-408 engine (assembled by Iberia for eight Spanish aircraft), plus radar (extending nose by 0.43 m, 1 ft 5 in), FLIR, and future weapon capability to include AMRAAM, Sparrow, Sea Eagle and Harpoon; enlarged LERX. RAF type (eight-pylon) wing. Fatigue life of 6,000 hours; improved ECM.

AVIONICS: Generally as Night Attack AV-8B, but also

Radar: Hughes AN/APG-65 multimode, pulse Doppler radar.

ARMAMENT: Integration of AIM-120 AMRAAM under consideration, 1993, for all three operators. Italy confirmed AIM-120 and AGM-65 Maverick ASM in 1994.

DIMENSIONS, EXTERNAL: As AV-8B except:

Length overall 14.55 m (47 ft 9 in)

WEIGHTS AND LOADINGS:

Operating weight empty 6,740 kg (14,860 lb)
Max T-O weight 14,061 kg (31,000 lb)

PERFORMANCE (estimated, with 137 m, 450 ft short T-O deck run, 6.5° ski-jump, 20 kt, 37 km/h, 23 mph wind over deck, air temperature 32°C, optimum cruise conditions, incl reserves for landing):

Anti-shipping combat radius with two Harpoons, two Sidewinders and two 1,136 litre (300 US gallon, 250 Imp gallon) drop tanks 609 n miles (1,128 km, 701 miles)

Combat air patrol (incl 2 min combat) with four AMRAAM and two 300 US gallon tanks: time on station

at 100 n mile (185 km; 115 mile) radius 2 h 42 min
at 200 n mile (370 km; 230 mile) radius 2 h 6 min

Sea surveillance combat radius (incl 50 n miles, 92 km, 57 mile dash at S/L) with two Sidewinders and two 300 US gallon tanks 608 n miles (1,127 km, 700 miles)

UPDATED

MCDONNELL DOUGLAS/BRITISH AEROSPACE JAST

TYPE: Joint Advanced Strike Technology combat aircraft.

PROGRAMME: In late 1992 an MDC/BAe team was among five contenders in an ARPA contest for an SSF (short take-off/vertical landing [STOVL] strike fighter) to replace the AV-8B and F/A-18 in about 2015. Selected in March 1993 for further studies for a Common (ASTOVL/CTOL) Affordable Lightweight Fighter (CALF) in competition with Lockheed. Subsequent to award of contracts to MDA/BAe and Lockheed for remote lift fan systems, Boeing and Northrop Grumman continued to pursue alternative concepts with former receiving ARPA funding support in 1994. McDonnell Douglas Corporation team includes BAe and General Electric as principal subcontractors, plus Rolls-Royce as subcontractor to GE. Phase II, beginning April 1993, covered critical technology risk reduction via model testing, simulation and construction and testing of a large-scale powered wind tunnel model to be tested at NASA Ames in 1995. Phase II also included outline design of a flight demonstrator and addressed affordability.

UK and US governments signed an MoU on 9 August 1994 to cover UK collaboration in Phase II that could eventually lead to an ASTOVL replacement for the Sea Harrier. In early 1995, however, DoD merged SSF/ASTOVL with JAST programme (see USAF entry in US section) and UK involvement renegotiated. JAST programme has subsumed the projected ARPA Phase III technology demonstrator vehicle manufacture and flight test programme planned to begin in 1996. JAST expected to seek solution to replacement of F-16, F/A-18 and Harrier II through development of CTOL and STOVL versions of a common airframe.

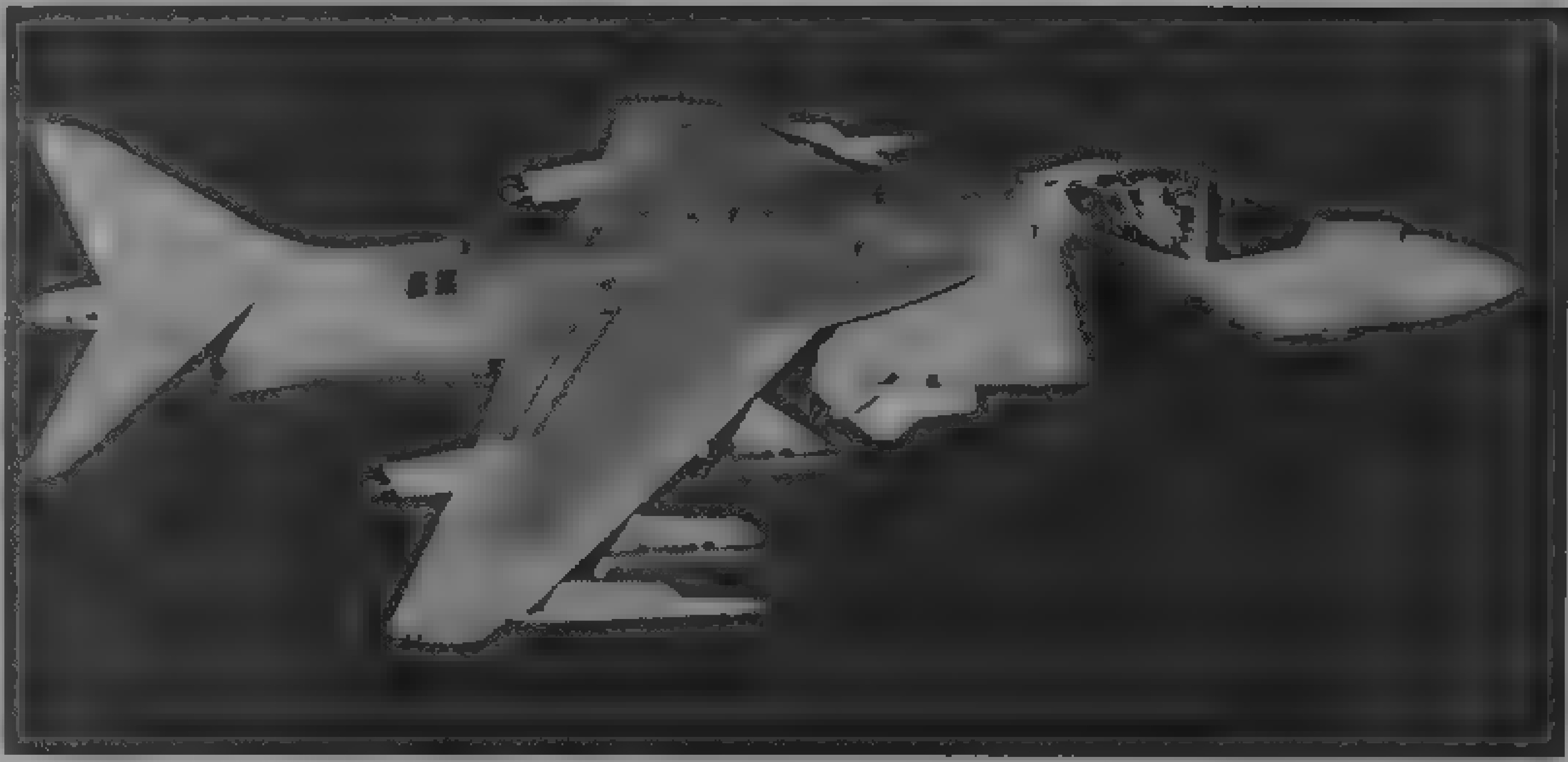
DESIGN FEATURES: MDC/BAe tender for ASTOVL had single General Electric YF120 variable-cycle engine in 165 kN (37,000 lb st) class with vectoring exhaust nozzles similar to Harrier; additionally, compressed air bleed to propel lifting fan for short take-offs; variable-cycle engine to facilitate 'supercruise' (supersonic flight without afterburner) and reduced fuel consumption at subsonic speeds. Low observables features included blended wing/body design.

UPDATED

MCDONNELL DOUGLAS/BRITISH AEROSPACE T-45A GOSHAWK

TYPE: Two-seat intermediate and advanced jet trainer.

PROGRAMME: Selected 18 November 1981 (from five other candidates) as winner of US Navy VTXTS (now T45TS) competition for undergraduate jet pilot trainer to replace T-2C Buckeye and TA-4J Skyhawk; original plan was for initial 54 'dry' (land-based) T-45Bs followed by 253 carrier-capable 'wet' T-45As. B model eliminated in FY84 in favour of 300 'all-wet' T-45As; FSD phase began October 1984, construction of two prototypes by Douglas began February 1986, funding approved 16 May 1986 for first three production lots (including 60 T-45As and 15 flight simulators during FY88-90); Lot 1 production contract (12 aircraft) awarded 26 January 1988. FSD prototypes made first flights 16 April (162787) and November 1988 (162788); original planned date for first deliveries



Harrier II Plus of first operational squadron, VMA-542
1994

(October 1989) delayed by further airframe and power plant changes requested by US Navy; announced 19 December 1989 that entire T45TS programme to be transferred to McDonnell Aircraft Co at St Louis; modified FSD prototypes made first flights September and October 1990, two Douglas production aircraft (163599 and '600) delivered to NATC Patuxent River, Maryland, on 10 October and 15 November 1990; first carrier landing (162787 on USS *Kennedy*) 4 December 1991; first McAir production aircraft (163601) flew at St Louis 16 December 1991 and handed over to USN 23 January 1992. Digital 'glass' cockpit under development as 'Cockpit 21', first to this standard (37th aircraft, 163635) made first flight 19 March 1994; planned production line introduction at 73rd aircraft, to be delivered October 1996; retrofit planned from mid-1998. Production one per month in 1995 following successful passing of US DoD Milestone III review on 17 January 1995 authorising full-rate production. Final delivery in 2003.

CURRENT VERSIONS: **T-45A Goshawk**: Based on BAe Hawk 60 series (see UK section), with airframe/power plant/

US NAVY PROCUREMENT

FY	Lot	Qty	First aircraft
88	1	12	163599
89	2	24	163611
92	3	12	163635
93	4	12	163647
94	5	12	165057
95	6	12	165069*
Sub-total		**84**	
Planned			
96	7	12	
97	8	12	
98	9	12	
99	10	24	
00-02	11-13	53	
Total		**197**	

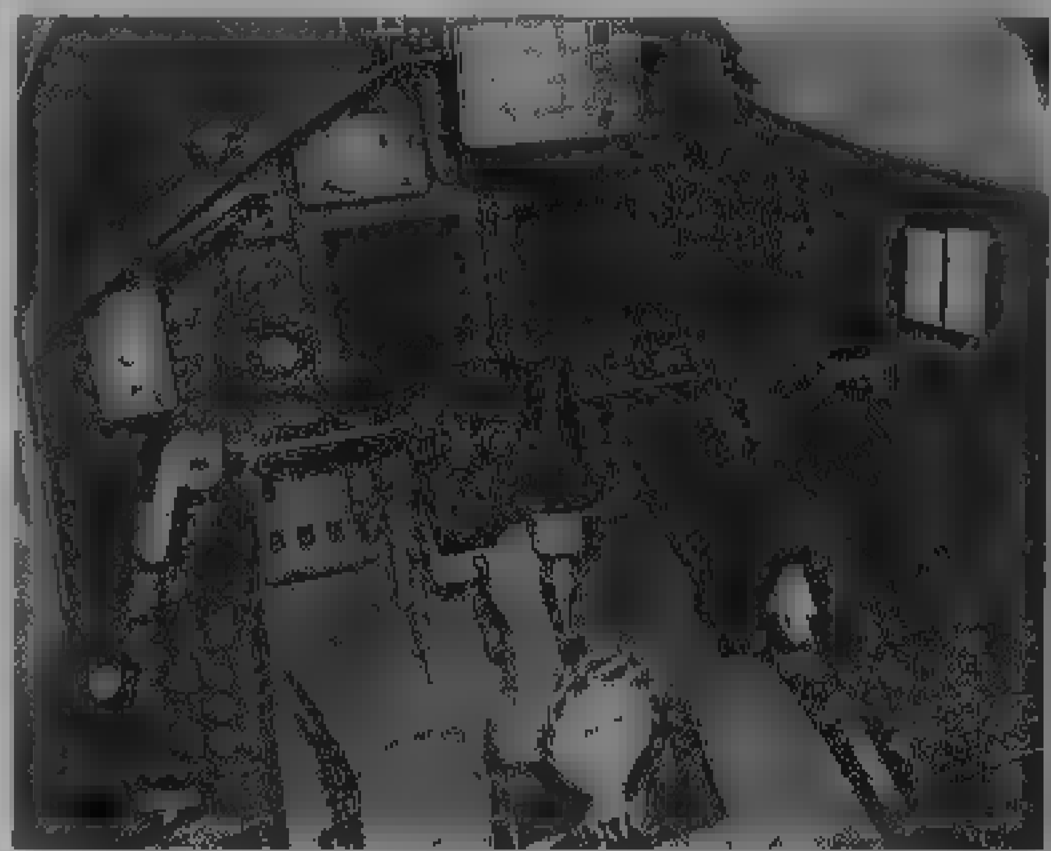
Notes: Procurement rate slowed by 1994 defence review, was to have involved 24 in FY95 and 30 per year in FY96-00

* First production aircraft with 'Cockpit 21'

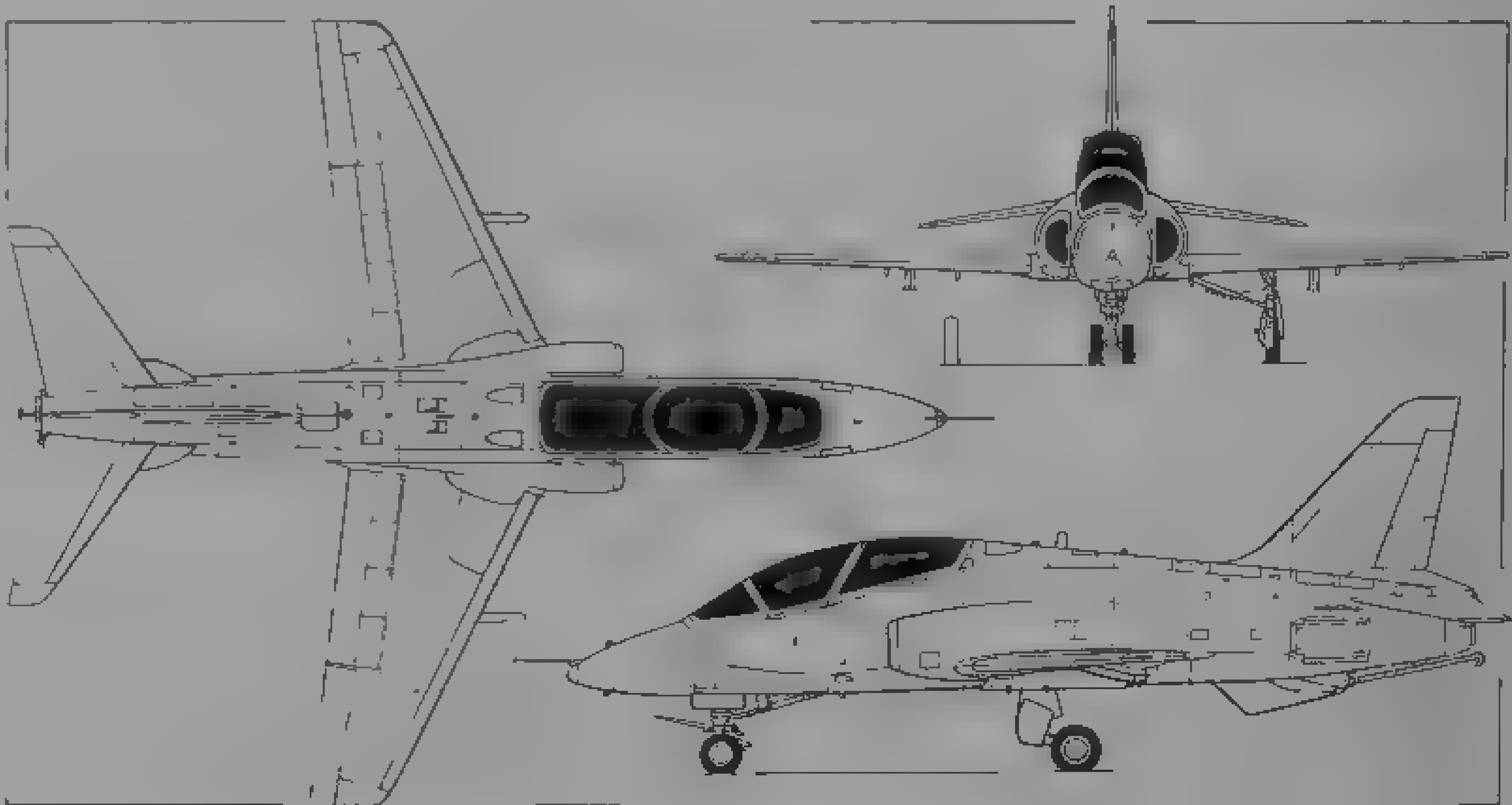
avionics changes necessary to meet USN specification. Introduction expected to meet USN training requirements with 42 per cent fewer aircraft than at present, 25 per cent fewer flight hours, and 46 per cent fewer personnel.

CUSTOMERS: US Navy: two FSD prototypes and 197 production aircraft currently envisaged, of which 72 contracted and 46 delivered by January 1995; complete T45TS programme also involves 19 (originally 32) flight simulators (built by Hughes Training Inc); 32 (originally 49) computer-aided instructional devices, one training integration system mainframe, 155 terminals, plus academic materials and contractor operated logistic support. Requirement for 218 if funding permits. Four training squadrons (VT) to equip: VT-21 and VT-22 of Training Wing 2 at Kingsville, Texas, in 1992-96, VT-7 and 19 of TW-1 at Meridian, Mississippi, 1996-99. TW-2 assigned aircraft Nos 3-36 and 38-72; TW-1 to receive 'Cockpit 21' Goshawks Nos 73-218.

VT-21 operational 27 June 1992 for instructor training; four-aircraft operational evaluation begun by VT-21 on 18 October 1993 for one month first phase, student training begun 4 January 1994, first student flight 11 February 1994, first solo 23 March 1994, course graduated 5 October 1994. Second phase of operational evaluation (advanced tactics/weapons and carrier qualification) on



T-45A Goshawk 'Cockpit 21' digital avionics
1995



McDonnell Douglas/BAe T-45A Goshawk tandem-seat basic and advanced trainer *(Jane's/Dennis Punnett)*
1987

USS *Eisenhower* ended with clearance for fleet introduction being recommended on 5 July 1994. Primary sea platform is training carrier USS *Forrestal*. T-45 syllabus is 132 sorties (175½ hours) plus 72 simulator sessions (98 hours).

COSTS: $316 million for 12 aircraft in FY96 procurement.

DESIGN FEATURES: Generally as for two-seat BAe Hawk, but redesigned (including deeper and longer forward fuselage) and strengthened to accommodate new landing gear and withstand carrier operation, twin airbrakes of composites material, fin height increased by 15.2 cm (6 in) and single ventral fin added, rudder modified, tailplane span increased by 10.2 cm (4 in), wingtips squared off, nose tow launch bar added, underfuselage arrester hook, deployable 20° to each side of longitudinal axis.

FLYING CONTROLS: Differences from two-seat BAe Hawk include electrically actuated/hydraulically operated full-span wing leading-edge slats (operation limited to landing configuration); aileron/rudder interconnect, two fuselage side airbrakes instead of one under fuselage and associated autotrim system for horizontal stabiliser when brakes deployed, GEC-Marconi yaw damper computer and addition of 'smurf' (side mounted unit root fin), a small curved surface forward of each tailplane leading-edge root, to eliminate pitch-down during low-speed manoeuvres. Dowty actuators for slats and airbrakes.

STRUCTURE: BAe (principal subcontractor) builds wings, centre and rear fuselage, fin, tailplane, windscreen, canopy and flying controls.

LANDING GEAR: Wide-track hydraulically retractable tricycle type, stressed for vertical velocities of 7.28 m (23.9 ft)/s. Single wheel and long-stroke oleo (increased from 33 cm, 13 in of standard Hawk to 63.5 cm, 25 in) on each main unit, twin-wheel steerable nose unit with 40.6 cm (16 in) stroke. Articulated main gear, by AP Precision Hydraulics, is of levered suspension (trailing arm) type with a folding side-stay. Cleveland Pneumatic nose gear, with Sterer digital dual gain steering system (high gain for carrier deck operations). Nose gear has catapult launch bar and holdback devices. Main units retract inward into wing, forward of front spar; nose unit retracts forward. All wheel doors sequenced to close after gear lowering; inboard mainwheel doors bulged to accommodate larger trailing arm and tyres. Gear emergency lowering by free-fall. Goodrich wheels, tyres and brakes. Mainwheel tyres size 24 × 7.7-10; nosewheels have size 19 × 5.25-10 tyres. Tyre pressure (all units) 22.40 bars (325 lb/sq in) for carrier operation, reduced for land operation. Hydraulic multidisc mainwheel brakes with Dunlop adaptive anti-skid system.

POWER PLANT: One 26.00 kN (5,845 lb st) Rolls-Royce Turbomeca F405-RR-401 (navalised Adour Mk 871) non-afterburning turbofan (FSD aircraft powered by a 24.24 kN, 5,450 lb st F405-RR-400L, equivalent to Adour Mk 861-49.) AlliedSignal F124 assessed as alternative power plant under US Congressional directive, power plant change abandoned January 1994 in favour of modified Adour with increased TBO in 85th and subsequent Goshawks. Air intakes and engine starting as described for BAe Hawk. Fuel system similar to BAe Hawk, but with revision for carrier operation. Total internal capacity of 1,635 litres (432 US gallons, 360 Imp gallons). Retrofit kits ordered in October 1993 to add 133 litres (35 US gallons, 29 Imp gallons) in engine air intake tanks, but these cancelled in 1994. Provision for carrying one 591 litre (156 US gallon, 130 Imp gallon) drop tank on each underwing pylon.

ACCOMMODATION: Similar to BAe Hawk, except that ejection seats are of Martin Baker Mk 14 NACES (Navy aircrew common ejection seat) zero/zero rocket-assisted type.

SYSTEMS: Air conditioning and pressurisation systems, using engine bleed air. Duplicated hydraulic systems, each 207 bars (3,000 lb/sq in), for actuation of control jacks, slats, flaps, airbrakes, landing gear, arrester hook and anti-skid wheel brakes. No. 1 system has flow rate of 36.4 litres (9.6 US gallons, 8.0 Imp gallons)/min, No. 2 system a rate of 22.7 litres (6.0 US gallons, 5.0 Imp gallons)/min. Reservoirs nitrogen pressurised at 2.75 to 5.5 bars (40 to 80 lb/sq in). Hydraulic accumulator for emergency operation of wheel brakes. Pop up Dowty Aerospace ram air turbine in upper rear fuselage provides emergency hydraulic power for flying controls in event of engine or No. 2 pump failure. No pneumatic system. DC electrical power from single brushless generator, with two static inverters to provide AC power and two batteries for standby power. Onboard oxygen generating system (OBOGS).

AVIONICS: Avionics and cockpit displays optimised for carrier-compatible operations.

Comms: Collins AN/ARN-182 UHF/VHF, Bendix/King APX-100 IFF.

Flight: AN/ARN-144 VOR/ILS by Collins, Honeywell AN/APN-194 radio altimeter, Sierra AN/ARN-136A Tacan, GEC Marconi yaw damper computer. Digital avionics aircraft (No. 73 onwards) have revised navigation package comprising Litton LN-100G ring laser gyro and Collins five-channel GPS linked by 12 state Kalman filter.

Instrumentation: US Navy AN/USN-2 standard attitude and heading reference system (SAHRS), Smiths Industries Mini-HUD (front cockpit), Racal Acoustics avionics management system, and Teledyne caution/warning system. Digital avionics from 73rd production aircraft onwards: two 127 × 127 mm (5 × 5 in) Elbit monochrome multifunction screens in both cockpits, MIL-STD-1553B databus and Smiths HUD.

Mission: Electrodynamics airborne data recorder.

ARMAMENT: No built in armament, but weapons delivery capability for advanced training is incorporated. Single pylon under each wing for carriage of practice multiple bomb rack, rocket pods or auxiliary fuel tank. Provision also for carrying single stores pod on fuselage centreline. CAI Industries gunsight in rear cockpit.

DIMENSIONS, EXTERNAL:

Wing span	9.39 m (30 ft 9¾ in)
Wing chord: at root	2.87 m (9 ft 5 in)
at tip	0.89 m (2 ft 11 in)
Wing aspect ratio	4.99
Length, overall, incl nose probe	11.98 m (39 ft 4 in)
Height overall	4.26 m (14 ft 0 in)
Tailplane span	4.59 m (15 ft 0¾ in)
Wheel track (c/l of shock-struts)	3.90 m (12 ft 9½ in)
Wheelbase	4.31 m (14 ft 1¾ in)

AREAS:

Wings, gross	17.66 m² (190.1 sq ft)
Ailerons (total)	1.05 m² (11.30 sq ft)
Trailing-edge flaps (total)	2.50 m² (26.91 sq ft)
Airbrakes (total)	0.88 m² (9.47 sq ft)
Fin	2.61 m² (28.1 sq ft)
Rudder, incl tab	0.58 m² (6.24 sq ft)
Tailplane	4.43 m² (47.64 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	4,460 kg (9,834 lb)
Internal fuel: early production	1,312 kg (2,893 lb)
enhanced capacity	1,433 kg (3,159 lb)
Normal T-O weight	5,783 kg (12,750 lb)
Max T-O weight	6,387 kg (14,081 lb)
Max wing loading	361.7 kg/m² (74.1 lb/sq ft)
Max power loading	245.65 kg/kN (2.41 lb/lb st)

PERFORMANCE (at max T-O weight):

Design limit diving speed at 1,000 m (3,280 ft)	575 kts (1,065 km/h, 662 mph)
Max true Mach number in dive	1.04
Max level speed at 2,440 m (8,000 ft)	543 kts (1,006 km/h, 625 mph)
Max level Mach number at 9,150 m (30,000 ft)	0.84
Carrier launch speed	121 kts (224 km/h, 139 mph)
Approach speed (typical)	125 kts (232 km/h, 144 mph)
Max rate of climb at S/L	2,440 m (8,000 ft)/min
Time to 9,150 m (30,000 ft), clean	7 min 40 s
Service ceiling	12,200 m (40,000 ft)
T-O to 15 m (50 ft)	1,100 m (3,610 ft)
Landing from 15 m (50 ft)	1,009 m (3,310 ft)
Ferry range, internal fuel only (20 min reserves)	826 n miles (1,532 km, 952 miles)
g limits	+7.33/−3

UPDATED

'Everything down' flypast by prototype T-45A Goshawk showing nose towbar, slats, flaps, airbrakes and hook

1993

Production McDonnell Douglas/BAe T-45A Goshawk in the markings of Training Wing 2

1994

MYASISHCHEV/NAL

PARTICIPATING COMPANIES:

Myasishchev: see under Russia

National Aerospace Laboratories: see under India

UPDATED

MYASISHCHEV/NAL M-102 DUET/SĀRAS

TYPE: Twin-turboprop multipurpose transport.

PROGRAMME: Originated as six/nine-passenger light transport shown in model form at Moscow Aerospace '90 exhibition, revised design announced by Myasishchev 1993, with name Delphin; NAL India had comparable project; general agreement concluded 1993 to combine Myasishchev and NAL programmes, Russian version being known as M-102 Duet and NAL version as Sāras (species of Indian crane). Full scale mockup shown at MosAeroshow '93. Prototype construction (two in Russia, one in India) planned to begin in September 1994, but Indian share of private venture capital not secured at that time. First flights of Russian prototypes scheduled for November

Full-scale mockup of the Myasishchev/NAL M-102 Duet/Saras at MosAeroshow '93 *(R. J. Malachowski)*

1994

995 and June 1996. Myasishchev proposed 746 kW (1,000 shp) TVD-20M turboprop in 1995 as cheaper alternative to PT6A-66.

COSTS: Estimated programme cost (1992) Rs860 million ($27.5 million)

DESIGN FEATURES: High-aspect ratio low mounted wings, with straight taper; pressurised circular-section fuselage, T tailplane on sweptback fin; triangular tail bumper aft of wing/body fairing, engines pylon-mounted each side of fuselage, with pusher propellers, suitable for operations in hot and high conditions (typically, airfield at 2,000 m, 6,560 ft, at up to 45°C), and from semi-prepared runways

FLYING CONTROLS: Primary surfaces manual/mechanical; electrically operated pitch trim and trailing-edge flaps; tabs on rudder and starboard elevator; integrated three-axis autopilot

STRUCTURE: Mixed construction of aluminium alloy (fuselage, engine pylons and fixed portion of wing) and composites (nosecone, wing/body fairing, wing moving surfaces and tips, engine cowlings and entire tail unit); designed for 30,000 hour life, fail-safe philosophy for all primary structures and major attachments, incorporates damage tolerance features. Fuselage and landing gear by Myasishchev, wings, tail and power plant installation by NAL

LANDING GEAR: Retractable tricycle type, with single main wheels and twin-wheel steerable nose unit. Mainwheels retract inward into wingroot fairings, nose unit rearward

POWER PLANT: Two 634 kW (850 shp) Pratt & Whitney Canada PT6A-66 turboprops, six-blade, constant-speed feathering and reversible-pitch pusher propellers, rotating in opposite directions. Integral fuel tank in each wing, combined capacity 1,500 litres (396 US gallons; 330 Imp gallons). Gravity refuelling point in each wing upper surface, single-point pressure refuelling optional

ACCOMMODATION: Two-person flight deck with dual controls, but to be certificated also for one-pilot operation. Up to 14 seats in cabin. Commuter layout can seat 14 economy class passengers in single seats at 79 cm (31 in) pitch, with centre aisle, rear toilet and total of 1.1 m³ (38.8 cu ft) for baggage in forward and rear compartments. Typical executive interior could have seven seats, tables, wardrobe, baggage compartment, galley and toilet. Ambulance version capable of carrying six stretchers, with seats for two medical attendants, medical supplies storage, baggage compartment and toilet. Various passenger/cargo arrangements or special mission interiors optional in combi version. Door at front on port side, overwing emergency exit on starboard side. Baggage compartment door on port side of tailcone

SYSTEMS: Bootstrap environmental control system; cabin pressure differential 0.55 bar (8.0 lb/sq in). Hydraulic system (pressure 207 bars; 3,000 lb/sq in) for landing gear actuation, brakes and nosewheel steering

Primary electrical power is 28 V DC, supplied by two 9 kW starter/generators, 40 Ah Ni/Cd battery provides emergency power for essential loads for approximately 20 minutes, including three engine restarts. Two solid state inverters supply 115 V AC power at 400 Hz for instrumentation. AC power for anti-icing and galley/windscreen heating obtained via alternators. Emergency oxygen system for crew (two 500 litre; 17.6 cu ft bottles) and passengers (two 0.2 m³; 7.06 cu ft bottles). Engine fire and cabin smoke detection systems. Halon fire extinguishing system (two 130 litre, 4.6 cu ft bottles)

AVIONICS: Integrated digital system (ARINC 429 compatible)

Comms: VHF (two) and HF radio, intercom/PA system and CVR

Radar: Weather radar

Flight: Autopilot, ADF, VOR/ILS, marker beacon receiver, DME, GPS, radar altimeter, air data sensors and computer, twin-gyro AHRS, flight control computer and flight director

Instrumentation: Five-tube EFIS; 'return home' standby instrumentation

DIMENSIONS, EXTERNAL:	
Wing span	14.70 m (48 ft 2¾ in)
Length overall	14.20 m (46 ft 7 in)
Height overall	5.15 m (16 ft 10¾ in)
Tailplane span	5.20 m (17 ft 0¾ in)
Wheel track	2.80 m (9 ft 2¼ in)
Wheelbase	5.70 m (18 ft 8¼ in)
Propeller diameter	2.16 m (7 ft 1 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	5.69 m (18 ft 8 in)
Max width	1.77 m (5 ft 9¾ in)
Aisle width at floor	0.54 m (1 ft 9¼ in)
Max height	1.70 m (5 ft 7 in)
Volume	16.0 m³ (565 cu ft)
WEIGHTS AND LOADINGS:	
Max fuel weight	1,200 kg (2,645 lb)
Max payload	1,300 kg (2,865 lb)
Max T-O and landing weight	5,700 kg (12,565 lb)
Max zero-fuel weight	5,100 kg (11,243 lb)
Max power loading	4.50 kg/kW (7.39 lb/shp)
PERFORMANCE (estimated, at max T-O weight, ISA, except where indicated):	
Max level speed at S/L	275 kts (510 km/h, 317 mph)
Max cruising speed at 9,000 m (29,525 ft)	350 kts (650 km/h, 404 mph)
Stalling speed at S/L	92 kts (170 km/h, 106 mph)
Max rate of climb at S/L	810 m (2,657 ft)/min
Rate of climb at S/L, OEI	260 m (853 ft)/min
T-O run: at S/L, ISA	380 m (1,247 ft)
at 2,400 m (7,875 ft), ISA + 20°C	630 m (2,067 ft)
T-O to 15 m (50 ft): at S/L, ISA	580 m (1,903 ft)
at 2,400 m (7,875 ft), ISA + 20°C	860 m (2,822 ft)
Landing from 15 m (50 ft): at S/L, ISA	510 m (1,674 ft)
at 2,400 m (7,875 ft), ISA	600 m (1,969 ft)
Landing run: at S/L, ISA	260 m (853 ft)
at 2,400 m (7,875 ft), ISA	290 m (952 ft)
Range at long-range cruising speed with max payload and 260 kg (573 lb) fuel reserves: at 7,500 m (24,600 ft)	1,025 n miles (1,900 km, 1,180 miles)
at 9,000 m (29,525 ft)	1,300 n miles (2,400 km, 1,490 miles)

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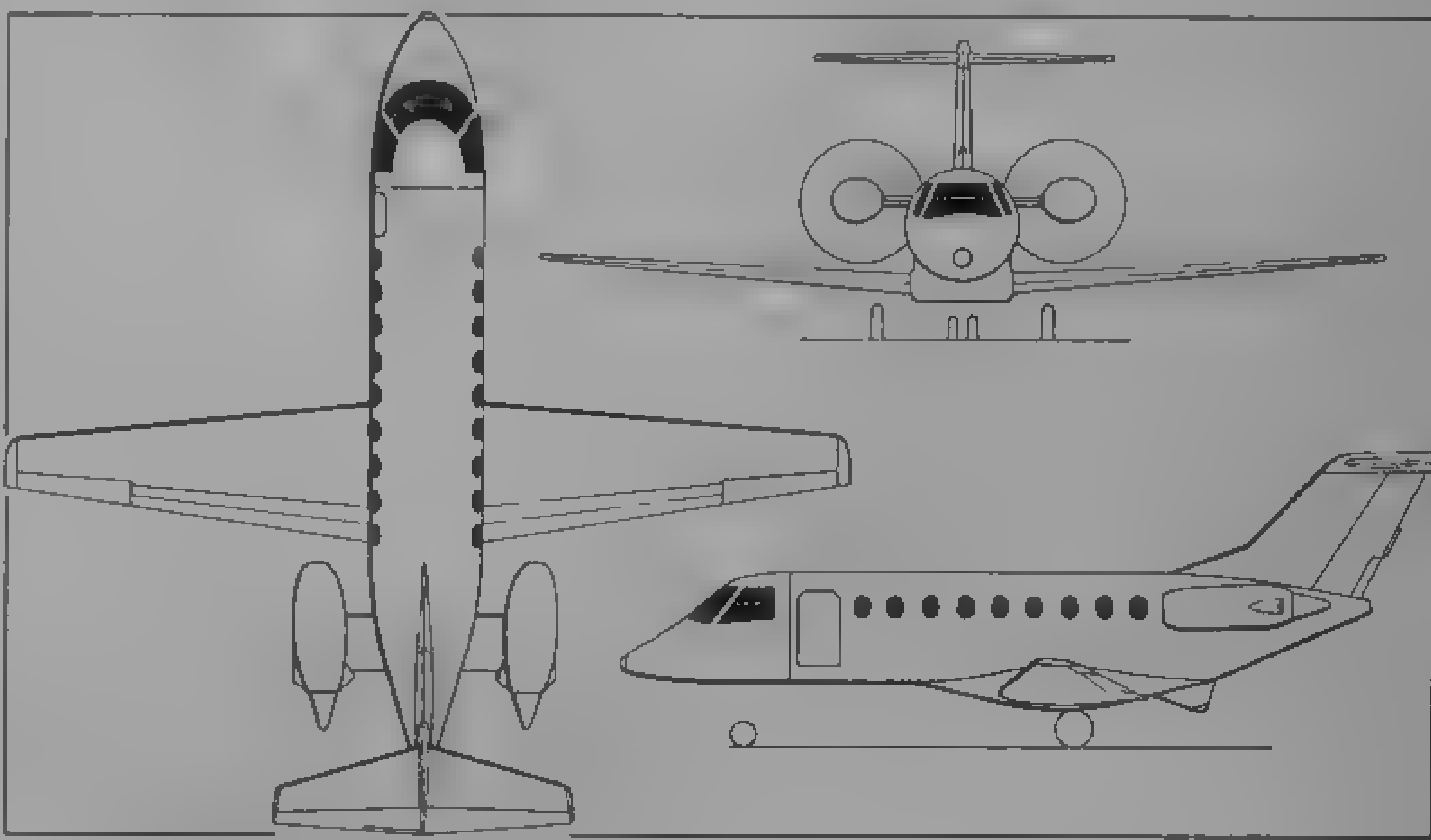


Myasishchev/NAL M-102 twin-turboprop multipurpose transport *(Jane's/Mike Keep)*

1994

NH INDUSTRIES

NH INDUSTRIES sarl

Le Quatuor, Batiment C, 42 route de Galice, F 13082 Aix en Provence Cedex 2, France
Telephone: 33 42 95 97 00
Fax: 33 42 95 97 49

GENERAL MANAGER: Jean-Pierre Barthelemy

PARTICIPATING COMPANIES:
Agusta: see under Italy
Eurocopter Deutschland: see this section
Eurocopter France: see this section
Fokker Aircraft: see under Netherlands

NH Industries established 1992 to manage design and development of NH 90; shares are Agusta 26.9 per cent, Eurocopter Deutschland 24.0 per cent, Eurocopter France 42.4 per cent, Fokker 6.7 per cent. NFT (Norway) joined in 1994 as risk-sharing partner of Eurocopter France. NH Industries is prime contractor for design and development, industrialisation and production, logistic support, marketing and sales.

Joint agency NAHEMA (NATO Helicopter Management Agency) formed February 1992 by the four governments, within NATO framework, to manage programme. NAHEMA located alongside NH Industries in Aix

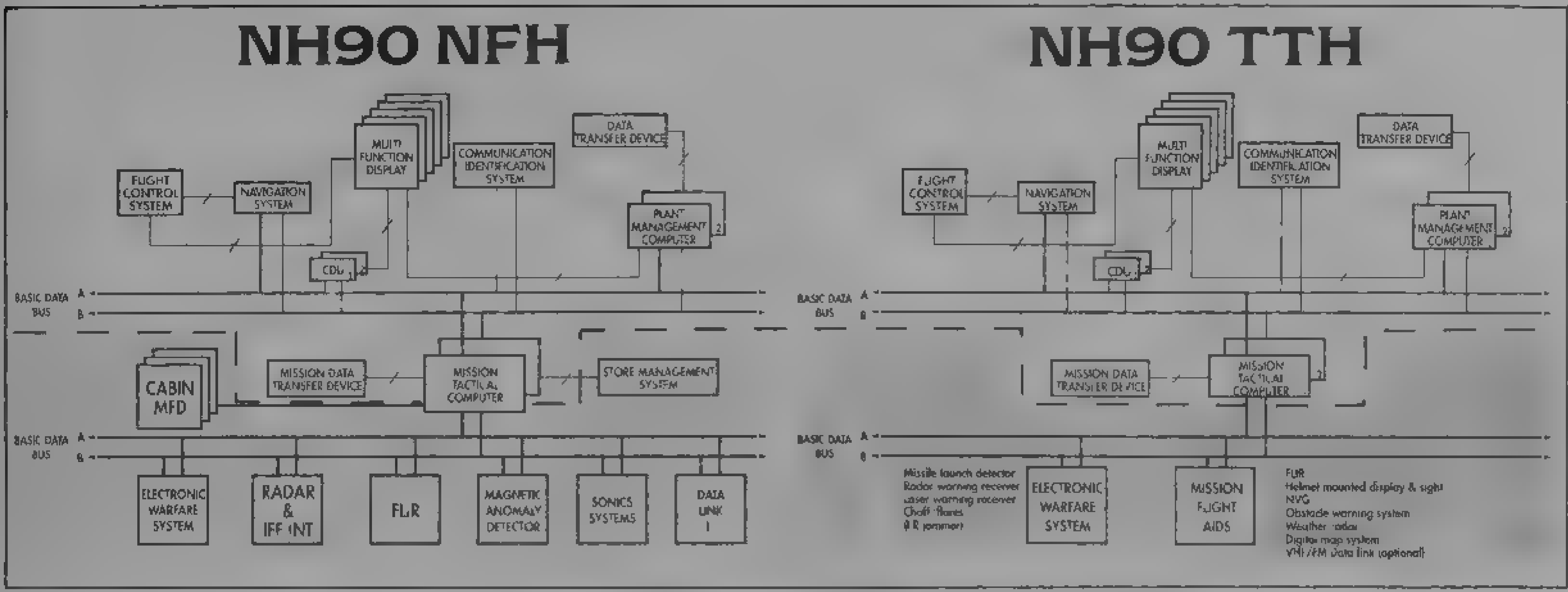
VERIFIED

NH INDUSTRIES NH 90

TYPE: Multirole naval (NFH) and tactical transport (TTH) medium helicopter

PROGRAMME: Initial studies by NIAG SG14 in 1983-84; September 1985 MoU between defence ministers of France, Germany, Italy, Netherlands and UK led to 14 month feasibility/predefinition study for new naval/army NH 90 (NATO helicopter for the 1990s), initial design phase approved December 1986; second MoU in September 1987 led to predefinition phase and completion of weapons system definition in 1988. UK withdrew from programme April 1987, German work-share reduced early 1990, Italian participation renegotiated later 1990; French and German launch decision 26 April 1990; two ministerial MoUs in December 1990 and June 1991 cover design and development responsibilities; intercompany agreement signed March 1992; design and development contract signed 1 September 1992, five prototypes and GTV (ground test vehicle) planned, with prototype produced in France, TTH in Germany and NFH in Italy, assembly of prototype began at Marignane, October 1993, development suspended May 1994, re-started July 1994, but all new-development items subject to rigorous cost examination, preference for off the-shelf components; first fuselage centre-section delivered to Marignane 20 September 1994, first flight P01 expected end 1995 and initial deliveries in 2001; signature of production contract expected 1997. P04 is first TTH, P05 first NFH

CURRENT VERSIONS (general): **NFH** (NATO Frigate Helicopter): Naval version, primarily for autonomous ASW and ASVW, additional applications include vertrep, SAR, transport and anti-air warfare support; designed for all-weather/severe ship motion environment, fully integrated mission system for crew of three (optionally four); ECM anti-radar and IR protection systems.



NH 90 avionics. Core system above broken line is identical for both versions

1995

TTH (Tactical Transport Helicopter). Land-based army/air force version, primarily for tactical transport, airmobile operations and SAR, additional applications include tactical support, special EW, airborne command post, VIP transport and training, defensive weapons suite; rear-loading ramp/door to be provided for French, Italian and German armies to accommodate light armoured anti-tank missile vehicle high manoeuvrability and survivability for NOE operation near front line

CURRENT VERSIONS (specific) **PT1** Prototype; common basic configuration; assembled at Marignane; first flight due December 1995 with RTM 322 engines, later retrofit with T700 engines

PT2: Common basic configuration, first flight mid-1996

PT3 Common basic configuration, first flight late 1996.

PT4. TTH mission system, first flight late 1997

PT5: NFH mission system, first flight early 1997 (sic)

GTV Ground test vehicle at Cascina Costa

CUSTOMERS. Estimated total requirements (most of which are expected to be reduced) are as under

Customer	TTH	NFH
France	160	60
Germany, Air Force	114	
Army	120	
Navy		38
Italy	150	64
Netherlands		20
Sub-total	**544**	**182**
Total	**726**	

Artist's impression of NH 90 NFH *(NHI/Enzo Maio)*

1995

COSTS. Reported development cost ECU1,376 million (1988); in addition, Eurocopter France to contribute ECU161 24 million, Eurocopter Deutschland and ECU[illegible] million, and Fokker ECU2 65 million.

DESIGN FEATURES: Titanium main rotor hub with elastomeric bearings, four composite blades with advanced aerofoils and curved tips [illegible] at 256 6 [illegible] (719 ft)/s tip speed, bearingless tail rotor with four blades of similar design and construction, tail rotor with cross-beam hub turns at 1,235 4 rpm with 207 m (679 ft)/s tip speed, automatic folding of main rotor blades and tail pylon in NFH, overall design will aim for low vulnerability/detectability, reduced maintenance requirements, and day/night operability within temperature range of −40 to +50°C

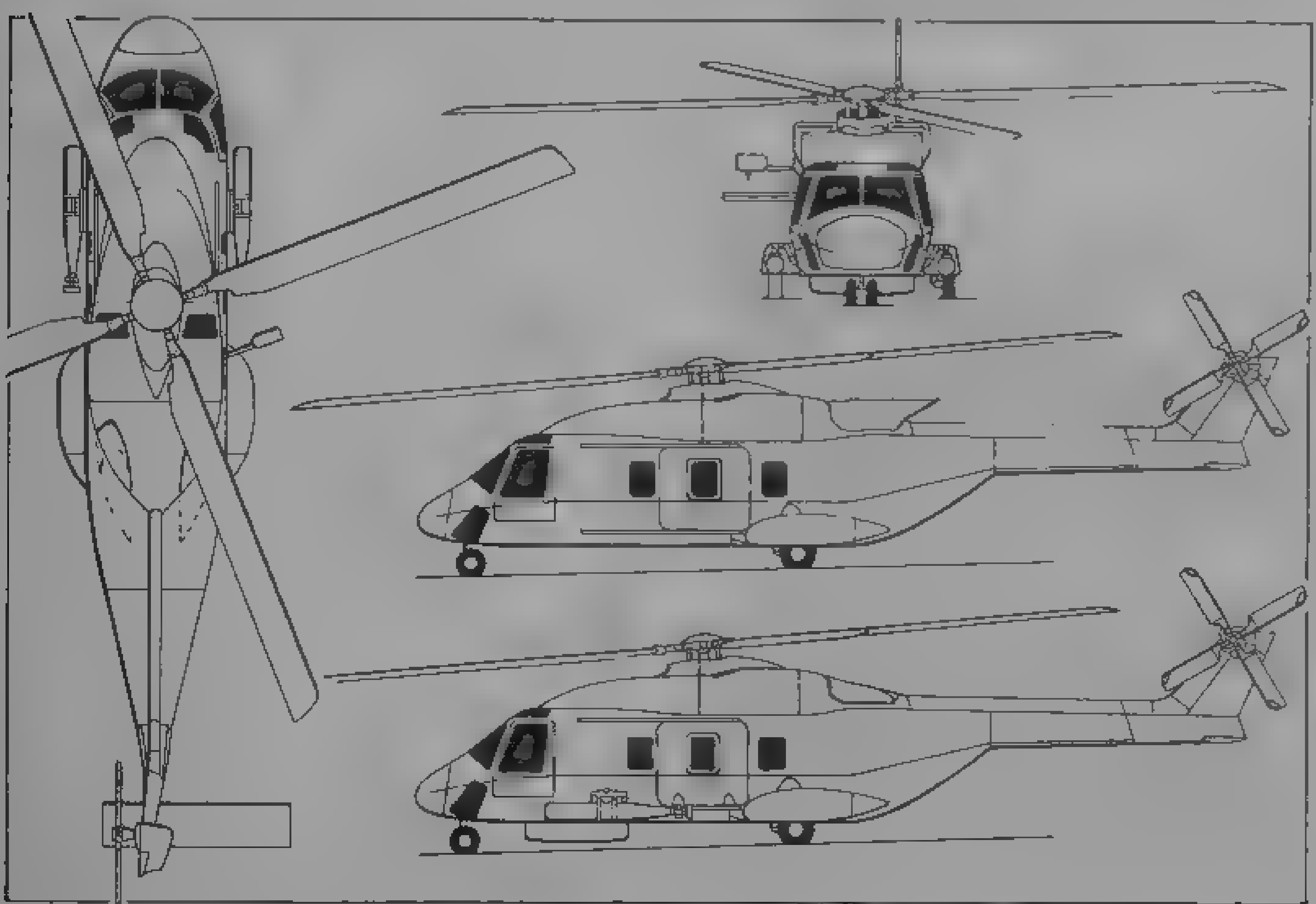
FLYING CONTROLS Quadruplex fly-by-wire controls eliminate cross-coupling between control axes Flight control system developed by Eurocopter France optimised for NOE flight and minimal vulnerability to small arms damage.

STRUCTURE. All-composites fuselage with low radar signature; fail-safe design of structure, rotating parts and systems for high safety levels First set of main and tail rotor blades completed for ground testing May 1994, leading-edge box and roved parts of blade prefabricated to reduce time in main mould, resin used will reduce material ageing in damp and hot regions, blades designed and manufactured using Catia CAD/CAM

Front fuselage built at Marignane (France), centre at Ottobrunn (Germany); rear at Cascina Costa (Italy); tail structure at Ypenburg (Netherlands); blades at La Courneuve (France); main rotor hub at Marignane, main gear box and rotor shaft at Cascina Costa, tail gearbox at Marignane and landing gear in Netherlands.

LANDING GEAR Retractable crashworthy tricycle gear by DAF Special Products with twin-wheel nose unit and single-wheel main units; emergency flotation gear.

POWER PLANT: Two engines, required power from each engine during normal operation at 1,000 m (3,280 ft) in ISA + 15°C is 1,360 kW (1 824 shp) for 30 minutes, 1,253 kW (1,680 shp) maximum continuous, OEI maximum contingency (2½ minutes) 1,484 kW (1,990 shp), emergency at S/L ISA, 1,942 kW (2,604 shp). Decided on 25 January 1994 that NFH and TTH will be developed and qualified



NH Industries NH 90 NFH, with additional side view (upper) of TTH *(Jane's/Mike Keep)*

1994

with RTM 322-01/9 made by European consortium of Turbomeca, Rolls-Royce, MTU, Piaggio and Topps; during development, the GE T700-T6E will be partially qualified by Alfa Romeo, GE and Fiat Avio to meet Italian military requirements. Engine control by FADEC, engine RFP issued April 1992. Transmission rating 2,545 kW (3,413 shp) with both engines, 2,050 kW (2,749 shp) for 30 seconds OEI main gearbox can run dry for 30 minutes, fuel system has crash resistant self-sealing cells

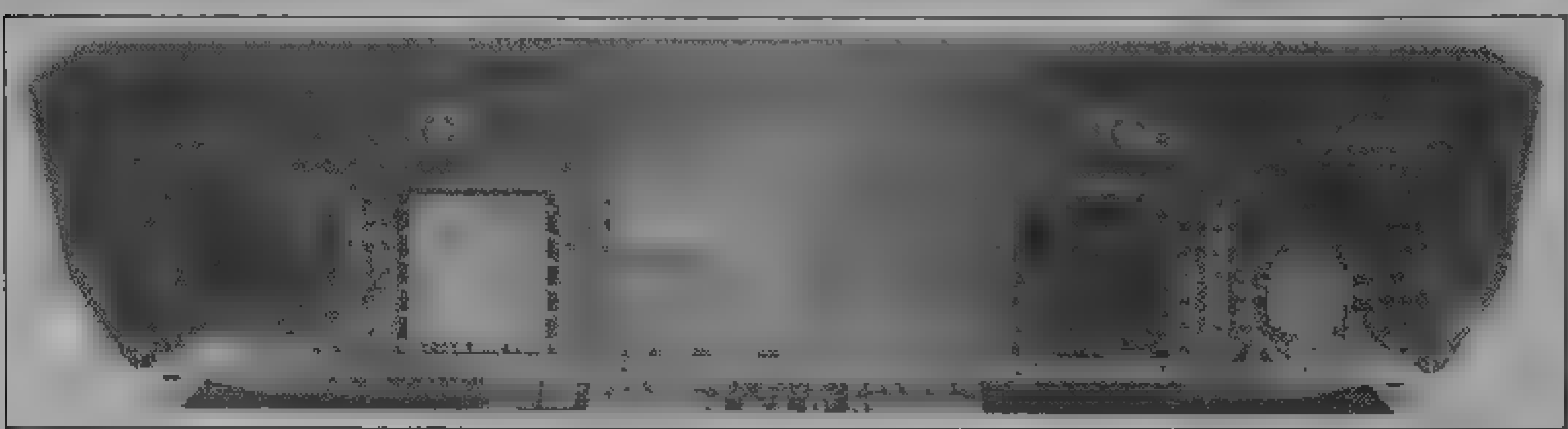
ACCOMMODATION: Minimum crew one pilot VFR and IFR,

Artist's impression of NH 90 TTH (*NHI/Enzo Maio*)

1995

Front and centre sections of NH 90 prototype immediately prior to joining, Marignane, December 1994

1995



Five-screen EFIS of NH 90

1995

NFH crew, pilot, co-pilot/TACCO on flight deck and one system operator in cabin, optionally, two pilots on flight deck and one TACCO, one SENSO in cabin, TTH two pilots or one pilot and one crewman on flight deck and up to 20 equipped troops or one 2 tonne tactical vehicle in cabin

SYSTEMS: Full redundancy for all vital systems; hydraulic system has two mechanically driven and one electric pump electrical system has two batteries and four AC generators feeding DC buses through transformer-rectifiers; APU for electrical engine starting, environmental control on ground and emergency use in flight; fire detection and suppression in engine bays, APU and cabin

AVIONICS: Core avionic system based on dual MIL-STD-1553B data highways allows integration of aircraft and mission equipment through several computers.

Comms: Integrated management of com and IFF systems.

Radar: NFH has 360° surveillance radar, TTH has weather radar

Flight: Obstacle warning system in TTH

Instrumentation: Five-screen colour EFIS TTH has digital map Provision for helmet-mounted display

Mission: NFH, Dipping sonar, FLIR, MAD, Link 11 datalink, electronic warfare subsystem TTH FLIR, optional datalink

Self-defence: Provision for MAWS, RWR, LWR, chaff/flares and IR jammer

ARMAMENT: TTH can have area suppression and self-defence armament, NFH to carry air-to-surface missiles weighing up to 700 kg (1,543 lb) and anti-submarine torpedoes, air-to-air missiles optional

DIMENSIONS, EXTERNAL:

Main rotor diameter	16.30 m (53 ft 5½ in)
Tail rotor diameter	3.20 m (10 ft 6 in)
Main rotor blade chord	0.65 m (2 ft 1½ in)
Tail rotor blade chord	0.32 m (1 ft 0½ in)
Length: overall, rotors turning	19.56 m (64 ft 2 in)
fuselage	16.02 m (52 ft 6¾ in)
folded (NFH)	13.50 m (44 ft 3½ in)
Height: folded (NFH)	4.10 m (13 ft 5½ in)
overall, tail rotor turning	5.44 m (17 ft 10 in)
Width: max	4.37 m (14 ft 4 in)
over mainwheel fairings	3.63 m (11 ft 11 in)
fuselage	2.60 m (8 ft 6¼ in)
NFH folded	3.80 m (12 ft 5½ in)
Tailplane half-span (stbd)	2.55 m (8 ft 4 in)
Wheel track	3.20 m (10 ft 6 in)
Wheelbase	6.083 m (19 ft 11½ in)

DIMENSIONS, INTERNAL:

Cabin: Length, excl rear ramp	4.00 m (13 ft 1½ in)
Max width	2.00 m (6 ft 6¾ in)
Max height	1.58 m (5 ft 2¼ in)
Volume	18.0 m^3 (635.7 cu ft)

AREAS:

Main rotor disc	208.67 m^2 (2,246.1 sq ft)
Tail rotor disc	8.04 m^2 (86.57 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped: NFH	6,428 kg (14,171 lb)
Weight empty, basic configuration	5,400 kg (11,905 lb)
Standard fuel: NFH (usable)	1,902 kg (4,193 lb)
Mission payload (both)	more than 2,000 kg (4,409 lb)
Max payload	4,600 kg (10,141 lb)
Mission T-O weight: TTH	8,700 kg (19,180 lb)
NFH	9,100 kg (20,062 lb)
Max T-O weight	10,000 kg (22,046 lb)
Mission disc loading: TTH	41.7 kg/m^2 (8.54 lb/sq ft)
NFH	43.6 kg/m^2 (8.93 lb/sq ft)
Mission power loading: TTH	3.78 kg/kW (6.22 lb/shp)
NFH	3.96 kg/kW (6.50 lb/shp)

PERFORMANCE (estimated, at appropriate mission T-O weight, ISA):

Dash speed at S/L: TTH	162 kts (300 km/h, 186 mph)
Max cruising speed at S/L:	
NFH	140 kts (260 km/h, 162 mph)
TTH	156 kts (290 km/h, 180 mph)
Service ceiling: TTH	4,250 m (13,945 ft)
Absolute ceiling: TTH	6,000 m (19,685 ft)
Hovering ceiling: IGE, TTH	3,600 m (11,810 ft)
OGE, TTH	3,000 m (9,850 ft)
Ferry range: TTH	650 n miles (1,204 km; 748 miles)
Time on station 60 n miles (111 km, 69 miles) from base, 30 min reserves: NFH	3 h
Max endurance at 75 kts (140 km/h, 87 mph):	
NFH	5 h 5 min

UPDATED

NEW LARGE AIRPLANE (NLA) — *see UHCA/VLCT entry in this section*

PANAVIA

PANAVIA AIRCRAFT GmbH

Airport Business Centre, Am Soldermoos 17, D-85399 Hallbergmoos
Telephone: 49 (811) 80 1238/9
Fax: 49 (811) 80 1386
MANAGING DIRECTOR: Reinhold Falthauser
PUBLIC RELATIONS MANAGER: W D Gnamm

PARTICIPATING COMPANIES:
Alenia: see under Italy
British Aerospace: see under UK
Daimler Benz Aerospace: see under Germany

Panavia formed 26 March 1969 as industrial prime contractor to design, develop and produce an all-weather MRCA (multirole combat aircraft) for air forces of UK, Germany (including Navy), Italy and Netherlands, Netherlands withdrew July 1969, shareholdings then being readjusted to UK and Germany 42.5 per cent each, Italy 15 per cent. Tornado programme, one of largest European industrial ventures yet undertaken, is guided and monitored on behalf of the three governments by NAMMO (NATO MRCA Management Organisation), whose executive agency NAMMA (formed 15 December 1968) is co-located with Panavia. Tornado production involved three major versions: IDS (interdictor/strike), ECR (electronic combat and reconnaissance) and ADV (air defence variant). Tornados of all variants and operators flew 3,250 sorties in 1991 Gulf War and achieved 1 million flying hours in May 1992. Work has started on Saudi Arabian follow-on order for 48.

UPDATED

PANAVIA TORNADO IDS

RAF designations: GR Mks 1, 1A, 1B, 4 and 4A

TYPE: All-weather close air support/battlefield interdiction, interdiction/counter-air strike, naval strike and reconnaissance aircraft.

PROGRAMME: Six-government feasibility study (originally involving Belgium and Canada) initiated 17 July 1968, project definition began 1 May 1969; development phase started 22 July 1970; structural design completed August 1972, first flight 14 August 1974 by first of nine prototypes (P01-09: see 1978-79 *Jane's* for details); Tornado name adopted September 1974. German procurement approved 19 May 1976; production programme initiated 29 July 1976 by three-government MoU for 809 aircraft in six batches (640 IDS, 165 ADV, plus four preseries aircraft brought up to IDS production standard).

First flight 5 February 1977 by first of six preseries Tornados (PP11-16: see 1980-81 and earlier editions). Italian production approved 8 March 1977; first flights by production IDS in UK and Germany 10 and 27 July 1979 respectively.

Deliveries for operational conversion training (to Trinational Tornado Training Establishment at RAF Cottesmore) began 1 July 1980, first flight by Italian production aircraft 25 September 1981, operational squadron deliveries began 1982 to RAF (6 January), Germany (Navy, 2 July) and Italy (27 August); first export delivery (to Saudi Arabia) March 1986, batch 7 contract (57 IDS, 35 ECR and 32 ADV) awarded 10 June 1986.

Contract to develop mid-life update for RAF GR. Mk 1 awarded 16 March 1989, 26 GR Mk 4s (part of proposed batch 8) cancelled 18 June 1990. Final Italian aircraft (MM7088) delivered 12 July 1989; final German IDS (4622) 31 May 1989: final ECR and last German built Tornado (4657) handed over 19 December 1991 and delivered 28 January 1992, final RAF GR Mk 1 (ZG794) delivered 19 November 1992. New reconnaissance system being acquired for 40 ex-naval aircraft transferred to German Air Force during 1993.

CURRENT VERSIONS: **ECR**: Electronic combat and reconnaissance version, utilising IDS airframe, described separately.

German Air Force IDS: Equips 10 squadrons: two each with JBGs 31 (Norvenich), 33 (Buchel) and 34 (Memmingen), and two in reconnaissance role with AG 51 (Schleswig Jagel), all NATO-assigned, plus two (one until mid 1994) with weapons training unit JBG 38 (Jever); others at TTTE in UK and WTD 61 at Manching. AG 51 reformed, 1 January 1994, with 40 ex-Navy Tornados nominally in reconnaissance role, although initially with only nine recce pods, new recce system agreed June 1994, comprising two optical cameras, IRLS, data storage system and real time display in rear cockpit, total 55 pods. JBG 32 (Lechfeld) and JBG 38 each with one IDS and one ECR squadron until latter grouped at Lechfeld, mid 1994, JBG 32 to be first with MLI aircraft. All German Tornados cleared for in-flight refuelling by USAF KC-10A and KC-135 tankers. Principal weapons B61, MW 1, AIM 9L, AGM-65, AGM-88. Apache modular standoff weapon available from 1996.

German Air Force MLI: Mid life improvement confirmed, January 1993, some trial installations in aircraft 4560/9860; planned in two parts, first (from late 1998) is Neue Avionsstruktur (New Avionics Structure) involving computer upgrade from 256 kbyte to 8 Mbyte, change of language from Assembler to Ada, and MIL-STD-1760 digital databus for precision-guided munition and standoff missile capability, revised displays under consideration, decision awaited on laser designator pod (Thomson CLDP, GEC-Marconi TIALD or Rafael Litening). Second stage involves FLIR, integrated laser INS and GPS, plus new defensive aids computer, missile approach warning and enhanced radar warning equipment.

German Navy IDS: Equips two operational squadrons (NATO-assigned) with Marinefliegergeschwader 2 (Eggebeck) for strike missions against sea and coastal targets and (1/MFG 2) reconnaissance using MBB/Alenia multisensor pod, mid life improvement under development (see preceding paragraph). Naval Tornado strength reduced to 54 during 1993 with transfer of 40 Tornados from MFG 1 (Schleswig/Jagel) to air force. Principal weapons carried are BL755, AIM 9L, AGM 88, Kormoran 1 and (from 1995) 2.

Italian Air Force IDS: In service with four operational squadrons: 154° Gruppo (6° Stormo at Brescia Ghedi), 155° Gruppo (50° Stormo, Piacenza), Kormoran anti-shipping 156° Gruppo (36° Stormo, Gioia del Colle) and, from September 1993, 102° Gruppo of 6° Stormo, additionally with Reparto Sperimentale di Volo at Pratica di Mare and TTTE in UK. All delivered. No. 154 Squadron in fighter-bomber role, No. 156 support of maritime operations, No. 155 suppression of air defences (see Tornado ECR) and No. 102, reconnaissance (with pods previously used by No. 154). Principal weapons carried are B61, MW-1, AIM-9L, AGM 65D, AGM 88, BL755, Mk 82, Mk 83, Rockeye, Kormoran 1 and GBU-16 Paveway II (from 1994 in parallel with receipt of Thomson-TRT CLDP laser designator pods), mid-life update under development (see German Air Force MLI paragraph for details).

Royal Air Force GR Mk 1: UK IDS version, meeting Air Staff Requirement 392, equipping four NATO assigned squadrons with RAF Germany (Nos IX, 14, 17 and 31 at Brüggen), plus UK training units (TTTE at Cottesmore, TWCU/No. XV (Reserve) Squadron at Lossiemouth), Strike/Attack Operational Evaluation Unit (Boscombe Down) and A&AEE. Squadron deliveries (to No. IX) began 6 January 1982, modification for tactical nuclear weapon carriage began 1984, first combat use (Gulf War) 17 January 1991, to be redesignated GR Mk 4 (which see) after receiving mid-life update.

Interim Phase 2 modifications introduced 1990 include RAM on forward facing surfaces, Have Quick 2 secure radios, filters for NVG use, GPS and provision for 2 250 litre (594 US gallon, 495 Imp gallon) drop tanks. Mk XII Mode 4 IFF for 1991 Gulf War deployment. Principal weapons carried are WE177B, 1,000 lb bomb, JP233, BL755, AIM-9L, ALARM, Paveway II (Paveway III ordered July 1994, conventional SOM required.) No. IX Squadron operational with ALARM, 1 January 1993 (but weapon first used two years previously); most TIALD designator-capable Tornados grouped in No. 14 Squadron from Autumn 1993. Two former SACEUR strike squadrons transferred to maritime strike/attack 1993-94 (see GR Mk 1B).

Royal Air Force GR Mk 1A: UK day/night all-weather tactical reconnaissance version, equipping Nos. 2 and 13 Squadrons at Marham, one development aircraft (ZA402, first flight 11 July 1985) followed by 15 others also converted from GR Mk 1 (delivered from 3 April 1987) and 14 new-production Mk 1As (delivered from 13 October 1989 to 5 December 1990). Retains air-to-surface role except for deletion of guns, identifiable by small underbelly blister fairing (immediately behind laser rangefinder pod) and transparent side panels for BAe SLIR (sideways looking infra-red) system and Vinten Linescan 4000 surveillance system, has Computing Devices Company signal processing and video recording system (first video-based tac/recce system with replay facility) offering capability for future real-time reconnaissance data relay, first operational mission in Gulf War, night of 18/19 January 1991. To be upgraded to **Mk 4A** by MLU.

Royal Air Force GR Mk 1B: Retrofit by RAF at St Athan of 24 GR Mk 1s for maritime attack. IOC 1994 with four BAe Sea Eagle (or two, plus two drop tanks), second phase modification to permit up to five Sea Eagles (or four, plus one tank). First aircraft is ZA407 which entered rework at BAe, Warton, on 20 January 1993. No. 27 Squadron reassigned from SACEUR strategic strike to maritime role and simultaneously renumbered No. 12 Squadron 1 October 1993, to Lossiemouth 7 January 1994. No. 617 Squadron similarly retasked and transferred Marham to Lossiemouth, 27 April 1994. First delivery was ZA456 to No. 617 Squadron on 14 February 1994.

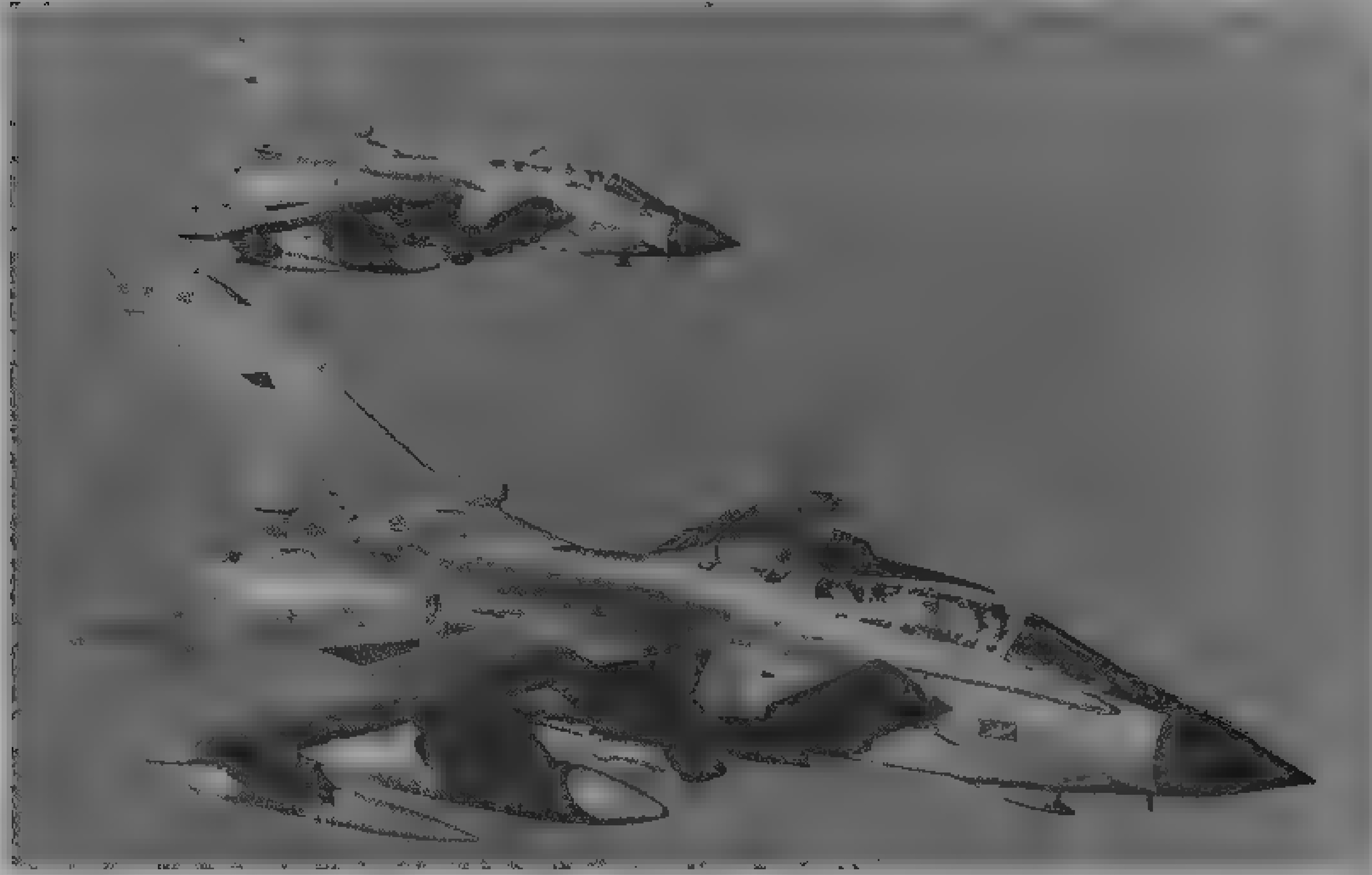
Royal Air Force GR Mk 4: Designation to be applied to 142 GR Mk 1s after receiving MLU (mid-life update) in satisfaction of Air Staff Requirement 417, modifications include new GEC-Marconi Defence Systems EW, updated weapon control system, FLIR; GPS; and interface for TIALD pod. Several other systems abandoned in 1993 as cost saving measure, including terrain-referenced navigation and terrain-following 3D display. Also deleted was redesigned engine air intake of lower radar cross-section. Prototype Mk 4 (ZD708) first flight 29 May 1993, followed

50 years of RAF fighters — Tornado F Mk 3 and Spitfire Mk XVI *(Paul Jackson)*

1994

Tornado GR Mk 1As and earlier generation Canberra PR Mk 9 *(Paul Jackson)*

1995



Tornado GR Mk 1B maritime strike/attack aircraft of No. 617 Squadron, nearest flown by Flt Lt Jo Salter, RAF's first female combat pilot *(Paul Jackson)*

1995

by ZG773 on 1 September 1993, some MLU items also tested in P15/XZ631 MLU contract awarded to Panavia 29 July 1994; work at Warton between 1996 and 2002, release to service planned in February 1998

Royal Saudi Air Force IDS: Equips two squadrons (Nos. 7 and 66), each including some of six configured for reconnaissance, deliveries March 1986 to October 1987 (first 20), further 28 (completing initial order) between May 1989 and 25 November 1991. Second batch of 48 confirmed on 28 January 1993 and contract signed in June 1993. Principal weapons carried are JP233, 1,000 lb bomb, AIM-9L, ALARM, Sea Eagle on order

Tornado 2000 Proposed successor to RAF GR Mk 4, optimised for low-level/high-speed/long-range penetration and able to carry standoff weapons, longer fuselage than current IDS, containing increased fuel tankage; faceted nose section and pitot intakes to minimise radar signature. Studies continuing in 1995

CUSTOMERS See table. Total of 828 IDS/ECR (plus four refurbished preseries IDS) ordered for Germany (359, air force 157 strike including two preseries, 35 ECR and 55 dual control, navy 112 strike including 12 dual), Italy (100 air force 88 strike including one preseries, plus 12 dual), Saudi Arabia (96 air force 28 attack, six recce, 14 dual, 48 more to follow) and UK (229 air force 164 strike, 14 recce, and 51 dual including one preseries) United Arab Emirates offered lease of RAF Tornados, 1994, as lead-in to purchase of Eurofighter 2000

COSTS $7,500 million programme for 48 aircraft, RSAF, 993 RAF MLU, £750 million DM300 million reconnaissance conversion (40 aircraft and 55 pods) Germany, 1994 estimate

DESIGN FEATURES Continuously variable-geometry shoulder wings, with leading-edge sweep angles from 25° (minimum) to 67° (maximum) on movable portions (limited to 63° when 2,250 litre drop tanks carried), 60° on fixed inboard portions, modest overall dimensions, high wing loading to minimise low altitude gust response, swivelling wing pylons to retain stores alignment with fuselage

FLYING CONTROLS Full-span double-slotted fixed-vane flaperons (four segments per side), all-moving tailplane (taileron) and inset rudder, all actuated by electrically controlled tandem hydraulic jacks, full-span wing leading-edge slats (three segments each side); two upper surface spoilers/lift dumpers forward of each central pair of flaperons tailerons operate together for pitch control and differentially for roll control; spoilers provide augmented roll control at unswept and intermediate wing positions at low speed Krueger flap on leading-edge of each wing glove box; door type airbrake each side on top of rear fuselage, wing sweep hydraulically powered via ballscrew actuators (aircraft can land safely with wings fully swept if sweep mechanism fails), triple-redundant CSAS (command stability augmentation system), APFD (autopilot/flight director) and TFE (terrain-following E-scope), as detailed under Avionics.

STRUCTURE Basically all-metal (mostly aluminium alloy with integrally stiffened skins, titanium alloy for wing carry-through box and pivot attachments), FRP for nosecone, dielectric panels and interface between fixed and movable portions of wings, Teflon plated wing pivot bearings, elastic seal between outer wings and fuselage sides, nosecone hinges sideways to starboard for access to radar antennae, slice of fuselage immediately aft of nosecone also hinges to starboard for access to forward avionics bay and rear of radars; passive ECM antenna fairing near top of fin; ram air intake for heat exchanger at base of fin. Alenia builds entire outer wings (including moving surfaces), with Microtecnica as prime contractor for sweep system; BAe (Warton) builds front and rear fuselage portions (including engine installation), nosecone and entire tail unit, DASA is prime contractor for centre-fuselage (including engine intake ducts, wing centre-section box, pivot mechanism, and interface with outer wings).

The following details apply to the basic IDS production version, subsystem details are listed by team leader only, for the sake of clarity

LANDING GEAR. Hydraulically retractable tricycle type, with forward-retracting twin-wheel steerable nose unit Single-wheel main units retract forward and upward into centre section of fuselage. Emergency extension system, using nitrogen gas pressure. Development and manufacture of complete landing gear and associated hydraulics headed by Dowty (UK). Dunlop aluminium alloy wheels, hydraulic multidisc brakes and low-pressure tyres (to permit operation from soft, semi-prepared surfaces) and Goodyear anti-skid units. Mainwheel tyres size 30 × 11 50-14 5, Type VIII (24 or 26 ply); nosewheel tyres size 18 × 5.5, Type VIII (12 ply). Runway arrester hook beneath rear of fuselage

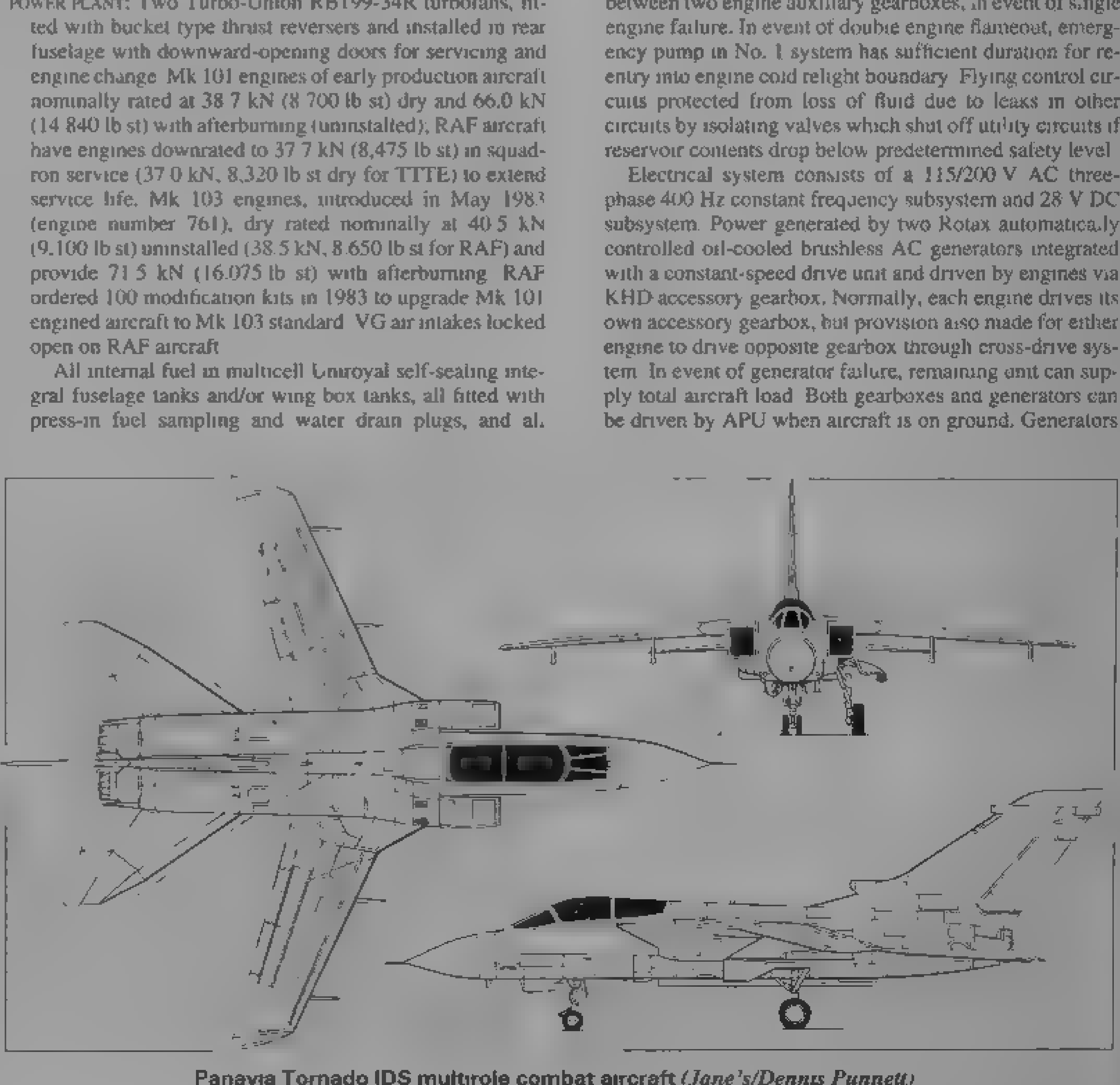
POWER PLANT: Two Turbo-Union RB199-34R turbofans, fitted with bucket type thrust reversers and installed in rear fuselage with downward-opening doors for servicing and engine change Mk 101 engines of early production aircraft nominally rated at 38 7 kN (8 700 lb st) dry and 66.0 kN (14 840 lb st) with afterburning (uninstalled); RAF aircraft have engines downrated to 37 7 kN (8,475 lb st) in squadron service (37 0 kN, 8,320 lb st dry for TTTE) to extend service life. Mk 103 engines, introduced in May 1983 (engine number 761), dry rated nominally at 40 5 kN (9,100 lb st) uninstalled (38 5 kN, 8 650 lb st for RAF) and provide 71 5 kN (16,075 lb st) with afterburning RAF ordered 100 modification kits in 1983 to upgrade Mk 101 engined aircraft to Mk 103 standard VG air intakes locked open on RAF aircraft

All internal fuel in multicell Uniroyal self-sealing integral fuselage tanks and/or wing box tanks, all fitted with press-in fuel sampling and water drain plugs, and all refuelled from a single-point NATO connector. Wing tanks total 955 litres (252 US gallons, 210 Imp gallons). fuselage tanks total 4,887 litres (1,290 US gallons; 1,075 Imp gallons). Additional 551 litre (145.5 US gallon, 121 Imp gallon) tank in fin (on RAF aircraft only). Total internal fuel 5,842 litres (1,542 US gallons; 1,285 Imp gallons) in German and Italian aircraft, 6,393 litres (1,688 US gallons, 1,406 Imp gallons) in RAF and Saudi aircraft. Detachable and retractable in-flight refuelling probe can be mounted on starboard side of fuselage, adjacent cockpit Provision for one or two drop tanks to be carried on underfuselage shoulder pylons (each 1,500 litres; 396 US gallons, 330 Imp gallons) and single tanks on inboard underwing pylons (1,500 or 2,250 litres; 396 or 594 US gallons; 330 or 495 Imp gallons). Some German Navy, Italian Air Force and (from 1991) RAF aircraft adapted to carry a Sargent-Fletcher Type 28-300 1,135 litre (300 US gallon, 250 Imp gallon) buddy type hose/drogue refuelling pod, but RAF GR Mk 1Bs to receive FRL Mk 20 pods. Dowty afterburning fuel control system

ACCOMMODATION. Crew of two on tandem Martin Baker Mk 10A zero/zero ejection seats under Kopperschmidt one-piece, rear-hinged, upward-opening canopy. Flat centre armoured windscreen panel and curved side panels, built by Lucas Aerospace, incorporate Sierracote electrically conductive heating film for windscreen anti-icing and demisting. Canopy (and windscreen in emergency) demisted by engine bleed air Windscreen, hinged at front, can be opened forward and upward, allowing access to back of pilot's instrument panel. Seats provide safe escape at zero altitude and at speeds from zero up to 630 knots (1,166 km/h, 725 mph) IAS

SYSTEMS Cockpit air conditioned and pressurised (maximum differential 0 36 bar; 5 25 lb/sq in) by Normalair-Garrett conventional air cycle system (with bootstrap cold air unit) using engine bleed air with ram air precooler, Marston intercooler and Teddington temperature control system Nordmicro air intake control system, and Dowty engine intake ramp control actuators Two independent hydraulic systems, each of 276 bars (4,000 lb/sq in pressure), are supplied from two separate, independently driven Vickers pumps, each mounted on an engine accessory gearbox. Each system supplied from separate bootstrap type reservoir Systems provide fully duplicated power for primary flight control system, tailerons, rudder, flaps, slats, wing sweep, pitch Q-feel system, and refuelling probe Port system also supplies power for Krueger flaps, inboard spoilers, port air intake ramps, canopy, and wheel brakes, starboard system for airbrakes, outboard spoilers, starboard air intake ramps, landing gear, nosewheel steering, and radar stabilisation and scanning Main system includes Dowty accumulators and Teves power pack. Fairey Hydraulics system for actuation of spoilers, rudder and taileron control. Provision for reversion to single-engine drive of both systems, via mechanical cross-connection between two engine auxiliary gearboxes, in event of single engine failure. In event of double engine flameout, emergency pump in No. 1 system has sufficient duration for re-entry into engine cold relight boundary Flying control circuits protected from loss of fluid due to leaks in other circuits by isolating valves which shut off utility circuits if reservoir contents drop below predetermined safety level

Electrical system consists of a 115/200 V AC three-phase 400 Hz constant frequency subsystem and 28 V DC subsystem Power generated by two Rotax automatically controlled oil-cooled brushless AC generators integrated with a constant-speed drive unit and driven by engines via KHD accessory gearbox. Normally, each engine drives its own accessory gearbox, but provision also made for either engine to drive opposite gearbox through cross-drive system In event of generator failure, remaining unit can supply total aircraft load Both gearboxes and generators can be driven by APU when aircraft is on ground. Generators



Panavia Tornado IDS multirole combat aircraft *(Jane's/Dennis Punnett)*

1993

Maritime attack Tornado GR. Mk 1B armed with two Sea Eagle missiles below the fuselage

1995

supply two main AC busbars and an AC essential busbar DC power provided from two fan-cooled transformer-rectifier units (power being derived from main AC system), these feeding power to two main DC busbars, one essential DC busbar and a battery busbar Either TRU can supply total aircraft DC load Fifth DC busbar provided for maintenance purposes only. Rechargeable Ni/Cd battery provides power for basic flightline servicing and starting APU; in event of main electrical system or double TRU failure, it is connected automatically to essential services busbar to supply essential electrical loads

Normalair-Garrett demand type oxygen system, using 10 litre (2 6 US gallon; 2 2 Imp gallon) lox converter Emergency oxygen system on each seat GEC-Marconi flow metering system Eichweber fuel gauging system and Flight Refuelling flexible couplings. Graviner fire detection and extinguishing systems. Rotax contactors. Smiths engine speed and temperature indicators Telefunken SystemTechnik intake de-icing system

AVIONICS *Comms* GEC-Plessey PTR 1721 (UK and Italy) or Rohde & Schwarz (Germany) UHF/VHF transceiver; Telefunken SystemTechnik UHF/ADF (UK and Germany only), SIT emergency UHF with Rohde & Schwarz switch, BAe HF/SSB aerial tuning unit; Rohde & Schwarz (UK and Germany) or Montedel (Italy) HF/SSB radio; Ultra communications control system; GEC-Marconi central suppression unit (CSU); Leigh voice recorder; Chelton UHF communications and landing system aerials and Siemens (Germany) or Cossor SSR-3100 (UK and Saudi Arabia) IFF transponder

Radar: European built Texas Instruments multimode forward looking, terrain following ground-mapping radar

Flight: GEC-Marconi FIN 1010 three-axis digital inertial navigation system (DINS) and combined radar/map display, Decca Type 72 Doppler radar system, with Kalman filtering of Doppler and inertial inputs for extreme navigational accuracy, Microtecnica air data computer Litef Spirit 3 central digital computer (64 k initially, but progressively upgraded to 256 k); Alenia radio/radar altimeter (being replaced on RAF aircraft by GEC Marconi AD1990 covert radar altimeter and on German aircraft by Thomson-CSF AHV 9 TLP during 1993-98) GEC-Marconi triplex command stability augmentation system (CSAS), incorporating fly-by-wire and autostabilisation, GEC-Marconi autopilot and flight director (APFD), using two self monitoring digital computers GEC-Marconi triplex transducer unit (TTU), with analog computing and sensor channels. Microtecnica air data set APFD provides preselected altitude, heading or barometric height hold, heading and track acquisition, and Mach number or airspeed hold with autothrottle Flight director operates in parallel with, and can be used as back-up for autopilot, as a duplex digital system with extensive range of modes Automatic approach, terrain-following and radio height-holding modes also available SEL (with Setac) or (in UK aircraft) GEC-Marconi AD2770 (without Setac) Tacan Cossor CILS 75/76 ILS. Bodenseewerk attitude director indicator; Dornier flight data recorder Dornier onboard life monitoring system (OLMOS) retrofitted to all German Air Force Tornados 1991-92

Instrumentation. Smiths electronic HUD with Davall camera; GEC-Marconi TV tabular display, Astronautics (USA) bearing, distance and heading indicator and contour map display GEC-Marconi terrain-following E scope Smiths HSI, VSI and standby altimeter; Litef standby AHRS German aircraft to receive display video recording system by BKT, including HUD camera and TEAC V-80 recorder, installation from 1996

Mission: RAF Tornados have GEC-Marconi nose mounted laser rangefinder and marked target seeker Nine RAF Tornados (Nos 31 and 617 Squadrons, but No. 14 Squadron from Autumn 1993) wired for GEC-Marconi TIALD (thermal imaging airborne laser designator) night/adverse visibility pod, second TIALD order placed January 1994 CLDP designator pod on Italian aircraft German and Italian Air Force Tornados can carry DASA/Alenia multisensor reconnaissance pod on centreline pylon RAF GR Mk 1A fitted with infra-red cameras in ammunition bay Italian Tornados retrofitted with SMS-9-0 stores management system in 1994

Self-defence. Elettronica ARI 23284 RWR (replaced in GR Mk 1 from 1987 by GEC-Marconi Defence Systems Hermes RHWR) Production batches 6 and 7 (556th IDS onwards) incorporate MIL STD-1553B databus, upgraded radar warning equipment and active ECM, improved missile control unit, and integration of HARM anti-radar missile GEC-Marconi Sky Shadow (jamming deception) and BOZ 101 (Germany), 102 (Italy) or 107 (UK) chaff/flare ECM pods Elta (Israel)/DASA Cerberus II, III or (from late 1994) IV jammer pods on German and Italian aircraft

ARMAMENT Fixed armament comprises two 27 mm IWKA Mauser cannon, one in each side of lower forward fuselage, with 180 rds/gun Other armament varies according to version, with emphasis on ability to carry wide range of advanced weapons GEC-Marconi stores management system; Sandall Mace 355 and 762 mm (14 and 30 in) ejector release units standard on UK Tornados; German and Italian aircraft use multiple weapon carriage system (MWCS) ejector release units. ML Aviation CBLS 200 practice bomb carriers also standard Battlefield interdiction version capable of carrying weapons for hard or soft targets Weapons carried on seven fuselage and wing hardpoints one centreline pylon fitted with single ejection release unit (ERU), two fuselage shoulder pylons each with three ERUs, and, under each wing, one inboard and one outboard pylon each with single ERU Among weapons carried (see also Current Versions) are B61 and UK WE177B nuclear bombs; Sidewinder air-to-air, and ALARM or AGM 88 HARM anti-radiation missiles, JP233 low altitude airfield attack munition dispenser Paveway II and III laser-guided bomb Maverick, Sea Eagle and Kormoran air-to-surface missiles, napalm, BL755 cluster bombs (277 kg, 611 lb Mk 1 or 264 kg; 582 lb Mk 2), MW 1 munitions dispenser; 1,000 lb bombs, smart or retarded bombs, BLU 1B 750 lb fire bombs, Mk 83 1,000 lb and Mk 82 500 lb bombs, Mk 20 Rockeye cluster bombs, Matra 250 kg ballistic and retarded bombs, Lepus flare bombs, LAU 51A and LR 25 rocket launchers. Apache standoff weapons dispenser from 1996

DIMENSIONS, EXTERNAL

Wing span fully spread	13 91 m (45 ft 7½ in)
fully swept	8 60 m (28 ft 2½ in)
Length overall	16 72 m (54 ft 10¼ in)
Height overall	5 95 m (19 ft 6¼ in)
Tailplane span	6.80 m (22 ft 3½ in)
Wheel track	3 10 m (10 ft 2 in)
Wheelbase	6 20 m (20 ft 4 in)

AREAS

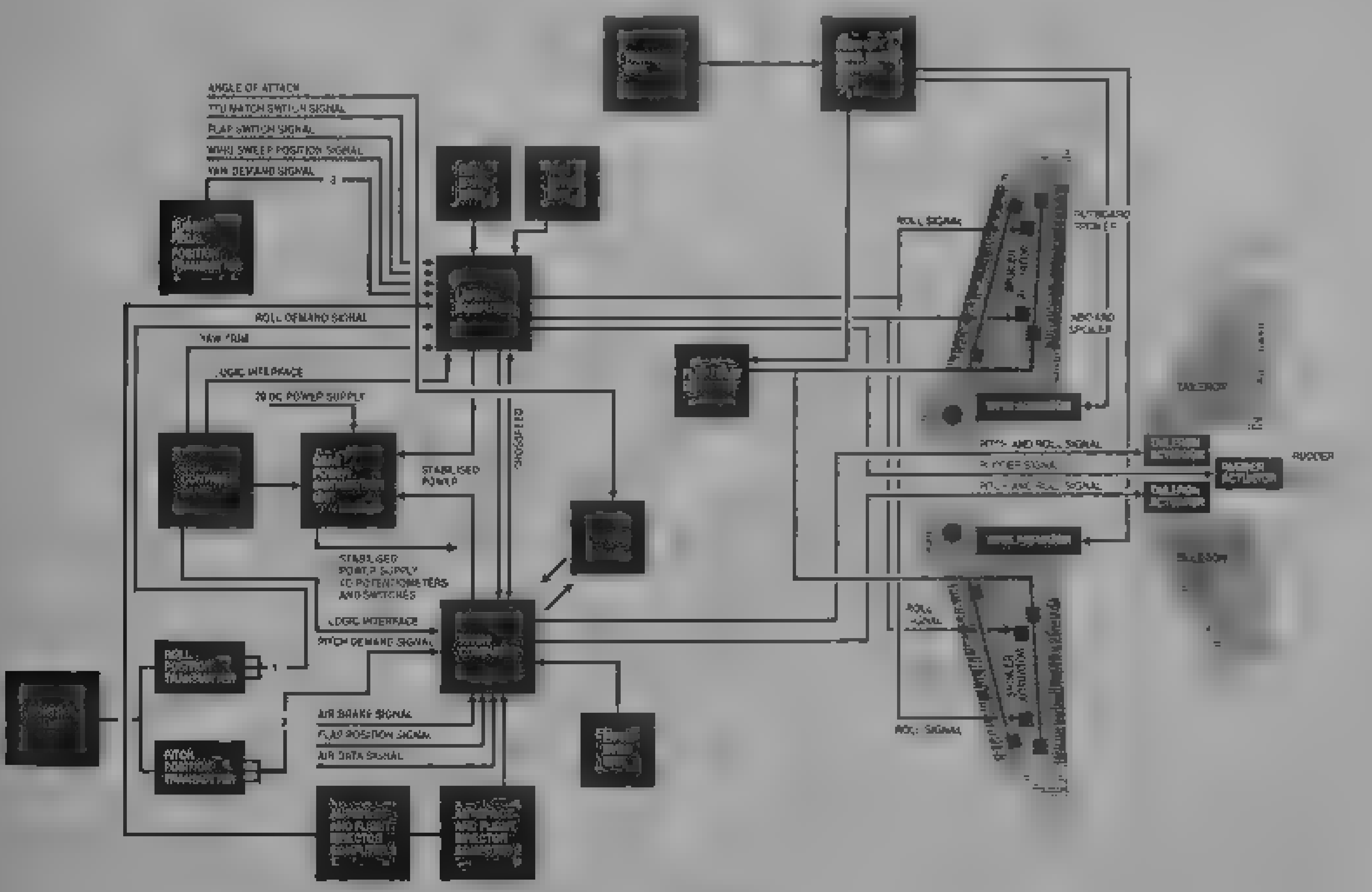
Wings, gross (to fuselage c/l, 25° sweepback)	26 60 m² (286.3 sq ft)

WEIGHTS AND LOADINGS

Basic weight empty	approx 13,890 kg (30,620 lb)
Weight empty, equipped	14,091 kg (31,065 lb)
Fuel (JP 4)	
internal wing/fuselage tanks	4,663 kg (10,280 lb)
fin tank RAF and Saudi only	440 kg (970 lb)
drop tanks (each) 1,500 l	1 200 kg (2 646 lb)
2 250 l	1,800 kg (3 968 lb)
Nominal max external stores load	more than 9,000 kg (19,840 lb)
Max T-O weight	
clean, full internal fuel	20,411 kg (45,000 lb)
with external stores	approx 27,950 kg (61,620 lb)

PERFORMANCE

Max Mach number in level flight at altitude, clean	2 2
Max level speed, clean	above 800 kts (1,480 km/h, 920 mph) IAS



Tornado IDS fly-by-wire flight control system

1995

German development Tornado IDS carrying two Matra Apache stand-off weapons beneath the fuselage *1995*

Max level speed with external stores
Mach 0.92 (600 kts, 1,112 km/h, 691 mph)
Landing speed approx 115 kts (213 km/h, 132 mph)
Time to 9,150 m (30,000 ft) from brake release
less than 2 min
Automatic terrain following down to 61 m (200 ft)
Required runway length less than 900 m (2,950 ft)
Landing run 370 m (1,215 ft)
Max 360° rapid roll clearance with full lateral control
4g
Radius of action with heavy weapons load, hi-lo-lo-hi
750 n miles (1,390 km, 863 miles)
Ferry range
approx 2,100 n miles (3,890 km, 2,417 miles)
g limit +7.5

UPDATED

PANAVIA TORNADO ECR

TYPE: Electronic combat and reconnaissance version of Tornado IDS.

PROGRAMME: Selected by German Luftwaffe; 35 included in batch 7 production contract signed 10 June 1986; two development aircraft (s/n 9803 and 9879) converted from IDS (first flight 18 August 1988), first production aircraft (s/n 4623) made first flight 26 October 1989; deliveries (to 2/JBG 38 in Italy, later to 2/JBG 32) began 21 May 1990, ended with s/n 4657, 28 January 1992, but not operational until April 1993 when emitter location system became available. First Tornado ECR with ELS redelivered to Luftwaffe on 8 February 1993. All aircraft concentrated in JBG 32 from mid-1994. Italian prototype (conversion of IDS MM7079) rolled out 19 March 1992, first flight 20 July 1992, to re-equip current IDS squadron, 155° Gruppo of 50° Stormo at Piacenza from 1996. In interim No. 155 Squadron achieved IOC on 1 April 1994 using unconverted Tornados armed with AGM-88B HARM missiles.

CURRENT VERSIONS: **ECR**: Standoff reconnaissance and border control, reconnaissance via image-forming and electronic means, electronic support, and employment of anti-radar guided missiles. Italian equivalent designated **IT ECR** but has no IR imaging capability.

CUSTOMERS: Germany (Air Force 35 new-build); Italy converting 16 IDS to IT ECR.

POWER PLANT (German ECR only): Mk 105 version of RB199 engine, providing approximately 10 per cent more thrust than Mk 103.

AVIONICS: Include Texas Instruments ELS (emitter location system) initially fitted in five German trials aircraft in 1992. Honeywell/STN Atlas infra-red linescan, Zeiss PAMIR-N (Passive Modular Infra-Red) system, onboard processing/storing/transmission systems for reconnaissance data, advanced tactical displays for pilot and weapons officer. ECR has Thomson-CSF AHV 9 TLP radar altimeter which adopted for retrofit to German IDS. IT ECR has Zeiss FLIR, video recording of data (dry silver film in German variant), different radar warning system by Elettronica, and SMS 90 stores management system.

ARMAMENT: Both internal cannon deleted, external load stations can be used for ECR or fighter-bomber missions, or a combination of both, normally configured to carry two HARM missiles, two AIM-9L Sidewinders, active ECM pod, chaff/flare dispenser pod and two 1,500 litre (396 US gallon, 330 Imp gallon) underwing fuel tanks.

UPDATED

PANAVIA TORNADO ADV

RAF designations: Tornado F Mks 2, 2A and 3

TYPE: All-weather air defence interceptor, air superiority fighter and combat patrol aircraft.

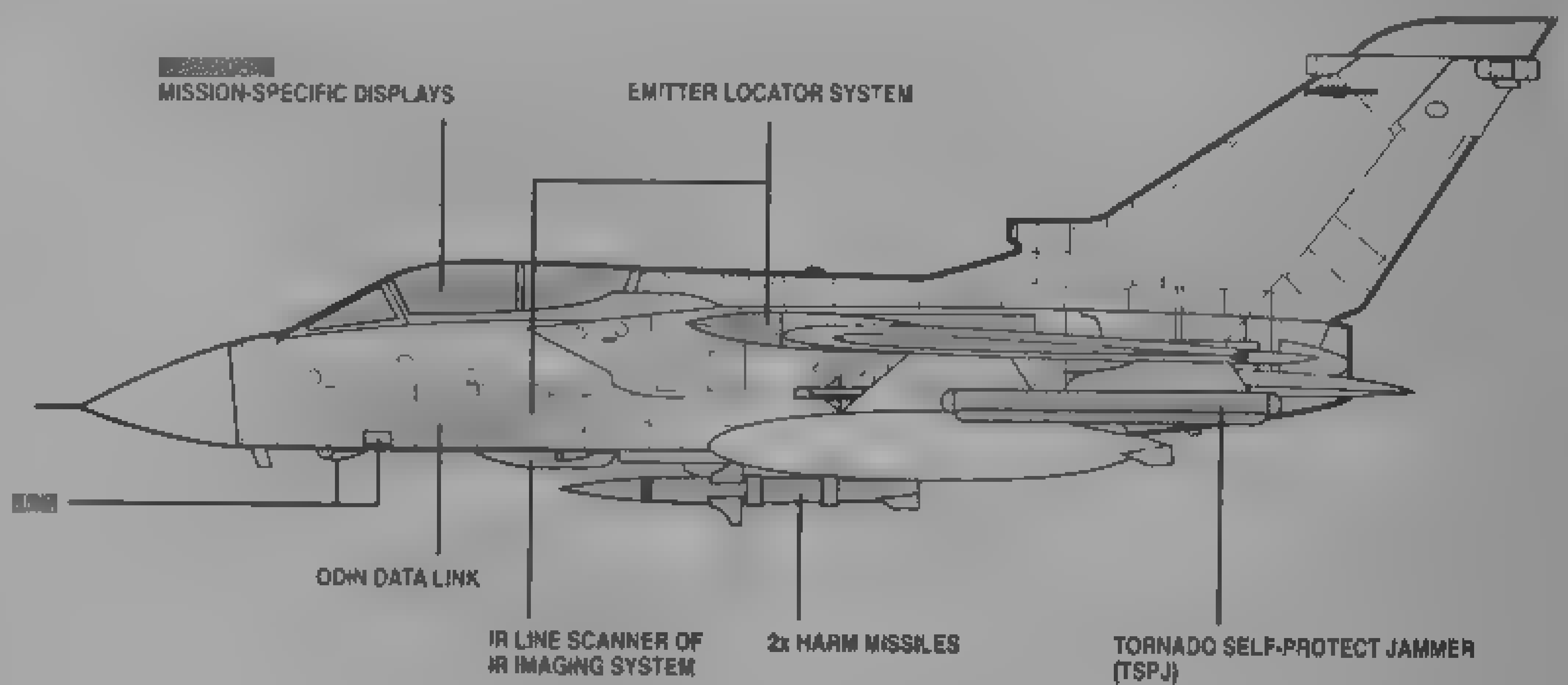
PROGRAMME: Feasibility studies for ADV (air defence variant) for UK, begun in 1968, given impetus by MoD Air Staff Requirement 395 of 1971 for interceptor with advanced radar and Sky Flash air-to-air missiles, full-scale development authorised 4 March 1976, three prototypes (first flight 27 October 1979) included in production batch 1, first flight by F Mk 2 production aircraft 5 March 1984, last F Mk 2 delivered 9 October 1985, first flight by F Mk 3 made 20 November 1985; first export order (by Saudi Arabia) placed 26 September 1985. Production temporarily ended with delivery of ZH559 on 24 March 1993, restarted to manufacture follow-on batch of Saudi IDS aircraft.

CURRENT VERSIONS: **Royal Air Force F. Mk 2.** Designation of first 18 (batch 4) production ADVs, with RB199 Mk 103 engines (further details in 1989-90 and earlier *Jane's*), most in store or ground training use but ZD902 (dual control) first flown 18 August 1992 as **TIARA**: Tornado Integrated Avionics Research Aircraft, operated by Defence Scientific & Technical Agency, fitted with 220 modifications, including GEC-Marconi IRST system, wide-angle diffractive HUD, GEC-Marconi Defence Systems RHWR and JTIDS Class 2. Front cockpit configured as single-seat fighter, with three colour MFDs, helmet-mounted sight and, later, voice activated functions. Gained GEC FLIR in 1995, to receive Blue Vixen radar (as Sea Harrier F/A Mk 2) 1996.

Tornado F Mk 2 ZD901 from storage to BAe at Warton by road, 24 November 1994, as first of 16 to donate fuselage centre-sections to F Mk 3s damaged during overhaul.

Royal Air Force F. Mk 2A. Designation reserved for F Mk 2s after proposed upgrade largely to F. Mk 3 standard except for retention of Mk 103 engines. Programme abandoned.

Royal Air Force F. Mk 3. Definitive production version (batches 5-7), delivered from 28 July 1986 (to No. 229 OCU/65 Squadron at Coningsby, which became No. 56 (Reserve) Squadron on 1 July 1992); now equips six UK air defence squadrons (Nos. 5 and 29 at Coningsby, Nos 11 and 25 at Leeming and Nos. 43 and 111 at Leuchars), No. 23 Squadron disbanded, 28 February 1994 at Leeming. In Falkland Islands, four aircraft issued to No. 1435 Flight from July 1992. Primary missions are air defence of UK, protection of NATO's northern and western approaches and long-range air defence of UK maritime forces, main differences from F Mk 2 are uprated (Mk 104) engines,



Tornado ECR vital systems *1995*

TORNADO PRODUCTION

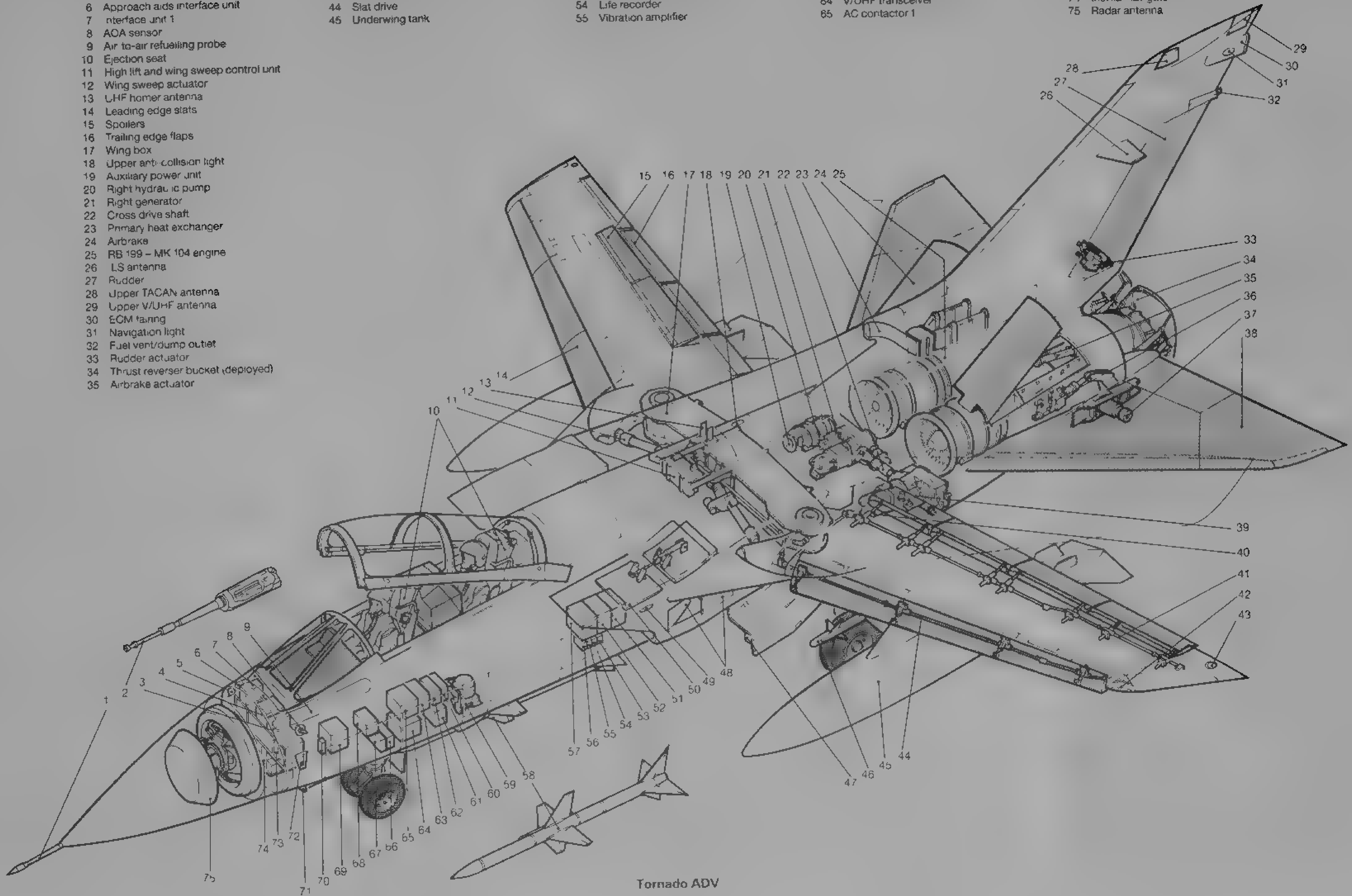
		IDS RAF		IDS GAF		IDS GN		IDS IAF		IDS RSAF		ADV RAF		ADV RSAF		Total	Cum
Batch	Block	S	T	S	T	S	T	S	T	S	T	S	T	S	T		total
1	1	8	8	3	11							2	1			33	33
1	2	3	4	—	3											10	43
2	3	8	7	7	3	1	—	2	2							30	73
2	4	18	4	8	5			3	2							40	113
2	5	13	5			11	5	5	1							40	153
3	6	25	7			32	—	9	4							77	230
3	7	35	1	24	12			14	1							87	317
4	8	23	6	27	4			13	—				6			79	396
4	9	22	2	29	4			14	—			10	2			83	479
5	10	2	—	29	—	—	5	11	2	11	3	12	6			81	560
5	11			2	—	32	—	16	—	3	3	22	12			90	650
5	12					2	—									2	652
6	12			21	5	9	2					39	7			83	735
6	13			5	8	13	—					12	10	18	6	72	807
7	14	14[1]		18[2]						10	4	7	—			53	860
7	15	7	6	17[2]	—					10[3]	4	17	—			61	921
7	16											—	8			8	929
8	17									48[5]						48	977
		178	50	190	55	100	12	87	12	82	14	121	52	18	6		
		228		245		112		99		96		173		24			
Sub-total						780 IDS						197 ADV					
Prototype		3	1	3	—			2	—							9	986
Preseries		1	1[4]	2[4]	1			1[4]	—							6	992
Sub-total		234		251		112		102		96		173		24			
Totals						795 IDS						197 ADV					992

Notes: [1]New-build GR Mk 1A
[2]Tornado ECR
[3]Including six reconnaissance (equivalent of GR. Mk 1A)
[4]Refurbished to production standard
[5]May include some dual control

RAF Royal Air Force
GAF German Air Force
GN German Navy
IAF Italian Air Force
RSAF Royal Saudi Air Force
S single control
T dual control

TORNADO ADV

1 Pitot static probe
2 Mauser 27 mm Gun
3 Radar altimeter
4 TACAN
5 Upper IFF antenna
6 Approach aids interface unit
7 Interface unit 1
8 AOA sensor
9 Air-to-air refuelling probe
10 Ejection seat
11 High lift and wing sweep control unit
12 Wing sweep actuator
13 UHF homer antenna
14 Leading edge slats
15 Spoilers
16 Trailing edge flaps
17 Wing box
18 Upper anti-collision light
19 Auxiliary power unit
20 Right hydraulic pump
21 Right generator
22 Cross drive shaft
23 Primary heat exchanger
24 Airbrake
25 RB 199 – MK 104 engine
26 ILS antenna
27 Rudder
28 Upper TACAN antenna
29 Upper V/UHF antenna
30 ECM fairing
31 Navigation light
32 Fuel vent/dump outlet
33 Rudder actuator
34 Thrust reverser bucket (deployed)
35 Airbrake actuator
36 Taileron actuator
37 Taileron spigot
38 Taileron
39 Left hydraulic pump
40 Left generator
41 Flap drive
42 Formation light
43 Obstruction light
44 Slat drive
45 Underwing tank
46 Sidewinder AIM-9 L
47 Landing lamp
48 Air intake auxiliary doors
49 Navigation light
50 Variable air intake ramps
51 Air intake ramps control unit
52 Main engine control unit 1
53 Pyrometer amplifier
54 Life recorder
55 Vibration amplifier
56 NL/NH Governor
57 Missile programming unit
58 Sky Flash MRAAM
59 Lox converter
60 AICS 1
61 IFF interrogator
62 TV tab waveform generator
63 Engine health monitor
64 V/UHF transceiver
65 AC contactor 1
66 Generator control unit 1
67 IFF auto code change
68 Transformer rectifier unit 1
69 Battery
70 Battery bus bar
71 Lower TACAN antenna
72 Lower UHF antenna
73 Battery charger
74 Inertial navigator
75 Radar antenna



Tornado ADV

Panavia Tornado F. Mk 3 interceptors *(Paul Jackson)* 1995

automatic wing sweep and manoeuvring systems, and improved avionics (see Flying Controls, Structure, Power Plant and Avionics paragraphs). Stage 1 update (new-build from Block 13, plus retrofits), from 1989, introduced HOTAS-type 'combat stick' for pilot, type 'AA' radar upgrade, improvements to Hermes RHWR, 5 per cent combat boost switch for power plants, and chaff/flare dispensers beneath rear fuselage. All except chaff/flare systems implemented by early 1992, although auto wing sweep disconnected. Stage 2G radar upgrade under trial in 1992 for installation in mid-1990s. Nos 5 and 29 Squadrons to be reissued with Block 15/16 aircraft after retrofit with JTIDS datalink (NATO Link 16). Aircraft of Tornado F3 Operational Evaluation Unit (formed, Coningsby, April 1987) conducted JTIDS service trials, including first major test, 27 October 1993, with data transfer between two RAF E-3D AWACS, French E-3F and two Tornados. Further tests at Mountain Home AFB, Idaho, August 1994, involving joint operations with USAF F-15C Eagles.

Royal Saudi Air Force ADV: Equips No. 29 Squadron at Dhahran; deliveries began 20 March 1989, ended 8 October 1990. Formation of No. 34 Squadron abandoned, all assigned to No. 29 from early 1993.

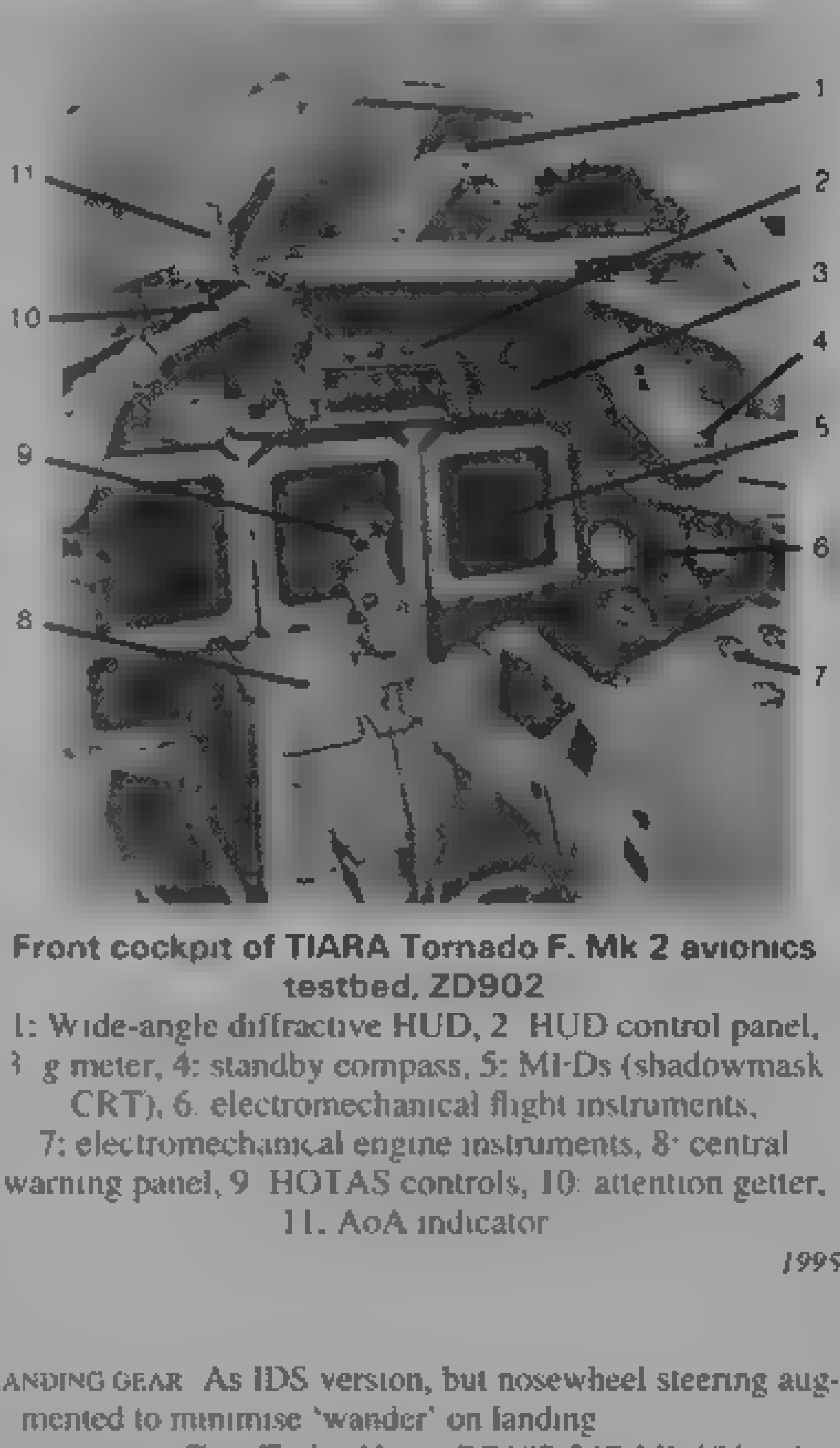
Italian Air Force F. Mk 3: Leased from RAF. Agreed by UK and Italian defence ministers, 17 November 1993, IAF to lease 24 ex-RAF aircraft for 10 years. Crew training by No. 56 (R) Squadron at RAF Coningsby; first 12 aircraft to 12° Gruppo of 36° Stormo at Gioia del Colle, beginning 7 July 1995, second 12 to 18° Gruppo of 37° Stormo at Trapani/Birgi from January 1997. Minor modifications required for compatibility with Aspide AAM.

CUSTOMERS: Total 197 ordered for UK (RAF 173 including 52 dual control) and Saudi Arabia (Air Force 24 including six dual). RAF total includes eight dual control aircraft transferred from cancelled Omani order. Deliveries completed. One static test airframe.

DESIGN FEATURES: Structural changes reduce drag, especially at supersonic speed, compared with IDS version, and longer fuselage provides more space for avionics and additional 10 per cent internal fuel.

FLYING CONTROLS: Similar to IDS, but with AWS (automatic wing sweep), AMDS (automatic manoeuvre device system) and SPILS (spin prevention and incidence limiting system); AWS allows scheduling of four different sweep angles (25° at speeds up to Mach 0.73, 45° from there up to Mach 0.88, 58° up to Mach 0.95 and 67° above Mach 0.95), enabling specific excess power at transonic speeds and turning capability at subsonic speeds to be maximised; buffet free handling can be maintained, to limits defined by SPILS, by using AMDS, which schedules with wing incidence to deploy either flaperons and slats at 25° sweep angle or slats-only at 45° (beyond 45°, both flaperons and slats are scheduled in). AWS provisions embodied in late production aircraft but not activated (is reactive system; air combat requires wing sweep selection in advance of manoeuvre). Fly-by wire CSAS/APFD system modified for increased roll rate and reduced pitch stick forces.

STRUCTURE: Generally as IDS version except: fuselage lengthened forward of front cockpit to accommodate longer radome, and aft of rear cockpit to allow Sky Flash missiles to be carried in two tandem pairs; CG shift compensated by extending fixed inboard portions of wings to increase chord and give 67° leading-edge sweep angle. Krueger flaps deleted; afterburner nozzles extended by 360 mm (14 in) on F. Mk 3, requiring modification to adjacent contours of rudder and tailerons; port internal gun deleted; wing/tailplane/fin leading-edges of some F. Mk 3s coated with radar absorbent material (RAM) for early 1991 Gulf operations; inner faces of engine air intake ducts similarly treated. Fatigue diminution measures for future embodiment include 80 kg (176 lb) wingtip weights and wing fuel auto hold fuel management system which empties fuselage tanks first, latter installed in ZH552 of No. 56 Squadron in 1993.



Front cockpit of TIARA Tornado F. Mk 2 avionics testbed, ZD902

1: Wide-angle diffractive HUD, 2: HUD control panel, 3: g meter, 4: standby compass, 5: MFDs (shadowmask CRT), 6: electromechanical flight instruments, 7: electromechanical engine instruments, 8: central warning panel, 9: HOTAS controls, 10: attention getter, 11: AoA indicator 1995

LANDING GEAR: As IDS version, but nosewheel steering augmented to minimise 'wander' on landing.

POWER PLANT: Two Turbo Union RB199-34R Mk 104 turbofans, each with uninstalled rating of 40.5 kN (9,100 lb st) dry and 73.5 kN (16,520 lb st) with afterburning. Lucas DECU 500 digital engine control. Fuel in wing, fuselage and fin tanks as RAF Tornado GR. Mk 1, plus 750 litres (198 US gallons, 165 Imp gallons) in 'Tank 0' immediately behind rear cockpit. Total internal fuel capacity 7,143 litres (1,886 US gallons, 1,571 Imp gallons). Internally mounted, fully retractable in-flight refuelling probe in port side of nose, adjacent cockpit. Provision for drop tanks of 1,500 or 2,250 litres (396 or 594 US gallons, 330 or 495 Imp gallons) capacity to be carried on underwing pylons. For ferrying, two of smaller tanks may replace underfuselage missiles.

ACCOMMODATION: As for IDS version.

SYSTEMS: Generally as described for IDS version, with addition of radar-dedicated cold air unit to cool Foxhunter radar, and pop-up ram air turbine to assist recovery in event of engine flameout at high altitude in zoom climb.

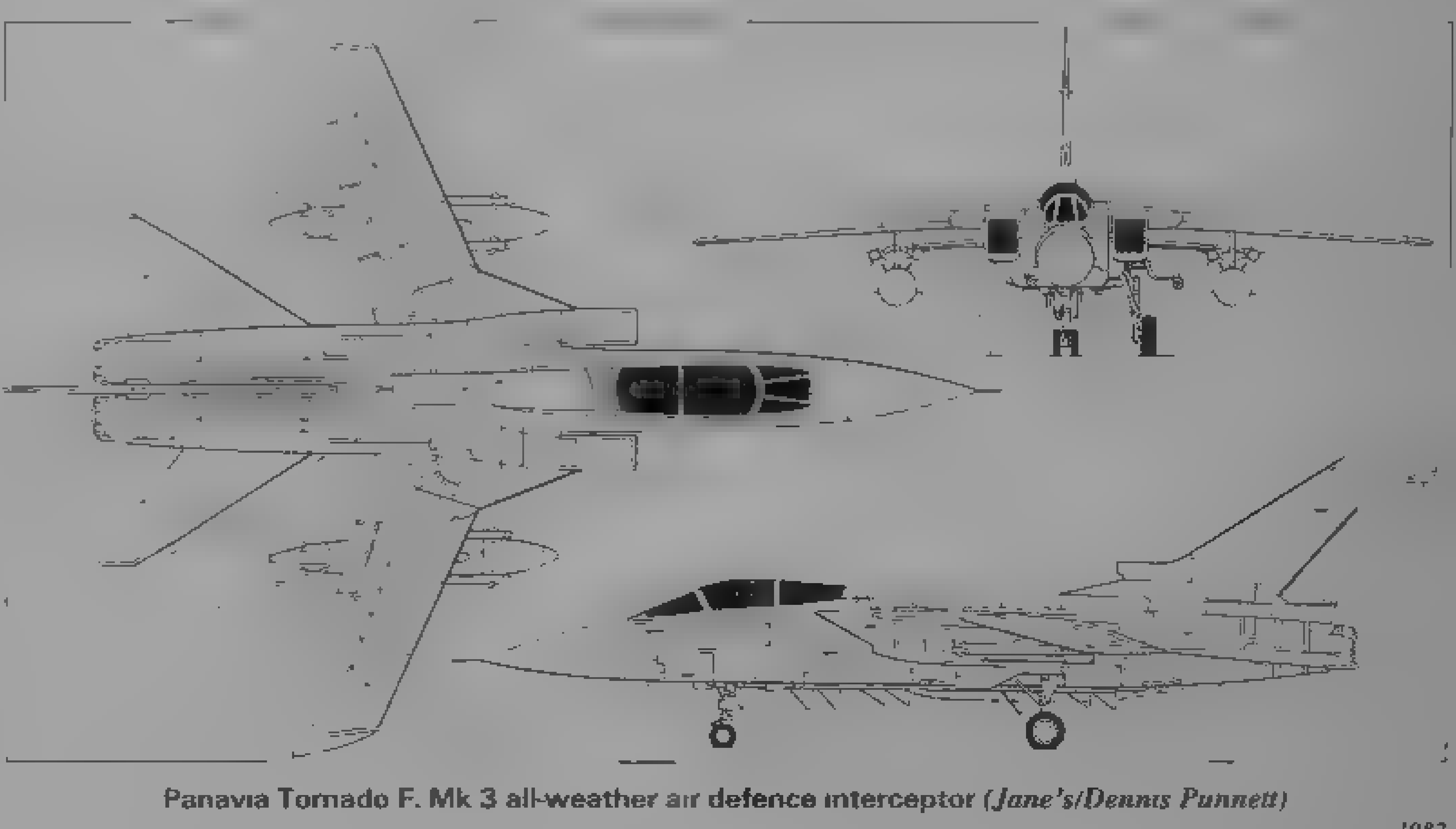
AVIONICS: Compare Tornado IDS. Among those retained in ADV are communications equipment (GEC-Plessey VHF/UHF transceiver, SIT emergency UHF, Rohde & Schwarz HF SSB, Ultra communications control system and Epsylon cockpit voice recorder); GEC-Marconi triplex fly-by-wire CSAS and APFD, Litef Spirit 3 central digital computer (capacity 224 kbytes) and data transmission system, Smiths electronic head up and navigator's radar display, GEC-Marconi FIN 1010 INS (to which is added a second 1010 to monitor HUD), GEC-Marconi Tacan, Cossor ILS, and Cossor IFF transponder. Those deleted include Texas Instruments nose radar, Decca 72 Doppler radar with terrain-following, GEC-Marconi laser rangefinder and marked target seeker, and Litef standby AHRS.

Radar: Nose-mounted GEC-Marconi Defence Systems AI Mk 24 Foxhunter multimode track-while-scan pulse Doppler radar with FMICW (frequency modulated interrupted continuous wave), with integrated Cossor IFF-3500 interrogator and radar signal processor to suppress ground clutter. System is intended to detect targets more than 100 n miles (185 km, 115 miles) away, and to track several targets simultaneously; ground mapping mode for navigation back-up is available. GEC-Marconi is subcontractor for Foxhunter transmitter and aerial scanning mechanism. 'AA' standard Foxhunter, meeting original RAF specification, installed from early 1989 (Block 13 and onwards, beginning ZE862 and first RSAF aircraft); earlier radars modified from Type 'W' and Type 'Z'. New data processor, being introduced during mid-1990s, offers final Foxhunter standard considerably more capable than earlier versions of this radar, in particular more automation to improve close combat capability. Modification kits will bring radars already in service up to new 'AB' standard.

Instrumentation: Compared with IDS, pilot's HDD is added. GEC-Marconi displayed data video recorder (DDVR) replaces navigator's wet-film display recorder. HUD/HDD are on front instrument panel only, radar control and datalink presentations on rear panel only; both panels have weapon control and RHWR displays. GEC-Marconi FH 31A AC driven, 7.6 cm (3 in) artificial horizon in rear cockpit, in addition to providing attitude display for navigator, feeds pitch and roll signals to other avionics systems in aircraft in certain modes.

Mission: GEC-Marconi Defence Systems Hermes modular RHWR. Installation of JTIDS datalink due from 1994, initially in RAF Block 15/16 aircraft. ZE155 was original BAe trials Tornado for JTIDS. ADV can contribute significantly to transfer of vital information over entire tactical area and can, if necessary, partially fulfil roles of both AEW and ground-based radar. Smiths Industries/Computing Devices Company missile management system (MMS), which also controls tank jettison, has provision for pilot override, optimised for visual attack. Studies being undertaken for 1553B multiplex digital databus associated with AMRAAM and Sidewinder replacement.

Self-defence: Two Tracor AN/ALE-40(V) chaff/flare dispensers beneath rear fuselage of RSAF aircraft, initially on some RAF Mk 3s, but replaced early 1991 by Vinten VICON 78 Srs 210 flare dispensers. VICON 78 Srs 400 to be standard on all RAF Mk 3s. Bofors Phimat chaff dispenser on starboard or both outer Sidewinder pylons (RAF, optional); future installation of Bofors BOL 304 dispenser in rear of Sidewinder launch rails.



Panavia Tornado F. Mk 3 all-weather air defence interceptor *(Jane's/Dennis Punnett)* 1983

ARMAMENT: Fixed armament of one 27 mm IWKA-Mauser cannon in starboard side of lower forward fuselage. Four Sky Flash semi-active radar homing medium-range air-to-air missiles semi-recessed under centre fuselage, carried on internally mounted Frazer-Nash launchers, two European built AIM-9L Sidewinder infra-red homing short-range air-to-air missiles on each inboard underwing station (outboard stations not used on RAF ADVs). Sky Flash missiles, each fitted with MSDS monopulse seeker head, can engage targets at high altitude or down to 75 m (250 ft), in face of heavy ECM, and at standoff ranges of more than 25 n miles (46 km, 29 miles). Release system permits missile to be fired over Tornado's full flight envelope.

DIMENSIONS, EXTERNAL: As for IDS version, except:

Length overall	18.68 m (61 ft 3½ in)

WEIGHTS AND LOADINGS (approx):

Operational weight empty	14,500 kg (31,970 lb)
Fuel (JP-4):	
internal: wing/fuselage tanks	5,263 kg (11,603 lb)
fin tank	as for IDS version
drop tanks	as for IDS version
Max external combat fuel	3,600 kg (7,936 lb)
Nominal max external stores load	8,500 kg (18,740 lb)
Max T-O weight	27,986 kg (61,700 lb)

PERFORMANCE:

Max Mach number in level flight at altitude, clean	2.2
Max level speed, clean	800 kts (1,480 km/h; 920 mph) IAS
Rotation speed, depending on AUW	145-160 kts (269-297 km/h; 167-184 mph)
Normal touchdown speed	115 kts (213 km/h; 132 mph)
Demonstrated roll rate at 750 kts (1,390 km/h; 864 mph) and up to 4 g	180°/s
Operational ceiling	approx 21,335 m (70,000 ft)
T-O run:	
with normal weapon and fuel load	760 m (2,500 ft)
ferry configuration (four 1,500 l drop tanks and full weapon load)	approx 1 525 m (5,000 ft)
T-O to 15 m (50 ft)	under 915 m (3,000 ft)
Landing from 15 m (50 ft)	approx 610 m (2,000 ft)
Landing run with thrust reversal	370 m (1,215 ft)
Intercept radius: supersonic	more than 300 n miles (556 km, 345 miles)
subsonic	more than 1,000 n miles (1,852 km, 1,151 miles)

Endurance:

2 h combat air patrol at 300-400 n miles (555-740 km, 345-460 miles) from base, incl time for interception and 10 min combat

UPDATED

PROMAVIA/MiG

Association dissolved in 1994, ATTA 3000 jet trainer now described under Promavia in the Belgian section

UPDATED

ROCKWELL/DASA

PARTICIPATING COMPANIES:

Rockwell: see under USA

Daimler-Benz Aerospace: see under Germany

Known also by programme title EFM (Enhanced Fighter Maneuverability), X-31A is first US 'X' series experimental aircraft developed jointly with another country, and was one of first NATO co-operative efforts part-funded under Nunn-Quayle R&D initiative. ARPA (US Advanced Research Projects Agency), acting through US Naval Air Systems Command, is working with German Ministry of Defence to manage development programme. NASA and US Air Force joined programme in January 1992 and flight testing moved to Dryden research centre at Edwards AFB.

UPDATED

ROCKWELL/DASA X-31A EFM

TYPE: Single-seat combat manoeuvrability research aircraft.

PROGRAMME: Evolved from work begun at MBB (now Daimler-Benz Aerospace Military Aircraft Division) in 1977; joined by Rockwell 1983, feasibility study began November 1984, followed by US/German MoU May 1986 and start of one-year Phase 2 (vehicle preliminary design) September 1986, two prototypes funded August 1988 and assembled by Rockwell under 22 month Phase 3, first prototype (BuAer No. 164584) rolled out 1 March 1990, making first flight 11 October 1990, first flight of second prototype (164585) 19 January 1991, first aircraft made first flight with thrust vectoring paddles installed 14 February 1991, post-stall testing started November 1991 and 52° angle of attack reached by end 1991, after total 108 flights, International Test Organisation formed when testing moved to Dryden in January 1992.

Phase 4 high angle of attack (AoA) tests started June 1992, final target 70° AoA with 45° bank reached 18 September; first ever 360° rolls at 70° AoA performed 6 November, post-stall programme completed March 1993 and followed by tactical utility trials with military pilots at NASA Dryden; then dissimilar combat against operational aircraft (F-14, F/A-18). On 17 March 1994, X-31 climbed to 11,582 m (38,000 ft) and showed stability and manoeuvrability at Mach 1.2 with fin and rudder used to destabilise the aircraft and using only engine thrust vectoring for stability and directional control. First 180° heading reversal ('Herbst Manoeuvre') at 70° AoA achieved 29 April 1993. In 1993 dogfights against an evenly matched F/A-18, the X-31 showed high lethality in attack and good survival in defensive situations. Some flights were flown with the pilot wearing a GEC Marconi Avionics Viper visual and audio display helmet to evaluate spatial situational awareness and advanced missile capabilities.

Further flight tests late in 1994 investigated lateral/directional stability and control by use of thrust vectoring throughout flight regime (including take-off, landing and ground attack). Funding provided by JAST programme (see USAF entry in US section). Tests funded to early 1995, with reporting period up to mid-1995. Fighting of a 'virtual' enemy generated by onboard computers demonstrated in January 1995, but on 19 January, 164584 was successfully abandoned after in-flight loss of control apparently caused by pitot icing.

COSTS: Costs shared USA 75 per cent, Germany 25 per cent.

DESIGN FEATURES: Low-mounted cranked delta wings with Rockwell transonic aerofoil section (thickness/chord ratio 5.5 per cent), incorporating camber and twist, no dihedral or anhedral; incidence 0°, sweepback at quarter-chord 48° 6' inboard, 36° 36' outboard, sweptback foreplanes, fin and rudder; no horizontal tail surfaces. Design integrates several technologies to expand manoeuvring flight envelope, including vectored thrust, integrated control systems and pilot assistance, enhanced manoeuvrability yields significant exchange ratio advantages in close-in fighter combat, and X-31A broke so-called stall barrier by demonstrating close-in aerial combat beyond normal stall angles of attack, design also expected to enable extremely rapid target acquisition and fuselage pointing for low-speed, close-in engagements, earlier programmes such as Rockwell HiMAT RPV and MBB's TKF-90 contributed much useful data to X-31A design and development. Rockwell primarily responsible for configuration, aerodynamics and construction, DASA for control systems and thrust-vectoring design, plus some major components and subassemblies (including wings).

FLYING CONTROLS: Inboard and outboard trailing-edge flaperons, two-segment leading-edge flaps, all-moving active foreplanes, and rudder, door type airbrake each side of rear fuselage, Bendix and AiResearch electrical signalling system for control surfaces, Honeywell flight control computers; Bendix (modified V-22) rudder and foreplane actuators. Pitch and roll stability and control by flaperons, pitch and yaw by thrust-vectoring, pitch (up to 70° angle of attack) by foreplanes and engine intake control lip, leading-edge flaps also scheduled for high AoA stability and control, and for conventional performance, three thrust vectoring paddles attached to rear of nozzles can deflect engine exhaust through about 10° for yaw control, and can also act as additional airbrakes for rapid deceleration.

STRUCTURE: Wings have aluminium spars and ribs, CFRP upper and lower skins, flaps, fin and rudder, ailerons and foreplanes, all with CFRP skins, fuselage mostly has conventional bulkheads and stringers of aluminium, forward panels are honeycomb with CFRP skin, mid-fuselage has aluminium skin, rear 0.76 m (2 ft 6 in) has titanium bulkheads and skin; nose radome is GFRP.

LANDING GEAR: Menasco landing gear adapted from F-16, hydraulically retractable tricycle type, main units retracting forward into fuselage, nose unit rearward. Main units have Goodrich (Cessna Citation III) wheels and brakes and Vought A-7D tyres (pressure 15.51 bars; 225 lb/sq in). Syndex tail braking parachute.

POWER PLANT: One 71.17 kN (16,000 lb st class with afterburning) General Electric F404-GE-400 turbofan. Single fuel tank in fuselage, with gravity feed filler just aft of canopy. Single ventral air intake, with movable lower lip.

ACCOMMODATION: Pilot only, on Martin Baker SJU-5/6 ejection seat in pressurised, heated and air conditioned cockpit. Windscreen and rear-hinged, upward-opening canopy from McDonnell Douglas F/A-18 Hornet. General Electric's Aerospace Business Group assisted in cockpit development.

SYSTEMS: Include a Sundstrand electrical power generator, AlliedSignal (modified F-16 hydrazine system) emergency power unit to provide 4½ minutes of electrical/hydraulic power, and AlliedSignal (hydrazine powered) emergency air start system from Northrop F-20.

DIMENSIONS, EXTERNAL:

Wing span	7.26 m (23 ft 10 in)
Wing aspect ratio	2.51
Foreplane span	2.64 m (8 ft 8 in)
Length overall: incl nose probe	14.85 m (48 ft 8½ in)
excl probe	13.21 m (43 ft 4 in)
fuselage, excl probe	12.39 m (40 ft 8 in)
Height overall	4.44 m (14 ft 7 in)
Wheel track	2.29 m (7 ft 6⅛ in)
Wheelbase	3.51 m (11 ft 6⅛ in)

AREAS:

Wings, gross	21.02 m² (226.3 sq ft)
Foreplanes (total)	2.19 m² (23.60 sq ft)
Ailerons (total)	1.29 m² (13.88 sq ft)
Trailing-edge flaps (total)	1.73 m² (18.66 sq ft)
Leading-edge flaps: inboard (total)	0.60 m² (6.42 sq ft)
outboard (total)	0.77 m² (8.28 sq ft)
Fin, incl dorsal fin	2.68 m² (28.87 sq ft)
Rudder	0.81 m² (8.68 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	5,175 kg (11,410 lb)
Fuel weight	1,876 kg (4,136 lb)
Normal flying weight	6,622 kg (14,600 lb)
Max T-O weight	7,228 kg (15,935 lb)
Max wing loading	343.8 kg/m² (70.4 lb/sq ft)

Rockwell/DASA X-31A EFM enhanced fighter manoeuvrability research aircraft, during trials for JAST programme

1995

PERFORMANCE (estimated, at max T-O weight)

Never-exceed (V_{NE}) and max level speed	
S/L to 8,535 m (28,000 ft)	1,485 kts (2,752 km/h; 1,710 mph)
8,535-12,200 m (28,000-40,000 ft)	Mach 1.3
Max rate of climb at S/L	13,106 m (43,000 ft)/min
Max operating altitude	12,200 m (40,000 ft)
T-O run	457 m (1,500 ft)
T-O to 15 m (50 ft)	823 m (2,700 ft)
Landing from 15 m (50 ft)	1,128 m (3,700 ft)
Landing run	823 m (2,700 ft)
Design g limits	+9/-4

UPDATED

ROCKWELL/DASA FR-06 RANGER 2000

TYPE: Military jet trainer, initially aimed at US JPATS programme (see US Air Force in US section).

PROGRAMME: International programme launched (as Fan-Ranger) May 1991; first flight (D-FANA) at Manching 15 January 1993, second prototype (D-FANB) flown 14 June 1993 but lost, 27 July 1993, in accident attributed partly to airbrake spoilers on upper surface of wing masking tail plane in certain conditions; test flying resumed 13 December 1993; third prototype (D-FANC/N104NA) flew 20 June 1994 and delivered to Rockwell in time for JPATS evaluation. Decision, June 1995, rejected Ranger in favour of Pilatus PC-9.

FLYING CONTROLS: Conventional manual with fixed high-mounted tailplane and central elevator trim tab; servo tabs in ailerons, spoiler-type airbrakes in upper surface of wing replaced by panel under fuselage.

STRUCTURE: Cabin section, wings, centre-fuselage and engine nacelle of CFRP/GFRP, produced by DASA Augsburg and Rhein Flugzeugbau (RFB) (which see under Germany); metal rear fuselage and tail by RFB. Structure developed from that of RFB Fantrainer with cabin section based on single structural keel beam.

LANDING GEAR: Retractable tricycle type.

POWER PLANT: One 14.19 kN (3,190 lb st) P&WC JT15D-5C turbofan. Maximum internal fuel 860 litres (227 US gallons; 189 Imp gallons).

ACCOMMODATION: Two pilots in tandem on UPCO Stencel zero/zero ejection seats, rear seat raised, birdproof windscreen, cockpit pressurised and air conditioned.

AVIONICS: *Instrumentation:* Collins four-tube EFIS flight instruments in each cockpit.

DIMENSIONS, EXTERNAL:

Wing span	10.46 m (34 ft 4 in)
Wing aspect ratio	7.40
Length overall	7.85 m (25 ft 9¼ in)
Height overall	3.91 m (12 ft 10 in)

AREAS:

Wings, gross	15.55 m² (167.4 sq ft)

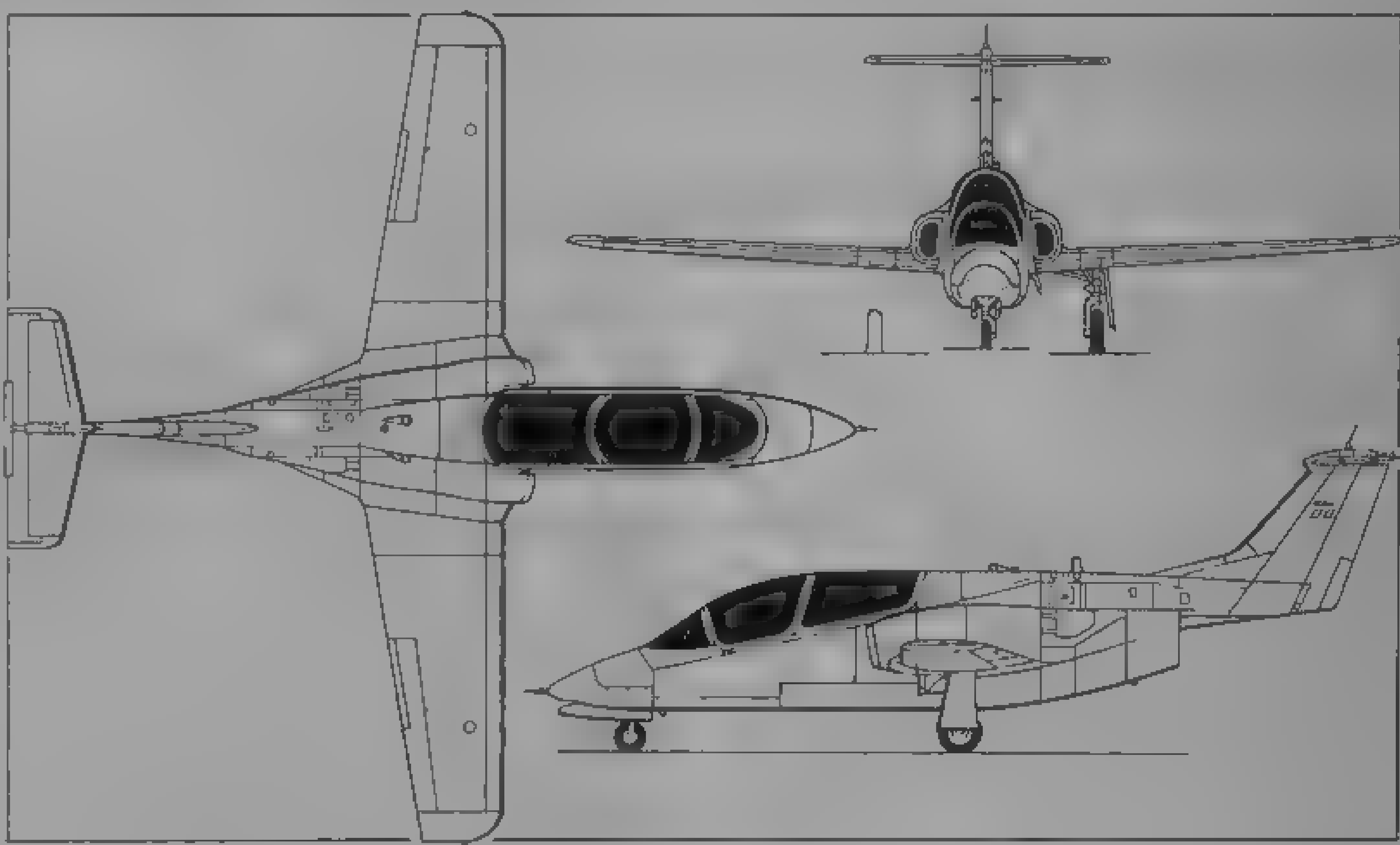
WEIGHTS AND LOADINGS: Not released

PERFORMANCE:

Max level speed, at S/L	329 kts (610 km/h; 379 mph)
at 9,150 m (30,000 ft)	392 kts (726 km/h; 451 mph)
Approach speed, landing configuration	107 kts (198 km/h; 123 mph)
Operational ceiling	10,670 m (35,000 ft)
Range with max internal fuel	971 n miles (1,800 km; 1,118 miles)

UPDATED

Rockwell/DASA Ranger 2000 third prototype during JPATS evaluation *1995*



Rockwell/DASA Ranger 2000 (one P&WC JT15D-5C turbofan) *(Jane's/Mike Keep)* *1993*

SATIC

SPECIAL AIRCRAFT TRANSPORT INTERNATIONAL COMPANY

PARTICIPATING COMPANIES:

Aerospatiale: see under France

Daimler-Benz Aerospace Airbus: see under DASA, Germany

PRESIDENT: Ugo Drager

UPDATED

SATIC A300-600ST SUPER TRANSPORTER (BELUGA)

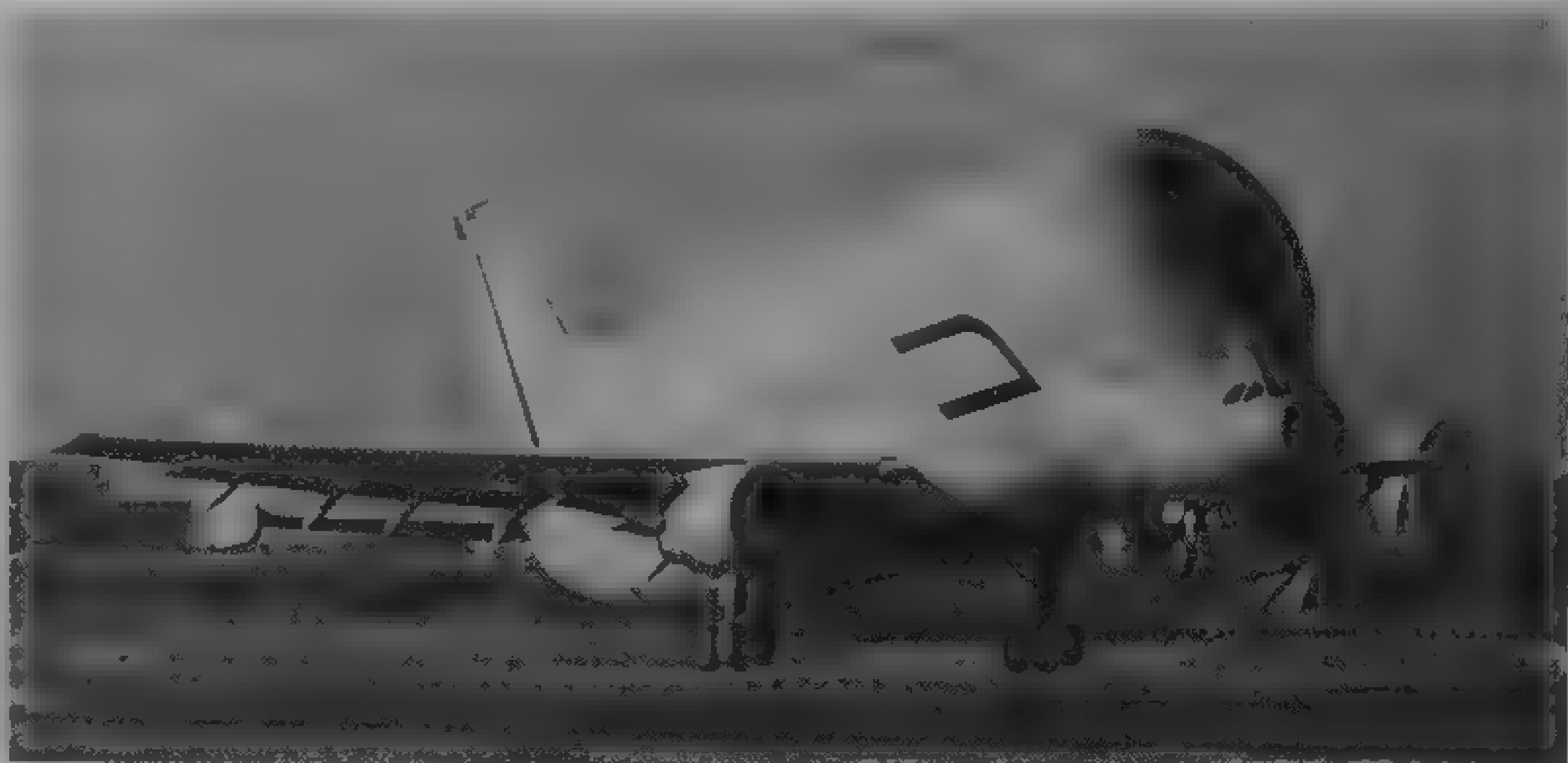
TYPE: Replacement for turboprop Super Guppy transporters of Airbus components.

PROGRAMME: Announced December 1990; airframe contractors chosen May 1992; first subassemblies delivered to Latécoère plant near Toulouse May 1993; first nose section delivered August 1993; roll-out 23 June 1994; first flight (F-WAST) 13 September 1994; 400 hour test programme leading to certification and service entry September 1995; remaining three to be delivered in March 1996, April 1997 and June 1998, fifth on option.

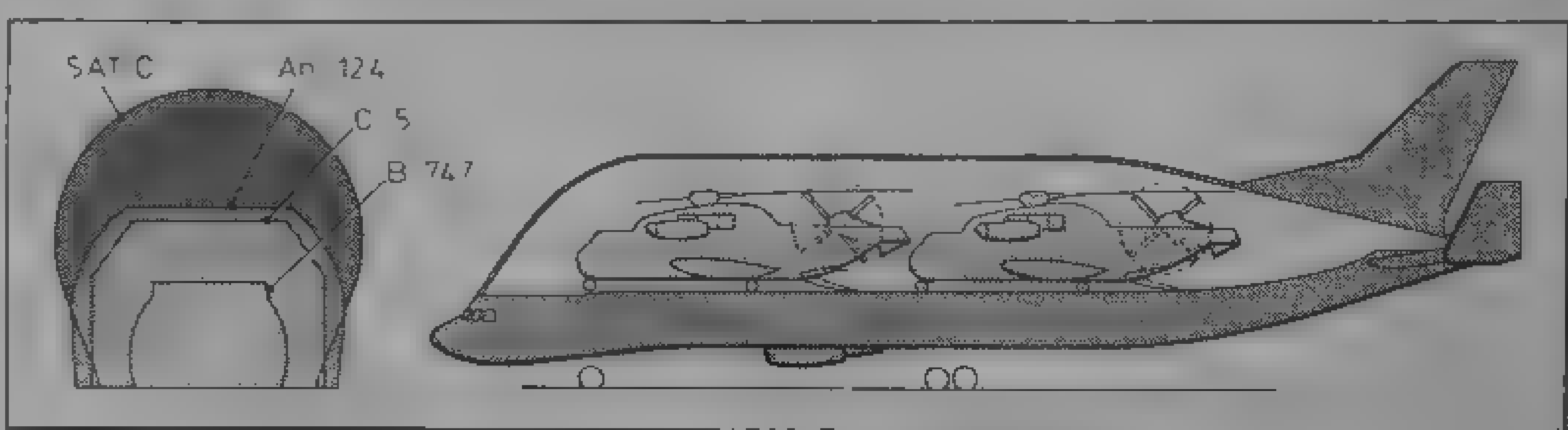
CUSTOMERS: Airbus Industrie requires four Super Transporters to transport large Airbus subassemblies between group factories. Potential market for 20 more, civil and possibly military.

COSTS: Programme cost reported as $1 billion, aircraft price about $100 million.

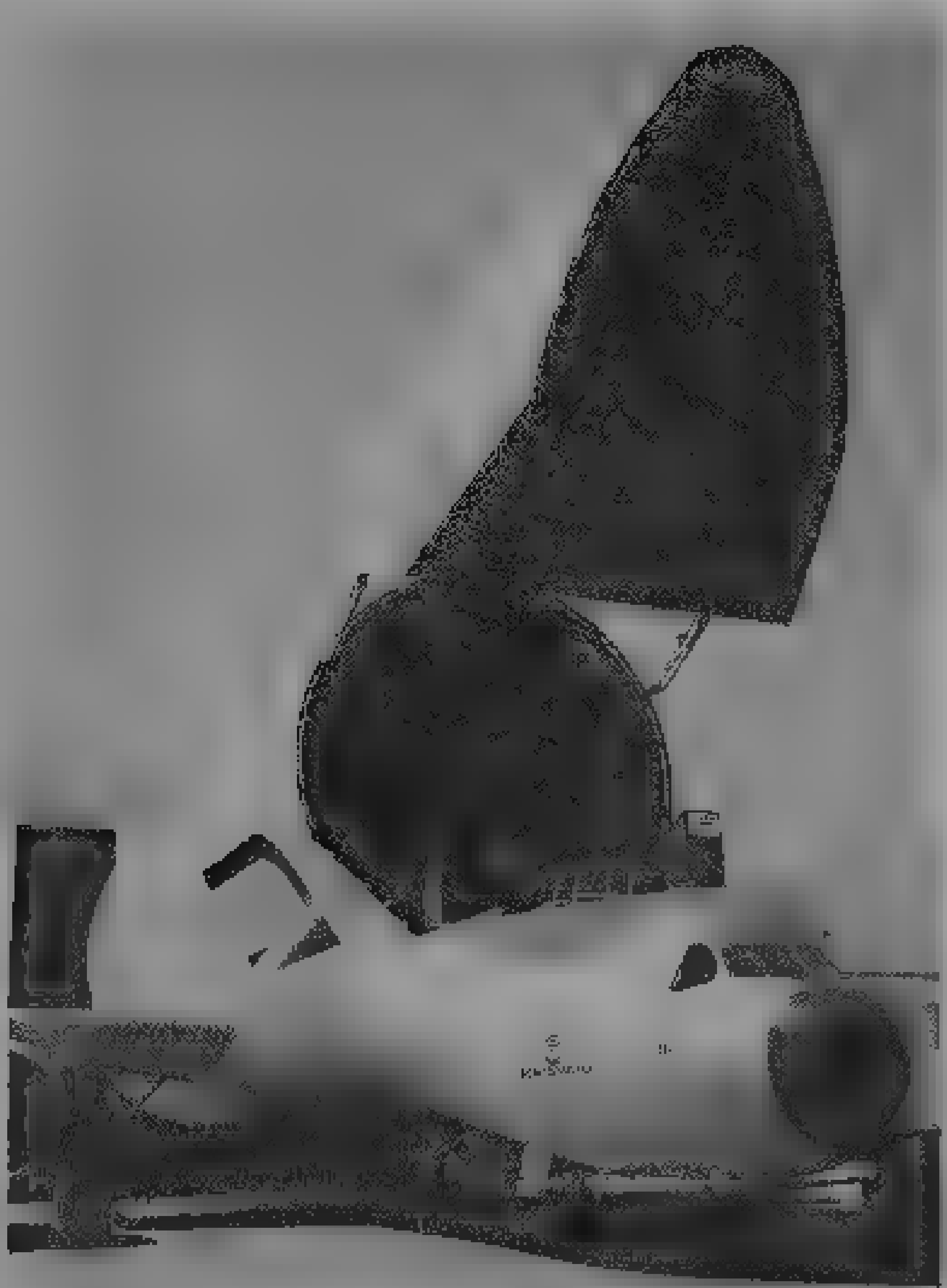
DESIGN FEATURES: Based on new A300-600 airframe, with enlarged unpressurised upper fuselage, accessed via new upward hinging door above flight deck; fin raised and tail plane reinforced and fitted with endplate fins; pressurised flight deck set below main deck floor level permits roll-on/roll-off loading of main hold; nose door can be operated in winds up to 25 knots (46 km/h; 29 mph) and turnround times are reduced from several hours to 45 minutes.



First SATIC A300-600ST Super Transporter *1995*

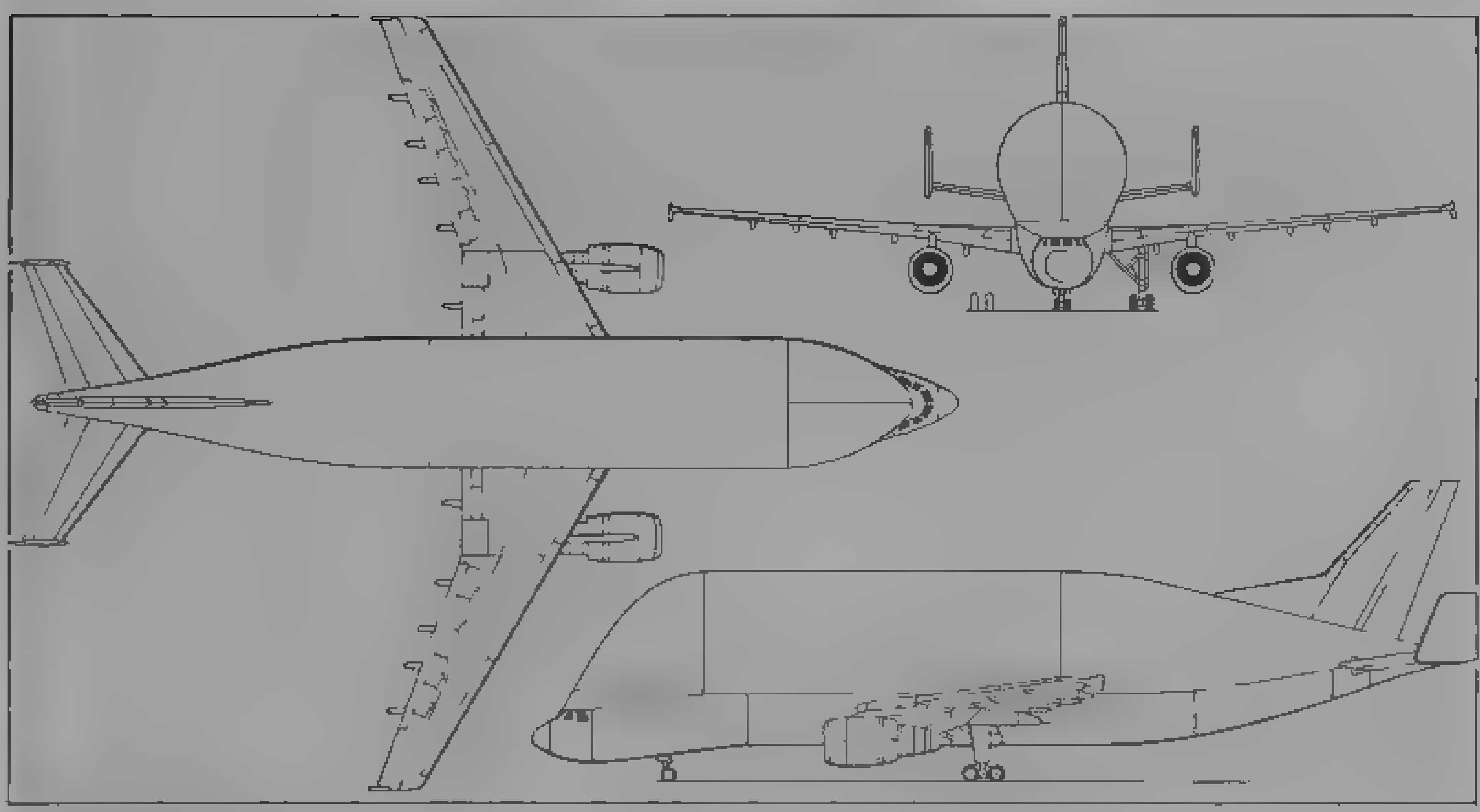


Interior layout of A300-600ST Super Transporter *(Jane's/Mike Keep)* *1994*



SATIC A300-600ST showing front loading arrangement
1995

STRUCTURE: Latécoère chosen as lead contractor for programme in May 1992 with overall integration responsibility and to design cargo hold, floor, pressure bulkhead and rear side doors, SOGERMA-SOCEA making upward-hinging nose door, side panels and airtight floor above pressurised flight deck, Hurel-Dubois produced nose landing gear fittings and structure of transverse pressure bulkhead aft of flight deck, Socata produced rear lower fuselage lobe, CASA (Spain) produced forward upper fuselage panels and Elbe Flugzeugwerke (Deutsche Aerospace Airbus, formerly East German) made the redesigned tail section



SATIC A300-600ST Super Transporter built to transport Airbus airframe sections (*Jane's/Mike Keep*)
1993

POWER PLANT: Two General Electric CF6-80C2A8 turbofans (normally fitted to A310) giving 262.4 kN (59,000 lb st) each

DIMENSIONS, EXTERNAL:

Wing span	44.84 m (147 ft 0 in)
Length overall	56.16 m (184 ft 3 in)
Height overall	17.245 m (56 ft 7 in)
Height of loading door, when open	16.78 m (55 ft 1 in)
Height to loading door sill	5.01 m (16 ft 5¼ in)

DIMENSIONS, INTERNAL:

Cabin length: usable	37.70 m (123 ft 8¼ in)
cylindrical portion*	21.34 m (70 ft 0 in)
Cabin diameter	7.40 m (24 ft 3¼ in)
Cabin volume	1,400 m³ (49,440 cu ft)

WEIGHTS AND LOADINGS:

Max payload	45,500 kg (100,310 lb)
Max T-O weight	150,000 kg (330,675 lb)
Max zero-fuel weight	130,000 kg (286,600 lb)

PERFORMANCE:

Max cruising speed
Mach 0.7 (421 kts, 780 km/h, 484 mph)
Range 900 n miles (1,666 km; 1,035 miles)

* *rearwards from freight door hinge*

UPDATED

SEPECAT

SOCIÉTÉ EUROPÉENNE DE PRODUCTION DE L'AVION E. C. A. T

PARTICIPATING COMPANIES:
British Aerospace: see under UK
Dassault Aviation: see under France

PRESIDENT: J. P. Weston (BAe)
VICE-PRESIDENT: R. Dubost (Dassault)

Anglo-French company formed May 1966 by Breguet Aviation and British Aircraft Corporation to design and produce Jaguar strike fighter/trainer; production now in India only

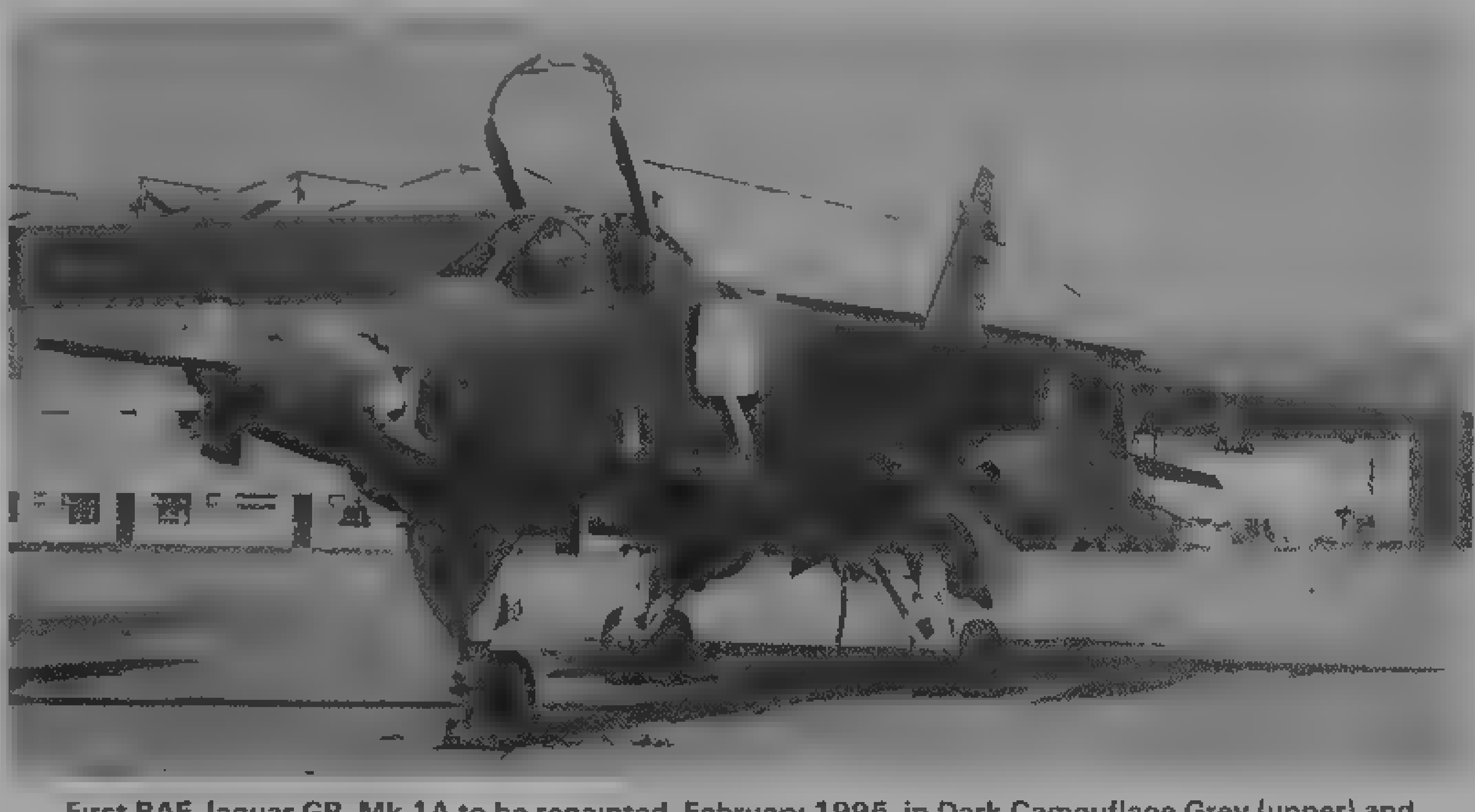
VERIFIED

SEPECAT JAGUAR

Details of the Jaguar appear in the HAL entry, Indian section (which see), data particular to RAF GR. Mk 1A last appeared under SEPECAT heading in the 1993-94 *Jane's*

In 1994-95, RAF upgrading 12 Jaguars to **GR. Mk 1B** (10) and **T. Mk 2B** (two) standard with provision for GEC-Marconi TIALD target designation pods and appropriate cockpit modifications (see *Jane's Aircraft Upgrades*).

UPDATED



First RAF Jaguar GR. Mk 1A to be repainted, February 1995, in Dark Camouflage Grey (upper) and Camouflage Grey, with radar-absorbent material on leading-edges and drop-tank noses (*Paul Jackson*)
1995

SOKO/AVIOANE

PARTICIPATING COMPANIES:
Soko: see under Bosnia Hercegovina
Utva: see under Yugoslavia
Avioane: see under Romania

VERIFIED

SOKO J-22 ORAO (EAGLE) and AVIOANE IAR 93

TYPE: Single-seat close support, ground attack and tactical reconnaissance aircraft, with secondary capability as low-level interceptor. Combat capable two-seat versions used also for advanced flying and weapon training

PROGRAMME: Joint design by Yugoslav and Romanian engineers, started 1970 under original project name Yurom, to meet requirements of both air forces, two single-seat prototypes started in each country 1972, making simultaneous first flights 31 October 1974, first flight in each country of a two-seat prototype 29 January 1977, each manufacturer then built 15 preproduction aircraft (first flights 1978); series production began in Romania (IAv Craiova, now Avioane) 1979, in Yugoslavia (Soko) 1980; production halted by damage and dismantling of Soko's Mostar factory in Bosnia-Hercegovina in 1992, but may be continuing at Utva factory in Pančevo (which see under Yugoslavia). No confirmation of this, or of ongoing Romanian production, by early 1995. See 1994-95 and earlier editions, or current *Jane's Aircraft Upgrades*, for full description, following is an abbreviated version

CURRENT VERSIONS: **IAR-93A**: Romanian single- and two-seat versions with non-afterburning Viper Mk 632-41 turbojets, first flight 1981; production completed. Details in 1994-95 *Jane's*

IAR-93B: Romanian single- and two-seat versions with afterburning Viper Mk 633-47 turbojets, first flight 1985. Avionics of two-seaters being upgraded early 1993

IJ-22 and INJ-22 Orao: Yugoslav non-afterburning preseries aircraft for tactical reconnaissance (INJ-22 also a conversion trainer); at least 24 single-seat IJ-22 and two-seat INJ-22 built. Details in 1994-95 *Jane's*

NJ-22 Orao: Production two-seat tactical reconnaissance version, some with/some without afterburning engines, first flight 18 July 1986; total 35 ordered (all delivered)

J-22 Orao: Production single-seat attack version, some with/some without afterburning engines; first flight 20 October 1983. Plans to upgrade with modern avionics including integration of radar and inertial nav/attack system via new databus, intake and wing leading-edge de-icing

CUSTOMERS: Romanian Air Force (26 single-seat and 10 two-seat IAR 93A, all delivered, and 165 IAR 93B ordered), former Yugoslav Air Force (24 IJ/INJ-22, 35 NJ-22, all delivered, 165 J-22 ordered, of which 74 delivered by Soko by early 1992). Some acquired by Serbian Republic of Bosnia-Hercegovina (238 Squadron at Banja Luka)

POWER PLANT (afterburning versions): Two Turbomecanica/Orao (licence built Rolls-Royce) Viper Mk 633-47 turbojets, each rated at 17.79 kN (4,000 lb st) dry and 22.24 kN (5,000 lb st) with afterburning. Production aircraft have five fuselage tanks and two collector tanks, plus two integral wing tanks, giving total internal capacity of 3,120 litres (824 US gallons, 686 Imp gallons). Provision for carrying three 500 litre (132 US gallon; 110 Imp gallon) auxiliary fuel tanks, one on underfuselage stores attachment and one inboard under each wing. Pressure refuelling point in fuselage below starboard air intake; gravity refuelling

Single- and two-seat versions of the Romanian Air Force's IAR 93B

1994

points at fuselage rear, starboard wing trailing-edge and in each external tank.

ACCOMMODATION: Single-seat or tandem two-seat cockpit(s), with Martin-Baker zero/zero seat for each occupant (RU10J in IAR-93, Y-10LB in Orao), capable of ejection through canopy. Canopy of single-seat J-22 hinged at rear and actuated electrically to open upward; single-seat IAR-93B, and all two-seaters, have manually operated canopies opening sideways to starboard. All accommodation pressurised, heated and air conditioned. Dual controls in two-seat versions.

ARMAMENT (IAR-93B): Two 23 mm GSh 23L twin barrel cannon in lower front fuselage, below engine air intakes, with 200 rds/gun. Gun camera and GEC-Marconi D282 gyro gunsight. Five external stores stations, of which inboard underwing pair and fuselage centreline station are each stressed for loads up to 500 kg (1,102 lb), outboard underwing stations stressed for up to 300 kg (661 lb) each, giving maximum external stores load of 1,500 kg (3,307 lb).

Typical weapon loads can include two or three 500 kg bombs, four or five 250 kg bombs, four multiple carriers each with three 100 kg or 50 kg bombs, two such multiple carriers plus two L-57-16MD launchers each with sixteen 57 mm rockets, four L-57-16MD launchers, four launchers each with two 122 mm, one 128 mm or one 240 mm rocket (122 and 240 mm not used on Orao), a GSh-23L cannon pod with four L-57-16MD rocket launchers; four 160 kg KPT-150 or similar munition dispensers, or four L-57-32 launchers each with thirty-two 57 mm rockets. Some IAR 93Bs equipped to carry up to eight air-to-air missiles, on twin launch rails, on four underwing stations.

ARMAMENT (Orao): Guns, gun camera and centreline reconnaissance pod as for IAR-93B. All four wing stations stressed for 500 kg (1,102 lb), and fuselage station for 800 kg (1,763 lb), giving maximum external stores capacity of 2,800 kg (6,173 lb).

Typical weapon loads include five 50 kg, 100 kg, 250 kg or 500 kg bombs; four multiple carriers for total of twelve 50 or 100 kg or eight 250 kg bombs; four FLAB 350 napalm bombs (each 360 kg; 794 lb); five BL755 bomblet dispensers, or eight on four multiple carriers; 16 BRZ-127 5 in HVAR rockets; four pods of L-57-16MD or L-128-04 (four 128 mm) rockets, or eight pods on multiple carriers, five 500 kg AM-500 sea mines, or two launch rails for AGM-65B Maverick or Yugoslav Grom air-to-surface missiles. The 100 kg and 250 kg bombs can be parachute retarded.

DIMENSIONS, EXTERNAL:
Wing span: 9.30 m (30 ft 6¼ in)
Wing chord: at root: 4.20 m (13 ft 9⅜ in)
at tip: 1.40 m (4 ft 7 in)
Wing aspect ratio: 3.33
Length overall, incl probe:
single-seater: 14.90 m (48 ft 10⅝ in)
two-seater: 15.38 m (50 ft 5½ in)
Length of fuselage: single-seater: 13.02 m (42 ft 8½ in)
two-seater: 14.44 m (47 ft 4½ in)
Fuselage: Max width: 1.62 m (5 ft 3¾ in)
Height overall: 4.52 m (14 ft 10 in)
Tailplane span: 4.59 m (15 ft 0¾ in)
Wheel track (c/l of shock struts): 2.50 m (8 ft 2½ in)
Wheelbase: single-seater: 5.40 m (17 ft 8½ in)
two-seater: 5.88 m (19 ft 3½ in)

AREAS:
Wings, gross: 26.00 m² (279.86 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped: IAR-93B: 5,750 kg (12,676 lb)
J-22: 5,500 kg (12,125 lb)
Max internal fuel: IAR 93B: 2,400 kg (5,291 lb)
J-22: 2,430 kg (5,357 lb)
Max external stores load: IAR-93B: 2,500 kg (5,511 lb)
J-22: 2,800 kg (6,173 lb)
Normal T-O weight clean:
IAR-93B: 8,400 kg (18,519 lb)
J-22: 8,170 kg (18,012 lb)
Max T-O weight: IAR-93B: 10,900 kg (24,030 lb)
J-22: 11,080 kg (24,427 lb)
Max landing weight: IAR-93B: 9,360 kg (20,635 lb)
J-22: 9,500 kg (20,944 lb)
Max wing loading: IAR-93B: 419.2 kg/m² (85.9 lb/sq ft)
J-22: 426.1 kg/m² (87.3 lb/sq ft)
Max power loading:
IAR-93B: 245.2 kg/kN (2.40 lb/lb st)
J-22: 249.2 kg/kN (2.44 lb/lb st)

PERFORMANCE (IAR-93B at 8,400 kg; 18,519 lb T-O weight, J-22 at clean T-O weight with 50% internal fuel, except where indicated):
Max level speed at S/L:
IAR-93B: 586 kts (1,086 km/h; 675 mph)
J-22: 610 kts (1,130 km/h; 702 mph)
Max level speed at altitude: J-22 at 11,000 m (36,100 ft): Mach 0.96 (550 kts; 1,019 km/h; 633 mph)
Max cruising speed: IAR-93B at 5,000 m (15,240 ft): 587 kts (1,089 km/h; 676 mph)
J-22 at 11,000 m (36,100 ft): Mach 0.7 (401 kts; 743 km/h; 462 mph)
Stalling speed at S/L:
IAR 93B: 148 kts (274 km/h; 171 mph)
J-22, gear and flaps down: 100 kts (185 km/h; 115 mph)
Max rate of climb at S/L:
IAR 93B: 3,900 m (12,800 ft)/min
J-22: 5,340 m (17,520 ft)/min
Service ceiling: IAR 93B: 13,600 m (44,625 ft)
J-22: 15,000 m (49,210 ft)
Time to 6,000 m (19,685 ft): J-22: 1 min 20 s
T-O run: IAR 93B: 800 m (2,625 ft)
J-22 at 9,443 kg (20,818 lb) with four BL755s: 880 m (2,888 ft)
T-O to 15 m (50 ft): IAR 93B: 1,150 m (3,775 ft)
J-22: 1,255 m (4,118 ft)
Landing from 15 m (50 ft): IAR-93B: 1,520 m (4,987 ft)
IAR-93B with brake-chute: 990 m (3,250 ft)
J-22: 1,295 m (4,249 ft)
Landing run: IAR-93B: 1,050 m (3,445 ft)
IAR-93B with brake-chute: 690 m (2,265 ft)
J-22: 755 m (2,477 ft)
Landing run with brake-chute:
IAR-93B: 670 m (2,200 ft)
J-22: 530 m (1,739 ft)
Tactical radius, IAR-93B:
lo-lo-lo with four rocket launchers, 5 min over target: 140 n miles (260 km; 161 miles)
hi-hi-hi patrol with three 500 l drop tanks, 45 min over target: 205 n miles (380 km; 236 miles)
lo-lo-hi with two rocket launchers, six 100 kg bombs and one 500 l drop tank, 10 min over target: 243 n miles (450 km; 280 miles)
hi-hi-hi with four 250 kg bombs and one 500 l drop tank, 5 min over target: 286 n miles (530 km; 329 miles)
Tactical radius, J-22:
hi-lo-hi with four BL755s and 1,500 l centreline drop tank, 2 min reheat: 282 n miles (522 km; 324 miles)
hi-lo-hi with four 500 kg air mines and 1,500 l centreline drop tank, 1.2 min reheat: 248 n miles (460 km; 286 miles)
hi-lo-hi with eight 250 kg bombs and one 500 l drop tank, 2 min reheat: 200 n miles (370 km; 300 miles)
Ferry range: IAR 93B, with three 500 l drop tanks: 1,025 n miles (1,900 km; 1,180 miles)
J-22, with two 500 l drop tanks, at 6,000 m (19,685 ft): 712 n miles (1,320 km; 820 miles)
g limits: IAR-93B, J-22: +8/−4.2

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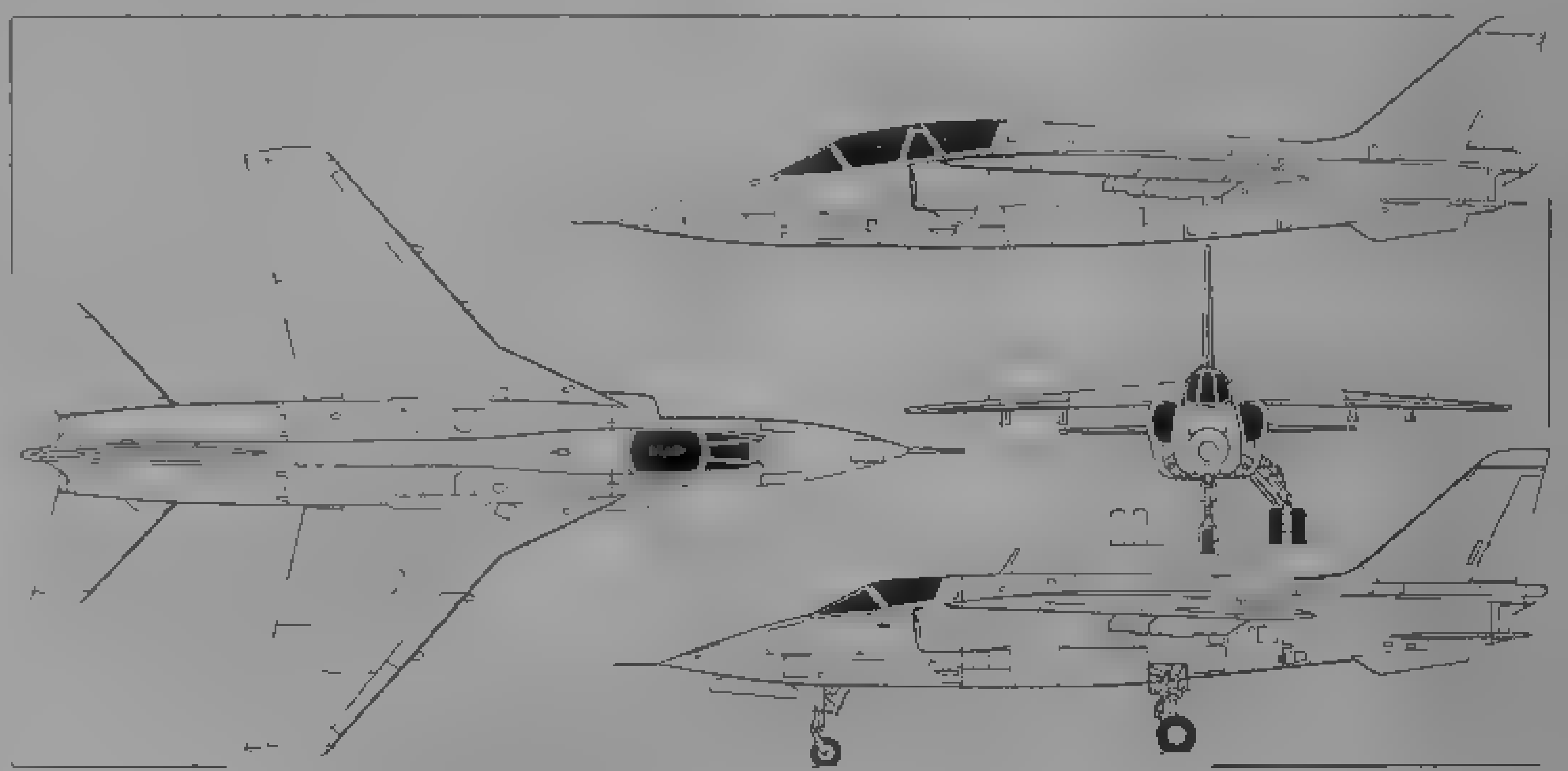

Single-seat J-22 Orao close support/ground attack aircraft, with additional side view (top) of two-seat NJ-22 (*Jane's/Dennis Punnett*)

1993

SUPERSONIC AIRLINER STUDIES

This and the Ultra High Capacity Airliner are the most likely major new civil programmes for the next 20 years. Cost and the size of the market make it virtually certain that large consortia will form to develop them. Below are the moves so far towards a firm advanced SST programme.

VERIFIED

ADVANCED SUPERSONIC AIRLINER

TYPE: Second-generation supersonic airliner programme.

PROGRAMME: Work on second-generation SST begun by Aerospatiale and French national institute ONERA in June 1989; SNECMA and Rolls-Royce began joint engine studies also in 1989: MTU and FiatAvio joined later; Aerospatiale and BAe started joint study in April 1990; SCT (supersonic commercial transport) Group started with Boeing, McDonnell Douglas and Daimler Benz Aerospace Airbus in May 1990; Anglo-French team joined SCT to form Supersonic Commercial Transport International Co-operative Study Group, nicknamed Group of Five, objective to study market and environmental problems; Alenia, Tupolev and Japan Aircraft Development Corporation (Mitsubishi, Kawasaki and Fuji) joined during 1991, P&W and GE working together on engine problems. Phase 1 market, certification, noise and environmental study completed by mid-1993 and

Phase 2 launched to study technical and economic feasibility.

NASA has launched two High-Speed Research programmes. Six year Phase 1 costing $450 million started in 1990 and examines environmental acceptability. Phase 2 technology programme ($1.5 billion), started in 1993, will last eight years and examine all critical aerodynamic, propulsion and technology areas. After Phase 2, industry will know whether it can profitably build a supersonic airliner. A new X series aircraft might be built during Phase 2, with funding starting in 1996.

Baseline airliner would carry about 300 passengers at Mach 2.4 for 5,500 n miles (10,175 km; 6,329 miles). Preliminary concept could be ready 1995, early configuration by 1998, and firm by 2001. Industrial launch would follow in 2001, first flight in 2004, certification in 2005 or 2006.

Europe not providing corresponding funding for SST research, leaving its manufacturers with prospect of subsidiary status in eventual programme. BAe studies show new SST should have, by comparison with Concorde, 27.5 per cent better cruise lift/drag ratio, 40 per cent lower specific weight and 10.5 per cent lower specific fuel consumption. Maximum T-O weight 317,500 kg (700,000 lb), wing area 780 m² (8,400 sq ft), range with 250 to 300 passengers in three classes: 5,500 n miles (10,175 km, 6,329 miles).

Of the ¥11.29 billion Japanese government aerospace budget for 1994-95, ¥5.89 billion devoted to SST research and including ¥3,929 million to propulsion research and ¥1,846 million to work on high temperature materials.

CURRENT VERSIONS: **Alliance:** Name defines joint BAe/Aerospatiale/ONERA/SNECMA study for Concorde-style 250- to 300-passenger SST with range of 5,935 n miles (11,000 km, 6,835 miles), double delta wing with high-aspect ratio outer panels.

European Supersonic Research Programme (ESRP): Current title of joint European research effort designed to strengthen European position in the face of the US-only HSR programme described above. Aerospatiale, British Aerospace and Daimler-Benz Aerospace signed MoU in April 1994 for assessment of technical and economic viability of ESRP, and study of key technological issues such as materials, aerodynamics, systems and power plant integration.

Tu-244. Tupolev designation for its own SST study as successor to original Tu-144; model shown at Paris Air Show 1993; 300 seats; range 4,975 n miles (9,200 km, 5,725 miles); maximum T-O weight 350,000 kg (771,625 lb); four engines of 324 kN (72,750 lb st) each.

ASCT: Advanced Supersonic Commercial Transport, generic name for various US and Japanese studies. One Japanese proposal, by Mitsubishi, centres on 6,480 n mile (12,000 km; 7,455 mile) range and 400,000 kg (881,850 lb) maximum T-O weight; span 41.3 m (135 ft), length 104.5 m (343 ft), height 18 m (59 ft). See also JADC entry in Japanese section.

HSCT: Boeing and Douglas use this general designation (High-Speed Commercial Transport) of a future SST.

CUSTOMERS: World market estimated as $125-250 billion up to 2025, representing 500 to 1,000 aircraft.

DESIGN FEATURES: Generally discussed specifications include cruising speed Mach 2.05 chosen to allow cruising at lower altitudes, where emissions are not so critical, fare surcharge not more than 10 to 20 per cent for three-class layout. Dimensions of ESRP/PERS configuration, fuselage length 89 m (292 ft 0 in), wing span 42 m (138 ft 0 in).

POWER PLANT: Could be four dual-cycle engines meeting normal FAR 36 Stage 3 noise levels, nitrous oxide emission reduced by 80 per cent, dual-cycle concept under study by SNECMA, Rolls-Royce, MTU and Fiat Avio is designated Mid Tandem Fan, promises 15 to 20 dB noise reduction at take-off; fuel consumption 0.043 kg/seat/km (0.175 lb/seat/n mile), MTF engine has fan operating in bypass duct mounted between the low- and high-pressure compressor spools.

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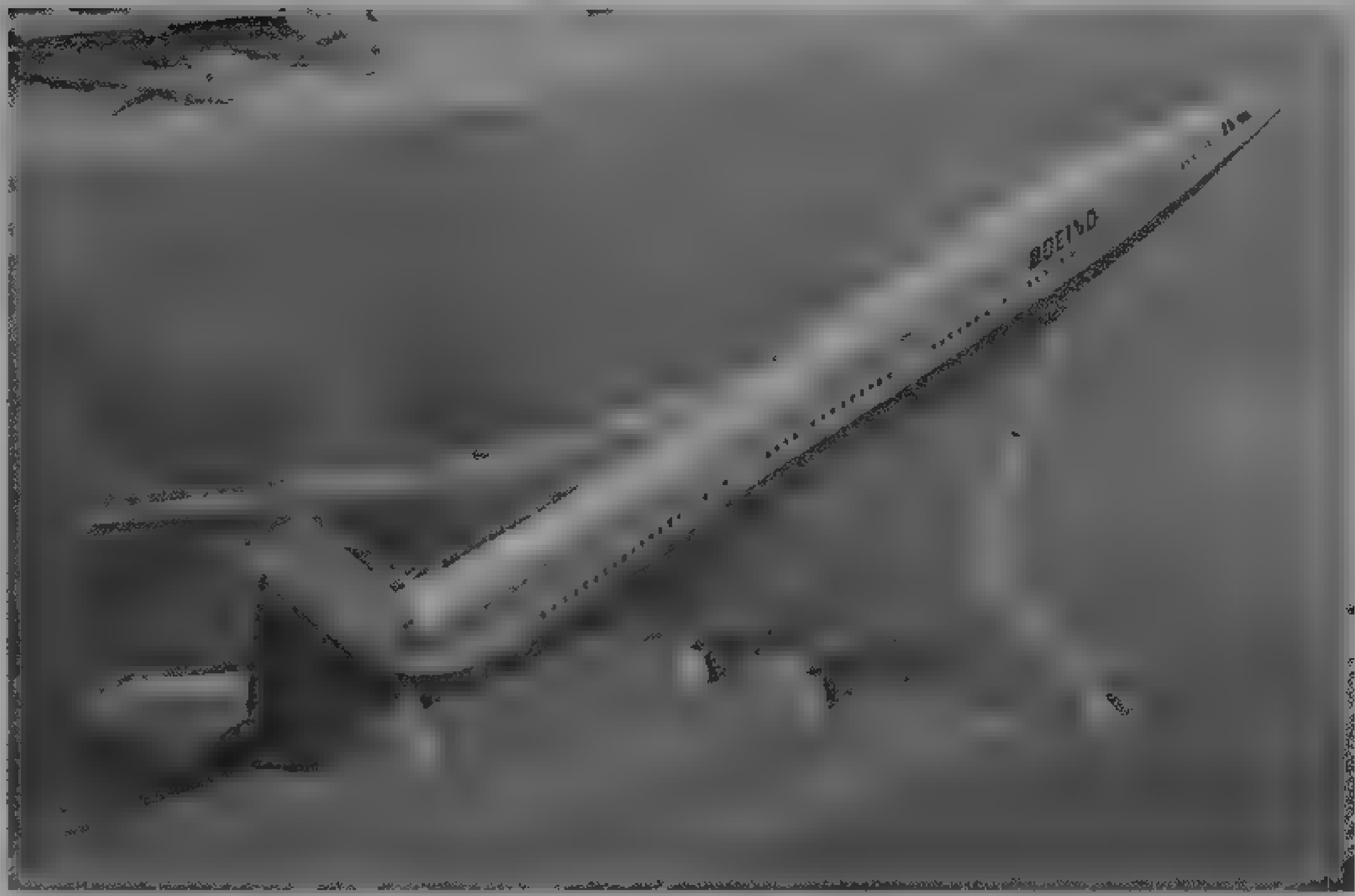
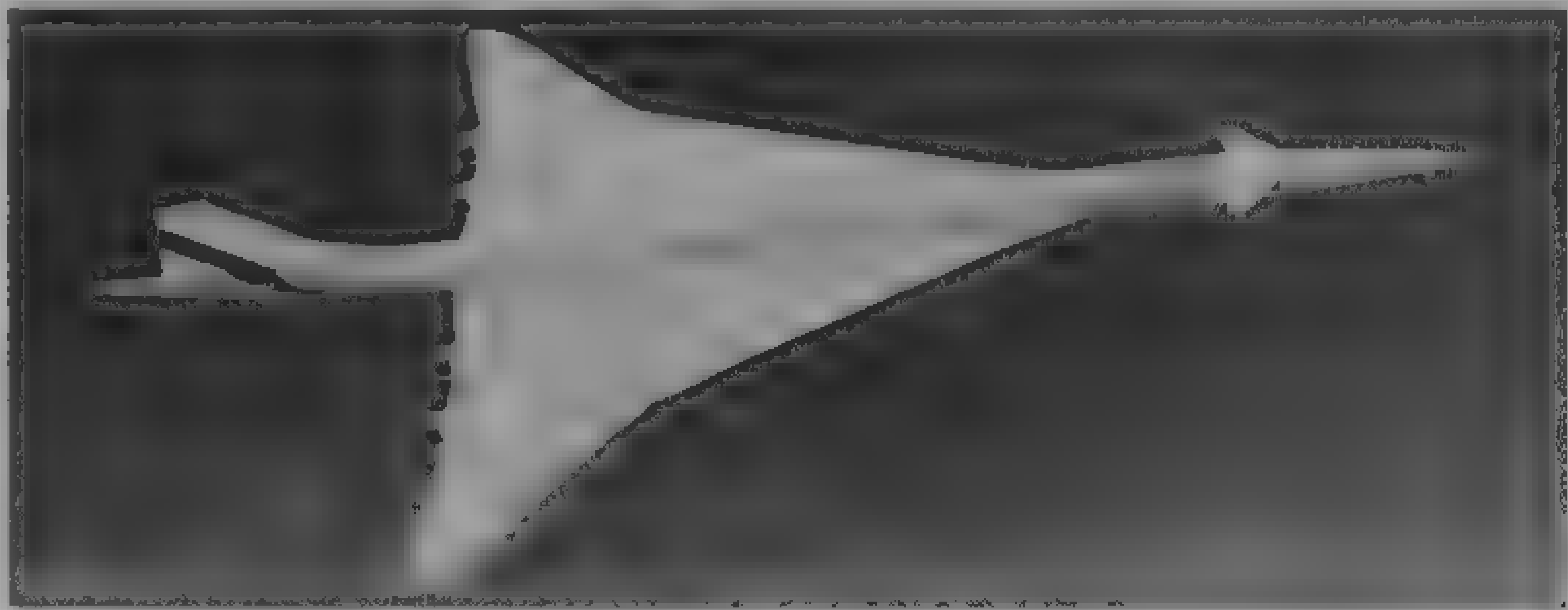
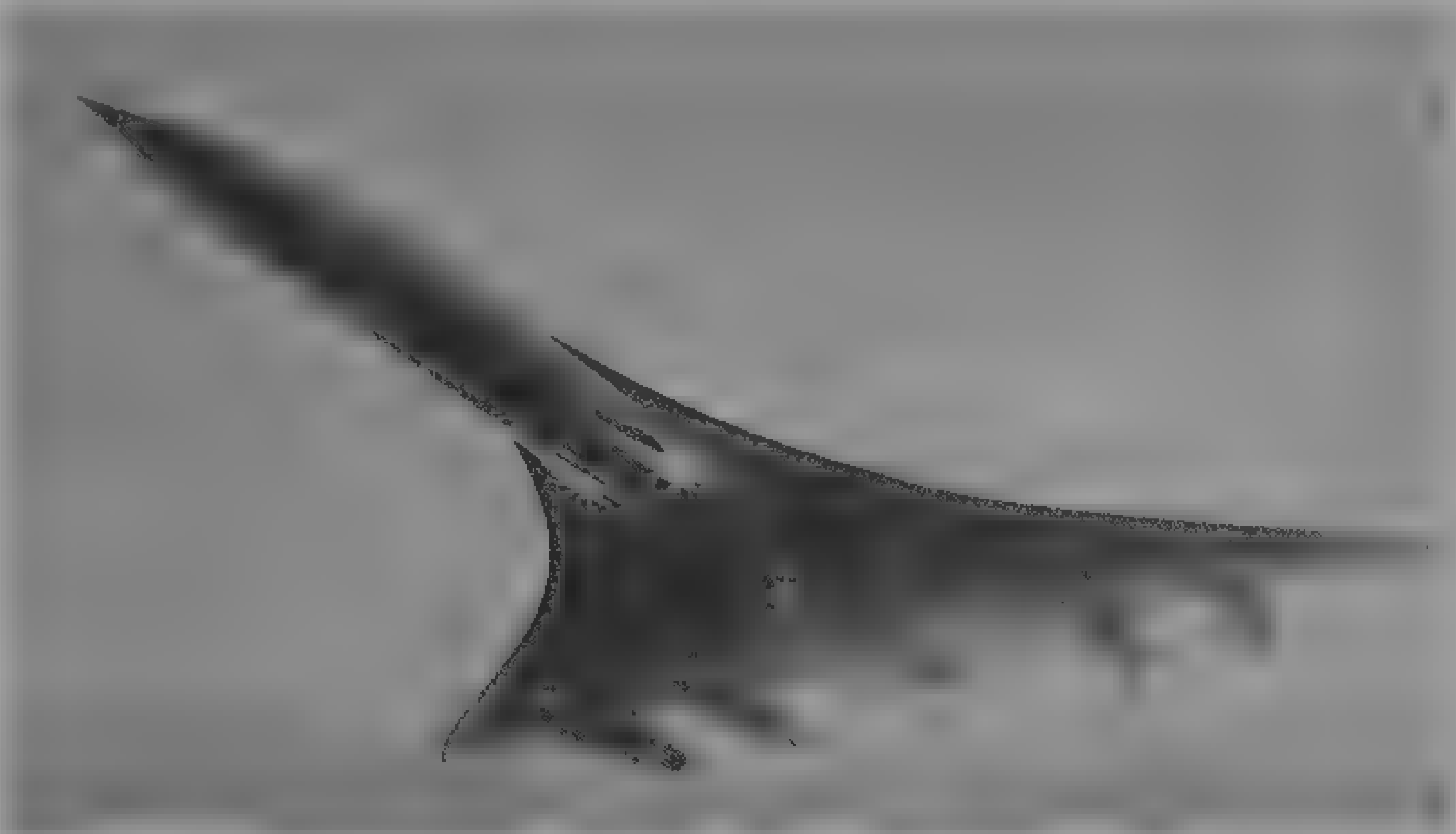


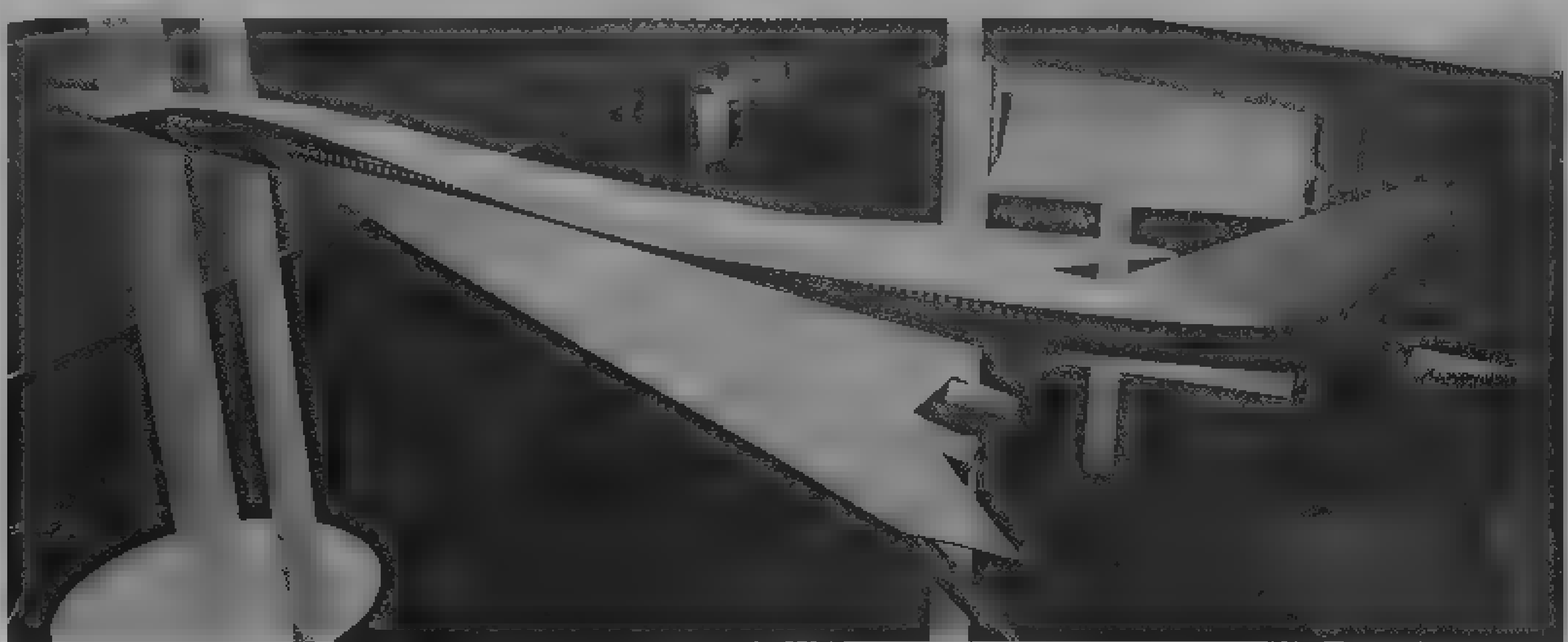
Artist's impression of 'general supersonic transport configuration' by Boeing *1993*



Common configuration agreed by Aerospatiale, BAe and Daimler-Benz Aerospace for the European Supersonic Research Programme (ESRP) advanced supersonic transport *1994*



A Japanese ASCT proposal by Mitsubishi *1995*



Kawasaki of Japan offers an ASCT which departs from the wing planform consensus *(Paul Jackson)* *1995*

UHCA/VLCT

ULTRA-HIGH CAPACITY AIRLINER/VERY LARGE COMMERCIAL TRANSPORT

PARTICIPATING COMPANIES:
Airbus Industrie: see in this section
Aerospatiale: see under France
British Aerospace: see under UK
CASA: see under Spain
Daimler-Benz Aerospace: see under Germany
Boeing Commercial Airplane: see under USA
Japan: see Mitsubishi, Kawasaki and Fuji under Japan

UPDATED

ULTRA-HIGH CAPACITY AIRLINER/ VERY LARGE COMMERCIAL TRANSPORT

TYPE: Airliners for 500 to 800 passengers, also known as New Large Airplane

PROGRAMME: Aimed initially at trans Pacific and south east Asian region, in service early next century. MoU signed 26 January 1993 between Airbus, Boeing, Aerospatiale, Daimler Benz Aerospace, British Aerospace and CASA to launch a one year general study of various aspects of UHCA, Airbus Industrie joined programme in first quarter 1994 in an advisory role; programme extended to 1995, beginning to study technical issues. Formal report, 10 July 1995, confirmed technical feasibility but deferred launch for lack of market; re-examination due in early 1996.

CURRENT VERSIONS: Each Airbus partner company has proposed outline designs, including ASX 500 and 600 from Aerospatiale and A 2000 from Daimler-Benz Aerospace Airbus. Alternative Aerospatiale study, revealed May 1995, is 1,000-seat flying wing spanning 96 m (315 ft). Boeing proposals have included double-deck and stretched developments of 747 and the New Large Airplane (NLA). Airbus Industrie's joint proposal is now designated A3XX (see entry in this section).

CUSTOMERS: Market for 400 to 500 aircraft foreseen by 2010.

COSTS: Development cost estimates vary from $10 billion (Airbus) to $17 billion.

DESIGN FEATURES: Design objective is to carry from 500 to 800 passengers over a distance of about 7,000 n miles (12,964 km, 8,055 miles). UHCA could have a T-O weight of 681,000 kg (1,501,346 lb) or 548,846 kg (1,210,000 lb), according to the estimate, but will not need to be as big as the An-225 Mriya, engine noise, economy and pollution at the powers envisaged represent the most difficult limitations on the design, wake vortex must not impose burdens on operations of other aircraft, direct operating cost will have to be 15 per cent lower than those of present large airliners.

FLYING CONTROLS: Large size and inertia of the aircraft will demand special flying controls and combinations of control surfaces and very high actuator powers.

STRUCTURE: New materials, such as Glare fibre/metal laminate, will be necessary to control the weight of the UHCA, because the aircraft will be built by a consortium of companies, large assemblies will have to be transported from factory to factory, requiring major structural joints.

UPDATED

VENGA/BAOSHAN

PARTICIPATING COMPANIES:

Venga Aerospace Systems Inc, Place Lancaster, 61 Cameron (Suite 230), PO Box 665, Hudson, Quebec J0P 1H0, Canada
Telephone: 1 (514) 458 5659
Fax: 1 (514) 458 3377
PRESIDENT: Jay Lumiere

Baoshan Iron and Steel Corporation, New Business Development Division, Baosteel Administrative Building, Shanghai 201900, People's Republic of China
Telephone: 86 (21) 664859
Fax: 86 (21) 6648593
PROJECT MANAGER: Lin Qi Zhen

Can-Aero International Ltd, Executive Suites, 42 Keefer Court, Hamilton, Ontario L8E 4V4, Canada
Telephone: 1 (416) 573 3031
Fax: 1 (416) 573 7717
PRESIDENT: Philip A Nelson

Venga incorporated (as Venga Aircraft Inc) May 1985 to develop, manufacture and market all-composites jet trainer/light attack aircraft known as TG-10, now named Brushfire. Project dormant since last appearance in *Jane's* (see 1989-90 edition), due to funding difficulties during world recession, but rejuvenated by signature 23 February 1994 of agreement with Baoshan, China's largest steel company, for joint venture to construct manufacturing facility in Shanghai for production of Brushfire and, eventually, other designs such as Shaman/Timberwolf light piston aircraft.

UPDATED

VENGA/BAOSHAN TG-10 BRUSHFIRE

TYPE: Two-seat jet trainer or single-seat light attack aircraft.

PROGRAMME: Designed in late 1980s, prototype constructed by Venga at Dorval, Quebec, fabrication under way of pre-production aircraft, for transfer to Shanghai 1995 as pattern aircraft for series production. Shanghai factory to be ready for production by end of 1995.

COSTS: Approximately $3 million (1995).

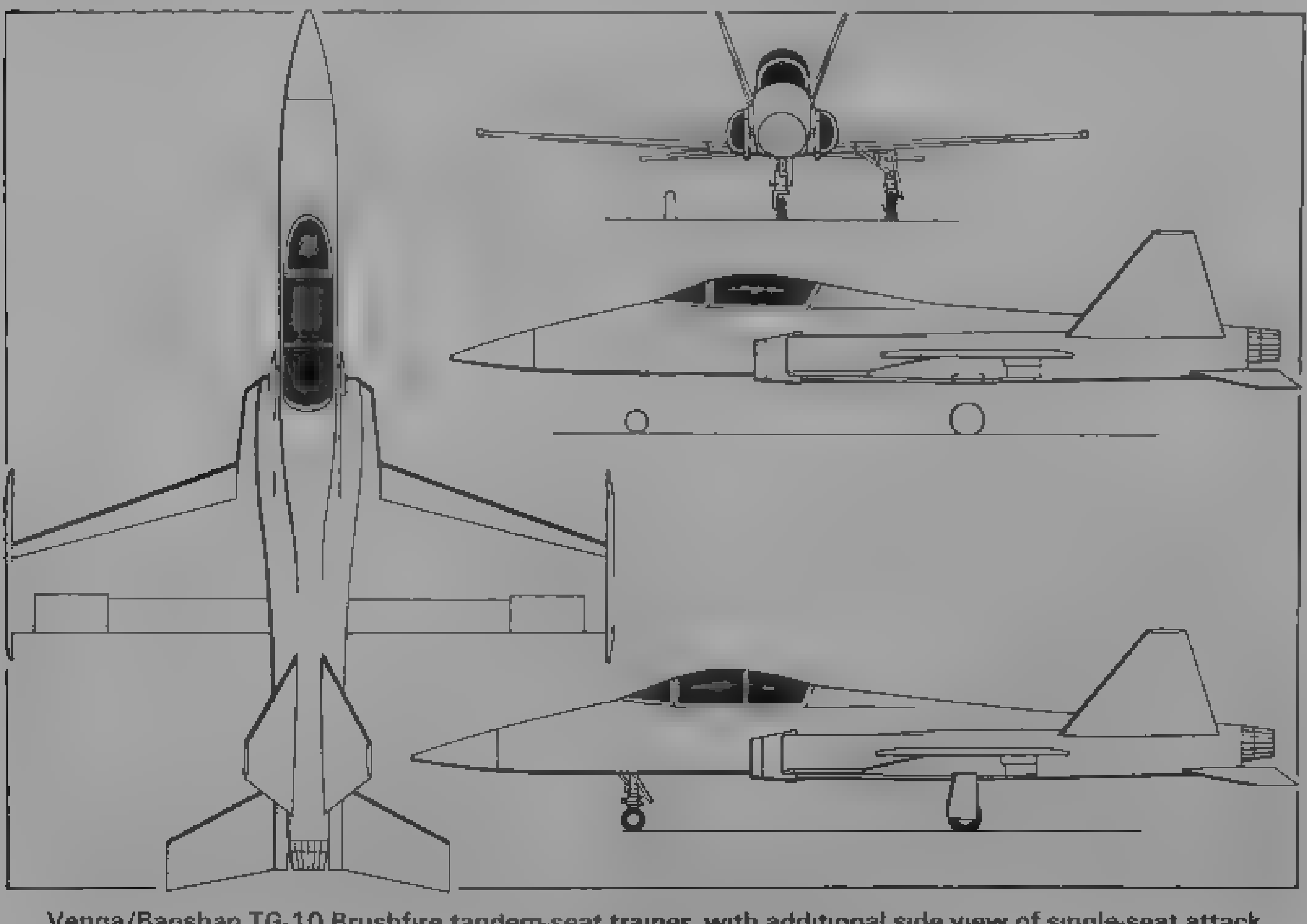
DESIGN FEATURES: Configuration broadly similar to Northrop F-5E and McDonnell Douglas F/A-18, incorporates low-observables features to improve survivability; modular design for in-field repair; 10,000 hours airframe life, operable from unimproved airstrips. Slightly sweptback wing with 2° 30′ dihedral, outward canted twin fins and rudders, slight anhedral on tailplane.

FLYING CONTROLS: Differential ailerons, elevators and twin inset rudders. Electrically operated trailing-edge flaps with CAP actuators. Electrohydraulically actuated underfuselage airbrake.

STRUCTURE: Modular all-composites construction from pressure formed foam core laminates bonded into single lightweight moulded unit. Primary structure entirely of composites, with extensive use of carbonfibre for high stress and other critical areas, other materials include layers of aircraft grade glassfibre cloth bonded to a core of PVC foam in vacuum process using resin matrices.

LANDING GEAR: Retractable tricycle type, with electrohydraulic actuation, nosewheel retracts forward, mainwheels inward into fuselage. Wheel sizes 5.00-5 (nose), 6.00-10 (main). Nosewheel steerable through 30°. Mainwheels have hydraulic brakes and parking brake. Ground turning radius 6.10 m (20 ft 0 in).

POWER PLANT: Prototype powered by one 13.01 kN (2,925 lb st) General Electric J85-GE-5 turbojet; standard engine for basic production version will be an 11.12 kN (2,500 lb st) Pratt & Whitney Canada JT15D-4C turbofan, but customer options will include General Electric CJ610 or Rolls-Royce Viper 632 or 680 turbojets. Intakes are each fitted with a large splitter plate, and are designed to inhibit foreign object damage. Fuel system, designed to permit fully aerobatic manoeuvres, comprises three fuselage cells with total usable capacity of 1,223 litres (323 US gallons, 269 Imp gallons). A 265 litre (70 US gallon, 58 Imp gallon) drop tank can be carried on the fuselage centreline station in the single-seat attack configuration.



Venga/Baoshan TG-10 Brushfire tandem-seat trainer, with additional side view of single-seat attack version ***(Jane's/Mike Keep)***

1994

ACCOMMODATION: Standard trainer has tandem accommodation for pupil (in front) and instructor on UPC zero/zero ejection seats under jettisonable bubble canopy, with internal screen between cockpits. Seats are reclined, adjustable horizontally and vertically, and can accommodate back-type parachutes. Dual controls standard, except for switches for fuel pumps, weapon control panel and parking brake; in lieu of these, rear panel has a full set of indicators for the weapons system, an override switch to prevent firing, and a parking brake indicator. Rail-mounted rear seat and rear instrument panel module are easily removable to permit quick conversion to single-seat light attack configuration. Cockpit(s) fully air conditioned, but not pressurised, latter may be offered later as a customer option.

SYSTEMS: 28 V DC electrical system, powered by a 24 V starter/generator and Gates Energy Products lead-acid battery with second battery for emergency back-up. Power sources are coupled to three busbars in front cockpit (main, avionics and emergency) containing trip-free circuit breakers. NATO type external ground power socket. Normalair-Garrett diluter demand oxygen system, capacity 225 litres (8 cu ft).

AVIONICS: *Comms*: V/UHF; SSR/IFF.
Radar: Provision for radar in dielectric nose.
Flight: VOR/ILS; ADF; DME.
Instrumentation: IFR capability, electrically driven gyro instruments. AoA indicator; back-up magnetic compass; HUD.

ARMAMENT: One centreline and four underwing hardpoints, each stressed for loads of up to 181.5 kg (400 lb), for weapons, fuel tank (centreline only), survival or rescue packs, or other stores, subject to a maximum external load of 845 kg (1,864 lb) in single-seat attack version. Weapons specified at present include up to three Portsmouth Aviation 7.62 mm FN gun pods with 450 rds/gun, up to three HMP 0.50 in Browning gun pods with 250 rds/gun, two Giat 20 mm M621 gun pods with 150 rds/gun, various rocket launchers (Matra F2 with six 68 mm, Aerea AL 18-50 with eighteen 2 in, AL 8-70 with eight 2.75 in FFAR, AL 6-80 with six 81 mm, LAU-32 with seven 2.75 in FFAR, SNIA 2 in, Brandt 7 with seven 68 mm, or SURA-D 81 mm); SAMP 32 kg or 50 kg general purpose or 120 kg fragmentation bombs, 11 kg Mk 76 practice bombs, or a 70 mm automatic panoramic IRLS reconnaissance pod.

DIMENSIONS, EXTERNAL:

Wing span	8.23 m (27 ft 0 in)
Wing chord at root	2.29 m (7 ft 6 in)
Wing aspect ratio	5.40
Length overall	11.89 m (39 ft 0 in)
Fuselage: Max width	1.42 m (4 ft 8 in)
Height overall	4.04 m (13 ft 3 in)
Tailplane span	3.96 m (13 ft 0 in)
Wheel track	3.05 m (10 ft 0 in)

AREAS:

Wings, gross	12.54 m² (135.0 sq ft)
Trailing-edge flaps (total)	1.30 m² (14.0 sq ft)
Rudders (total, incl tabs)	1.11 m² (12.0 sq ft)
Tailplane	1.67 m² (18.0 sq ft)
Elevators (total, incl tab)	1.67 m² (18.0 sq ft)

WEIGHTS AND LOADINGS (A: two-seat trainer, B: single-seat attack):

Weight empty, equipped (incl unusable fuel):	
A	1,288 kg (2,840 lb)
B	1,047 kg (2,308 lb)
Max usable internal fuel: A, B	908 kg (2,002 lb)
Max external stores load: A	277 kg (610 lb)
B	845 kg (1,864 lb)
Max T-O weight: A	2,645 kg (5,832 lb)
Max wing loading: A	210.9 kg/m² (43.2 lb/sq ft)
B	230.2 kg/m² (47.1 lb/sq ft)
Max power loading (J85-GE-5):	
A	203.45 kg/kN (1.99 lb/lb st)
B	222.01 kg/kN (2.18 lb/lb st)

PERFORMANCE (estimated: prototype with J85 engine at 2,645 kg; 5,832 lb max T-O weight):

Max level speed
at S/L, ISA 485 kts (899 km/h, 558 mph)
at 9 150 m (30,000 ft), ISA
450 kts (834 km/h, 518 mph)
Stalling speed, flaps down 78 kts (145 km/h, 90 mph)
Max rate of climb at S/L, ISA 2,134 m (7,000 ft)/min
Time to 9 150 m (30,000 ft) 7 min 12 s
T-O run at S/L, ISA 186 m (610 ft)
T-O to 15 m (50 ft) at S/L, ISA 402 m (1,320 ft)
Max range: internal fuel only, 10% reserves
950 n miles (1,760 km, 1 094 miles)
with c/l drop tank, no reserves
1,271 n miles (2 355 km, 1,463 miles)
Max endurance at 9 150 m (30 000 ft), 10% reserves
2 h 30 min

UPDATED

VENGA TIMBERWOLF/BAOSHAN SHAMAN

TYPE. Two-seat trainer (Shaman) or two/four seat sport aircraft (Timberwolf) with 70 per cent commonality

PROGRAMME. Announced at Asian Aerospace show, Singapore, February 1994. To be offered fully assembled or in kit form.

CURRENT VERSIONS. **Shaman:** Two-seat trainer or utility aircraft, with 89 5 to 104 kW (120 to 140 hp) piston engine constant chord wings and non-retractable landing gear

Timberwolf: Two/four seat sport or military aircraft, with 224 kW (300 hp) engine, laminar flow/supercritical wing and retractable gear

COSTS: Target prices (1994) $60,000 to 80,000 for Shaman. $120,000 to 130,000 for Timberwolf, kit versions $35,000 to 45,000

DESIGN FEATURES. Reinforced cabin surround; integral wing box fuel tank. Fuselage (aft of firewall), tail unit and canopy common to both versions.

STRUCTURE: All composites

ACCOMMODATION: Two seats side by side in Shaman, two in tandem or two side by side pairs in tandem in Timberwolf

DIMENSIONS, EXTERNAL (approx):
Wing span 7 92 m (26 ft 0 in)
Length overall 8 53 m (28 ft 0 in)
Height overall 2 74 m (9 ft 0 in)

DIMENSIONS, INTERNAL (approx):
Cockpit. Length 2 74 m (9 ft 0 in)
Width 1 07 m (3 ft 6 in)

WEIGHTS AND LOADINGS:
Max T-O weight less than 1,225 kg (2,700 lb)

PERFORMANCE (estimated):
Max level speed.
Shaman more than 122 kts (225 km/h, 140 mph)
Timberwolf 217 kts (402 km/h, 250 mph)
g limit +9/−9

UPDATED

IRAN

DORNA

H. F. DORNA COMPANY

4 Satary Street (PO Box 16315-345), Mirmotahary Avenue. Seyed Khandan, Tehran 15419
Telephone: 98 (21) 2278278
Fax: 98 (21) 8089120
MANAGING DIRECTOR: Y Antesary

Company established March 1989 (see 1991-92 *Jane's*) to specialise in aircraft design and development, and in composite materials technology. Current product is Dorna Two

NEW ENTRY

DORNA TWO

TYPE: Two-seat light aircraft

PROGRAMME: Launched beginning of 1994, prototype manufacture (two aircraft) started mid-1994, first flight planned June 1995. To be certificated to JAR-VLA standard by Iranian FAA

CUSTOMERS. Approximately 30 ordered by Autumn 1994 customer(s) not identified

COSTS: Programme cost by August 1994 $700,000; standard aircraft $90,000 to $100,000

DESIGN FEATURES: Conventional low-wing. fixed-gear lightplane, designed for low-cost, easy-to-fly/maintain operation. Wings have constant chord, NACA 63-215 aerofoil section, 2° 30' dihedral from roots and 2° incidence

FLYING CONTROLS: Conventional mechanical (push/pull rods for ailerons and elevators, cables for rudder); elevator electric trim, plain flaps

STRUCTURE: All-composites. Two-spar wing, single-spar horizontal tail, monocoque fuselage

LANDING GEAR: Non-retractable tricycle type, with Goodyear 5 00-5 tyres (6 ply on mainwheels, 4 ply on nosewheel). Cantilever self-sprung steel and composites leg on each unit. Cleveland mainwheel brakes

POWER PLANT: One Teledyne Continental IO-240 flat-four engine (93 2 kW, 125 hp at 2,800 rpm), driving an MT Propeller MT 170 or 180-30 fixed-pitch or MT 17-0/178-17 variable-pitch two-blade propeller. Fuel tank in each wing, combined capacity 128 7 litres (34 US gallons, 28 3 Imp gallons); gravity filling point on each tank. Oil capacity 6 litres (1 6 US gallons; 1.3 Imp gallons)

ACCOMMODATION: Two seats side by side, with baggage compartment aft of seats. Fully transparent canopy is hinged at rear and opens upward

SYSTEMS. Electrical system 12 V DC, powered by 60 A alternator and 35 Ah battery

AVIONICS: *Comms*: Radio
Instrumentation: Conventional VFR

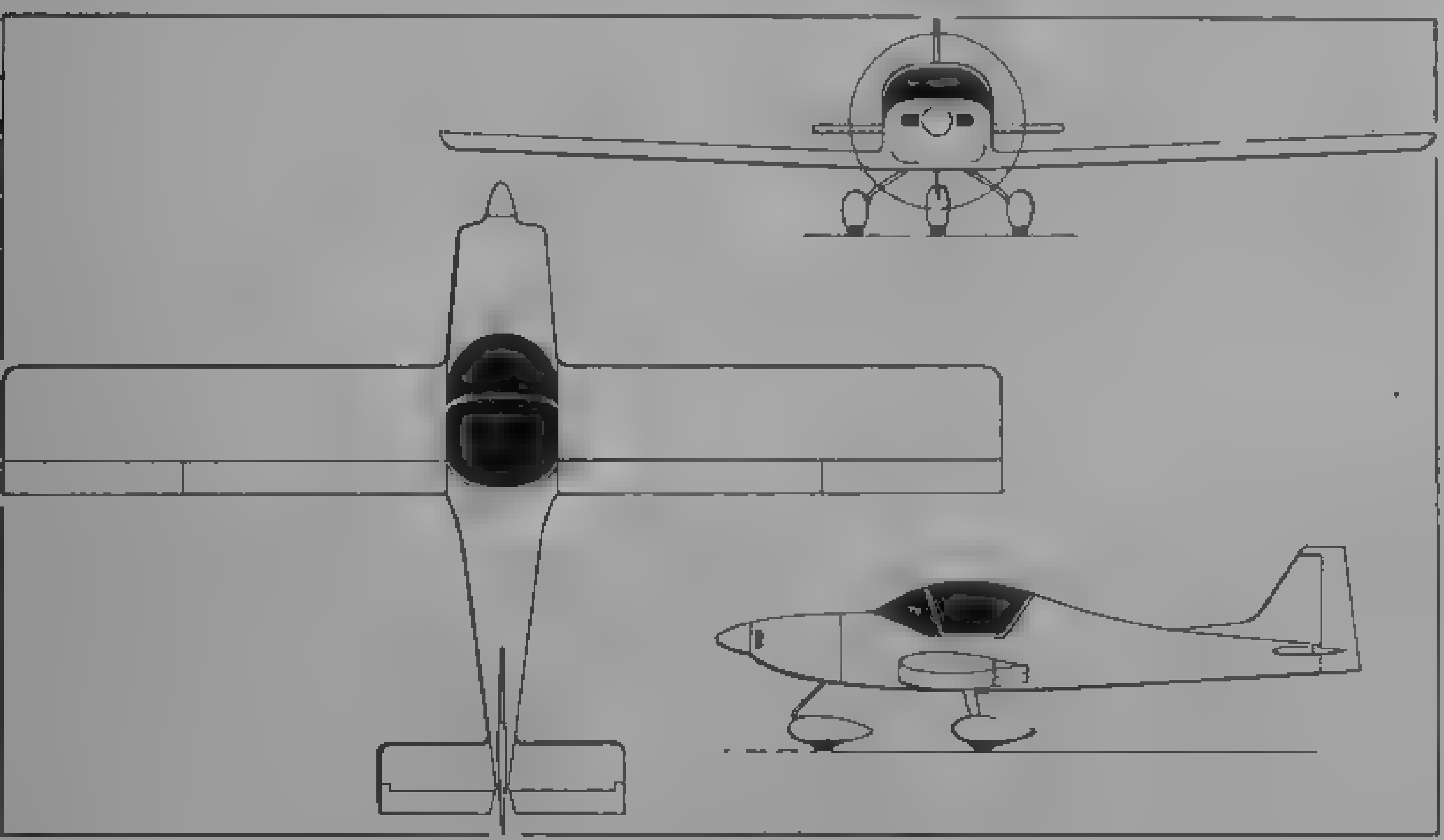
DIMENSIONS, EXTERNAL:
Wing span 9 30 m (30 ft 6¼ in)
Wing chord, constant 1 17 m (3 ft 10 in)
Wing aspect ratio 7 95
Length overall 6 017 m (19 ft 9 in)
Fuselage max width 1 00 m (3 ft 3¼ in)
Height overall 1 96 m (6 ft 5¼ in)
Tailplane span 2 25 m (7 ft 4½ in)
Wheel track 1,585 m (5 ft 2½ in)
Wheelbase 1 50 m (4 ft 11 in)
Propeller diameter 1.70 m (5 ft 7 in)
Propeller ground clearance 0 15 m (1 ft 7¾ in)

AREAS:
Wings, gross 10 88 m² (117.1 sq ft)
Ailerons (total) 1 00 m² (10.76 sq ft)
Trailing-edge flaps (total) 1 50 m² (16.15 sq ft)
Fin 0 84 m² (9.04 sq ft)
Rudder 0 40 m² (4 [illegible] sq ft)
Tailplane 1.43 m² (15.3[illegible] sq ft)
Elevators (total) 0.50 m² (5.38 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 398 kg (877 lb)
Max fuel weight 93 kg (205 lb)
Max T-O and landing weight 658 kg (1 450 lb)
Max wing loading 60 5 kg/m² (12.39 lb/sq ft)
Max power loading 7 06 kg/kW (11 60 lb/hp)

PERFORMANCE (estimated, at max T-O weight):
Never-exceed speed (VNE) 217 kts (402 km/h, 250 mph)
Max level speed at 3,660 m (12,000 ft)
174 kts (322 km/h, 200 mph)
Max cruising speed at 3,660 m (12,000 ft)
156 kts (290 km/h; 180 mph)
Econ cruising speed at 3,660 m (12,000 ft)
121 kts (225 km/h, 140 mph)
Stalling speed, flaps down 46 kts (84 km/h, 52 mph)
Max rate of climb at S/L 518 m (1,700 ft)/min
Service ceiling 4,265 m (14,000 ft)
T-O run 214 m (700 ft)
T-O to 15 m (50 ft) 390 m (1,278 ft)
Landing from 15 m (50 ft) 427 m (1,400 ft)
Landing run 244 m (800 ft)
Range with max fuel 782 n miles (1,448 km; 900 miles)

NEW ENTRY



Dorna Two two-seat light aircraft *(Jane's/James Goulding)*

1995

ISRAEL

IAI

ISRAEL AIRCRAFT INDUSTRIES LTD

Ben-Gurion International Airport, Israel 70100
Telephone: 972 (3) 9358509 and 9358514
Fax: 972 (3) 9358512
Telex: 381033 ISRAV IL
CHAIRMAN: Zvi Zur
PRESIDENT AND CEO: Moshe Keret
CORPORATE EXECUTIVE VICE-PRESIDENTS:
A. Ostrinsky
Dr M. Dvir
VICE-PRESIDENT, MARKETING: D. Onn
DIRECTOR OF CORPORATE COMMUNICATIONS: Doron Suslik

Founded 1953 as Bedek Aviation; ceased being unit of Ministry of Defence and became government owned corporation 1967, name changed to Israel Aircraft Industries 1 April 1967; number of divisions reduced from five to four February 1988 (Aircraft, Electronics, Technologies and Bedek Aviation).

Covered floor space 680,000 m² (7 32 million sq ft), total workforce 13,410 at beginning of 1995. Approved as repair station and maintenance organisation by Israel Civil Aviation Administration, US Federal Aviation Administration, UK Civil Aviation Authority and Israeli Air Force. Further restructuring took place 1994, but no details provided.

Products include aircraft of own design, in-house produced airframe systems and avionics, service, upgrading and retrofit packages for civil and military aircraft and helicopters; other activities include space technology, missile and ordnance development, and seaborne and ground equipment.

Aircraft Division
Follows this entry

Bedek Aviation Division
Follows Aircraft Division entry

Electronics Division
PO Box 105, Yahud Industrial Zone, Israel 56000
Telephone: 972 (3) 5315555 and 5314021
Fax: 972 (3) 5365205 and 5363975
Telex: 341450 MBT IL
GENERAL MANAGER: M. Ortasse

IAI's largest Division; covered floor area 150,000 m² (1,614,585 sq ft). Plants include Elta Electronic Industries (wholly owned subsidiary of IAI), MBT Systems and Space Technology, Tamam Precision Instruments Industries and MLM System Engineering and Integration. Division products include electronics and electro-optical systems and components, space technologies (including SDI environment) and wide range of civil and military hardware and software products and services. TR/TN90 family of strapdown inertial reference and navigation systems now upgraded to include

GPS receivers. Tamam producing laser night targeting system (NTS) for AH-1S attack helicopters of Israeli Air Force (40) and AH-1W SuperCobras of US Marine Corps, to replace M-65 TOW sighting system; first redelivery to Israeli Air Force 17 December 1992, first to USMC 1993

Technologies Division
Follows Bedek Aviation Division entry

UPDATED

AIRCRAFT DIVISION

Ben-Gurion International Airport, Israel 70100
Telephone: 972 (3) 9344136 and 9711471
Fax: 972 (3) 9721266
Telex: 381014 and 381033 ISRAV IL
GENERAL MANAGER: S. Alkon

Established February 1988. Five autonomous plants: Lahav, military aircraft; Matan, civil aircraft; Malat, unmanned air vehicles; Malkam, manufacturing; Tashan, engineering and testing. Military aircraft plant operating third Lavi prototype as advanced combat technology demonstrator. Civil work includes production of Astra, support for IAI Arava and Westwind and development of Astra Galaxy. Manufacturing plant produces structural components for foreign and domestic customers. Engineering services include analysis, design, development, integration and testing of platforms and systems for domestic and foreign military and civil customers.

VERIFIED

IAI 1125 ASTRA SP and SPX

TYPE: Twin-turbofan business transport.

PROGRAMME: Descendant of US Aero Commander 1121 Jet Commander (first flight 27 January 1963), acquired by IAI 1967 and developed successively as 1121 Commodore Jet, 1123 and 1124 Westwind and 1124A Westwind 2; 1125 model launched at NBAA October 1979, renamed Astra 1981; construction of two prototypes and one static/fatigue test aircraft started April 1982, roll-out 1 September 1983, first flight (4X-WIN, c/n 4001) 19 March 1984, first flight 4X-WIA (c/n 4002) August 1984, first flight production Astra (4X-CUA, 20 March 1985, FAR Pts 25 and 36 certification 29 August 1985, first delivery 30 June 1986. Astra SP introduced at NBAA October 1989, first delivery of this version, N60AJ (c/n 042) late 1990. Astra SPX announced at NBAA 1994. Production to continue alongside Galaxy (which see).

CURRENT VERSIONS: **Astra**: Initial production version; see 1992-93 and earlier *Jane's*.

Astra SP: New interior, upgraded avionics with Collins digital autopilot and EFIS, aerodynamic refinements for high-altitude performance; range with NBAA reserves extended by 63 n miles (117 km; 72 miles). *Detailed description applies to this version except where indicated.*

Astra SPX: First flight (4X-WIX, c/n 073) 18 August 1994, available from late 1995. Winglets and Collins Pro Line 4 avionics. Change to AlliedSignal TFE731-40R-200G turbofans of 18.90 kN (4,250 lb st) with FADEC, hydromechanical fuel control back-up and Dee Howard thrust reversers increases weights and payload/range performance and shortens T-O run.

Astra Galaxy: Improved and redesigned version described separately.

CUSTOMERS: Earlier sales of 1121/23/24/24A models by Aero Commander and IAI totalled 441 by end of 1987; combined production of Astra and Astra SP totalled 76 by February 1995, of which approximately 90 per cent to US customers. Eight sold in 1994, including first two Astra SPXs, ordered by Hewlett-Packard December 1994 for 1996 delivery.

COSTS: Astra SP $7,537,200 (1992); SPX $8.3 million (1994).

DESIGN FEATURES: Wing section high-efficiency IAI Sigma 2; leading-edge sweep 34° inboard, 25° outboard, trailing-edge sweep on outer panels.

FLYING CONTROLS: Control surfaces operated by pushrods and hydraulically powered, tailplane incidence controlled by three motors running together to protect against runaway or elevator disconnect; ailerons can be separated in case of jam; spoiler/lift dumper panels ahead of Fowler flaps, dual actuated rudder trim tab, flaps interconnected with leading-edge slats, both electrically actuated.

STRUCTURE: One-piece, two-spar wing with machined ribs and skin panels, attached by four main and five secondary frames; wing/fuselage fairings, elevator and fin tips and tailcone of GFRP; ailerons, spoilers, inboard leading-edges and wingtips of Kevlar and Nomex honeycomb, nose avionics bay door and nosewheel doors of Kevlar, Kevlar reinforced nacelle doors and panels, chemically milled fuselage skins; some titanium fittings, heated windscreens of laminated polycarbonate with external glass layer to resist scratching.

LANDING GEAR: SHL hydraulically retractable tricycle type, with oleo-pneumatic shock absorber and twin wheels on each unit. Trailing-link main units retract inward, nosewheels forward. Tyre sizes 23 × 7 in (main), 16 × 4.4 in (nose). Hydraulic extension, retraction and nosewheel steering; hydraulic multidisc anti-skid mainwheel brakes. Compressed nitrogen cylinder provides additional power source for emergency extension.

POWER PLANT: Two 16.46 kN (3,700 lb st) AlliedSignal TFE731-3C-200G turbofans, with Northrop Grumman hydraulically actuated target type thrust reversers, pylon mounted in Northrop Grumman nacelle on each side of rear fuselage. Standard fuel in integral tank in wing centre-section, two outer-wing tanks, and upper and lower tanks in centre-fuselage (combined usable capacity 4,910 litres; 1,297 US gallons; 1,080 Imp gallons). Additional fuel can be carried in 378.5 litre (100 US gallon; 83.3 Imp gallon) removable auxiliary tank in forward area of baggage compartment. Single pressure refuelling point in lower starboard side of fuselage aft of wing, or single gravity point in upper fuselage, allow refuelling of all tanks from one position. Fuel sequencing automatic.

ACCOMMODATION: Crew of two on flight deck. Dual controls standard. Sliding door between flight deck and cabin. Standard accommodation in pressurised cabin for six persons, two in forward facing seats at front and four in club layout, galley (port or starboard) at front of cabin, coat closet forward (starboard), toilet at rear. All six seats individually adjustable fore and aft, laterally, and can be swivelled or reclined, all fitted with armrests and headrests. Two wall-mounted foldaway tables between club seat pairs. Coat closet houses stereo tape deck. Maximum accommodation for nine passengers.

Plug type airstair door at front on port side; emergency exit over wing on each side. Heated baggage compartment aft of passenger cabin, with external access. Service compartment in rear fuselage houses aircraft batteries (or optional APU), electrical relay boxes, inverters and miscellaneous equipment. Cabin soundproofing improved compared with Westwind 2.

SYSTEMS: AiResearch environmental control system, using engine bleed air, with normal pressure differential of 0.615 bar (8.9 lb/sq in). AlliedSignal GTCP36-150(W) APU available optionally. Two independent hydraulic systems each at pressure of 207 bars (3,000 lb/sq in). Primary system operated by two engine-driven pumps for actuation of anti-skid brakes, landing gear, nosewheel steering, spoilers/lift dumpers and ailerons. Back-up system, operated by electrically driven pump, provides power for emergency/parking brake, ailerons and thrust reversers.

Electrical system comprises two 300 A 28 V DC engine-driven starter/generators, with two 1 kVA single-phase solid-state inverters operating in unison to supply single-phase 115 V AC power at 400 Hz and 26 V AC power for aircraft instruments. Two 24 V Ni/Cd batteries for engine starting and to permit operation of essential flight instruments and emergency equipment. 28 V DC external power receptacle standard.

Pneumatic de-icing of wing leading-edge slats and tailplane leading-edges; thermal anti-icing of engine intakes. Oxygen system for crew (pressure demand) and passengers (drop-down masks) supplied by 1.35 m³ (48 cu ft) cylinder. Two-bottle Freon type engine fire extinguishing system standard.

AVIONICS: *Comms:* Dual Collins VHF-22A radios and TDR-90 transponders, dual Baker audio systems.

Radar: Collins WXT-250A colour weather radar.

Flight: Collins VIR-32 nav, DME-42, RMI-36, C-14 compass systems and FCS-80 flight director systems (all dual), Collins APS-85 autopilot, ADS-85 air data system, AHS-85 AHRS, VNI-80D vertical nav system, ADF-60A and ALT-50A radio altimeter. Provisions for GNS-1000, GNS-X or UNS-1A flight management system.

Instrumentation: Collins five-tube EFIS-86C standard.

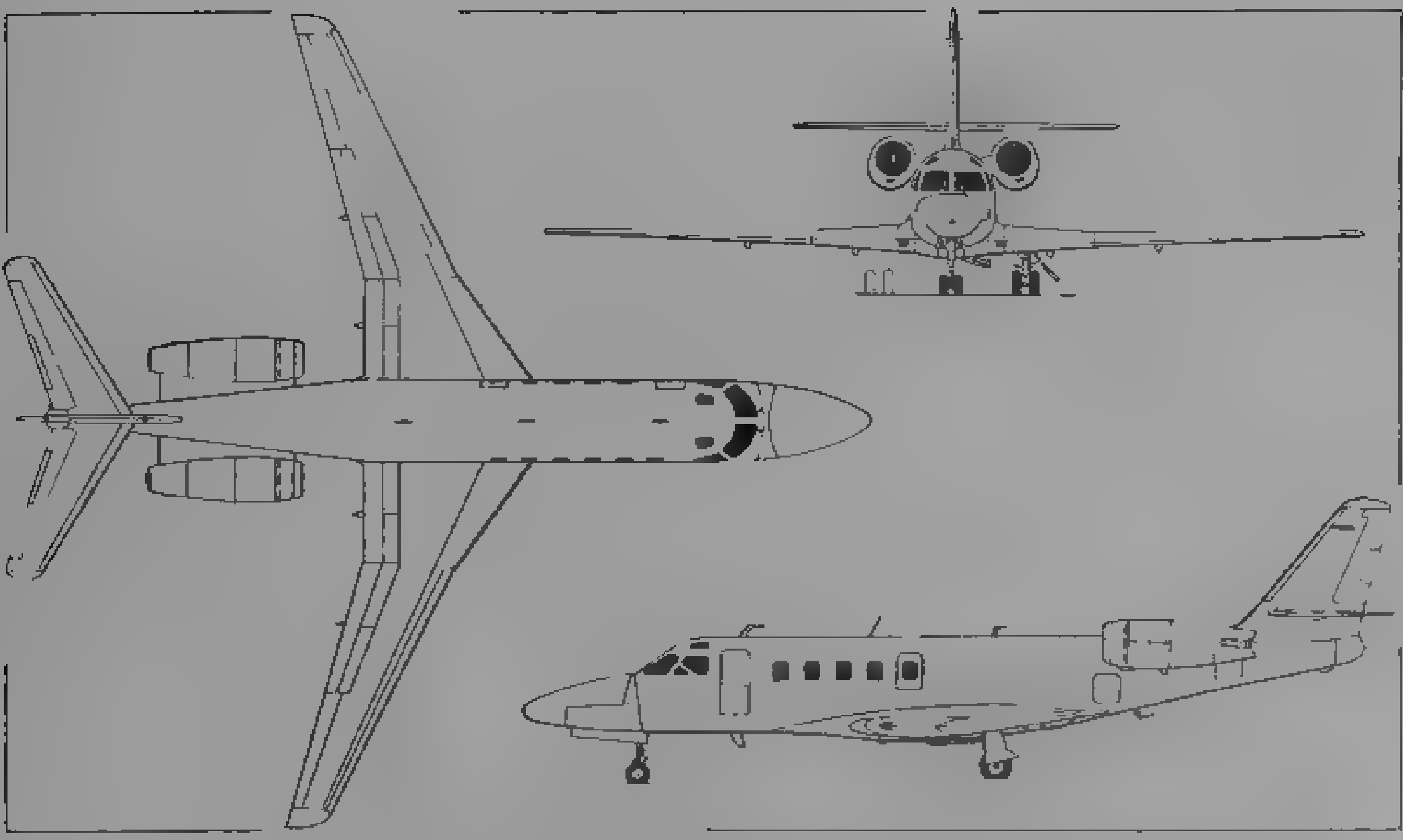
EQUIPMENT: Standard equipment includes electric windscreen wipers, electric (warm air) windscreen demisting, cockpit and cabin fire extinguishers, axe, first aid kit, wing ice inspection lights, landing light in each wingroot, taxying light inboard of each mainwheel door, navigation and strobe lights at wingtips and tailcone, rotating beacons under fuselage and on top of fin, and wing/tailplane static wicks.

DIMENSIONS, EXTERNAL:

Wing span	16.05 m (52 ft 8 in)
Wing aspect ratio	8.76
Length overall	16.94 m (55 ft 7 in)

IAI 1125 Astra SP twin-turbofan business transport

1994



IAI 1125 Astra SP business transport (two AlliedSignal TFE731 3A-200G turbofans)
(Jane's/Dennis Punnett)

1993

Fuselage: Max width 1.57 m (5 ft 2 in)
Max depth 1.905 m (6 ft 3 in)
Height overall 5.54 m (18 ft 2 in)
Tailplane span 6.40 m (21 ft 0 in)
Wheel track (c/l of shock-struts) 2.77 m (9 ft 1 in)
Wheelbase 7.34 m (24 ft 1 in)
Passenger door (fwd, port): Height 1.37 m (4 ft 6 in)
Width 0.66 m (2 ft 2 in)
Overwing emergency exits (each):
Height 0.69 m (2 ft 3 in)
Width 0.48 m (1 ft 7 in)

DIMENSIONS, INTERNAL:
Cabin: Length, incl flight deck 6.86 m (22 ft 6 in)
excl flight deck 5.23 m (17 ft 2 in)
Max width 1.50 m (4 ft 11 in)
Max height 1.70 m (5 ft 7 in)
Baggage compartment volume 1.56 m³ (55 cu ft)

AREAS:
Wings, gross 29.40 m² (316.5 sq ft)

WEIGHTS AND LOADINGS (Astra SP, A: without, B: with, long-range fuel tank):
Basic operating weight empty 5,999 kg (13,225 lb)
Max usable fuel: A 3,942 kg (8,692 lb)
B 4,248 kg (9,365 lb)
Fuel with max payload: A, B 3,470 kg (7,650 lb)
Max payload: A, B 1,259 kg (2,775 lb)
Max ramp weight: A, B 10,727 kg (23,650 lb)
Max T-O weight: A, B 10,659 kg (23,500 lb)
Max landing weight: A, B 9,389 kg (20,700 lb)
Max zero-fuel weight: A, B 7,257 kg (16,000 lb)
Max wing loading: A, B 362.4 kg/m² (74.23 lb/sq ft)
Max power loading: A, B 323.8 kg/kN (3.18 lb/lb st)

WEIGHTS AND LOADINGS (Astra SPX):
Weight empty, equipped 7,711 kg (17,000 lb)
Max usable fuel as for SP
Max payload 1,500 kg (3,307 lb)
Max T-O weight 11,181 kg (24,650 lb)
Max landing weight as for SP
Max wing loading 380.31 kg/m² (77.89 lb/sq ft)
Max power loading 295.9 kg/kN (2.90 lb/lb st)

PERFORMANCE (Astra SP, at max T-O weight ISA except where indicated):
Max cruising speed at 10,670 m (35,000 ft), AUW of 7,257 kg (16,000 lb) 463 kts (858 km/h; 533 mph)
Max operating speed (V_{MO}/M_{MO}):
S/L to 7,620 m (25,000 ft)
363 kts (673 km/h; 418 mph) IAS
above 7,620 m (25,000 ft) Mach 0.855
Stalling speed at max landing weight:
flaps and gear up 111 kts (206 km/h; 128 mph)
flaps and gear down 92 kts (171 km/h; 106 mph)
Max rate of climb at S/L 1,112 m (3,650 ft)/min
Rate of climb at S/L, OEI 335 m (1,100 ft)/min
Max certificated altitude 13,715 m (45,000 ft)
Service ceiling, OEI 5,790 m (19,000 ft)
FAR 25 balanced field length
S/L, ISA 1,600 m (5,250 ft)
S/L, ISA + 27°C 976 m (3,200 ft)
FAR 25 landing field length at S/L at max landing weight
829 m (2,720 ft)
Range with four passengers, 45 min VFR reserves
2,814 n miles (5,211 km; 3,238 miles)

PERFORMANCE (Astra SPX, estimated):
Max operating Mach number 0.87
Max cruising speed 470 kts (870 km/h; 540 mph)
Econ cruising speed 432 kts (800 km/h; 497 mph)
Max rate of climb at S/L 1,160 m (3,805 ft)/min
Rate of climb at S/L, OEI 411 m (1,348 ft)/min
Service ceiling 13,715 m (45,000 ft)
T-O run 1,510 m (4,955 ft)
Range: with eight passengers
2,286 n miles (4,235 km; 2,631 miles)
with max fuel 3,026 n miles (5,605 km; 3,482 miles)

OPERATIONAL NOISE LEVELS (Astra SP, FAR 36 at max T-O weight, estimated):
T-O, normal 89.9 EPNdB
with thrust cutback 84.1 EPNdB
Approach 89.8 EPNdB
Sideline 89.7 EPNdB

UPDATED

IAI ASTRA GALAXY

TYPE: Twin-turbofan business and commuter transport.

PROGRAMME: Initiated as derivative of Astra SP; design (then called Astra IV) finalised late 1992 in anticipation of 1993 launch; co-production with Yakovlev of Russia discussed during early part of 1993; formal announcement of launch as Galaxy, with minor design changes, announced 20 September 1993 just before NBAA convention in Atlanta, Georgia, USA, followed next day by news that Yakovlev to be risk-sharing partner; other partners to be Rockwell Collins (avionics supplier) and eventual engine manufacturer (P&WC since selected). Additional risk-sharing partner(s) being sought Spring 1995. First flight scheduled for early 1996, with certification to FAR Pt 25 Amendment 75 and FAR Pts 34 and 36 one year later, permitting service entry 1997.

CURRENT VERSIONS: Seen as four/eight-passenger business/executive (standard model), with option of alternative interior seating up to 19 passengers for regional transport operation.

CUSTOMERS: IAI estimates break-even at 100 sales and potential market for 200. Deposits for 15 aircraft reported by February 1994.

COSTS: Approximately $13 million flyaway (1992); total programme cost approximately $152 million.

DESIGN FEATURES: Designed for transatlantic range (non-stop Paris to New York). Essentially same wing as Astra SP, except for addition of winglets and Krueger flaps; new widebody fuselage, longer and with more headroom. Some wing and fuselage components to be manufactured by GAMESA in Spain; wings, final assembly and certification by IAI.

POWER PLANT: Two Pratt & Whitney Canada PW306A turbofans, each flat rated at 25.4 kN (5,700 lb st), pylon-mounted on sides of rear fuselage. Fuel capacity 7,882 litres (2,080 US gallons; 1,732 Imp gallons).

ACCOMMODATION: Standard club-type seating for four to eight persons in business/executive version; legroom between facing seats allows enough space for full reclining and berthing; spacious galley with room for refrigerator, microwave oven, coffee maker and storage. Three-abreast seating for up to 19 passengers, with single aisle, in regional airliner configuration. Generous baggage compartment in rear fuselage, accessed by external airstair door, can accommodate baggage for all 19 passengers. Entire accommodation, including baggage compartment, is pressurised.

AVIONICS: All-digital Rockwell Collins Pro Line 4 state standard.

DIMENSIONS, EXTERNAL:
Wing span 17.42 m (57 ft 2 in)
Length overall 19.30 m (63 ft 4 in)
Height overall 6.40 m (21 ft 0 in)
Tailplane span 6.40 m (21 ft 0 in)

DIMENSIONS, INTERNAL:
Cabin:
Length: incl flight deck 9.25 m (30 ft 4 in)
excl flight deck 7.39 m (24 ft 3 in)
Max width 2.18 m (7 ft 2 in)
Max height 1.91 m (6 ft 3 in)
Baggage compartment volume 3.68 m³ (130 cu ft)

WEIGHTS AND LOADINGS (estimated):
Weight empty, equipped 8,060 kg (17,770 lb)
Max fuel weight 6,327 kg (13,950 lb)
Max payload 1,905 kg (4,200 lb)
Max T-O weight 15,172 kg (33,450 lb)
Max landing weight 12,474 kg (27,500 lb)
Max power loading 299.4 kg/kN (2.93 lb/lb st)

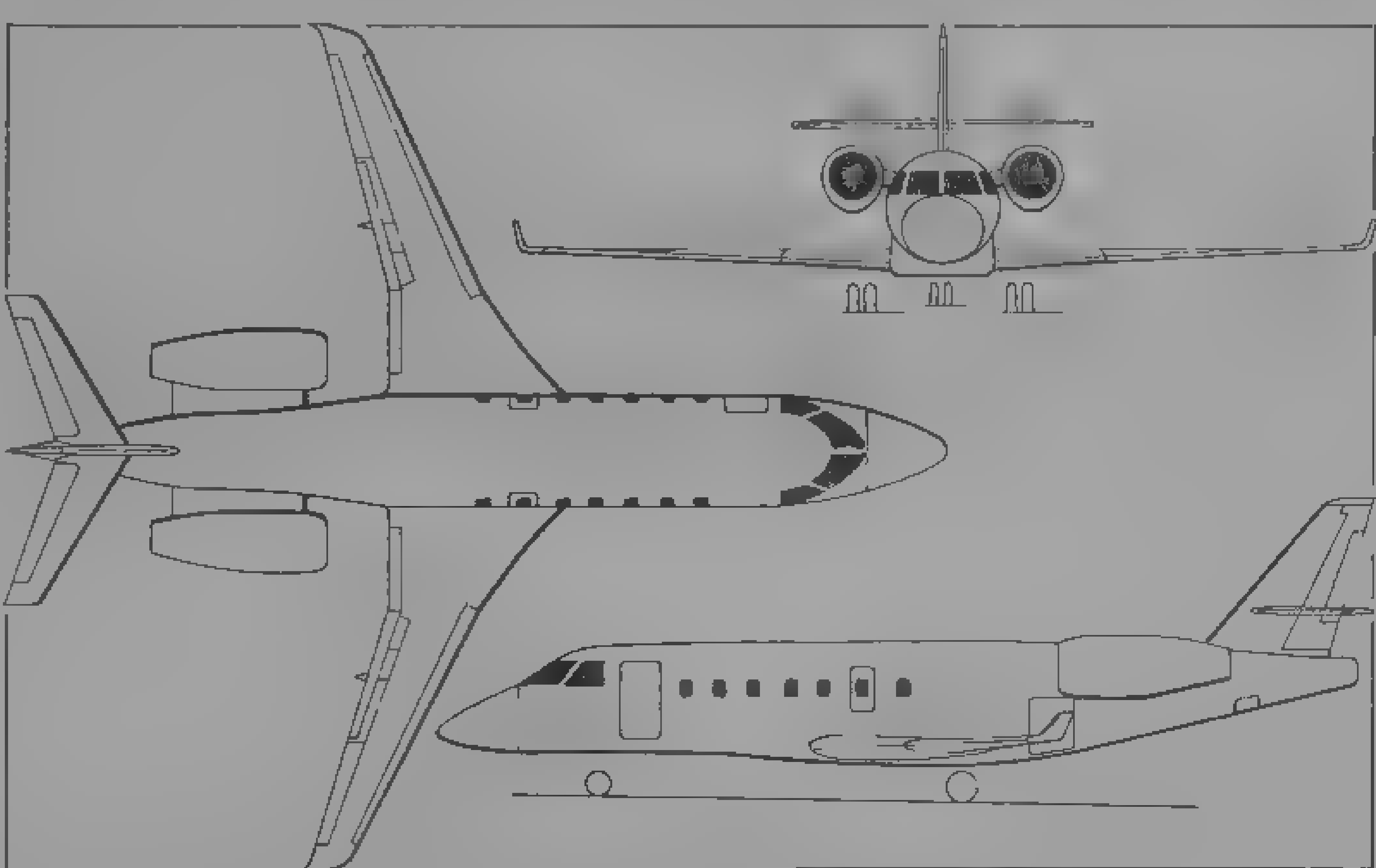
PERFORMANCE (design):
Max operating Mach number (M_{MO}) 0.85
Max cruising Mach number (M_{MC}) 0.75
Max operating speed (V_{MO})
360 kts (667 km/h; 414 mph) IAS
Max cruising speed (V_{MC}) 475 kts (880 km/h; 547 mph)
Long-range cruising speed 430 kts (797 km/h; 495 mph)
Max operating altitude 13,715 m (45,000 ft)
T-O balanced field length 1,838 m (6,030 ft)
Landing balanced field length 1,037 m (3,400 ft)
Range with four passengers, NBAA IFR reserves
3,700 n miles (6,852 km; 4,258 miles)

UPDATED

OTHER AIRCRAFT

Readers are now referred to *Jane's Aircraft Upgrades* for descriptions of the IAI TD (Technology Demonstrator) and Kfir; last full descriptions in *Jane's* appeared in the 1991-92 edition.

NEW ENTRY



Preliminary drawing of the IAI Astra Galaxy twin-turbofan business and commuter transport
(Jane's/Mike Keep)

1994

BEDEK AVIATION DIVISION

Ben-Gurion International Airport, Israel 70100
Telephone: 972 (3) 9358964
Fax: 972 (3) 9712298
Telex: 381014 and 381033 ISRAV IL
GENERAL MANAGER: A. Raz (Brig Gen Retd)

Internationally approved as single site civil and military airframe, power plant, systems and accessory service and upgrading centre, plants are Matam (aircraft services and infrastructure), Shaham (aircraft maintenance and upgrading), Masham (engine maintenance) and Mashav (components maintenance). Covered floor space 110,000 m² (1,184,030 sq ft).

Current programmes (actual or available) include upgrades of various combat aircraft, and modification of large transports to passenger/cargo, tanker, AEW and reconnaissance configurations, as detailed in the 1994-95 and previous editions of *Jane's*. These programmes are now covered in our sister yearbook *Jane's Aircraft Upgrades*. More than 25 types of aircraft being handled, including Boeing 707/727/737/747/767, McDonnell Douglas DC-8/-9/-10 and Lockheed C-130; combat aircraft include A-4 Skyhawk, F-4 Phantom, F-5, F-15 Eagle, F-16 Fighting Falcon, various MiG fighters and Mirage III/5, 30 types of civil and military engine include JT3D, JT8D, JT9D, F100, J79, Atar 9C/9K-50, TFE731, T56, PT6, Allison 250, T53 and T64, more than 6,000 types of accessory and instruments serviced; Bedek provides total technical support and holds warranty and/or approved service centre appointments for domestic and foreign regulatory agencies, air arms and manufacturers, approving agencies include Israeli CAA, Israeli Air Force, US military, US FAA, UK CAA and German LBA.

UPDATED

Nose and side antennae of the Phalcon 707 *(Paul Jackson)*

1995

IAI (BOEING) PHALCON 707

TYPE: Airborne early warning conversion of Boeing 707.

PROGRAMME: Boeing 707-320C airframe supplied by Chile; IAI Elta Electronics is prime contractor for system installation, first flight (4X-JYI) 12 May 1993; public debut Paris Air Show 14 June 1993, flight testing nearing completion February 1994, delivery to Chile made on 2 May 1995 after delays attributed to mission system software problems.

CUSTOMERS: Chilean Air Force (one). Reported Israeli Air Force interest in system, with Airbus A321 being considered as possible platform aircraft in late 1994.

COSTS: Conversion for Chilean Air Force reportedly $150 million (1995).

DESIGN FEATURES: First operational AEW aircraft to use solid state phased-array radar technology. Phalcon system can be installed in several different configurations. Maximum configuration for 360° azimuth coverage utilises four phased-array conformal antennae along fuselage sides: one, size 12 × 2 m (39.37 × 6.56 ft), in 0.46 m (1 ft 6 in) deep box on each side forward of wing, and one, size 4 × 2 m (13.12 × 6.56 ft), in similar box each side aft of wing plus 3 m (9.84 ft) diameter antenna in enlarged bulbous nose and a sixth antenna under tail. System can be installed in aircraft of various sizes, from Boeing 747 to Lockheed C-130 or smaller.

ACCOMMODATION: Flight crew plus workstations for mission crew of 13 (mission commander; five radar operators, one each ESM, elint, communications, communications support and datalink management, plus two for test equipment).

AVIONICS (Chilean Phalcon 707): *Comms:* IAI Elta EL/K-7031 HF/VHF/UHF comint system; solid-state IFF.

Radar: IAI Elta EL/2075 D-band phased-array radar (detection/tracking range up to 200 n miles, 370 km, 230 miles), rear fuselage and undertail antennae not fitted thus providing only 260° coverage. Each array contains several hundred discrete liquid-cooled transmit/receive (T/R) modules and is scanned electronically, allowing allocation of energy when and where needed. Targets can typically be detected, acquired and confirmed in 2 to 4 seconds.

Mission: C-band (UHF) data uplink/downlink, MIL-STD-1553B databus.

Self-defence: IAI Elta EL/L-8312 ESM/elint system, with conformal antennae at each wingtip and in nose and tail positions.

PERFORMANCE

Nominal mission endurance	8-10 h

UPDATED

Boeing 707 reconfigured by Israel Aircraft Industries for the Chilean Air Force with Elta Phalcon AEW system

1994

TECHNOLOGIES DIVISION

PO Box 190, Lod Industrial Zone, Lod 71101
Telephone: 972 (8) 239111 and 223050
Fax: 972 (8) 222792
Telex: 381520 SHLD IL
GENERAL MANAGER: David Arzi

Division runs four plants: SHL (Servo Hydraulics Lod), Ramta Structures and Systems, MATA Helicopters and Golan Industries.

SHL designs and produces hydraulic system components, flight control servos, landing gears and brake systems, air actuated chucks, miniature gears, clutches and brakes. Products fitted in Kfir, Arava, Westwind, Astra, IDF Black Hawks. Manufacturing approvals include Boeing, Dornier, Lockheed Fort Worth and General Electric.

Ramta makes metal and advanced composites structures for F-4, F-16, E-2C, Kfir, Westwind and Astra, as well as ground vehicles and patrol boats.

MATA repairs, modifies and remanufactures helicopter structures and components and produces equipment and systems for helicopters, see 1994-95 edition and *Jane's Aircraft Upgrades* for recent **Yasur (Albatross) 2000** upgrade of IDF CH-53Ds. Other recent contracts include upgrade of two Agusta Bell 212s for Venezuelan Navy. MATA also has agreement with LHTEC to collaborate on Huey 800 upgrade programme. Its subsidiary Golan designs and produces aircraft crew and passenger seats (including crashworthy troop seats for Bell/Boeing V-22 Osprey), aircraft wheels and cockpit controls. Current contract for components and seats for McDonnell Douglas Explorer helicopter.

UPDATED

ISRAVIATION

ISRAVIATION LTD

PO Box, 90001, Industrial Park, Tel-Hai, Upper Galilee 12100
Telephone 972 (6) 949033
Fax 972 (6) 950173
PRESIDENT: Stephane Juffa
VICE-PRESIDENT AND CHIEF ENGINEER: Dany Kleiman
MARKETING: **Euraviation SA**, 7 Roi Victor Amé, CH 1227 Geneva, Switzerland
Telephone: 41 (22) 342 2488
Fax: 41 (22) 342 3161
GENERAL MANAGER: Eric del Marmol

UPDATED

ISRAVIATION ST-50

TYPE: Five-seat, single-turboprop business aircraft; world marketing by Euraviation SA, Switzerland, and in USA by Cirrus Design Corporation (which see).

PROGRAMME: Development rights to ST 50 acquired from Cirrus Design Corporation on 8 July 1992; proof of concept (POC) ST 50 completed in USA by Cirrus and Isravation engineers and made first flight (N50ST) 7 December 1994; transferred to Israel and reassembled at Kiryat-Shemona May 1995; damaged in forced landing, 19 May; Isravation meanwhile building two (first is 4X-A1X) turboprop-powered versions of similar Cirrus VK30, designated ST-40, these to be followed by two ST-50s as certification and production prototypes; simultaneous Israeli and US certification planned to FAR Pt 23, Amendment 45, Normal category in 1996; series production of ST-50 to start second half of 1995, first deliveries 1996.

CURRENT VERSIONS: **ST-40**: Turboprop-powered VK30.

ST-50: Intended production version. *Detailed description applies to this version.* Future versions under consideration for airline pilot training, photo-mapping and small package cargo transport.

COSTS: $1 million, flyaway.

DESIGN FEATURES: All-composites, single-turboprop pusher design; wing planform and aerofoil sections selected for stable low-speed characteristics and low drag at normal cruising speeds; straight-tapered, unswept low wing with dihedral 4° 30′ from roots; no tailplane dihedral; separate fins and rudders above and below fuselage (lower portion serves as over-rotation bumper and propeller strike protector).

FLYING CONTROLS: Conventional mechanical via push/pull rods and/or steel cables. Ailerons aerodynamically and mass balanced; elevator has electric pitch trim; electric aileron trim tabs optional. Flaps, actuated electrically, can be partially deflected for T-O; landing flap setting approximately 38°, relative to wing chord.

STRUCTURE: One-piece wing (two C-section carbonfibre spars, rear auxiliary spar and front shear web), with integral fuel tank, aileron and 35 per cent chord Fowler flap in each half. Semi-monocoque pressurised fuselage. Primary structure built from glass prepreg fabrics laid-up on female moulds; all exterior skins of co-cured glassfibre and rigid urethane sandwich. Carbonfibre flaps, glassfibre ailerons, primary tail assembly of composite sandwich ribs and skins; underside vertical tail surfaces of composites and polyurethane foam.

LANDING GEAR: Retractable tricycle type, actuated hydraulically, with single wheel and oleo-pneumatic shock-strut on each unit. Nose gear retracts rearward, trailing-link main gear inward into wings and fuselage. Nosewheel steerable by rudder pedals and by differential braking. Hydraulic mainwheel brakes and parking brake.

POWER PLANT: One Pratt & Whitney Canada PT6A 135/7 turboprop, flat rated at 373 kW (500 shp), with planetary reduction gearing via Kamatics driveshaft to an MT Propeller MTV-9-ECFR three-blade, constant-speed, fully feathering pusher propeller with reverse pitch and beta control. Maximum propeller speed, 1,900 rpm. Engine installed aft of rear pressure bulkhead; has ventral scoop air inlet with de-iced lip.

Fuel in two 303 litre (80 US gallon; 66.6 Imp gallon) integral wing tanks and 57 litre (15 US gallon; 12.5 Imp gallon) fuselage tank, giving total capacity of 663 litres (175 US gallons; 145.7 Imp gallons), of which 643.5 litres (170 US gallons; 141.5 Imp gallons) are usable. Fuel tanks not pressurised. Oil capacity 8.7 litres (2.3 US gallons; 1.9 Imp gallons).

ACCOMMODATION: Intended for single-pilot, all-weather operation. Pilot and co-pilot or passenger side by side in front, three-place bench seat behind. Crew seats have reclining backrests, fore and aft tracking, vertical adjustment, flip-up bottoms for egress, and five-point restraints. Bench seat has three separate reclining backrests with four-point restraints for each passenger; centre seat embodies fold-out table. Baggage compartment, capacity 136 kg (300 lb), aft of bench seat. Downward-opening crew/passenger door, with integral folding stairs, forward of wing on port side; emergency exit opposite cabin door, starboard side.

SYSTEMS: Environmental control system for aircraft heating (by engine bleed air), cooling (electrically driven vapour cycle) and pressurisation (maximum differential 0.41 bar; 6.0 lb/sq in). Emergency oxygen system for crew and passengers. Hydraulic system for landing gear actuation; separate, independent hydraulic system for brakes. Fire and lightning protection systems.

Single-voltage (28 V DC) electrical system, powered by 250 A engine-driven starter/generator, 130 A alternator and 24 V 43 Ah lead-acid battery; essential bus powers flaps, trim, landing gear, standby fuel pump, de-icing, landing light and other flight essential equipment; non-essential bus powers air conditioning, lighting and other less critical items; two other buses provide redundancy for avionics.

De-icing system (type to be decided) for wing, tailplane and fin leading-edges, windscreen, engine air inlet, nose, pitot static ports and AoA probes. Anti-collision strobe light in each wingtip; two white anti-collision lights in tail; 250 W landing light; 150 W taxi light in nosewheel strut; wing de-icing inspection light in port side of fuselage. Internal instrument panel, cockpit and cabin lighting, including overhead reading light for each occupant.

AVIONICS: Arnav Systems ICDS-2000 integrated suite including four-tube EFIS panel (two primary flight displays, one multifunction display and EICAS, each 200 × 150 mm; 5.1 × 3.8 in).

Comms: Bendix/King dual KX 155 760-channel transceivers and KT 70 transponder.

Radar: Provision for weather radar.

Flight: Two-axis autopilot, Bendix/King KA 134 altimeter; flight management system. Fibre optic gyro AHRS optional.

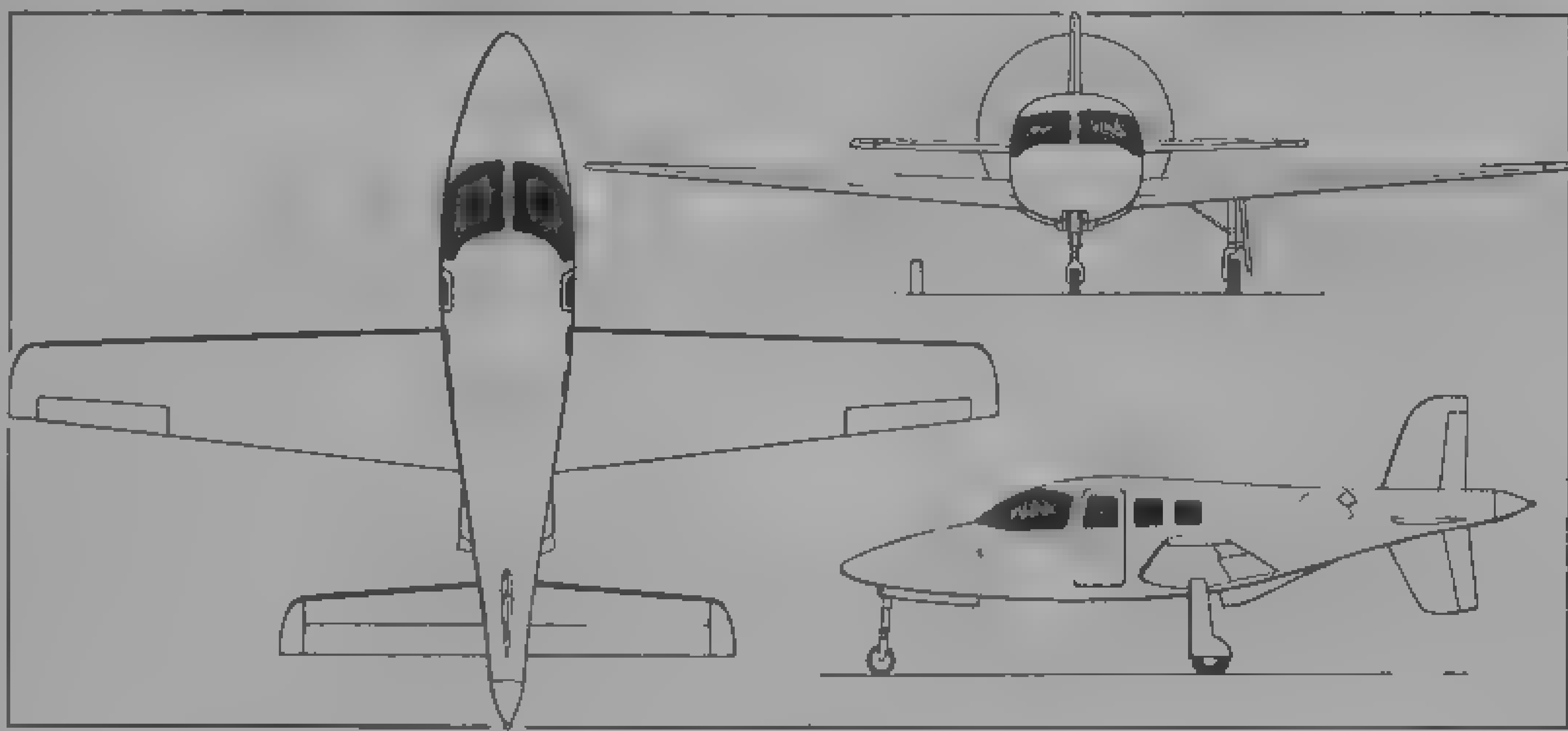
Instrumentation: Full VFR/IFR, plus pilot's standby flight instruments.

DIMENSIONS, EXTERNAL:

Wing span	11.89 m (39 ft 0 in)
Length overall	7.92 m (26 ft 0 in)
Height overall	3.56 m (11 ft 8 in)
Tailplane span	5.38 m (17 ft 8 in)
Wheel track	3.21 m (10 ft 6½ in)
Wheelbase	3.68 m (12 ft 1 in)
Propeller diameter	2.24 m (7 ft 4 in)
Propeller ground clearance	0.89 m (2 ft 11 in)
Cabin door: Height	1.37 m (4 ft 6 in)
Max width	0.61 m (2 ft 0 in)

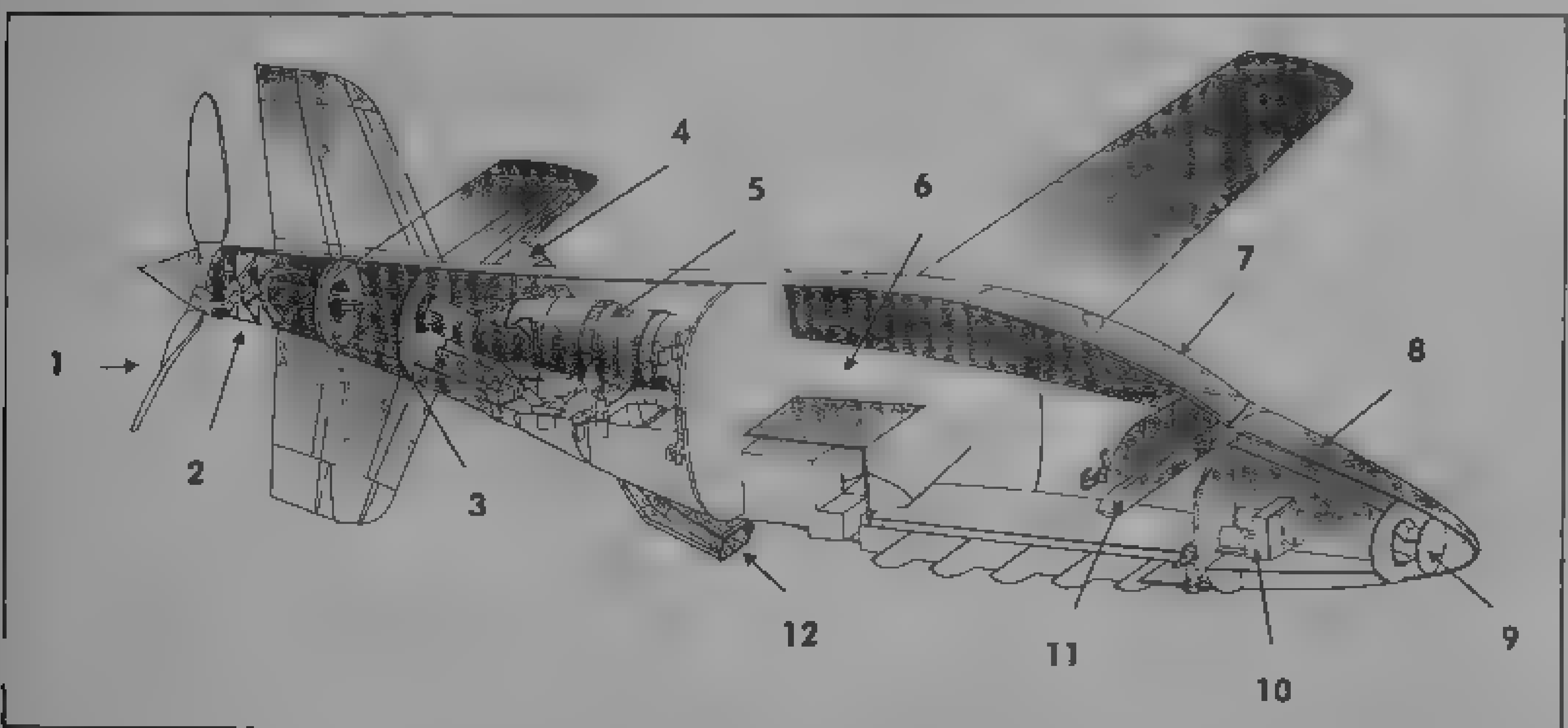
US built proof-of-concept ST 50 on an early test flight

1995



Isravation ST-50 five-passenger business aircraft *(Jane's/Mike Keep)*

1995



Cutaway drawing of the ST-50's main features

1: pusher propeller, 2: propeller housing, 3: driveshaft, 4: exhaust, 5: engine, 6: pressurised cabin, 7: stretched acrylic windscreen, 8: avionics compartment, 9: weather radar, 10: air conditioning, 11: instrument panel, 12: air inlet

1995

DIMENSIONS, INTERNAL:
Cabin: Length 3.18 m (10 ft 5 in)
Max width 1.52 m (5 ft 0 in)
Width at floor 1.27 m (4 ft 2 in)
Max height 1.32 m (4 ft 4 in)
Baggage compartment volume approx 0.74 m³ (26 cu ft)
AREAS:
Wings, gross 15.33 m² (165.0 sq ft)
Horizontal tail surfaces (total) 4.23 m² (45.5 sq ft)
WEIGHTS AND LOADINGS:
Weight empty, standard 1,383 kg (3,050 lb)
Max T-O and landing weight 2,268 kg (5,000 lb)
Max wing loading 147.9 kg/m² (30.3 lb/sq ft)
Max power loading 6.09 kg/kW (10.0 lb/shp)
PERFORMANCE (estimated):
Max diving speed Mach 0.60 (258 kts, 478 km/h; 297 mph EAS)
Max operating speed Mach 0.54 (230 kts, 426 km/h; 264 mph EAS)
Max cruising speed at 9,140 m (30,000 ft) 280 kts (518 km/h; 322 mph)
Max speed, flaps and landing gear extended 180 kts (333 km/h; 207 mph) EAS
Max manoeuvring speed 150 kts (278 km/h; 172 mph) EAS
Stalling speed, flaps down 61 kts (113 km/h; 70 mph) EAS
Max rate of climb at S/L 548 m (1,800 ft)/min
Max operating altitude 9,450 m (31,000 ft)
T-O run 427 m (1,400 ft)
Landing run 366 m (1,200 ft)
Max range, standard fuel, 45 min reserves 1,100 n miles (2,037 km; 1,266 miles)
g limits: flaps down +2.0
flaps up +3.8/–1.9

UPDATED

ITALY

AERONAUTICA MACCHI

AERONAUTICA MACCHI SpA

Via P. Foresio, I-21040 Venegono Superiore
Telephone: 39 (331) 865912
Fax: 39 (331) 865910
CHAIRMAN: Dott Fabrizio Foresio

Original Macchi company, founded 1913 in Varese, produced famous line of high-speed flying-boats and seaplanes. Aeronautica Macchi became holding company with all operating activities in wholly owned company Aermacchi SpA; group includes, besides Aermacchi SpA, SICAMB (airframe and equipment manufacturing, including licence production of Martin-Baker ejection seats), and Logic (electronic equipment). A 25 per cent holding in Aeronautica Macchi was acquired by Aeritalia, now Alenia, in 1983.

Transfer of all company activities to the Venegono airfield site completed 31 August 1993.

UPDATED

AERMACCHI

AERMACCHI SpA (Subsidiary of Aeronautica Macchi SpA)

Via P. Foresio, PO Box 101, I-21040 Venegono Superiore
Telephone: 39 (331) 813111
Fax: 39 (331) 827595
CHAIRMAN: Dott Fabrizio Foresio
MANAGING DIRECTOR: Dott Ing Giorgio Brazzelli
GENERAL MANAGER:
Dott Ing Bruno Cussigh
TECHNICAL DIRECTOR: Dott Ing Massimo Lucchesini
COMMERCIAL MANAGER: Dott Cesare Cozzi

Aermacchi is aircraft manufacturing company of Aeronautica Macchi group; plants at Venegono airfield occupy total area of 274,000 m² (2,949,310 sq ft), including 52,000 m² (559,720 sq ft) covered space; flight test centre has covered space of 5,100 m² (54,900 sq ft) in total area of 28,000 m² (301,390 sq ft); total workforce at end of 1994 was 1,631.

Aermacchi active in aerospace ground equipment, produces fuselages for Dornier 328 (50th delivered 2 March 1995), also has important roles in AMX, Tornado and Eurofighter 2000 programmes.

UPDATED

AERMACCHI MB-339A

TYPE: Two-seat basic and advanced trainer and attack aircraft.

PROGRAMME: First flights of two prototypes (MM588) 12 August 1976 and (MM589) 20 May 1977, first flight of production MB-339A 20 July 1978, initial 51 (first aircraft delivered 8 August 1979) included batch used as radio calibration aircraft at Pratica di Mare and 21 PANs for Frecce Tricolori aerobatic team (in service 27 April 1982); last of 102 IAF aircraft (minus one to Aermacchi as demonstrator) delivered 1987, six more on order; development continues.

CURRENT VERSIONS: **MB-339A**: Current standard military basic/advanced trainer (full details in 1990-91 *Jane's*). *Description applies to this version except where indicated.*

MB-339 PAN: Special version for Italian Air Force national aerobatic team Pattuglia Acrobatica Nazionale; smoke generator added.

MB-339AM: Special anti-ship version armed with OTO Melara Marte Mk 2A missile, avionics, equivalent to MB-339C, include new inertial navigator, Doppler radar, navigation and attack computers, head-up display and multifunction display. Prototype converted from MB-339A, qualification completed January 1995.

MB-339B: Powered by 19.57 kN (4,400 lb st) Viper Mk 680-43; larger tip tanks. Prototype (demonstrator I-GROW) modified in 1993 with two LCD EFIS displays and air-to-air refuelling (AAR), testing in progress 1995.

Radiomisure: Three radio calibration aircraft produced for Italian Air Force, 1981, withdrawn and transferred to training.

T-Bird II: Modified for US JPATS competition, described separately.

CUSTOMERS: Italian Air Force (107); Argentine Navy (10 delivered 1980), Peruvian Air Force (16 delivered 1981-82), Royal Malaysian Air Force (13 delivered 1983-84), Dubai (two delivered 1984, three in 1987, two in 1992), Nigeria (12 delivered 1985), Ghana Air Force (two delivered 1987 plus one in 1994, one in 1995). Possible further order from Dubai.

DESIGN FEATURES: For full details, see 1990-91 *Jane's*; all IAF trainers camouflaged for use as emergency close air support.

POWER PLANT: One Italian made Rolls-Royce Viper Mk 632-43 turbojet, rated at 17.8 kN (4,000 lb st). Fuel in two-cell rubber fuselage tank, capacity 781 litres (206 US gallons, 172 Imp gallons), and two integral tip tanks, combined capacity 1,000 litres (264 US gallons; 220 Imp gallons). Total usable internal capacity 1,781 litres (470.5 US gallons, 392 Imp gallons). Single-point pressure refuelling receptacle in port side of fuselage, below wing trailing-edge. Gravity refuelling points on top of fuselage and each tip tank. Provision for two drop tanks, each of 325 litres (86 US gallons; 71.5 Imp gallons) usable capacity, on centre underwing stations. In-flight refuelling now offered as an option.

AVIONICS: Conventional military IFR avionics and instruments, EFIS cockpits now being offered.

Mission: Optional photographic pod with four 70 mm Vinten cameras.

Self-defence: Optional underwing Elettronica ECM pod.

EQUIPMENT: Provision for towing type A-6B (1.83 × 9.14 m, 6 × 30 ft) and A-4 aerial banner targets, tow attachment point on inner surface of ventral airbrake.

ARMAMENT: Up to 2,040 kg (4,500 lb) of external stores can be carried on six underwing hardpoints, inner four of which are stressed for loads of up to 454 kg (1,000 lb) each and outer two for up to 340 kg (750 lb) each. Integration of Marte Mk 2A anti-ship missiles began 1991, first launch 17 June 1992. Provisions on two inner stations for two Macchi gun pods, each containing either a 30 mm DEFA 553 cannon with 120 rounds, or a 12.7 mm AN/M-3 machine gun with 350 rounds. Other typical loads can include two Matra 550 Magic or AIM-9 Sidewinder air-to-air missiles on two outer stations, four 1,000 lb or six 750 lb bombs; six SUU-11A/A 7.62 mm Minigun pods with 1,500 rds/pod, six Matra 155 launchers, each for eighteen 68 mm rockets, six Matra F-2 practice launchers, each for six 68 mm rockets, six LAU-68/A or LAU-32G launchers each for seven 2.75 in rockets, six Aerea AL-25-50 or AL-18-50 launchers, each with twenty-five or eighteen 50 mm rockets respectively, six Aerea AL-12-80 launchers, each with twelve 81 mm rockets, four LAU-10/A launchers, each with four 5 in Zuni rockets, four Thomson Brandt 100-4 launchers, each with four 100 mm Thomson Brandt rockets, six Aerea BRD bomb/rocket dispensers; six Aermacchi 11B29-003 bomb/flare dispensers; six Thomson Brandt 14-3-M2 adaptors, each with six 100 mm anti-runway bombs or 120 mm tactical support bombs. Provision for Alenia 8 105 924 fixed reflector sight or Saab RGS 2 gyroscopic gunsight, a gunsight can also be installed in rear cockpit, to enable instructor to evaluate manoeuvres performed by student pilot. All gunsights can be equipped with fully automatic Teledyne TSC 116-2 gun camera.

DIMENSIONS, EXTERNAL:
Wing span over tip tanks 10.858 m (35 ft 7½ in)
Wing aspect ratio 6.1
Length overall 10.972 m (36 ft 0 in)
Height overall 3.994 m (13 ft 1¼ in)
WEIGHTS AND LOADINGS:
Weight empty, equipped 3,125 kg (6,889 lb)
Fuel load (internal, usable) 1,100 kg (2,425 lb)
T-O weight, clean 4,400 kg (9,700 lb)
Max T-O weight with external stores 5,895 kg (13,000 lb)
PERFORMANCE (at clean T-O weight, ISA):
Mach/IAS limit Mach 0.85 (500 kts, 926 km/h, 575 mph)
Max level speed at S/L 485 kts (898 km/h; 558 mph) IAS
Stalling speed 80 kts (149 km/h; 93 mph)
Max rate of climb at S/L 2,010 m (6,595 ft)/min

UPDATED

LOCKHEED MARTIN/AERMACCHI/ROLLS-ROYCE T-BIRD II

In October 1989, Aermacchi and Lockheed signed co-operation agreement to compete in Joint Primary Aircraft Training System (JPATS) for US Air Force and Navy, using T-Bird II, a 'missionised' version of the MB-339A, rejected in favour of Pilatus PC-9, June 1995. Rolls-Royce joined team in September 1990 and Textron in June 1993. Demonstrator delivered to Lockheed's factory at Marietta, Georgia, on 20 May 1992. Power plant is Rolls-Royce Viper 680-582 of 17.79 kN (4,000 lb st) with improved maintainability. In 1994 it was fitted with a noise reduction kit in order to comply with FAR 36 stage 3 noise requirements. See also T-Bird II entry under Lockheed and JPATS entry under USAF heading.

UPDATED

AERMACCHI MB-339C

TYPE: Two-seat advanced fighter lead-in trainer and attack aircraft.

PROGRAMME: Development begun 1982-83, first flight (I-AMDA) 17 December 1985.

CUSTOMERS: Royal New Zealand Air Force ordered 18 in May 1990; deliveries completed in 1993.

DESIGN FEATURES: Designed to MIL-A-8860A for 10,000 hours service life. Wing section NACA 64A-114 (mod) at centreline, 64A-212 (mod) at tip, quarter-chord sweepback 8° 29'.

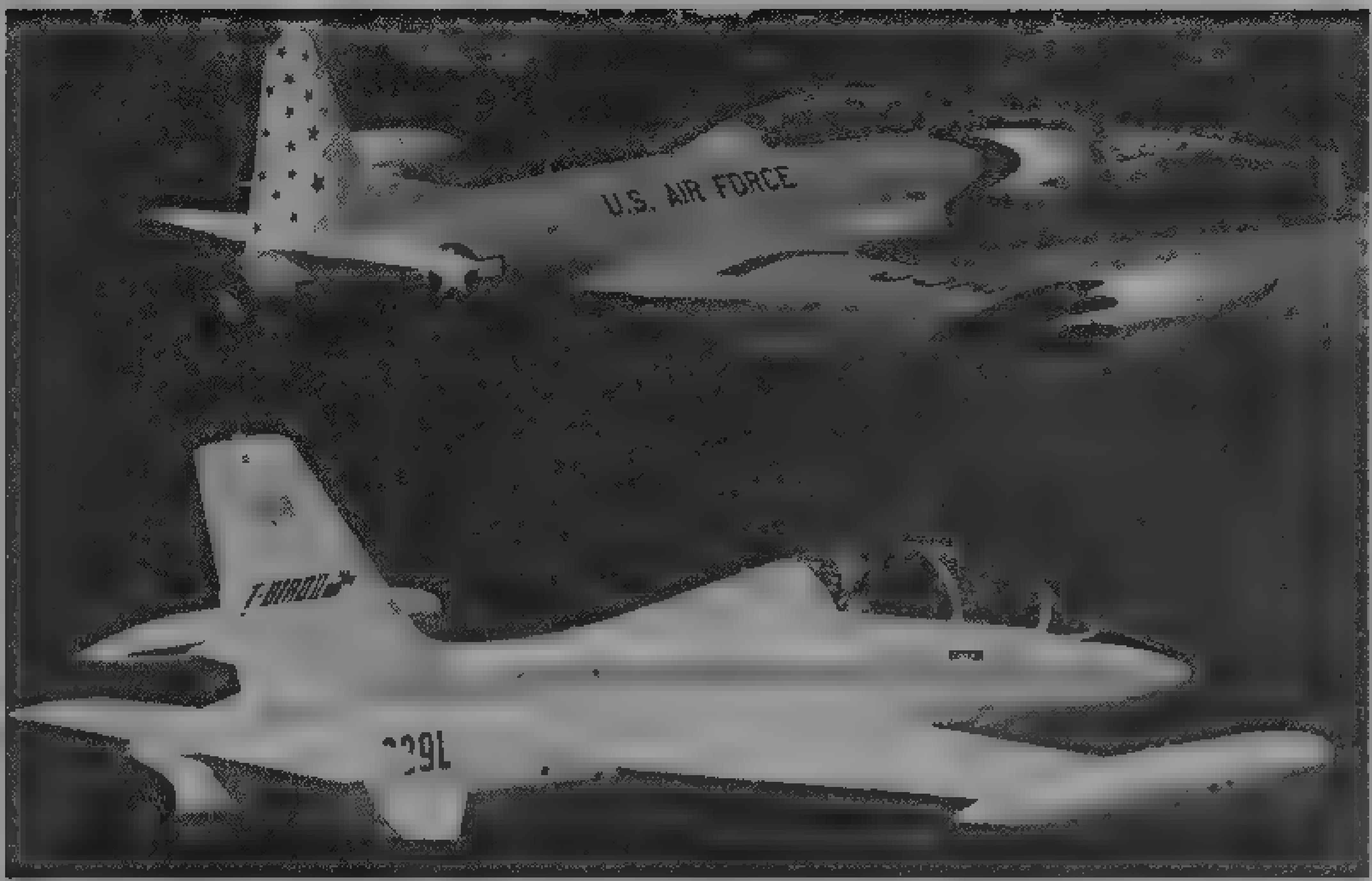
FLYING CONTROLS: Power assisted ailerons with servo tabs to assist manual reversion, fixed tailplane and manual elevators and rudder; electrically controlled servo tab for control assistance and trimming on elevator; hydraulically actuated single-slotted flaps, two ventral strakes under tail, electrohydraulically actuated airbrake panel under forward fuselage, wing fence ahead of aileron inboard edge, both pilots have HUD; rear pilot elevated sufficiently to be able to aim guns and air-to-surface weapons and fly visual approaches (see nav/attack system under Avionics heading).

STRUCTURE: All metal, stressed-skin wings with main and auxiliary spars and spanwise stringers, bolted to fuselage, tip tanks permanently attached, rear fuselage detachable by four bolts for engine access.

LANDING GEAR: Hydraulically retractable tricycle type with oleo-pneumatic shock absorbers, suitable for operation from semi-prepared runways. Hydraulically steerable nosewheel retracts forward, main units retract outward into wings. Low-pressure mainwheel tubeless tyres size 545 × 175-10 (14 ply rating), nosewheel tubeless tyre size 380 × 150-4 (6 ply rating). Emergency extension system. Hydraulic disc brakes with anti-skid system. Minimum ground turning radius 8.63 m (28 ft 3¾ in).

POWER PLANT: One Rolls-Royce Viper Mk 680-43 turbojet, rated at 19.57 kN (4,400 lb st). Fuel in two-cell rubber fuselage tank, capacity 781 litres (206 US gallons, 172 Imp gallons), and two wingtip tanks with combined capacity of 1,000 litres (264 US gallons, 220 Imp gallons). Total internal usable capacity 1,781 litres (470.5 US gallons, 392 Imp gallons). Single-point pressure refuelling point in port side of fuselage, below wing trailing-edge. Gravity refuelling points on top of fuselage and each tip tank. Provision for two drop tanks, each of 325 litres (86 US gallons; 71.5 Imp gallons) usable capacity, on centre underwing stations.

ACCOMMODATION: Crew of two in tandem, on Martin-Baker IT10LK zero/zero ejection seats in pressurised cockpit. Rear seat elevated 32.5 cm (1 ft 1 in). Rearview mirror for each occupant. Two-piece moulded transparent canopy, opening sideways to starboard.



Lockheed Martin/Aermacchi/Rolls-Royce T-Bird II trainer proposed for US JPATS programme, accompanied by original Lockheed T-33 T Bird in background

1994

SYSTEMS: Pressurisation system maximum differential 0.24 bar (3.5 lb/sq in), cockpit designed for 40,000 pressurisation cycles. Bootstrap type air conditioning system, also providing air for windscreen and canopy demisting. Hydraulic system, pressure 172.5 bars (2,500 lb/sq in), for actuation of flaps, aileron servos, airbrake, landing gear, wheel brakes and nosewheel steering. Back-up system for wheel brakes and emergency extension of landing gear. Main electrical DC power from one 28 V 9 kW engine-driven starter/generator and one 28 V 6 kW secondary generator. Two 24 V 22 Ah Ni/Cd batteries for engine starting. Fixed frequency 115/26 V AC power from two 600 VA single phase static inverters, provision for additional inverter for three-phase AC. External power receptacle. Low-pressure demand oxygen system, operating at 28 bars (400 lb/sq in). Anti-icing system for engine air intakes.

AVIONICS (typical): *Comms:* include Bendix/King AN/APX-100 IFF.

Flight: GMAv 620 kbit navigation computer; RT-1159/A or Collins AN/ARN-118(V) Tacan, or Bendix/King KDM 706A DME; Collins 51RV-4B VOR/ILS and MKI-3 marker beacon receiver; Collins ADF-60A ADF/I (or, optionally, DF-301E V/UHF ADF); GMAv AD-660 Doppler velocity sensor integrated with Litton LR-80 inertial platform. HOTAS controls.

Instrumentation: Alenia CRT multifunction display; Alenia/Honeywell HG7505 radar altimeter; Astronautics AN/ARU-50/A attitude director indicator and AN/AQU-13 HSI.

Mission: Kaiser Sabre head-up display and weapon aiming computer; Logic stores management system; FIAR P 0702 laser rangefinder; Fairchild Weston video camera, photographic pod with four Vinten 70 mm cameras.

Self-defence: ELT-156 radar warning system, single Elettronica/ELT-555 ECM pod combined with Tracor AN/ALE-40 chaff/flare dispenser.

ARMAMENT: Up to 1,814 kg (4,000 lb) of external stores on six underwing hardpoints. Four inner hardpoints each stressed for up to 454 kg (1,000 lb) load, and two outer hardpoints each for up to 340 kg (750 lb) load. RNZAF aircraft fitted for AIM-9 Sidewinder and AGM-65 Maverick. Provision on two inner stations for installation of two Macchi gun pods, each containing either a 30 mm DEFA 553 cannon with 120 rounds or a 12.7 mm AN/M-3 machine gun with 350 rounds. Other typical loads can include two Matra 550 Magic or AIM-9 Sidewinder air-to-air missiles on two outer stations, six general purpose or cluster bombs of appropriate weights; six AN/SUU-11A/A 7.62 mm Minigun pods, each with 1,500 rounds, six Matra 155 launchers, each for eighteen 68 mm rockets, six AN/LAU-68/A or AN/LAU-32G launchers, each for seven 2.75 in rockets, six Aerea AL-25-50 or AL-18-50 launchers, each with twenty-five or eighteen 50 mm rockets respectively; six Aerea AL-18-80 launchers, each with twelve 81 mm rockets, four AN/LAU-10/A launchers, each with four 5 in Zuni rockets, four Thomson Brandt 100-4 launchers, each with four 100 mm Thomson Brandt rockets, six Bristol Aerospace LAU-5002 launchers for CRV-7 high-velocity rockets, six Aerea BRD bomb/rocket dispensers, six Aermacchi 11B29-003 bomb/flare dispensers, six Thomson Brandt 14-3-M2 adaptors, each with six BAP 100 anti-runway bombs or BAT 120 tactical support bombs. Marte 2A anti-ship missile completed MB-339 qualification trials in February 1995.

DIMENSIONS, EXTERNAL:
Wing span over tip tanks 11.22 m (36 ft 9¾ in)
Wing aspect ratio 6.52
Length overall 11.24 m (36 ft 10½ in)
Height overall 3.994 m (13 ft 1¼ in)
Elevator span 4.164 m (13 ft 8 in)
Wheel track 2.483 m (8 ft 1¾ in)
Wheelbase 4.369 m (14 ft 4 in)

AREAS:
Wings, gross 19.30 m² (207.7 sq ft)
Ailerons (total) 1.328 m² (14.29 sq ft)
Trailing-edge flaps (total) 2.55 m² (27.4 sq ft)
Airbrake 0.52 m² (5.6 sq ft)
Fin 2.21 m² (23.78 sq ft)
Rudder, incl tab 0.68 m² (7.3 sq ft)
Tailplane 3.38 m² (36.38 sq ft)
Elevators (total incl tabs) 0.979 m² (10.54 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 3,430 kg (7,562 lb)
Fuel load (internal, usable) 1,388 kg (3,060 lb)
T-O weight, clean 4,982 kg (10,983 lb)
Max T-O weight with external stores 6,350 kg (14,000 lb)
Max wing loading 329.0 kg/m² (67.39 lb/sq ft)
Max power loading 324.7 kg/kN (3.18 lb/lb st)

PERFORMANCE (at trainer clean T-O weight, ISA, except where indicated):
Max level speed at S/L 486 kts (900 km/h, 558 mph)
Max level speed at 9,150 m (30,000 ft) Mach 0.77 (441 kts, 815 km/h, 508 mph)
Max speed for landing gear extension 175 kts (324 km/h; 202 mph)
T-O speed 100 kts (185 km/h; 115 mph)
Approach speed over 15 m (50 ft) obstacle 98 kts (182 km/h; 113 mph)
Stalling speed 85 kts (157 km/h, 98 mph)
Max rate of climb at S/L 2,160 m (7,085 ft)/min
Time to 9,150 m (30,000 ft) 6.7 min
Service ceiling (30.5 m; 100 ft/min rate of climb) 14,240 m (46,700 ft)
T-O run at S/L 490 m (1,608 ft)
Landing run at S/L 460 m (1,509 ft)
Max ferry range with two underwing drop tanks, 10% reserves 1,100 n miles (2,037 km, 1,266 miles)
Max endurance with drop tanks 3 h 50 min
g limit +7.33

UPDATED

AERMACCHI MB-339CD/FD

Developed (as **MB-339CD**) for Italian Air Force advanced/fighter lead-in training. One Rolls-Royce Viper Mk 632-43 engine; provision for in-flight refuelling (probe and drogue with removable probe); new avionic architecture based on a single central mission computer, MIL-STD-1553B digital databus, one ring laser gyro platform with embedded GPS, EFIS cockpit with HUD, three liquid crystal colour MFDs and HOTAS controls. Other details generally as MB-339C (above). No orders yet received.

'Full Digital' **MB-339FD**, offered to Australia in 1994, has enhanced avionics, assessment continuing.

NEW ENTRY

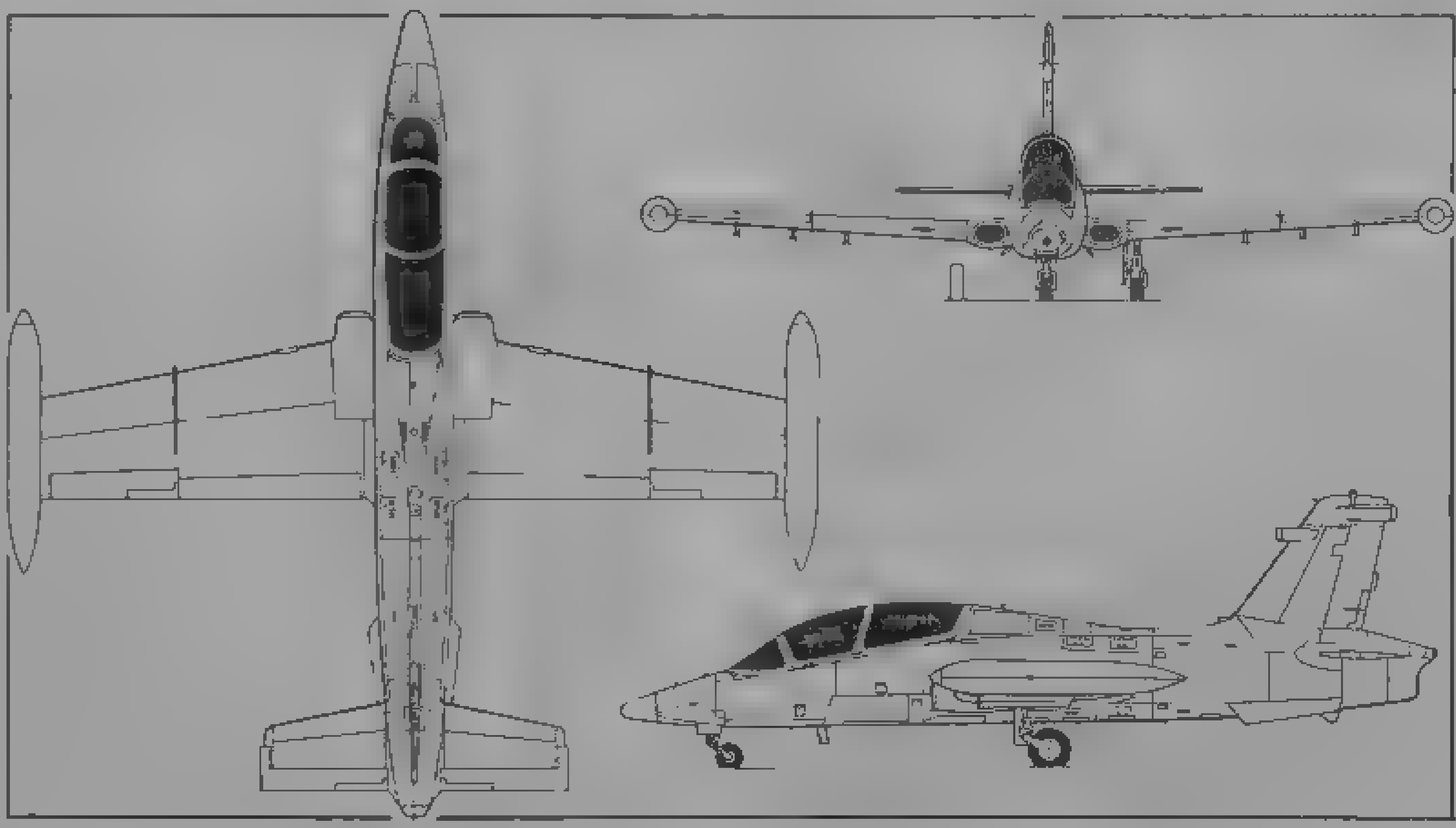
OTHER AIRCRAFT

Details of the **Yak-130** jet trainer, for which Aermacchi shares design rights and has production and modification rights, appear in the Russian section. See International section for Aermacchi/Alenia/Embraer **AMX** attack aircraft.

NEW ENTRY

Aermacchi MB-339B with air-to-air refuelling system and noise reduction unit

1995



Aermacchi MB-339C advanced trainer and attack aircraft (*Jane's/Dennis Punnett*)

1994

AGUSTA

AGUSTA SpA

(A Finmeccanica company)

Via Giovanni Agusta 520, I-21017 Cascina Costa di Samarate (VA)
Telephone: 39 (331) 229111
Fax: 39 (331) 222595
Telex: 332569 AGUCA I
OFFICES:
Via Sicilia, I-00187 Rome
Telephone: 39 (6) 49801
Fax: 39 (6) 6799944
Telex: 614398 AGU RO I
CHAIRMAN: Gen Basilio Cottone
CEO: Amedeo Caporaletti
MARKETING AND SALES: Dott Enrico Guerra

Formed in 1977, the Agusta group (see 1980-81 *Jane's*) completely reorganised from 1 January 1981 under new holding company Agusta SpA; became part of Italian public holding company EFIM, employing nearly 10,000 people in 12 factories in various parts of Italy. Workforce in Italy and abroad was about 6,000 in 1993 and turnover was Lit1,000 billion. The order book was Lit3,500 billion.

As part of recovery of liquidated state-owned EFIM Agusta group, including OMI, OTO Melara, Breda Meccanica Bresciana, Galileo and SMA, was transferred to Finmeccanica from 1 January 1993; Agusta finally integrated into Finmeccanica on 12 February 1994.

Various domestic activities of Agusta are grouped under location of works. Familiar names of Costruzioni Aeronautiche Giovanni Agusta, Caproni Vizzola Costruzioni Aeronautiche and BredaNardi Costruzioni Aeronautiche no longer used; SIAI-Marchetti initially became Sesto Calende works, but reverted to SIAI-Marchetti in early 1994. In addition, Elicotteri Meridionali is domestic affiliate and Agusta is parent of Agusta Aerospace Corporation of Philadelphia, USA, and no longer has international affiliates in South Korea and Turkey. The various works and affiliates are now as follows:

DOMESTIC WORKS

Benevento Works
(ex-FOMB—Fonderie e Officine Meccaniche di Benevento SpA)
Contrada Ponte Valentino, S S 90bis, I 82100 Benevento
Telephone: 39 (824) 53440, 53441 and 53447
Fax: 39 (824) 53418
Telex: 710667
Specialises in aircraft co-production and overhaul of helicopters and multi-engined aircraft

Brindisi Works
(ex-IAM—Industrie Aeronautiche Meridionali SpA)
Contrada Santa Teresa Pinti, I-72100 Brindisi
Telephone: 39 (831) 8911
Fax: 39 (831) 452659
Telex: 813360

Cascina Costa Works
(ex-Costruzioni Aeronautiche Giovanni Agusta SpA)
Via Giovanni Agusta 520, I 21017 Cascina Costa di Samarate (VA)
Telephone: 39 (331) 229111
Fax: 39 (331) 222595
Telex: 332569 AGUCA I

Monteprandone Works
(ex-BredaNardi Costruzioni Aeronautiche SpA)
Casella Postale 108, San Benedetto del Trento (Ascoli Piceno), Monteprandone (AP)
Telephone: 39 (735) 801721
Fax: 39 (735) 701927
Telex: 560165 BRENAR I

SIAI-Marchetti
Via Indipendenza 2, I-21018 Sesto Calende (VA)
Telephone: 39 (331) 929111
Fax: 39 (331) 922525
Telex: 331848 SIAICO
Planned to be transferred to Aermacchi

Somma Lombarda Works
(ex-Caproni Vizzola Costruzioni Aeronautiche SpA)
Via Per Tornavento 15, I 21019 Somma Lombarda
Telephone: 39 (331) 230826
Fax: 39 (331) 230622
Telex: 332554 CAVIZ I

Tradate Works
(ex-Agusta Sistemi SpA)

DOMESTIC AFFILIATES

Elicotteri Meridionali SpA
Via G. Agusta 1, Frosinone

Servizi Elicotteristici Italiani (SEI)
Via della Vasca Navale 79/81, I-00146 Rome
Telephone: 39 (6) 49801

INTERNATIONAL AFFILIATES

Agusta Aerospace Corporation
2655 Interplex Drive, Travose, Philadelphia, Pennsylvania 19047, USA
Telephone: 1 (215) 281 1400
Fax: 1 (215) 281 0440
Telex: 6851181
CHAIRMAN AND CEO: Ing Giuseppe Orsi

Agusta Aerospace Services SA
Belgium
Telephone: 32 (2) 648585 and 6485515
Telex: 63349
GENERAL MANAGER: Dott Riccardo Baldini

EH Industries Ltd
500 Chiswick High Road, London W4 5RG, UK
Telephone: 44 (81) 995 8221
Fax: 44 (81) 995 5207/5990

Monacair SAM
Héliport de Fontvieille, Principality of Monaco, MC-98000

VERIFIED

CASCINA COSTA WORKS

Original Agusta company established 1907 by Giovanni Agusta; acquired licence for Bell Helicopter Model 47 in 1952, first flight of first Agusta example 22 May 1954; some other Bell models still in production, also produced various versions of Sikorsky S-61 under licence and is partner with Westland in EH 101 (see under EHI in International section), participates in Eurofar tilt-rotor and NH 90 programmes (see International). Own designs include A 109 multirole helicopter, A 119 Koala (see Addenda), A 129 anti-tank and projected A 139 battlefield utility transport.

AGUSTA A 109C

Belgian Army designations: A 109HO and A 109HA

TYPE: Twin-turbine light transport helicopter.

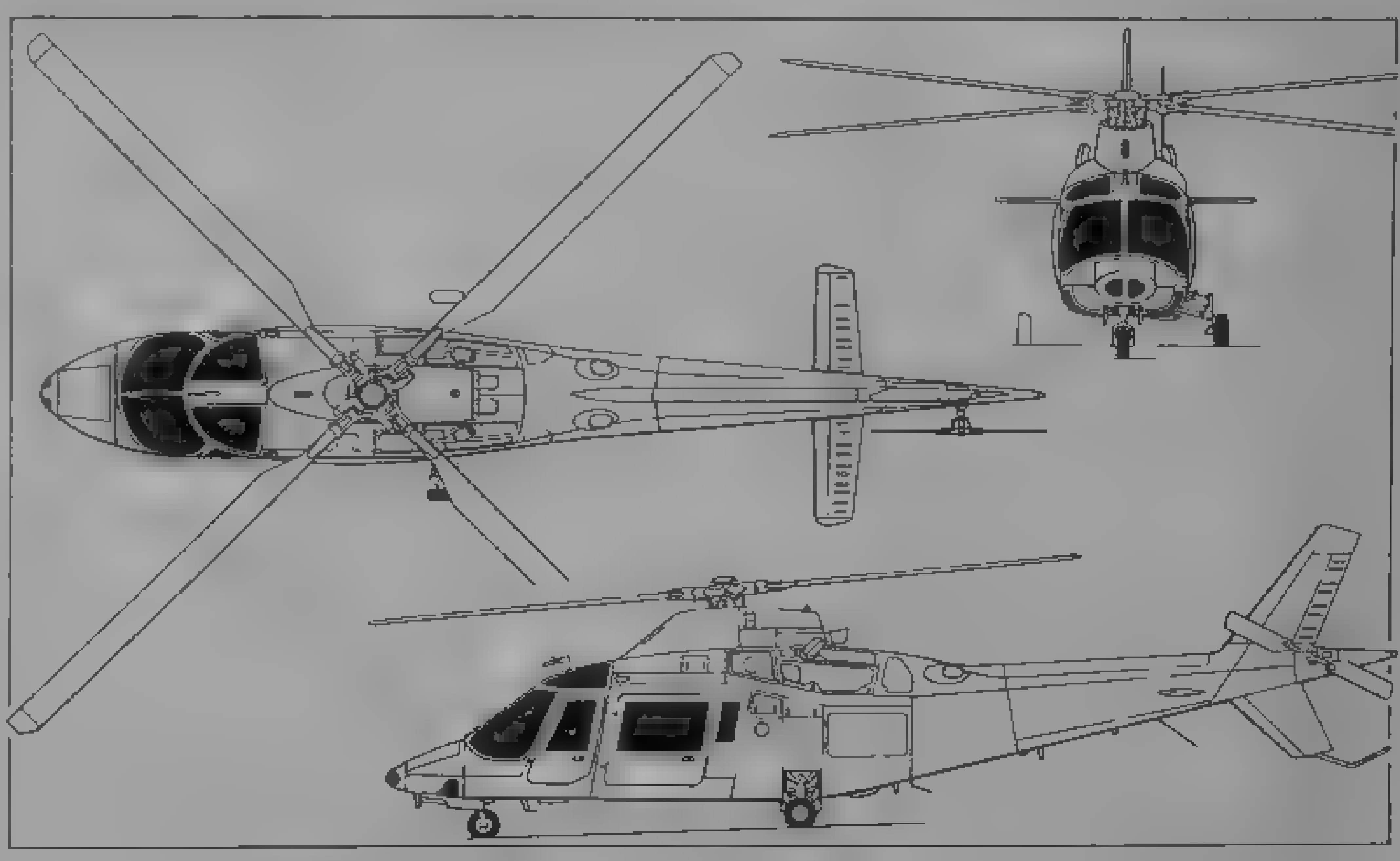
PROGRAMME: First flight 4 August 1971, deliveries of A 109A started early 1976, single-pilot IFR certification 20 January 1977, deliveries of uprated A 109 Mk II began September 1981; A 109C certificated 1989.

CURRENT VERSIONS: **A 109C**: Certificated in USA by Agusta Aerospace Corporation in early 1989 approved for single-pilot IFR operation; transmission uprated from 552 kW (740 shp) to 589 kW (790 shp); 'wide-body' cabin, new composites main rotor blades, Wortmann aerofoil on tail rotor; strengthened landing gear; maximum T-O weight raised to 2,720 kg (5,997 lb), affording 109 kg (240 lb) increase in payload. Other civil/public service roles include law enforcement (maximum useful load 1,130 kg, 2,491 lb) and coastal patrol with 360° radar (maximum useful load 1,105 kg, 2,436 lb).

A 109CM: Military version of civil A 109C powered by two 335.6 kW (450 hp) Allison 250-C20R/1, can have sliding doors and fixed landing gear, ventral fin removed; first customer Belgian Army (Agusta designation **109BA**) with 18 scout versions and 28 anti-tank versions designated **109HO** and **109HA** respectively by customer; ordered 1988; first delivery, from offset supplier Sabca, February 1992, first 109BA with equipped weight reduced to originally specified 1,944 kg (4,286 lb) delivered 25 November 1992; maximum T-O weight increased to 2,850 kg (6,283 lb); this was 11th of 46 109BAs, composites sliding doors, relocated batteries and custom Collins/Alcatel Bell avionics, scouts have roof-mounted Saab Helios stabilised observation sight, anti-tank system has roof-mounted Saab/ESCO HeliTOW 2 sight and TOW-2A missiles on lateral pylons; firing trials completed in Sardinia late 1992. Last Belgian aircraft delivered 4 February 1994. Other roles for 109CM include electronic warfare, command and control, medevac, shipborne ASV/ASW and UAV launching.

A 109EOA: Italian Army scout version powered by Allison 250-C20R/1, 24 (16 EOA 1 and eight EOA 2) delivered in 1988 as Elicottero d Osservazione Avanzata to Aviazione dell'Esercito; fitted with sliding doors, roof mounted SFIM M334-25 daytime sight with CILAS laser ranger, variety of armament options, fixed landing gear,

Agusta A 109CM/BA/HA for Belgian Army Aeromobilité programme with TOW launchers *(Paul Jackson)*
1995



Agusta A 109C civil helicopter (two Allison 250-C20R turboshafts)
(Jane's/Dennis Punnett)
1994

crashworthy fuel tanks and ECM. Maximum flight weight with slung load 2,850 kg (6,283 lb)

Max: Medevac configuration certificated in USA by Agusta Aerospace Corporation early 1989 and now installed there; large upward-opening bulged doors and fairings give 3 96 m³ (140 cu ft) cabin volume and allow for two stretchers across main cabin and three sitting attendants/patients.

CUSTOMERS. Total more than 500 all versions delivered

DESIGN FEATURES. Fully articulated four-blade metal main rotor hub with tension/torsion blade attachment and elastomeric drag dampers, delta-hinged two-blade tail rotor, manual blade folding and rotor brake optional Main blade section NACA 23011 with drooped leading-edge, thickness/chord ratios 11 3 per cent at root, 6 per cent at tip

FLYING CONTROLS. Fully powered hydraulic, IFR system with autopilot available

STRUCTURE. Prior to introduction of composites, main and tail rotor blades were bonded aluminium alloy with Nomex core, airframe conventional all-metal, Mk II introduced self-damping engine mounts, redesigned tailboom, removable floor in baggage compartment and systems improvements

LANDING GEAR. Retractable tricycle type, with oleo-pneumatic shock-absorber in each unit Single mainwheels and self-centring nosewheel castoring ±45°. Hydraulic retraction, nosewheel forward, mainwheels upward into fuselage Hydraulic emergency extension and locking. Magnaghi disc brakes on mainwheels All tyres are tubeless of same size (650 × 6) and pressure (5 9 bars 85 lb/sq in). Tailskid under ventral fin Emergency pop-out flotation gear and fixed snow skis optional

POWER PLANT: Two Allison 250-C20R/1 turboshafts, each rated at 335 kW (450 shp) for 5 minutes for T-O and 283 kW (380 shp) maximum continuous, flat rated at 258 kW (346 shp) for twin-engine operation, engines mounted side by side in upper rear fuselage and separated from passenger cabin and from each other by firewalls

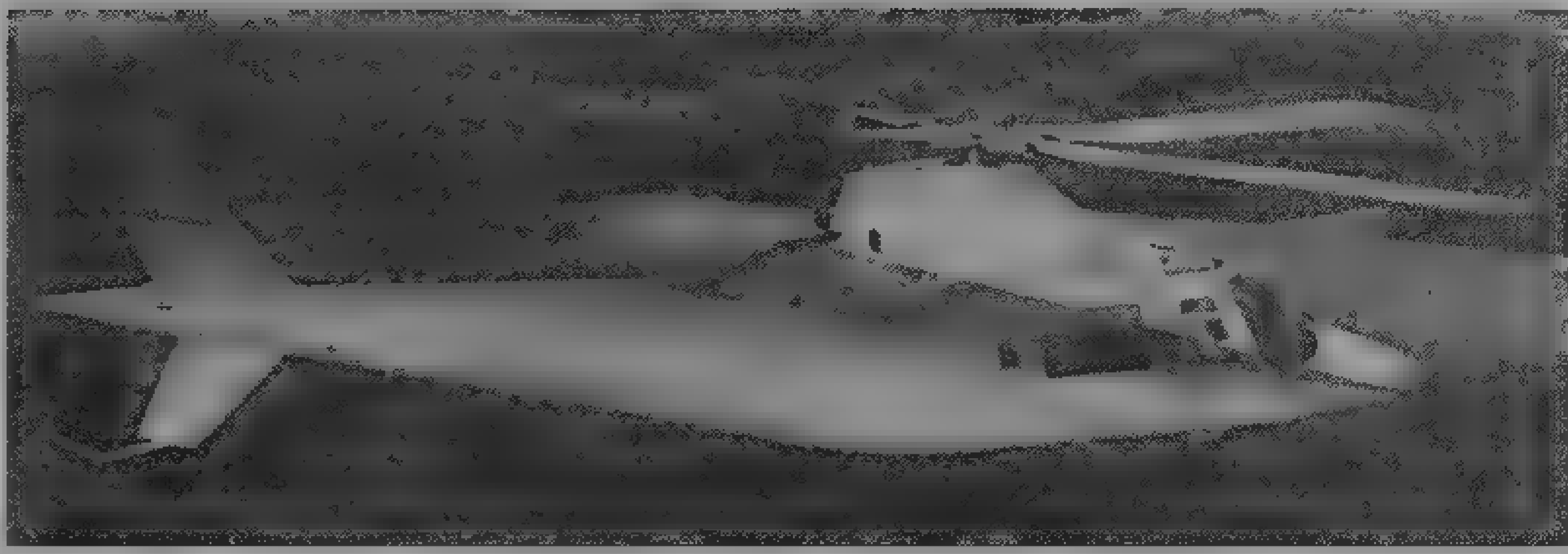
Transmission ratings 589 kW (790 shp) for take-off and 567 kW (760 shp) for maximum continuous twin-engined operation, with maximum contingency rating of 607 kW (814 shp) for 6 seconds. Rating for single-engined operation is 336 kW (450 shp) for take-off (5 minutes limit)

Two bladder fuel tanks in lower rear fuselage, combined capacity 560 litres (148 US gallons, 123 Imp gallons), of which 550 litres (145 3 US gallons, 121 Imp gallons) are usable Refuelling point in each side of fuselage, near top of each tank Oil capacity 7 7 litres (2 0 US gallons, 1.7 Imp gallons) for each engine and 12 litres (3 2 US gallons, 2 6 Imp gallons) for transmission Provision for internal auxiliary tank containing up to 150 litres (39 6 US gallons, 33 Imp gallons) of fuel

EQUIPMENT: Most recently certificated equipment includes Spectrolab 30 Med SX-16 searchlight and civil slung load system

DIMENSIONS EXTERNAL

Main rotor diameter	11 00 m (36 ft 1 in)
Tail rotor diameter	2 00 m (6 ft 6 in)
Length overall, rotors turning	13 035 m (42 ft 9¼ in)
Fuselage Length	11.44 m (37 ft 6 in)
Height over tailfin	3 5 m (11 ft 5¾ in)
Tailplane span	2 88 m (9 ft 5¼ in)
Width over mainwheels	2 45 m (8 ft 0¼ in)
Wheelbase	3.535 m (11 ft 7¼ in)
Passenger doors (each): Height	1 06 m (3 ft 5¾ in)
Width	1 15 m (3 ft 9¼ in)
Height to sill	0 65 m (2 ft 1¼ in)
Baggage door (port, rear) Height	0 51 m (1 ft 8 in)
Width	1 00 m (3 ft 3¼ in)



Agusta A 109C (two Allison 250-C20R/1)

1994

Rotor head of Agusta A 109C showing tabs on trailing-edge of composite blades designed to reduce cabin vibration *(Mark Lambert)*

1994

DIMENSIONS INTERNAL

Cabin, excl flight deck Length	1.63 m (5 ft 4¼ in)
Max width	1 44 m (4 ft 8½ in)
Max height	1 28 m (4 ft 2½ in)
Volume	2 82 m³ (100 cu ft)
Baggage compartment volume	0 52 m³ (18 4 cu ft)

AREAS

Main rotor blades (each)	1 84 m² (19.8 sq ft)
Tail rotor blades (each)	0 203 m² (2 185 sq ft)
Main rotor disc	95 03 m² (1022 9 sq ft)
Tail rotor disc	3 24 m² (34 87 sq ft)

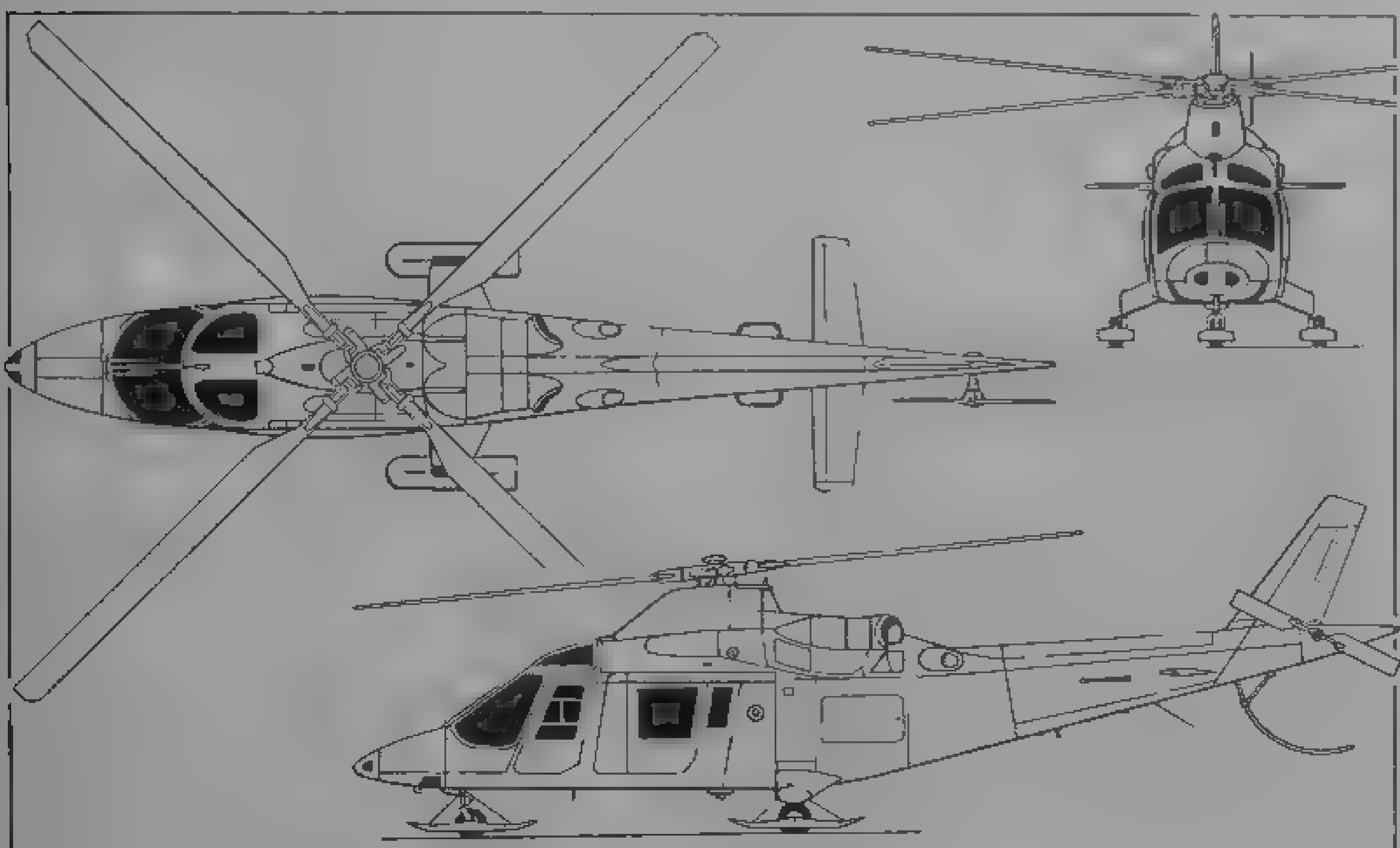
WEIGHTS AND LOADINGS

Basic weight empty, equipped	1,590 kg (3,503 lb)
Max external slung load	907 kg (2,000 lb)
Max baggage	150 kg (331 lb)
Max certificated T-O weight	2,720 kg (5,997 lb)
Max disc loading	28 6 kg/m² (5 86 lb/sq ft)
Max power loading	4.61 kg/kW (7 59 lb/shp)

PERFORMANCE (A civil EMS and law enforcement versions. B coastal patrol version)

Never-exceed speed (V_{NE})	
A, B	168 kts (311 km/h; 193 mph)
Max cruising speed A	154 kts (285 km/h, 177 mph)
B	152 kts (281 km/h, 175 mph)
Max rate of climb at S/L: A, B	516 m (1,700 ft)/min
Rate of climb at S/L, OEI A	108 m (354 ft)/min
B	96 m (315 ft)/min
Service ceiling: A, B	4,572 m (15,000 ft)
Service ceiling, OEI A, B	2,134 m (7,000 ft)
Hovering ceiling IGE, A	3,474 m (11,398 ft)
B	3,200 m (10,500 ft)
Hovering ceiling OGE: A	2,438 m (8,000 ft)
B	2,300 m (7,546 ft)
Range with max standard fuel, no reserves, best speed and height A	420 n miles (778 km, 483 miles)
B	360 n miles (667 km; 414 miles)
Endurance with max fuel, no reserves, best speed and height A	4 h 20 min
B	3 h 50 min

UPDATED



Agusta A 109K2 civil rescue and utility helicopter (two Turbomeca Arriel 1K1 turboshafts) *(Jane's/Dennis Punnett)*

1993

AGUSTA A 109K

TYPE: Military and special civil utility helicopter

PROGRAMME. First flight April 1983, first flight of production representative second aircraft March 1984

CURRENT VERSIONS **A 109KM.** Military version, roles include anti-tank/scout, escort, command and control, utility, ECM and SAR/medevac, fixed landing gear; sliding side doors

A 109KN. Shipboard version with equivalent roles to A 109KM, including anti-ship, over-the-horizon surveillance and targeting and vertical replenishment

A 109K2: Special civil rescue version first sold to Swiss REGA non-profit rescue service, REGA equipment includes Spectrolab SX46 searchlight, 200 kg (440 lb) winch, GPS, Elbit moving map display, single-pilot IFR system

A 109 Improved Versions: Upgraded models reported to be under development in early 1995, featuring new avionics and possibly a Pratt & Whitney Canada PW200-powered version

CUSTOMERS. Swiss REGA mountain rescue service ordered 15 A 109K2s; first aircraft delivered December 1991, eight by Autumn 1993, one more ordered to replace attrition in operation in USA early 1993 by Eastern Idaho Regional Medical Center and LDS Medical Hospital Utah) and by Elilario in Italy; seven A 109K2s delivered in 1994 more than 20 then built, three A 109K2s ordered by Dubai Police in March 1995

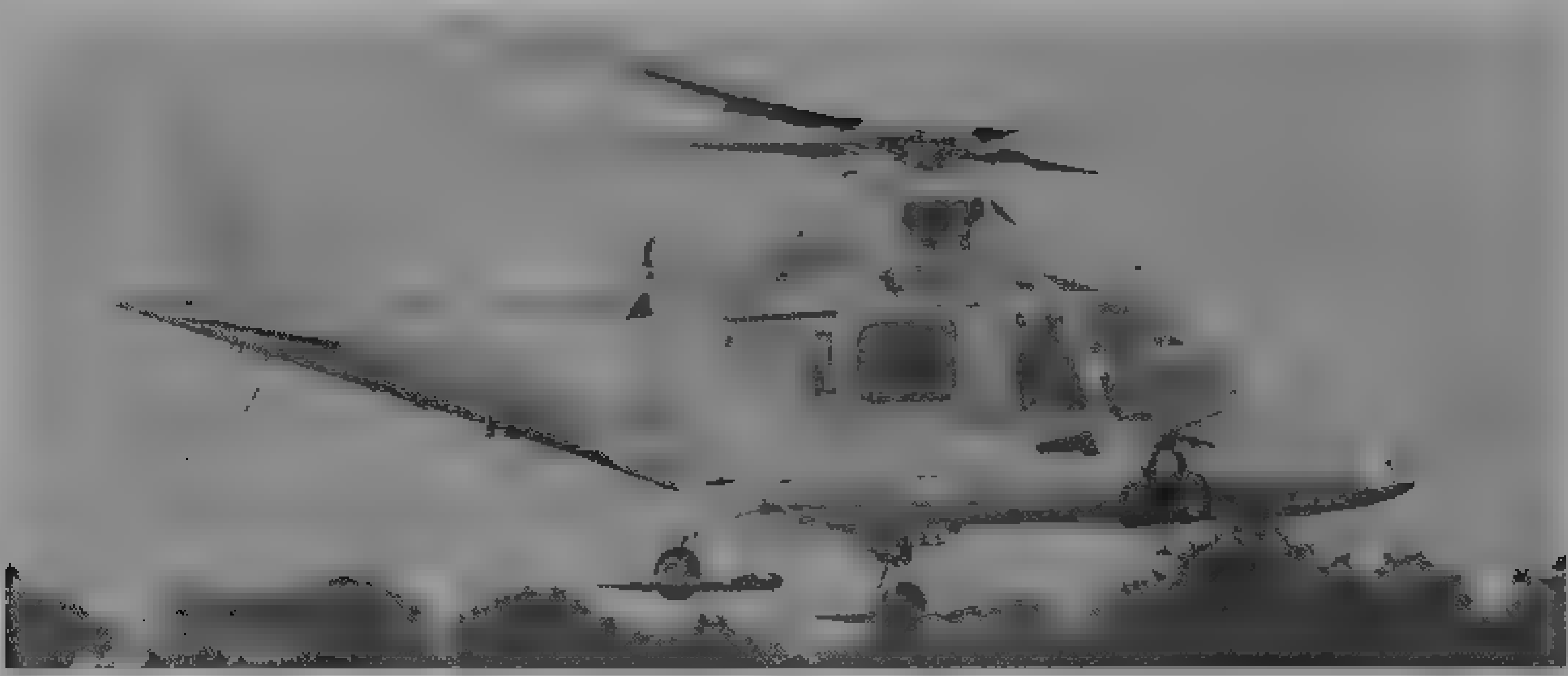
COSTS Price of 15 REGA A 109K2s with spares, logistics and training approximately $70 million (1991)

DESIGN FEATURES: Composites main rotor blades; tail rotor with Wortmann aerofoil and stainless steel skins; optional rotor brake, lengthened cabin to hold two stretchers fore-and-aft, modified fuel system, smaller instrument panel

Data below for military and civil versions and dimensions different from A 109C

LANDING GEAR Non-retractable tricycle type, giving increased clearance between fuselage and ground. Changes restricted to replacement of nose leg actuator by fixed strut, and replacement of each main leg actuator by fixed strut and V support frame

POWER PLANT Two Turbomeca Arriel 1K1 turboshafts, each rated at 575 kW (771 shp) for 2½ minutes, 550 kW (737 shp) for take-off (30 minutes) and 471 kW (632 shp) maximum continuous power Engine particle separator optional. Main transmission uprated to 671 kW (900 shp) for take-off and maximum continuous twin-engined operation, single-engine emergency rating is 477 kW



Agusta A 109K2 of Swiss REGA rescue service *(Paul Jackson)*

1994

(640 shp), single-engined continuous rating 418 kW (560 shp). Main rotor rpm 384, tail rotor 2,085. Standard usable fuel capacity 750 litres (198 US gallons, 165 Imp gallons), with optional 150 litre (39.6 US gallon, 33 Imp gallon) auxiliary tanks. Optional closed circuit refuelling system and optional 200 litre (53 US gallon, 44 Imp gallon) ferry tanks in cabin. Self-sealing fuel tanks optional. Independent fuel and oil system for each engine.

AVIONICS: *Mission*: Radar and laser warning systems, FLIR, gyrostabilised sight, night vision goggles and chaff/flare dispenser are among options.

EQUIPMENT: Options include rescue hoist, searchlight, cargo platform for military versions, cargo hook and EMS interior.

ARMAMENT (optional): Total of four stores attachments, two on each side of cabin, on outriggers. Typical loads include two 7.62 or 12.7 mm gun pods, 70 or 80 mm rocket launchers, or up to eight TOW anti-armour missiles (with roof-mounted sight), Stinger air-to-air missiles, LAVs, plus 7.62 or 12.7 mm side-firing gun in cabin.

DIMENSIONS, EXTERNAL:
Main rotor diameter 11.0 m (36 ft 1 in)
Tail rotor diameter 2.00 m (6 ft 6¾ in)
Length of fuselage 11.44 m (37 ft 6 in)
Length, rotors turning 13.03 m (42 ft 9 in)
Height to top of fin 3.50 m (11 ft 5¾ in)

DIMENSIONS, INTERNAL:
Cabin: Width 1.59 m (5 ft 2½ in)
Length 2.09 m (6 ft 10 in)
Max height 1.29 m (4 ft 2¾ in)

AREAS:
Tail rotor disc 3.143 m² (33.83 sq ft)

WEIGHTS AND LOADINGS:
Weight empty: KM/KN, K2 1,650 kg (3,638 lb)
Max slung load 907 kg (2,000 lb)
Max T-O weight: KM, KN 2,850 kg (6,283 lb)
K2 2,720 kg (5,997 lb)
Max flight weight with slung load:
KM/KN, K2 3,000 kg (6,614 lb)
Max disc loading: KM, KN 30.0 kg/m² (6.14 lb/sq ft)
K2 28.6 kg/m² (5.86 lb/sq ft)
Max power loading: KM/KN 4.24 kg/kW (6.98 lb/shp)
K2 4.05 kg/kW (6.66 lb/shp)

PERFORMANCE (at max T-O weight except where indicated):
Never-exceed speed (V_{NE}) 152 kts (281 km/h, 175 mph)
Max cruising speed at S/L, clean:
KM, KN 142 kts (263 km/h, 163 mph)
K2 144 kts (266 km/h, 166 mph)
Max rate of climb at S/L:
KM/KN, K2 618 m (2,020 ft)/min
Rate of climb at S/L, OEI: KM/KN 168 m (560 ft)/min
K2 214 m (702 ft)/min
Service ceiling: KM/KN, K2 6,100 m (20,000 ft)
Service ceiling, OEI: KM/KN 3,050 m (10,000 ft)
K2 3,900 m (12,795 ft)
Hovering ceiling IGE:
KM/KN, K2 5,670 m (18,600 ft)
Hovering ceiling OGE:
KM, KN, K2 4,630 m (15,190 ft)
Certificated operating altitude 4,575 m (15,000 ft)
Demonstrated service ceiling 6,100 m (20,000 ft)
Max range, best height and speed:
KM/KN, K2 442 n miles (820 km, 509 miles)
Max range, full payload (ISA+20°C, 4,265 m, 14,000 ft)
293 n miles (543 km, 337 miles)
Max endurance 4 h 16 min

UPDATED

AGUSTA A 129 MANGUSTA (MONGOOSE)

TYPE: Light anti-tank and scout helicopter.

PROGRAMME: Italian Army specification issued 1972, A 129 given go-ahead March 1978, final form settled 1980; detail design completed 30 November 1982, first flights of five development aircraft 11 September 1983, 1 July and 5 October 1984, 27 May 1985 and 1 March 1986; first delivery October 1990.

CURRENT VERSIONS: **Anti-tank**: Italian Army version; also demonstrated for export (*described below*). Lot 2 aircraft (from 16th production onward - MM81391) equipped with IR suppressors, IR jammers, GMAv laser warning system, improved main computer software, auxiliary fuel tanks and folding main rotor blades.

Shipborne: Proposed maritime anti-ship version, no orders received by mid-1995.

A 129 International: T800-powered export version; first flight of prototype powered by two Allison/AlliedSignal LHTEC T800-LHT-800 turboshafts October 1988, demonstrated in Gulf during 1990; first flight with production standard five-blade rotor (converted prototype MMX592) 9 January 1995, tail rotor diameter slightly increased; T800-LHT-800 gives between 20 and 40 per cent more power than Gem 1004, in potential growth versions, transmission uprated to 1,268 kW (1,699 shp), gross weight increased to 5,000 kg (11,023 lb), maximum level speed 150 knots (278 km/h; 173 mph), M197 three-barrelled 20 mm cannon in nose turret and provision for Stinger AAMs.

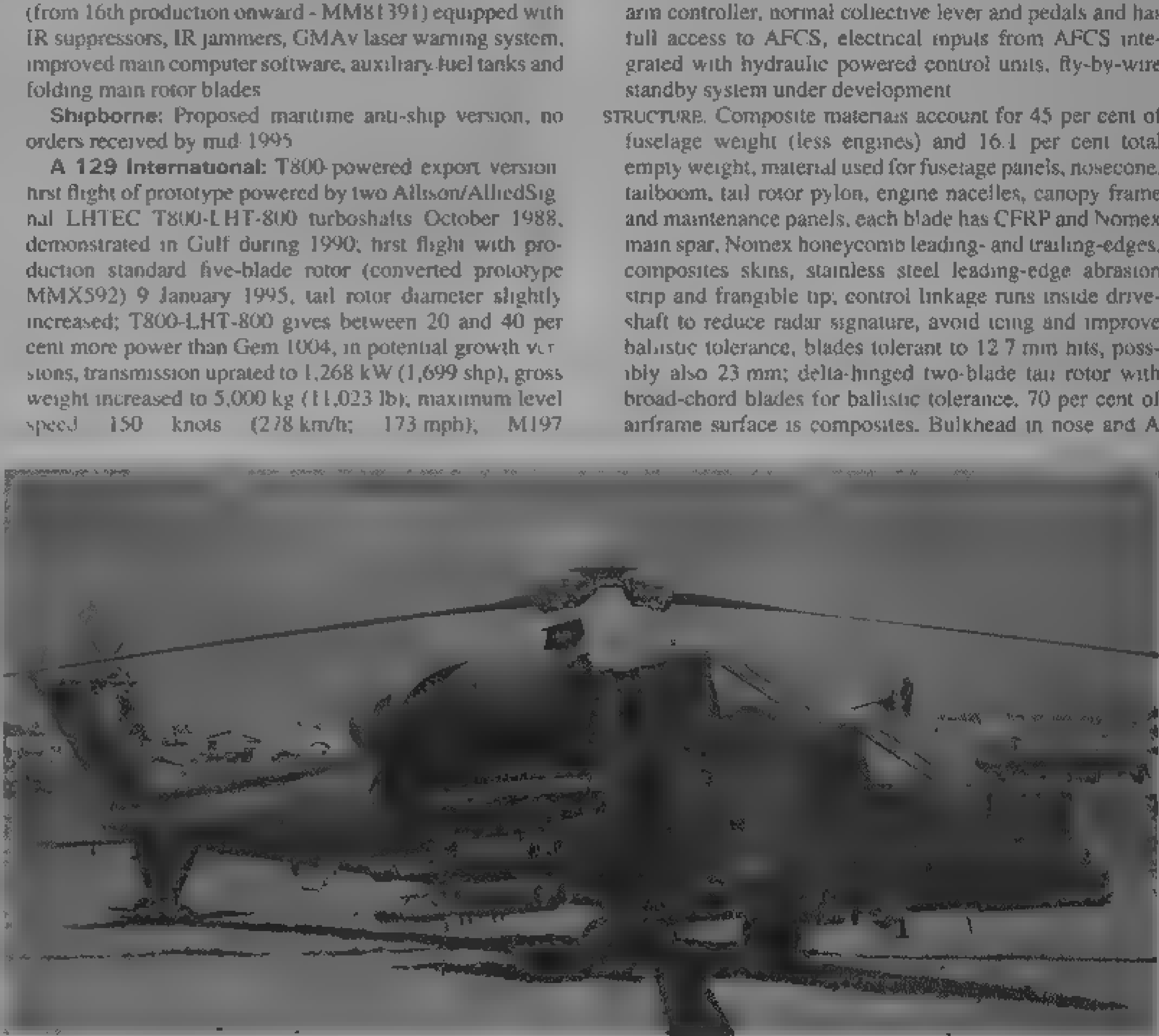
CUSTOMERS: First five of planned 60 for Italian Army anti-tank squadrons (15 Lot 1 and 45 Lot 2) delivered October 1990 after delay of more than a year to allow fitting of Saab/ESCO HeliTOW system with nose-mounted sight, operated by 49° Gruppo Squadroni at Casarsa and 46° GS at Vercelli, plus Army Aviation Centre, Viterbo, total of 30 in service by end of 1994, further batch of 30 expected, first Lot 2 A 129 with Honeywell/OMI helicopter IR navigation system (HIRNS) and helmet display delivered early 1993.

DESIGN FEATURES: Fully articulated four blade main rotor with blades retained by single elastomeric bearing and restrained by hydraulic drag damper and mechanical droop stop; main rotor blade folding on Lot 2 aircraft.

Main transmission has independent oil cooling system, intermediate and tail rotor gearboxes grease lubricated, all designed for at least 30 minutes run dry, accessory gearbox can be run independently on ground without rotor engagement by No. 1 engine engaged by pilot-operated clutch.

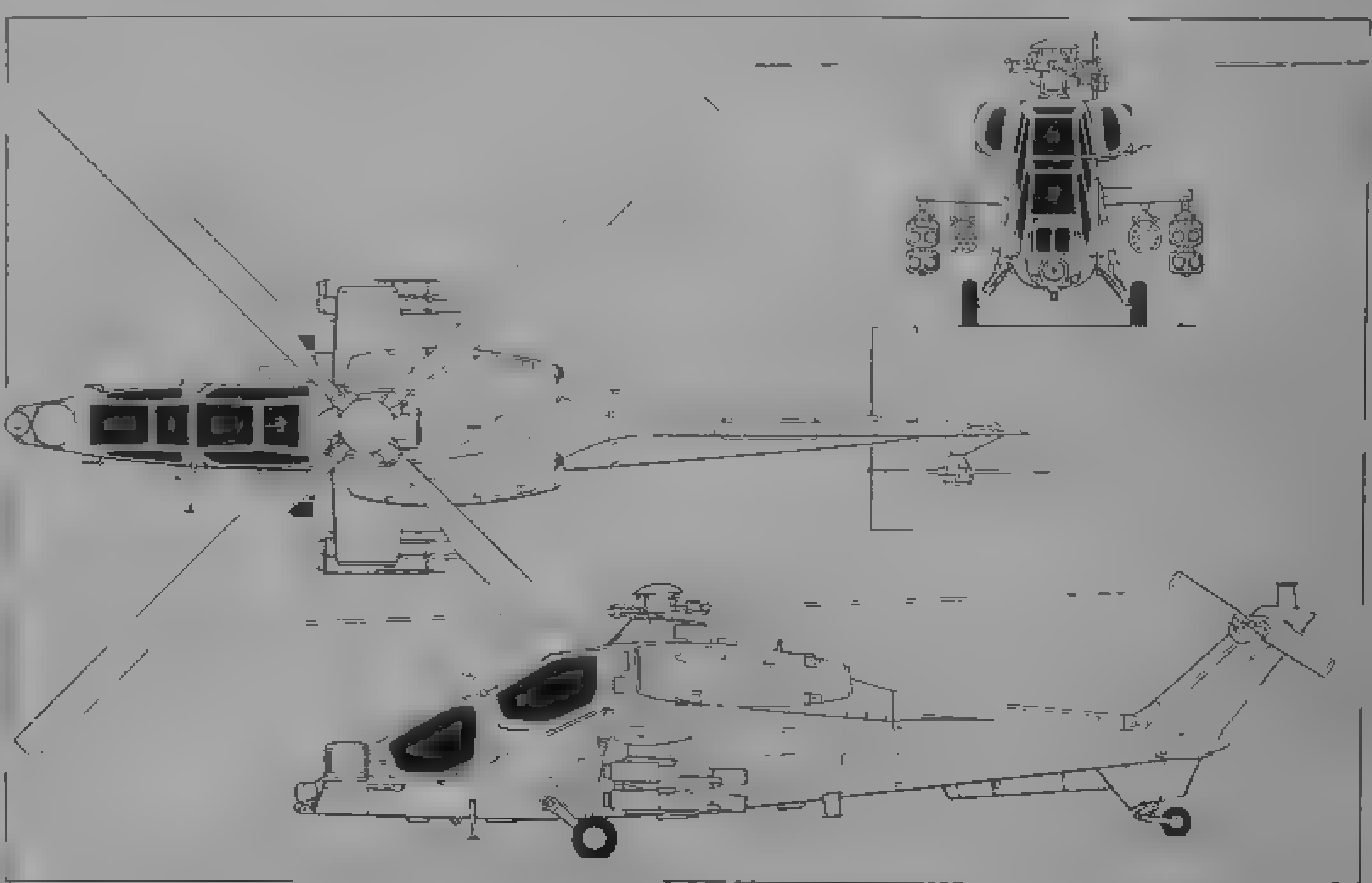
FLYING CONTROLS: Full-time dual electronic flight controls, with full manual reversion, provide automatic heading hold, autohover, autopilot modes and autostabiliser modes, all selectable by pilot, gunner in front seat has cyclic side-arm controller, normal collective lever and pedals and has full access to AFCS, electrical inputs from AFCS integrated with hydraulic powered control units, fly-by-wire standby system under development.

STRUCTURE: Composite materials account for 45 per cent of fuselage weight (less engines) and 16.1 per cent total empty weight, material used for fuselage panels, nosecone, tailboom, tail rotor pylon, engine nacelles, canopy frame and maintenance panels, each blade has CFRP and Nomex main spar, Nomex honeycomb leading- and trailing-edges, composites skins, stainless steel leading-edge abrasion strip and frangible tip; control linkage runs inside driveshaft to reduce radar signature, avoid icing and improve ballistic tolerance, blades tolerant to 12.7 mm hits, possibly also 23 mm; delta-hinged two-blade tail rotor with broad-chord blades for ballistic tolerance, 70 per cent of airframe surface is composites. Bulkhead in nose and A



Italian Army Agusta A 129 (Lot 1) attack helicopter during type's first operational deployment, in Somalia *(Paul Jackson)*

1995



Agusta A 129 light anti-tank, attack and advanced scout helicopter *(Jane's/Dennis Punnett)*

1987

frame running up through fuselage to rotor pylon protect crew against roll-over; overall infra-red suppressing paint. airframe meets MIL-STD-1290 crashworthiness covering vertical velocity changes of 11 2 m (36 ft 9 in)/s and longitudinal changes of 13 1 m (43 ft 0 in)/s

LANDING GEAR: Non-retractable tailwheel type, with single wheel on each unit. Two-stage hydraulic shock strut in each main unit designed to withstand normal loads and hard landings at descent rates in excess of 10 m (32 8 ft)/s.

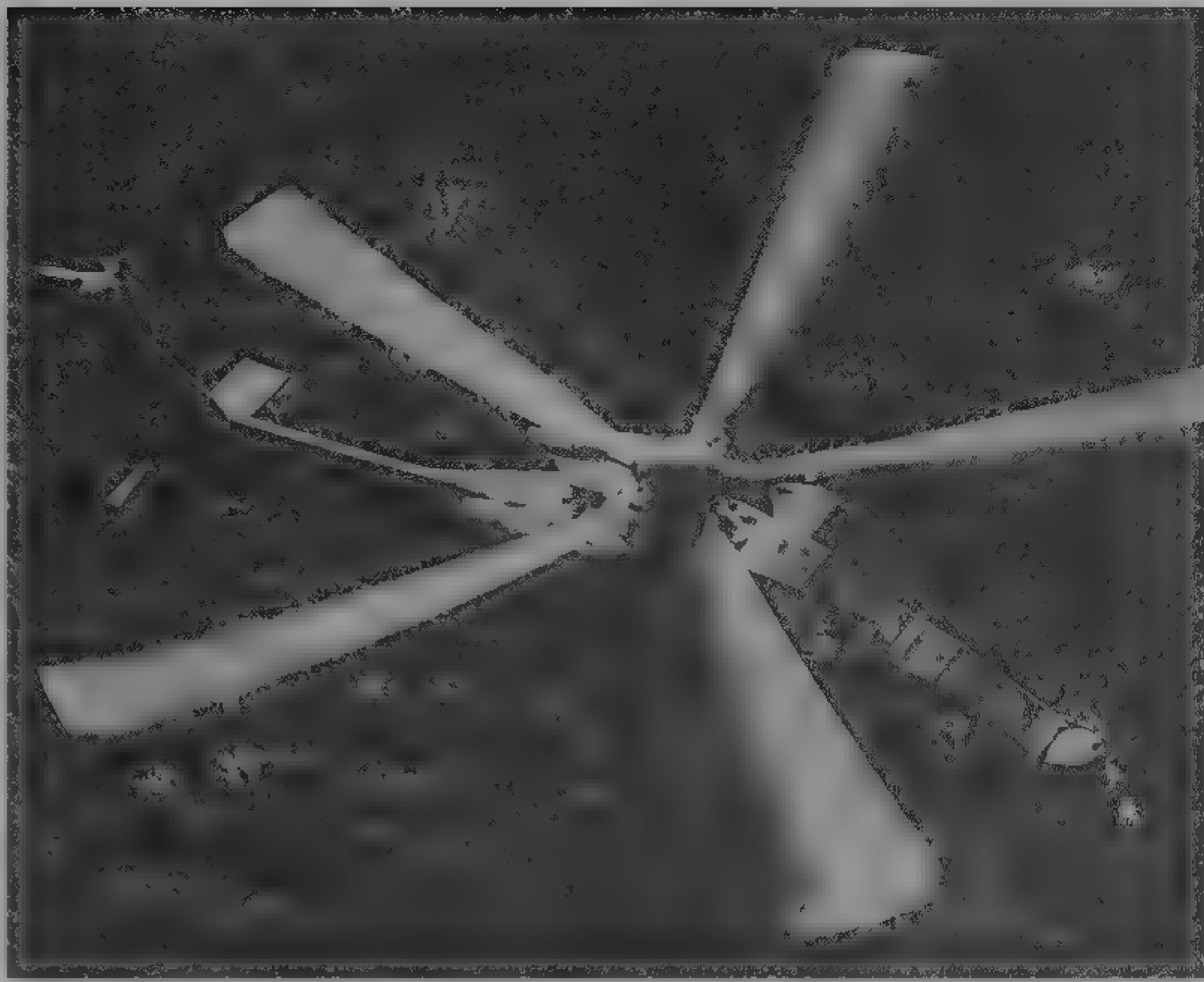
POWER PLANT: Two Rolls-Royce 1004 turboshafts, each with a maximum continuous rating of 615 kW (825 shp) for normal twin-engined operation, intermediate contingency rating of 657 kW (881 shp) for 1 hour, maximum contingency rating of 704 kW (944 shp) for 2½ minutes, and emergency rating (S/L, ISA) of 759 kW (1,018 shp) for 20 seconds. Transmission rating is 969 kW (1,300 shp) (two engines), 704 kW (944 shp) for single-engined operation, with emergency rating of 759 kW (1,018 shp), power input into transmission is at 27 000 rpm from the RR 1004 and 23,000 rpm in opposite direction from T800 Production engines licence-built in Italy by Piaggio. Fireproof engine compartment, with engines widely spaced to improve survivability from enemy fire

Two separate fuel systems, with cross feed capability interchangeable self-sealing and crash-resistant tanks, self-sealing lines, and digital fuel feed control. Tanks can be foam-filled for fire protection. Single-point pressure refuelling. Infra-red exhaust suppression system (from Lot 2) and low engine noise levels. Separate independent lubrication oil-cooling system for each engine. Provision (Lot 2 aircraft) for auxiliary (self-ferry) fuel tanks on inboard underwing stations

ACCOMMODATION: Pilot and co-pilot/gunner in separate cockpits in tandem. Elevated rear (pilot's) cockpit. External crew field of view exceeds MIL-STD-850B. Each cockpit has a flat plate low-glint canopy with upward-hinged door panels on starboard side, blow-out port side panel for exit in emergency, and Martin-Baker crashworthy seat with sliding side panels of composites armour. Landing gear design and crashworthy seats reduce impact from 50 g to 20 g in crash

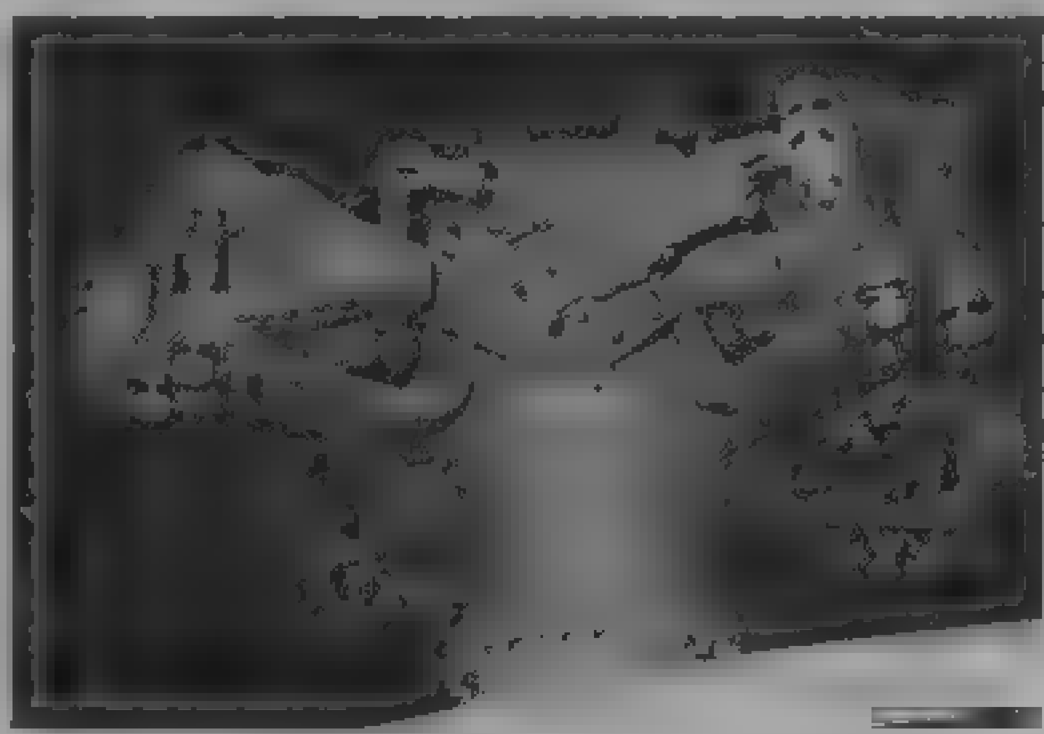
SYSTEMS: Hydraulic system includes two main circuits dedicated to flight controls and two independent circuits for rotor and wheel braking. Main system operates at pressure of 207 bars (3,000 lb/sq in) and is fed by two independent power groups integrated and driven mechanically by the main transmission. Tandem actuators are provided for main and tail rotor flight controls. Hydraulic system flow rate 23 6 litres (6.2 US gallons, 5 2 Imp gallons)/min in each main group. Spring type reservoirs, pressurised at 0.39 bar (5 6 lb/sq in)

AVIONICS: *Flight*. Fully integrated digital multiplex system (IMS) controls navigation, flight management, weapon control, autopilot, monitoring of transmission and engine condition, fuel/hydraulic/electrical systems, caution and warning systems, IMS managed by two Agusta Sistemi/Harris central computers, each capable of operating independently, backed by two interface units which pick up outputs from sensors and avionic equipment and transfer them, via redundant MIL-STD-1553B databuses, to main computers for real-time processing, processed information is presented to pilot and co-pilot/gunner on separate graphic/alphanumeric head-down multifunction displays (MFDs) with standard multifunction keyboards for easy access to information, including area navigation using up to 100 waypoints, weapons status and selection, radio tuning and mode selection, caution and warning, and display of aircraft performance; conventional instruments and dials are provided as back-up; IMS computer can store up to 100 preset frequencies for HF, VHF and UHF radio management; navigation is controlled by navigation computer of IMS coupled to Doppler radar and radar altimeter with low airspeed indicator, normally used for rocket aiming, providing back up velocity data when the Doppler is beyond limits, synthetic map presentation of waypoints, target areas and dangerous areas is shown on pilot's or co-pilot's MFD, Litton strapdown inertial reference for both flight control and navigation is integrated into the IMS



Prototype A 129 International on an early test flight, January 1995

1995



Rotor head of Agusta A 129 Mangusta showing blade retention fittings held by single elastomeric bearings, hydraulic drag dampers and control linkage emerging from top of cylindrical rotor mast

1994

AFCS provides either three-axis stabilisation or full attitude and heading hold, automatic hover, downward trim station to hover or holds for altitude, heading and airspeed or groundspeed and automatic track following

Instrumentation. Full day/night operational capability with equipment designed to give both crew members a view outside helicopter irrespective of light conditions cockpit lighting compatible with night vision goggles

Mission. Pilot's night vision system (HIRNS helicopter infra-red night system) allows nap-of-earth (NOE) flight by night with outside view generated by Honeywell mini FLIR sensor mounted on a Ferranti/OMI steerable platform at nose of aircraft and presented to both crewmen through the monocle of the Honeywell integrated helmet and display sighting system (IHADSS), to which it is slaved by helmet position sensors, flight information symbology superimposed onto image, giving true head-up reference. HeliTOW sight gives co-pilot/gunner direct view optics and FLIR, plus laser for ranging provision for mast-mounted sight (MMS

Self-defence. Active and passive self-protection systems (ECCM and ECM) standard on Italian Army A 129; Have Quick frequency-hopping radio will follow, onboard nav/weapon system can connect directly or by datalink with Italian CATRIN C³I combat information system, passive electronic warfare systems include radar jammer and radar and laser warning receivers, chaff/flare dispensers and IR jammer

ARMAMENT: Four underwing attachments stressed for loads of up to 300 kg (661 lb) each, all stations incorporate articulation which allows pylon to be elevated 2° and depressed 10° to increase missile launch envelope, they are aligned with aircraft automatically, with no need for boresighting. Initial armament of up to eight thermal tracking TOW 2 or 2A wire-guided anti tank missiles (two, three or four in carriers suspended from each wingtip station), with Saab ESCO HeliTOW aiming system with these can be carried on inboard stations, either two 7 62, 12.7 or 20 mm gun pods, or two launchers each for seven air-to-surface rockets. For general attack missions, rocket launchers can be carried on all four stations (two 19-tube plus two seven tube); Italian Army has specified SNIA BPD 81 and 70 mm rockets. Alternatively, A 129 can carry up to eight Hellfire anti-tank missiles with autonomous laser spot tracking capability; eight HOT missiles, AIM 9L Sidewinder, Mistral, Javelin or Stinger air-to-air missiles for aerial combat; two gun pods plus two 19-tube rocket launchers or grenade launchers

Lucas 0 50 in self contained gun turret qualified, but not used by the Italian Army. A 12.7 mm turret has also been fired and 20 or 12 7 mm Gatling turrets have been investigated. Optional upgrades offered for export include an autotracking sight, a laser designator for Hellfire and an MMS for scouting

DIMENSIONS, EXTERNAL

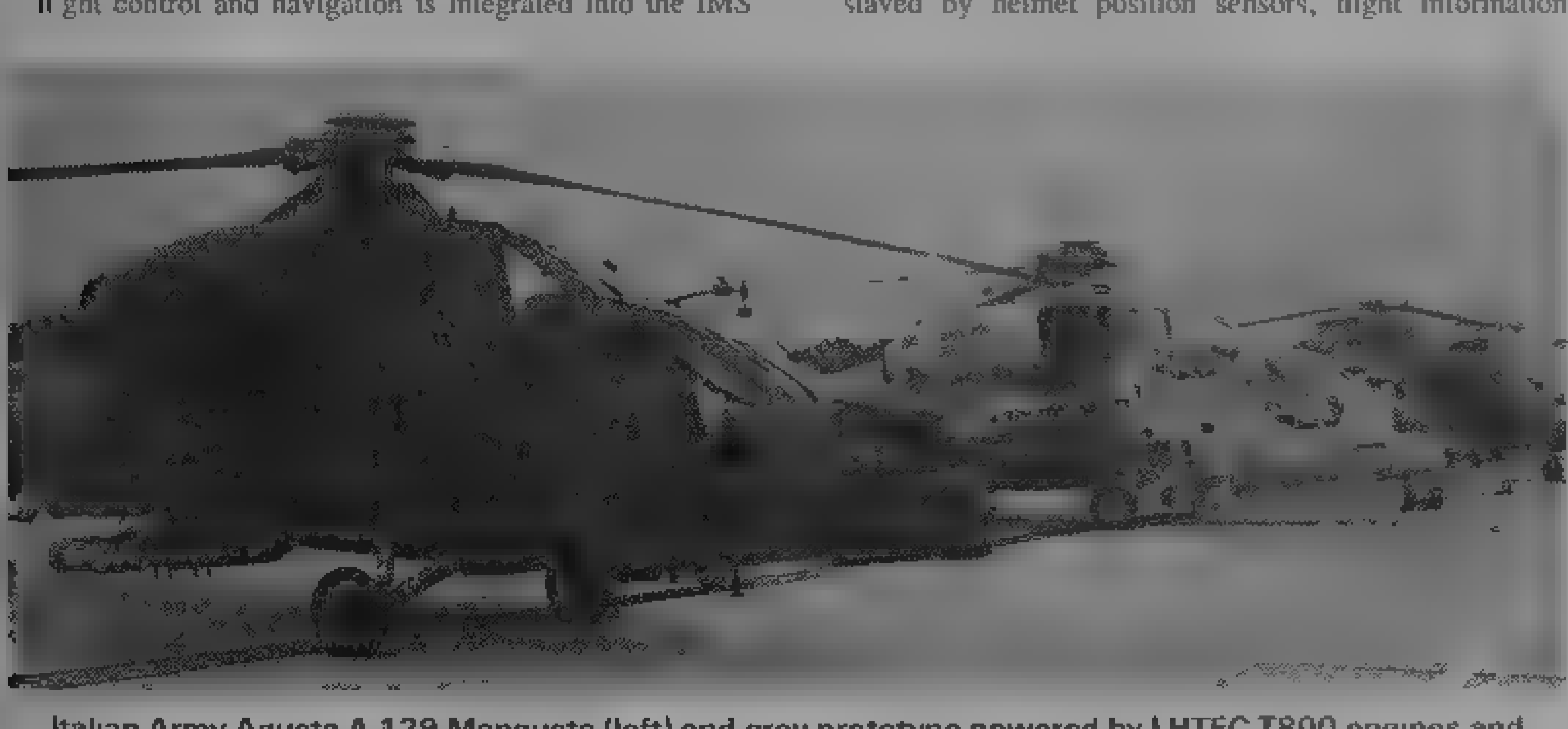
Main rotor diameter	11 90 m (39 ft 0½ in)
Tail rotor diameter	2 32 m (7 ft 7 in)
Wing span	3 20 m (10 ft 6 in)
Width over TOW pods	3 60 m (11 ft 9¾ in)
Length overall, both rotors turning	14.29 m (46 ft 10½ in)
Fuselage: Length	12 275 m (40 ft 3¼ in)
Max width	0 95 m (3 ft 1½ in)
Height	
over tailfin, tail rotor horizontal	2 75 m (9 ft 0¼ in)
tail rotor turning	3 315 m (10 ft 10½ in)
to top of rotor head	3.35 m (11 ft 0 in)
Tailplane span	2 50 m (8 ft 2½ in)
Wheel track	2.23 m (7 ft 3¾ in)
Wheelbase	6.955 m (22 ft 9¾ in)

AREAS

Main rotor disc	111 2 m² (1,196 95 sq ft)
Tail rotor disc	4 23 m² (45.5 sq ft)

WEIGHTS AND LOADINGS (Italian Army)

Weight empty, equipped	2,529 kg (5,575 lb)
Max internal fuel load	750 kg (1,653 lb)
Max external weapons load	1 200 kg (2,645 lb)



Italian Army Agusta A 129 Mangusta (left) and grey prototype powered by LHTEC T800 engines and fitted with optional three-barrel 12 7 mm gun turret under nose

1994

Max T-O weight	4,100 kg (9,039 lb)
Max disc loading	36.8 kg/m² (7.5 lb/sq ft)
Max power loading	4.23 kg/kW (6.95 lb/shp)

PERFORMANCE (Italian Army, with eight TOW):

At mission T-O weight of 3,950 kg (8,708 lb), at 2,000 m (6,560 ft), ISA+20°C, except where indicated:

Dash speed	159 kts (294 km/h; 183 mph)
Max level speed at S/L	135 kts (250 km/h; 155 mph)
Max rate of climb at S/L	618 m (2,028 ft)/min
Hovering ceiling: IGE	3,140 m (10,300 ft)
OGE	1,890 m (6,200 ft)

Basic 2 h 30 min mission profile with eight TOW and 20 min fuel reserves:

Fly 54 n miles (100 km; 62 miles) to battle area, mainly in NOE mode, 90 min loiter (incl 45 min hovering), and return to base

Max endurance, no reserves	3 h 5 min
g limits	+3.5/–0.5

UPDATED

Agusta-Bell 412 HP Griffon utility helicopter with lateral weapon carriers

1994

AGUSTA A 139 UTILITY

Agusta aims to create a family of new helicopters, with a civil/military utility version combining the dynamics, systems and integrated avionics of A 129 with completely new cabin-type fuselage, originally designated Light Battlefield Helicopter. No progress reported by mid-1995.

UPDATED

AGUSTA-BELL 412 HP and GRIFFON

TYPE: Multipurpose medium helicopter.

PROGRAMME: First flight of Bell 412 SP August 1979; deliveries started January 1981. Agusta licence production of civil version started 1981; first flight of military Griffon August 1982, deliveries began January 1983. Bell 412 HP (see Canadian section of 1993-94 *Jane's*) certificated 29 June 1990.

CURRENT VERSIONS: **Griffon**: Military derivatives developed for direct fire support, scouting, assault transport, equipment transport, SAR and maritime surveillance.

CUSTOMERS: Those in Italy include Army (18), Carabinieri (20) and Special Civil Protection fleet (six), Coast Guard (ultimately 25), national fire service (eight), national forest service (nine) and Guardia di Finanza (12); others include Zimbabwe Air Force (10), Ugandan Army (two), and Finnish Coast Guard (two), Royal Netherlands Air Force ordered three for search and rescue and ambulance in October 1992, cost about L1t30 billion; Swedish Army (five), Dubai Police (two, designated 412EP, ordered March 1995).

DESIGN FEATURES: Griffon has reinforced impact-absorbing landing gear, selective armour protection and differences noted below.

POWER PLANT: One 1,342 kW (1,800 shp) Pratt & Whitney Canada PT6T-3BE Twin Pac (single-engine ratings 764 kW, 1,025 shp for 2½ minutes and 723 kW, 970 shp for 30 minutes). IR emission reduction devices optional. Fuel capacity 1,249 litres (330 US gallons, 275 Imp gallons). Single-point refuelling. Two 76 or 341 litre (20 or 90 US gallon, 16.7 or 75 Imp gallon) auxiliary fuel tanks optional, single-point refuelling.

ACCOMMODATION: One or two pilots on flight deck, on energy-absorbing, armour protected seats. Fourteen crash attenuating troop seats in main cabin in personnel transport roles, six patients and two medical attendants in ambulance version, or up to 1,814 kg (4,000 lb) of cargo or other equipment. Space for 181 kg (400 lb) of baggage in tailboom. Total of 51 fittings in cabin floor for attachment of seats, stretchers, internal hoist or other special equipment.

SYSTEMS: Generally as for Bell 212/412.

ARMAMENT: Wide variety of external weapon options for Griffon includes swivelling turret for 12.7 mm gun, two 25 mm Oerlikon cannon, four or eight TOW anti-tank missiles, two launchers each with nineteen 2.75 in SNORA or twelve 81 mm rockets, 12.7 mm machine guns (in pods or door-mounted), four air-to-air or air defence suppression missiles, or, for attacking surface vessels, four Sea Skua or similar air-to-surface missiles.

WEIGHTS AND LOADINGS:

Weight empty, equipped (standard configuration)	2,950 kg (6,505 lb)
Max T-O weight	5,400 kg (11,905 lb)

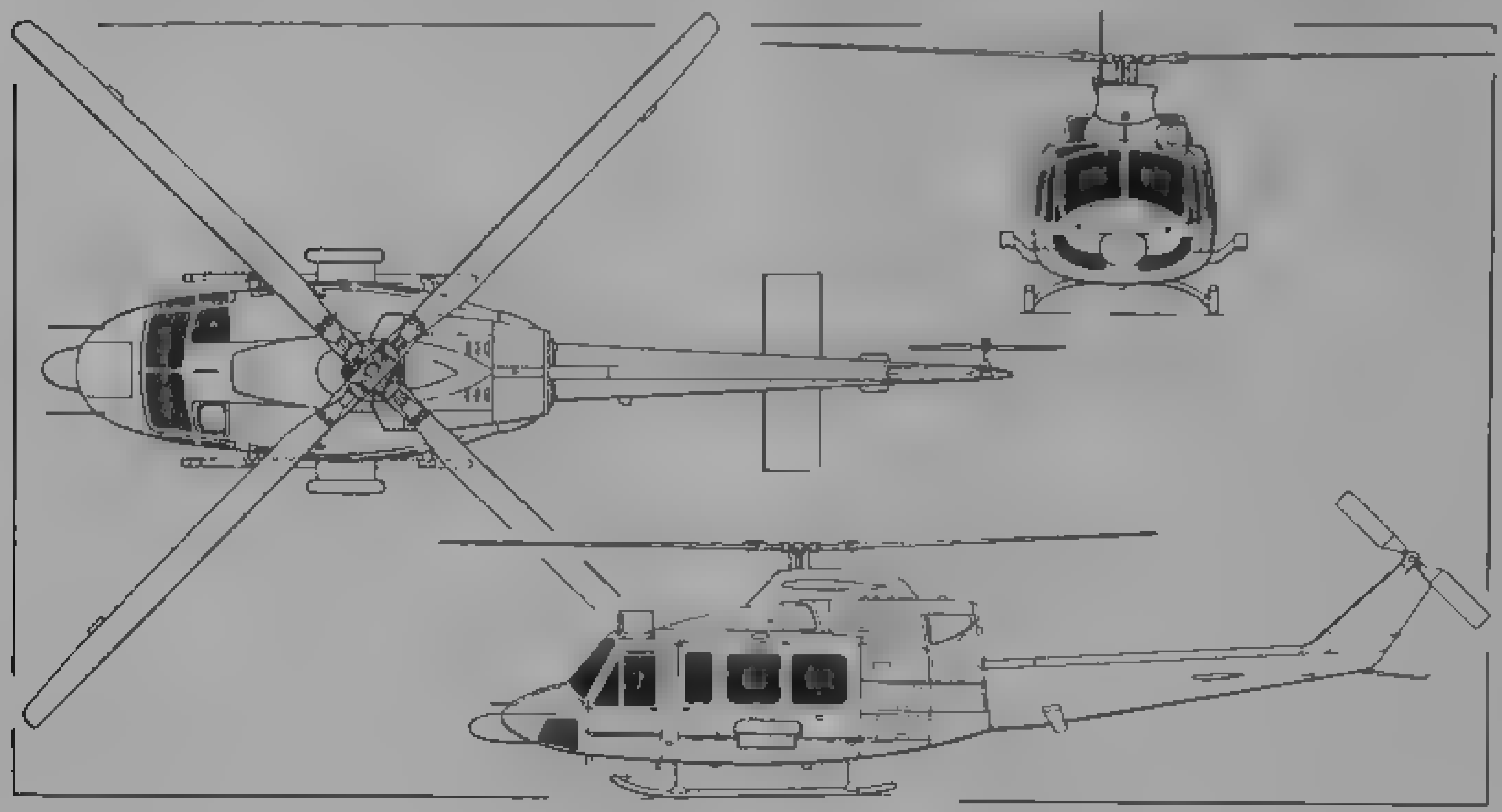
PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (VNE) at S/L	140 kts (259 km/h, 161 mph)
Cruising speed: at S/L	122 kts (226 km/h, 140 mph)
at 1,500 m (4,920 ft)	125 kts (232 km/h, 144 mph)
at 3,000 m (9,840 ft)	123 kts (228 km/h, 142 mph)
Max rate of climb at S/L	438 m (1,437 ft)/min
Rate of climb at S/L, OEI	168 m (55? ft)/min
Service ceiling, 30.5 m (100 ft)/min climb rate	5,180 m (17,000 ft)
Service ceiling, OEI, 30.5 m (100 ft)/min climb rate	2,320 m (7,610 ft)
Hovering ceiling: IGE	3,110 m (10,200 ft)
OGE	1,585 m (5,200 ft)

Range with max standard fuel at appropriate cruising speed (see above), no reserves:

at S/L	354 n miles (656 km, 407 miles)
at 1,500 m (4,920 ft)	402 n miles (745 km, 463 miles)
at 3,000 m (9,840 ft)	434 n miles (804 km; 500 miles)
Max endurance: at S/L	3 h 36 min
at 1,500 m (4,920 ft)	4 h 12 min

UPDATED



Agusta-Bell 412 Griffon military helicopter (*Jane's/Dennis Punnett*)

1985

OTHER AIRCRAFT

Refer to Canadian section for details of **Bell 206B-3 JetRanger III** manufactured under licence by Agusta; to USA section for **McDonnell Douglas Helicopter Systems MD 500/530** and **MD 520N**, for which Agusta's Monteprandone works (formerly Breda Nardi) holds manufacturing and marketing licences for central Europe, and **Schweizer 300C**, which Agusta markets in Europe after import from the manufacturer; refer to *Jane's Aircraft Upgrades* for details of **Agusta-Sikorsky AS-61** and **ASH-3H**. **Bell 212 Twin Two-Twelve** is no longer produced.

NEW ENTRY

SIAI-MARCHETTI

MAIN WORKS: Sesto Calende (Varese).

AIRFIELD AND WORKS: Vergiate and Malpensa.

Founded in 1915, SIAI Marchetti produced wide range of military and civil landplanes and flying boats up to end of Second World War. Current products include piston, turboprop- and turbofan-powered trainers.

On 6 October 1988 a memorandum of intent signed with Grumman Aircraft Systems (a division of Grumman Corporation), to offer version of S.211 for USAF/USN's Joint Primary Aircraft Training System (JPATS) requirement (see US section).

SIAI overhauls and repairs various types of aircraft (notably C-130 Hercules, DHC-5 Buffalo and Cessna Citation II), participates in national or multinational programmes, producing parts for Alenia G222, Panavia Tornado, AMX, Airbus A310 and Atlantique 2.

Works at Sesto Calende, Vergiate and Malpensa total 1,370,267 m² (14,749,416 sq ft) in area, of which 119,494 m² (1,286,221 sq ft) are covered.

UPDATED

SIAI-MARCHETTI SF.260

TYPE: Military and civil basic trainer.

PROGRAMME: Originated as F.250 designed by Stelio Frati and made by Aviamilano (see 1965-66 *Jane's*); civil SF.260 A and B detailed in 1980-81 *Jane's*; military training SF.260C detailed in 1985-86 *Jane's*; SF.260M military trainer detailed in 1984-85 and earlier *Jane's*, still in production as military trainer in early 1995.

CURRENT VERSIONS: **SF.260E/F**: Direct injection (E) and carburetted (F) versions with 100 kg (220 lb) higher aerobatic weight than D. Supersedes lighter SF.260D. Certificated by RAI on 21 January 1992 and by FAA on 17 August 1994. *Main description applies to this version and E/F Warrior.*

SF.260E/F Warrior: Trainer/tactical support version. Two underwing pylons, for up to total 300 kg (661 lb) of external stores, and cockpit stores selection panel. Able to undertake a wide variety of roles, including low level strike, forward air control, forward air support, armed reconnaissance, and liaison. Customers as listed in 1984-85 and earlier *Jane's*.

SF.260TP: Turboprop-powered development. Described separately.

CUSTOMERS: Total more than 860 produced. Customers include Sabena and air forces of Belgium, Zambia, Zaïre (early versions); Royal Air Maroc, Singapore AF, Thailand AF, Philippine AF, Tunisian AF, Dubai AF, Myanmar AF (B, M and W), air forces of Italy, Eire, Libya, Bolivia, Burundi and Brunei and Somali Airline and Alitalia (C, M, W). For SF.260TP sales, see separate entry. Turkish Air Force ordered 40 SF.260Ds for military training with an agreement for co-production by the TAI aerospace manufacturing group; 10 delivered complete; first Turkish built aircraft completed April 1992, nine SF.260Ds built for Belgian Air Force in 1992.

DESIGN FEATURES: Wing section NACA 64_1 212 (modified) at root, 64_1 210 (modified) at tip; dihedral 6° 20′ from roots.

FLYING CONTROLS: Differential Frise ailerons, each with servo tab, trims in all three axes, four-way trim button on each stick top; electrically operated slotted flaps; controls operated by dual cables.

STRUCTURE: All metal stressed skin structure, wing skin formed of butt-jointed panels flush riveted; single main spar and auxiliary rear spar, press-formed ribs, wings bolted together on centreline and attached to fuselage by six bolts

LANDING GEAR: Electrically retractable tricycle type, with manual emergency actuation. Inward-retracting main gear, of trailing arm type, and rearward-retracting nose unit, each embodying Magnaghi oleo-pneumatic shock absorber (Type 2/22028 in main units). Nose unit is of leg and fork type, with coaxial shock absorber and torque strut. Cleveland P/N 3080A mainwheels, with size 6.00-6 tube and tyre (6 ply rating), pressure 2.45 bars (35.5 lb/sq in). Cleveland P/N 40-77A nosewheel, with size 5.00-5 tube and tyre (8 ply rating), pressure 1.96 bars (28.4 lb/sq in). Cleveland P/N 3000-500 independent hydraulic single-disc brake on each mainwheel, parking brake. Nosewheel steering (±20°) operated directly by rudder pedals

POWER PLANT: SF 260F powered by one 194 kW (260 hp) Textron Lycoming O-540-E4A5 flat-six engine, driving a Hartzell HC-C2YK-1BF/8477-8R two-blade constant-speed metal propeller. Fuel-injection AEIO-540-D4A5 engine powers SF 260E. Fuel in two light alloy tanks in wings each holding 49.5 litres (13.1 US gallons, 10.9 Imp gallons), and two permanent wingtip tanks each holding 72 litres (19 US gallons, 15.85 Imp gallons). Total internal fuel capacity 243 litres (64.2 US gallons; 53.3 Imp gallons), of which 235 litres (62.1 US gallons, 51.7 Imp gallons) are usable. Individual refuelling point on top of each tank. In addition, SF 260W may be fitted with two 80 litre (21.1 US gallon, 17.5 Imp gallon) auxiliary tanks on underwing pylons. Oil capacity (all models) 11.4 litres (3 US gallons, 2.5 Imp gallons)

ACCOMMODATION: Two pilots side by side in adjustable seats with full blind-flying panel on right and reduced panel and radio on left. Third seat in rear. All three seats equipped with lap belts and shoulder harnesses. Baggage compartment aft of rear seat. Upper portion of sliding canopy tinted. Emergency canopy release handle for front seat occupant. Steel tube windscreen frame for protection in the event of an overturn. Air conditioning, oxygen and enlarged canopy optional

SYSTEMS: Foot-powered hydraulics for mainwheel brakes only. No pneumatic system. 24 V DC electrical system of single-conductor negative earth type, including 70 A Prestolite engine-mounted alternator/rectifier and 24 V 24 Ah battery for engine starting, flap and landing gear actuation, fuel booster pumps, electronics and lighting. Sealed battery compartment in rear of fuselage on port side. Connection of an external power source automatically disconnects the battery. Heating system for carburettor air intake. Emergency electrical system for extending landing gear if normal electrical actuation fails, provision for mechanical extension in the event of total electrical failure. Cabin heating, and windscreen de-icing and demisting, by heat exchanger using engine exhaust air. Additional manually controlled warm air outlets for general cabin heating

AVIONICS: *Comms:* Bendix/King or Collins airways radio with dual com and nav. in SF 260E/F, avionics mounted aft of cabin and battery moved forward

EQUIPMENT: Military equipment to customer's requirements. External stores can include one or two reconnaissance pods with two 70 mm automatic cameras, or two supply containers or two external tanks. Landing light in nose, below spinner

ARMAMENT (SF 260W): Two underwing hardpoints, able to carry external stores on NATO 14 in shackles up to a maximum of 300 kg (661 lb) when flown as a single-seater. Typical alternative loads can include one or two SIAI gun pods, each with one or two 7.62 mm FN machine guns and 500 rounds, two 0.50 Browning machine gun pods, two Aerea AL-8-70 launchers each with eight 2.75 in rockets, two LAU-32 launchers each with seven 2.75 in rockets, two Aerea AL-18-50 launchers each with eighteen 2 in rockets, two Aerea AL-8-68 launchers each with eight 68 mm rockets, two Aerea AL-6-80 launchers each with six 81 mm rockets, two LUU-2/B parachute flares; two SAMP EU 32 125 kg general purpose bombs or EU 13 120 kg fragmentation bombs; two SAMP EU 70 50 kg general purpose bombs, Mk 76 11 kg practice bombs, two cartridge throwers for 70 mm multipurpose cartridges, F 725 flares or F 130 smoke cartridges. One or two photo reconnaissance pods with two 70 mm automatic cameras, two supply containers

DIMENSIONS, EXTERNAL:

Wing span over tip tanks	8.35 m (27 ft 4¾ in)
Wing chord: at root	1.60 m (5 ft 3 in)
mean aerodynamic	1.325 m (4 ft 4¼ in)
at tip	0.784 m (2 ft 6¾ in)
Wing aspect ratio (excl tip tanks)	6.3
Wing taper ratio	2.2
Length overall	7.10 m (23 ft 3½ in)
Fuselage: Max width	1.10 m (3 ft 7¼ in)
Max depth	1.042 m (3 ft 5 in)
Height overall	2.41 m (7 ft 11 in)
Elevator span	3.01 m (9 ft 10½ in)
Wheel track	2.274 m (7 ft 5½ in)
Wheelbase	1.66 m (5 ft 5¼ in)
Propeller diameter	1.93 m (6 ft 4 in)
Propeller ground clearance	0.32 m (1 ft 0½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	1.66 m (5 ft 5¼ in)
Max width	1.00 m (3 ft 3¼ in)
Height: seat cushion to canopy	0.98 m (3 ft 2½ in)
with enlarged canopy	1.07 m (3 ft 6 in)
Volume	1.50 m³ (53 cu ft)
Baggage compartment volume	0.18 m³ (6.36 cu ft)

AREAS:

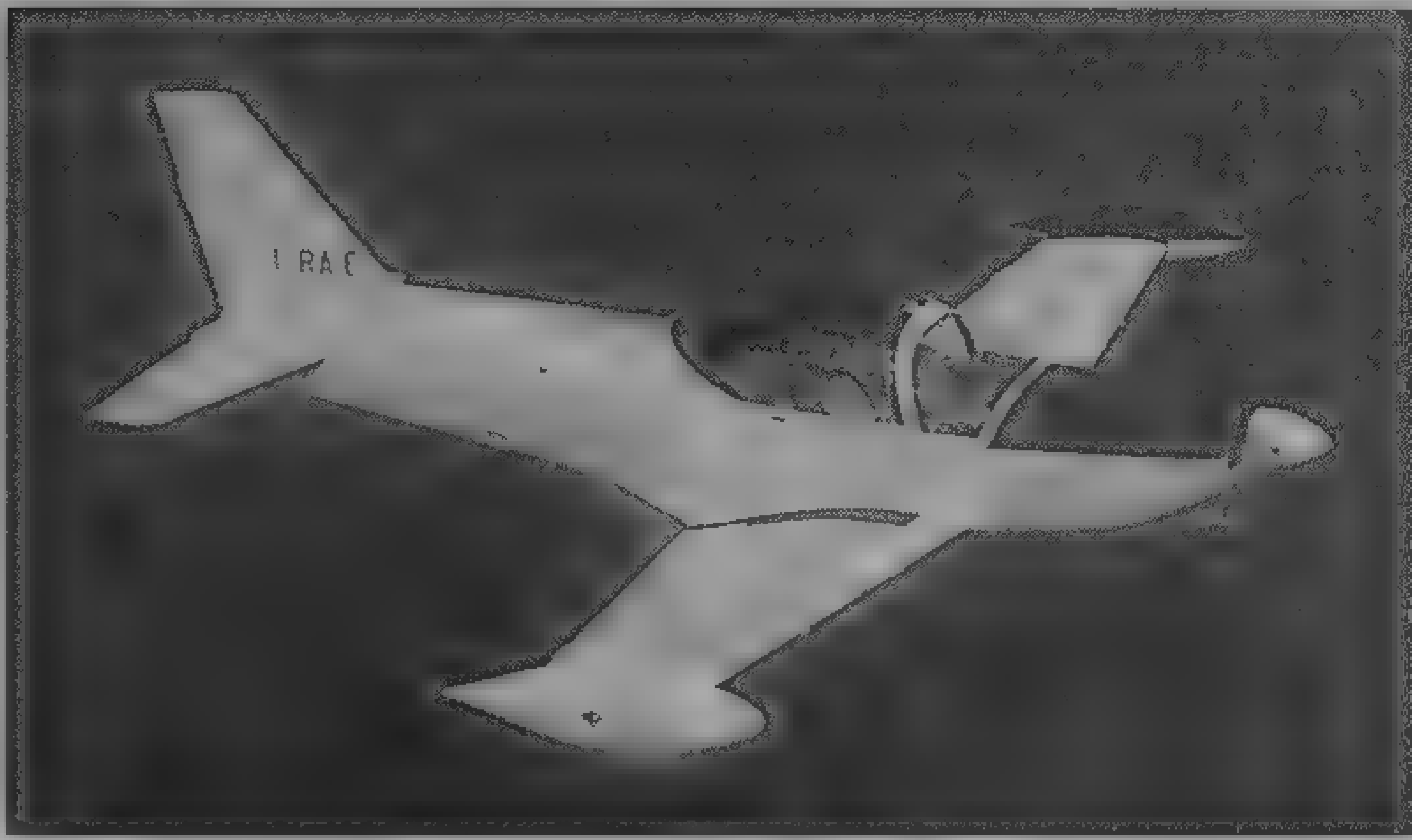
Wings, gross	10.10 m² (108.70 sq ft)
Ailerons (total, incl tabs)	0.762 m² (8.20 sq ft)
Trailing-edge flaps (total)	1.18 m² (12.70 sq ft)
Fin	0.76 m² (8.18 sq ft)
Dorsal fin	0.16 m² (1.72 sq ft)
Rudder, incl tab	0.60 m² (6.46 sq ft)
Tailplane	1.46 m² (15.70 sq ft)
Elevator, incl tab	0.96 m² (10.30 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's basic weight empty	779 kg (1,717 lb)
Fuel: in-wing and wingtip tanks (all versions)	169 kg (372.5 lb)
underwing tanks	115.2 kg (254 lb)
Max T-O weight	1,200 kg (2,645 lb)
Max wing loading: E/F	118.8 kg/m² (24.3 lb/sq ft)
Warrior	128.7 kg/m² (26.4 lb/sq ft)
Max power loading: E/F, M	6.18 kg/kW (10.17 lb/hp)
Warrior	6.70 kg/kW (11.02 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	236 kts (437 km/h, 272 mph)
Max level speed at S/L	187 kts (347 km/h, 215 mph)
Stalling speed, flaps down	61 kts (113 km/h, 70 mph)
Max rate of climb at S/L	548 m (1,800 ft)/min
Service ceiling	5,790 m (19,000 ft)
T-O run at S/L	480 m (1,575 ft)
Landing run at S/L	445 m (1,459 ft)
Range with max internal fuel, two pilots	596 n miles (1,104 km; 686 miles)
g limits	+6/−3



Agusta SF 260E fitted with an enlarged canopy

1995

UPDATED

SIAI-MARCHETTI SF 260TP

TYPE: Turboprop-powered version of SF 260.

PROGRAMME: First flight July 1980, airframe virtually unchanged aft of firewall except for inset rudder trim tab and automatic fuel feed system. Italian civil certification received 29 October 1993.

SF 260E/F description applies also to TP except in the following details:

CUSTOMERS: More than 60 SF 260TP sold to Dubai, Ethiopia, Sri Lanka, Zimbabwe and Philippines (which see).

POWER PLANT: One fully aerobatic Allison 250-B17D turboprop, flat rated at 261 kW (350 shp) and driving a Hartzell HC-B3TF-7A/T10173-25R three-blade constant-speed fully feathering and reversible-pitch propeller. Fuel capacity as for SF 260E/F, automatic fuel feed system. Oil capacity 7 litres (1.8 US gallons, 1.5 Imp gallons).

ARMAMENT: Four underwing hardpoints, able to carry external stores on NATO 14 in shackles up to a maximum of 300 kg (661 lb) when flown as single-seater.

DIMENSIONS, EXTERNAL:

Length overall	7.40 m (24 ft 3¼ in)

WEIGHTS AND LOADINGS:

Weight empty, equipped	750 kg (1,654 lb)
Max T-O weight: trainer	1,200 kg (2,645 lb)
armed	1,350 kg (2,976 lb)
Max power loading: trainer	4.60 kg/kW (7.56 lb/shp)
armed	4.98 kg/kW (8.19 lb/shp)

PERFORMANCE (at trainer Utility T-O weight of 1,200 kg; 2,645 lb, ISA):

Never-exceed speed (VNE)	236 kts (437 km/h, 271 mph)
Max level speed at 3,050 m (10,000 ft)	230 kts (426 km/h, 265 mph)
Max cruising speed at 3,050 m (10,000 ft)	216 kts (400 km/h, 248 mph)
Econ cruising speed at 4,575 m (15,000 ft)	170 kts (315 km/h, 195 mph)
Stalling speed at S/L, flaps down, power off	61 kts (113 km/h, 70 mph)
Max rate of climb at S/L	661 m (2,170 ft)/min
Service ceiling	7,500 m (24,600 ft)
T-O run	298 m (978 ft)

SIAI-Marchetti SF 260TP

1995

Landing run, without reverse pitch 307 m (1,007 ft)
Range at 4,575 m (15,000 ft) with max fuel, 30 min reserves 512 n miles (949 km; 589 miles)

UPDATED

SIAI-MARCHETTI S.211

TYPE: Two-seat turbofan trainer and light attack aircraft

PROGRAMME: Revealed June 1977; first flight (I-SITF) 10 April 1981; deliveries began November 1984

CURRENT VERSIONS: **S.211.** Standard production version for all customers so far. *Description applies to this version and S.211A*

S.211A. Uprated version with more powerful P&WC JT15D-5C; more internal fuel, greater external loads capability, higher powered engine gives shorter field length, higher rate of climb, better sustained turn rate and higher maximum speed, maximum airspeed at 7,620 m (25,000 ft) 414 knots (767 km/h; 476 mph), small ventral fins and drooped wingtips to improve lateral/directional behaviour and weapon aiming and tracking, landing gear reinforced for 3.96 m (13 ft)/s sink rate; empty weight 2,020 kg (4,453 lb); T-O weight for training 2,900 kg (6,393 lb), maximum T-O weight 4,000 kg (8,818 lb). First flight (I-PATS) September 1992. RAI certification achieved 8 July 1994

JPATS: S.211A entered in US Air Force/Navy JPATS training system competition in association with Grumman Aircraft Systems (see Northrop Grumman entry); first S.211A delivered to Grumman 1992, second (I-JPAT) with EFIS, early 1993; envisaged workshare 70:30 with Northrop Grumman manufacturing front fuselage and assembling aircraft. Proposal rejected, June 1995

CUSTOMERS: Philippines (18 S.211 ordered in 1988 and another six delivered 1994 out of original option for 18), Singapore (30). 14 of Philippine aircraft assembled by Philippine Aerospace Development Corporation (which see): first aircraft delivered September 1989; completed end 1991; first six Singapore aircraft delivered as kits, remainder manufactured by SAMCO subsidiary of Singapore Aerospace (SA, which see)

DESIGN FEATURES: Shoulder wing NASA GAW-1 aerofoil sweepback 15° 30′ at quarter-chord, thickness/chord ratio 15 per cent at root, 13 per cent at tip, anhedral 2° from root, twist −3° 17′, S.211A has drooped wingtips

FLYING CONTROLS: Variable incidence tailplane; servo tab and horn balanced elevator; ailerons powered by single hydraulic actuator in fuselage with electrically actuated trim bias in aileron linkage, trimmable rudder; electrically actuated Fowler flaps, airbrake under centre-fuselage

STRUCTURE: Two-spar, one-piece metal wing forming integral tank in torsion box and bolted to fuselage; upper and lower skins formed in single sheets. 60 per cent of external surfaces of fuselage in composites. Intake trunking made of GFRP moulding reinforced with helically wound CFRP tapes and metal-sprayed on inner surface. Airframe designed for 14,400 flight hours to MIL-A-8866B

LANDING GEAR: Hydraulically retractable tricycle type, of Messier/Magnaghi design. Oleo-pneumatic shock-absorber in each unit. All units retract forward into fuselage (main units turning through 90° to lie flat in undersides of engine air intake trunks). Nosewheel steerable ±18°, powered steering system may be offered. Mainwheels size 6.50-8, nosewheel size 5.00-5 with water-deflecting chined tyre. Designed for sink rate of 4 m (13 ft)/s. Wheel brakes actuated hydraulically, independently of main hydraulic system. Provision for emergency free-fall extension. S.211A gear reinforced and has more powerful brakes

POWER PLANT: S.211 powered by one 11.13 kN (2,500 lb st) Pratt & Whitney Canada JT15D-4C turbofan, with electronic fuel control, mounted in rear of fuselage, lateral intake each side of fuselage, with splitter plate. S.211A powered by 14.19 kN (3,190 lb st) JT15D-5C with automatic ignition, chip detectors and compressor bleed valve to eliminate surge; noise and emissions meet FAR 36 and ICAO rules. Fuel in 650 litre (171.5 US gallon; 143 Imp gallon) integral wing tank and 150 litre (39.5 US gallon; 33 Imp gallon) fuselage tank, total capacity 800 litres (211 US gallons; 176 Imp gallons); S.211A fuel capacity increased by 91 kg (200 lb). Single gravity refuelling point in top surface of starboard wing. Electric fuel pump for engine starting and emergency use. Fuel and oil systems permit inverted flight. Provision for two 270 litre (71.3 US gallon; 59.4 Imp gallon) drop tanks on inboard underwing stores points. Oil capacity 10 kg (22 lb)

ACCOMMODATION: Two pilots in tandem, stepped up 28 cm (11 in) in rear, on Martin-Baker Mk 10 lightweight zero/zero ejection seats. Blast screen between seats. Pressurised and air conditioned cockpit under one-piece framed canopy opening sideways to starboard

SYSTEMS: ECS for cockpit pressurisation and air conditioning, using engine bleed air for heating. Freon R-12 vapour for cooling, S.211A uses R-134A ozone-friendly cooling gas instead of Freon. Maximum pressure differential 0.24 bar (3.5 lb/sq in). Hydraulic system, pressure 207 bars (3,000 lb/sq in), for actuation of airbrake, landing gear, Freon compressor and aileron boost, and independent actuation of wheel brakes. Primary electrical system is 28 V DC, using engine-driven starter/generator, Ni/Cd battery; two static inverters supply AC power for instruments and avionics. External power receptacle in port side of lower fuselage aft of wing. Demand type main oxygen system, at 124 bars (1,800 lb/sq in) pressure, sufficient to supply both occupants for 4 hours, plus bottles for emergency oxygen supply. S.211A carries 20 per cent more oxygen

AVIONICS: *Comms*: Dual V/UHF transceivers, intercom, and IFF or ATC transponder, standard

Radar: Provision for Doppler radar

Flight: VOR/ILS, DME or Tacan; AHRS, HSI; ADF, attitude indicator. Provision for R/Nav and radar altimeter

Instrumentation: Provision for HUD

Mission: Provision for dual gyrostabilised gunsight system with miniaturised video recording or film camera. Inboard wing stations can each carry a photographic reconnaissance pod containing four cameras and an IRLS

Self defence: Provisions for radar warning system and ECM

EQUIPMENT: Inboard wing stations can carry two photo-reconnaissance pods, each with four cameras and infra-red linescan

ARMAMENT: S.211 has four underwing hardpoints, stressed for loads of up to 330 kg (727.5 lb) inboard, 165 kg (364 lb) outboard, maximum external load 660 kg (1,455 lb). S.211A has four underwing hardpoints, stressed for loads of up to 350 kg (772 lb) inboard and 250 kg (551 lb) outboard, belly pod stressed for 90 kg (198 lb), maximum external load 1,090 kg (2,403 lb). Typical loads as for S.211

Typical loads can include four single- or twin-gun 7.62 mm machine gun pods, four 12.7 mm gun pods, or (inboard only) two 20 mm gun pods; four AL-18-50 (eighteen 50 mm), Matra F2 (six 68 mm), LAU-32 (seven 2.75 in), or AL-6-80 (six 81 mm) rocket launchers, or (inboard only) two Matra 155 (eighteen 68 mm), SNORA RWK-020 (twelve 81 mm) or 100 mm rocket launchers; four bombs or practice bombs of up to 150 kg size, or (inboard only) two bombs or napalm containers of up to 300 kg; or four 74 mm cartridge throwers, or parachuting containers. S.211A can have special container or 12.7 mm gun pod on fuselage centreline pylon. GMAv ISIS D-211 optical weapon aiming system optional

DIMENSIONS, EXTERNAL:
Wing span 8.43 m (27 ft 8 in)
Wing chord: at root 2.151 m (7 ft 0¾ in)
mean aerodynamic 1.646 m (5 ft 4¾ in)
at tip 1.00 m (3 ft 3¼ in)
Wing aspect ratio 5.64
Length overall 9.5 m (31 ft 2 in)
Height overall 3.80 m (12 ft 5½ in)
Tailplane span 3.96 m (13 ft 0 in)
Wheel track 2.29 m (7 ft 6 in)
Wheelbase 4.02 m (13 ft 2¼ in)

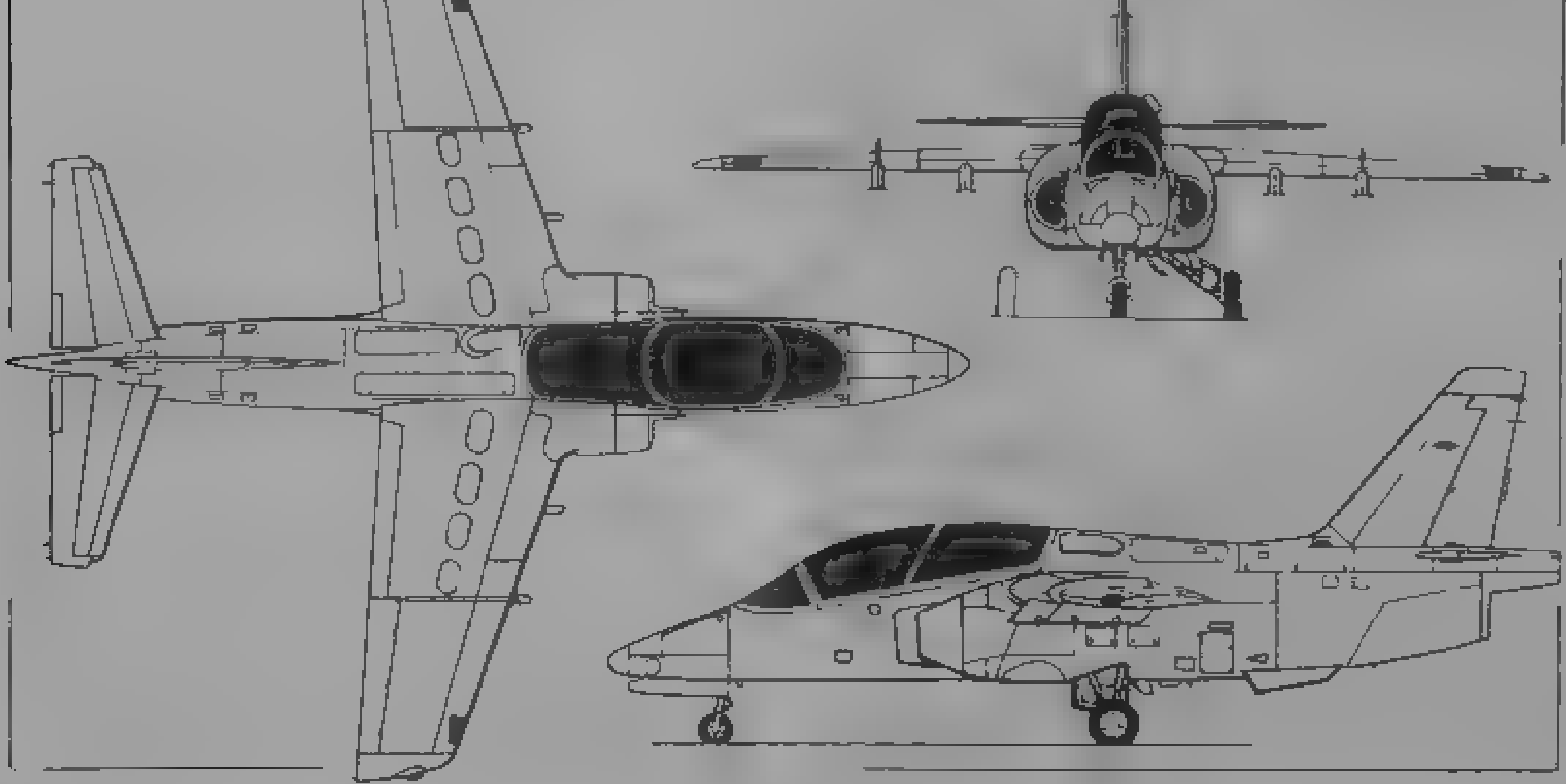
AREAS:
Wings, gross 12.60 m² (135.63 sq ft)
Airbrake 0.42 m² (4.52 sq ft)
Vertical tail surfaces (total) 2.01 m² (21.64 sq ft)
Horizontal tail surfaces (total) 3.378 m² (36.36 sq ft)

WEIGHTS AND LOADINGS (A: S.211, B: S.211A):
Weight empty, equipped: A 1,850 kg (4,078 lb)
B 2,030 kg (4,475 lb)
Max usable fuel, internal: A 622 kg (1,371 lb)
B 680 kg (1,500 lb)
external: A, B 390 kg (860 lb)
Max T-O weight: trainer, clean: A 2,750 kg (6,063 lb)
B 2,900 kg (6,393 lb)
armed version: A 3,150 kg (6,944 lb)
B 4,000 kg (8,818 lb)
Max wing loading:
trainer, clean: A 218.25 kg/m² (44.70 lb/sq ft)
B 230.16 kg/m² (47.14 lb/sq ft)
armed version: A 250.00 kg/m² (51.20 lb/sq ft)
B 317.46 kg/m² (65.02 lb/sq ft)
Max power loading:
trainer, clean: A 247.4 kg/kN (2.42 lb/lb st)
B 204.36 kg/kN (2.00 lb/lb st)
armed version: A 283.4 kg/kN (2.78 lb/lb st)
B 281.88 kg/kN (2.76 lb/lb st)

PERFORMANCE (A at T-O weight of 2,500 kg, 5,511 lb, B at T-O weight of 2,900 kg, 6,393 lb):
Never-exceed speed (V_{NE}): A, B Mach 0.80 (400 kts, 740 km/h; 460 mph EAS)
Max cruising speed at 7,620 m (25,000 ft):
A 360 kts (667 km/h; 414 mph)
B 414 kts (767 km/h; 476 mph)
Rotation speed: A 90 kts (167 km/h; 104 mph)
Stalling speed, flaps down:
A 74 kts (138 km/h; 86 mph)
B 88 kts (163 km/h; 102 mph)
Max rate of climb at S/L: A 1,280 m (4,200 ft)/min
B 1,554 m (5,098 ft)/min
Time to 6,100 m (20,000 ft): A 6 min 12 s
B 4 min 30 s
Service ceiling: A 12,200 m (40,000 ft)
B 12,800 m (42,000 ft)
T-O run (S/L, ISA): A 390 m (1,280 ft)
B 440 m (1,443 ft)
T-O to 15 m (50 ft): A 512 m (1,680 ft)
B 670 m (2,198 ft)
Landing from 15 m (50 ft): A 705 m (2,313 ft)
B 893 m (2,930 ft)
Landing run (S/L, ISA): A 361 m (1,185 ft)
B 488 m (1,601 ft)

Agusta (SIAI-Marchetti) S.211A in the guise of the Northrop Grumman-Agusta bid for the USAF/USN JPATS order

1995



Agusta (SIAI-Marchetti) S.211 basic trainer and light attack aircraft *(Jane's/Dennis Punnett)*

1995

Min air turning radius at S/L:
A, B less than 305 m (1,000 ft)
Typical attack radius with four rocket launchers, AUW of 3,150 kg (6,944 lb): A
hi-lo-hi, out and back at 265 kts (491 km/h; 305 mph) at 9,150 m (30,000 ft), 2 h 50 min mission (incl 5 min over target), 60 kg (132 lb) of fuel remaining
300 n miles (556 km; 345 miles)
lo-lo-lo, out and back at 250 kts (463 km/h; 288 mph) at less than 305 m (1,000 ft), 1 h 5 min mission (incl 5 min over target), 60 kg (132 lb) of fuel remaining
125 n miles (231 km; 144 miles)
Max range on internal fuel, 30 min reserves
900 n miles (1,667 km; 1,036 miles)
Ferry range:
A (AUW of 3,150 kg, 6,944 lb, max internal and external fuel) at 270 kts (500 km/h; 311 mph) at 9,150 m (30,000 ft), 90 kg (198 lb) of fuel remaining
1,340 n miles (2,482 km; 1,542 miles)
B (AUW of 3,550 kg, 7,826 lb) at 270 kts (500 km/h; 311 mph) at 10,670 m (35,000 ft), 90 kg (198 lb) of fuel remaining
1,450 n miles (2,685 km; 1,668 miles)
Endurance, 30 min reserves: A 3 h 50 min
B, 10% reserve 4 h 15 min
Sustained *g* limit at 4,575 m (15,000 ft): A 3.4
B 3.0
g limits: A +6/−3 clean
B +7/−3 clean
+5/−2.5 with external stores

UPDATED

SIAI-MARCHETTI SF.600A CANGURO

TYPE: Twin-turboprop light transport.

PROGRAMME: First built by General Avia powered by Textron Lycoming piston engines, first flight 1978, now powered by Allison 250-B17F turboprops; total nine (including prototype) produced in Italy, between 1979 and 1988; plans to produce Canguro in South Korea have not succeeded, but SIAI-Marchetti still publicising the aircraft and discussing possible Philippines production in 1995; for details see 1991-92 *Jane's*.

UPDATED

ELICOTTERI MERIDIONALI SpA

Formed with assistance from Agusta October 1967, remains separate commercial entity affiliated to Agusta. In 1968 EM acquired rights to co-production, marketing and servicing of Boeing CH-47C Chinook transport helicopter for customers in Italy and certain foreign countries; Italian production of CH-47C airframe by Agusta.

Works of EM occupy total area of more than 300,000 m² (3,229,170 sq ft); participates in manufacturing of Agusta A 109 and A 129, Agusta-Bell 212/412, and Agusta-Sikorsky S-61 variants, has facilities for overhaul, repair and field assistance; designated overhaul organisation for all types of Italian Army helicopter, and is distributor in Italy for Allison 250 turboshaft engines.

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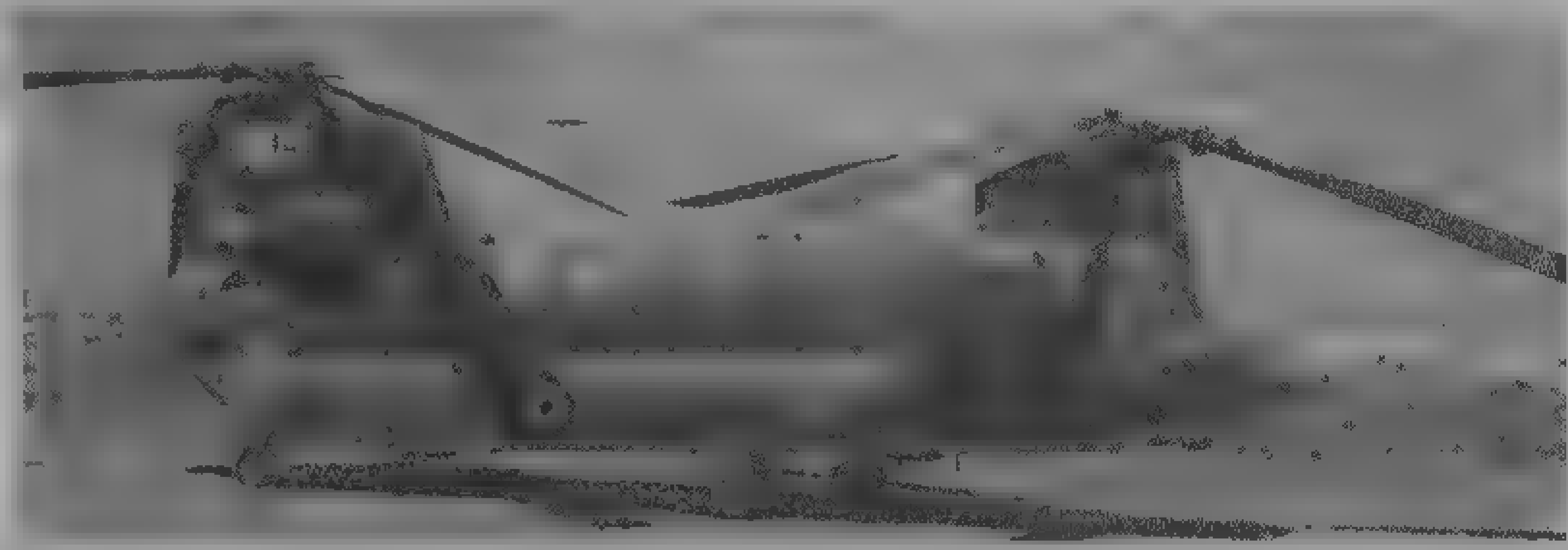

Italian built Boeing CH-47C Plus with T55-L-712E engines on relief operations in Mogadishu *(Paul Jackson)* *1993*

EM (BOEING) CH-47C CHINOOK

Italian manufacture of CH-47C began in Spring 1970 for Italian Army Aviation, later customers included Egypt (15), Greece (10), Libya (20), Morocco (nine), Iran (68 of 95 originally ordered) and US Army (11); 173 built by late 1994 including 34 assembled by Boeing (30 of these also Boeing kits) and six for Italian civilian operators.

Ten **CH-47C Plus** produced for operation by Italian Army on behalf of Civil Protection Agency; upgrading programme begun to fit earlier aircraft with new AlliedSignal T55-L-712E engines, composite rotor blades and more advanced transmission system; maximum T-O weight increased to 22,680 kg (50,000 lb).

Agusta developed, jointly with Hosp Ital SpA (a division of Cogefar) of Milan, an **ESFC** (emergency surgery flying centre) version of Chinook for use as mobile hospital (details in 1983-84 *Jane's*); one delivered to Italian Army in 1987, six more CH-47Cs ordered for Italian Army Aviation unit at Castelnuovo di Porto specialising in disaster relief and firefighting.

Italian Army's entire fleet of Chinooks overhauled at rate of three a year by EM, first of 23 then operational aircraft redelivered March 1986; roles include firefighting using 5,000 litre (1,321 US gallon; 1,100 Imp gallon) metal tank.

UPDATED

ALENIA

(A Finmeccanica company)

Via E. Petroni 2, I-00197 Rome
Telephone: 39 (6) 807781
Fax: 39 (6) 8072215, 8075184
Telex: 611395 Alenia I
CEO: Giorgio Zappa
MARKETING AND SALES: Nicolas Zalonis
VICE-PRESIDENT, PUBLIC RELATIONS AND PRESS:
Fabio Dani

Alenia formed by merger of Aeritalia and Selenia (both members of Finmeccanica) within state industrial group IRI in December 1990. On 8 October 1992, Alenia reorganised with central operations department intended to avoid duplication, and activities divided into sectors covering aeronautics, aero-engines, space, defence and control systems, naval systems and commercial systems. Aeronautical activities were handled by separate divisions covering defence aircraft, aerostructures, commuter, transport aircraft overhaul and modification and Alfa Romeo Avio (engines).

In further major reorganisation of February 1993, IRI companies Alenia, Ansaldo and Elsag Bailey merged into Finmeccanica with IRI as the majority shareholder (86.6 per cent) in the new company.

Agusta, Breda Meccanica Bresciana, Galileo, OMI, OTO Melara and SMA, former members of the EFIM state holding company, came under management of Finmeccanica when EFIM was liquidated during 1993. The companies were merged with Finmeccanica in January 1994.

Alenia employees reduced to 25,000 during 1993 and sales remained constant at LIt5,000 billion. General privatisation to be started by end 1996.

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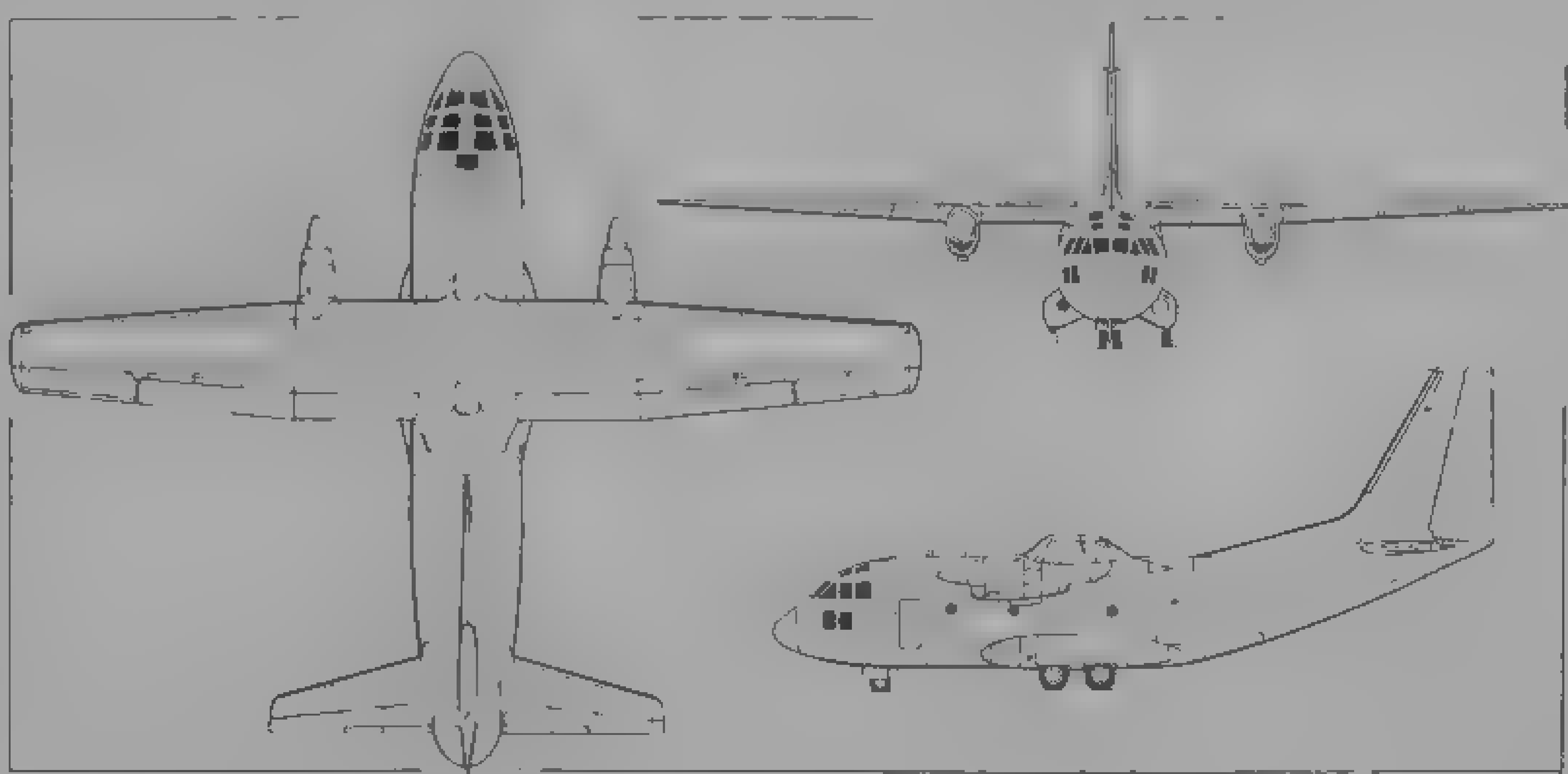


Alenia G222 (C-27A Spartan) twin-turboprop general purpose military transport *(Jane's/Dennis Punnett)* *1992*

ALENIA G222

US Air Force designation: C-27A Spartan

TYPE: Pressurised twin-turboprop tactical transport.

PROGRAMME: First flight 18 July 1970; early history in 1987-88 *Jane's*. Alenia started new batch of 10 in 1993, these have been absorbed by new orders.

CURRENT VERSIONS: **G222**: Standard military transport. *Detailed description applies to this version.* Italian aircraft designated **G222TCM**.

G222PROCIV: For Italian Ministry of Civil Defence (Servizio Nazionale Protezione Civile — SNPC).

G222RM Radiomisure: Navaid calibration version (see 1989-90 *Jane's*).

G222SAA Sistema Aeronautico Antincendio: Firefighting version (see 1989-90 *Jane's*).

G222T: Powered by Rolls-Royce Tyne turboprops, 20, including two in VIP configuration, sold to Libya (see 1986-87 *Jane's*).

G222VS Versione Speciale: Electronic warfare version (see 1989-90 *Jane's*).

C-27A Spartan (G222-710): US Air Force transport for Panama and South America, fitted with mission equipment by Chrysler Technologies Airborne Systems (see CTAS in US section of 1993-94 *Jane's*). US Air Force ordered total 10 in August 1990 and February 1991, all delivered: eight options. USAF C-27A certificated in USA to weights and performance required for US mission; these figures differ considerably from those for original Italian G222.

CUSTOMERS: See table. From April 1978, Italian Air Force received 46 G222s, including 30 standard transports, 10 G222SAAs, four G222RMs and two G222VSs. Italian Ministry for Civil Defence received five for rapid intervention squadron equipped for firefighting, aeromedical evacuation and airlift. Six more ordered 1993.

DESIGN FEATURES: Full description in 1987-88 *Jane's*.

STRUCTURE: Subcontractors include Aermacchi (outer wings), Piaggio (wing centre-section), Agusta (tail unit), CIRSEA (landing gear) and Aeronavali Venezia (airframe components).

POWER PLANT: Two Fiat built General Electric T64-GE-P4D turboprops, each flat rated at 2,535 kW (3,400 shp) at ISA + 25°C and driving a Hamilton Standard 63E60-27 three-blade variable- and reversible-pitch propeller. Fuel in integral tanks, two in outer wings, combined capacity 6,800 litres (1,796 US gallons; 1,495 Imp gallons); two centre-section tanks, combined capacity 5,200 litres (1,374 US gallons; 1,143 Imp gallons); crossfeed provision to either engine. Total overall fuel capacity 12,000 litres (3,170 US gallons; 2,638 Imp gallons).

ACCOMMODATION: Two-pilot crew on flight deck with third seat, provision for loadmaster or jumpmaster when required. Standard troop transport version has 34 foldaway sidewall seats and 12 stowable seats for 46 fully equipped troops. Paratroop transport version can carry up to 40 fully equipped paratroops, and is fitted with 32 sidewall seats, plus eight stowable seats, door jump platforms and static lines. Cargo transport version can accept standard pallets of up to 2.24 m (88 in) wide, and can carry up to 9,600 kg

(21,164 lb) of freight. Hydraulically operated rear loading ramp and upward-opening door in underside of upswept rear fuselage, which can be opened in flight for airdrop operations. In cargo version, five pallets of up to 1,000 kg (2,205 lb) each can be airdropped from rear opening, or single pallet of up to 5,000 kg (11,023 lb). Paratroop jumps can be made either from this opening or from rear side doors. Entire accommodation pressurised

DIMENSIONS, EXTERNAL:

Wing span	28.70 m (94 ft 2 in)
Wing aspect ratio	10.0
Length overall	22.70 m (74 ft 5½ in)
Height overall	10.57 m (34 ft 8¼ in)
Fuselage: Max diameter	3.55 m (11 ft 7¾ in)
Rear-loading ramp/door: Width	2.45 m (8 ft 0½ in)
Height	2.25 m (7 ft 4½ in)

DIMENSIONS, INTERNAL:

Main cabin: Length	8.58 m (28 ft 1¾ in)
Width	2.45 m (8 ft 0 in)
Height	2.25 m (7 ft 4 in)
Floor area: excl ramp	2[illegible].01 m² (226.0 sq ft)
incl ramp	25.68 m² ([illegible]76.4 sq ft)
Volume	58.0 m³ (2,048 cu ft)

WEIGHTS AND LOADINGS:

Operating weight empty	15,700 kg (34,610 lb)
Max payload (cargo)	9,000 kg (19,840 lb)
Max fuel load	9,400 kg (20,725 lb)
Max T-O weight	28,000 kg (61,730 lb)
Max landing weight	26,500 kg (58,420 lb)
Max zero-fuel weight	24,700 kg (54,454 lb)
Max cargo floor loading	1,500 kg/m² (307.2 lb/sq ft)
Max wing loading	341.5 kg/m² (69.9 lb/sq ft)
Max power loading	5.52 kg/kW (9.08 lb/shp)

PERFORMANCE (at max T-O weight except where indicated):

Max level speed at 4,575 m (15,000 ft)	263 kts (487 km/h, 303 mph)
Long-range cruising speed at 6,000 m (19,680 ft)	236 kts (437 km/h, 272 mph)
Airdrop speed (paratroops or cargo)	110-140 kts (204-259 km/h, 127-161 mph) IAS
Stalling speed, flaps down	92 kts (171 km/h, 106 mph)
Time to 4,500 m (14,760 ft)	16 min
Max rate of climb at S/L	381 m (1,250 ft)/min
Rate of climb at S/L, OEI	[illegible] m (33[illegible] ft)/min
Service ceiling	7,835 m (25,7[illegible] ft)
Service ceiling, OEI	3,660 m (12,[illegible] ft)
T-O run	686 m (2,250 ft)
Landing run at max landing weight	872 m (2,860 ft)
Range with max payload, at optimum cruising speed and height	680 n miles (1,260 km, 783 miles)
Ferry range with max fuel	2,530 n miles (4,685 km, 2,911 miles)
g limit	+2.5

UPDATED

Thai Air Force Alenia G222

1995

G222 PRODUCTION

Customer	Qty	First aircraft	Delivered
Argentine Army	3	AE260	29 Mar 1977
Dubai Air Force	1	321	21 Nov 1976
Italian: prototypes	2	MM582	21 Dec 1971
Air Force (TCM)	38[3]	MM62101	Apr 1978
Air Force (RM)	4	MM62139	Jan 1983
Air Force (VS)	2	MM62107	1978
SNPC (PROCIV)	11	MM62145	1986
Libyan Air Force (T)	20	221	1981
Nigerian Air Force	5	950	Sep 1984
Somali Air Force	2	AM-94	1980
Venezuelan: Army	2	EV-8228	1982
Air Force	6	1258	1984
Thai Air Force	6		1995
US Air Force (C-27A)	10	I-RAIS[1]	17 Apr 1991
Total	112[2]		

[1]For delivery to USA
[2]Prototypes and 22 early aircraft built at Turin, remainder at Naples
[3]Including 10 with provision for rapid conversion to 222SAA

OTHER AIRCRAFT

Alenia is involved with Aermacchi and Embraer in the **AMX** attack aircraft, with Aerospatiale on **ATR** regional transports and is member of **Eurofighter**, **Euroflag** and **Panavia** consortia, all described in International section; also produces components for **Dassault Falcon 2000** (French section) and **Airbus A321** (International), avionics upgrade for **NAMC A-5M** (China), modifies **Boeing** 707 to **707TT** and updates Italian Air Force **Lockheed F-104S Starfighters** as described in *Jane's Aircraft Upgrades*. Subsidiaries perform conversion work on **Douglas DC-8**, **Boeing 727** (both Dee Howard) and **McDonnell Douglas DC-10F/MD-11** (Aeronavali Venezia) as also covered by *Jane's Aircraft Upgrades*.

NEW ENTRY

GENERAL AVIA

GENERAL AVIA COSTRUZIONI AERONAUTICHE SRL

HEAD OFFICE: Via U. Comandini 38, I-00173 Rome
Telephone: 39 (6) 723 651
Fax: 39 (6) 7234536
WORKS: Via Trieste 22-24, I-20096 Pioltello, Milan
Telephone: 39 (2) 9266774 and 92161286
Fax: 39 (2) 92160395
MANAGING DIRECTORS:
Dott Ing Silvio Angelucci
Maurizio Ruggiero
TECHNICAL DIRECTOR: Dott Ing Stelio Frati
MARKETING: Cmdte Alessandro Ghisleni
PUBLIC RELATIONS: Carla Biell

Dott Ing Stelio Frati is well known for many successful light aircraft which, as a freelance designer, he has developed since 1950; these include F 8 Falco, F 15 Picchio, the F 250 (now manufactured by Agusta/SIAI-Marchetti as the SF 260), SF 600A Canguro (now a SIAI-Marchetti programme) and F 20 Pegaso (see 1981-82 *Jane's*). In 1984 started construction of F1300 Jet Squalus, financed by Promavia of Belgium (which see); Promavia bought out whole Jet Squalus programme. Latest versions of F 15 now marketed by Eurospace (which see in International section).

UPDATED

GENERAL AVIA F.22/A, F.22/B and F.22/C PINGUINO (PENGUIN)

TYPE: Side by side two-seat primary trainer.

PROGRAMME: First flight of prototype F.22/A (I-GEAD) from Orio al Serio (Bergamo) 13 June 1989; certification achieved May 1993, certification of 119 kW (160 hp) F.22/B (prototype I-GEAG) Summer 1993, followed by F.22/C (I-GEAH) and F.22/R (see next entry), certification conducted in association with Aermacchi at Venegono.

CURRENT VERSIONS: **F.22/A**: Basic version powered by 86.5 kW (116 hp) engine.

F.22/B: Powered by 119 kW (160 hp) engine.

F.22/C: Flying early 1993; powered by one 134 kW (180 hp) Textron Lycoming IO-360-A1A driving Hartzell HC-C2YK-1BF constant-speed two-blade metal propeller. Fuel capacity 160 litres (42.3 US gallons, 35.2 Imp gallons).

F.22/R: All three Pinguinos offered with optional retractable landing gear.

DESIGN FEATURES: Classic Frati design.

FLYING CONTROLS: Conventional, with fixed tailplane and elevator trim tab; electrically actuated flaps.

STRUCTURE: All-metal single-spar wing built as one piece; all-metal fuselage.

LANDING GEAR: First aircraft have non-retractable tricycle type, with steerable nosewheel; oleo shock-absorbers, faired main legs. Retractable landing gear optional.

POWER PLANT: *F.22/A* powered by one 86.5 kW (116 hp) Textron Lycoming O-235-N2C flat-four engine, driving a two-blade wooden propeller. *F.22/B* powered by 119 kW (160 hp) O-320-D2A flown in second prototype; electric starter. Constant-speed propeller optional. *F.22/C* powered by one 134 kW (180 hp) Textron Lycoming IO-360A1A driving Hartzell HC-C2YK-1BF constant-speed metal two-blade propeller. Fuel capacity 105 litres (28 US gallons, 23 Imp gallons) in F.22/A, 135 litres (36 US gallons, 30 Imp gallons) in F.22/B and 160 litres (42.3 US gallons, 35.2 Imp gallons) in F.22/C; optional long-range tank.

ACCOMMODATION: Two seats side by side; sliding canopy.

AVIONICS: Bendix/King Silver Crown.
Comms: VHF and transponder.
Flight: ADF.

DIMENSIONS, EXTERNAL:

Wing span	8.50 m (27 ft 10¾ in)
Wing chord: at root	1.589 m (5 ft 2½ in)
at tip	0.876 m (2 ft 10½ in)
Wing aspect ratio	6.68
Length overall	7.40 m (24 ft 3¼ in)
Height overall	2.84 m (9 ft 3¾ in)
Tailplane span	3.00 m (9 ft 10 in)
Wheel track	2.90 m (9 ft 6¼ in)
Wheelbase	1.86 m (6 ft 1¼ in)
Propeller diameter	1.78 m (5 ft 10 in)

AREAS:

Wings, gross	10.82 m² (116.25 sq ft)
Fin	0.738 m² (7.94 sq ft)
Rudder	0.505 m² (5.44 sq ft)
Tailplane	1.24 m² (13.35 sq ft)
Elevator, incl tab	1.02 m² (10.98 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped: F.22/A	510 kg (1,124 lb)
F.22/B	530 kg (1,168 lb)
F.22/C	585 kg (1,290 lb)
Max T-O weight:	
Aerobatic: F.22/A	750 kg (1,653 lb)
F.22/B	800 kg (1,763 lb)
F.22/C	850 kg (1,874 lb)
Utility: F.22/A	780 kg (1,719 lb)
F.22/B	850 kg (1,874 lb)
F.22/C	900 kg (1,984 lb)
Max wing loading:	
Aerobatic: F.22/A	69.32 kg/m² (14.20 lb/sq ft)
F.22/B	73.94 kg/m² (15.14 lb/sq ft)
F.22/C	78.56 kg/m² (16.09 lb/sq ft)
Utility: F.22/A	72.08 kg/m² (14.82 lb/sq ft)
F.22/B	78.55 kg/m² (16.08 lb/sq ft)
F.22/C	83.18 kg/m² (17.04 lb/sq ft)

General Avia Pinguinos: left to right, F 22/B (160 hp), F.22/R Sprint (160 hp) and F 22/A (116 hp)

1993

Max power loading	
Aerobatic: F 22/A	8.67 kg/kW (14.25 lb/hp)
F 22/B	6.7 kg/kW (10.74 lb/hp)
F 22/C	6.34 kg/kW (10.41 lb/hp)
Utility: F 22/A	9.0 kg/kW (14.78 lb/hp)
F 22/B	7.14 kg/kW (11.73 lb/hp)
F 22/C	6.71 kg/kW (11.02 lb/hp)

PERFORMANCE

Max level speed: F 22/A	128 kts (237 km/h; 147 mph)
F 22/B	145 kts (269 km/h; 166 mph)
F.22/C	178 kts (330 km/h; 205 mph)
Cruising speed, 75% power:	
F.22/A	120 kts (220 km/h; 138 mph)
F 22/B	130 kts (241 km/h; 149 mph)
Stalling speed, flaps down:	
F 22/A, F 22/B	48 kts (89 km/h; 55 mph)
F 22/C	54 kts (100 km/h; 63 mph)
Max rate of climb at S/L: F 22/A	213 m (700 ft)/min
F.22/B	335 m (1,100 ft)/min
F 22/C	540 m (1,772 ft)/min
Service ceiling: F 22/A	4,100 m (13,450 ft)
F 22/B	5,030 m (16,500 ft)
F 22/C	6,100 m (20,000 ft)
T-O run: F 22/A	295 m (968 ft)
F 22/B	240 m (787 ft)
F 22/C	200 m (656 ft)
Landing run: F.22/A	160 m (525 ft)
F.22/B	170 m (557 ft)
F 22/C	240 m (787 ft)
Max range, standard tank:	
F 22/A	485 n miles (899 km; 557 miles)
F.22/B	595 n miles (1,102 km; 684 miles)
F 22/C	755 n miles (1,400 km; 870 miles)
Max range, long-range tank:	
F 22/A	595 n miles (1,102 km; 684 miles)
F 22/B	730 n miles (1,352 km; 839 miles)

UPDATED

GENERAL AVIA F.22/R PINGUINO-SPRINT

TYPE: Two-seat light club aircraft.

PROGRAMME: First flight (I-GEAE) 16 November 1990, certification undertaken in 1993. Production not yet begun.

DESIGN FEATURES: Airframe largely as F 22 Pinguino, but powered by 119 kW (160 hp) Textron Lycoming O-320-D1A driving constant-speed propeller and with retractable landing gear.

WEIGHTS AND LOADINGS:

Weight empty, incl radio	575 kg (1,268 lb)
Max T-O weight: Aerobatic	750 kg (1,653 lb)
Utility	850 kg (1,873 lb)
Max wing loading:	
Aerobatic	69.32 kg/m² (14.20 lb/sq ft)
Utility	78.56 kg/m² (16.09 lb/sq ft)
Max power loading:	
Aerobatic	6.29 kg/kW (10.33 lb/hp)
Utility	7.13 kg/kW (11.71 lb/hp)

PERFORMANCE (at 800 kg; 1,764 lb AUW):

Max level speed at S/L	164 kts (305 km/h; 189 mph)
Stalling speed, flaps down	53 kts (98 km/h; 61 mph)
Max rate of climb at S/L	420 m (1,378 ft)/min
Service ceiling	5,650 m (18,535 ft)
T-O run	200 m (657 ft)
Landing run	230 m (755 ft)
Max range	700 n miles (1,300 km; 805 miles)

UPDATED

GENERAL AVIA F.220 AIRONE (HERON)

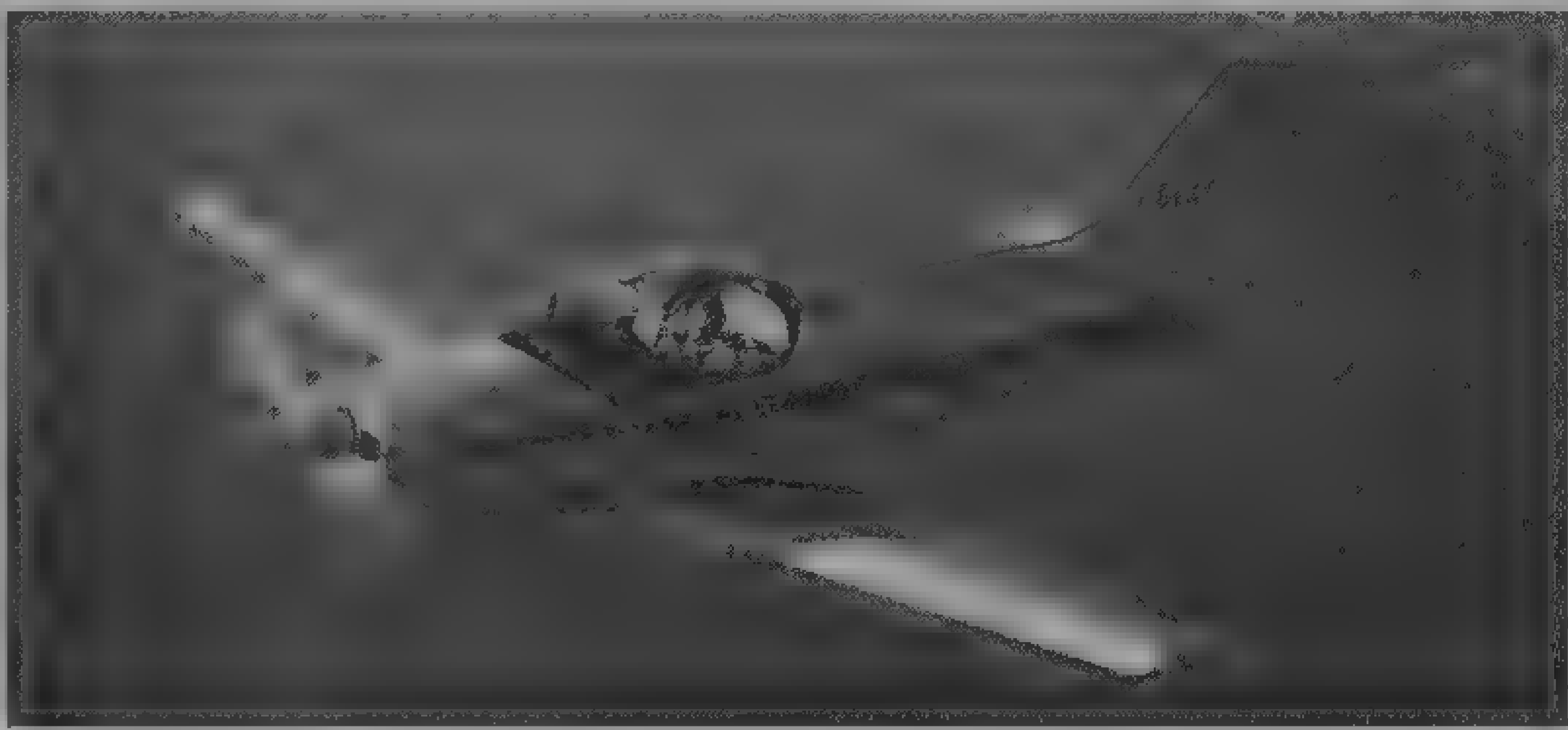
TYPE: Light four-seat touring aircraft.

PROGRAMME: First flight expected September 1993, but programme deferred.

DESIGN FEATURES: Extrapolation of F 22/R Pinguino-Sprint.

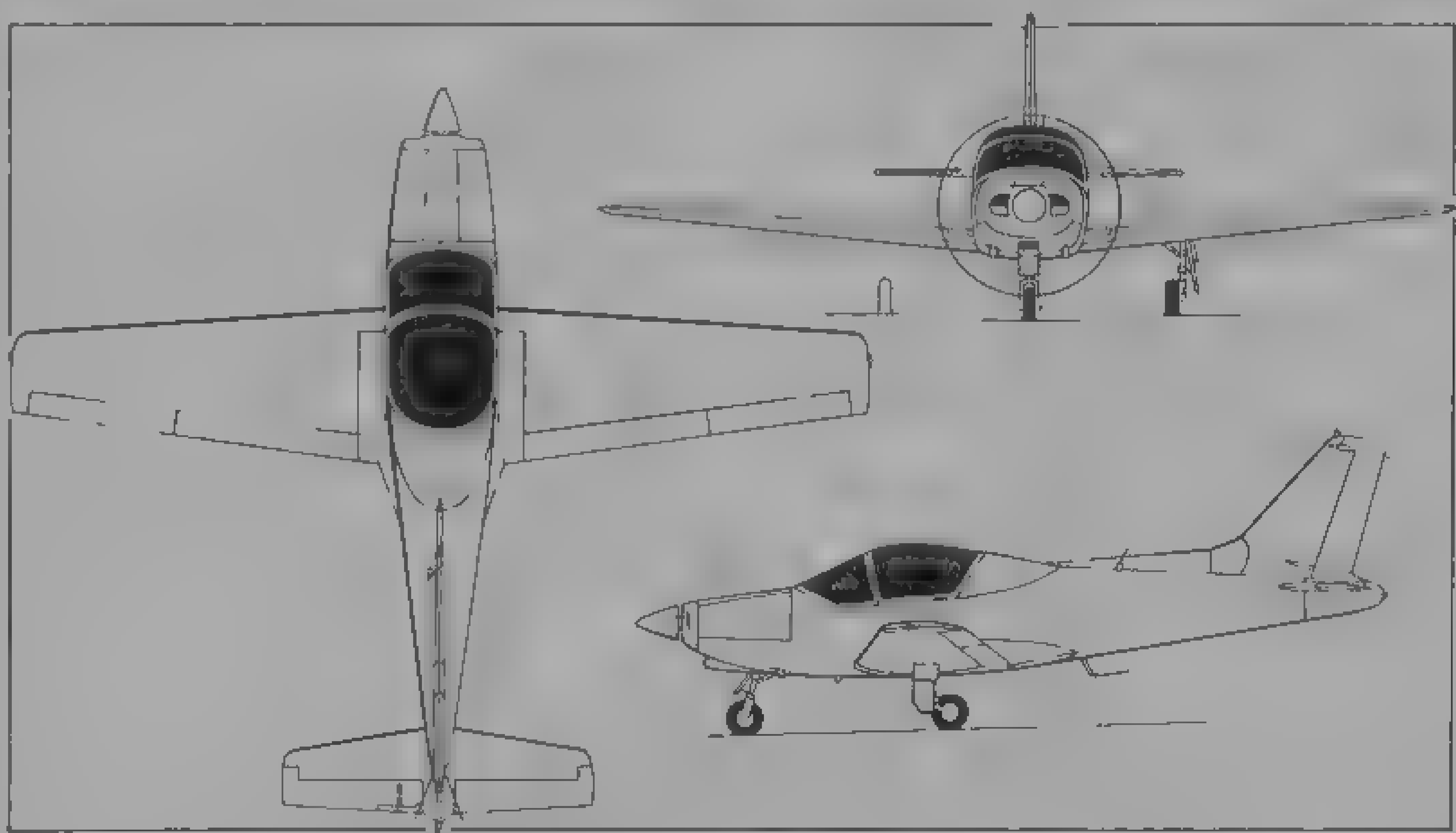
FLYING CONTROLS: As Pinguinos, dual controls, but with aileron wheels.

STRUCTURE: Metal stressed-skin structure analogous to that of F 22/R Pinguino-Sprint.



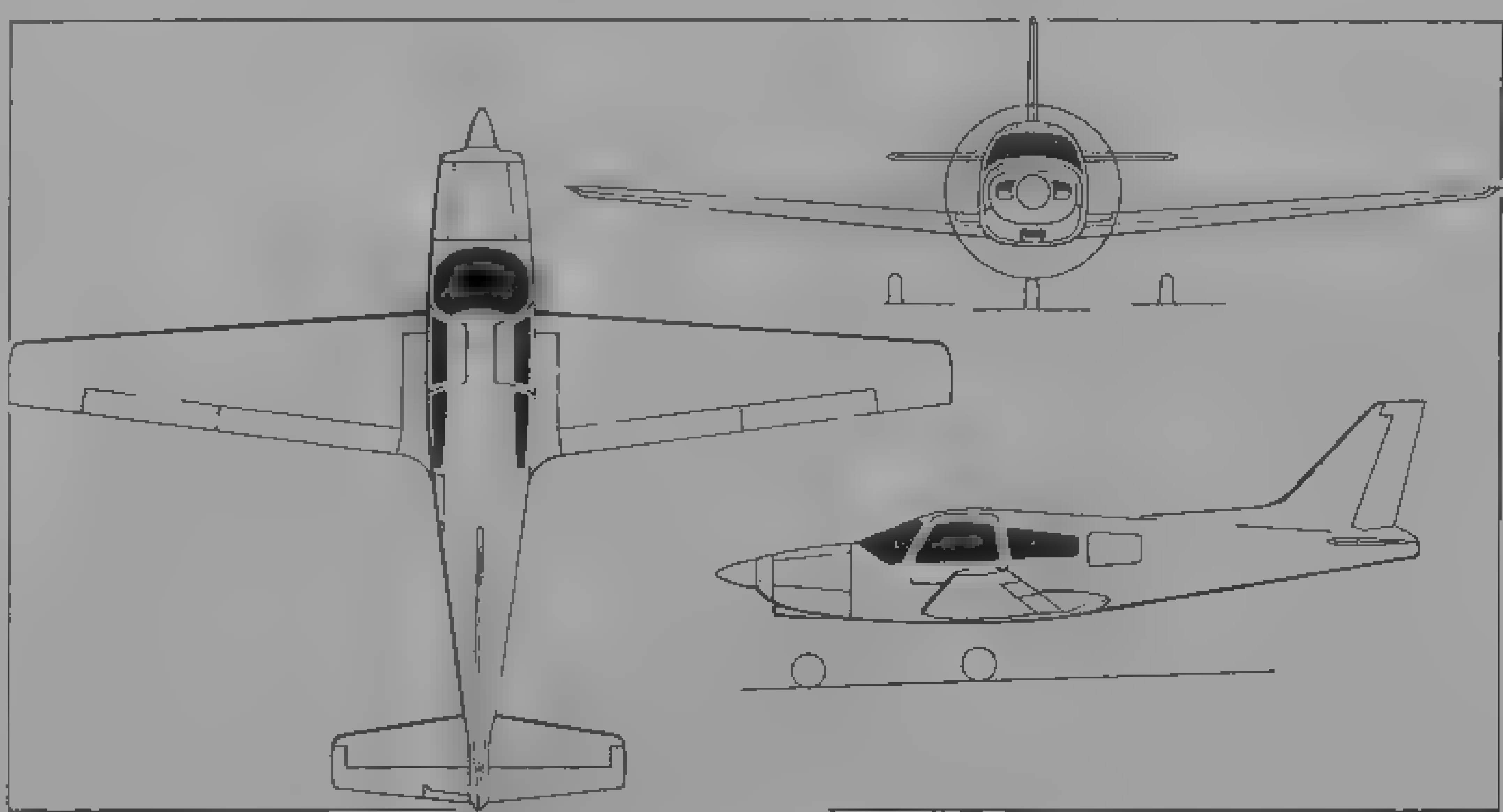
Retractable landing gear General Avia F 22/R Pinguino-Sprint

1993



General Avia F.22/R Pinguino-Sprint two-seater *(Jane's/Mike Keep)*

1993



General Avia F.220 Airone four-seater (one Textron Lycoming IO-360) *(Jane's/Mike Keep)*

1993

LANDING GEAR: Retractable tricycle, steerable nosewheel; electromechanical actuation.

POWER PLANT: One 149 kW (200 hp) Textron Lycoming IO-360-A1A flat four engine, driving a Hartzell constant-speed propeller. Fuel capacity 245 litres (64.7 US gallons, 53.9 Imp gallons) in integral wing tanks.

ACCOMMODATION: Four seats under hard roof; door on each side.

AVIONICS: AlliedSignal Silver Crown.

DIMENSIONS, EXTERNAL:

Wing span	9.70 m (31 ft 10 in)
Wing aspect ratio	8.0
Length overall	9.40 m (30 ft 10 in)

AREAS:

Wings, gross	11.76 m² (126.6 sq ft)
Horizontal tail surfaces (total)	2.26 m² (24.32 sq ft)
Vertical tail surfaces (total)	1.24 m² (13.35 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, with radio	700 kg (1,543 lb)
Max T-O weight	1,150 kg (2,535 lb)
Max wing loading	97.79 kg/m² (20.03 lb/sq ft)
Max power loading	7.72 kg/kW (12.68 lb/hp)

PERFORMANCE:

Max level speed	185 kts (343 km/h; 213 mph)
Cruising speed, 75% power at 2,440 m (8,000 ft)	175 kts (324 km/h; 201 mph)
Stalling speed	57 kts (106 km/h; 66 mph)
Max rate of climb at S/L	427 m (1,400 ft)/min
Service ceiling	5,945 m (19,500 ft)
T-O run	259 m (850 ft)
Landing run	244 m (800 ft)
Max range at 2,440 m (8,000 ft)	1,000 n miles (1,852 km; 1,151 miles)
Endurance	6 h 0 min

UPDATED

III

INIZIATIVE INDUSTRIALI ITALIANE SpA

Corso Trieste n. 150, I-00198 Rome

Telephone: 39 (6) 854 6341/853 01461/853 01794

Fax: 39 (6) 855 7162

PRESIDENT AND MANAGING DIRECTOR: Avv Furio Lauri

Company formed April 1947 in Trieste, as Meteor SpA. Main R&D and production facility then in Monfalcone, where two- and four-seat aircraft produced for training and sport flying, plus target aircraft and electronic systems for military market. Present company created in 1985; relocated to new facility in Monterotondo near Rome, 1989; now produces pleasure boats and general aviation aircraft.

III Sky Arrow 650 ultralight

1995

III SKY ARROW 1200 LC

TYPE: Light tandem-seat sports and training aircraft.

PROGRAMME: Prototype under construction 1992; first flight March 1993, certified by FAA in primary aircraft sport category; 15 aircraft produced and sold by January 1995, production rate three per month (1995).

CURRENT VERSIONS: **1200 LC**: Described below; designation refers to maximum take-off weight in lb.

480: For Canadian market; 480 kg maximum T-O weight.

650 TC: 650 kg T-O weight.

1450 LC: As 650 TC, but expressed in lb.

DESIGN FEATURES: Designed with objectives of good view from cockpit, lightness, ease of maintenance, ease of disassembly for transport and storage. Capable of being converted to an amphibian. High mounted engine behind wing, pusher propeller; low-mounted pod fuselage below propeller carries T tail.

Wing aerofoil Gottingen 398 modified; constant wing chord; dihedral 1° 30′, twist 1°; wings easily detachable at centreline joint.

FLYING CONTROLS: Full dual controls (sidestick and rudder) and two throttles; electrically actuated half span flaps and tabs, centrally mounted elevator tab for trimming.

STRUCTURE: Airframe, wings, tail unit and landing gear manufactured from carbon sandwich Kevlar reinforced, composite material.

LANDING GEAR: Fixed tricycle, hydraulic disc brakes, nosewheel with rubber and spring shock-absorber.

POWER PLANT: One 59.7 kW (80 hp) Rotax 912 UL flat-four four-stroke with four-blade carbonfibre propeller with ground pitch adjustment. Fuel 70 litres (18.5 US gallons, 15.4 Imp gallons).

ACCOMMODATION: Two seats in tandem, side-opening canopy, baggage compartment behind rear seat.

SYSTEMS: Hydraulic brakes. Electrical system includes 12 V 30 Ah battery, alternator.

AVIONICS: Customer specified.

DIMENSIONS, EXTERNAL:

Wing span	9.60 m (31 ft 6 in)
Wing chord	1.40 m (4 ft 7 in)
Wing aspect ratio	6.86
Length overall	7.60 m (24 ft 11¼ in)
Height overall	2.56 m (8 ft 4¾ in)
Tailplane span	2.80 m (9 ft 2¼ in)
Tailplane chord	0.75 m (2 ft 5½ in)
Wheel track	1.75 m (5 ft 9 in)
Width of fuselage	0.75 m (2 ft 5½ in)

AREAS:

Wings, gross	13.44 m² (144.67 sq ft)

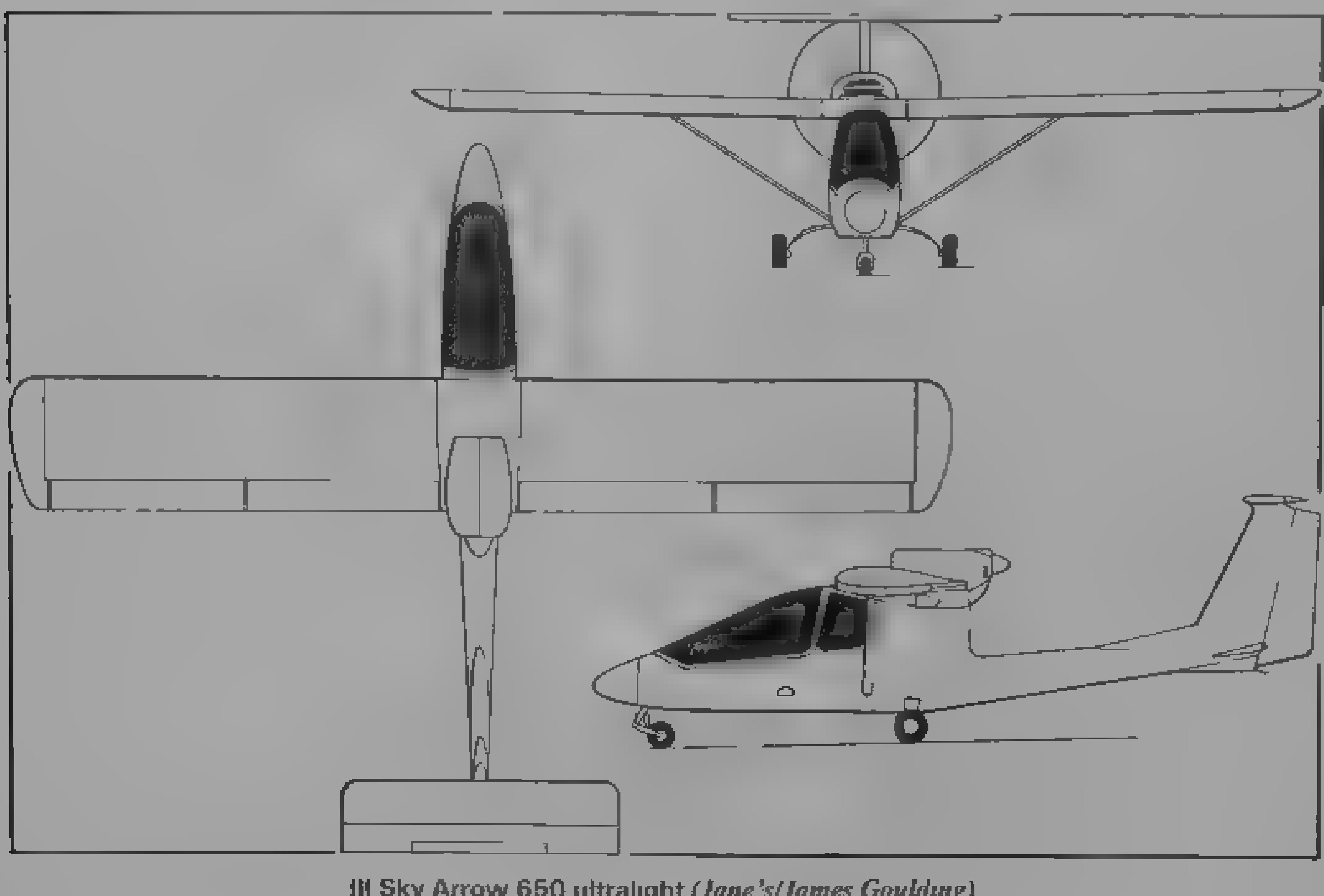
WEIGHTS AND LOADINGS:

Weight empty	330 kg (728 lb)
Max T-O weight	545 kg (1,202 lb)
Max wing loading	40.55 kg/m² (8.31 lb/sq ft)
Max power loading	9.24 kg/kW (15.18 lb/hp)

PERFORMANCE (at max T-O weight):

Max level speed	108 kts (200 km/h; 124 mph)
Econ cruising speed at 60% power	87 kts (162 km/h; 101 mph)
Stalling speed, power off, flaps down	32 kts (59 km/h; 37 mph)
Max rate of climb at S/L	259 m (849 ft)/min
Service ceiling	4,000 m (13,120 ft)
T-O run	150 m (493 ft)
T-O distance to 15 m (50 ft)	250 m (821 ft)
Landing distance from 15 m (50 ft)	150 m (493 ft)
Landing run	100 m (328 ft)
Range with max internal fuel	378 n miles (700 km; 435 miles)
Endurance with max internal fuel	4 h 30 min
g limits	+4/−2

NEW ENTRY



III Sky Arrow 650 ultralight *(Jane's/James Goulding)*

1995

SKY ARROW 480

PROGRAMME: Developed from Sky Arrow 1200 LC for Canadian market as an ultralight aircraft certified under Canadian standard TP 10141. Performance similar to 1200 LC when flown at similar weight.

WEIGHTS AND LOADINGS: As for 1200 LC except:

Weight empty	300 kg (661 lb)
Max T-O weight	480 kg (1,058 lb)

NEW ENTRY

SKY ARROW 1450 LC/650 TC

PROGRAMME: Uprated version, higher power and weight, certified under JAR VLA.

POWER PLANT: One 59.7 kW (80 hp) Rotax 912, Rotax 914 turbocharged engine of 74.6 kW (100 hp), constant up to 4,575 m (15,000 ft), to be offered when certified.

WEIGHTS AND LOADINGS:

Weight empty	350 kg (772 lb)
Max T-O weight	650 kg (1,433 lb)
Max wing loading	48.4 kg/m² (9.9 lb/sq ft)
Max power loading	10.91 kg/kW (17.92 lb/hp)

PERFORMANCE: As 1200 LC except:

Stalling speed, flaps down	40 kts (73 km/h; 46 mph)
T-O run	200 m (657 ft)
T-O to 15 m (50 ft)	350 m (1,149 ft)
Landing from 15 m (50 ft)	250 m (821 ft)
Landing run	150 m (493 ft)
g limits	+3.8/−1.9

NEW ENTRY

PARTENAVIA

PARTENAVIA COSTRUZIONI AERONAUTICHE SpA (An Aercosmos company)

HEAD OFFICE: 24 Corso Vittorio Emanuele, I-20122 Milan
Telephone: 39 (2) 76001847
Fax: 39 (2) 783147
WORKS: Hangar 19, Naples Capodichino Airport
Telephone: 39 (81) 599 1564
CHAIRMAN AND CEO: Dott Luciano Zanotti
MARKETING DIRECTOR: Mrs B Contini

Company founded 1957, taken over by Aercosmos, an Aerospace Engineering company of Milan, March 1993, currently producing five Partenavia light twins basic P 68C light piston twin, P 68TC turbocharged version, P 68 Observer 2 with transparent nose, P 68 Observer 2TC and AP 68TP 600 11 seat turboprop

UPDATED

PARTENAVIA PD 93 IDEA

TYPE: Four-seat trainer and utility aircraft

PROGRAMME: Tentative programme announced at Paris Air Show 1993, intended as a single-engined member of the Partenavia product line.

DESIGN FEATURES: Pascale design begun before Aercosmos took over Partenavia, incorporates cantilever wing, rear fuselage and tail surfaces of P 68 light twin, wing span 1 m (3 ft 3¼ in) less than P 68, designed to latest version of FAR Pt 23 Utility category, roles include training, civilian parachuting, aerial photography, ambulance, fire patrol and aerial work.

FLYING CONTROLS: Slab tailplane with anti-balance/trim tab, wide-span slotted flaps.

STRUCTURE: Same as P 68 with new materials to improve maintainability and reliability

LANDING GEAR: Initially fixed tricycle type with spring leaf main legs and oleo-pneumatic nosewheel strut, retractable landing gear to be offered later

POWER PLANT: One 149 kW (200 hp) Textron Lycoming IO-360-A1B6 flat-four engine, driving a GFRP three-blade constant-speed propeller Fuel tanks between spars at root of each wing contain total 250 litres (66 US gallons; 55 Imp gallons).

ACCOMMODATION: Four-seat cabin with rear baggage space door next to pilot's seat at front; rear cabin door to starboard, floor hatch behind pilots

AVIONICS: Provision for IFR avionics.

DIMENSIONS, EXTERNAL:
Wing span 11 00 m (36 ft 1 in)
Wing chord, constant 1 55 m (5 ft 1 in)
Wing aspect ratio 7 10
Length overall 8 00 m (26 ft 3 in)
Height overall 3 20 m (10 ft 6 in)

AREAS:
Wings, gross 17 05 m² (183.5 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 770 kg (1,698 lb)
Max T-O and landing weight 1,250 kg (2,756 lb)
Max wing loading 73.31 kg/m² (15 02 lb/sq ft)
Max power loading 8 39 kg/kW (13.78 lb/hp)

PERFORMANCE (estimated):
Never-exceed speed (VNE) 200 kts (370 km/h, 230 mph)
Max cruising speed, 75% power at 2,285 m (7,500 ft) 137 kts (254 km/h, 158 mph)
Econ cruising speed, 55% power at 3,660 m (12,000 ft) 122 kts (226 km/h, 140 mph)
Stalling speed flaps up 57 kts (104 km/h, 65 mph)
flaps down 47 kts (87 km/h, 54 mph)
Max rate of climb at S/L 289 m (950 ft)/min
Service ceiling 5 485 m (18,000 ft)
Range, 45 min reserves
at 75% power, 2,285 m (7,500 ft) 756 n miles (1,400 km, 870 miles)
at 55% power, 3 660 m (12,000 ft) 945 n miles (1,750 km, 1,087 miles)
g limits +4.4/−1 76

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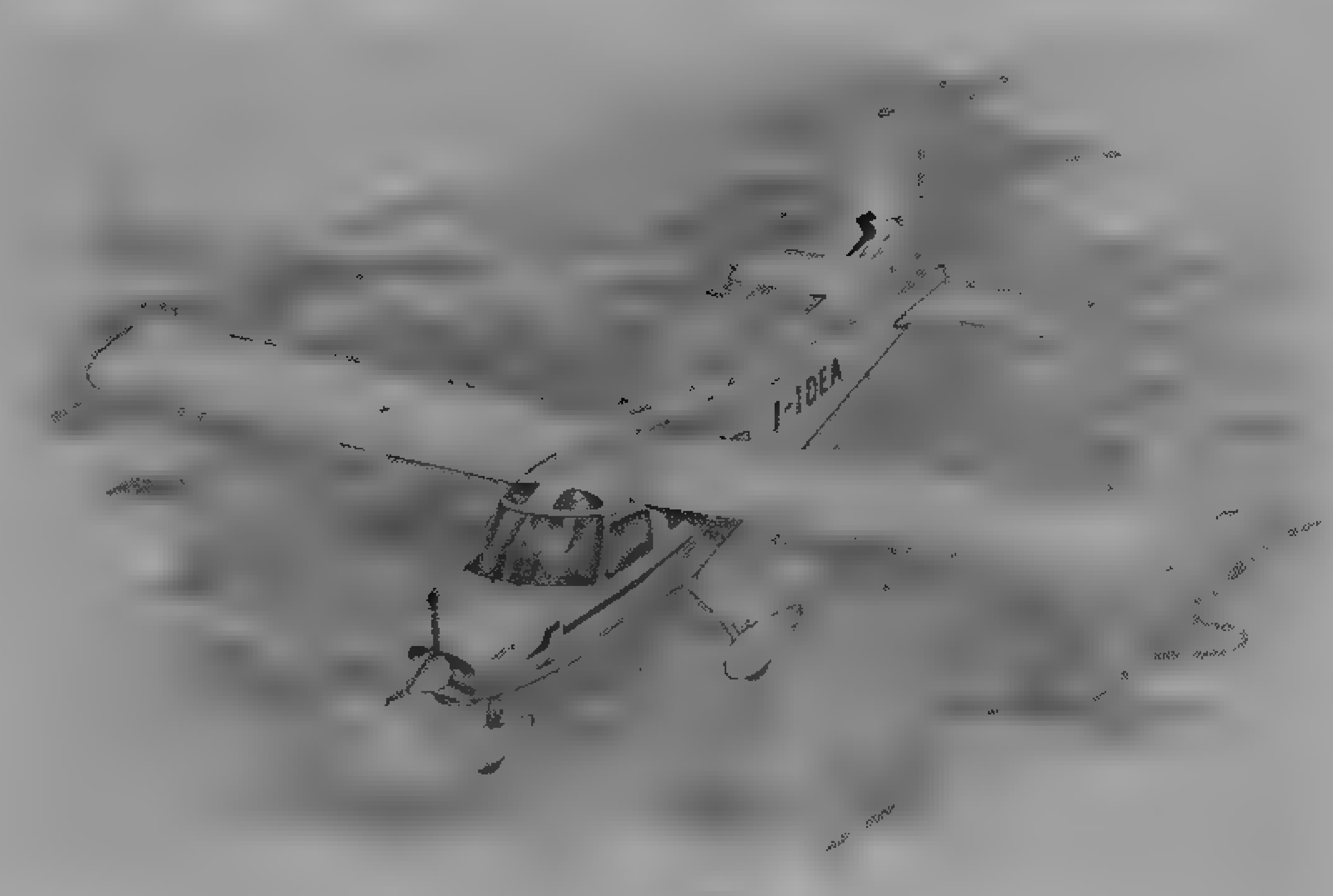
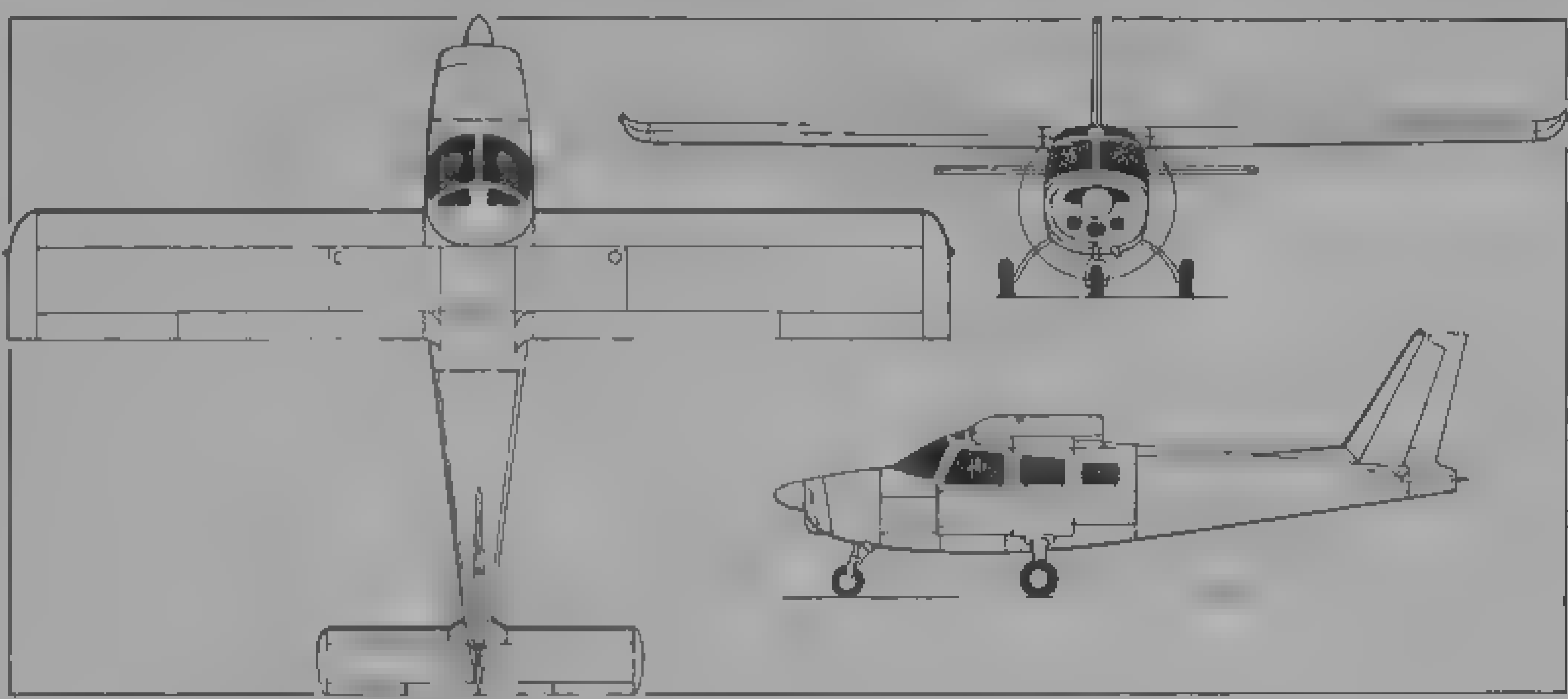


Artist's impression of Partenavia PD 93 Idea utility aircraft based on P 68 components

1993



Partenavia PD 93 Idea (Textron Lycoming IO-360-A1B6) *(Jane's/Mike Keep)*

1993

PARTENAVIA P.68C, P.68TC, P.68 OBSERVER 2 and OBSERVER 2TC

TYPE: Six/seven-seat light twin

PROGRAMME: Production of P 68C started 1978 and P 68TC 1980; output slowed down in late 1980s, restarted 1993

CURRENT VERSIONS: **P 68C**: Basic version

P 68TC: As P 68C, but with turbocharged engines for better hot and high performance

P 68 Observer 2: For use by government and special used services for patrol, surveillance and search, largely transparent nose section with lowered, compact instrument panel, can carry variety of electro-optical sensors, slightly different equipment from other versions

P 68 Observer 2TC: Turbocharged version of Observer 2 for hot/high performance.

CUSTOMERS: Italian police operate 12 P 68 Observers and in November 1994 ordered a further four Discussions completed with Indian manufacturer Taneja Aerospace (which see), to assemble two demonstrators and 30 kits from Partenavia Demonstrators delivered to India by March 1994; three kits delivered by April 1995 P.68 Observer 2TC delivered to USA July 1994 Total 400 built by January 1995

COSTS: Approximately $400,000 to $500,000 depending on avionics and equipment.

DESIGN FEATURES: High wing with NACA 63-3515 aerofoil section, and Hoerner tips; dihedral 1°, incidence 1° 3

FLYING CONTROLS: Conventional rod and cable actuated, with slab tailplane and anti-balance tab acting also as trim tab trim tab in rudder; electrically operated single-slotted flaps

STRUCTURE: Light alloy stressed skin fuselage with frames and longerons; stressed skin two-spar torsion box wing metal stressed skin tailplane and fin fuselage/wing fairings mainly GFRP

LANDING GEAR: Non-retractable, with spring steel main legs oleo suspension for nosewheel, steered from rudder pedals. mainwheels Cleveland 40-142 with Pirelli 8 ply 6 00-6 or 7 00-6 tyres, nosewheel Cleveland 40-77B with Goodyear 6 ply 5 00-5 or 6 00-6 tyre, Cleveland Type 30-61 foot-powered hydraulic disc brakes, streamlined wheel fairings optional P 68 Observer 2 has larger mainwheel tyres as standard Minimum ground turning radius 5.70 m (18 ft 8 in)

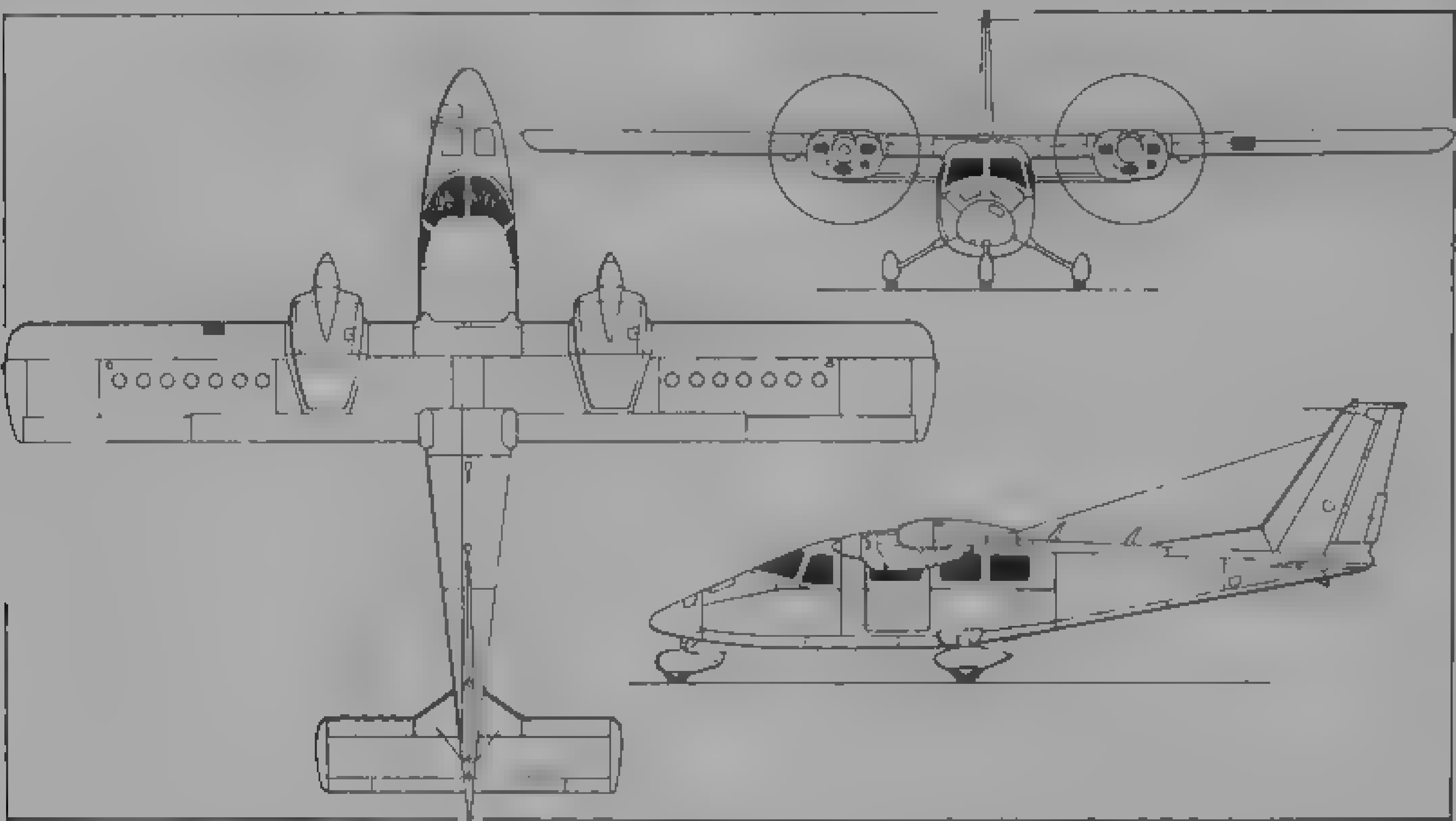
POWER PLANT: *P 68C*: Two 149 kW (200 hp) Textron Lycoming IO-360-A1B6 flat-four engines, each driving a Hartzel HC-C2YK-2C two-blade constant-speed propeller *P 68TC*: Two 156.6 kW (210 hp) Textron Lycoming TIO-360-C1A6D; same propellers as P 68C Fuel capacity 269 litres (71 US gallons, 59 Imp gallons) in integral tank in each wing, of which 260 litres (68 7 US gallons, 57 Imp gallons) usable; overwing gravity refuelling. Oil capacity 7.5 litres (1 98 US gallons, 1.65 Imp gallons) for each engine *P 68 Observer 2* has unsupercharged engines and optional extra tanks giving total 150 litres (39 6 US gallons, 33 Imp gallons) more usable fuel

ACCOMMODATION: One or two pilots and five or six passengers, cabin has two forward-facing seats in middle and three-seat rear bench, club seating optional, baggage door

Partenavia P 68 Observer 2 with fully transparent nose for observation flying

1993

Partenavia P 68 Observer 2 with transparent radar nose *1995*



Partenavia P 68C (*Jane's/Mike Keep*) *1993*

at rear and pilot door at front on starboard side, passenger door to port in centre cabin, maximum baggage weight allowance 181 kg (399 lb), accessible from inside cabin. P 68 Observer 2 has no front starboard door for pilots

SYSTEMS: Two 24 V 70 Ah alternators (100 Ah in P 68 Observer 2) and one 24 V 17 Ah battery; Goodrich pneumatic de-icing boots optional, air conditioning optional.

AVIONICS: Choice of VFR or full IFR Bendix/King Silver Crown or Collins avionics with KFC 150 autopilot.

Radar: Weather radar optional in Observer 2.

Mission: Observer 2 can carry FLIR, ATAL video surveillance pod with data downlink and SLAR.

DIMENSIONS, EXTERNAL (C: P 68C, TC: P 68TC, O: P 68 Observer 2):

Wing span	12.00 m (39 ft 4½ in)
Wing chord, constant	1.55 m (5 ft 1 in)
Wing aspect ratio	7.74
Length overall: C, TC	9.55 m (31 ft 4 in)
O, normal	9.35 m (30 ft 8 in)
O, with ATAL pod in nose	9.55 m (31 ft 4 in)
Height overall	3.40 m (11 ft 1¾ in)
Tailplane span	3.90 m (12 ft 9 in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase	3.80 m (12 ft 5 in)
Propeller diameter: all versions	1.83 m (6 ft 0 in)
Propeller ground clearance	0.77 m (2 ft 6¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length	3.58 m (11 ft 9 in)
Max width	1.16 m (3 ft 9½ in)
Max height	1.20 m (3 ft 11¼ in)
Baggage compartment volume	0.56 m³ (19.78 cu ft)

AREAS:

Wings, gross	18.60 m² (200.2 sq ft)
Ailerons (total)	1.79 m² (19.27 sq ft)
Trailing-edge flaps (total)	2.37 m² (25.51 sq ft)
Fin	1.59 m² (17.11 sq ft)
Rudder, incl tab	0.44 m² (4.74 sq ft)
Tailplane, incl tab	4.41 m² (47.47 sq ft)

WEIGHTS AND LOADINGS:

Weight empty equipped: C, TC	1,300 kg (2,866 lb)
Max T-O weight: C, TC	1,990 kg (4,387 lb)
O	2,084 kg (4,594 lb)
Max ramp weight: O	2,100 kg (4,630 lb)
Max zero-fuel weight: O	1,890 kg (4,167 lb)
Max landing weight: all	1,980 kg (4,365 lb)
Max wing loading: C, TC	106.99 kg/m² (21.92 lb/sq ft)
O	112.04 kg/m² (22.94 lb/sq ft)
Max power loading: C	6.68 kg/kW (10.97 lb/hp)
TC	6.36 kg/kW (10.45 lb/hp)
O	6.99 kg/kW (11.49 lb/hp)

PERFORMANCE:

Never-exceed speed (V_{NE}):	
C, TC	193 kts (358 km/h; 222 mph)
O	193.5 kts (359 km/h; 223 mph)
Max level speed	
C at S/L	174 kts (322 km/h; 200 mph)
TC at 3,660 m (12,000 ft)	190 kts (352 km/h; 219 mph)
O at S/L	173 kts (321 km/h; 199 mph)
Max cruising speed, 75% power	
C at 2,285 m (7,500 ft)	166 kts (308 km/h; 191 mph)
TC at 4,265 m (14,000 ft)	175 kts (324 km/h; 201 mph)
O at 2,135 m (7,000 ft)	165 kts (306 km/h; 190 mph)
Cruising speed, 55% power	
C at 3,050 m (10,000 ft)	150 kts (278 km/h; 173 mph)
TC at 4,265 m (14,000 ft)	152 kts (282 km/h; 175 mph)
O at 3,660 m (12,000 ft)	150 kts (278 km/h; 173 mph)
Stalling speed, power off	
flaps up: C, TC	70 kts (129 km/h; 80 mph)
O	68 kts (126 km/h; 79 mph)
flaps down: TC, O	57 kts (106 km/h; 66 mph)
C	58 kts (108 km/h; 67 mph)
Max rate of climb at S/L: C	457 m (1,500 ft)/min
TC	472 m (1,550 ft)/min
O	378 m (1,240 ft)/min
Max rate of climb, OEI: C	82 m (270 ft)/min
TC	88 m (290 ft)/min
O	64 m (210 ft)/min
Service ceiling: C, O	5,850 m (19,200 ft)
TC	8,230 m (27,000 ft)
Service ceiling, OEI: C	2,100 m (6,900 ft)
TC	4,420 m (14,500 ft)
O	1,770 m (5,800 ft)
T-O run: C, TC	230 m (755 ft)
O	241 m (791 ft)
T-O to 15 m (50 ft): C	396 m (1,300 ft)
TC	385 m (1,264 ft)
O	400 m (1,313 ft)
Landing from 15 m (50 ft)	
C, TC	488 m (1,601 ft)
O	600 m (1,970 ft)
Landing run: C, TC	215 m (706 ft)
O	221 m (725 ft)
Range with max payload	
TC	300 n miles (556 km; 345 miles)
O with max fuel	590 n miles (1,093 km; 679 miles)
Range with max fuel	
C	1,210 n miles (2,241 km; 1,392 miles)
TC	1,040 n miles (1,926 km; 1,197 miles)
O	1,525 n miles (2,824 km; 1,755 miles)

UPDATED

PARTENAVIA AP.68TP 600 VIATOR

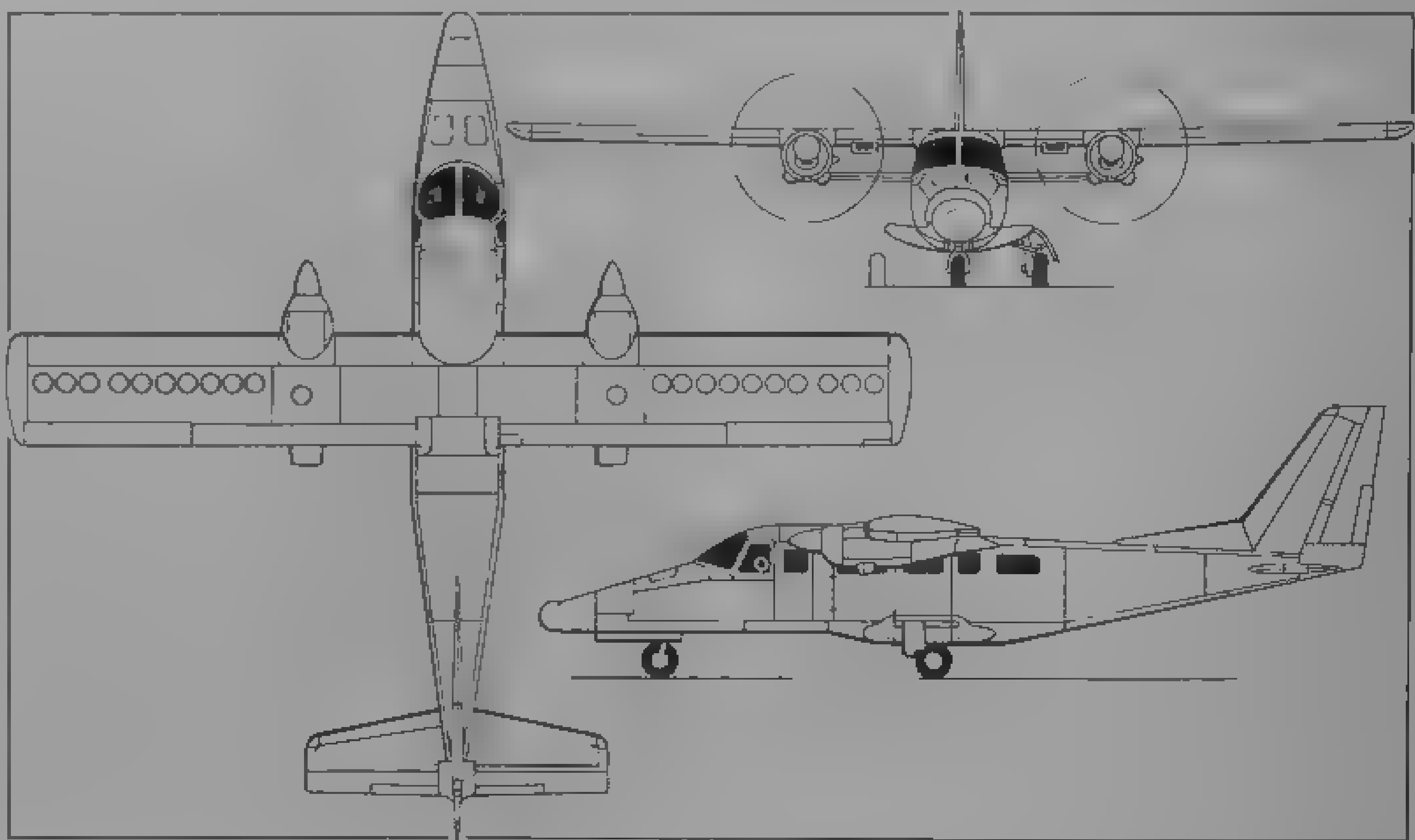
TYPE: Eleven-seat multipurpose twin-turboprop.

PROGRAMME: First flight 29 March 1985; production started 1989.

CUSTOMERS: Government institutions, VIP transport and private operators. Seven built, including one in 1994.

COSTS: $1,210,000.

DESIGN FEATURES: Cantilever, untapered high wing of same span and form as P 68C; aerofoil section NACA 63-3515, with Hoerner wingtips, dihedral 1°, incidence 1° 3'



Partenavia AP.68TP 600 Viator (*Jane's/Mike Keep*) *1993*

FLYING CONTROLS: Rod and cable actuated primary surfaces, fixed tailplane; elevator has vortex generators under leading-edge, down spring in elevator circuit, stall strips on wing leading edges; trim tabs for elevator, rudder and ailerons electrically actuated single-slotted flaps.

STRUCTURE: All metal stressed skin fuselage; two-spar torsion box wing, metal control surfaces.

LANDING GEAR: Retractable tricycle type; main gear retracts hydraulically inward into fuselage fairings, nosewheel forward. Cleveland mainwheels size 40-163EA; Cleveland 40-778 nosewheel, McCreary 6.50-8 mainwheel tyres and 6.00-6 on nosewheel, Cleveland powered hydraulic disc brakes. Minimum ground turning radius 5.45 m (17 ft 11 in).

POWER PLANT: Two Allison 250-B17C turboprops, each flat rated at 244.6 kW (328 shp) and driving a Hartzell HC-B3TF-7A three-blade constant speed reversible pitch propeller. One integral fuel tank in each wing and a 38 litre (10 US gallon; 8.35 Imp gallon) tank in each engine nacelle, giving total capacity of 840 litres (222 US gallons, 184.8 Imp gallons). Oil capacity 5.7 litres (1.5 US gallons, 1.25 Imp gallons) each engine.

ACCOMMODATION: One or two pilots, nine or 10 passengers, two doors to port, one for pilot and one for passengers, two doors to starboard, one for co-pilot and one for baggage; baggage compartment variable by using part of cabin, baggage accessible in flight.

SYSTEMS: Two 150 Ah 28 V DC starter/generators, one 24 V 29 Ah battery; hydraulics for brakes and landing gear actuation, pressurised by electric pump, electric anti-icing for engine intake and propellers, and pneumatic de-icing boots standard.

AVIONICS: VFR radio and instruments standard, full IFR with weather radar and Bendix/King Silver Crown or Collins radios optional, observation equipment optional.

DIMENSIONS, EXTERNAL:

Wing span	12.00 m (39 ft 4½ in)
Wing chord, constant	1.55 m (5 ft 1 in)
Wing aspect ratio	7.74
Length overall	11.27 m (36 ft 11½ in)
Height overall	3.64 m (11 ft 11 in)
Tailplane span	4.01 m (13 ft 1¾ in)
Wheel track	2.167 m (7 ft 1¼ in)
Wheelbase	3.51 m (11 ft 6¼ in)
Propeller diameter	2.03 m (6 ft 8 in)
Propeller ground clearance	0.725 m (2 ft 4½ in)
Port doors (each): Height	1.01 m (3 ft 3¾ in)
Width	0.80 m (2 ft 7½ in)
Height to sill	0.79 m (2 ft 7 in)
Starboard doors (each): Height	0.92 m (3 ft 0¼ in)
Width	1.10 m (3 ft 7¼ in)
Height to sill	0.79 m (2 ft 7 in)

DIMENSIONS, INTERNAL:

Cabin, excl cockpit and baggage compartment:	
Length	5.29 m (17 ft 4¼ in)
Max width	1.13 m (3 ft 8½ in)
Max height	1.26 m (4 ft 1½ in)
Floor area	5.75 m² (61.89 sq ft)
Baggage/cargo compartment volume	0.65 m³ (22.95 cu ft)

AREAS:

Wings, gross	18.60 m² (200.2 sq ft)
Ailerons (total)	1.76 m² (18.94 sq ft)
Trailing-edge flaps (total)	2.42 m² (26.05 sq ft)
Vertical tail surfaces (total)	4.54 m² (48.87 sq ft)
Horizontal tail surfaces (total)	5.06 m² (54.47 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty	1,680 kg (3,704 lb)
Max payload	870 kg (1,918 lb)
Max fuel weight	675 kg (1,488 lb)
Max T-O weight	3,000 kg (6,614 lb)
Max ramp weight	3,025 kg (6,669 lb)
Max zero-fuel weight	2,550 kg (5,622 lb)
Max landing weight	2,850 kg (6,283 lb)
Max wing loading	153.23 kg/m² (31.38 lb/sq ft)
Max power loading	6.13 kg/kW (10.08 lb/shp)

PERFORMANCE:

Max level speed at S/L	200 kts (370 km/h, 230 mph)
Max cruising speed at 3,050 m (10,000 ft)	214 kts (397 km/h, 247 mph)
Econ cruising speed at 3,050 m (10,000 ft)	170 kts (315 km/h, 196 mph)
Stalling speed, power off:	
flaps up	75 kts (139 km/h, 87 mph)
flaps down	65 kts (120 km/h, 75 mph)
Max rate of climb at S/L	503 m (1,650 ft)/min
Rate of climb at S/L, OEI	59 m (194 ft)/min
Service ceiling	7,925 m (26,000 ft)
Service ceiling, OEI	3,475 m (11,400 ft)
T-O run	400 m (1,313 ft)
T-O to 15 m (50 ft)	600 m (1,970 ft)
Landing from 15 m (50 ft)	700 m (2,297 ft)
Landing run	320 m (1,050 ft)
Range:	
with max payload	530 n miles (982 km, 610 miles)
with max fuel	860 n miles (1,594 km, 990 miles)

UPDATED

Partenavia AP 68TP 600 Viator 11-seater

1993

PARTENAVIA PD 90 TAPETE AIR TRUCK

TYPE: Twin-turboprop light utility transport.

PROGRAMME: Announced at Paris Air Show 1993, preparatory design work continuing, feasibility study status.

DESIGN FEATURES: Twin-boom layout allows integrated loading ramp/airstair; intended missions include 18-passenger commuter, freighter with 1,800 kg (3,968 lb) payload, ambulance, parachuting, tactical transport, maritime surveillance and firefighting.

FLYING CONTROLS: Fixed T tail with elevator and trim tab inset, flaps inboard and outboard of tailbooms.

STRUCTURE: Conventional light metal, stressed skin.

LANDING GEAR: Retractable tricycle type with twin wheels on each main unit.

POWER PLANT: Two 559 kW (750 shp) Pratt & Whitney Canada PT6 turboprops, driving three-blade feathering, reversible-pitch metal propellers. Fuel capacity 1,810 litres (478 US gallons, 398 Imp gallons).

ACCOMMODATION: Rectangular cabin, five windows each side, crew access on port side, side door at starboard rear, integral airstair/ramp openable in flight.

DIMENSIONS, EXTERNAL:

Wing span	18.00 m (59 ft 0¾ in)
Wing aspect ratio	8.59
Length overall	13.40 m (43 ft 11½ in)
Height overall	4.70 m (15 ft 5 in)

DIMENSIONS, INTERNAL:

Cabin: Length	5.00 m (16 ft 4¾ in)
Max width	2.00 m (6 ft 6¾ in)
Max height	1.70 m (5 ft 7 in)

AREAS:

Wings, gross	37.71 m² (405.9 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, standard	3,600 kg (7,937 lb)
Max payload	1,790 kg (3,946 lb)
Max T-O and landing weight	6,300 kg (13,889 lb)
Max ramp weight	6,340 kg (13,977 lb)
Max zero-fuel weight	5,550 kg (12,236 lb)
Max wing loading	167.1 kg/m² (34.22 lb/sq ft)
Max power loading	5.64 kg/kW (9.26 lb/shp)

PERFORMANCE (estimated):

Max level speed at 4,270 m (14,000 ft)	240 kts (445 km/h, 276 mph)
Max cruising speed at 3,660 m (12,000 ft)	232 kts (430 km/h, 267 mph)
Stalling speed: flaps up	83 kts (154 km/h, 96 mph)
flaps down	71 kts (130 km/h, 81 mph)
Max rate of climb at S/L:	
both engines	579 m (1,900 ft)/min
OEI	122 m (400 ft)/min
Service ceiling: both engines	9,145 m (30,000 ft)
OEI	4,270 m (14,000 ft)
T-O to 15 m (50 ft)	450 m (1,477 ft)
Landing from 15 m (50 ft)	600 m (1,969 ft)
Range, at 3,050 m (10,000 ft), 45 min reserves:	
long-range cruise with max fuel	1,058 n miles (1,960 km, 1,218 miles)
max cruise with max payload	418 n miles (775 km, 481 miles)

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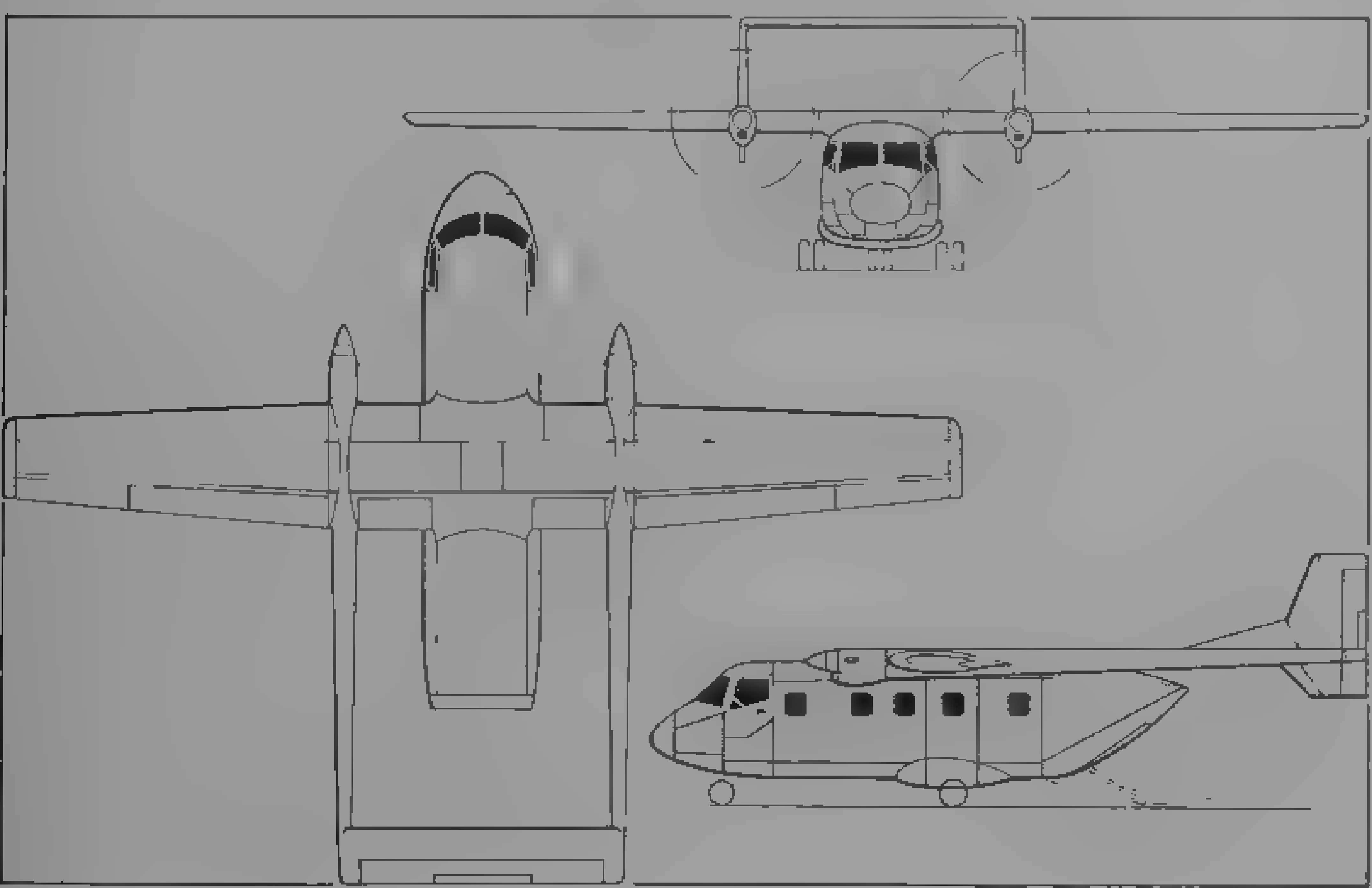


Partenavia PD 90 Tapete Air Truck utility transport project (*Jane's/James Goulding*) *1995*

PIAGGIO

INDUSTRIE AERONAUTICHE E MECCANICHE RINALDO PIAGGIO SpA

Via Cibrario 4, I 16154 Genova Sestri, Genoa
Telephone: 39 (10) 64811
Fax: 39 (10) 603376 (Sales 6520160)
Telex: 270695 AERPIA I
WORKS: Genova Sestri, Finale Ligure (SV), and Wichita, Kansas, USA
BRANCH OFFICE: Via A. Gramsci 34, I-00197 Rome
PRESIDENT: Dott Rinaldo Piaggio
DIRECTOR GENERAL AND CEO: Ing Roberto Mannu
DIRECTOR OF OPERATIONS: Ing R. Ludovico Ughi
MARKETING AND SALES: Enzo Train

Aircraft production began at Genoa Sestri 1916 and later extended to Finale Ligure; present company formed 29 February 1964; covered floor area Sestri and Finale Ligure 120,000 m² (1,291,670 sq ft), workforce 1,300. Piaggio Aviation Inc with 10,000 m² (107,640 sq ft) factory in Wichita and head office in Dover, Delaware, founded 9 September 1987, now devoted to North American marketing. Early in 1993, Rinaldo Piaggio restructured with Piaggio family retaining 19 per cent of stock, Alenia holds 30.9 per cent, IMI 10 per cent and a pool of banks the remaining 40 per cent. Paid-up capital was then raised from Lit15 billion to Lit45.5758 billion.

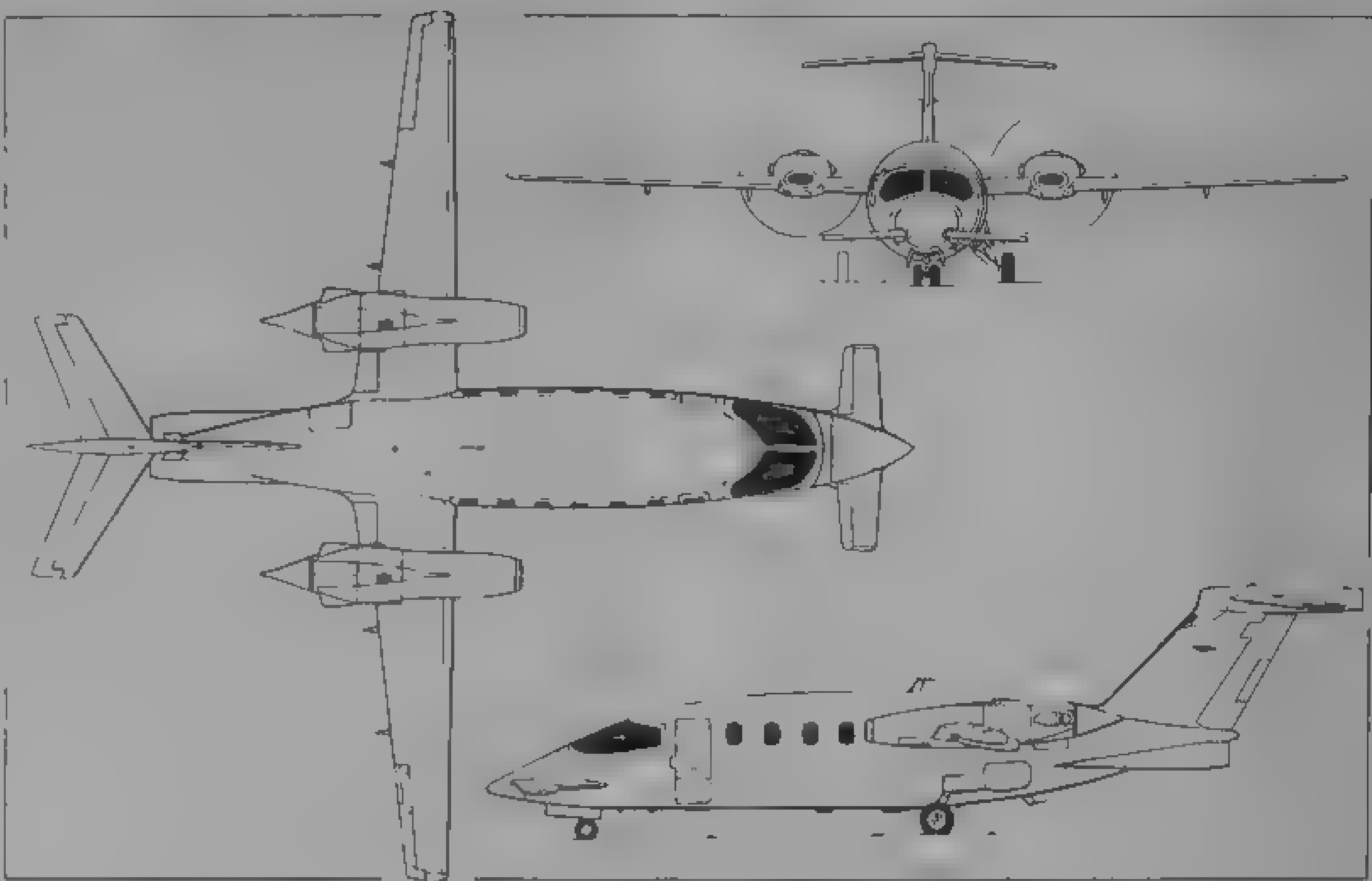
Alenia acquired 31 per cent holding in Piaggio in 1988, adjusted to 24.5 per cent in 1992, but raised to 30.9 per cent in early 1993 following further restructuring and reorganisation.

P.180 Avanti and P.166-DL3SEM in production; Piaggio also produces engines (see Aero-Engines section) and shelters, and manufactures subassemblies of Alenia G222, Panavia Tornado, AMX and Dassault Falcon 2000.

UPDATED

Piaggio P.180 Avanti (two P&WC PT6A-66 turboprops)

1995



Piaggio P.180 Avanti corporate transport (*Jane's/Dennis Punnett*)

1995

PIAGGIO P.180 AVANTI

TYPE: Twin-turboprop high-speed corporate transport.

PROGRAMME: Launched 1982, Gates Learjet became partner in 1983 but withdrew for economic reasons on 13 January 1986, all existing Learjet P.180 tooling and first three forward fuselages transferred to Piaggio; first flights of two prototypes I-PJAV 23 September 1986 and I-PJAR 14 May 1987, two static test fuselages, first Italian certification 7 March 1990; first flight full production P.180 (I-RAIH/N180BP), 30 May 1990; Italian and US certification 2 October 1990; first customer delivery (N180BP to Robert Pond) 30 September 1990; French certification March 1993. P.180 is certificated to Italian RAI Pt 223 and FAA Part 23 including single pilot, night and day, VFR/IFR and flight into known icing.

CURRENT VERSIONS: Increased gross weight giving higher payload/range decided 1991 and early aircraft retrofitted with minor modifications to allow new weights; weights increased again in 1992.

CUSTOMERS: Total 30 delivered by early 1995. Customers include Air Enterprise, France, six; Alpi Eagles, Italy, two; Bulgarian Lucky Flight, two; Trend-Air, Germany, one; Winair, Germany, two (plus one second-hand); Duncan Aviation, USA, two; Union Gas, Canada, one; and corporate operators in Spain and USA. Italian Air Force ordered six for communications: first delivery MM62159 14 May 1993; further three (six-blade propellers) ordered 1994.

COSTS: 1994 sale price $4.68 million in USA and Europe including single point refuelling, three-tube EFIS, Collins avionics and colour radar.

DESIGN FEATURES: Three-surface control with foreplane and T tail to allow unobstructed cabin with maximum headroom to be placed forward of mid-mounted wing carry through structure; pusher turboprops aft of cabin and wing reduce cabin noise and propeller vortices on wing; mid-wing avoids root bulges of low-set wings and spar does not pass through cabin; lift from foreplane allows horizontal tail to act as lifting surface and thereby reduce required wing area.

Wing section Piaggio PE 1491 G (mod) at root, PE 1332 G at tip; thickness/chord ratio 13 per cent; dihedral 2°; no sweep; foreplane aerofoil Piaggio PE 1300 GN4 unswept. 5° anhedral on foreplane and tailplane.

FLYING CONTROLS: Variable incidence swept tailplane for trim, electrically actuated trim tab in starboard aileron, trim tab in rudder, two 'delta fin' strakes under tail; electrically actuated outboard and inboard flaps on wing synchronised with flaps in foreplanes; dual control circuits; heated stall warning system.

STRUCTURE: Fuselage precision stretch-formed in large seamless sections and inner structure matched to precise outer contour; CFRP in high stress areas and Kevlar/epoxy elsewhere used for tail unit, engine nacelles, foreplanes, wing outboard flaps, nosecone, tailcone and landing gear doors; wing main spar integral with rear pressure bulkhead and landing gear attachments.

Composites parts manufactured by Sikorsky and Edo; wings and tail section produced by Piaggio in Genoa and forward fuselages by Piaggio Aviation in Wichita; final assembly in Genoa.

LANDING GEAR: Dowty Aerospace hydraulically retractable tricycle type, with single-wheel main units and steerable, twin-wheel nose unit. Main units retract rearward into sides of fuselage; nose unit retracts forward. Dowty hydraulic shock-absorbers. Tyre sizes 6.50-10 (main) and 5.00-5 (nose). Multidisc carbon brakes.

POWER PLANT: Two 1,107 kW (1,485 shp) Pratt & Whitney Canada PT6A-66 turboprops, flat rated at 634 kW (850 shp), each mounted above wing in all-composite nacelle and driving a Hartzell five-blade constant-speed fully feathering reversible-pitch pusher propeller; propellers handed to counterrotate. Fuel in two fuselage tanks total ling 680 litres (180 US gallons; 149.5 Imp gallons) and two 460 litre (121.5 US gallon; 101 Imp gallon) wing tanks; total fuel capacity 1,500 litres (396 US gallons; 352 Imp gallons). Single pressure refuelling point in lower centre-fuselage. Gravity refuelling point in upper part of fuselage.

ACCOMMODATION: Crew of one or two on flight deck, certificated for single-pilot operation. Seating in main cabin for up to nine passengers, with galley, fully enclosed toilet and coat storage area; choice of nine-passenger high-density or five-seat VIP cabins. Club passenger seats are armchair type, which can be reclined, tracked and swivelled, and locked at any angle. Foldaway tables can be extended between facing club seats. Two-piece wraparound electrically heated windscreen. Rectangular cabin windows, including one emergency exit at front on starboard side. Indirect lighting behind each window ring, plus individual overhead lights. Airstair door at front on port side. Baggage compartment aft of rear pressure bulkhead, with door immediately aft of wing on port side. Entire cabin area pressurised and air conditioned.

SYSTEMS: AiResearch bleed air ECS, with maximum pressure differential of 0.62 bar (9.0 lb/sq in). Single hydraulic system driven by electric motor, with hand pump for emergency back-up, for landing gear, brakes and steering. Electrical system powered by two 400 A 28 V starter/generators and 25 V 38 Ah Ni/Cd battery; 0.62 m³ (22 cu ft) oxygen system. Hot air anti-icing of main wing outer and inner leading edges; electric anti-icing for foreplane and windscreen; rubber boot for engine intakes, with dynamic particle separator; propeller blades de-iced by engine exhaust.

AVIONICS: *Comms:* Dual Collins VHF-22A tranceivers; dual Collins TDR 90 transponders.

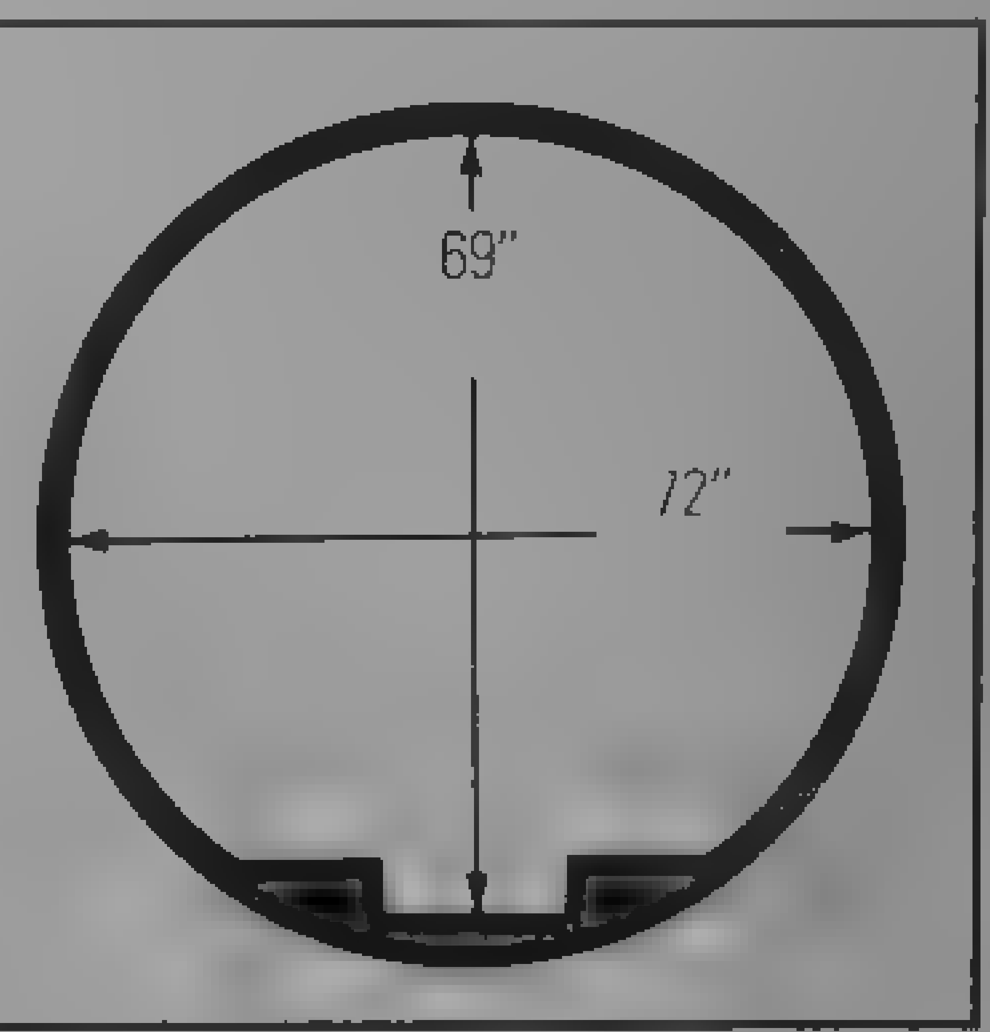
Radar: Collins WXR 840 weather radar.

Flight: Dual VIR-32 VOR/LOC/MKR, ADF-462, DME-42, ALT-55B radar altimeter and MCS-65 compass (all Collins), dual Aeronetics RMI 3337. Collins APS 65 autopilot with yaw damper and ADS 65 air data system.

Instrumentation: Collins EFIS-85B dual colour CRT MFDs, MFD-85B radar display, EHSI-74 colour display for co-pilot.

DIMENSIONS, EXTERNAL:

Wing span	14.03 m (46 ft 0½ in)
Foreplane span	3.38 m (11 ft 1 in)
Wing chord: at root	1.82 m (5 ft 11¾ in)
at tip	0.62 m (2 ft 0½ in)
Foreplane chord: at root	0.79 m (2 ft 7 in)
at tip	0.55 m (1 ft 9⅝ in)
Wing aspect ratio	12.30



Fuselage cross-section of Piaggio Avanti

1995

Internal arrangement of Piaggio P 180 Avanti Black engine nacelle and fin indicate CFRP structure

1993

Foreplane aspect ratio	5.05
Length overall	14.41 m (47 ft 3½ in)
Fuselage Length	12.53 m (41 ft 1¼ in)
Max width	1.95 m (6 ft 4¾ in)
Height overall	3.94 m (12 ft 11 in)
Tailplane span	4.25 m (13 ft 11¼ in)
Wheel track	2.84 m (9 ft 4 in)
Wheel base	5.79 m (19 ft 0 in)
Propeller diameter	2.16 m (7 ft 1 in)
Propeller ground clearance	0.80 m (2 ft 7½ in)
Distance between propeller centres	4.13 m (13 ft 6½ in)
Passenger door (fwd, port) Height	1.35 m (4 ft 5 in)
Width	0.61 m (2 ft 0 in)
Height to sill	0.58 m (1 ft 10¾ in)
Baggage door (rear, port). Height	0.60 m (1 ft 11¾ in)
Width	0.70 m (2 ft 3½ in)
Height to sill	1.38 m (4 ft 6¼ in)
Emergency exit (stbd) Height	0.67 m (2 ft 2¼ in)
Width	0.48 m (1 ft 7 in)
DIMENSIONS, INTERNAL	
Passenger cabin Length	4.45 m (14 ft 7¼ in)
Max width	1.83 m (6 ft 0 in)
Max height	1.75 m (5 ft 9 in)
Volume	10.62 m³ (375.0 cu ft)
Baggage compartment: Floor length	1.70 m (5 ft 7 in)
Max length	2.10 m (6 ft 10¾ in)
Volume	1.25 m³ (44.14 cu ft)
AREAS	
Wings, gross	16.00 m² (172.22 sq ft)
Ailerons (total, incl tab)	0.66 m² (7.10 sq ft)
Trailing-edge flaps (total)	1.60 m² (17.23 sq ft)
Foreplane	2.25 m² (24.22 sq ft)
Foreplane flaps (total)	0.58 m² (6.30 sq ft)
Fin	4.73 m² (50.91 sq ft)
Rudder, incl tab	1.05 m² (11.30 sq ft)
Tailplane	3.83 m² (41.23 sq ft)
Elevators (total, incl tabs)	1.24 m² (13.35 sq ft)
WEIGHTS AND LOADINGS	
Weight empty, equipped	3,402 kg (7,500 lb)
Operating weight empty, one pilot	3,479 kg (7,670 lb)
Max usable fuel load	1,193 kg (2,630 lb)
Max payload	907 kg (2,000 lb)

Piaggio P.180 Avanti operated by the Italian Air Force (*Paul Jackson*)

1995

Payload with max fuel	567 kg (1,250 lb)
Max T-O weight	5,239 kg (11,550 lb)
Max ramp weight	5,262 kg (11,600 lb)
Max landing weight	4,965 kg (10,945 lb)
Max zero-fuel weight	4,309 kg (9,500 lb)
Max wing loading	327.43 kg/m² (67.07 lb/sq ft)
Max power loading	4.13 kg/kW (6.79 lb/shp)
PERFORMANCE	
Max operating Mach number (MMO)	0.67
Max operating speed (VMO)	260 kts (482 km/h, 299 mph) IAS
Max level speed at 8,625 m (28,300 ft)	395 kts (732 km/h, 455 mph)
Stalling speed at max landing weight:	
flaps up	109 kts (202 km/h, 125 mph)
flaps down	94 kts (174 km/h, 108 mph)
Max rate of climb at S/L	899 m (2,950 ft)/min
Rate of climb at S/L, OEI	230 m (755 ft)/min
Service ceiling	12,500 m (41,000 ft)
Service ceiling, OEI	7,620 m (25,000 ft)
T-O to 15 m (50 ft) ISA, S/L at max T-O weight	869 m (2,850 ft)
Landing from 15 m (50 ft) ISA, S/L at max landing weight	872 m (2,860 ft)
Range at 11,890 m (39,000 ft), one pilot and six passengers: NBAA IFR reserves	1,400 n miles (2,594 km, 1,611 miles)
VFR reserves	1,700 n miles (3,150 km, 1,956 miles)

UPDATED

Avanti flight deck

1995

PIAGGIO P.166-DL3SEM

TYPE: Twin-turboprop multirole utility aircraft

PROGRAMME: P 166DL2 described in 1978-79 *Jane's* and earlier versions in previous editions, total 113 P 166s of earlier versions, first flight of current version 3 July 1976 (I-PIAC), Italian and US certification 1978; production continues on demand

CURRENT VERSIONS: **P 166-DL3SEM:** Current production reconnaissance version able to carry chin mounted radar and underwing FLIR sensor, training, transport, medical and special patrol/observation versions offered

CUSTOMERS: Two DL3 to Alitalia, one DL3 to Transavio, two DL3MP to Somali Air Force, two DL3-Cargo to Somali government, six DL3APH for Italian Air Force communications (303° Gruppo at Rome/Guidonia), (two Alitalia Aircraft transferred to Guardia di Finanza customs service), total 13 non-surveillance DL3s, including prototype; further 12 DL3SEM to Capitanerie di Porto coastguard service (four each for 1° Nucleo Volo Capitanerie at Catania, 2° NVC at Luni; and 3° NVC at Pescara) delivered by mid 1990, 10 DL3SEM to Guardia di Finanza between 23 January 1992 and 1994, plus five more on order, including two for 1995 delivery. Total 22 SEMs built by early 1995, 40 of all DL3 versions ordered

DESIGN FEATURES: Full details in 1990-91 *Jane's*

POWER PLANT: Two AlliedSignal LTP 101-700 turboprops, each flat rated at 447.5 kW (600 shp) and driving a Hartzell HC B3DL/LT10282-9.5 three-blade constant-speed fully feathering metal pusher propeller Fuel in two 212 litre (56 US gallon, 46.5 Imp gallon) outer-wing main tanks, two 323 litre (85.3 US gallon, 71 Imp gallon) wingtip tanks, and a 116 litre (30.6 US gallon; 25.5 Imp gallon) fuselage collector tank; total standard internal fuel capacity 1,186 litres (313.3 US gallons, 260.9 Imp gallons). Auxiliary fuel system available optionally, comprising a 232 litre (61.3 US gallon, 51 Imp gallon) fuselage tank, transfer pump and controls; with this installed, total usable fuel capacity is increased to 1,418 litres (374.6 US gallons, 312 Imp gallons). Gravity refuelling points in each main tank and tip tank. Provision for two 177 or 284 litre (46.8 or 75 US gallon; 39 or 62.5 Imp gallon) underwing drop tanks. Air intakes and propeller blades de-iced by engine exhaust

ACCOMMODATION: Crew of two on raised flight deck, with dual controls. Aft of flight deck, accommodation consists of a passenger cabin, utility compartment and baggage

compartment. Access to flight deck via passenger/cargo double door on port side, forward of wing, or via individual crew door on each side of flight deck. External access to baggage compartment via port side door aft of wing. Passenger cabin extends from rear of flight deck to bulkhead at wing main spar; fitting of passenger carrying, cargo or other interiors facilitated by two continuous rails on cabin floor, permitting considerable flexibility in standard or customised interior layouts. Standard seating for eight passengers, with individual lighting, ventilation and oxygen controls. Flight deck can be separated from passenger cabin by a screen. Door in bulkhead at rear of cabin provides access to utility compartment, in which can be fitted a toilet, bar, or mission equipment for various roles. Entire accommodation heated, ventilated and soundproofed. Emergency exit forward of wing on starboard side. Wind screen hot-air demisting standard. Windscreen wipers, washers and methanol spray de-icing optional

DIMENSIONS, EXTERNAL:

Wing span over tip tanks	14 69 m (48 ft 2½ in)
Length overall	11 88 m (39 ft 0 in)
Height overall	5 00 m (16 ft 5 in)
Cabin door: Height	1 38 m (4 ft 6 in)
Width	1 28 m (4 ft 2 in)

WEIGHTS AND LOADINGS:

Weight empty, equipped	2,688 kg (5 926 lb)
Max fuel	1,036 kg (2,284 lb)
Max payload	1,092 kg (2,407 lb)
Max T-O weight	4,300 kg (9,480 lb)
Max ramp weight	4,320 kg (9,524 lb)
Max zero-fuel weight	3,800 kg (8,377 lb)
Max landing weight	4,085 kg (9 006 lb)
Max wing loading	161 9 kg/m² (33 16 lb/sq ft)
Max power loading	4 81 kg/kW (7 90 lb/shp)

PERFORMANCE (at max T-O weight except where indicated):

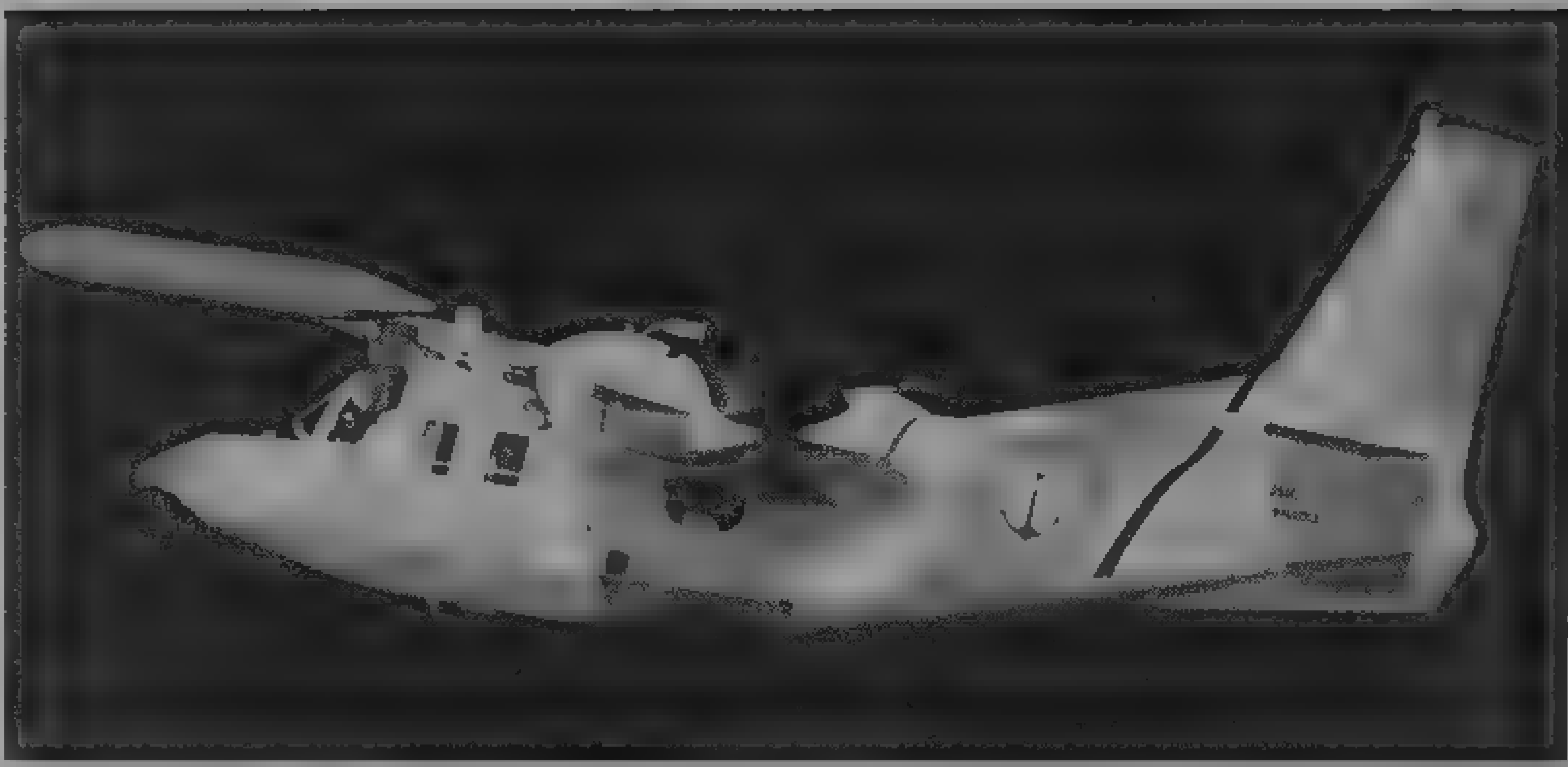
Never-exceed speed (VNE) 220 kts (407 km/h, 253 mph) CAS

Max level and max cruising speed at 3,050 m (10,000 ft) 215 kts (400 km/h, 248 mph)

Range, VFR

with max payload	750 n miles (1,389 km; 863 miles)
with max fuel	1,150 n miles (2,130 km; 1,323 miles)

UPDATED



Piaggio P 166-DL3SEM operated by 1° Nucleo Volo Capitanerie at Catania. Note radar under nose *1995*

SIVEL

SIVEL srl

Via Aldo Moro 10, I-25125 Brescia
Telephone: 39 (39) 2291232
Fax: 39 (30) 224563
Telex: 30015 SIBABS I

MANAGING DIRECTOR: Mauro Balzarini

HEAD OF FLIGHT TEST: Col Andrea Canetto

HEAD OF TECHNICAL DEPARTMENT: Ernesto Valtorta

Sivel stands for Societa Italiana Velivoli Leggeri. Sivel srl was formed in 1990 to produce light aircraft. The company is owned by the Balzarini family, produces the SD27 and is building the SV28

UPDATED

SIVEL SD27 CORRIEDALE

TYPE: Two-seat very light trainer and club aircraft

PROGRAMME: Prototype (I-JARR) flying 1992, certification to JAR-VLA 1 July 1994, deliveries from April 1995

COSTS: Price Lit100 million ($65,000)

CUSTOMERS: First delivery April 1995

DESIGN FEATURES: Combines efficient aerodynamics and lightweight structure able to perform all manoeuvres required for club training within the limits of JAR-VLA certification

FLYING CONTROLS: Conventional, with fixed tailplane, swept fin and rudder, flaps

STRUCTURE: Basic all-metal structure

LANDING GEAR: Non-retractable tricycle type. Mainwheels carried on cantilever spring struts, swivelling nosewheel on tubular spring leg, steering by differential braking

POWER PLANT: One 59 7 kW (80 hp) Rotax 912A four cylinder four-stroke engine, driving a fixed pitch two-blade wooden propeller or optional MT two-blade constant-speed propeller. Fuel in 80 litre (21 1 US gallon, 17 6 Imp gallon) tank in fuselage

ACCOMMODATION: Two seats side by side in fully enclosed cabin

DIMENSIONS, EXTERNAL:

Wing span	10 00 m (32 ft 9½ in)
Wing aspect ratio	8 00
Length overall	7 00 m (22 ft 11½ in)
Height overall	2 76 m (9 ft 0½ in)
Propeller diameter	1 70 m (5 ft 7 in)

DIMENSIONS, INTERNAL:

Cabin: Max width	1 10 m (3 ft 7¼ in)

AREAS:

Wings, gross	12 50 m² (134 5 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	370 kg (816 lb)
Max T-O weight	620 kg (1,367 lb)
Max wing loading	49 6 kg/m² (10 16 lb/sq ft)
Max power loading	10 39 kg/kW (17 09 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	132 kts (245 km/h, 152 mph)
Max level speed	105 kts (195 km/h, 121 mph)
Max cruising speed 75% power, at 2,440 m (8,000 ft)	95 kts (176 km/h, 109 mph)
Stalling speed, power off: flaps up	45 kts (83 km/h, 52 mph)
flaps down	41 kts (76 km/h, 48 mph)
Max rate of climb at S/L at 55 kts (102 km/h, 63 mph)	282 m (925 ft)/min
Service ceiling	4,000 m (13,125 ft)
T-O run	150 m (493 ft)
T-O to 15 m (50 ft)	300 m (984 ft)
Landing from 15 m (50 ft)	130 m (427 ft)
Landing run	100 m (328 ft)
Max range	539 n miles (1,000 km, 621 miles)
Endurance	6 h

UPDATED

SIVEL SV28 LINCOLN

TYPE: Two-seat sport and aerobatic aircraft

PROGRAMME: Prototype in build, to fly late 1995

DESIGN FEATURES: Low-wing monoplane, fixed tricycle undercarriage, low-mounted tailplane. 7° dihedral no tailplane dihedral. Constant chord wing with flaps inboard and ailerons outboard

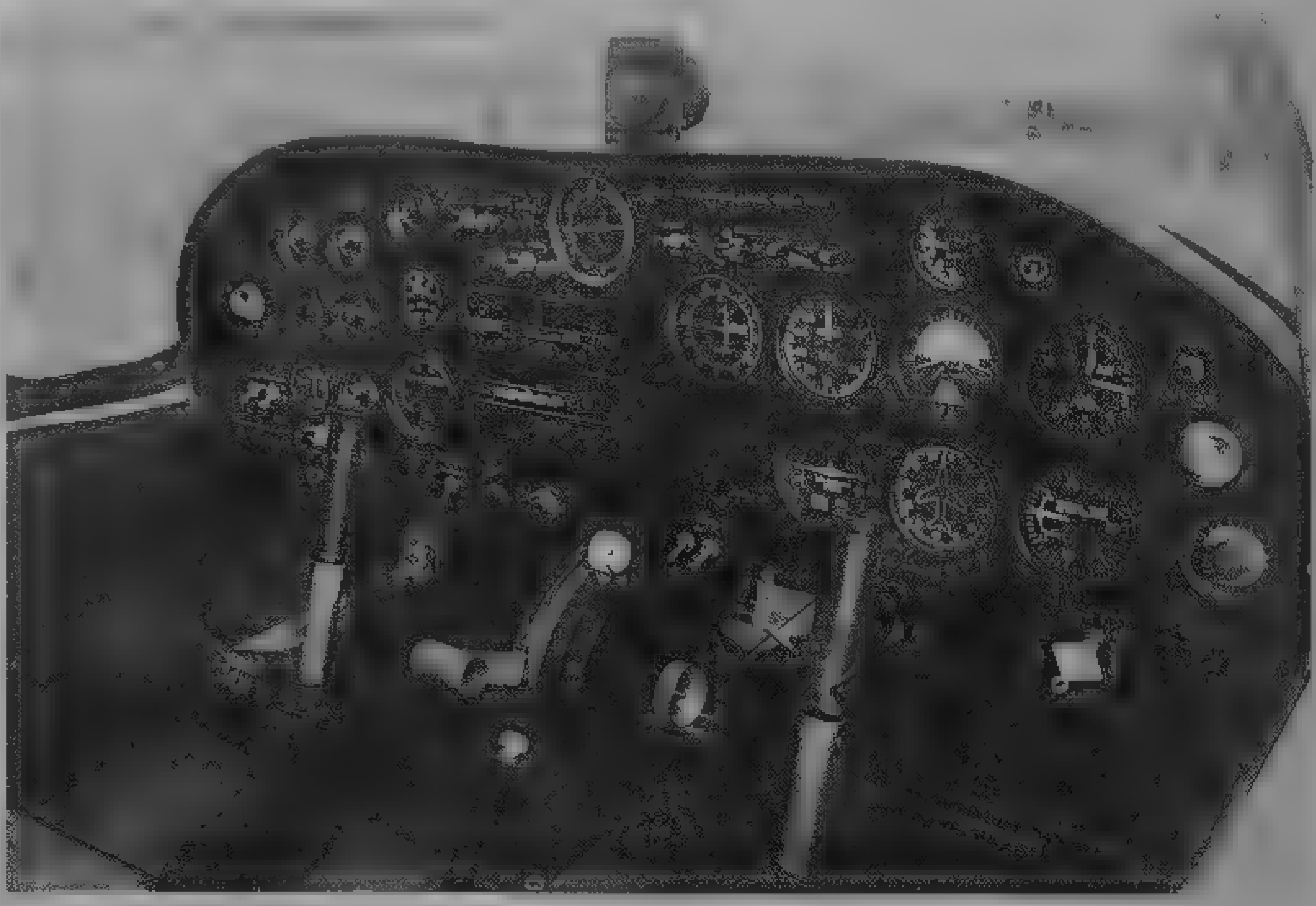
FLYING CONTROLS: Conventional mechanical ailerons, elevator and rudder. Elevator for pitch trim

STRUCTURE: All metal

LANDING GEAR: Fixed tricycle type

POWER PLANT: One 119 kW (160 hp) Textron Lycoming AEIO-320-D flat four, driving a three-blade Muhlbauer MTV-12C/180-17 propeller. Fuel capacity 160 Litres (42 2

Sivel SD27 Corriedale to JAR-VLA specification *1995*



Instrument panel of Sivel SD27 Corriedale *(Paul Jackson)* *1995*

US gallons, 35.2 Imp gallons) in two wing tanks. Fuel and oil system designed for inverted flight

ACCOMMODATION: Two side by side seats, full dual controls, baggage stowage behind seats

SYSTEMS: Electrical system, 12 V 30 Ah battery

AVIONICS: Customer specified

DIMENSIONS, EXTERNAL

Wing span	approx 8.40 m (27 ft 6¾ in)
Wing aspect ratio	6.4
Length overall	6.80 m (22 ft 3¾ in)
Height overall	2.76 m (9 ft 0¾ in)
Wheel track	2.31 m (7 ft 7 in)
Wheelbase	1.67 m (5 ft 5¾ in)

AREAS

Wings, gross	10.00 m² (107.64 sq ft)

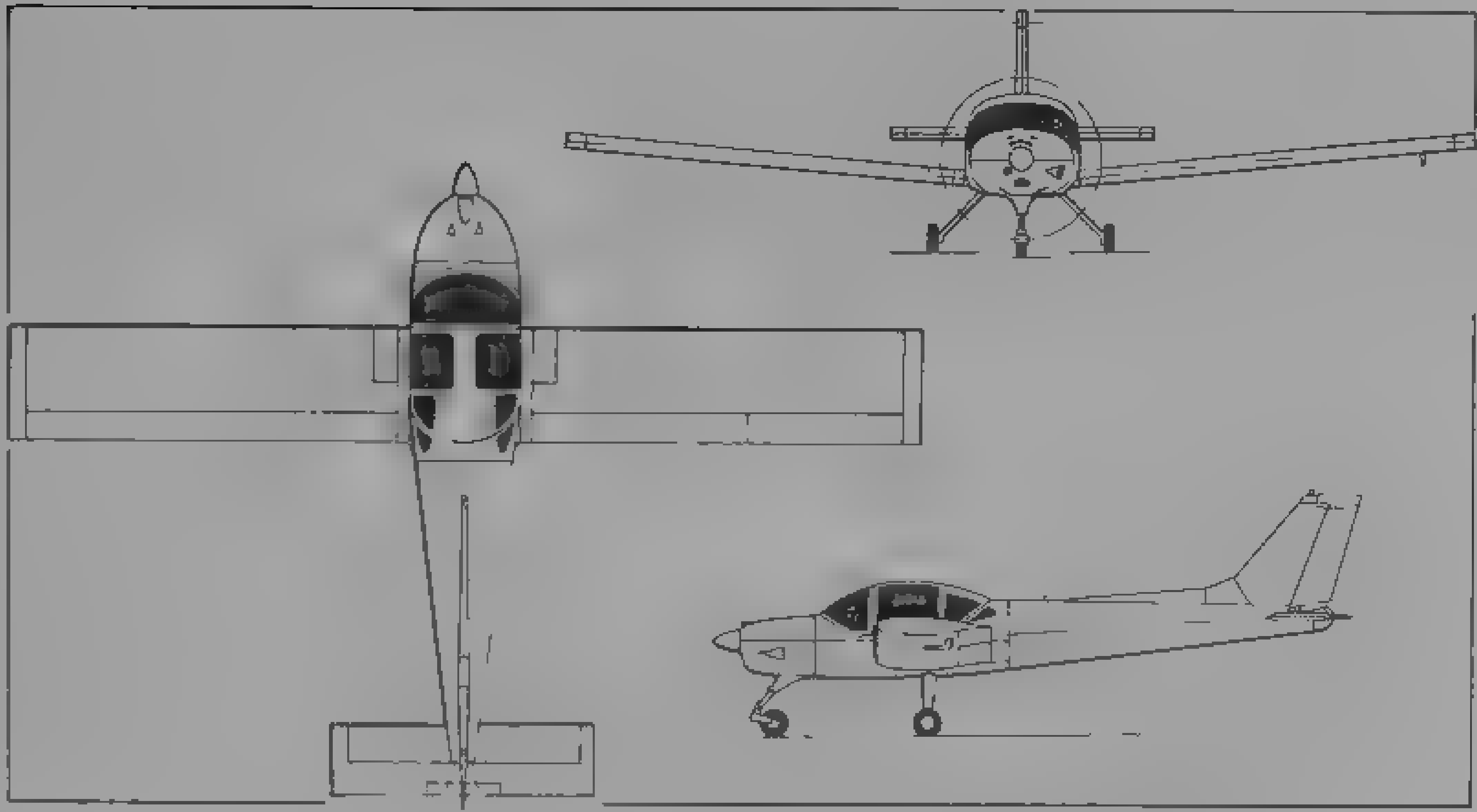
WEIGHTS AND LOADINGS

Weight empty	530 kg (1,168 lb)
Max T-O weight	800 kg (1,763 lb)
Max wing loading	80.0 kg/m² (16.4 lb/sq ft)
Max power loading	6.72 kg/kW (11.05 lb/hp)

PERFORMANCE (at max T-O weight):

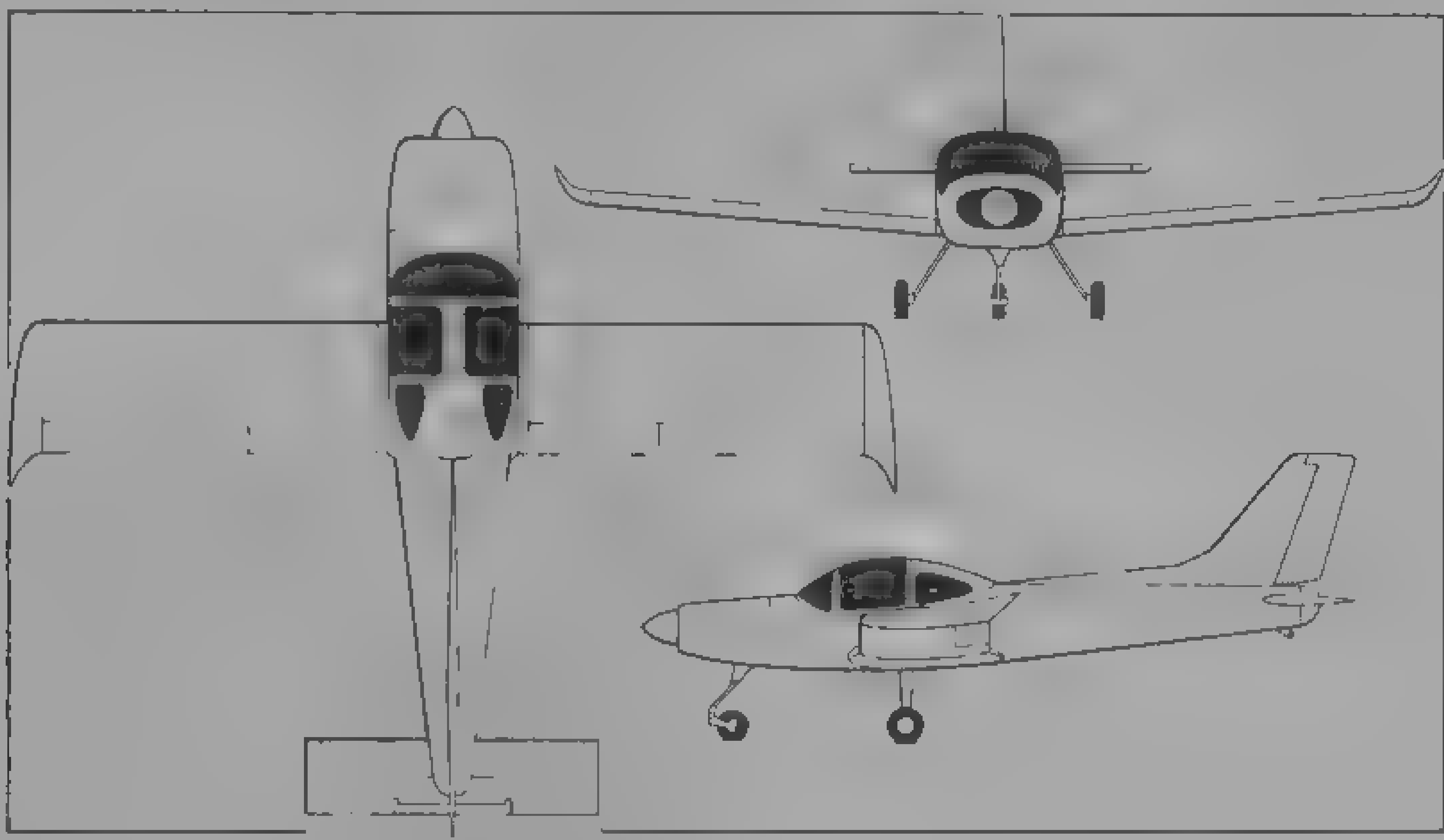
Max level speed	145 kts (268 km/h, 167 mph)
Cruising speed at 75% power	135 kts (250 km/h, 155 mph)
Range with max internal fuel, 75% power	550 n miles (1,018 km; 633 miles)

NEW ENTRY



Sivel SD27 Corriedale very light aircraft (one Rotax 912A) *(Jane's/James Goulding)*

1995



Sivel SV28 Lincoln design, now in build *(Jane's/James Goulding)*

1995

TECNAM

COSTRUZIONI AERONAUTICHE TECNAM srl

la Traversa Via G. Pascoli, I-80026 Casoria (Naples)
Telephone: 39 (81) 758 3210, 758 8751 and 758 8854
Fax: 39 (81) 758 4528

PRESIDENT: Dott Ing Luigi Pascale Langer

MANAGING DIRECTOR: Dott Giovanni Pascale Langer

Company founded 1986, after Pascale brothers were released from the original Pascale company, Partenavia, which had been placed under control of Alenia in 1981. Tecnam manufactures tailplane and other components of ATR 42/72, fuselage panels for MD-90, fuselages of former Partenavia (now Partenavia/Aerecosmos) P.68 and parts of Agusta A 109. Workshops qualified to NATO AQA04. Also developing new P92 Echo light aircraft to FAR Pt 21 sport aircraft category.

TECNAM P92 ECHO

TYPE: Two-seat trainer/club aircraft to JAR-VLA.

PROGRAMME: First flight March 1993, production rate 1995 six to eight per month. JAR-VLA certified version (April 1995) has higher maximum T-O weight than 450 kg (992 lb) prototype.

CUSTOMERS: Total 100 orders and 50 deliveries end 1994, two delivered to Israel, six to Cambodian Air Force (first two September 1994).

DESIGN FEATURES: Objectives of lightness, simplicity and accessibility for inspection and servicing. Braced high wing with metal torsion box and composite leading edge; aerofoil chosen for good performance at low Reynolds number; untapered with 1° 30' dihedral; underside of fuselage mostly flat for ease of kit assembly; large one piece windscreen; inward tapered inboard wing leading-edges, large windows in doors and rearview window give good view from pilot's seat.

FLYING CONTROLS: Full dual controls and two throttles, differential Frise ailerons, slab tailplane with anti-balance/trim tab; electrically actuated flaps cover half trailing-edge.

STRUCTURE: Each wing easily removed and replaced without adjustment, ailerons of metal structure with Dacron covering, steel tube cabin section contains strong frame carrying wing attachment, landing gear and seats, metal sheet skin panels also provide diagonal bracing, stressed skin rear fuselage, tailplane of metal structure with Dacron covering aft of spar; rudder all-metal with GFRP tip fairing, tailplane halves based on tubular spars which can be unpinned and removed quickly from central tube for transport, engine cowling consists of GFRP lower shell and partly metal upper shell, both removable by undoing four quick latches to reveal whole power plant.

LANDING GEAR: Non-retractable tricycle type; main legs steel alloy self-sprung, hand-powered hydraulic disc brakes operated together from single lever in cockpit; main leg attachments accessible outside fuselage, all tyres 5.00-5, levered suspension nosewheel with rubber-in-compression spring, nosewheel steered from rudder pedals, designed for grass field operation.

POWER PLANT: One 59.7 kW (80 hp) Rotax 912 four-cylinder four-stroke liquid/air-cooled engine with opposed cylinders; integrated reduction gear 1:2.27 driving two-blade wooden propeller.

Limbach 2000 (59.7 kW, 80 hp) and Rotax 582 (47.7 kW, 64 hp) two-stroke offered as options, prototype had the latter. Fuel contained in tanks in tapered portion of each wingroot.

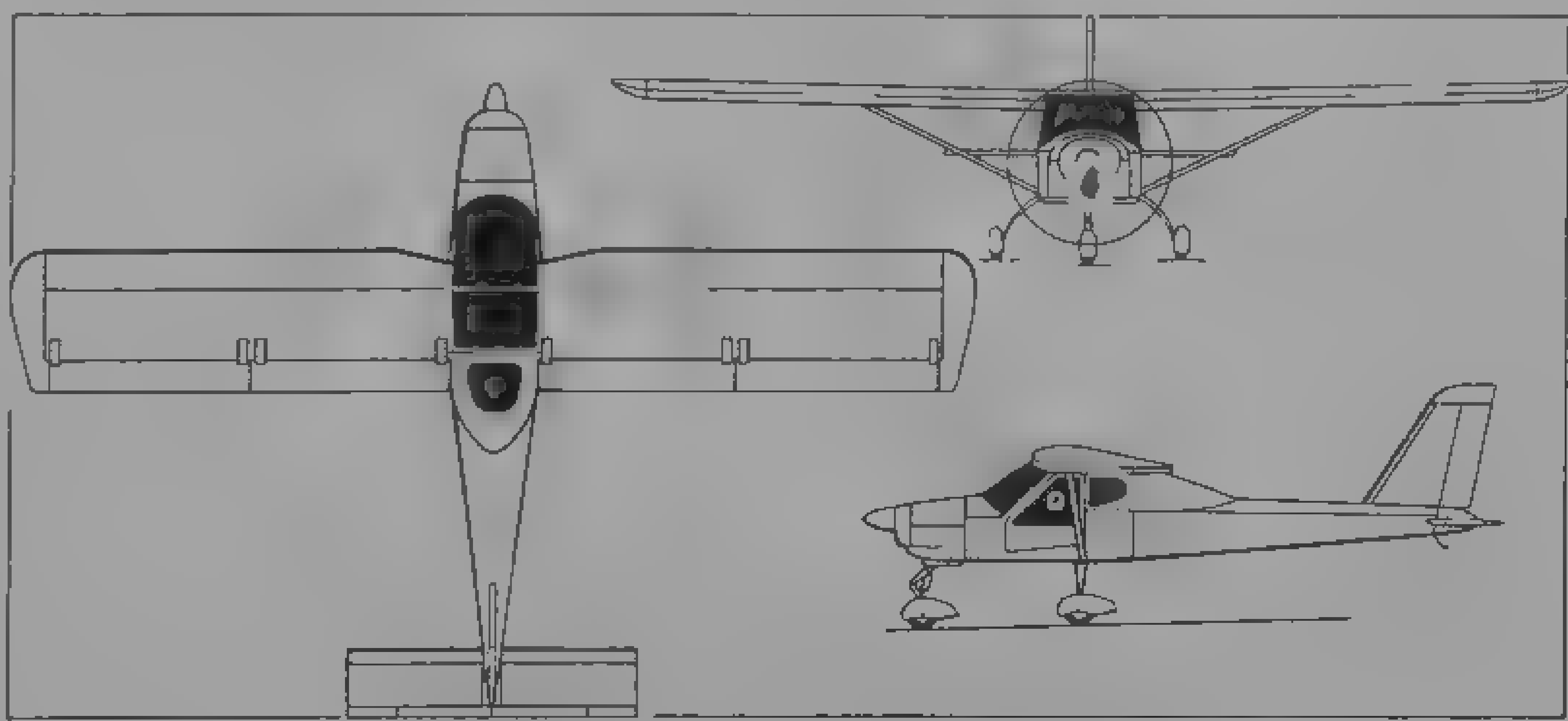
ACCOMMODATION: Side by side seats with three-point harness, baggage space behind seats.

SYSTEMS: 12 V battery, 100 W alternator.

AVIONICS: Customer specified, panel space for blind-flying instruments and com/nav fit.

DIMENSIONS, EXTERNAL

Wing span	9.60 m (31 ft 6 in)



Tecnam P92 Echo very light aircraft *(Jane's/Mike Keep)*

1995

Tecnam P92 Echo (one Rotax 912 four-stroke)

1995

Wing chord, constant	1.40 m (4 ft 7 in)
Wing aspect ratio	6.98
Length overall	6.30 m (20 ft 8 in)
Height overall	1.125 m (3 ft 8¼ in)
Tailplane span	2.90 m (9 ft 6 in)
Wheel track	1.80 m (5 ft 10¾ in)
Wheelbase	1.60 m (5 ft 3 in)
Propeller diameter	1.65 m (5 ft 5 in)
AREAS:	
Wings, gross	13.20 m² (142.1 sq ft)
Tailplane	1.972 m² (21.23 sq ft)
WEIGHTS AND LOADINGS:	
Basic weight empty	282 kg (622 lb)
Max T-O weight	520 kg (1,146 lb)
Max wing loading	39.39 kg/m² (8.07 lb/sq ft)
Max power loading	8.72 kg/kW (14.32 lb/hp)
PERFORMANCE (with 20° pitch propeller):	
Max level speed at S/L	116 kts (215 km/h; 133 mph)
Cruising speed at 2,200 propeller rpm (65% power)	92 kts (170 km/h; 106 mph)
Cruising speed at 2,100 propeller rpm (55% power)	86 kts (159 km/h; 99 mph)
Stalling speed: flaps up	36 kts (68 km/h; 42 mph)
flaps down	34 kts (63 km/h; 39 mph)
Max rate of climb at S/L at 59 kts (109 km/h; 68 mph)	330 m (1,082 ft)/min
T-O run	90 m (296 ft)
T-O to 15 m (50 ft)	165 m (542 ft)
Endurance	4 h 30 min

UPDATED

TERZI

TERZI AERODINE

Piazzale A. Baiamonti 1, I-20154 Milan
Telephone: 39 (2) 3360 9080
Fax: 39 (2) 3360 7996

Company offers Terzi T30 Katana specialised aerobatic aircraft, in kit form, and Stiletto. Two Katanas completed by early 1995.

UPDATED

TERZI T-9 STILETTO

TYPE: Two-seat very light sporting aircraft.

PROGRAMME: First flights (I-STIL) December 1990 (with Limbach engine), November 1991 (with Rotax engine). JAR-VLA certification being sought.

DESIGN FEATURES: Wing section Wortmann FX67-K-150/17 (constant chord; dihedral 2° 30′; twist 0°; wings easily [illegible]; fin and rudder have NACA 64A 008 section. Aircraft designed to be easily dismantled for repair and storage.

FLYING CONTROLS: Slab tailplane with Wortmann FX 71-L-150/20 aerofoil, manually operated three-position flaps.

STRUCTURE: Light alloy single-spar wing with auxiliary spars spigoted to fuselage, riveted skin panels; steel tube forward fuselage with removable GFRP shell, stressed skin metal tailboom.

LANDING GEAR: Non-retractable tricycle type with GFRP cantilever legs mounted on fuselage frame; hydraulic disc brakes controlled from rudder pedals; fully castoring nosewheel.

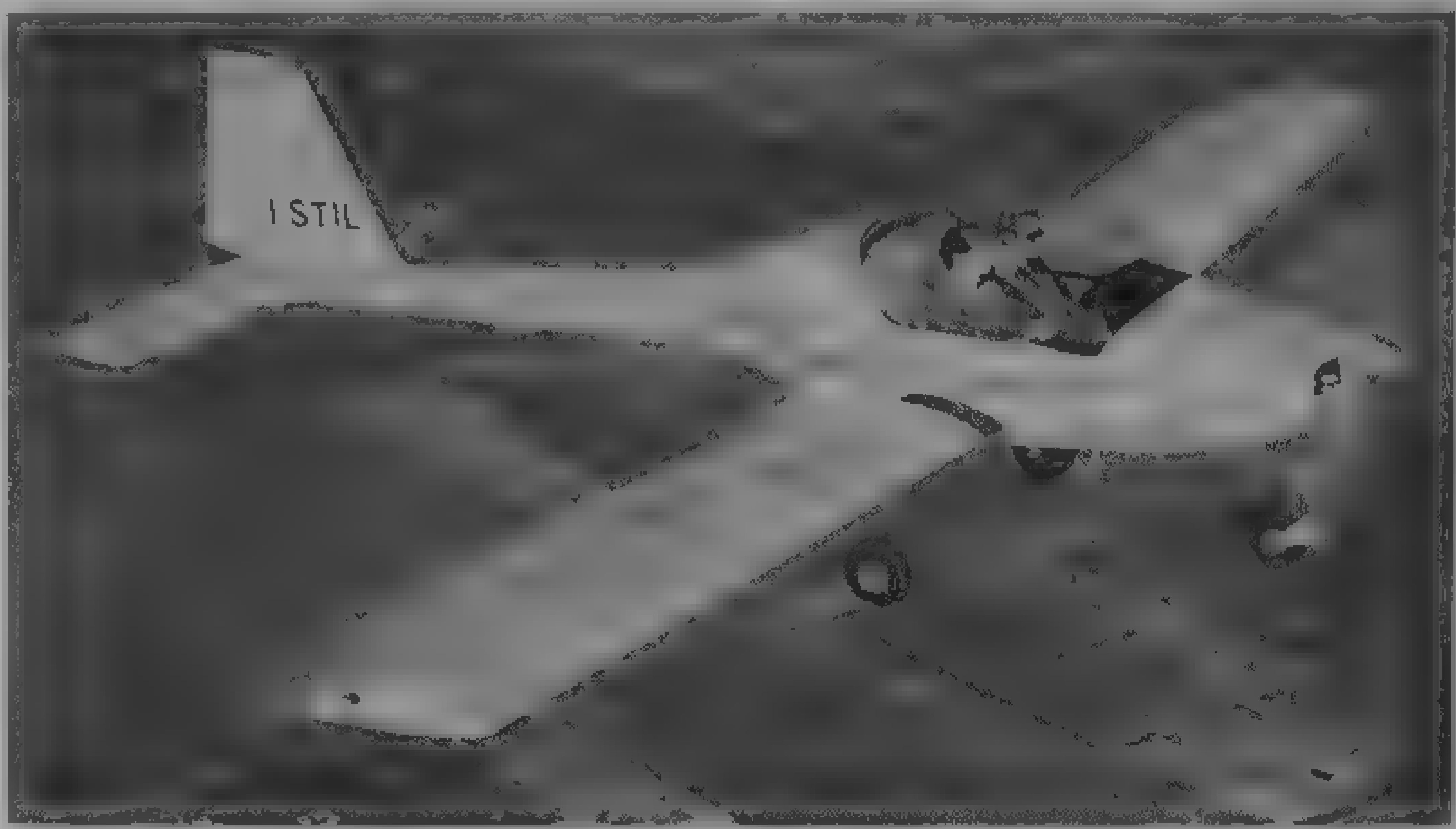
POWER PLANT: One 59 kW (79 hp) Rotax 912A flat four four-stroke engine, driving an MT Elcoprop two-blade wooden propeller. Fuel in 80 litre (21.1 US gallon; 17.6 Imp gallon) tank behind seats.

ACCOMMODATION: Two individually adjustable seats side by side, upward-opening canopy, baggage shelf behind seats.

SYSTEMS: 12/14 V electrical system with alternator and battery.

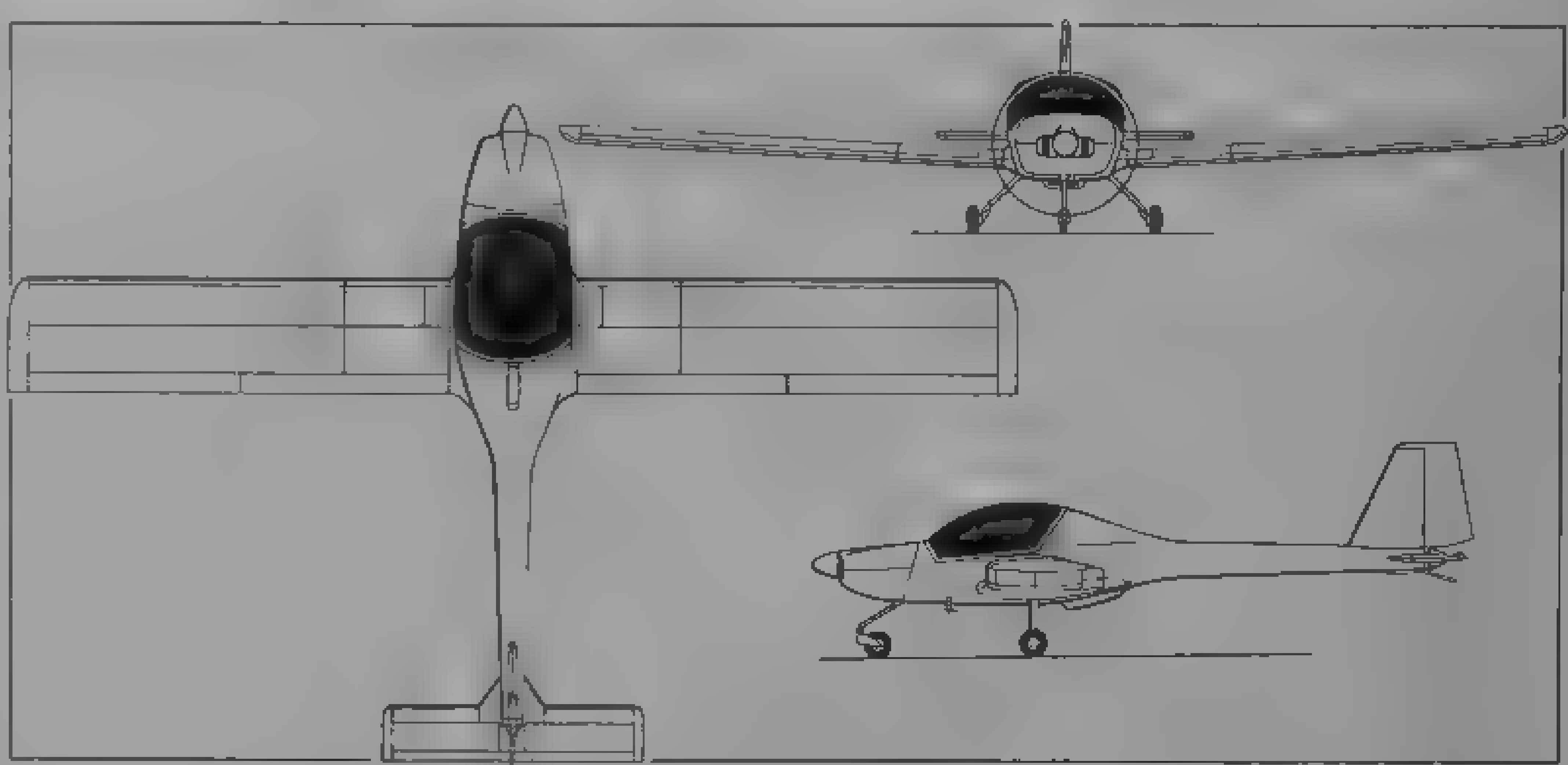
AVIONICS: *Comms:* Optional VHF com and transponder.
Flight: Optional ADF.

DIMENSIONS, EXTERNAL:	
Wing span	10.26 m (33 ft 8 in)
Wing aspect ratio	8.56
Length overall	6.85 m (22 ft 5¾ in)
Height overall	2.30 m (7 ft 6½ in)
Wheel track	2.01 m (6 ft 7¼ in)
AREAS:	
Wings, gross	12.30 m² (132.4 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	380 kg (838 lb)
Max T-O weight	650 kg (1,433 lb)
Max wing loading	52.84 kg/m² (10.82 lb/sq ft)
Max power loading	11.09 kg/kW (18.22 lb/hp)
PERFORMANCE:	
Max level speed	108 kts (200 km/h; 124 mph)
Cruising speed, 60% power	87 kts (162 km/h; 100 mph)
Stalling speed, flaps down	40 kts (74 km/h; 46 mph)
Max rate of climb at S/L	244 m (800 ft)/min
T-O to 15 m (50 ft)	190 m (624 ft)
Landing from 15 m (50 ft)	175 m (575 ft)
g limits	+3.8/−2.2



Terzi Aerodine T-9 Stiletto (Rotax 912A four-stroke)

1993



Terzi Aerodine T-9 Stiletto very light aircraft *(Jane's/Mike Keep)*

1994

UPDATED

JAPAN

CAC

COMMERCIAL AIRPLANE COMPANY

CAC's production of Boeing 767 components by its member companies was last detailed in the 1994-95 *Jane's*.

UPDATED

FUJI

FUJI HEAVY INDUSTRIES LTD
(Fuji Jukogyo Kabushiki Kaisha)

Subaru Building, 7-2 1-chome, Nishi-shinjuku, Shinjuku-ku, Tokyo 160
Telephone: 81 (3) 3347 2525
Fax: 81 (3) 3347 2588
Telex: 232 2268 FUJI J
PRESIDENT: Isamu Kawai

Aerospace Division
GENERAL MANAGERS:
Yasuyuki Kogure (Managing Director)
Kisaburo Wani (Commercial Business)

Utsunomiya Manufacturing Division
1-11 Yonan 1-chome, Utsunomiya, Tochigi 320
Telephone: 81 (286) 58 1111
DIRECTOR AND GENERAL MANAGER: Tsutou Ono
DEPUTY GENERAL MANAGER: Masaomi Kadoya

Established 15 July 1953 as successor to Nakajima. Utsunomiya Manufacturing Division (aircraft and rolling stock plants) occupies 559,400 m² (6,021,326 sq ft) site, including 188,490 m² (2,028,887 sq ft) floor area; employed 3,100 people in April 1994.

In addition to T-5, Fuji producing Bell UH-1J (see *Jane's Aircraft Upgrades*) and AH-1S HueyCobra helicopters, wing main assemblies for JMSDF Lockheed Martin P-3Cs (see Kawasaki entry), main landing gear doors and some titanium airframe parts for Japanese built McDonnell Douglas F-15J/DJs (see Mitsubishi); and wings, tailplanes and canopies for Kawasaki T-4 (which see). Commercial aircraft components produced are spoilers, inboard and outboard ailerons for Boeing 747, outboard flaps for Boeing 757; wing/body fairings and main landing gear doors for Boeing 767 and 777, plus centre wing box for 777, outboard ailerons for McDonnell Douglas MD-11, rudders and elevators for Fokker 50. Other products include BQM-34AJKai (modified Firebee) target drone.

Fuji is also participating in such projects as design of the H-II space launch rocket, preliminary design of NASDA HOPE unmanned space shuttle, and development of NAL (which see) aero-spaceplane. Research has also begun on SST/HST (supersonic/hypersonic transport), including a thermal protection system, heat-resistant structures and composite materials (see International section).

UPDATED

FUJI T-5

TYPE: Two/four-seat primary trainer; turboprop version (KM-2Kai) of KM 2.

PROGRAMME: Fuji refitted KM 2 with Allison 250-B17D turboprop in 1984, first flown 28 June 1984 as KM-2D; JCAB certification (Aerobatic and Utility categories) gained 14 February 1985, ordered March 1987 as replacement for 31 JMSDF KM-2s; first flight of production KM-2Kai 27 April 1988, deliveries began 30 August 1988.

CURRENT VERSIONS: **T 5**: For JMSDF; Aerobatic and Utility applications; *description applies to this version*.

CUSTOMERS: See table. Total of 32 T 5s delivered to JMSDF by December 1994 for 201 Squadron of Ozuki Air Training Group.

FUJI T-5 FUNDING (JMSDF)

FY	Qty	Cum Total
86	1	1
87	2	3
88	3	6
89	2	8
90	7	15
91	9	24
92	5	29
93	3	32
94	—	32
95	2	34

DESIGN FEATURES: Turboprop engine, sliding canopy, modernised cockpit, visibility, payload and cockpit volume increased.

Wing section NACA 23016.5 at root, NACA 23012 at tip, no sweep; dihedral 6°; incidence 4° at root, 1° at tip.

FLYING CONTROLS: Mechanically actuated plain ailerons, balanced elevators and rudder; single-slotted wing flaps, aileron anti servo tabs, port tab controllable for trim, controllable tabs in elevators, rudder anti servo tab.

STRUCTURE: All-metal light alloy.

Fuji T 5 two/four-seat trainer of the Japan Maritime Self-Defence Force *(Katsumi Hinata)*

1995

LANDING GEAR: Electrically retractable tricycle type, with emergency manual control. Oleo-pneumatic shock-absorber in each unit. Main units retract inward into wings, nose unit rearward into fuselage. Single Parker wheel and Goodyear tyre on each main unit, size 6.50-8 (6 ply); Goodyear nosewheel and tyre, size 5.00-5 (4 ply). Nose unit steerable ±16°. Parker single-disc hydraulic brakes. Minimum ground turning radius 7.38 m (24 ft 2½ in).

POWER PLANT: One Allison 250-B17D turboprop, flat rated at 261 kW (350 shp), driving a Hartzell HC-B3TP-7A/T10173-18 three-blade constant speed fully feathering propeller. Two bladder type fuel tanks in each wing, one of 94.6 litres (25 US gallons, 20.8 Imp gallons) capacity and one of 87 litres (23 US gallons; 19.2 Imp gallons), total capacity 363 litres (96 US gallons, 80 Imp gallons). Gravity refuelling point in top surface of each wing. Oil capacity 9.5 litres (2.5 US gallons, 2.1 Imp gallons).

ACCOMMODATION: Enclosed cabin seating two persons side by side, with dual controls (Aerobatic version), or four persons in pairs in Utility version. Rearward-sliding canopy, optional IFR training hood. Accommodation heated and ventilated.

SYSTEMS: Hydraulic system for brakes only. Electrical system includes 30 V 150 A starter/generator, two 160 VA static inverters, and 24 Ah battery for engine starting and emergency.

AVIONICS: *Comms:* UHF and VHF radio, intercom, SIF.
Flight: Include ADF and Tacan.

DIMENSIONS, EXTERNAL:

Wing span	10.04 m (32 ft 11¼ in)
Wing chord: at root	2.13 m (6 ft 11¾ in)
at tip	1.07 m (3 ft 6¼ in)
Wing aspect ratio	6.11
Length overall	8.44 m (27 ft 8¼ in)
Height overall	2.96 m (9 ft 8½ in)
Elevator span	3.71 m (12 ft 2 in)
Wheel track	2.92 m (9 ft 7 in)
Wheelbase	2.27 m (7 ft 5⅜ in)
Propeller diameter	2.12 m (6 ft 11½ in)
Propeller ground clearance	0.37 m (1 ft 2½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.90 m (9 ft 6¼ in)
Max width	1.27 m (4 ft 2 in)
Max height	1.33 m (4 ft 4½ in)

AREAS:

Wings, gross	16.50 m² (177.6 sq ft)
Ailerons (total, incl tabs)	1.09 m² (11.73 sq ft)
Trailing-edge flaps (total)	1.98 m² (21.31 sq ft)
Fin, incl dorsal fin	1.28 m² (13.78 sq ft)
Rudder, incl tab	0.66 m² (7.10 sq ft)
Tailplane	3.46 m² (37.24 sq ft)
Elevators (total, incl tabs)	1.39 m² (14.96 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility):

Weight empty: A, U	1,082 kg (2,385 lb)
Max fuel weight: A, U	644 kg (1,420 lb)
Max T-O weight: A	1,585 kg (3,494 lb)
U	1,805 kg (3,979 lb)
Max wing loading: A	96.06 kg/m² (19.67 lb/sq ft)
U	109.39 kg/m² (22.40 lb/sq ft)
Max power loading: A	6.07 kg/kW (9.98 lb/shp)
U	6.92 kg/kW (11.37 lb/shp)

PERFORMANCE (at max Aerobatic T-O weight except where indicated):

Never-exceed speed (V_{NE})	223 kts (413 km/h, 256 mph) EAS
Max level speed at 2,440 m (8,000 ft)	193 kts (357 km/h, 222 mph)
Econ cruising speed at 2,440 m (8,000 ft)	155 kts (287 km/h, 178 mph)
Stalling speed, flaps and landing gear down, power off	56 kts (104 km/h, 65 mph)
Max rate of climb at S/L	518 m (1,700 ft)/min
Service ceiling	7,620 m (25,000 ft)
T-O run	302 m (990 ft)
T-O to 15 m (50 ft)	430 m (1,410 ft)
Landing from 15 m (50 ft)	515 m (1,690 ft)
Landing run	174 m (570 ft)
Range with max payload (Utility version), MIL-C-5011A reserves	510 n miles (945 km, 587 miles)

UPDATED

FUJI-BELL AH-1S

TYPE: Fuji built Bell anti-armour helicopter.

PROGRAMME: Fuji selected FY82 as prime contractor for licensed manufacture of AH 1S for JGSDF; Kawasaki building T53 engine; first flight 2 July 1984.

CURRENT VERSIONS: **Fuji-Bell AH-1S**: Based on US Army AH-1F (see under Bell heading in US section of 1993-94 *Jane's*).

CUSTOMERS: See table. Ordered by JGSDF following operational evaluation of two Bell AH-1Es (bought 1977-78, later upgraded to F standard). Total of 80 delivered by March 1995. Equips five anti-tank squadrons, with surplus for attrition and training: 1st Anti-Tank Helicopter Squadron at Tokachi, 2nd at Hachinone, 3rd at Metabaru, 4th at Kisarazu, and 5th at Akeno; plus HQ Squadron and Air Training Support Squadron, both at Akeno.

FUJI-BELL AH-1S FUNDING (JGSDF)

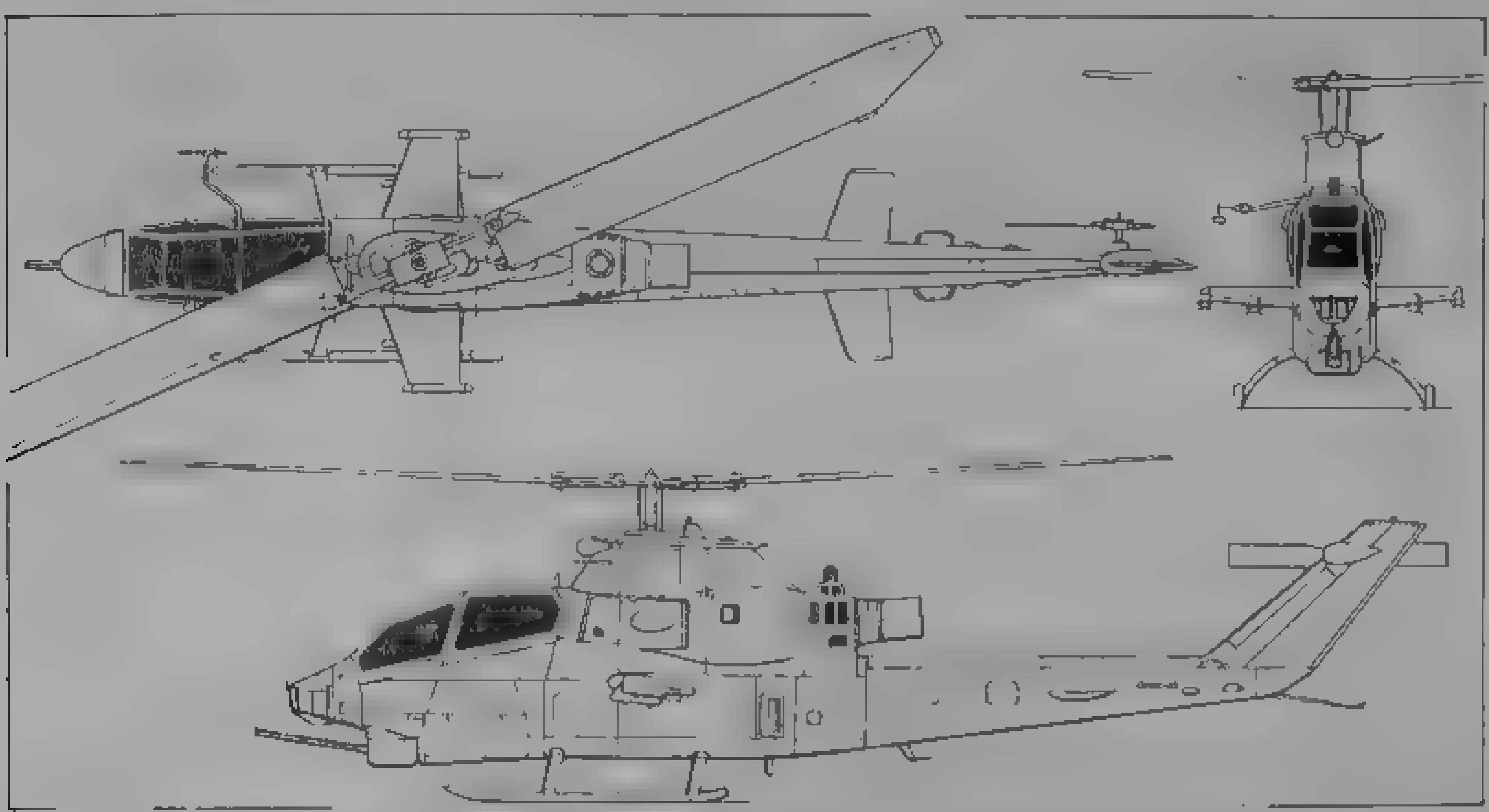
FY	Qty	Cum Total
77	1*	1
78	1*	2
82	12	14
83	5	19
84	5	24
85	8	32
86	8	40
87	8	48
88	8	56
89	9	65
90	8	73
91	6	79
92	4	83
93	2	85
94	2	87
95	2	89

* Built by Bell

DESIGN FEATURES: Corresponds to US Army AH 1F, cockpits to be adapted for NVGs and integrated nav/com control and display panel. Kaman composite blades can tolerate hits by 23 mm shells and have tungsten carbide bearing sleeves, outer 15 per cent of each blade is tapered in chord and thickness, tailboom strengthened against 23 mm hits

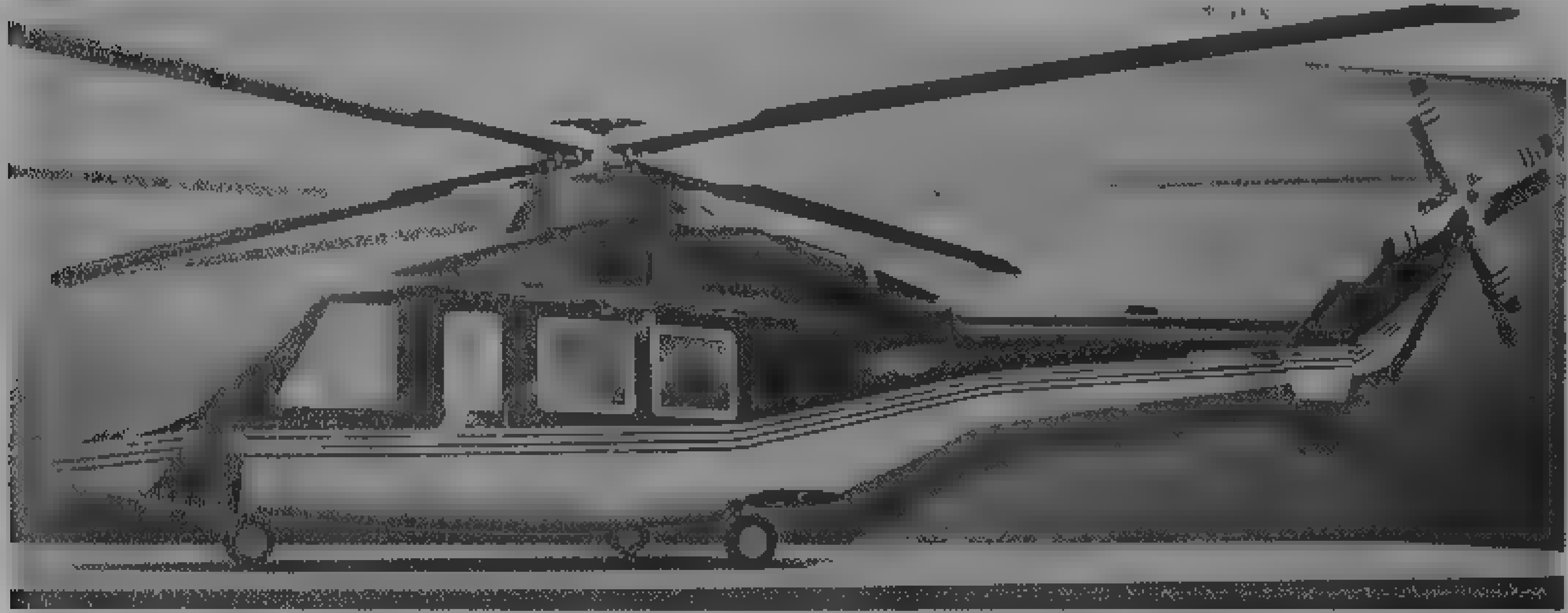
Fuji built AH-1S HueyCobra of the JGSDF's 4th Anti-Tank Helicopter Squadron *(Katsumi Hinata)*

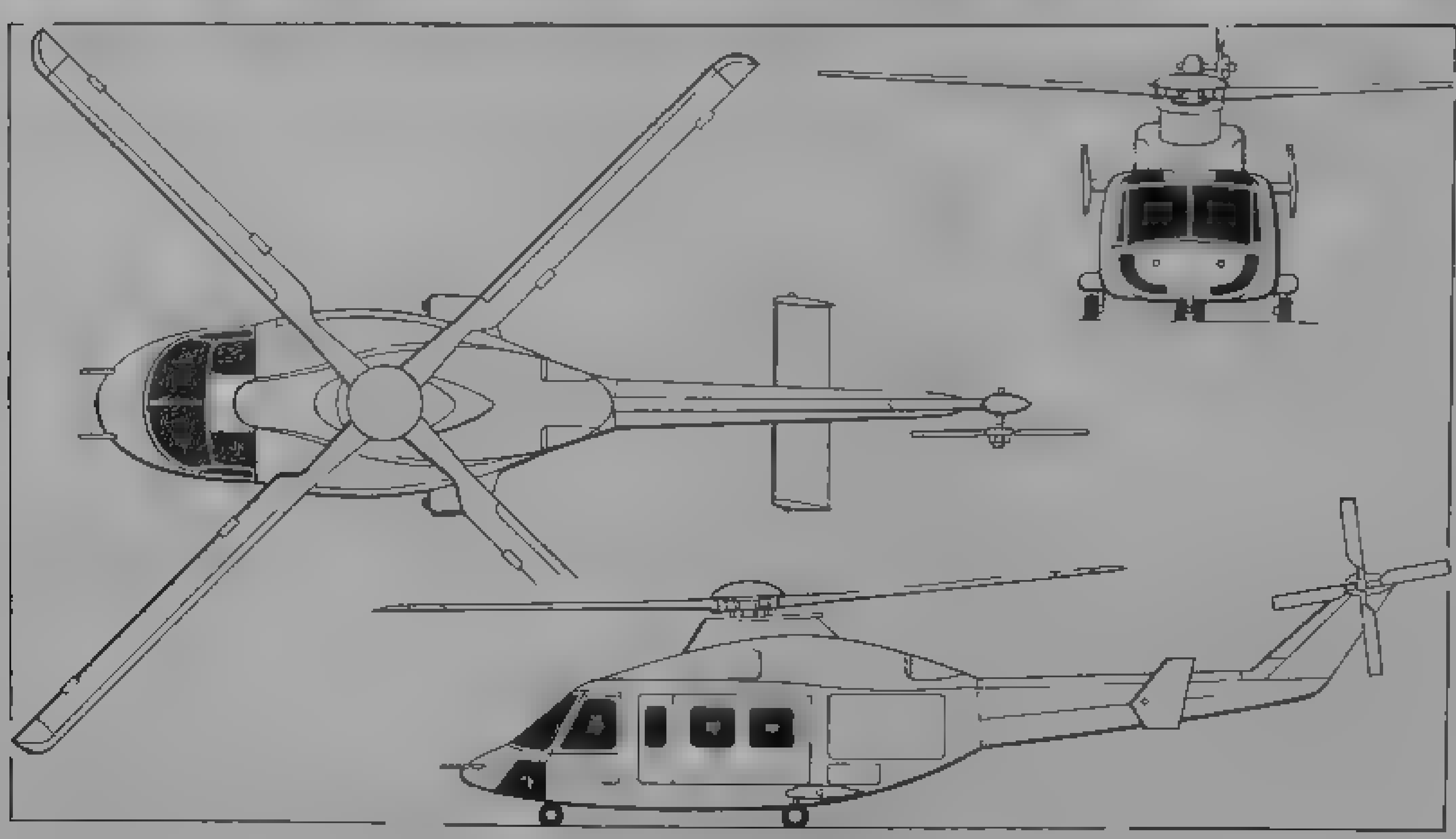
1995



Fuji-Bell AH-1S HueyCobra (Kawasaki T53-K-703 turboshaft) *(Jane's/Dennis Punnett)*

1993





Drawing *(Jane's/James Goulding)* and model photograph *(Paul Jackson)* of Fuji's proposed twin-turboshaft advanced medium helicopter

1995

POWER PLANT: One 1,342 kW (1,800 shp) Kawasaki-built T53-K-703 turboshaft. Transmission rated at 962 kW (1,290 shp) for take-off and 845 kW (1,134 shp) maximum continuous. Closed circuit refuelling. Fuel capacity 980 litres (259 US gallons, 216 Imp gallons). IR suppression nozzle on exhaust.

ACCOMMODATION: Flat-plate canopy has seven planes of viewing surfaces, designed to minimise glint and reduce possibility of visual detection during nap-of-the-earth (NOE) flying; instrument lighting compatible with night vision goggles. Independently operating window/door ballistic jettison system to facilitate crew escape in emergency.

SYSTEMS: Electrical system includes 10 kVA 400 Hz AC alternator with emergency bus. Dual hydraulic systems, pressure 103.5 bars (1,500 lb/sq in), maximum flow rate 22.7 litres (6 US gallons, 5 Imp gallons)/min; emergency (electrical pump) pressure 69 bars (1,000 lb/sq in). Open reservoir. Battery-driven Abex standby pump, for use in event of main hydraulic system failure, can be used for collective pitch control and for boresighting turret and TOW missile system.

AVIONICS: *Comms:* AN/ARC-114 VHF-FM, E-Systems (Memcor) AN/ARC-115 VHF-AM with secure voice system, UHF-AM; Toyo AN/APX-100 solid-state IFF transponder.

Flight: AN/ASN-128 Doppler nav system, HSI, radar altimeter, push/pull anti-torque controls for tail rotor, co-pilot's standby magnetic compass.

Instrumentation: Shimadzu HUD for pilot, VSI, omnidirectional airspeed system to improve gun and rocket accuracy; TKK M-143 air data subsystem.

Mission: Toshiba digital fire control computer for turreted weapon and underwing rockets; NEC C-Nite stabilised sight.

Self-defence: Sanders AN/ALQ-144 infra-red jammer (above engine).

ARMAMENT: M65L C-Nite system with eight Hughes TOW missiles, disposed as two two-round clusters on each outboard underwing station. Inboard wing stations remain available for other stores. Electrically powered Sumitomo universal turret designed to accommodate either 20 or 30 mm weapon, although only 20 mm M197 three-barrel gun (with 750 rounds) normally mounted in this turret. Rate of fire 675 rds/min. Turret position is controlled by pilot or co-pilot/gunner through helmet sights, or by co-pilot using M65 TOW missile system's telescopic sight unit. Field of fire up to 110° to each side of aircraft, 20.5° upward and 50° downward. Tamagawa M138 wing stores management subsystem, providing means to select and fire, singly or in groups, any one of five types of external 2.75 in rocket store. These mounted in launchers each containing 7 to 19 tubes, additional to TOW missile capability.

DIMENSIONS, EXTERNAL:

Main rotor diameter	13.41 m (44 ft 0 in)
Main rotor blade chord	0.76 m (2 ft 6 in)
Tail rotor diameter	2.59 m (8 ft 6 in)
Tail rotor blade chord	0.305 m (1 ft 0 in)
Wing span	3.28 m (10 ft 9 in)
Length overall, rotors turning	16.18 m (53 ft 1 in)
Width: fuselage	0.99 m (3 ft 3 in)
over TOW pods	3.56 m (11 ft 8 in)
Height to top of rotor head	4.09 m (13 ft 5 in)
Elevator span	2.11 m (6 ft 11 in)
Width over skids	2.13 m (7 ft 0 in)

AREAS:

Main rotor disc	141.26 m² (1,520.23 sq ft)
Tail rotor disc	5.27 m² (56.75 sq ft)

WEIGHTS AND LOADINGS*:

Operating weight empty	2,993 kg (6,598 lb)
Mission weight	4,524 kg (9,975 lb)
Max T-O and landing weight	4,535 kg (10,000 lb)
Max disc loading	32.10 kg/m² (6.58 lb/sq ft)
Max power loading	4.72 kg/kW (7.75 lb/shp)

PERFORMANCE (at max T-O weight, ISA)*:

Never-exceed speed (V_{NE}) (TOW configuration)	170 kts (315 km/h, 195 mph)
Max level speed (TOW configuration)	123 kts (227 km/h; 141 mph)
Max rate of climb at S/L, normal rated power	494 m (1,620 ft)/min
Service ceiling, normal rated power	3,720 m (12,200 ft)
Hovering ceiling IGE	3,720 m (12,200 ft)
Range at S/L with max fuel, 8% reserves	274 n miles (507 km, 315 miles)
g limits	+2.5/-0.5

* *For US Army AH-1F*

UPDATED

FUJI AMH

TYPE: Projected advanced medium helicopter.

PROGRAMME: Revealed at Paris Air Show June 1995; no commitment yet to build.

DESIGN FEATURES: See accompanying illustrations. Four-blade bearingless main rotor and lightweight advanced transmission, four-blade quiet tail rotor.

POWER PLANT: Two 1,044 kW (1,400 shp) class turboshafts.

DIMENSIONS, EXTERNAL:

Main rotor diameter	14.02 m (46 ft 0 in)
Tail rotor diameter	2.62 m (8 ft 7 in)

Length:	
overall, rotors turning	17.09 m (56 ft 1 in)
fuselage	13.34 m (43 ft 9 in)
Width: fuselage (max)	2.54 m (8 ft 4 in)
over mainwheel fairings	3.00 m (9 ft 10 in)
Height: over tail rotor	4.88 m (16 ft 0 in)
to top of rotor head	3.84 m (12 ft 7 in)
Tailplane span	2.84 m (9 ft 4 in)
Tail unit span (over fins)	3.02 m (9 ft 11 in)

NEW ENTRY

FUJI FNJ

At Tokyo Air Show, February 1995, Fuji displayed a model of a possible future six-seat business aircraft powered by twin fuselage-mounted AlliedSignal TFE731 turbofans. Design features include forward-swept wings of 10.40 m (34 ft 1½ in) span, canards and a 10.90 m (35 ft 9 in) long fuselage. Maximum T-O weight 2,900 kg (6,393 lb); performance estimates include a range of 1,500 n miles (2,780 km; 1,726 miles) at Mach 0.8 cruising speed.

NEW ENTRY

OTHER AIRCRAFT

Readers are referred to *Jane's Aircraft Upgrades* for current details of Fuji **UH-1H**, **UH-1J** and **205B**, last appearance in *Jane's* was in the 1994-95 edition.

NEW ENTRY

ISHIDA — *See US section*

JADC

JAPAN AIRCRAFT DEVELOPMENT CORPORATION

Toranomon Daichi Building, 2-3 Toranomon 1-chome, Minato-ku, Tokyo 105
Telephone: 81 (3) 3503 3225
Fax: 81 (3) 3504 0368
CHAIRMAN: Hiroshi Ohba

JADC is co-ordinating body for Japan's 20 per cent share in Boeing 777; participation includes design, testing, manufacturing and sales financing. 5[illegible] staff assigned to Boeing at end of 1993 for design and other activities.

JADC also co-ordinates work on YS-X airliner, for which Project Office opened July 1989; feasibility study conducted in FY89 and FY90 was followed by change of status in FY93 from government commissioned survey project to government supported programme involving whole Japanese aircraft industry. From 15 August 1991, JADC also commissioned to undertake supersonic transport development survey programme work previously handled by SJAC.

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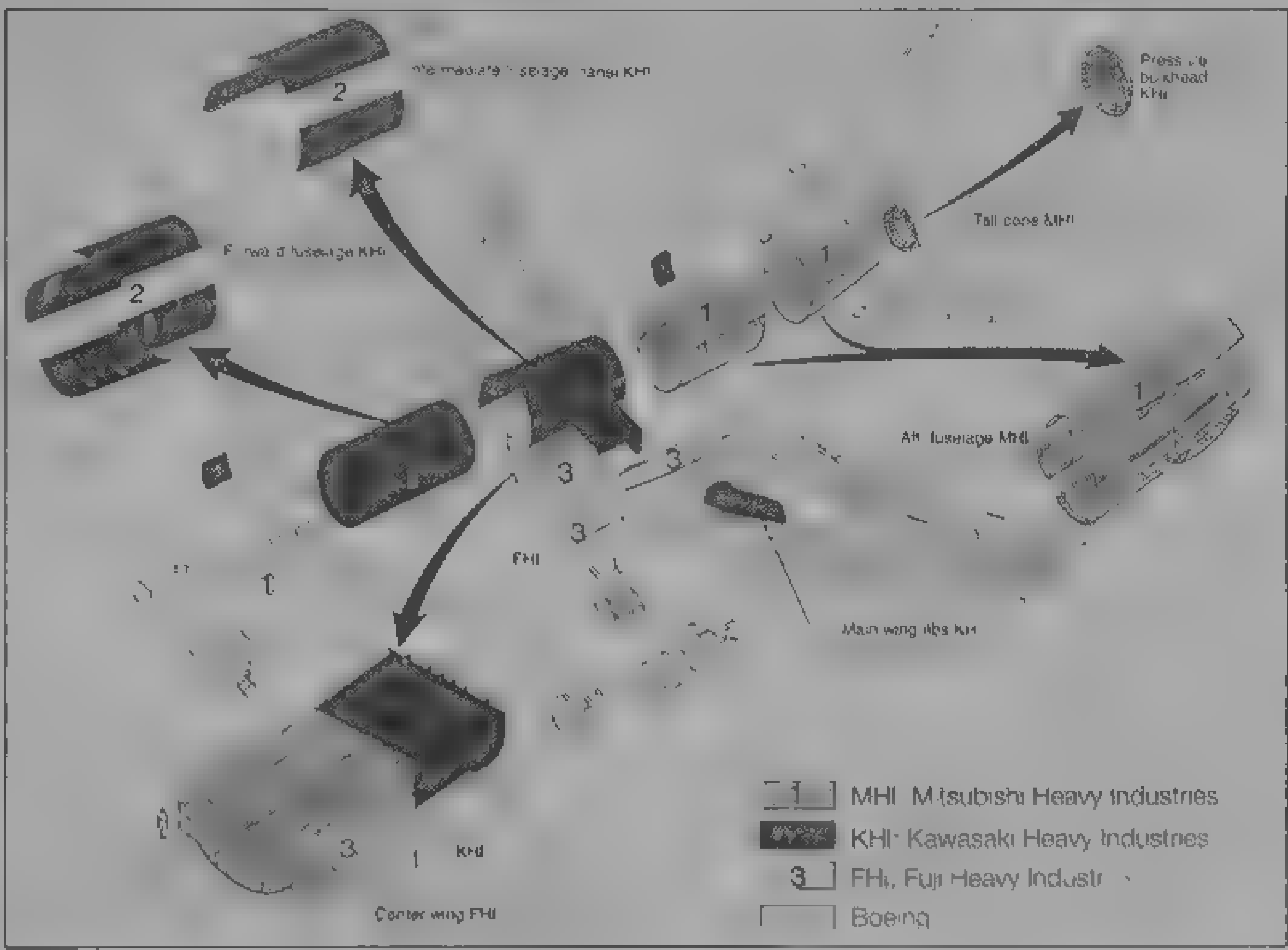

Exploded view of Boeing 777, showing Japanese industrial participation *1995*

YS-X

TYPE: Proposed regional airliner.

PROGRAMME: Entered predevelopment phase 1993 after two-year feasibility study, configuration design, programme planning and finding international partners expected to take several years, leading to in-service date in early 2000s. JMSDF reported in late 1994 to be considering ASW version as possible P-3C replacement.

DESIGN FEATURES: To compete with turboprop rivals, but powered by twin turbofans, probably underwing, low wing with 15° leading-edge sweep and aspect ratio of 10; circular-section fuselage with 3.40 m (11 ft 2 in) maximum internal width.

POWER PLANT: Two 53.4 kN (12,000 lb st) class turbofans.

ACCOMMODATION: Five-abreast seating for 90 to 110 passengers.

WEIGHTS AND LOADINGS:
Max T-O weight: approx 30,750 kg (67,790 lb)

PERFORMANCE (estimated):
Max cruising speed: Mach 0.76
Range with max fuel: more than 1,000 n miles (1,852 km; 1,151 miles)

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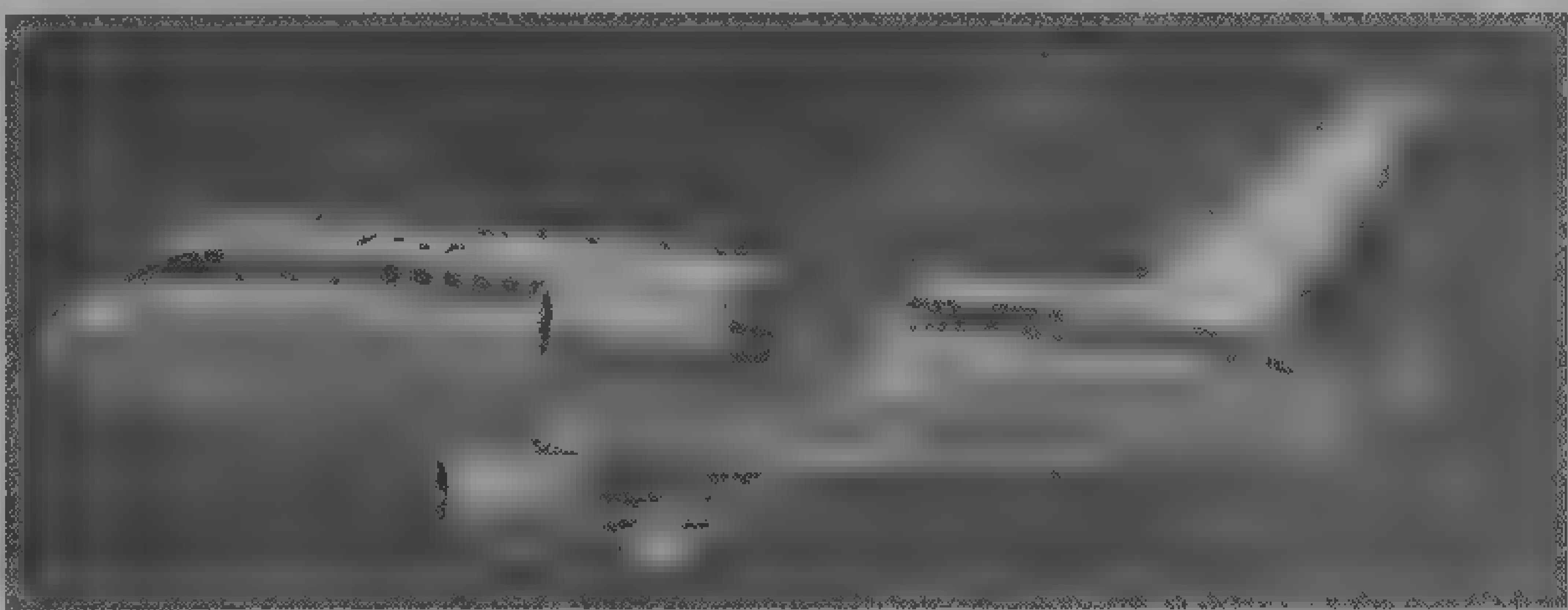


Artist's impression of a possible future YS-X *1995*

SST-X001

Japanese studies (intending eventual international collaboration) for supersonic transport, see International section Supersonic Airliner Studies.

UPDATED

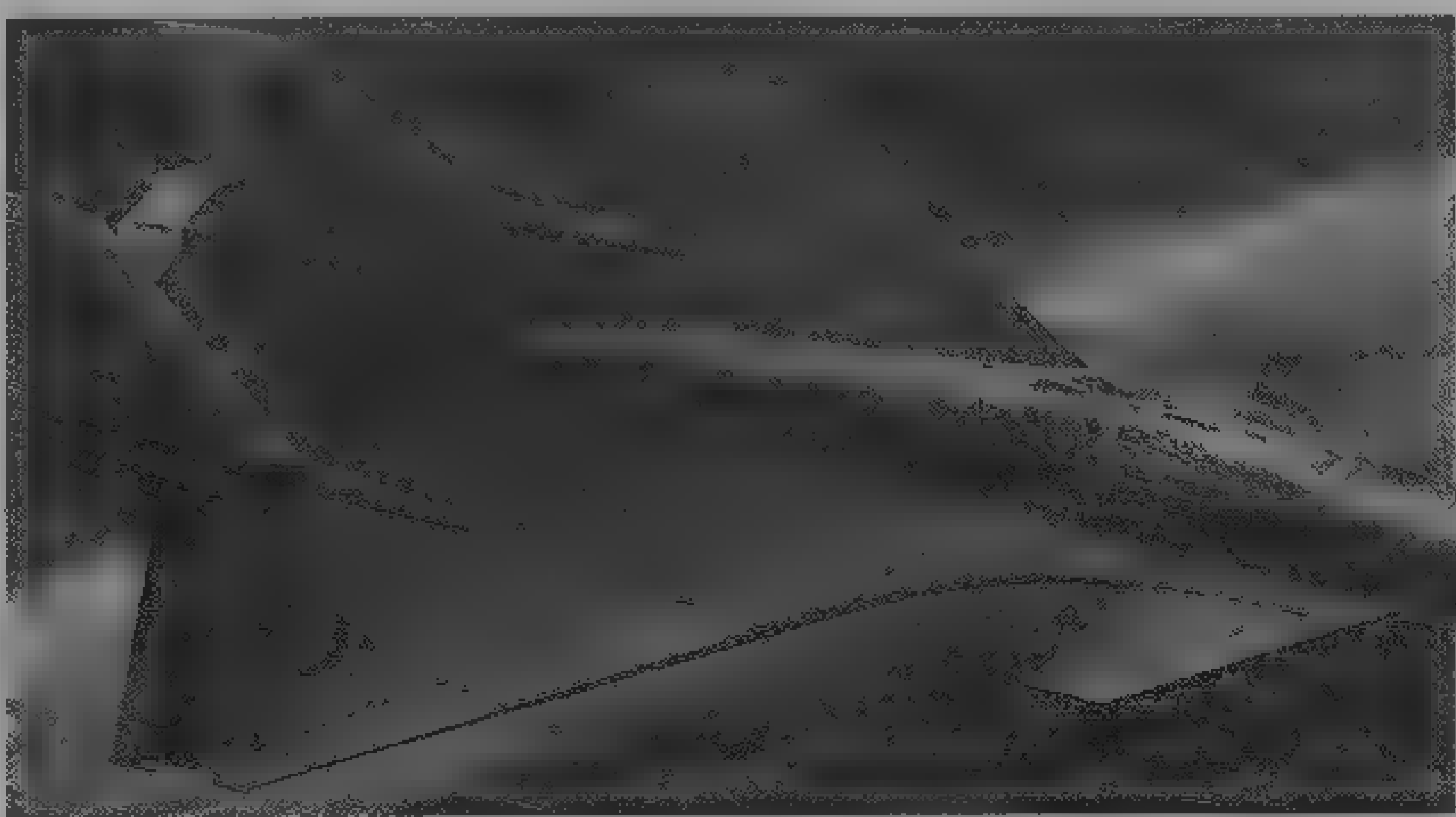
JDA

JAPAN DEFENCE AGENCY

9-7-45 Akasaka 9-chome, Minato-ku, Tokyo 107
Telephone/Fax: 81 (3) 3408 5211
DIRECTOR, PUBLIC INFORMATION: Kyoji Yanagisawa

Japanese armed forces requirements for which prime contractors have recently been selected include the OH-X scout and observation helicopter (see under Kawasaki), FS-X support fighter (see under Mitsubishi) and U-X utility support aircraft (which became U-4: see Gulfstream IV in US section). Other near term requirements as yet unallocated include AH-X, C-X and FI-X.

NEW ENTRY



Artist's impression of possible FI-X configuration as JASDF's next-generation fighter *(Jane's/Keith Fretwell)* *1995*

AH-X

Attack helicopter requirement to replace JGSDF AH-1S, selection expected in FY96. Apache thought likely to be too expensive, alternatives could be four-blade derivative of AH-1W SuperCobra or attack variant of OH-X.

NEW ENTRY

C-X

JASDF replacement for Kawasaki C-1A twin-turbofan transport, with increased range and payload capacity. Kawasaki's own proposal has span and length of 41 and 40 m (134 5 and 131 2 ft) respectively, with maximum T-O weight of some 100,000 kg (220,462 lb) of which 25,000 kg (55,115 lb) represents payload. Power plant would be four turbofans (IAE V2500, BMW Rolls-Royce BR710, CFMI CFM56 Lite and P&W/MTU NSE among candidates); maximum range approximately 3,240 n miles (6,000 km; 3,728 miles).

Foreign proposals for the C-X requirement include the Airbus FLA, Boeing 747 and McDonnell Douglas C-17.

NEW ENTRY

FI-X

Programme for next-generation fighter, to succeed F-15J in next century, launched with FY95 allocation of ¥1 billion ($10 2 million) to IHI to develop new 50 kN (11,240 lb st) class turbofan as power plant, to be test-flown in technology demonstrator in about 2008. Preliminary TRDI (JDA Technology Research and Development Institute) design proposal for FI-X shows twin-engined configuration with canards, low aspect ratio tapered wings, twin fins and rudders and thrust-vectoring exhaust nozzles. Construction expected to include co-cured composites, radar-absorbent materials and digital fly-by-light and engine control systems. Wing span and length provisionally 9 15 m (30 ft) and 13 40 m (44 ft) respectively. Avionics to include conformal radar and IR seeker.

NEW ENTRY

KAC

KANEMATSU AEROSPACE CORPORATION

12F NOA Building, 2-3-5 Azabudai, Minato-ku, Tokyo 106
Telephone 81 (3) 3586 2651
Fax 81 (3) 3586 2693
Telex 2233374
PRESIDENT AND CEO: Goro Sato
SALES DIVISION MANAGER: Akiro Ohdoi

Kanematsu is prime contractor for outfitting Raytheon Hawker 800s (formerly BAe 125 Corporate 800) to JASDF specifications. Full description of standard aircraft under Raytheon heading in UK section. Fuji is system integrator and responsible for U-125/U-125A maintenance.

UPDATED

JASDF Raytheon Hawker U-125 visiting Nyutabaru Air Base *(Katsumi Hinata)*
1995

KAC (RAYTHEON) HAWKER 800

JASDF designation U-125

TYPE: Twin-turbofan aircraft for navaid calibration and SAR.

PROGRAMME: Raytheon Hawker 800 (see UK section) selected under JASDF H-X programme to replace Mitsubishi MU-2J and MU-2E in navaid calibration and SAR roles respectively, first U-125 delivered to JASDF 18 December 1992 and first U-125A (52-3003) on 11 December 1994; three U-125As delivered by 31 January 1995 in preparation for formal handover.

CURRENT VERSIONS: **U-125**: For navaid flight check role replacing MU-2J, first aircraft 29-3041, operated by Flight Check Squadron at Iruma.

U-125A: Search and rescue version, to replace MU-2E. 360° search radar, FLIR, airdroppable marker flares and rescue equipment, first aircraft 52-3001.

CUSTOMERS: JASDF (three U-125 and seven U-125A), options on further 20 U-125As.

DESIGN FEATURES: U-125A has deep observation 'patio' window each side of fuselage immediately ahead of wing, small ventral fin, and dinghy/rescue pack dropping system via pressure door built into lower fuselage which is exposed for operation when landing gear is deployed.

AVIONICS (U-125A): *Radar*: Toshiba built Texas Instruments 360° search radar.

Mission: Mitsubishi Electric infra-red imager in retractable underfuselage turret.

U-125/A ORDERS

FY	U-125	U-125A
90	1	
91	1	
92	1	3
93		1
94		1
95		2
Totals	**3**	**7**

UPDATED

KAWASAKI

KAWASAKI JUKOGYO KABUSHIKI KAISHA (Kawasaki Heavy Industries Ltd)

Kobe Crystal Tower, 1-3 Higashi-Kawasaki-Cho 1-chome, Chuo-ku, Kobe
TOKYO AND AEROSPACE GROUP OFFICE: World Trade Center Building, 4-1 Hamamatsu-Cho 2-chome, Minato-ku, Tokyo 105
Telephone 81 (3) 3435 2111
Fax 81 (3) 3436 3037
Telex 242-4371 KAWAJU J
PRESIDENT: Hiroshi Ohba
Aerospace Group
EXECUTIVE MANAGING DIRECTOR AND GROUP SENIOR GENERAL MANAGER: Ryozo Tsutsui
WORKS: Gifu, Nagoya 1 and 2, Akashi, Seishin and Harima

Kawasaki Aircraft Company built many US aircraft under licence from 1955, amalgamated with Kawasaki Dockyard Company and Kawasaki Rolling Stock Manufacturing Company to form Kawasaki Heavy Industries Ltd 1 April 1969. Aerospace Group employs some 4,500 people, Kawasaki has 25 per cent holding in Nippi (which see).

Kawasaki is currently prime contractor on T-4 programme and for OH-X new small observation helicopter, co-developer and co-producer, with Eurocopter, of BK 117 helicopter (see International section); manufactures MD 500 helicopters under licence (344 delivered by March 1994); is prime contractor for Japanese licence production of P-3C variants for JMSDF and CH-47 Chinooks for JGSDF and JASDF. Subcontract work includes rear fuselages, wings and tail units for Mitsubishi built F-15 Eagles; and forward and centre-fuselage panels and wing ribs for Boeing 767 and 777. Kawasaki also responsible for design and sole-source manufacturer of transmission for McDonnell Douglas Explorer helicopter. Nominated as prime contractor for maintenance and support of JASDF E-2C Hawkeyes and C-130 Hercules. Undertaking feasibility study for JDA for future C-1/C-130 transport replacement (see JDA entry).

Kawasaki also extensively involved in satellites and launch vehicles, and HOPE orbiting spaceplane to operate with NASA Space Station, is member of International Aero Engines consortium and produces AlliedSignal T53 and T55 engines under licence (see Aero-Engines section); overhauls engines, and builds hangars, docks, passenger bridges and similar airport equipment.

UPDATED

Kawasaki EP-3C electronic surveillance aircraft for the JMSDF *(Shojiro Ootake)*
1995

KAWASAKI (LOCKHEED MARTIN) P-3C

TYPE: Land-based maritime patrol and ASW aircraft.

PROGRAMME: Kawasaki is prime contractor for JMSDF P-3s; first of five P-3Cs assembled by Kawasaki from US-supplied knocked-down components flown 17 March 1982 and delivered 26 May to Fleet Squadron 51 at Atsugi Air Base, production continues.

CURRENT VERSIONS: **P-3C/Update II 5 and III**: Versions built under licence in Japan; Japan Defence Agency plans to modernise current Update II 5 configuration to Update III (see Lockheed Martin) from 1996.

EP-3C: Four ordered in FY87/88/92/95, equipped for electronic surveillance; first flight (9171) October 1990, third aircraft due for delivery September 1995. NEC and Mitsubishi Electric low- and high-frequency detector systems.

UP-3C: One flying testbed for JMSDF; ordered FY91, delivered February FY95.

UP-3D: Two ECM trainers for JMSDF. One ordered in FY94 and one in FY95.

Proposed variants: Ocean surveillance, military transport and systems testbed variants proposed to Japan Defence Agency.

CUSTOMERS: See table. 109 ordered by March 1995, first three (US built) P-3Cs handed over to JMSDF in April 1981. Current operating units are Nos. 1 and 7 (Patrol) Squadrons at Kanoya, Nos. 2 and 4 (Patrol) Squadrons at Hachinohe, Nos. 5 and 9 (Patrol) Squadrons at Naha, Nos. 3 and 6 (Patrol) Squadrons at Atsugi, No. 8 (Patrol) Squadron at Iwakuni, plus No. 51 (Air Development) Squadron (Atsugi), No. 206 (Air Training) Squadron (Shimofusa) and (EP-3C only) No. 81 (Air Training Support) Squadron (Iwakuni).

STRUCTURE: Kawasaki builds centre-fuselages and is responsible for final assembly and flight testing; Fuji, Mitsubishi, Nippi and ShinMaywa participate in production of airframe, IHI manufactures Allison T56-IHI-14 engines.

AVIONICS: *Flight*: Trial GPS installation 1994, for retrofit

Kawasaki built P-3C-II.5 of the Japan Maritime Self-Defence Force (*Katsumi Hinata*)

1995

KAWASAKI T-4

TYPE: Tandem two-seat intermediate jet trainer and liaison aircraft, replacing Lockheed T-33A and Fuji T-1A/B.

PROGRAMME: Kawasaki named prime contractor 4 September 1981 by Japan Defence Agency; T-4 based on Kawasaki KA-851 design, by engineering team led by Kohki Isozaki, basic design studies completed October 1982; funding approved in FY83 and FY84 for four flying prototypes, prototype construction began April 1984, first flight of first XT-4 (56-5601) 29 July 1985, all four prototypes delivered between December 1985 and July 1986, preceded by static and fatigue test aircraft, production began FY86, first flight of production T-4, 28 June 1988; production deliveries started 20 September 1988. Fuji and Mitsubishi each have 30 per cent share in production programme.

CURRENT VERSIONS: **T-4**: Standard version, *as detailed*.

Enhanced version: Proposed to Japan Defence Agency as possible replacement for Mitsubishi T-2.

CUSTOMERS: JASDF requires about 200 for pilot training, liaison and other duties, total of 162 (including prototypes) ordered by 31 March 1995, of which 131 delivered, used by Nos. 31 and 32 Flying Training Squadrons of 1st Air Wing at Hamamatsu, near Tokyo; and in small numbers by instrument rating/communications flights of most combat squadrons. First delivery to Blue Impulse aerobatic team 1994, eight to be operational for 1996 air show season, replacing Mitsubishi T-2s.

DESIGN FEATURES: High subsonic manoeuvrability, ability to carry external loads under wings and fuselage, anhedral mid-mounted wings, with extended chord outer panels giving dog tooth leading-edges; tandem stepped cockpits with dual controls, baggage compartment in centre-fuselage for liaison role.

Supercritical wing section; thickness/chord ratio 10.3 per cent at root, 7.3 per cent at tip; anhedral 7° from roots, incidence 0°; sweepback at quarter-chord 27° 30′.

FLYING CONTROLS: Hydraulically actuated controls, plain hinged ailerons with Teijin powered actuators, all-moving tailplane and rudder use Mitsubishi servo actuators; double-slotted trailing-edge flaps, no tabs, airbrake on each side of rear fuselage.

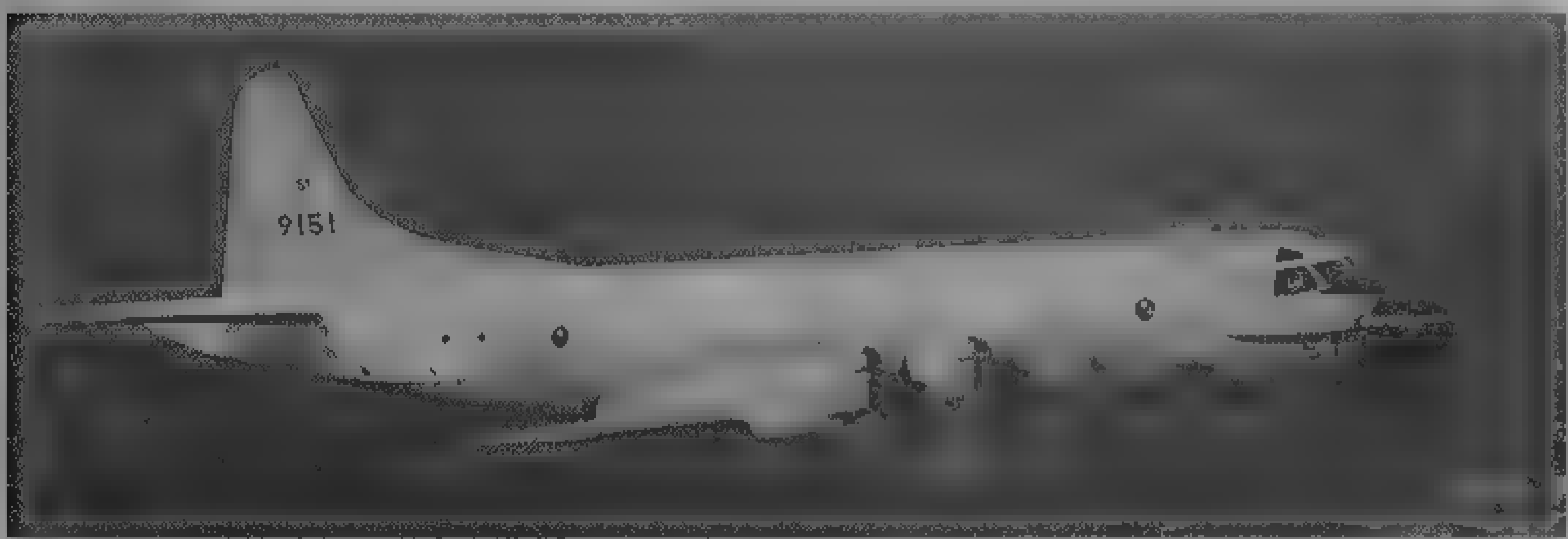
STRUCTURE: Aluminium alloy wings, with slow crack growth characteristics, CFRP ailerons, fin, rudder and airbrakes, aluminium alloy flaps with AFRP trailing-edges, aluminium alloy tailplane with CFRP trailing-edge; aluminium alloy fuselage with slow crack growth characteristics, and minimum use of titanium in critical areas. Kawasaki builds forward fuselage and is responsible for final assembly and flight testing, Fuji builds rear fuselage, wings and tail unit; Mitsubishi builds centre-fuselage and engine air intakes.

LANDING GEAR: Hydraulically retractable tricycle type, with Sumitomo oleo-pneumatic shock absorber in each unit. Single-wheel main units retract forward and inward, steerable nosewheel retracts forward. Bendix (Kayaba) mainwheels, tyre size 22 × 5.5-13.8, pressure 19.31 bars (280 lb/sq in); Bendix (Kayaba) nosewheel, tyre size 18 × 4.4-11.6, pressure 12.76 bars (185 lb/sq in). Bendix (Kayaba) carbon brakes and Hydro-Aire (Sumitomo) anti-skid units on mainwheels. Minimum ground turning radius 9.45 m (31 ft 0 in).

POWER PLANT: Two 16.28 kN (3,660 lb st) Ishikawajima-Harima F3-IHI-30 turbofans, mounted side by side in centre-fuselage. Internal fuel in two 401.25 litre (106 US gallon, 88.3 Imp gallon) wing tanks and two Japanese built Goodyear rubber bag tanks in fuselage, one of 776 litres (205 US gallons, 170.7 Imp gallons) and one of 662.5 litres (175 US gallons; 145.7 Imp gallons). Total internal capacity 2,241 litres (592 US gallons, 493 Imp gallons). Single pressure refuelling point in outer wall of port engine air intake. Provision to carry one 454 litre (120 US gallon; 100 Imp gallon) ShinMaywa drop tank on each underwing pylon. Oil capacity 5 litres (1.3 US gallons, 1.1 Imp gallons).

ACCOMMODATION: Crew of two in tandem in pressurised and air conditioned cockpit with wraparound windscreen and one piece sideways (to starboard) opening canopy. Dual controls standard, rear (instructor's) seat elevated 27 cm (10.6 in). UPCO (Stencel) SIIS-3 ejection seats and Teledyne McCormick Selph canopy severance system, licence built by Daicel Chemical Industries. Baggage compartment in centre of fuselage, with external access via door on port side.

SYSTEMS: Shimadzu bootstrap type air conditioning and pressurisation system (maximum differential 0.28 bar, 4.0 lb/sq in). Two independent hydraulic systems (one each for flight controls and utilities), each operating at 207 bars (3,000 lb/sq in) and each with separate air/fluid reservoir pressurised at 3.45 bars (50 lb/sq in). Flow rate of each hydraulic system 45 litres (12 US gallons; 10 Imp



Kawasaki UP-3C testbed of No 51 (Air Development) Squadron, JMSDF

1995

KAWASAKI (LOCKHEED MARTIN) P-3 PRODUCTION (JMSDF)

FY funded	Model	Qty	JMSDF serials	FY delivered	Cum Total
78	P-3C-II.5	3	5001-5003	81	3
78	P-3C-II.5	5[2]	5004-5008	82	8
79	—	—	—	—	8
80	P-3C-II.5	5	5009-5013	83	13
80	P-3C-II.5	5	5014-5018	84	18
81	—	—	—	—	18
82	P-3C-II.5	7	5019-5025	85	25
83	P-3C-II.5	7	5026-5032	86	32
84	P-3C-II.5	8	5033-5040	87	40
85	P-3C-II.5	10	5041-5050	88	50
86	P-3C-II.5	10	5051-5060	89	60
87	P-3C-II.5	9	5061-5069	90	69
87	EP-3C	1	71	90	70
88	P-3C-III	9	5070-5078	91	79
88	EP-3C	1	72	91	80
89	P-3C-III	10	5079-5088	92	90
90	P-3C-III	8	5089-5096[3]	93	98
91	P-3C-III	2	5097-5098[3]	94	100
91	UP-3C	1	9151	94	101
92	P-3C-III	1	5099	95	102
92	EP-3C	1		95	103
93	P-3C-III+	2		96	105
94	P-3C-III+	1		97	106
94	UP-3D	1		97	107
95	EP-3C	1		98	108
95	UP-3D	1		98	109

Notes: [1] Lockheed built
[2] Kawasaki assembled from Lockheed CKD kits
[3] Three (5089, 5097 and 5098) have large dielectric dome above forward fuselage

UPDATED

gallons)/min. No pneumatic system. Electrical system powered by two 9 kW Shinko engine-driven starter/generators. Tokyo Aircraft Instruments onboard oxygen generating system.

AVIONICS: *Comms*: Mitsubishi Electric J/ARC-54 VHF/UHF com, and Nagano JRC J/AIC-103 intercom.

Flight: Nippon Electric J/ARN-66 Tacan, Toshiba J/ARN-69 VOR/ILS, Toyo Communication (Teledyne Electronics) J/APX-106 SIF, Japan Aviation Electronics (Honeywell) J/ASN-3 AHRS, Tokyo Keiki (Honeywell) J/ASK-1 air data computer, and Tokyo Aircraft Instrument J/ASH-3 VGH recorder.

Instrumentation: Shimadzu (Kaiser) J/AVQ-1 HUD.

EQUIPMENT: Two Nippi pylons under each wing for carriage of drop tanks (see Power Plant) or travel pods, one Nippi pylon under fuselage, on which can be carried target towing equipment, ECM/chaff dispenser, travel pod or air sampling pod.

ARMAMENT: No built-in armament.

DIMENSIONS, EXTERNAL:

Wing span	9.94 m (32 ft 7½ in)
Wing chord: at root	3.11 m (10 ft 2½ in)
at tip	1.12 m (3 ft 8 in)
Wing aspect ratio	4.7
Length: overall	13.00 m (42 ft 8 in)
fuselage	11.96 m (39 ft 3 in)
Height overall	4.60 m (15 ft 1¼ in)
Tailplane span	4.40 m (14 ft 5¼ in)
Wheel track	3.20 m (10 ft 6 in)
Wheelbase	5.10 m (16 ft 9 in)

DIMENSIONS, INTERNAL:

Cockpit: Length	3.20 m (10 ft 6 in)
Max width	0.69 m (2 ft 3 in)
Max height	1.40 m (4 ft 7¼ in)

AREAS:

Wings, gross	21.00 m² (226.05 sq ft)
Ailerons (total)	1.51 m² (16.25 sq ft)
Trailing-edge flaps (total)	2.93 m² (31.54 sq ft)
Fin	3.78 m² (40.69 sq ft)
Rudder	0.91 m² (9.80 sq ft)
Tailplane	6.04 m² (65.02 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	3,790 kg (8,356 lb)
T-O weight, clean	5,690 kg (12,544 lb)
Max design T-O weight	7,500 kg (16,535 lb)
Max wing loading	357.1 kg/m² (73.15 lb/sq ft)
Max power loading	230.34 kg/kN (2.26 lb/lb st)

PERFORMANCE (in clean configuration. A: at weight of 4,850 kg, 10,692 lb with 50% fuel; B: at T-O weight of 5,690 kg, 12,544 lb):

Max level speed (A): at height	Mach 0.9
at S/L	560 knots (1,038 km/h; 645 mph)
Cruising speed: B	Mach 0.75
Stalling speed: A	90 knots (167 km/h; 104 mph)
Max rate of climb at S/L: B	3,050 m (10,000 ft)/min
Service ceiling: B	15,240 m (50,000 ft)
T-O run, 35°C: B	610 m (2,000 ft)
Landing run: A	640 m (2,100 ft)
Range (B) at Mach 0.75 cruising speed:	
internal fuel only	700 n miles (1,297 km; 806 miles)
with two 120 US gallon drop tanks	900 n miles (1,668 km; 1,036 miles)
g limits	+7.33/−3

UPDATED

KAWASAKI (BOEING) CH-47 CHINOOK

JASDF/JGSDF designation: CH-47J

TYPE: Twin-engined tandem-rotor helicopter.

PROGRAMME: FY84 defence budget approved purchase of three Boeing CH-47s, two for JGSDF and one for JASDF, first two built in USA and delivered Spring 1986, Nos 3 to 8 delivered CKD for assembly in Japan. Kawasaki granted manufacturing licence for Japanese services' Chinooks, first CH-47Js delivered late 1986.

CURRENT VERSIONS: **CH-47J**: Generally similar to US CH-47D.

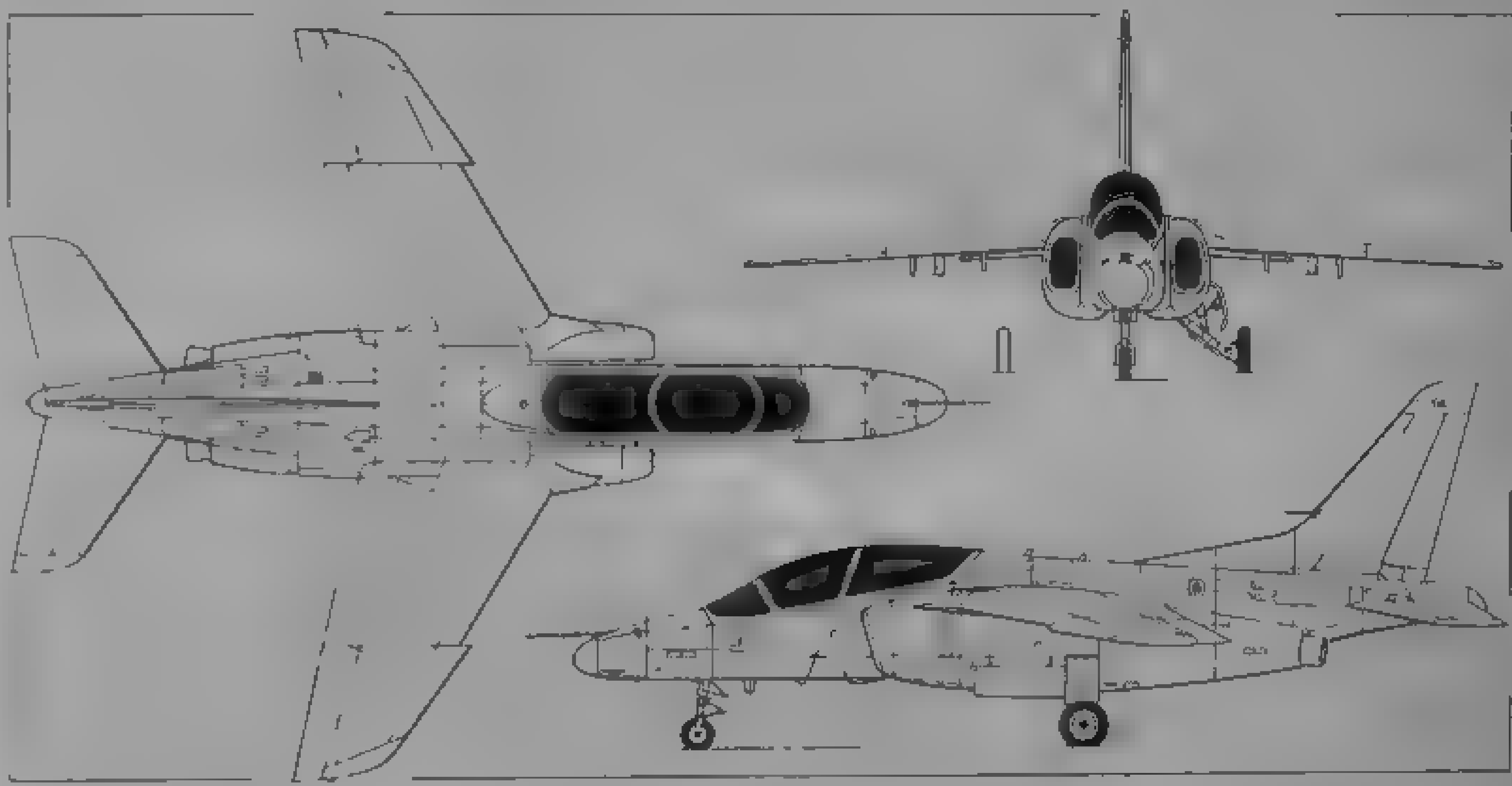
CUSTOMERS: See table. JGSDF has eventual requirement for 42, of which 34 delivered (of 40 ordered) by 31 March 1995, operated by 1st and 2nd Squadrons of 1st Helicopter

KAWASAKI CH-47J FUNDING*

FY	JASDF	JGSDF	Cum Total
84	1	2	3
85	1	3	7
86	3	4	14
87	2	4	20
88	3	5	28
89	2	5	35
90	2	5	42
91	1	3	46
92	—	3	49
93	—	2	51
94	1	—	52
95	1	2	55
Totals	**16**	**40**	**56**

*First eight built in USA (two) or assembled from kits

Kawasaki T-4 twin turbofan intermediate trainer of 202 Squadron, JASDF *(Katsumi Hinata)* 1995



Kawasaki T-4 trainer (two Ishikawajima-Harima F3-IHI-30 turbofans) *(Jane's/Dennis Punnett)* 1984

KAWASAKI T-4 FUNDING AND DELIVERY (JASDF)

	FUNDING			DELIVERY		
FY	Qty	Cum Total	CY	Qty	First Aircraft	Cum Total
83	3	3				
84	1	4				
85	—	4	85	2	56-5601	2
86	12	16	86	2	66-5603	4
87	20	36	87	—	—	4
88	20	56	88	8	86-5605	12
89	20	76	89	13	96-5613	25
90	19	95	90	29	06-5626	54
91	21	116	91	19	16-5655	73
92	19	135	92	19	26-5674	92
93	9	144	93	18	36-5693	110
94	9	153	94		46-5711	
95	9	162	95			

Kawasaki built Boeing CH-47J Chinook in JASDF camouflage *(Shojiro Ootake)* 1995

Brigade at Kisarazu. JASDF 15 delivered (of 16 ordered) by 31 March 1995, one each in 1986 to 1987, plus two per year in 1988-93.

AVIONICS: *Flight*: GPS in JGSDF aircraft from 1993.

UPDATED

KAWASAKI (McDONNELL DOUGLAS) MD 500D

JGSDF/JMSDF designation: OH-6D

TYPE: Light helicopter.

PROGRAMME: First flight of initial Kawasaki licence-built Hughes (now McDonnell Douglas) Helicopters 369D (500D) 2 December 1977; JCAB Normal category certification awarded 20 April 1978. Replacement now being developed under provisional designation OH-X (which see).

CUSTOMERS: See table. JGSDF has ordered 190 of which 153 delivered by end of March 1994; 10 delivered to JMSDF by 31 March 1994 for training role. Nine delivered for civil operation by same date.

KAWASAKI OH-6D FUNDING

FY	JGSDF	JMSDF	Cum Total
78	10	—	10
79	12	—	22
80	10	—	32
81	8	—	40
82	6	2	48
83	3	1	52
84	9	2	63
85	7	—	70
86	12	2	84
87	12	—	96
88	11	—	107
89	11	2	120
90	15	—	135
91	14	—	149
92	13	1	163
93	13	—	176
94	13	—	189
95	11	3	203
Totals	**190**	**13**	**203**

UPDATED

KAWASAKI OH-X

TYPE: Armed scout and observation light helicopter to replace OH-6D.

PROGRAMME: Japan Defence Agency (JDA) awarded ¥2.7 billion ($22.5 million) in FY92 to cover basic design phase. RFPs issued by Technical Research & Development Institute (TRDI) Spring 1992, Kawasaki selected as prime contractor (60 per cent of programme) September 1992, with Fuji and Mitsubishi (20 per cent each) as partners. Observation Helicopter Engineering Team (OHET) formed by these three companies began preliminary design phase 1 October 1992. Mockup made public September 1994 under Japanese name Kongata Kansoku (New Small Observation (Helicopter)). Programme to include seven prototypes (four flying, three for ground test), with first flight planned for mid-1996 and first deliveries 2000.

CUSTOMERS: Japan Ground Self-Defence Force requirement for 150-200.

COSTS: Total development programme, including engine, estimated at ¥80 billion ($666 million) (1992); Kawasaki contract (to December 1993) valued at ¥513 million ($23 million).

DESIGN FEATURES: Kawasaki bearingless and ballistic-tolerant four-blade main rotor and transmission system, Fenestron type tail rotor.

STRUCTURE: Rotor blades and hub manufactured from composites, centre-fuselage by Mitsubishi, tail unit/canopy/stub-wings by Fuji, rest by Kawasaki. Approximately 12 per cent of fuselage (by weight) in CFRP.

POWER PLANT: Twin 708 kW (950 shp) Mitsubishi MG5 turboshafts. Possibility of off the shelf alternative engines not ruled out. Stub-wings can carry auxiliary fuel tanks.

ACCOMMODATION: Crew of two on tandem armoured seats (pilot in front). Flat plate cockpit transparencies.

Kawasaki artist's impression of the OH-X in JGSDF markings

1995

Kawasaki (McDonnell Douglas) OH-6D light helicopter of the JGSDF *(Shojiro Ootake)*

1993

Engineering mockup of the OH-X observation helicopter

1995

AVIONICS: *Instrumentation*: Two large, flat-panel MFDs in each cockpit, roof-mounted sight immediately forward of main rotor head.

Mission: IR sensor, colour TV camera and laser rangefinder.

Self-defence: IR jammer based on Sanders AN/ALQ-144.

ARMAMENT: Four lightweight, short range air-to-air missiles on stub-wings.

DIMENSIONS, EXTERNAL (approx):

Main rotor diameter	11.5 m (37 ft 8¾ in)
Wing span	3.0 m (9 ft 10 in)
Fuselage: Length	12.0 m (39 ft 4½ in)
Max width	1.0 m (3 ft 3⅜ in)
Height overall	4.0 m (13 ft 1½ in)

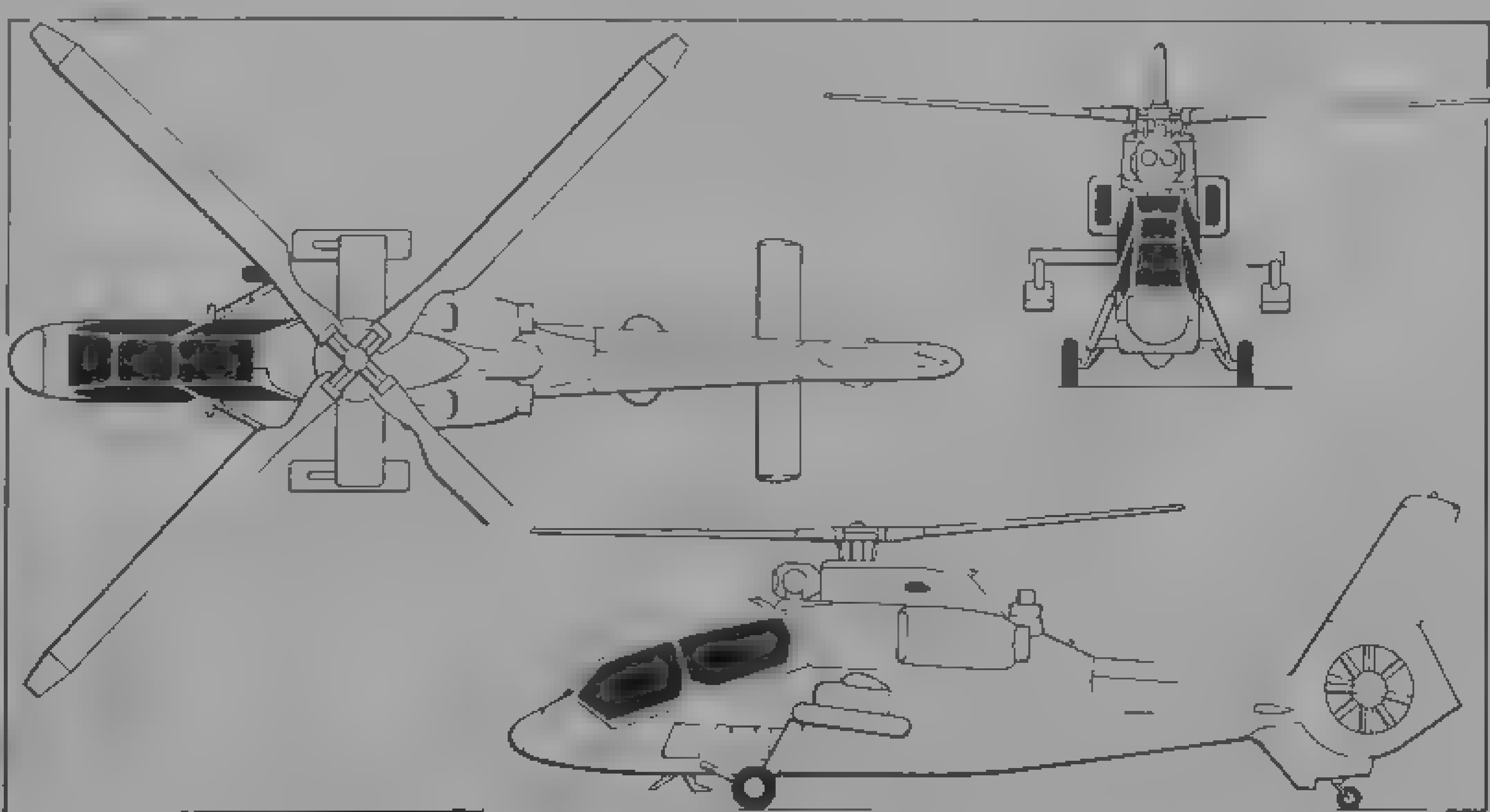
WEIGHTS AND LOADINGS:

Max T-O weight	3,500 kg (7,716 lb) class

PERFORMANCE (estimated):

Max level speed	140 kts (259 km/h; 161 mph)
Combat radius	108 n miles (200 km; 124 miles)

UPDATED



Provisional drawing of Kawasaki OH-X observation helicopter *(Jane's/James Goulding)*

1995

MITSUBISHI

MITSUBISHI JUKOGYO KABUSHIKI KAISHA (Mitsubishi Heavy Industries Ltd)

5-1 Marunouchi 2-chome, Chiyoda-ku, Tokyo 100
Telephone: 81 (3) 3212 3111
Fax: 81 (3) 3212 9865
Telex: J22443
NAGOYA AIRCRAFT WORKS: 10 Oye-cho, Minato-ku, Nagoya 455
PRESIDENT: Kentaro Aikawa
EXECUTIVE VICE PRESIDENTS:
Nobuichi Tsuruoka
Yu Tashiro
Takaaki Yamada (Managing Director, and General Manager of Aircraft and Special Vehicle Headquarters)
GENERAL MANAGER, AIRCRAFT DEPARTMENT:
Ichiro Ogawa

Present Komaki South plant built 1952; Nagoya facility is divided into Aerospace Systems Works and Guidance & Propulsion Systems Works, with combined floor area of 552 463 m² (5,946,666 sq ft).

Developed MU-2, MU-300, T-2 supersonic trainer and close support F-1 for JASDF. Built 167 HSS-2/2A/2B and 18 S-61A helicopters under Sikorsky licence (last aircraft delivered 2 March 1990). Is currently prime contractor for Japanese F-4E upgrades and conversions (see *Jane's Aircraft Upgrades*), F-15J, FS-X and SH/UH-60J helicopters. Subcontract work includes forward and rear fuselages for Kawasaki JMSDF P-3s, Boeing 767 rear passenger cabin sections (partly subcontracted by Mitsubishi to ShinMaywa), and McDonnell Douglas MD-11 tailcones. Participating in JDA feasibility study for new C-X transport aircraft to replace C-1 and C-130. To collaborate with Sikorsky in S-92 medium helicopter programme.

Aero-engine activities detailed in Engines section, also produces rocket engines and participates in H-I and H-II launchers and Japanese Experimental Module for US Space Station and for HOPE orbiting spaceplane.

UPDATED

Mitsubishi F-15J Eagle air superiority fighter of the JASDF *(Katsumi Hinata)*
1995

MITSUBISHI (MCDONNELL DOUGLAS) F-15J EAGLE

TYPE: Air superiority fighter.

PROGRAMME: Two US built F-15Js followed by eight assembled in Japan from US supplied CKD kits, first flight of CKD Eagle 26 August 1981, delivered 11 December; production to continue into late 1990s.

CURRENT VERSIONS: **F-15J**: Single seater, generally similar to US F-15C (see 1993-94 *Jane's*) but with Japanese designed and manufactured ECM and radar warning systems. *Description applies to this version.* Mitsubishi now only producer of this model. Starting FY91, F-15J's F100-PW-100 engines being upgraded to -220E standard and digital electronic engine control (DEEC) added.

F-15DJ: Two-seat combat-capable trainer (first 12 US built).

CUSTOMERS: See table. Japan Defence Agency plans to procure 223 Eagles for JASDF, including 14 (two F-15Js and 12 F-15DJs, built in USA, 209 F-15Js and DJs funded by March 1995, 194 delivered by December 1994.

First JASDF unit was No. 202 Squadron (5th Air Wing), activated April 1982 at Nyutabaru, other units are Nos 201 (April 1986) and 203 (April 1983) Squadrons (2nd Air Wing) at Chitose, Hokkaido, Nos. 204 (April 1984) and 305 (July 1993) (7th Air Wing) at Hyakuri. No. 303 (April 1987) (6th Air Wing) at Komatsu, and No. 304 (April 1990) (8th Air Wing) at Tsuiki. Additionally, Aggressor Squadron at Nyutabaru received six F-15DJs in 1990.

COSTS: $55.2 million, flyaway, Mitsubishi production in 1990.

DESIGN FEATURES: NACA 64A aerofoil section with conical camber on leading-edge; sweepback 38° 42′ at quarter-chord; thickness/chord ratio 6.6 per cent at root, 3 per cent at tip; anhedral 1°; incidence 0°. Twin fins positioned to receive vortex flow off wing and maintain directional stability at high angles of attack. Straight two-dimensional external compression engine air inlet each side of fuselage.

FLYING CONTROLS: Plain ailerons and all-moving tailplane with dog-tooth extensions, both powered by hydraulic actuators; hydraulically actuated rudders, no spoilers or trim tabs, boost and pitch compensator for control column, plain flaps; upward-opening airbrake in upper fuselage between fins and cockpit.

STRUCTURE: Wing based on torque box with integrally machined skins and ribs of light alloy and titanium; aluminium honeycomb wingtips, flaps and ailerons; airbrake panel of titanium, aluminium honeycomb and graphite/epoxy composites skin.

Mitsubishi building forward and centre-fuselages, and responsible for final assembly and flight testing, subcontractors are Fuji (landing gear doors), Kawasaki (wings and tail assembly), Nippi (pylons and missile launchers), ShinMaywa (drop tanks), Sumitomo (landing gear) and IHI (engines).

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel on each unit, all units retract forward. Nose and main units each incorporate oleo-pneumatic shock-absorber. Nosewheel and tyre size 22 × 6.6-10, pressure 17.93 bars (260 lb/sq in). Mainwheels have size 34.5 × 9.75-18 tyres, pressure 23.44 bars (340 lb/sq in). Carbon heat-sink brakes. Wheel braking skid control system.

POWER PLANT: Two IHI built Pratt & Whitney F100-PW-100 turbofans initially, but upgraded from FY91 to F100-PW-220E (65.3 kN; 14,670 lb st dry and 106.0 kN; 23,830 lb st with afterburning). Internal fuel in structural wing tanks and six fuselage tanks, total capacity 7,836 litres (2,070 US gallons, 1,724 Imp gallons). Provision for up to three 2,309 litre (610 US gallon; 508 Imp gallon) external fuel tanks. Maximum total internal and external fuel capacity 14,763 litres (3,900 US gallons, 3,247 Imp gallons). Conformal fuel tanks (CFTs) not carried by Japanese F-15s.

ACCOMMODATION: Pilot only, on McDonnell Douglas ACES II zero/zero ejection seat. Stretched acrylic canopy and windscreen.

SYSTEMS: Air conditioning system. Three independent hydraulic systems (each 207 bars; 3,000 lb/sq in) powered by engine-driven pumps. Electrical power generating system (40/50/60 kVA) has constant-speed drive units and transformer-rectifiers. Oxygen system includes a liquid oxygen indicator. APU for engine starting, and for limited electrical or hydraulic power on ground independently of main engines.

AVIONICS: *Comms:* As for USAF F-15C except for RT-1360A UHF/VHF transceiver and datalink communications set.

Radar: Upgraded radar (possibly improved Hughes APG-63 or Mitsubishi Electric active phased-array type) planned for approximately 100 JASDF F-15Js.

Self-defence: J/ALQ-8 ECM, J/APR-4A RWR and ALE-45 (J) chaff/flare dispenser. New podded ECM system being developed under TRDI three year (1994-96) contract.

ARMAMENT: Provision for carriage and launch of a variety of air-to-air weapons over short and medium ranges, including four AIM-9J/L Sidewinders and four AIM-7E/F Sparrows, 20 mm M61A1 six-barrel gun with 940 rounds of ammunition. Sidewinders to be replaced by Mitsubishi AAM-3 with NEC seeker and proximity fuze and Komatsu warhead. AN/AWG-27 armament control system keeps pilot informed of weapon's status and provides for their management. Three air-to-surface weapon stations allow for carriage of up to 10,705 kg (23,600 lb) of bombs, rockets or additional ECM equipment.

DIMENSIONS, EXTERNAL:

Wing span	13.05 m (42 ft 9¾ in)
Wing aspect ratio	3.01
Length overall	19.43 m (63 ft 9 in)
Height overall	5.63 m (18 ft 5½ in)
Tailplane span	8.61 m (28 ft 3 in)
Wheel track	2.75 m (9 ft 0¼ in)
Wheelbase	5.42 m (17 ft 9½ in)

AREAS:

Wings, gross	56.5 m² (608.0 sq ft)
Ailerons (total)	2.46 m² (26.48 sq ft)
Flaps (total)	3.33 m² (35.84 sq ft)
Fins (total)	9.78 m² (105.28 sq ft)
Rudders (total)	1.85 m² (19.94 sq ft)
Tailplanes (total)	10.34 m² (111.36 sq ft)

MITSUBISHI F-15J/DJ FUNDING AND DELIVERY (JASDF)

FY	FUNDING F-15J	F-15DJ	Cum Total	CY	DELIVERY F-15J	First Aircraft	F-15DJ	First Aircraft	Cum Total
78	2* + 15	6*	23	78					
79	—	—	23	79					
80	30	4*	57	80	2	02-8801			2
81	—	—	57	81	1	12-8803	4	12-8051	7
82	21	2*	80	82	12	22-8804	2	22-8055	21
83	13	—	93	83	12	32-8816	4	32-8057	37
84	17	—	110	84	17	42-8828			54
85	10	4	124	85	19	52-8845	2	52-8061	75
86	8	4	136	86	15	62-8864			90
87	6	6	148	87	17	72-8879			107
88	9	3	160	88	10	82-8896	4	82-8063	121
89	10	1	171	89	10	92-8906	4	92-8067	135
90	3	7	181	90	7	02-8916	3	02-8071	145
91	8	—	189	91	6	12-8923	4	12-8074	155
92	5	2	196	92	12	22-8929	2	22-8078	169
93	3	1	200	93	3	32-8941	8	32-8080	180
94	4		204	94		42-8944			194
95	2	3	209	95					
Totals	**166**	**43**							

* Built in USA

WEIGHTS AND LOADINGS.
Operating weight empty (no fuel, ammunition, pylons or external stores) 12,973 kg (28 600 lb)
Max fuel load internal (JP4) 6,103 kg (13 455 lb)
external tanks (three, total) 5,395 kg (11,895 lb)
max internal and external 11,498 kg (25,350 lb)
T-O weight (interceptor, full internal fuel, four Sparrows and 940 gun rounds) 20,244 kg (44,630 lb)
Max T-O weight (incl three 2,309 litre, 610 US gallon, 508 Imp gallon drop tanks) 26,521 kg (58,470 lb)
Max wing loading 469 5 kg/m² (96.2 lb/sq ft)
Max power loading 125 1 kg/kN (1 23 lb/lb st)
PERFORMANCE (F-15C: F-15J similar)
Max level speed more than Mach 2 5 (800 kts, 1 482 km/h, 921 mph CAS)
Approach speed 125 kts (232 km/h, 144 mph) CAS
Service ceiling 18,300 m (60,000 ft)
T-O run (interceptor) 274 m (900 ft)
Landing run (interceptor), without braking parachute 1,067 m (3,500 ft)
Ferry range with external tanks more than 2,200 n miles (4,074 km, 2,532 miles)
Design g limits +9/−3

UPDATED

MITSUBISHI FS-X

TYPE: Single-seat support fighter

PROGRAMME: Modified F-16C selected as Japan's FS-X replacement for Mitsubishi F-1 in October 1987, Mitsubishi appointed prime contractor November 1988, initial contracts awarded for airframe design March 1989 and prototype active phased-array radar February 1990, General Electric F110-GE-129 Improved Performance Engine selected December 1990 Programme delayed by questions of development sharing with General Dynamics (now Lockheed Martin) and technology transfer to Japan, but agreed at Japan 60 per cent and USA 40 per cent cost sharing: first subcontracts to GD let February 1990 for design and development of rear fuselage, wing, leading-edge flaps, avionics and computer based test equipment. Active phased-array radar (Mitsubishi), EW (ECM/ESM), mission computer and IRS being developed using Japanese domestic technology.

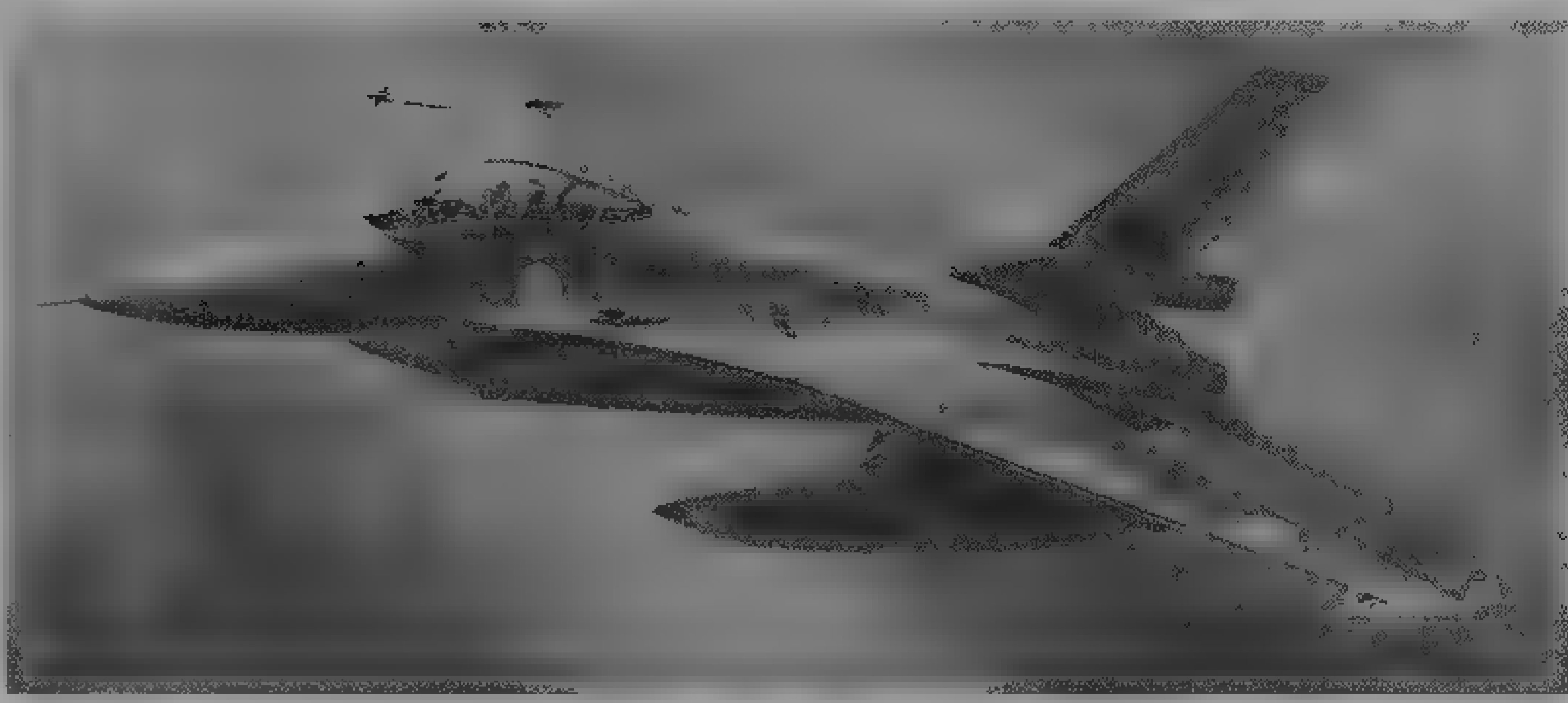
Japan totally responsible for FS-X programme, including all funding, subcontractors include Kawasaki and Fuji (see Structure) Programme to involve four flying prototypes (two single-seat, two tandem two-seat) and two for static and fatigue test; construction began early 1994, final assembly mid-1994, first prototype (63-0001) rolled out 12 January 1995, first flight expected September 1995, followed by handover to JDA March 1996. IOC targeted for 1999

CURRENT VERSIONS: **FS-X**: Single-seat support fighter
TFS-X: Combat capable two-seater

CUSTOMERS: JASDF (sole user) has requirement for approximately 72 to replace F-1, plans for others for additional roles, to overall total of up to 130, now seem unlikely to materialise.

COSTS: Total JDA expenditure since 1988 $3 27 billion, including ¥75 7 billion ($575 million) in FY92 to include first prototype and radar development further ¥96 5 billion ($804 million) in FY93 provided for three more flying prototypes and two for ground test First two Mitsubishi contracts to GD totalled $280.5 million, follow-on contract to Lockheed (5 February 1993) valued at $74 2 million

COSTS: Total programme funding (1988 to 1995) $3 27 billion



Artist's impression of Mitsubishi FS-X fighter

1995

DESIGN FEATURES: New co-cured composite wing of Japanese design, with greater span, root chord and area than that of F-16; tapered trailing-edge; slightly longer radome and forward fuselage to house new radar and other mission avionics, longer mid-fuselage and shorter jetpipes, increased-span tailplane; addition of brake chute adoption of increased performance engine. Wing leading-edge sweepback 33° 12', incidence 2° 30

FLYING CONTROLS: Initially planned vertical canards deleted CCV functions to be achieved by digital fly-by-wire system, developed jointly by Japan Aviation Electronics and Bendix/King Based on earlier Mitsubishi work with T-2 CCV testbed Available modes to include control augmentation, relaxed static stability, manoeuvre load control decoupled yaw and manoeuvre enhancement

STRUCTURE: All-composites co-cured wing, fuselage, tail and other structures also to use advanced materials and structure technology, including radar absorbent material

Mitsubishi to build forward fuselage and wings; other Japanese airframe companies involved include Fuji (upper wing skins, wing fairings, radome, flaperons, engine air intakes and tail unit) and Kawasaki (fuselage mid section and engine access doors). Lockheed Martin providing rear fuselage, wing boxes, leading-edge flaps, avionics systems and some test equipment for first six aircraft

POWER PLANT: One General Electric F110-GE-129 turbofan (131 7 kN; 29,600 lb st with afterburning). Maximum internal fuel capacity 4,675 litres (1,235 US gallons; 1,028 Imp gallons) (reduced to 3,978 litres, 1,051 US gallons 875 Imp gallons in TFS-X) Maximum external fuel capacity (both) 5,678 litres (1,500 US gallons; 1,249 Imp gallons) (one 1,135 5 litre, 300 US gallon, 249 8 Imp gallon and two 2,271 25 litre, 600 US gallon, 499 6 Imp gallon tanks)

AVIONICS: *Radar*: Mitsubishi Electric active phased-array radar

Flight: Inertial reference system

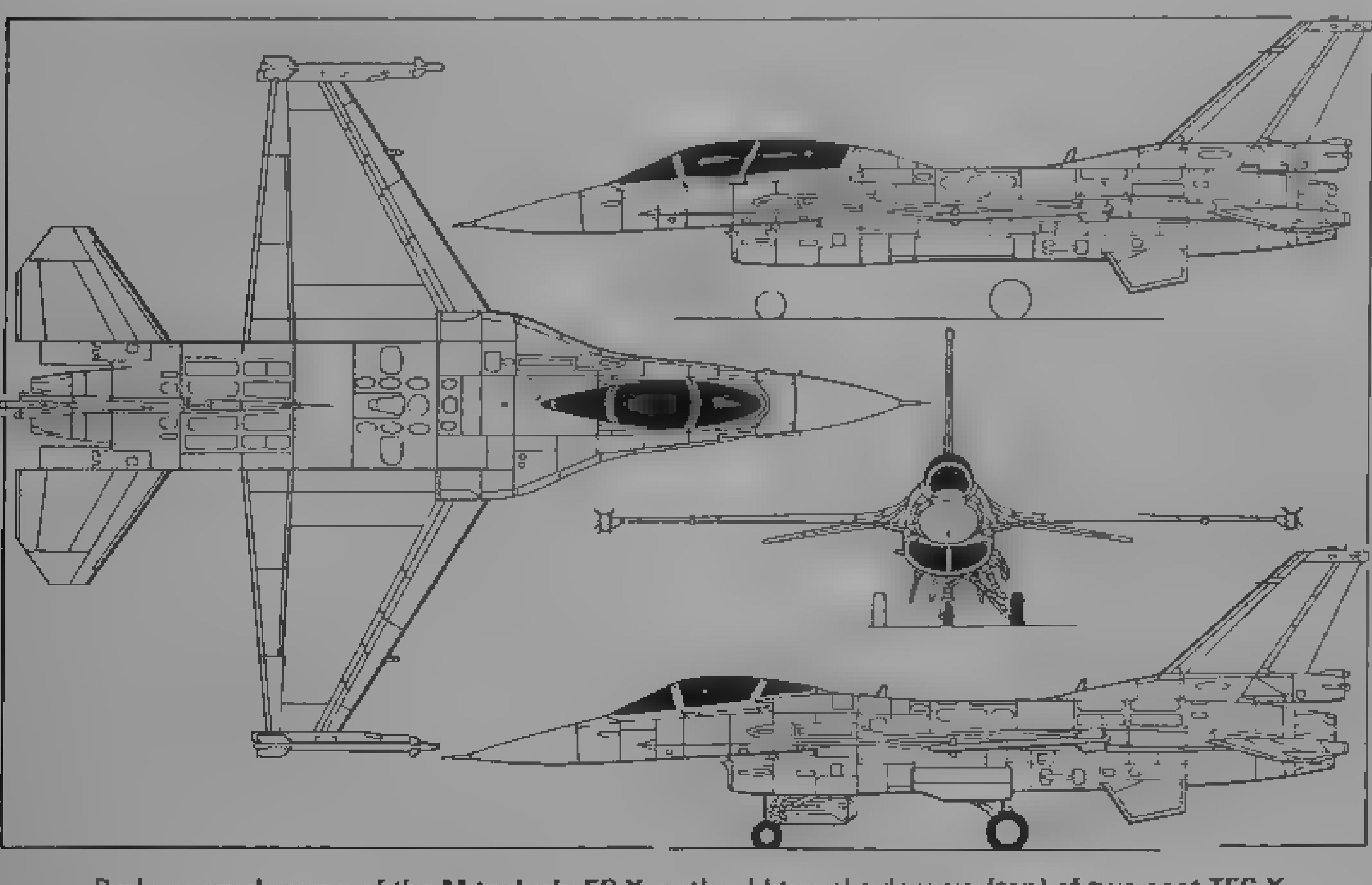
Instrumentation: Yokogawa LCD multifunction display, Shimadzu holographic display

Self-defence: Mitsubishi Electric integrated EW system.

ARMAMENT: One internal M61A1 Vulcan 20 mm multibarrel gun. Up to 13 external stores stations (one on centreline, one at each wingtip, and four or five under each wing), Frazer-Nash common rail launchers, to be built and installed by Nippi, will be configured initially for AIM-7F/M Sparrow medium-range air-to-air missiles; other armament expected to include AIM 9L or Mitsubishi AAM-3 air-to-air and ASM-1 and ASM-2 anti-shipping missiles 500 or 750 lb bombs, cluster bombs, and JLA /A or RL-4 rocket launchers Centreline and inboard underwing stations wet for carriage of drop tanks

DIMENSIONS, EXTERNAL
Wing span over missile rails 11 13 m (36 ft 6¼ in)
excl missile rails 10 80 m (35 ft 5¼ in)
Length overall 15 52 m (50 ft 11 in)
Height overall 4 96 m (16 ft 3¼ in)
Tailplane span 6.05 m (19 ft 10¼ in)
Wheelbase 4 05 m (13 ft 3½ in)
AREAS
Wings, gross 34 84 m² (375.0 sq ft)
Leading-edge flaps (total) 4.70 m² (50 59 sq ft)
Flaperons (total) 3 96 m² (42 63 sq ft)
Horizontal tail surfaces (total) 7 05 m² (75 89 sq ft)
WEIGHTS AND LOADINGS
Weight empty, equipped 12,000 kg (26,455 lb)
Max fuel load internal* 3,602 kg (7,941 lb)
external 4 422 kg (9,750 lb)
Max T-O weight with external stores 22,100 kg (48,722 lb)
Max wing loading 666 3 kg/m² (136 5 lb/sq ft)
Max power loading 171 4 kg/kN (1 68 lb/lb st)
* *3,099 kg (6,832 lb) in TFS-X*

UPDATED



Preliminary drawing of the Mitsubishi FS-X, with additional side view (top) of two-seat TFS-X *(Jane's/Mike Keep)*

1993

MITSUBISHI (SIKORSKY) SH-60J

TYPE: Anti-submarine helicopter

PROGRAMME: Detail design of S-70B-3 version of Sikorsky SH-60B Seahawk (see US section), to meet JMSDF requirements, started August 1983, Japanese avionics and equipment integrated by Technical Research and Development Institute of JDA First flight of first of two XSH-60J prototypes (8201), based on imported airframes, 31 August 1987, evaluation by 51st Air Development Squadron of JMSDF at Atsugi completed early 1991, first production SH-60J (8203) flown 10 May 1991, delivered 26 August JDA to assemble and test new advanced main rotor system from 1995, featuring all-composite blades with new aerofoil section, different planform and modified tips

CUSTOMERS: See table JMSDF requirement for 90; 64 ordered, of which 35 delivered, by March 1995, half of force will be land based Operated by Nos. 121 (at Tateyama), 122 (at Ohmura) and, from 1994, 123 (at Ohmura) Squadrons

POWER PLANT: T700-401C engines manufactured by IHI

ACCOMMODATION: Crew of three plus five systems operators/observers.

AVIONICS: *Radar*: Japanese HPS-104 search radar

Flight: Japanese automatic flight management system and ring laser gyro AHRS

MITSUBISHI SH/UH-60 FUNDING

FY	SH-60J (JMSDF)	UH-60J (JMSDF)	UH 60JA (JGSDF)	UH 60J (JASDF)	Cum Total
82	1	—	—	—	1
83	1[1]	—	—	—	2
88	12	—	—	3[2]	17
89	12	3	—	2	34
90	11	—	—	2	47
91	5	3		4	59
92	7	2	—	2	70
93	4	2	—	1	77
94	5	1		2	85
95	6	1	2	2	6
Totals	**64**	**12**	**2**	**18**	**96**

Note: [1] Sikorsky built XSH-60Js
[2] One Sikorsky built, two Mitsubishi assembled from CKD kits

Instrumentation: Japanese controls and displays subsystem, datalink and tactical data processor

Mission: Japanese HQS-103 sonar; Texas Instruments AN/ASQ-81D2(V) MAD, Ednac AN/ARR 75 sonobuoy receiver

Self-defence: General Instruments AN/ALR-66 (VE) RWR, Japanese HLR-108 ESM

EQUIPMENT: RAST, sonobuoys, rescue hoist and cargo sling

UPDATED

MITSUBISHI (SIKORSKY) UH-60J

TYPE: Combat search and rescue helicopter

PROGRAMME: Detail design to Japanese requirements started April 1988, one US built S-70A-12 imported, followed by two CKD kits for licence assembly (first flight 20 December 1989 at Sikorsky, delivered to JASDF 28 February 1991; second kit aircraft first flew February 1990, delivered to JASDF 29 March 1991). Remainder being built in Japan

CURRENT VERSIONS: **UH-60J**: Standard military version for JASDF and JMSDF: can fly one hour search at 250 n miles (463 km; 288 miles) from base

UH-60JA: JGSDF version

CUSTOMERS: See table. JASDF has total requirement for 46, JMSDF for 18, total of 17 delivered by March 1995 (JASDF 11, JMSDF six). JASDF aircraft operated by detached flights of Air Rescue Wing (HQ Komaki). JMSDF UH-60Js to Atsugi Rescue Squadron in 1992; subsequently Shimofusa and other bases. JGSDF requires 80 UH-60JAs

COSTS: $33.4 million programme unit cost, UH-60JA (1995 estimate)

POWER PLANT: T700-401C turboshafts manufactured by IHI. External long range fuel tanks

ACCOMMODATION: Crew of four (JMSDF) or five (JASDF) plus up to 12 other persons. Bubble windows for pilot and on each side at front of main cabin

AVIONICS: *Radar:* Nose-mounted Japanese search/weather radar

Flight: Sikorsky self-contained navigation system, including Loran

Mission: Turret mounted FLIR beneath nose

EQUIPMENT: Rescue hoist, ESSS and cargo sling

UPDATED

MITSUBISHI RP-1

TYPE: Eight-seat helicopter

PROGRAMME: Started 1992 as commercially secret in-house research programme, existence revealed April 1994, hover tests began 9 May 1994 and first flight made 14 September that year. Mitsubishi's first own-design helicopter; type certification requested Spring 1995. Design not finalised by then but production prototype expected to fly 1996, leading to first customer deliveries 1998

DESIGN FEATURES: Prototype has modified Sikorsky S-76A airframe (JA9598) combined with Mitsubishi designed four-blade main rotor and transmission and four blade tail rotor. Production version could have Fenestron-type tail unit

LANDING GEAR: Conventional twin-skid type

POWER PLANT: Twin Mitsubishi XTS 1 turboshafts, each approximately 634 kW (850 shp)

JMSDF No. 121 Squadron Mitsubishi (Sikorsky) SH-60J with external rescue hoist and MAD bird *(Katsumi Hinata)*

1995

ACCOMMODATION: Flight crew of two. Two rows of four passenger seats in production version

DIMENSIONS, EXTERNAL (prototype):

Main rotor diameter	12.00 m (39 ft 4½ in)
Length overall	15.00 m (49 ft 2½ in)
Height overall	4.30 m (14 ft 1¼ in)

DIMENSIONS, EXTERNAL (production model, provisional):

Main rotor diameter	12.2 m (40 ft 0 in)
Length overall, rotors turning	14.0 m (46 ft 0 in)
Height over tail unit	4.3 m (14 ft 0 in)
Skid track	2.7 m (8 ft 10 in)

WEIGHTS AND LOADINGS (A: prototype, B: production, provisional):

Max payload: B	2,000 kg (4,409 lb)
Max T-O weight: A	3,500 kg (7,716 lb)
B	4,000 kg (8,818 lb)

PERFORMANCE (B, estimated):

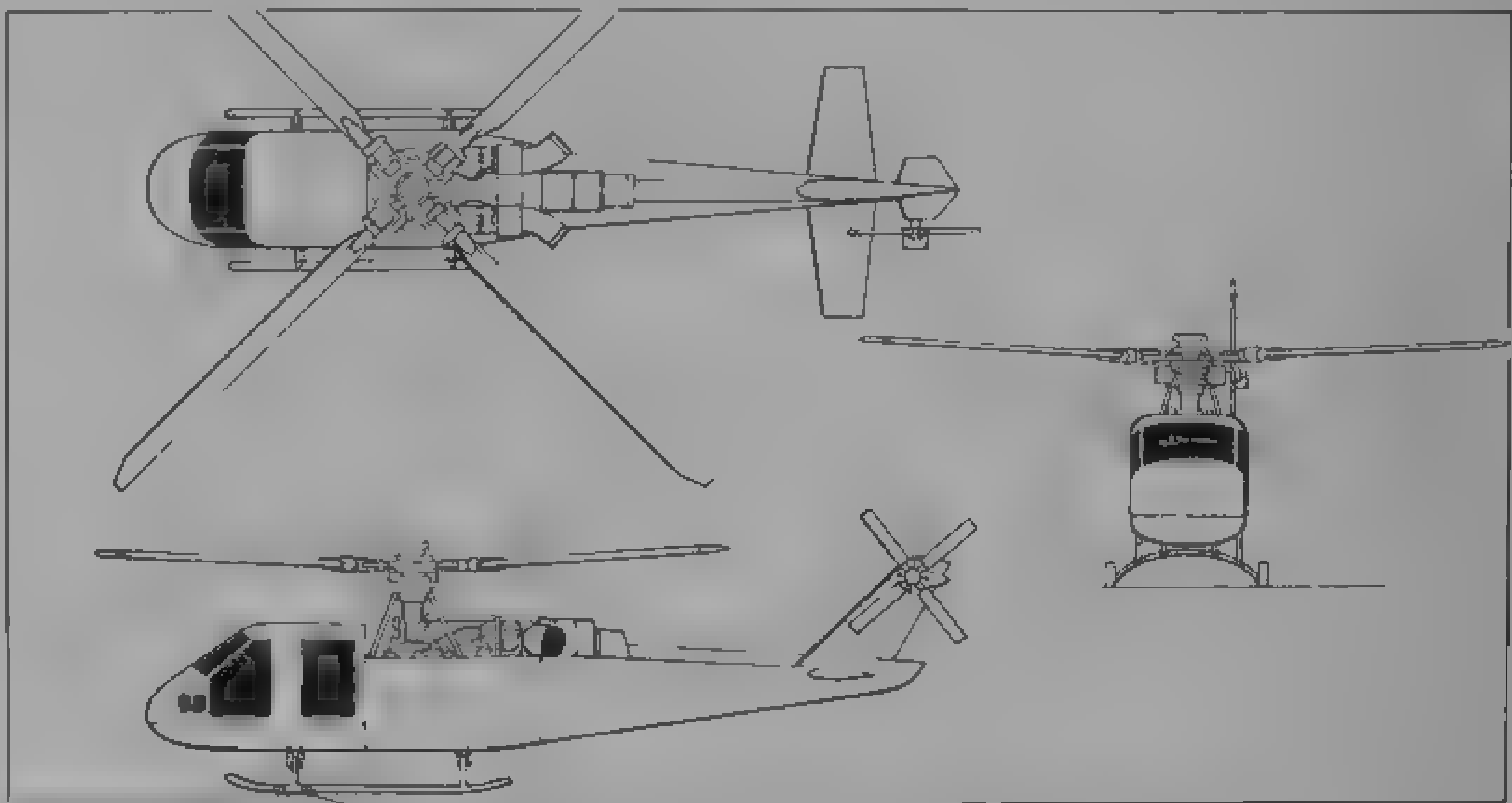
Max level speed	152 knots (281 km/h; 175 mph)
Range	400 n miles (741 km; 460 miles)

UPDATED

OTHER AIRCRAFT

Details of **F-4EJKai and RF-4EJ** upgrade and conversion programmes last appeared in 1994-95 edition of this yearbook, information now transferred to *Jane's Aircraft Upgrades*

NEW ENTRY



Provisional drawing of experimental Mitsubishi RP-1 *(Jane's/James Goulding)*

1995

NAL

NATIONAL AEROSPACE LABORATORY

7-44-1 Jindaijihigashi-machi, Chofu City, Tokyo 182

Telephone: 81 (422) 47 59 ..

DIRECTOR GENERAL: Kazuaki Takashima

DEPUTY DIRECTOR GENERAL: Dr Tatsuo Yamanaka

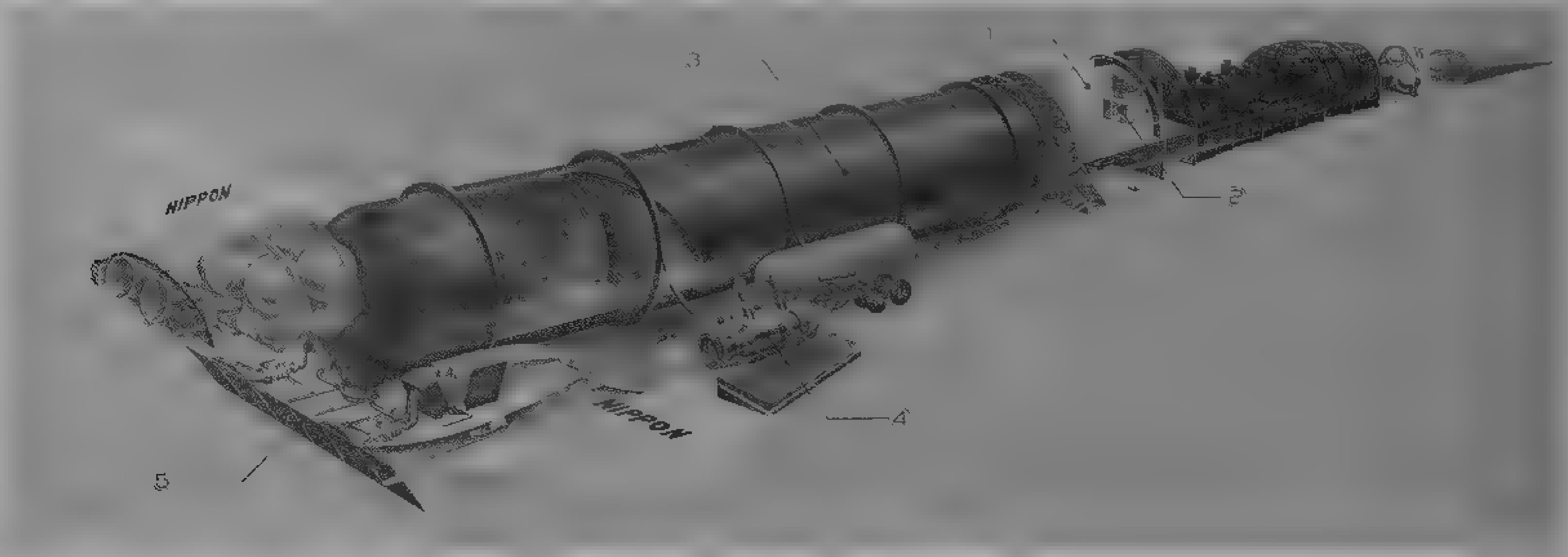
NAL is government establishment responsible for research and development in aeronautical and space sciences and technologies

VERIFIED

NAL AERO-SPACEPLANE STUDIES

TYPE: Aero-spaceplanes

PROGRAMME: NAL conducting research programme for possible future Japanese aero-spaceplane; tunnel testing of alternative configurations began 1982; Dornier 228-200 received 1988 for simulation of final approach and landing



Internal details of the NAL aero-spaceplane

1. cargo bay, 2. air lock, 3. hydrogen propellant tank, 4. jet engine for re-entry stage, and 5. air intake for scramjet

1995

phases of eventual craft. Extensive system study on single-stage-to-orbit (SSTO) aircraft carried out with aid of computational fluid dynamics on supercomputers: research on hypersonic air-breathing engines and lightweight high-temperature structures being conducted. Construction of ramjet/scramjet engine test facility completed October 1993, partly by remodelling existing high altitude rocket test facility at Kakuda, to test scramjets at Mach 4 to 8. Composite structure test facilities completed 1992 for test and evaluation of advanced materials and structures. Hypersonic wind tunnel test section being enlarged from 0.50 m (1 ft 7¾ in) to 1.27 m (4 ft 2 in). About half of NAL's research workers are engaged on aero-spaceplane technology.

COSTS: Expenditure about $5 million for technology research in 1993, plus about $12 million for facility construction.

DESIGN FEATURES: Dornier 228-200 equipped with INS, GPS and special workstation from which flight characteristics can be changed and controlled by computers.

POWER PLANT: LACE (liquefied air-cycle engine) for low speeds and in vacuum (operation as a rocket engine in a vacuum), scramjet for high speed within Earth atmosphere. First subscale Mach 4 scramjet tested May 1994.

ACCOMMODATION: Capacity for 10 persons.

DIMENSIONS, EXTERNAL:

Length overall	approx 94.0 m (308 ft)

WEIGHTS AND LOADINGS:

Fuselage weight	approx 110,000 kg (242,500 lb)
Max T-O weight	approx 350,000 kg (771,625 lb)

UPDATED

NAL VTOL AIRLINER STUDIES

TYPE: Medium-range lift/cruise fan 100-passenger VTOL airliner.

PROGRAMME: Study by NAL, Fuji and Ishikawajima, intended to fly 2010.

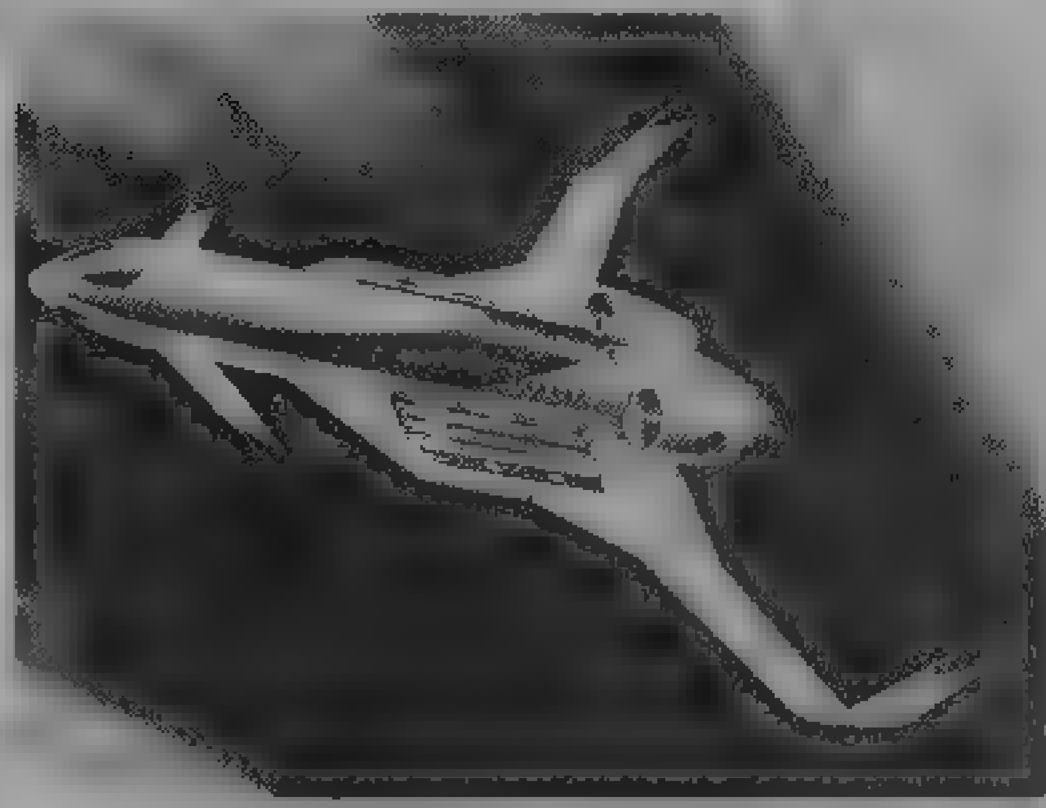
DESIGN FEATURES: Three core engines to drive either six lift fans beside centre-fuselage in aerodynamic wingroot sections or two propulsion fans at tail; rear-mounted swept back wings with large winglets, sweptback foreplanes; airscoops above rear fuselage.

FLYING CONTROLS: Pitch-axis control by reaction jets or small fans, rudders in winglets.

PERFORMANCE:

Cruising speed	Mach 0.8
Range	1,350 n miles (2,500 km, 1,550 miles)

VERIFIED



Artist's impression of the NAL fan-lift VTOL medium-range airliner

1991

NASDA

NATIONAL SPACE DEVELOPMENT AGENCY

World Trade Center Building, 2-4-1 Hamamatsu-cho Minato-ku, Tokyo 105
Telephone: 81 (3) 5470 4111
Fax: 81 (3) 3433 0796
PRESIDENT: Masato Yamano
EXECUTIVE DIRECTOR: Tomifumi Godai

NEW ENTRY

NASDA HOPE

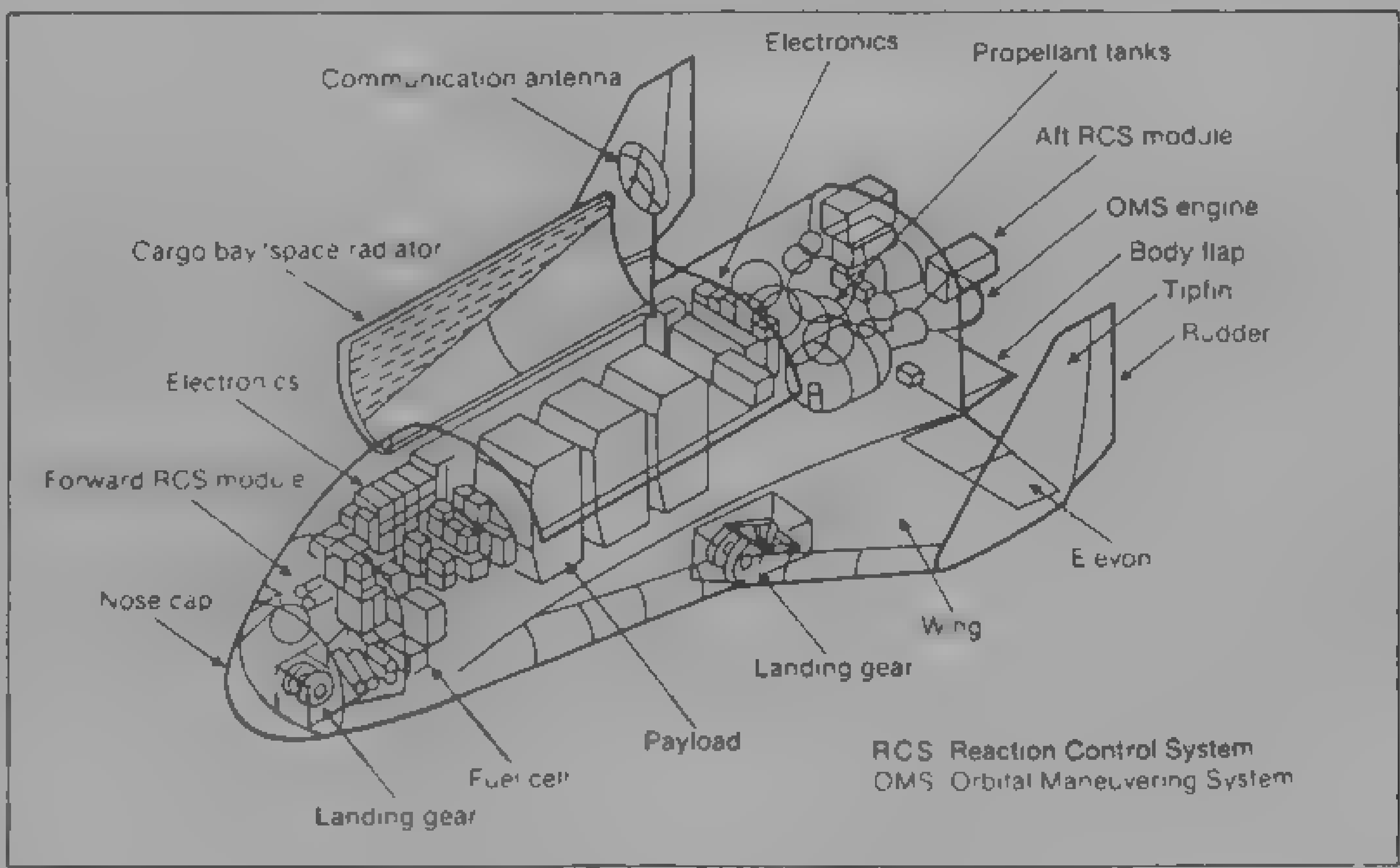
TYPE: Unmanned space shuttle.

PROGRAMME: HOPE (H-II Orbiting Plane) is research programme for winged, unmanned space vehicle to be launched by H-II two-stage launch rocket, to transport and recover material from orbiting space station and return it to Earth. Currently in feasibility study phase, with first HOPE launch not scheduled until beginning of next century. General configuration shown in accompanying drawing, although designs proposed by Fuji, Kawasaki and Mitsubishi differ in detail. Kawasaki tasked with system integration (already pretested with scale model) of automatic landing flight experiment.

Provisional details follow of proposed Kawasaki (KHI) and Mitsubishi (MHI) vehicles; those for Fuji vehicle not known.

DIMENSIONS, EXTERNAL:

Wing span: KHI	8.60 m (28 ft 2½ in)
MHI	12.00 m (39 ft 4½ in)
Length: KHI (overall)	16.54 m (54 ft 3¼ in)
MHI (fuselage only)	16.50 m (54 ft 1½ in)
Height, excl landing gear:	
KHI	3.87 m (12 ft 8½ in)
MHI	5.00 m (16 ft 4¾ in)



General design concept of the NASDA HOPE space shuttle

1995

WEIGHTS AND LOADINGS (approx):

Weight empty (both)	10,000 kg (22,046 lb)
Launch payload (both)	3,000 kg (6,614 lb)
Return payload (both)	5,000 kg (11,023 lb)
Landing weight: KHI	15,000 kg (33,069 lb)
MHI	13,000 kg (28,660 lb)

NEW ENTRY

Designs for HOPE proposed by Fuji (left), Kawasaki (centre) and Mitsubishi

1995

NIPPI

NIHON HIKOKI KABUSHIKI KAISHA (Japan Aircraft Manufacturing Co Ltd)

Nippi is no longer producing complete aircraft. Details of the company's subcontracting activities, as well as of the YS-11EA ESM aircraft, are to be found in *Jane's Aircraft Upgrades*.

UPDATED

The bow strakes and spray suppression slots can be seen clearly in this photograph of a JMSDF ShinMaywa US-1A

1994

SHINMAYWA

SHINMAYWA INDUSTRIES LTD

Nippon Building, 6-2 Otemachi 2-chome, Chiyoda-ku, Tokyo 100
Telephone: 81 (3) 3245 6611
Fax: 81 (3) 3245 6616
Telex: 222 243 SMIC T J
PRESIDENT: Shinji Tamagawa
EXECUTIVE VICE PRESIDENT: Shiko Saikawa
HEAD OFFICE: 5-25 Kosone-cho 1-chome, Nishinomiya 663
Telephone: 81 (798) 47 0331
Fax: 81 (798) 41 0755
Telex: 5644493

Aircraft Division

EXECUTIVE MANAGING DIRECTOR AND GENERAL MANAGER
Junpei Matsuo
BOARD DIRECTOR AND DEPUTY GENERAL MANAGER
Takaoki Kiho
DIRECTOR AND GENERAL MANAGER
Takao Masuda (Konan Plant)
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Yasushi Ikeda (Sales, Head Office)
GENERAL MANAGERS, SALES
Yoshi Tanaka (International and Domestic)
Junsei Nagai (New Business Development)
WORKS: Konan and Tokushima

Former Kawanishi Aircraft Company, became Shin Meiwa in 1949 and renamed ShinMaywa Industries in June 1992; major overhaul centre for Japanese and US military and commercial aircraft. Principal activities are production of US-1A for JMSDF, and overhaul work on amphibians. Manufactures external drop tanks for Mitsubishi built F-15Js and Kawasaki T-4s, nosecones and tailcones, ailerons and trailing-edge flaps for Kawasaki built P-3Cs, tailplanes for Mitsubishi built SH-60Js, internal cargo handling system for Kawasaki built CH-47J, wing and tail engine pylons for McDonnell Douglas MD-11; thrust reverser doors for McDonnell Douglas MD-80, under subcontract to Rohr Inc, fixed trailing-edges for Boeing 757/767, under subcontract to Vought, and other components for Boeing 767, under subcontract to Mitsubishi; design and manufacture of wing/body fairings for Boeing 777. In 1991, modified five Learjet 36As into U-36A naval fleet training support aircraft for JMSDF, in service centre for U-36A and Fairchild aircraft.

Continues to study and look for partners to develop Amphibious Air Transport System, which is 30/50-passenger airliner powered by two wing-mounted turbofans with upper surface blowing; range would vary from 500 n miles (926 km; 575 miles) with full payload to 1,200 n miles (2,222 km; 1,381 miles) with full fuel, take-off distance 1,000 m (3,280 ft) on water and 800 m (2,624 ft) on soft ground, cruising speed between 300 and 360 knots (556 and 667 km/h; 345 and 414 mph).

VERIFIED

SHINMAYWA US-1A

TYPE: Four-turboprop STOL search and rescue amphibian.

PROGRAMME: First flown 16 October 1974; first delivery (as US-1) 5 March 1975 (see 1985-86 *Jane's*); all now have T64-IHI-10J engines as US-1As.

CURRENT VERSIONS: **US-1A**: SAR amphibian, developed from PS-1 ASW flying boat; manufacturer's designation **SS-2A**. *Data apply to this version.*

Firefighting amphibian: PS-1 modified in 1976 to firefighting configuration, 7,348 kg (16,200 lb) capacity water tank in centre fuselage aft of step. Since then, US-1A modified experimentally, with more than 13,608 kg (30,000 lb) tank capacity; tank system developed by Conair of Canada.

CUSTOMERS: Fifteen US-1/1As ordered, of which 14 delivered by March 1994. No. 71 SAR Squadron of the JMSDF maintains fleet structure of seven aircraft at Iwakuni and Atsugi bases. Recent additional orders are for attrition due to phase-out of older aircraft.

DESIGN FEATURES: Boundary layer control system and extensive flaps for propeller slipstream deflection for very low landing and take-off speeds; low-speed control and stability enhanced by blowing rudder, flaps and elevators, and by use of automatic flight control system (see Flying Controls). Fuselage high length/beam ratio; V shaped single-step planing bottom, with curved spray suppression strakes along sides of nose and spray suppressor slots in lower fuselage sides aft of inboard propeller line; double-deck interior. Large dorsal fin.

FLYING CONTROLS: Automatic flight control system controlling elevators, rudder and outboard flaps. Hydraulically powered ailerons, elevators with tabs and rudder, all with 'feel' trim. High-lift devices include outboard leading-edge slats over 17 per cent of wing span and large outer and inner blown trailing-edge flaps deflecting 60° and 80° respectively; outboard flaps can be linked with ailerons; inboard flaps, elevators and rudder blown by BLC system. Two spoilers in front of outer flaps on each wing. Inverted slats on tailplane leading-edge.

STRUCTURE: All metal, two-spar wing box.

LANDING GEAR: Flying boat hull, plus hydraulically retractable Sumitomo tricycle landing gear with twin wheels on all units. Steerable nose unit. Oleo-pneumatic shock-absorbers. Main units, which retract rearward into fairings on hull sides, have size 40 × 14-22 (Type VII) tyres, pressure 7.79 bars (113 lb/sq in). Nosewheel tyres size 25 × 6.75-18 (Type VII), pressure 20.69 bars (300 lb/sq in). Three-rotor hydraulic disc brakes. No anti-skid units. Minimum ground turning radius 18.80 m (61 ft 8¼ in) towed, 21.20 m (69 ft 6¾ in) self-powered.

POWER PLANT: Four 2,605 kW (3,493 ehp) Ishikawajima built General Electric T64-IHI-10J turboprops, each driving a Sumitomo built Hamilton Standard 63E60-27 three-blade constant-speed reversible-pitch propeller. Fuel in five wing tanks, with total usable capacity of 11,640 litres (3,075 US gallons; 2,560.5 Imp gallons) and two fuselage tanks (10,849 litres; 2,866 US gallons; 2,386.5 Imp gallons), total usable capacity 22,489 litres (5,941 US gallons; 4,947 Imp gallons). Pressure refuelling point on port side, near bow hatch. Oil capacity 152 litres (40.2 US gallons; 33.4 Imp gallons). Aircraft can be refuelled on open sea, either from surface vessel or from another US-1A with detachable at-sea refuelling equipment.

ACCOMMODATION: Crew of three on flight deck (pilot, co-pilot and flight engineer), plus navigator/radio operator's seat in main cabin. Latter can accommodate up to 20 seated survivors or 12 stretchers, one auxiliary seat and two observers' seats. Sliding rescue door on port side of fuselage, aft of wing.

SYSTEMS: Cabin air conditioning system. Two independent hydraulic systems, each 207 bars (3,000 lb/sq in). No. 1 system actuates ailerons, outboard flaps, spoilers, elevators, rudder and control surface 'feel'; No. 2 system actuates ailerons, inboard and outboard flaps, wing leading-edge slats, elevators, rudder, landing gear extension/retraction and lock/unlock, nosewheel steering, mainwheel brakes and windscreen wipers. Emergency system, also of 207 bars (3,000 lb/sq in), driven by 24 V DC motor, for actuation of inboard flaps, landing gear extension/retraction and lock/unlock, and mainwheel brakes.

AlliedSignal GTCP85-131J APU provides power for starting main engines and shaft power for 40 kVA emergency AC generator. BLC system includes a C-2 compressor, driven by a 1,014 kW (1,360 shp) Ishikawajima built General Electric T58-IHI-10-M2 gas turbine, housed in upper centre portion of fuselage, which delivers compressed air at 14 kg (30.9 lb)/s and pressure of 1.86 bars (27 lb/sq in) for ducting to inner and outer flaps, rudder and elevators.

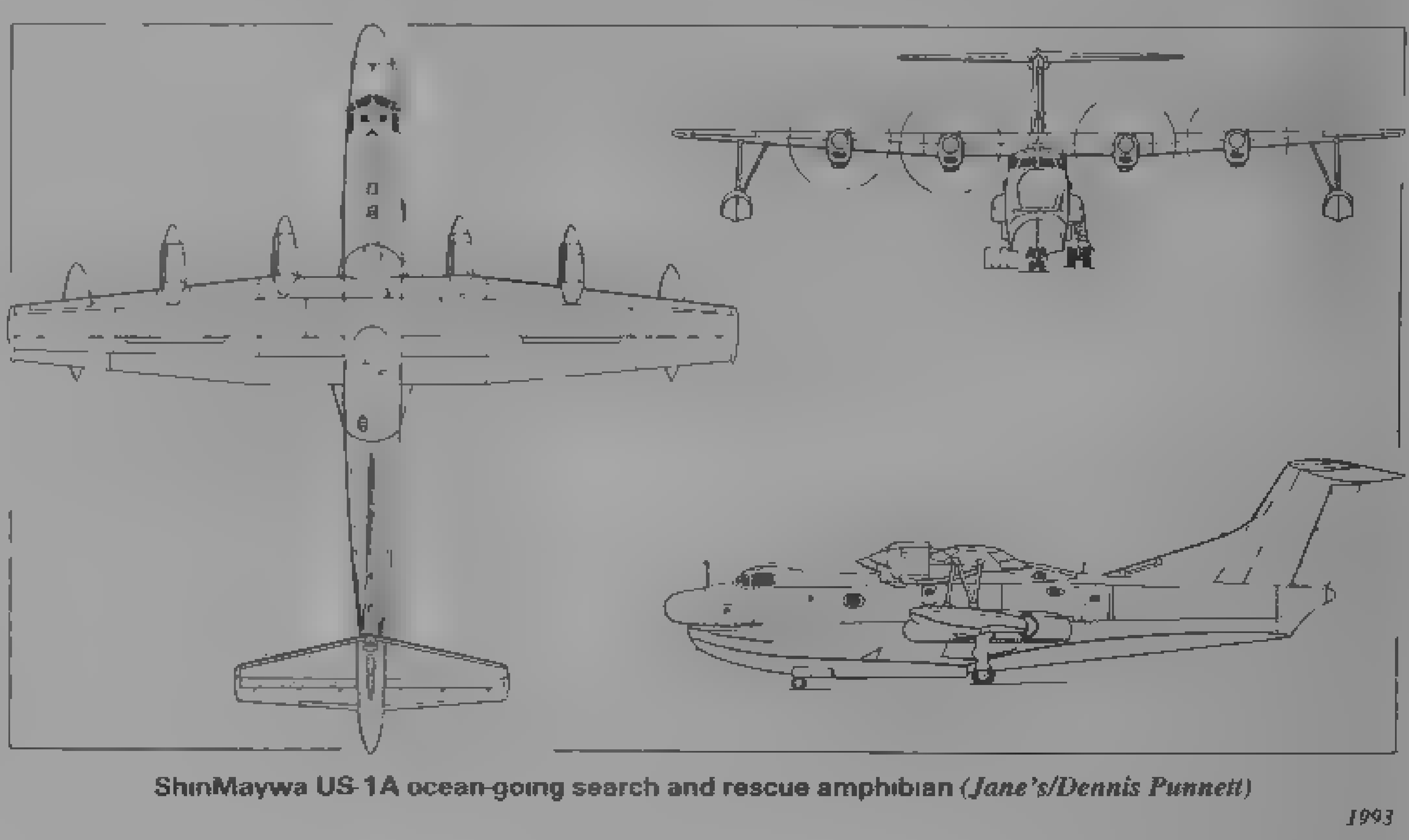
Electrical system includes 115/200 V three-phase 400 Hz constant-frequency AC and three transformer-rectifiers to provide 28 V DC. Two 40 kVA AC generators, driven by Nos. 2 and 3 main engines. Emergency 40 kVA AC generator driven by APU. DC emergency power from two 24 V 34 Ah Ni/Cd batteries.

De-icing of wing and tailplane leading-edges. Oxygen system for all crew and stretcher stations. Fire detection and extinguishing systems standard.

AVIONICS: *Comms*: HRC-106, HRC-107 HF and HRC-113 radios, N-CU-58/HRC antenna coupler; HIC-3 interphone, AN/APX-68-NB IFF transponder; RRC-22 emergency transmitter, HGC-102 teletypewriter.

Radar: AN/APS-115-2 search radar.

Flight: HRN-101 ADF, AN/ARA-50 UHF/DF, HRN-105B Tacan; HRN-115-1 GPS nav system, HRN-107B-1 VOR/ILS receiver, AN/APN-171 (N2)



ShinMaywa US-1A ocean-going search and rescue amphibian *(Jane's/Dennis Punnett)*

1993

radio altimeter; HPN 101B wave height meter; AN/APN-187C-N Doppler nav; AN/AYK-2 navigation computer; A/A24G-9 TAS transmitter; N-PT-3 dead reckoning plotting board HRA 5 nav display and N ID-66/HRN BDHI

EQUIPMENT: Marker launcher, 10 marine markers, six green markers, two droppable message cylinders, 10 float lights, pyrotechnic pistol, parachute flares, two flare storage boxes, binoculars, two rescue equipment kits, two droppable liferaft containers, rescue equipment launcher, lifeline pistol, lifeline, three lifebuoys, loudspeaker, hoist unit, rescue platform, lifeboat with outboard motor, camera, and 12 stretchers. Sea anchor in nose compartment Stretchers can be replaced by troop seats

DIMENSIONS, EXTERNAL

Wing span	33.15 m (108 ft 9 in)
Wing chord at root	5.00 m (16 ft 4¾ in)
at tip	2.39 m (7 ft 10 in)
Wing aspect ratio	8.09
Length overall	33.46 m (109 ft 9¼ in)
Height overall	9.95 m (32 ft 7⅝ in)
Tailplane span	12.36 m (40 ft 8½ in)
Wheel track	3.56 m (11 ft 8¼ in)
Wheelbase	8.33 m (27 ft 4 in)
Propeller diameter	4.42 m (14 ft 6 in)
Rescue hatch (port side, rear fuselage)	
Height	1.58 m (5 ft 2¼ in)
Width	1.46 m (4 ft 9½ in)

AREAS

Wings, gross	135.82 m² (1,462.0 sq ft)
Ailerons (total)	6.40 m² (68.90 sq ft)
Inner flaps (total)	9.40 m² (101.18 sq ft)
Outer flaps (total)	14.20 m² (152.85 sq ft)
Leading-edge slats (total)	2.64 m² (28.42 sq ft)
Spoilers (total)	2.10 m² (22.60 sq ft)
Fin	17.56 m² (189.0 sq ft)
Dorsal fin	6.32 m² (68.03 sq ft)
Rudder	7.01 m² (75.50 sq ft)
Tailplane	23.04 m² (248.0 sq ft)
Elevators, incl tab	8.78 m² (94.50 sq ft)

WEIGHTS AND LOADINGS (search and rescue)

Manufacturer's weight empty	23,300 kg (51,367 lb)
Weight empty, equipped	25,500 kg (56,218 lb)
Usable fuel: JP-4	17,518 kg (38,620 lb)
JP-5	18,397 kg (40,560 lb)
Max oversea operating weight	36,000 kg (79,365 lb)
Max T-O weight: from water	43,000 kg (94,800 lb)
from land	45,000 kg (99,200 lb)
Max wing loading	331.4 kg/m² (67.9 lb/sq ft)
Max power loading	4.32 kg/kW (7.10 lb/ehp)

PERFORMANCE (search and rescue, land T-O. A: at 36,000 kg, 79,365 lb weight, B: at 43,000 kg, 94,800 lb, C: at max T-O weight)

Max level speed: C 276 kts (511 km/h, 318 mph)
Max level speed at 3,050 m (10,000 ft)
A 282 kts (522 km/h, 325 mph)
Cruising speed at 3,050 m (10,000 ft)
C 230 kts (426 km/h, 265 mph)
Max rate of climb at S/L: A 713 m (2,340 ft)/min
C 488 m (1,600 ft)/min
Service ceiling: A 8,655 m (28,400 ft)
C 7,195 m (23,600 ft)
T-O to 15 m (50 ft) on land, 30° flap, BLC on (ISA),
C 655 m (2,150 ft)
T-O distance on water, 40° flap, BLC on (ISA),
B 555 m (1,820 ft)
Landing from 15 m (50 ft) on land, AUW of 36,000 kg (79,365 lb), 40° flap, BLC on, with reverse pitch (ISA)
A 810 m (2,655 ft)
Landing distance on water, AUW of 36,000 kg (79,365 lb), 60° flap, BLC on (ISA)
A 220 m (722 ft)
Runway LCN requirement: B 42
Max range at 230 kts (426 km/h, 265 mph) at 3,050 m (10,000 ft) 2,060 n miles (3,815 km, 2,370 miles)

UPDATED

KOREA, SOUTH

DHI

DAEWOO HEAVY INDUSTRIES CO LTD

6 Manseog-dong, Dong-gu, Inchon
Telephone 82 (32) 760 1114
Fax 82 (32) 762 1546
Telex DHILTD K 28473
PRESIDENT: Jin-Chul Suk

Aerospace Division

SEOUL OFFICE: Daewoo Center Building (20th Floor), 541-5ga, Namdaemun-ro, Jung-gu, Seoul 100714
Telephone 82 (2) 779 1669
Fax 82 (2) 756 2679
Telex K 23301
VICE-PRESIDENT AEROSPACE AND DEFENCE
Yo Kil Yoon
EXECUTIVE MANAGING DIRECTOR (MILITARY):
S H Kwak
GENERAL MANAGERS
K W Park (Commercial)
I K Kim (Military)
H Y Choi (Satellites)
MARKETING AND SALES MANAGER
Won Cheol Seo
CHANGWON PLANT: 3 Block Sungju Complex, Changwon
Telephone 82 (551) 80 6501
Fax 82 (551) 85 2383
Telex DHILTD K 53379
DIRECTORS
K J. Lee (Aerospace Division)
D J Ra (R & D Centre)
S. K Cho (R & D Centre)

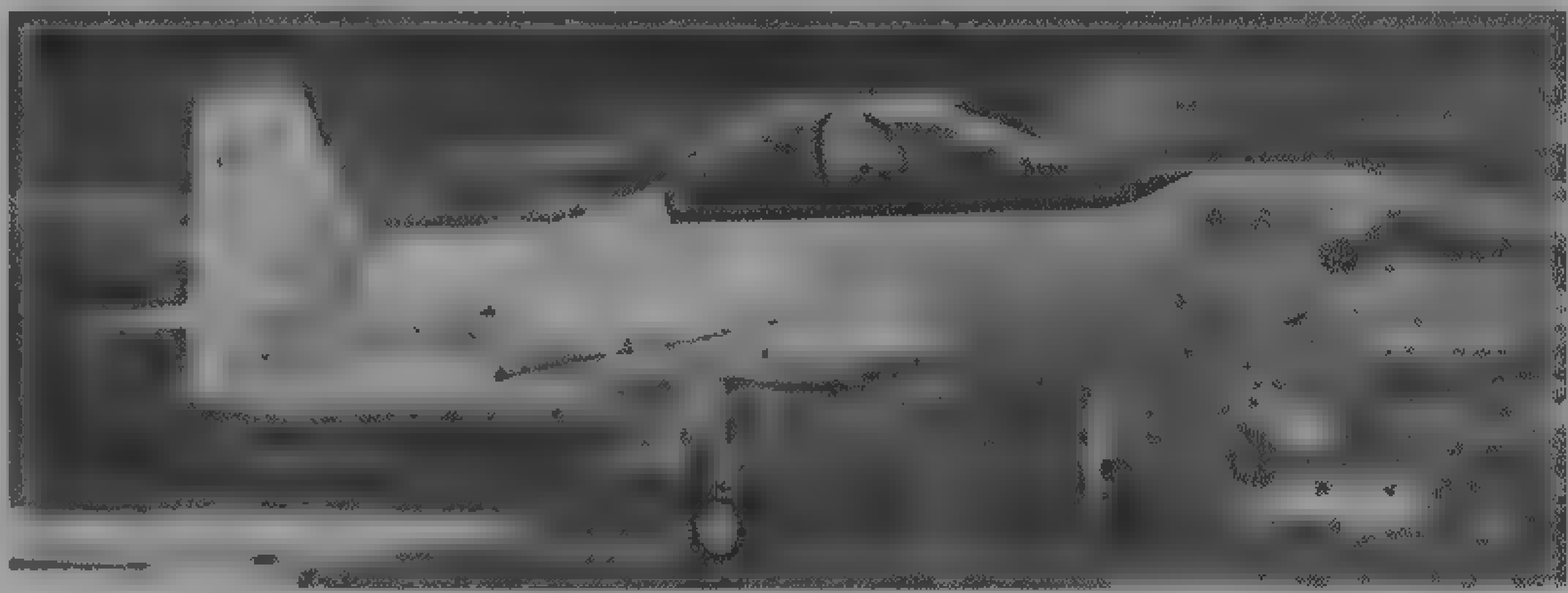
DHI established October 1976 as major member of Daewoo Group, although roots go back to founding of Chosun Machine Works in 1937 Aerospace Division at Changwon established 1984, began aircraft component manufacture 1985; currently occupies 38.5 ha (95.1 acre) site including 43,187 m² (464,860 sq ft) of floor space, with 1994 workforce of 1,300 Capabilities include fuselage and wing construction, manufacture of helicopter structures and dynamic components, final assembly of indigenous trainer, UAV design and manufacture, and satellite platform manufacture.

DHI is prime contractor for Korean Indigenous Trainer (see KTX 1 below) and Agricultural Remote Control Helicopter, and for Korean Light Scout Helicopter (KLH) Contenders in KLH programme are in 2½ to 4½ tonne class

Other current work includes approximately 100 F-16 centre fuselage assemblies for Korean Fighter Programme (see SSA entry), wing and fuselage components for Boeing 747, up to 400 complete fuselage shells for Dornier 328 (first delivery 13 January 1991), rotor hub assemblies for Bell 212/412, and wing construction for BAe Hawk Mk 67 and Lockheed Martin P-3C Orion

UPDATED

DAEWOO KTX-I YEO MYOUNG (DAWN)



First prototype of the Daewoo KTX-I Yeo-Myoung two-seat primary trainer
1994

TYPE: Turboprop-powered tandem seat primary trainer

PROGRAMME: Started February 1988, built under Korint (Korean Indigenous Trainer) programme to design of government agency, construction of first prototype began June 1991; six prototypes (01-04 flying and 001-002 for static and fatigue test), of which 01, with PT6A-25A engine, rolled out November 1991 and made first flight 12 December that year, 02, identical to 01, made first flight February 1992, 270 sorties flown by mid-1995, 03 (with PT6A-62A) and 04 scheduled to fly July and November 1995 Full-scale development due to continue until 1997 series production deliveries scheduled to begin 31 January 1998

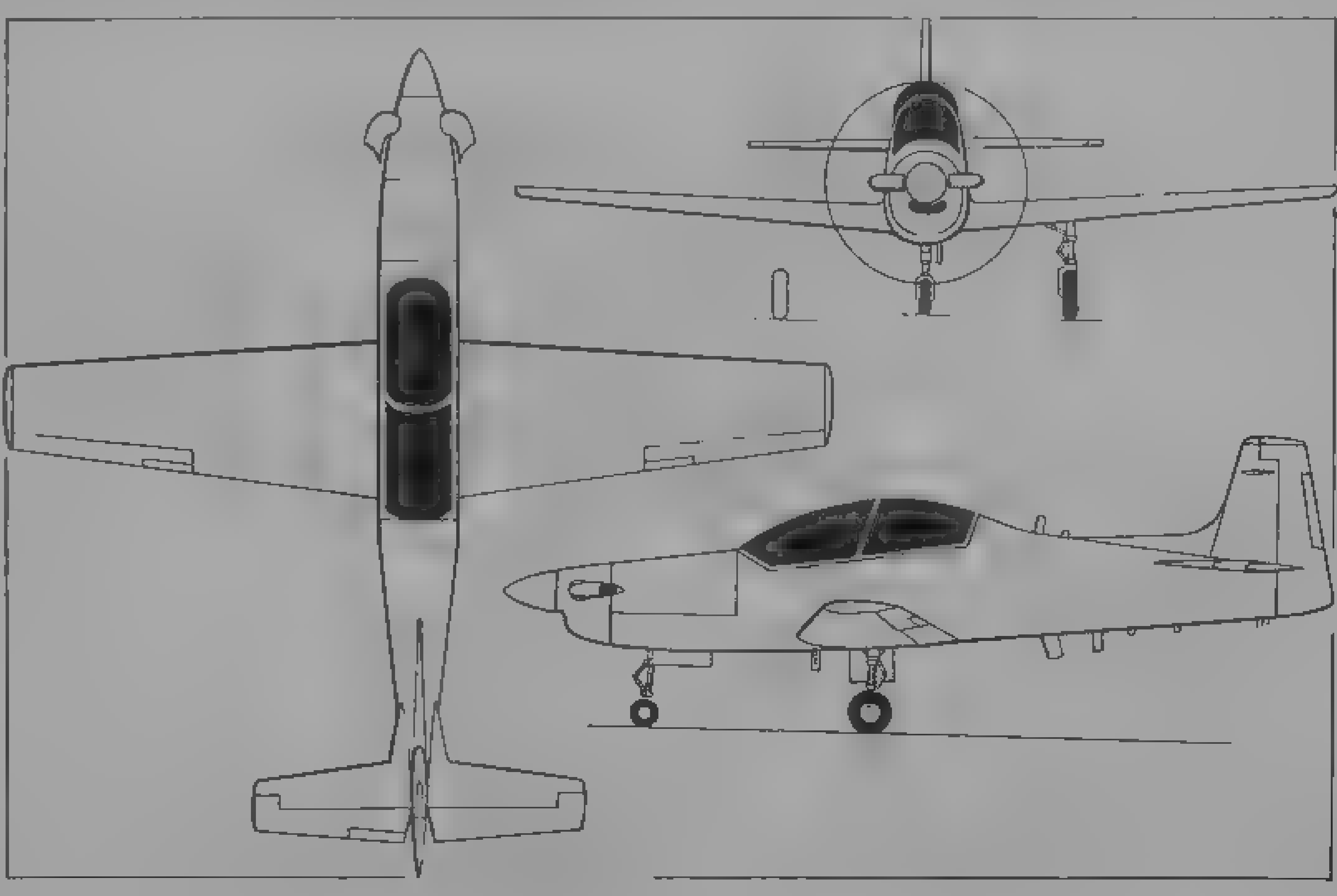
CUSTOMERS: 100 required by Republic of Korea Air Force (RoKAF) to replace Cessna T-37 and T-41

DESIGN FEATURES: Main design objectives are 320 knot (593 km/h, 368 mph) maximum diving speed, 11,580 m (38,000 ft) absolute ceiling, 900 n miles (1,668 km; 1,036 mile) range, and weapon training capability with guns and rockets

Unswept low wing with NACA 63-128 (mod) aerofoil section; tandem cockpits, conventional unswept vertical and horizontal tail surfaces (both with NACA 0012 section at root), retractable tricycle landing gear Present straight edged dorsal fin to be replaced by curved one of greater area

FLYING CONTROLS: Primary control surfaces actuated hydraulically, with electrically operated trim tabs in ailerons, port elevator and rudder Airbrake under centre fuselage, linked with elevators. Split flaps on wing trailing-edge

LANDING GEAR: Fairey Hydraulics hydraulically retractable tricycle type, with single wheel and oleo-pneumatic shock absorber on each unit Mainwheels retract inward



Daewoo KTX-I turboprop trainer, showing the new curved dorsal fin *(Jane's/James Goulding)*
1995

nosewheel is steerable ±22° and retracts rearward. Parker Hannifin mainwheels with size 18 × 5.5 tyres (10 ply rating), pressure 9.65 bars (140 lb/sq in), Dunlop nosewheel with 5.00-5 tyre (14 ply rating), pressure 6.90 bars (100 lb/sq in). Parker Hannifin hydraulic mainwheel brakes

POWER PLANT: One 410 kW (550 shp) Pratt & Whitney Canada PT6A-25A turboprop in first and second prototypes, with three-blade propeller. Third prototype has 708 kW (950 shp) PT6A-62A engine and Hartzell four-blade constant-speed propeller

Fuel in one 225 litre and one 80 litre integral tank in each wing (59.4 and 21.1 US gallons, 49.5 and 17.6 Imp gallons), plus a 30 litre (8.0 US gallon, 6.6 Imp gallon) tank in centre-fuselage giving total internal fuel capacity of 640 litres (169 US gallons, 140.8 Imp gallons). Attachment under each wing for a 189 litre (50 US gallon, 41.6 Imp gallon) external fuel tank. Gravity fuelling point in each wing upper surface. Oil capacity 5.7 litres (1.5 US gallons, 1.25 Imp gallons)

ACCOMMODATION: Instructor and pupil in tandem cockpits. Two-piece canopy

SYSTEMS: AiResearch two-wheel bootstrap pressurisation system. Fairey Hydraulics self-pressurised main and emergency hydraulic systems, operating pressure 207 bars (3,000 lb/sq in), flow rate 29.4 litres (7.76 US gallons, 6.46 Imp gallons)/min. Pneumatic back-up system, pressure 3.45-4.14 bars (50-60 lb/sq in), for landing gear, wheel bay doors, flaps and airbrake. Gaseous oxygen system, capacity 2,250 litres (79.4 cu ft). Fixed-geometry inertial separator for engine intake anti-icing

AVIONICS: *Comms*: UHF/VHF radios, interphone and communication control system.

Flight: VOR/ILS/marker beacon receiver and Tacan

Instrumentation: Attitude indicator (including standby), altitude indicator, ASI, VSI, directional gyro, AoA sensor/index and magnetic compass

DIMENSIONS, EXTERNAL

Wing span	10.12 m (33 ft 2½ in)
Wing aspect ratio	6.60
Length overall	10.30 m (33 ft 9½ in)
Height overall: 01/02	3.74 m (12 ft 3¼ in)
03/04	10.60 m (34 ft 9¼ in)
Tailplane span	4.00 m (13 ft 1½ in)
Wheel track	2.75 m (9 ft 0 in)
Wheelbase	2.96 m (9 ft 8½ in)
Propeller diameter	2.41 m (7 ft 11 in)
Propeller ground clearance	0.356 m (1 ft 2 in)

AREAS

Wings, gross	15.51 m² (167.0 sq ft)
Vertical tail surfaces (total)	2.06 m² (22.2 sq ft)
Horizontal tail surfaces (total)	3.36 m² (35.9 sq ft)

WEIGHTS AND LOADINGS

Weight empty	1,430 kg (3,153 lb)
Max fuel weight: internal	449 kg (990 lb)
external	36.3 kg (80 lb)
Max T-O and landing weight	
Aerobatic	1,928 kg (4,250 lb)
Utility	2,481 kg (5,470 lb)
Max wing loading	
Aerobatic	124.2 kg/m² (25.45 lb/sq ft)
Utility	159.9 kg/m² (32.75 lb/sq ft)
Max power loading (Utility):	
PT6A-25A	6.05 kg/kW (9.94 lb/shp)
PT6A-62A	3.50 kg/kW (5.76 lb/shp)

PERFORMANCE (at max T-O weight, PT6A-62A engine)

Never-exceed speed (VNE) at S/L	280 kts (518 km/h; 322 mph)
Max level speed at 3,050 m (10,000 ft)	310 kts (574 km/h; 357 mph)
Max rate of climb at S/L	1,067 m (3,500 ft)/min
Service ceiling	11,580 m (38,000 ft)
T-O to 15 m (50 ft)	397 m (1,300 ft)
Landing from 15 m (50 ft)	512 m (1,680 ft)
Range with max internal fuel	900 n miles (1,668 km; 1,036 miles)

UPDATED

OTHER AIRCRAFT

Details of **MK-30** (modified Mil Mi-172) programme with Mil Design Bureau and Kazan Helicopter Production Association (1994-95 *Jane's*) now transferred to *Jane's Aircraft Upgrades*; **ARCH** (Agricultural Remotely Controlled Helicopter) described in Kamov Ka-37 entry in *Jane's Unmanned Aerial Vehicles and Targets*

NEW ENTRY

KAIA

KOREA AEROSPACE INDUSTRIES ASSOCIATION

Daejee Building 8P 1-6 Daechi-Dong, Kangnam-ku, Seoul 135282

Telephone: 82 (2) 553 5681

Fax: 82 (2) 553 5683

Twin-engined 100/120-seat regional transport programme now described under KCAD/AVIC/DASA/Fokker heading in International section

UPDATED

KAL

KOREAN AIR LINES CO LTD

KAL Building, CPO Box 864, 41-3 Seosomun-Dong, Chung-Ku, Seoul

Telephone: 82 (2) 751 7114

Telex: KALHO K 27526

CHAIRMAN AND CEO: C. H. Cho

PRESIDENT: Y. H. Cho

Aerospace Division

Marine Center Building 22F-L, 118-2-ka, Namdaemun-Ro, Chung-Ku, Seoul 100770

Telephone: 82 (2) 726 6240

Fax: 82 (2) 756 7929

Telex: KALHO K 27526 (SELDBKE)

EXECUTIVE MANAGING VICE-PRESIDENT: Y. T. Shim

MANAGING VICE-PRESIDENT, PLANT OPERATION: B. S. Lee

Korean Institute of Aeronautical Technology (KIAT)

Address/telephone/fax/telex details as for Aerospace Division

VICE-PRESIDENT: S. Y. Yoo

Aerospace Division of Korean Air Lines established 1976 to manufacture and develop aircraft; at December 1994 occupied 64.75 ha (160 acre) site at Kim Hae, including floor area of 250,000 m² (2.69 million sq ft); workforce then about 2,100. Has overhauled RoKAF aircraft since 1978; programmed depot maintenance of US military aircraft in Pacific area began 1979, including structural repair of F-4s, systems modifications for F-16s, MSIP upgrading of F-15s and overhaul of C-130s. Began production in 1981 of first domestically manufactured fighter (Northrop F-5E/F), completing deliveries to RoKAF 1986. Since 1988 has delivered wing components for Boeing 747/777 and fuselage components for McDonnell Douglas MD-11 and Airbus A330/A340.

Since 1991, KAL has manufactured UH-60P helicopters under licence from Sikorsky (essentially same as current US Army UH-60L, with added avionics).

Korean Institute of Aeronautical Technology (KIAT), established as division of KAL in 1978, has grown to become a major Korean aerospace industry R&D centre.

As part of Korean industry development programme from 1988, KAL has designed and developed light aircraft (Chang-Gong 91); co-developed (with McDonnell Douglas) the MD 520MK military helicopter derived from the MD 500; is a major member of KFP Korean Fighter Programme (F-16 C/D), and domestically co-developed the KTX-I primary trainer (see Daewoo entry) for the RoKAF. KAL is currently participating in Korean consortium for joint international development of new 100/120-seat commercial transport (see KCAD/AVIC/DASA entry in International section).

UPDATED

Second prototype Korean Air Lines CHK-91 Chang-Gong 91 four/five-seat light aircraft *1995*

KAL CHK-91 CHANG-GONG 91 (BLUE SKY 91)

TYPE: Four/five-seat light cabin monoplane

PROGRAMME: Partly funded by Hankook fibre company and Samsun industrial company, design began 21 June 1988, construction of prototype started 20 December 1990, first flight 22 November 1991; static test aircraft also completed and second flying prototype completed at end of November 1992; domestic Ministry of Transportation certification in Normal category awarded 31 August 1993; environmental research conducted in joint project with Korean Ministry of Environment from October 1993 to September 1994; approximately 70 hours of flight testing scheduled between June 1993 and August 1995 to obtain stability and controllability data for flight simulator; nearly 220 hours flown by early 1995

COSTS: Programme cost $5 million (1991)

DESIGN FEATURES: Designed for S/L speed range of 51 to 135 knots (95 to 250 km/h; 59 to 155 mph); conventional low-wing, fixed gear cabin monoplane. Wing section NACA 63²-415, dihedral 6° from roots, incidence 2°, twist 3°, sweepback 2° 15′ on leading-edge, 0° 52′ 48″ at quarter-chord

FLYING CONTROLS: Manual/mechanical, piano hinged Frise ailerons with fixed tabs, all-moving tailplane with large central geared tab, balanced rudder; single-slotted trailing edge flaps

STRUCTURE: Aluminium alloy single-spar wings, light alloy fuselage; graphite/epoxy tail unit, wheel speed fairings, doors, engine cowling

LANDING GEAR: Non-retractable tricycle type, with single wheel, oleo-pneumatic shock-absorber and speed fairing on each unit. Cleveland 40-86B mainwheels and 40-77B nosewheel, former with Cleveland 30-55 disc brakes. Tyre sizes 6.00-6 (main) and 5.00-5 (nose), both 6 ply, pressures 3.45 bars (50 lb/sq in) and 2.90 bars (42 lb/sq in) respectively. Nosewheel steerable ±25°. Minimum ground turning radius 9.45 m (31 ft 0 in)

POWER PLANT: One Textron Lycoming IO-360-A1B6 flat-four engine (149 kW, 200 hp at 2,700 rpm), driving a Hartzell HC-C2YK-IBF/F7666A-2 two-blade constant-speed propeller. Two integral fuel tanks in wings, each holding 106 litres (28 US gallons, 23.3 Imp gallons). Total fuel capacity 212 litres (56 US gallons; 46.6 Imp gallons). Refuelling points in wing upper surfaces. Oil sump capacity 7.6 litres (2 US gallons; 1.7 Imp gallons)

ACCOMMODATION: Side by side seats in front for pilot and one passenger. Second pair of seats behind these, to rear of which is a fifth (child's) seat. Space for 45.4 kg (100 lb) of baggage behind rearmost seat. Front-hinged, outward-opening doors at front on starboard side, over wing, and at rear (aft of wing) on port side. Entire accommodation ventilated

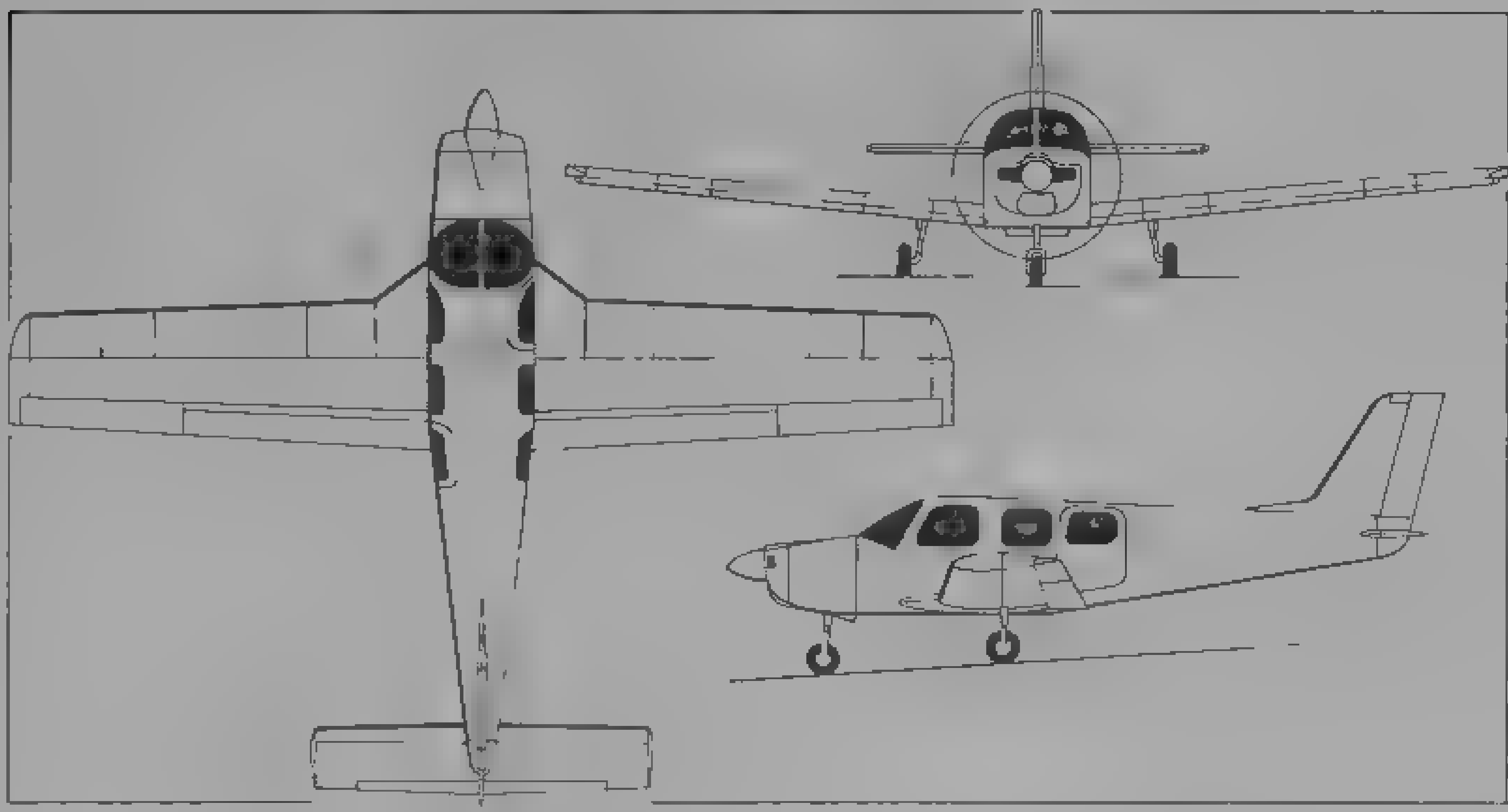
SYSTEMS: Electrical system (14 V DC) powered by engine-driven alternator. No air conditioning, oxygen, hydraulic or pneumatic systems

AVIONICS: *Comms*: Bendix/King KX 155, KT 79 transponder and KHA 24H audio control.

Flight: Bendix/King KN 62A DME, KR 87 ADF, KR 21 marker beacon receiver and KI 525A pictorial nav indicator.

DIMENSIONS, EXTERNAL:	
Wing span	10.21 m (33 ft 5 in)
Wing chord: at root	1.66 m (5 ft 5 in)
at tip	1.21 m (3 ft 11 in)
Wing aspect ratio	7.44
Length: overall	7.74 m (25 ft 4¾ in)
fuselage	7.00 m (22 ft 11½ in)
Height overall	2.70 m (8 ft 10¼ in)
Tailplane span	3.69 m (12 ft 1¼ in)
Wheel track	2.59 m (8 ft 6 in)
Wheelbase	1.71 m (5 ft 7¼ in)
Propeller diameter	1.88 m (6 ft 2 in)
Propeller ground clearance	0.34 m (1.2 1 in)
Passenger door (fwd, stbd):	
Height	0.97 m (3 ft 2 in)
Width	0.91 m (3 ft 0 in)
Height to sill	0.91 m (3 ft 0 in)
Passenger door (rear, port):	
Height	0.97 m (3 ft 2 in)
Width	0.79 m (2 ft 7¼ in)
Height to sill	0.70 m (2 ft 3½ in)
DIMENSIONS, INTERNAL:	
Cabin: Max length	3.05 m (10 ft 0 in)
Max width	1.17 m (3 ft 10 in)
Max height	1.86 m (6 ft 1¼ in)
Floor area	3.27 m² (35.2 sq ft)
Volume	2.14 m³ (75.7 cu ft)
Baggage compartment volume	0.34 m³ (12.0 cu ft)
AREAS:	
Wings, gross	14.86 m² (160.0 sq ft)
Ailerons (total)	1.18 m² (12.67 sq ft)
Trailing-edge flaps (total)	2.00 m² (21.55 sq ft)
Fin, incl dorsal fin	0.81 m² (8.70 sq ft)
Rudder, incl tab	0.52 m² (5.60 sq ft)
Tailplane, incl tab	2.60 m² (28.00 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	839 kg (1,850 lb)
Max fuel weight	159 kg (350 lb)
Max T-O and landing weight	1,225 kg (2,700 lb)
Max wing loading	82.39 kg/m² (16.87 lb/sq ft)
Max power loading	8.22 kg/kW (13.50 lb/hp)
PERFORMANCE (at max T-O weight):	
Max level speed at S/L	183 kts (339 km/h, 211 mph)
Max cruising speed at 1,525 m (5,000 ft)	119 kts (220 km/h, 137 mph)
Econ cruising speed (65% power) at 1,525 m (5,000 ft)	102 kts (189 km/h, 117 mph)
Stalling speed at S/L (65% power at 2,350 rpm):	
0° flap	63 kts (117 km/h, 73 mph)
13° flap	60 kts (111 km/h, 70 mph)
30° flap	57 kts (106 km/h, 66 mph)
40° flap	54 kts (100 km/h, 63 mph)
Max rate of climb at S/L	225 m (740 ft)/min
Service ceiling	5,030 m (16,500 ft)
T-O run at S/L	366 m (1,200 ft)
T-O to 15 m (50 ft)	625 m (2,050 ft)
Landing from 15 m (50 ft)	272 m (890 ft)
Landing run	125 m (410 ft)
Range at 1,525 m (5,000 ft), max fuel, 65% power at 2,350 rpm, no reserves	600 n miles (1,112 km; 691 miles)

UPDATED



Korean Air Lines CHK 91 Chang-Gong 91 (149 kW, 200 hp IO-360) *(Jane's/Mike Keep)*

1991

KAL (SIKORSKY) UH-60P

TYPE: Utility helicopter.

PROGRAMME: Licence agreement to build more than 80 UH-60P in Korea (S-70A-18 variant of Sikorsky UH-60L; see US section) to meet domestic military requirements signed March 1990. Seven US built aircraft imported 1991 followed by materials including kits and parts for licence manufacture; first Korean built UH-60P made first flight 15 February 1992 and delivered 26 March, completion rate about one per month by February 1995.

COSTS: $500 million total programme cost (80 helicopters) 1990 estimate.

POWER PLANT: Two General Electric T700-GE-701C turboshafts and 2,535 kW (3,400 shp) transmission assembled under licence agreement of March 1990.

ACCOMMODATION: Two pilots and two gunners, plus 10 fully equipped troops.

NEW ENTRY

OTHER AIRCRAFT

KAL's production of **McDonnell Douglas 500** helicopters has been concluded; details in 1994-95 and earlier *Jane's*.

Pattern aircraft for UH-60P (Sikorsky S-70A-18) utility helicopter in RoKAF camouflage

1995

SSA

SAMSUNG AEROSPACE INDUSTRIES LTD

Samsung Life Building, 150-2 ka, Taepyung-ro, Chung-ku, Seoul 100716
Telephone: 82 (2) 751 8807
Fax: 82 (2) 771 6552

First Korean company to enter aerospace, by producing jet engines from 1980; moved into commercial aerostructures 1984 and selected 1986 as prime contractor in licence manufacture of F-16s for RoKAF; also produces wing fixed trailing-edges for Boeing 757/767 and horizontal tail surfaces for Dash 8. Approved by South Korean government to produce medium helicopters in Korea, agreement with Bell calls for SSA to produce major fuselage and tailboom assemblies for 212 and 412, initial production began May 1988, plans then called for 93 per cent local manufacture by early 1990s.

In addition to head office in Seoul, SSA has a 21 million m² (226 million sq ft) final assembly plant at Sacheon, two other plants at Changwon, and an R&D centre at Yousung.

VERIFIED

SAMSUNG (LOCKHEED MARTIN) F-16C/D FIGHTING FALCON

TYPE: Multirole fighter.

PROGRAMME: Korean Fighter Programme (KFP) to co-produce 108 of 120 F-16s (80 Block 52D F-16Cs and 40 F-16Ds) announced by South Korean government 28 March 1981; SSA is main Korean contractor, with Daewoo and Hanjin as main subcontractors; programme is to acquire 12 aircraft and their engines off the shelf, assemble 36 from kits and manufacture remaining 72 locally. First Lockheed built F-16C handed over 2 December 1994; 120th aircraft due for delivery 1999.

COSTS: $5.2 billion for 120 aircraft programme.

POWER PLANT: One Pratt & Whitney F100-PW-229 turbofan.

AVIONICS: *Mission*: Lockheed Martin LANTIRN pods.

ARMAMENT: Will include AGM-84 Harpoon, AGM-88 HARM and AIM-120 AMRAAM missiles.

UPDATED

Artist's impression of the KTX-II configuration as displayed in late 1994 *(Jane's/Keith Fretwell)*

1995

SAMSUNG KTX-II

TYPE: Jet trainer and light attack aircraft.

PROGRAMME: Long term programme for indigenous replacement for RoKAF T-33As and T-37Cs; Samsung prime contractor, with team including Daewoo and Korean Air Lines. Preliminary design studies began early 1992 and due for completion by late 1995, service entry targeted for about 2005. Lockheed Martin providing technical assistance in development programme. Go-ahead decision had been expected to be taken in second quarter 1995, but deferred pending search for a cost sharing partner. Bids

from BAe, Dassault and DASA being evaluated in mid 1995

DESIGN FEATURES: Initial tentative configuration (model at Asian Aerospace, February 1994 see 1994-95 *Jane's*) was tandem seat, shoulder wing supersonic design with outward canted twin fins and rudders, lateral intakes for single engine and six external stores stations (four underwing and two wingtip); stepped cockpits, fly-by-wire flight controls.

New model shown at Aerospace Seoul '94 exhibition was delta winged, with single vertical tail and single 71 2 kN (16,000 lb st) class turbofan (variants of Adour, BR700 and P&W/MTU MTFE being studied)

Dimensions quoted for this configuration included a wing span of 7 80 m (25 ft 7 in) and length of 13 70 m (44 ft 11½ in)

UPDATED

LITHUANIA

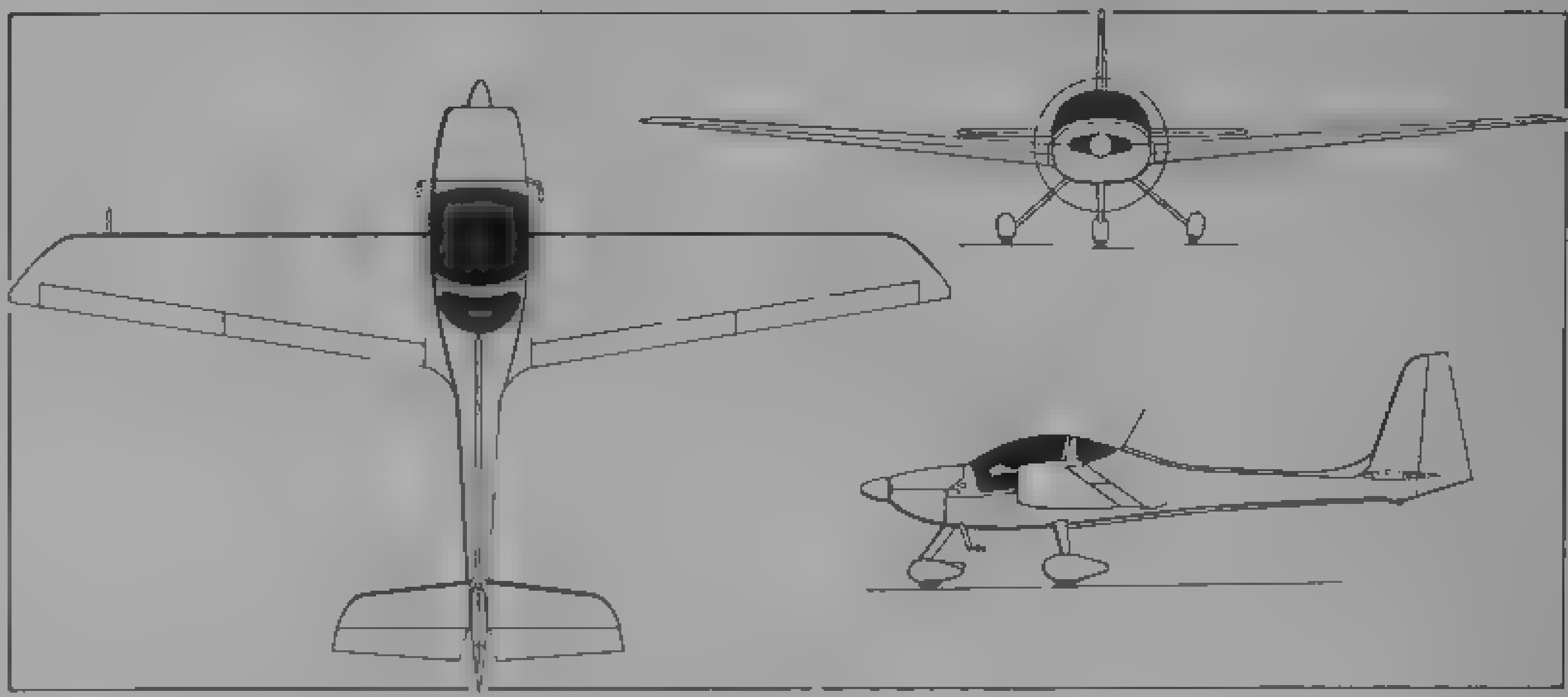
AP

AEROPLASTIKA

Valžganto 3-1, 3000 Kaunas
Telephone 370 (7) 200668
Fax 370 (7) 222451

Company formed in mid-1991 to develop new trainer/sport lightplane LAK X

VERIFIED



Production version of the Aeroplastika LAK-X *(Jane's/Mike Keep)*

1994

AEROPLASTIKA LAK-X

TYPE Two-seat light aircraft

PROGRAMME. First powered aircraft designed by Aeroplastika, prototype (LY XMH) displayed at MosAeroshow '93 available complete or as kitplane, and with choice of engines (see Power Plant paragraphs) Construction started early 1990; prototype made first flight 2 August 1992 with 50 7 kW (68 hp) Limbach L 1700 engine No further examples registered. Initials LAK stand for Lithuania Aero Konstruction, and are also used for the LAK series of gliders

CURRENT VERSIONS: **LAK-XA**: With choice of three engines each of less than 74.6 kW (100 hp)

LAK-XE With choice of two engines each of more than 74.6 kW (100 hp)

DESIGN FEATURES Mid-wing monoplane, high-aspect ratio wings with dihedral from roots; fuselage of oval cross section, large one piece cockpit canopy, hinging upward and forward, slim rear fuselage

FLYING CONTROLS. Conventional primary surfaces, ailerons deflect 10° down, flaps 40° down for landing

STRUCTURE Glassfibre/foam core sandwich basic airframe spar caps and landing gear legs unidirectional high temperature glassfibre/epoxy

LANDING GEAR. Non-retractable tricycle type, cantilever self-sprung legs single wheel, with fairing, on each unit

POWER PLANT (LAK XA): One 59 kW (79 hp) Rotax 912, 73.5 kW (98 6 hp) Rotax 914 or 69 8 kW (93 7 hp) Limbach L 2400 engine, two-blade propeller. Fuel capacity 85 litres (22 5 US gallons, 18 7 Imp gallons)

POWER PLANT (LAK-XE): One 86.5 kW (116 hp) PZL-F 4A-235B3 or 93 2 kW (125 hp) Teledyne Continental IO-240-A engine Fuel capacity 100 litres (26.4 US gallons, 22 Imp gallons)

ACCOMMODATION Two seats side by side

DIMENSIONS, EXTERNAL

Wing span. XA, XE	10.68 m (35 ft 0½ in)
Wing aspect ratio. XA, XE	9 47
Length overall XA	6 95 m (22 ft 9¾ in)
XE	7 00 m (22 ft 11½ in)
Height overall XA, XE	2 20 m (7 ft 2¾ in)

DIMENSIONS, INTERNAL

Cabin: Length: XA, XE	1 40 m (4 ft 7 in)
Width, Height XA, XE	1 10 m (3 ft 7¼ in)

AREAS

Wings, gross XA, XE	12.05 m² (129 7 sq ft)

WEIGHTS AND LOADINGS

Weight empty XA	400 kg (882 lb)
XE	440 kg (970 lb)
Max T-O weight XA	650 kg (1,433 lb)
XE	720 kg (1,587 lb)
Max wing loading XA	53 9 kg/m² (11 05 lb/sq ft)
XE	59 75 kg/m² (12 23 lb/sq ft)
Max power loading	
XA (Rotax 912)	11 04 kg/kW (18 14 lb/hp)
XA (Rotax 914)	8 85 kg/kW (14 53 lb/hp)
XA (Limbach)	9 31 kg/kW (15 29 lb/hp)
XE (PZL-F)	8 33 kg/kW (13.68 lb/hp)
XE (Continental)	7 73 kg/kW (12.70 lb/hp)

PERFORMANCE

Max level speed. XA	108 kts (200 km/h 124 mph)
XE	129 kts (240 km/h, 149 mph)
Nominal cruising speed XA	86 kt (160 km/h, 99 mph)
XE	108 kts (200 km/h, 124 mph)
Stalling speed, flaps down XA	41 kts (75 km/h, 47 mph)
XE	45 kts (82 km/h, 51 mph)
Max rate of climb at S/L XA	240 m (787 ft)/min
XE	300 m (985 ft)/min
T-O run. XA, XE	150 m (495 ft)
Landing run XA	100 m (330 ft)
XE	150 m (495 ft)
Range with max fuel	
XA, XE	458 n miles (850 km, 528 miles)
g limits XA	+5/–2 5
XE	+4/–2

UPDATED

Aeroplastika LAK-XA two-seat light aircraft *(R. J. Malachowski)*

1994

MALAYSIA

DORNIER SEASTAR

DORNIER SEASTAR MALAYSIA SENDIRIAN BERHAD

Tingkat 4, Bangunan KPDM, No. 1, Jalan Sulaiman, 50000 Kuala Lumpur
Telephone 60 (3) 273 1828 and 2673
Fax 60 (3) 273 1826

CHAIRMAN Tan Sri Dato Nasruddin Bahari

MANAGER, SALES AND CORPORATE FINANCE Raja Alang Muhammad

DIRECTOR, SALES AND MARKETING Rajinder Singh

Dornier Seastar Malaysia Sdn Bhd is joint venture company formed in 1993 between Dornier Seastar company of Germany (re-formed 1992 following 1991 voluntary liquidation of Dornier Composite Aircraft) and three Malaysian companies (Aerospace Industries Malaysia, Realmild and Koperasi Polis). Shareholdings Conrado Dornier 25 per cent Malaysian interests 75 per cent

DSM concluded agreement with Penang Development Corporation on 4 February 1994 to acquire 10 5 ha (26 acre) site near Penang Bayan Lepas International Airport on which to establish manufacturing facility (due for completion by end of 1996) and seaplane base. Eventual workforce expected to total about 400, including 40 to 50 from Germany

UPDATED

DORNIER SEASTAR CD 2

TYPE: Twin turboprop STOL utility amphibian

PROGRAMME. For detailed early history, see Dornier Composite entry in German section of 1991 92 *Jane's*. First flight in present CD 2 configuration was made by rebuilt first prototype D-ICDS on 24 April 1987; second (preproduction) aircraft D-ICKS has larger cabin windows, fully furnished interior, higher maximum T-O weight and PT6A 135A engines of production version D-ICKS made first flight in October 1988, received German LBA certification on 30 October 1990 and FAA type approval (FAR Pt 23, Amendment 34) in June 1991

DSM plans to start Malaysian production in 1996 and reach eventual rate of 36 per year

CURRENT VERSIONS. **Passenger:** For 12 passengers three-abreast at 81 cm (32 in) seat pitch and up to 180 kg (397 lb) in baggage compartment

Corporate: Up to nine passengers at same seat pitch, with toilet at rear

VIP Executive version, with six seats, toilet and galley

Ambulance Interior configured for three stretchers, a single-patient intensive care station, two medical attendants and medical equipment

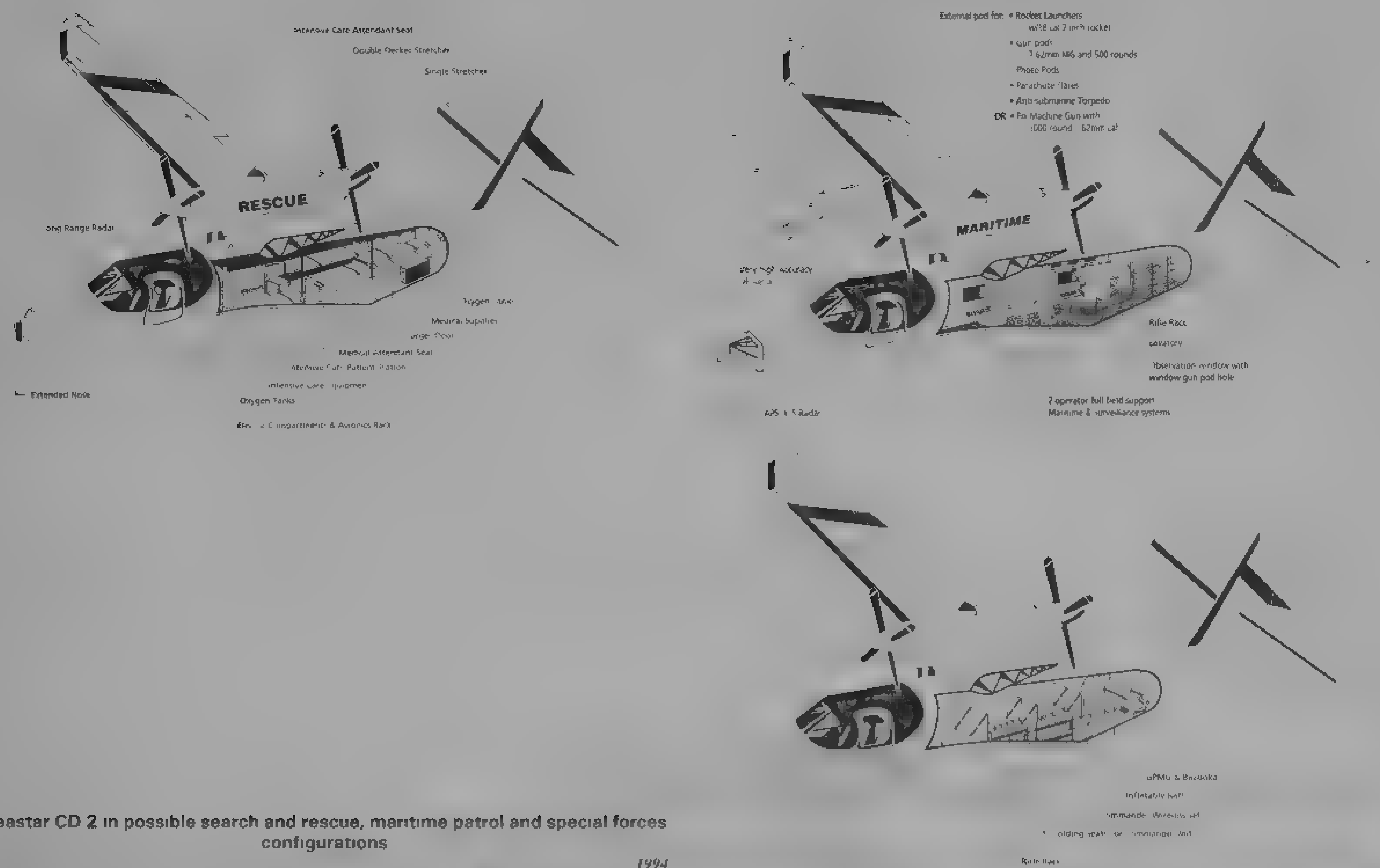
Cargo: Volume of 9 88 m³ (348 2 cu ft) available, including items up to 5 21 m (17 ft 1 in) long).

Maritime patrol, search and rescue and special forces versions See accompanying illustrations.

CUSTOMERS: Indonesian Air Transport (two) is launch customer, letters of intent claimed for 32 more from 12 other potential customers

COSTS Standard passenger version approximately $4 million (1994)

DESIGN FEATURES. Designed for 30,000 hour service life. Tandem engine arrangement for centreline thrust. Cantilever, no-dihedral parasol wing, without tip floats: unpressurised, two-step flying boat hull with large chined sponson each side containing fuel and main landing gear (function also as entry, loading and working platforms and provide rol.



Seastar CD 2 in possible search and rescue, maritime patrol and special forces configurations

1994

stability on water), flat, unobstructed floor and large cabin windows; conventional cruciform tail unit; flotation compartments in wing and fuselage. Wing section NACA 23015 (modified).

FLYING CONTROLS: Horn balanced ailerons, elevators and rudder all actuated mechanically; trim tabs in port aileron, both elevators and rudder. Drooped wing outboard leading-edges; electrically actuated single-slotted trailing-edge flaps. Variable incidence tailplane, also actuated electrically.

STRUCTURE: Almost entirely of GFRP and CFRP; only wing struts and engine supports are metal. Three-spar fail-safe wing is of GFRP with foam core; front and rear spars are carbonfibre reinforced. Fuselage and tail unit almost totally of GFRP.

LANDING GEAR: Hydraulically retractable tricycle type, with twin wheels on each main unit and single fully swivelling nosewheel. All wheels size 6.25-7.5. Main units retract forward into hull sponsons, nose unit forward into bow. Goodrich tyres, hydraulic double disc brakes.

POWER PLANT: Two Pratt & Whitney Canada PT6A-135A turboprops, each flat rated at 485 kW (650 shp), mounted in tandem above wing in continuous nacelle and driving one tractor and one pusher propeller at 1,900 rpm. Each is a four-blade McCauley C-760 series constant-speed reversible-pitch metal propeller. Fuel tank in each sponson, combined maximum usable capacity 1,734 litres (458 US gallons, 381 Imp gallons). Gravity refuelling through top of sponson. Oil capacity 13.25 litres (3.5 US gallons, 2.9 Imp gallons).

ACCOMMODATION: Two-person flight deck with dual controls, but approved for single-pilot operation. Alternative layouts according to role (see Current Versions). Crew door on port side, plus roof hatch to observe water manoeuvres. Upward-opening crew escape door at front of cabin on starboard side, upward-opening main door at rear on port side with optional airstair incorporated in adjacent sponson structure. Baggage compartment at rear of cabin, capacity 180 kg (397 lb), with optional external door on starboard side. All accommodation heated and ventilated, air conditioning optional.

SYSTEMS: Hydraulic system for landing gear actuation, electrically pressurised to 207 bars (3,000 lb/sq in); flow rate 11 litres (2.9 US gallons; 2.4 Imp gallons)/min. Two 28 V DC 200 A starter/generators, two 28 V DC to 26 V/115 V AC static inverters, one 40 Ah Ni/Cd battery. Pneumatic de-icing for wing and tail leading-edges and engine intakes, optional on wing struts.

AVIONICS: Complete single-pilot IFR Collins Pro Line II with EHSI 74 standard.

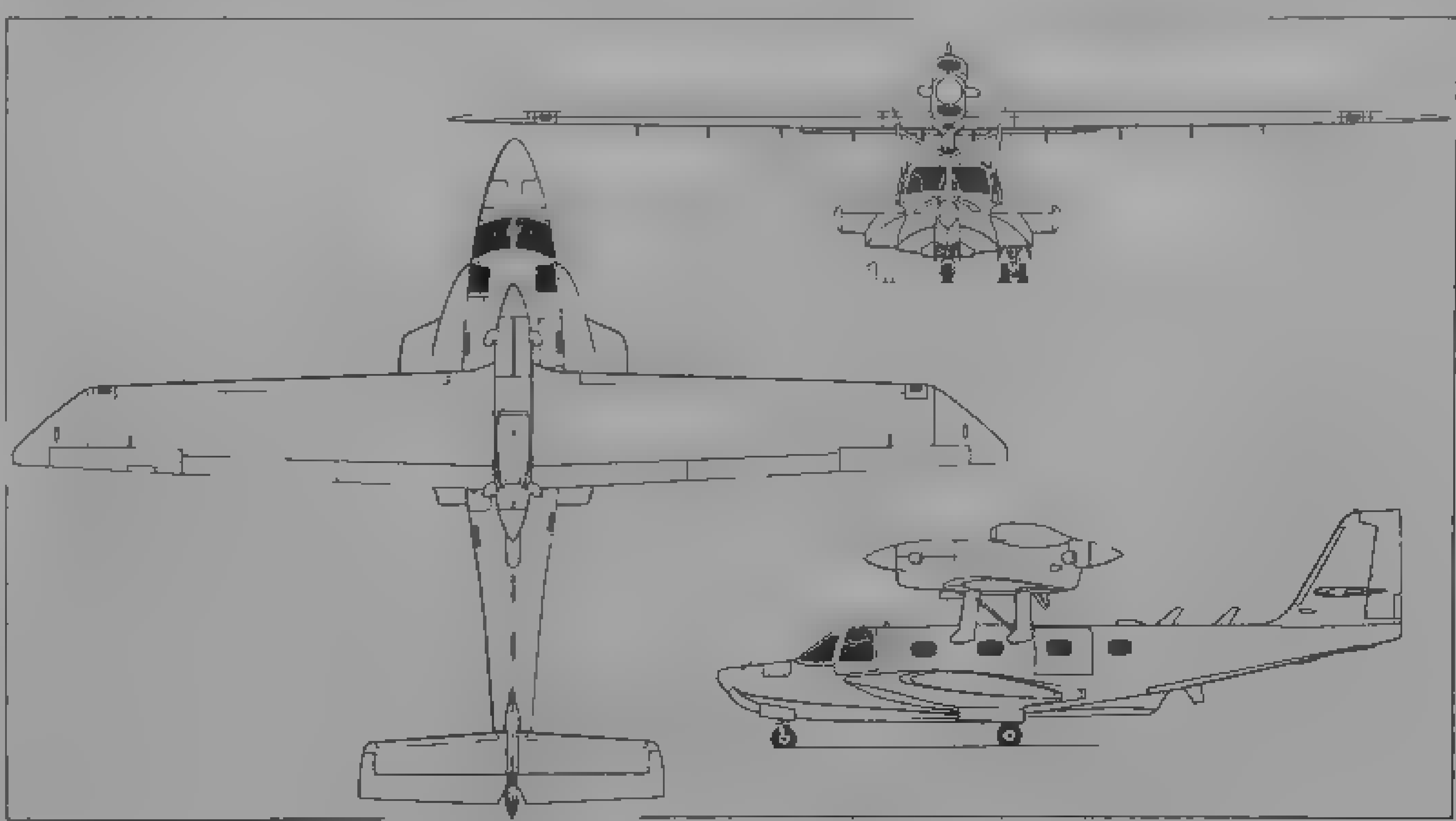
ARMAMENT: Four underwing stations available for loads of 250 kg (551 lb) each.

DIMENSIONS, EXTERNAL:

Wing span	17.74 m (58 ft 2½ in)
Wing chord, mean aerodynamic	1.825 m (6 ft 0 in)
Wing aspect ratio	10.28
Wing taper ratio	0.691
Width over sponsons	4.22 m (13 ft 10¼ in)
Length overall	12.70 m (41 ft 8 in)
Fuselage: Max width	1.90 m (6 ft 2¾ in)
Height overall (on land)	4.83 m (15 ft 10¼ in)
Tailplane span	5.56 m (18 ft 3 in)
Wheel track	2.50 m (8 ft 2½ in)
Propeller diameter: front	2.40 m (7 ft 10½ in)
rear	2.35 m (7 ft 8½ in)
Crew door: Height	0.85 m (2 ft 9½ in)
Width	0.70 m (2 ft 3½ in)
Excape door (fwd, stbd): Height	0.94 m (3 ft 1 in)
Width	1.12 m (3 ft 8 in)
Passenger door (rear, port): Height	0.94 m (3 ft 1 in)
Width	1.12 m (3 ft 8 in)
Height to sill	1.28 m (4 ft 2½ in)
Baggage compartment door (optional):	
Height	0.50 m (1 ft 7¾ in)
Width	0.75 m (2 ft 5½ in)
Height to sill	1.39 m (4 ft 6¾ in)

Second preproduction Dornier Seastar CD 2 amphibian (two P&WC PT6A-135A turboprops)

1994



Dornier Seastar Malaysia Seastar in its production form *(Dennis Punnett)*

1994

DIMENSIONS, INTERNAL:
Cabin, excl flight deck:
Length:
excl baggage compartment 4.00 m (13 ft 1½ in)
incl baggage compartment 5.50 m (18 ft 0½ in)
Max width: at floor 1.65 m (5 ft 5 in)
at shoulder height 1.75 m (5 ft 9 in)
Max height 1.40 m (4 ft 7 in)
Floor area:
excl baggage compartment 5.50 m² (59.2 sq ft)
Volume:
excl baggage compartment 8.23 m³ (290.6 cu ft)
incl baggage compartment 9.86 m³ (348.2 cu ft)
Rear baggage compartment volume
1.63 m³ (57.56 cu ft)

AREAS:
Wings, gross 30.60 m² (329.38 sq ft)
Vertical tail surfaces (total) 3.15 m² (33.9 sq ft)
Horizontal tail surfaces (total) 6.32 m² (68.0 sq ft)

WEIGHTS AND LOADINGS:
Standard weight empty 2,800 kg (6,173 lb)
Operating weight empty:
12 passengers 3,076 kg (6,781 lb)
all-cargo 2,890 kg (6,371 lb)
Max payload 1,116 kg (2,460 lb)
Max usable fuel weight 1,400 kg (3,086 lb)
Max T-O weight 4,600 kg (10,141 lb)
Max ramp weight 4,650 kg (10,250 lb)
Max landing weight 4,500 kg (9,921 lb)
Max wing loading 150.3 kg/m² (30.79 lb/sq ft)
Max power loading 4.74 kg/kW (7.80 lb/shp)

PERFORMANCE (at max T-O weight except where indicated):
Max cruising speed at 3,050 m (10,000 ft), ISA, at AUW of 4,000 kg (8,814 lb):
two engines (2 × 373 kW, 500 shp)
180 kts (333 km/h, 207 mph)
one engine (1 × 485 kW, 650 shp)
152 kts (282 km/h, 175 mph)
Stalling speed, 40° flap
65 kts (120 mph, 75 mph) CAS
Max rate of climb at S/L, ISA:
two engines 396 m (1,300 ft)/min
one engine 149 m (490 ft)/min
Service ceiling, AUW of 4,000 kg (8,814 lb):
two engines 9,150 m (30,000 ft)
one engine 6,890 m (22,600 ft)
T-O run at S/L: land 427 m (1,400 ft)
water 543 m (1,780 ft)
T-O to 10.7 m (35 ft) at S/L: land 564 m (1,850 ft)
water 762 m (2,500 ft)
Landing from 15 m (50 ft) at S/L, max landing weight:
land 686 m (2,250 ft)
water 717 m (2,350 ft)
Landing run at S/L, max landing weight:
land and water 366 m (1,200 ft)
Max endurance at 3,050 m (10,000 ft), ISA, at 110 kts (204 km/h, 127 mph) IAS:
two engines 7 h 45 min
one engine 9 h 30 min

UPDATED

EAM

EAGLE AIRCRAFT (MALAYSIA) SENDIRIAN BERHAD

6th Floor, No 3 Changkat Raja Chulan, 50200 Kuala Lumpur

EAM is investment holding company incorporated in Malaysia to facilitate the investment in Eagle Aircraft Pty Ltd (EAPL) of Australia by the Malaysian companies Petronas (Petroliam Nasional Berhad) and CTRM (Composite Technology Research [Malaysia] Sdn Bhd).

EAPL became wholly owned by EAM on 28 May 1993, but as initial production of the Eagle X-TS two-seat lightplane is so far confined to Australia the aircraft's description continues to be found under the EAPL heading in that section until a Malaysian production line is established.

VERIFIED

SME

SME AEROSPACE SENDIRIAN BERHAD

Lot 14643, Locked Bag 222, 47000 Sungai Buloh, Selangor Darul Ehsan
Telephone: (60 3) 656 1778
Fax: (60 3) 656 1832
GROUP GENERAL MANAGER: Tommy Tay
GENERAL MANAGER:
Lt Col (Retd) Prabhakaran Nair
US MARKETING:
SME Aero, 3226 Capital Circle South-West, Tallahassee, Florida 32310
Telephone: 1 (904) 575 4354
Fax: 1 (904) 575 2590

SME Aerospace Sdn Bhd is one of four divisions of SME Technologies Sdn Bhd, a group wholly owned by Malaysian government which provides products and services for defence, aerospace, plastics and metal-based manufacturing industries. It is manufacturing the MD3-160 trainer with technical support from the aircraft's designer, MDB Flugtechnik of Switzerland, and British Aerospace.

UPDATED

Second preproduction MD3-160 (119 kW; 160 hp O-320-D2A engine) *1994*

SME MD3-160

TYPE: Two-seat basic, aerobatic and instrument trainer.

PROGRAMME: Originated by Max Dätwyler in Switzerland in late 1960s, but much redesigned later with view to maximising common module interchangeability; first flight of MD3-160 (HB-HOH) 12 August 1983; first flight second prototype (HB-HOJ) 1990; Swiss FOCA certification to FAR Pt 23 awarded 22 January 1991; first flight of first preproduction aircraft (HB-HNA) July 1992; FAA certification to FAR Pts 21 and 23 received 2 September 1992; technology transfer agreement concluded between MDB Flugtechnik AG of Switzerland and SME Group of Malaysia on 30 June 1993. Five built in Switzerland; series production of MD3-160 in Malaysia started March 1994, first Malaysian aircraft due to fly May 1994; planned production capacity of 100 per year from 1996.

CURRENT VERSIONS: **MD3-116**: Primary trainer, powered by 86.5 kW (116 hp) Textron Lycoming O-235-N2A flat-four engine; first prototype, fitted with this engine, successfully completed performance and handling test flights Autumn 1991.

MD3-160: Aerobatic trainer and glider tug, with more powerful Textron Lycoming O-320-D2A engine; *description applies to this version*. Marketed in USA as **Aerotiga**.

MD3-160A: Fully aerobatic version, with AEIO-320-D2B fuel-injection engine and inverted flight fuel and oil systems.

CUSTOMERS: Total of 55 ordered by January 1994, including 20 each for Indonesian Air Force and Royal Malaysian Air Force. Twelve aircraft due for completion by end of 1995. Interest also expressed by Royal Thai Air Force.

COSTS: Basic standard aircraft $150,000 (1995).

DESIGN FEATURES: Components interchangeable with each other, and left with right, are: (1) ailerons, flaps, elevators and rudder; (2) wing leading-edges; (3) wing inboard panels; (4) wing outboard panels; (5) wingtips; (6) tailplane halves and fin; (7) elevator and rudder tips; (8) aileron, elevator and rudder tabs.

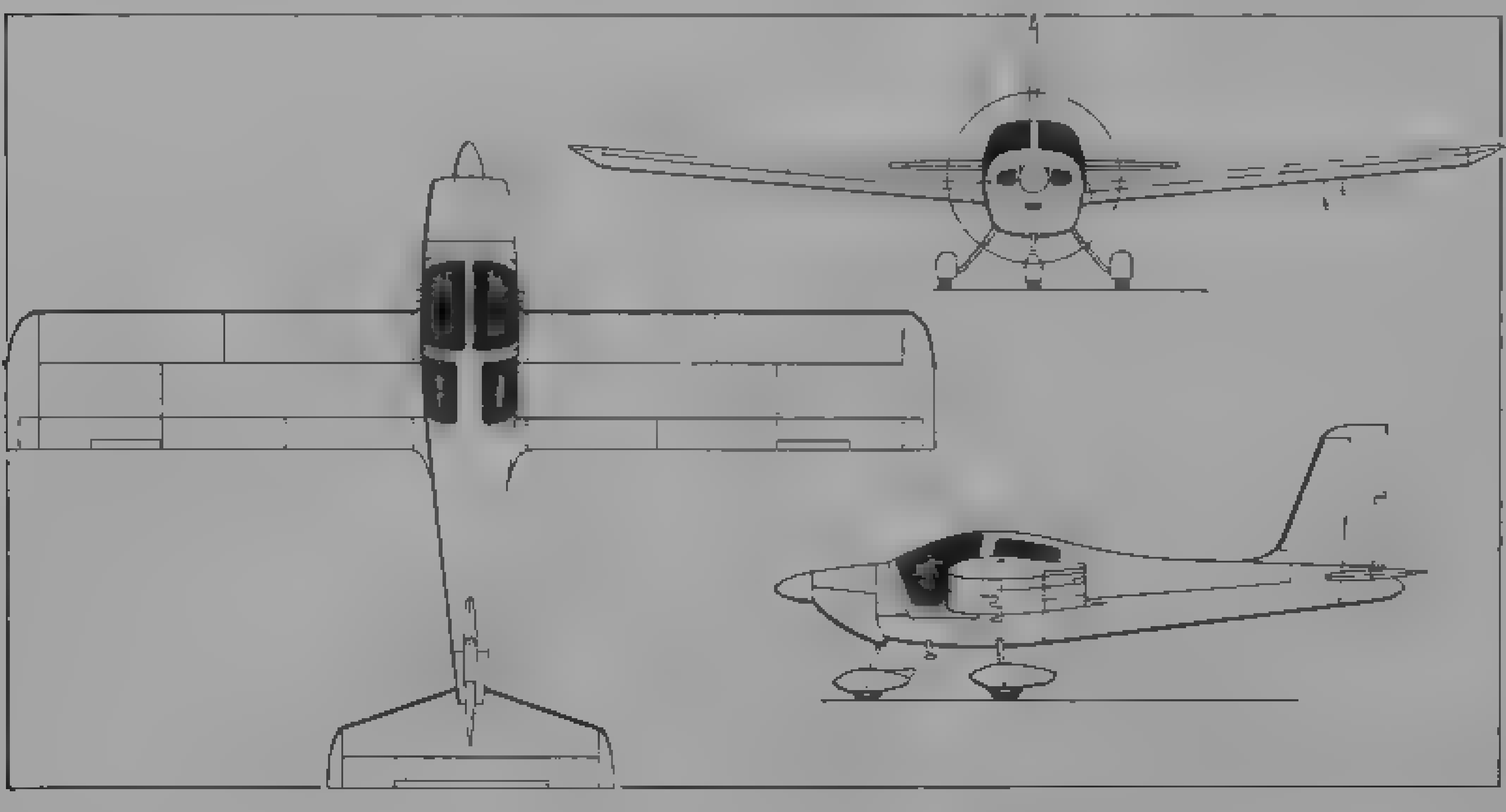
Wing section NACA 64_2-15414 (modified); dihedral 5° 30'; incidence 2°.

FLYING CONTROLS: Mechanical by push/pull rods; single-slotted ailerons; all primary surfaces mass balanced; trim tabs in each aileron, elevator and rudder; trim controls can be mechanical or electrical; electrically operated flaps.

STRUCTURE: All-metal except for glassfibre wingtips, dorsal fin fairing and wheel speed fairings and CFRP cowling; aluminium honeycomb skins; designed for easy construction; rear fuselage detachable.

LANDING GEAR: Non-retractable tricycle type with steerable nosewheel (30° left, 44° right). Main-gear legs are cantilever steel struts, descending at 45° from fuselage main bulkhead. Nose gear fitted with oleo-pneumatic shock absorber. Cleveland 6.00-6 mainwheels and 5.00-5 nosewheel with Michelin tyres. Tyre pressure 2.41 bars (35 lb/sq in) on all units. Independent Cleveland hydraulic disc brake on each mainwheel. Speed fairings on all three wheels.

POWER PLANT: One Textron Lycoming O-320-D2A flat-four engine (119 kW, 160 hp at 2,700 rpm), driving a Sensenich two-blade fixed-pitch metal propeller. Exhaust system extends full length under fuselage to extreme rear of tail cone, exhaust gases being emitted through narrow slot running along pipe. (Can also be fitted with short pipe; meets noise requirements with short or long exhaust.) Integral fuel tank in each wing: total capacity 148 litres (39 US gallons; 32.6 Imp gallons), of which 142 litres (37.5 US gallons; 31.2 Imp gallons) are usable. Refuelling point in top



MD3-160 basic, aerobatic and instrument trainer (*Jane's/Mike Keep*) *1993*

of each tank. Oil capacity 7.6 litres (2 US gallons; 1.7 Imp gallons)

ACCOMMODATION: Side by side adjustable seats for pilot and one pupil or passenger. Five-point fixed seat belts. Forward-sliding jettisonable canopy. Space behind seats for 50 kg (110 lb) of baggage. Dual controls, cabin ventilation and heating standard.

SYSTEMS: Hydraulic system for mainwheel brakes only. Electrical power for engine starting, lighting, instruments and comm/nav equipment provided by 28 V 70 A engine-driven alternator and 24 V 30 Ah battery.

AVIONICS: *Comms:* Bendix/King AlliedSignal radio and blind encoding transponder.

Flight: Provision for VOR, ADF, GPS, or other items at customer's option.

Instrumentation: Basic VFR standard, IFR optional.

EQUIPMENT: Equipment for glider towing optional.

DIMENSIONS, EXTERNAL:

Wing span	10.00 m (32 ft 9¾ in)
Wing chord, constant	1.50 m (4 ft 11 in)
Wing aspect ratio	6.67
Length overall	7.10 m (23 ft 3½ in)
Fuselage max width	1.15 m (3 ft 9¼ in)
Height overall	2.92 m (9 ft 7 in)
Tailplane span	3.00 m (9 ft 10 in)
Wheel track	0.95 m (3 ft 1½ in)
Wheelbase	2.05 m (6 ft 8¾ in)
Propeller diameter	1.88 m (6 ft 2 in)
Propeller ground clearance	0.24 m (9½ in)

DIMENSIONS, INTERNAL:

Cabin, from firewall to rear bulkhead:	
Length	1.30 m (4 ft 3¼ in)
Max width	1.12 m (3 ft 8 in)
Max height	1.08 m (3 ft 6½ in)

AREAS:

Wings, gross	15.00 m² (161.5 sq ft)
Ailerons (total)	1.13 m² (12.16 sq ft)
Trailing-edge flaps (total)	1.96 m² (21.10 sq ft)
Fin	0.89 m² (9.58 sq ft)
Rudder	0.51 m² (5.49 sq ft)
Tailplane	1.71 m² (18.41 sq ft)
Elevators (total)	1.04 m² (11.19 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic category, U: Utility, N: Normal):

Weight empty: A, U, N	640 kg (1,411 lb)
Max fuel weight	105 kg (231 lb)
Max T-O weight: A	880 kg (1,940 lb)
U	920 kg (2,028 lb)
N	1,060 kg (2,337 lb)
Max wing loading: A	58.7 kg/m² (12.02 lb/sq ft)
U	65.3 kg/m² (13.38 lb/sq ft)
N	70.7 kg/m² (14.47 lb/sq ft)
Max power loading: A	7.38 kg/kW (12.12 lb/hp)
U	8.22 kg/kW (13.50 lb/hp)
N	8.89 kg/kW (14.60 lb/hp)

PERFORMANCE (at above A, U and N max T-O weights except where indicated):

Never-exceed speed (V_{NE}):	
A	166 kts (308 km/h; 191 mph) IAS
U, N	175 kts (324 km/h; 201 mph) IAS
Max level speed at S/L: U	137 kts (253 km/h; 157 mph)
Cruising speed at 1,525 m (5,000 ft):	
75% power (all)	130 kts (241 km/h; 150 mph) IAS
66% power (all)	125 kts (231 km/h; 144 mph) IAS
Max manoeuvring speed (V_A):	
A	128 kts (238 km/h; 148 mph) IAS
U, N	121 kts (224 km/h; 139 mph) IAS
Stalling speed, power off:	
flaps up	56 kts (104 km/h; 65 mph) IAS
flaps down	47 kts (88 km/h; 55 mph) IAS
Max rate of climb at S/L: A	296 m (973 ft)/min
T-O run: A	138 m (453 ft)
U	165 m (541 ft)
T-O to 15 m (50 ft): A	274 m (899 ft)
U	338 m (1,109 ft)
Landing from 15 m (50 ft) at max landing weight:	
A, U	322 m (1,056 ft)
Landing run at max landing weight:	
A, U	173 m (568 ft)
Range with max fuel, no reserves	588 n miles (1,090 km; 677 miles)
Endurance, 45 min reserves	4 h 45 min
g limits: A	+6/−3
U	+4.4/−2

UPDATED

NETHERLANDS

FOKKER

NV KONINKLIJKE NEDERLANDSE VLIEGTUIGENFABRIEK FOKKER

CORPORATE CENTRE: PO Box 12222, NL-1100 AE Amsterdam-Zuidoost
Telephone: 31 (20) 605 6666
Fax: 31 (20) 605 70 15
Telex: 11526 FMHS NL
CHAIRMAN: Ben J. A. van Schaik
MARKETING, SALES AND SERVICES: Bernard E. Dijkhuizen

OPERATING COMPANIES:

Fokker Aircraft BV, as above

Fokker Aircraft Services BV, PO Box 3, NL-4630 AA Hoogerheide

Fokker Space and Systems BV, PO Box 32070, NL-2303 DB Leiden

Fokker Special Products BV, PO Box 59, NL-7900 AB Hoogeveen

Aircraft Financing and Trading BV, PO Box 12222, NL-1100 AE Amsterdam-Zuidoost

Avio-Diepen BV, PO Box 5952, NL-2280 ZH Rijswijk

Royal Netherlands Aircraft Factory Fokker founded by Anthony Fokker 21 July 1919. Since 1 January 1987, Fokker has had six operating companies. Main products are Fokker 50, 60, 70 and 100 airliners and their derivatives. Fokker Defence Marketing handles all defence activities.

Agreement reached 27 April 1993 for Daimler-Benz Aerospace (DASA) to acquire 51 per cent holding in Fokker; DASA to acquire Dutch government's 31.8 per cent holding in two stages, immediately and in 1996; DASA established new company, Fokker Holding, owning 51 per cent of NV Fokker, with remaining 49 per cent held by private shareholders; other companies could join Fokker Holding.

Total Fokker workforce reduced from 12,000 to 8,500 by late 1994, further 1,760 redundancies announced February 1995. Dordrecht plant closed; output to be increased from 70 aircraft a year in 1994 to 76 in 1995, management being streamlined and production facilities made more flexible; supplier prices being renegotiated. Despite this, Fokker is increasing its market share. Return to profitability predicted for 1996.

Schiphol plant, Amsterdam, engaged in Fokker 50, 60, 70 and 100 assembly and test flying facilities, design offices, spare parts stores, R&D department, numerically controlled milling department, electronics division, space integration and test facilities, and computer facilities.

Drechtsteden plant engaged on detail production and component assembly for Fokker 50, 60, 70 and 100 and F-16.

Ypenburg employed in construction of composites components for Fokker 50, 60, 70 and 100 and Westland Lynx (radomes and fairings); new 30,000 m² (322,917 sq ft) composites and bonding plant began operating May 1990.

Fokker Aircraft Services BV, situated at Woensdrecht, specialises in maintenance, overhaul, repair and modification of civil and military aircraft. ELMO plant, also at Woensdrecht, produces electrical and electronic systems and cable harnesses.

Hoogeveen (Fokker Special Products BV) engaged in industrial products activities, such as licence programmes, shelters, missile launchers, pylons, fuel tanks and thermoplastics components.

In August 1993, Fokker contracted to design and manufacture empennage of Gulfstream V, first delivery, by newly established Fokker Aerostructures at Papendrecht, undertaken June 1995.

As part of European F-16 programme, Fokker was responsible for component manufacture and assembly of F-16s for Netherlands (213, delivered between June 1979 and 27 February 1992), Norway (72) and Denmark (12), further two to USAF and one to Egypt; it continues to produce F-16 centre fuselages, wing moving surfaces, main landing gear doors and legs, tailplanes, rudders and fin leading-edges for Lockheed Martin.

UPDATED

FOKKER 50

TYPE: Twin-turboprop short-haul transport.

PROGRAMME: Follow-on development of F27 Friendship, announced 24 November 1983, more than 80 per cent of components new or modified; two prototypes used modified F27 fuselages, maiden flight of first prototype (PH-OSO) 28 December 1985; first flight of first production Fokker 50 (PH-DMO) 13 February 1987. JAR 25 certification by Dutch RLD 15 May 1987; first delivery (to Lufthansa CityLine) 7 August 1987. FAA type approval (FAR Pt 25) 16 February 1989. Early 1993 RLD certification of PW127B variant, called the Fokker 50 High Performance, first delivery (to Avianca, 2 April) 1993.

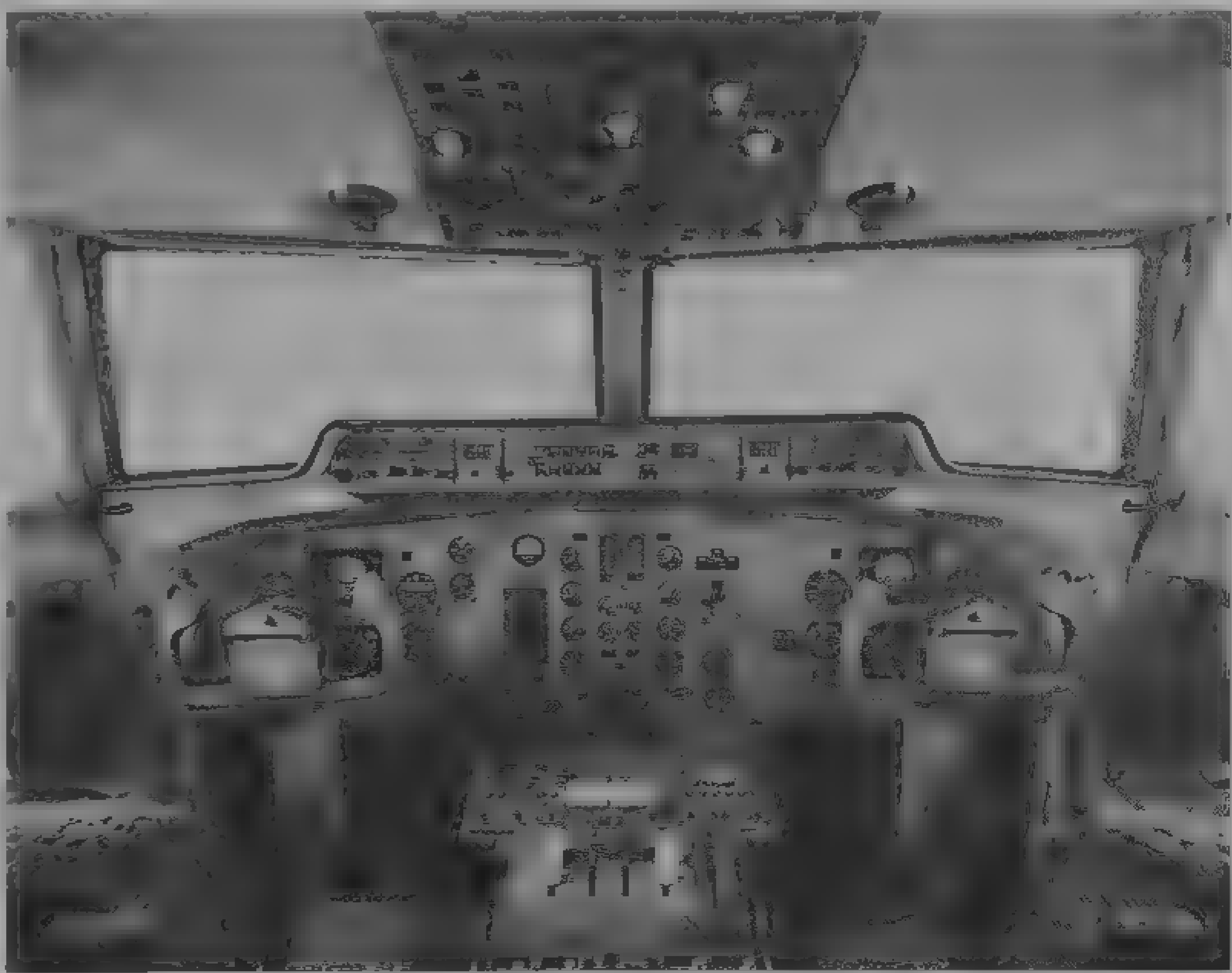
CURRENT VERSIONS: **Fokker 50**: Baseline model for up to 58 passengers, P&WC PW125B turboprop engines, available in four-door and three-door configuration. *Detailed description applies to baseline model, except where indicated.*

Fokker 50 High Performance: Same seating capacity as Fokker 50 but with more powerful PW127B turboprop engines, providing high performance from short runways and obstructed or hot and high airheads, available in four-door and three-door configuration. *Details, where different, incorporated with baseline version.*

Fokker 50 Utility (UTA): Based on standard Fokker 50 (three-door configuration), multipurpose door (height 1.65 m, 5 ft 5 in; width 1.30 m, 4 ft 3¼ in), and heavy-duty floor. Available for specific corporate and governmental requirements, configurations include passenger or cargo transport, para- and supply dropping and medevac. PW125B engine, optionally PW127B engine. Four delivered. *Sales of this variant included below.*

Fokker 60: Described separately.

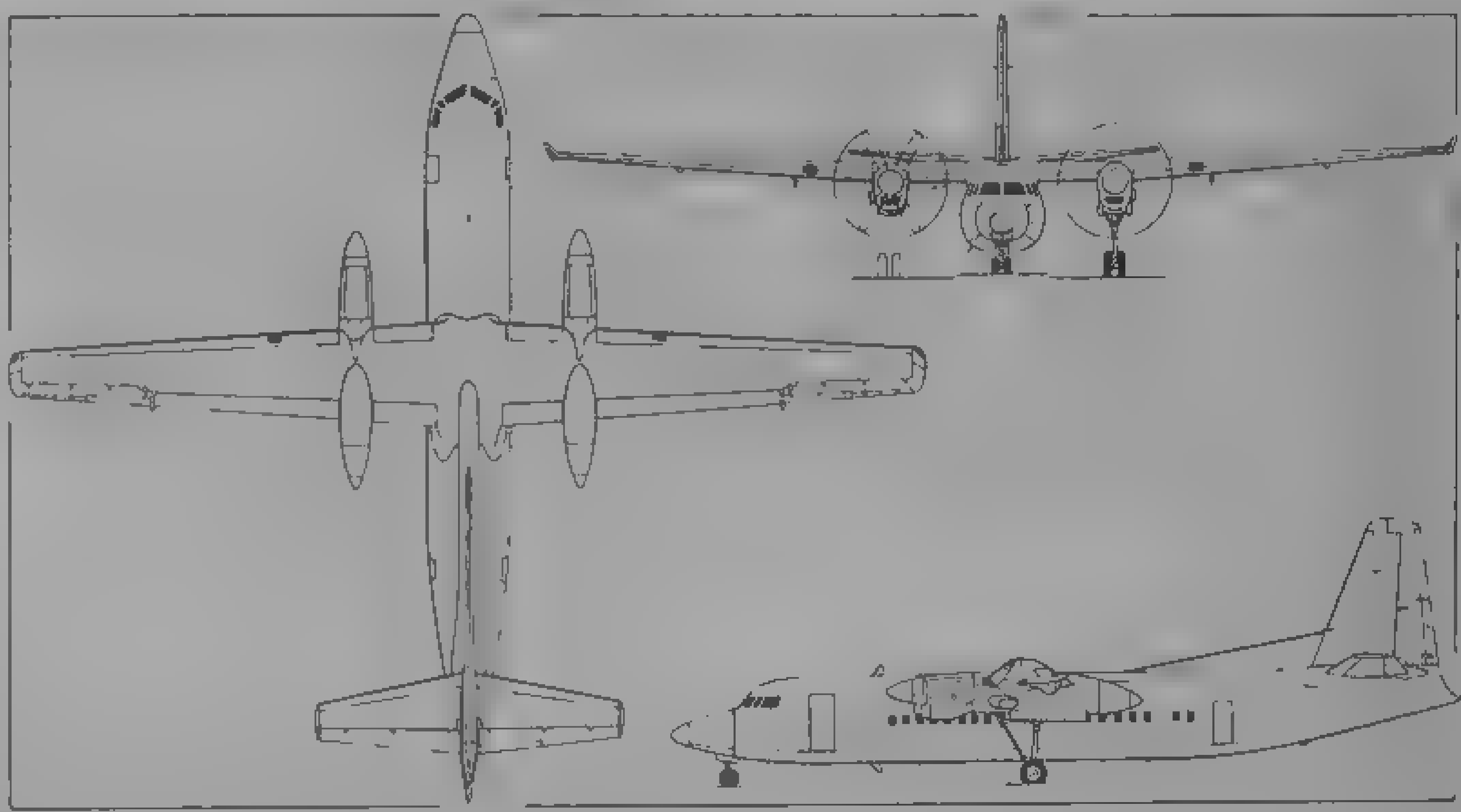
Special mission aircraft: Described separately.



Fokker 50 flight deck with EFIS for both pilots and optional multifunction display on centre console *1994*

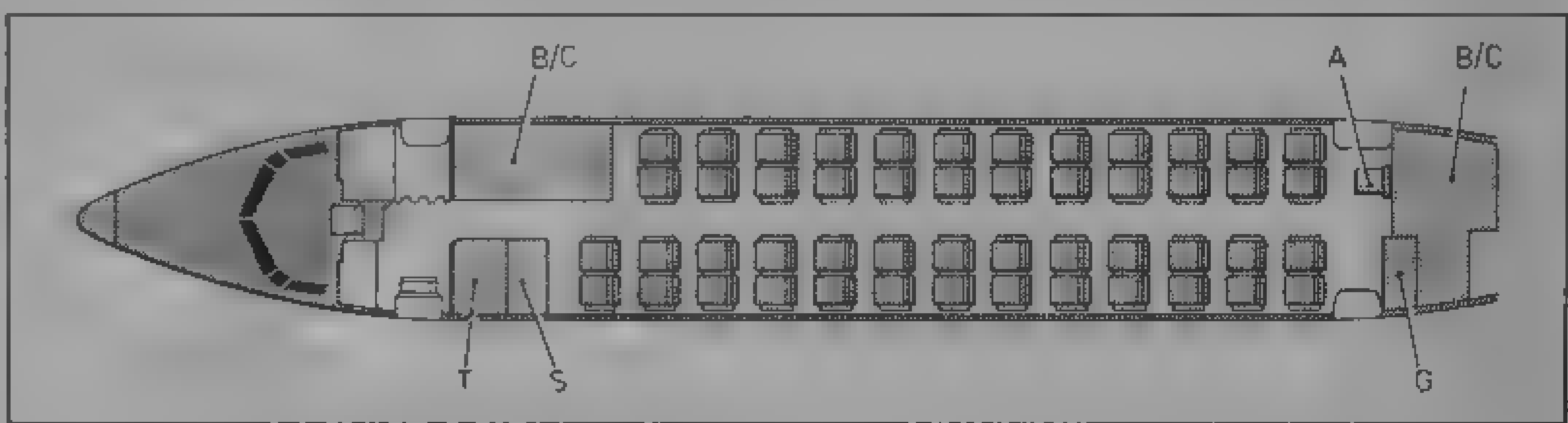
Fokker 50 twin-turboprop transport of Royal Brunei Airlines (two Pratt & Whitney Canada PW125B engines)

1995



Fokker 50 twin-turboprop short-haul transport *(Jane's/Dennis Punnett)*

1994



Fokker 50 standard configuration (50 seats at 81 cm; 32 in pitch) *(Jane's/Mike Keep)*
A attendant seat, B. baggage; C. cargo; G. galley; S stowage; T: toilet

1993

CUSTOMERS Firm orders for 200 plus options for 15 by April 1995

Customers at June 1995 comprised Aer Lingus Commuter (six) Air Nostrum (six); Air UK (nine); Air Zimbabwe (two), Ansett Express (seven), Austrian Airlines (six), Avianca (10); Crossair (five), Formosa Airlines (two), Icelandair (four), KLM Cityhopper (10), Kenya Airways (three), Lufthansa CityLine (21); Luxair (four); Maersk Air (nine), Malaysia Airlines (nine), Nakanihon Airline Service (two); NIOC (two); Nordeste (two), Norwegian Air Shuttle (four); Pelangi Air (four); Philippine Airlines (10), Rio-Sul (seven); Royal Brunei Airlines (two); Royal Thai Police (one); SAS Commuter (22), Singapore Air Force (two UTA-A and two UTA-B for No. 121 Squadron at Changi); Singapore Navy (five Maritime Enforcers), Skyways (two); Skywest Airlines (three), Sonangol (one); Sudan Airways (two); Taiwan government (three); Tanzania government (one), VLM (three) plus seven undisclosed Total 200, plus four Fokker 60s

DESIGN FEATURES Based on F27 proven airframe but with significant design and structural changes, allied to more efficient and fuel-efficient new technology engines in redesigned nacelles, driving specially designed six-blade propellers; 12 per cent higher cruising speed; carbon/aramid/glassfibre components in areas of wings, tailplane, fin, radome, engine nacelles and propellers, 'Foklet' horn balance at each wingtip to increase lateral stability at low airspeeds, passenger door relocated at front, greater passenger comfort and convenience, with more windows, new-design interior with extensive noise reduction, all new cockpit, with EFIS, advanced digital avionics, twin wheel nose gear; latest technology systems, pneumatic system replaced by hydraulic, improved airport handling. Wing section NACA 64_4-421 (modified) at root, 64_4-415 (modified) at tip; unswept, dihedral 2° 30′, washout 2° on outer wings, incidence 3° 30′

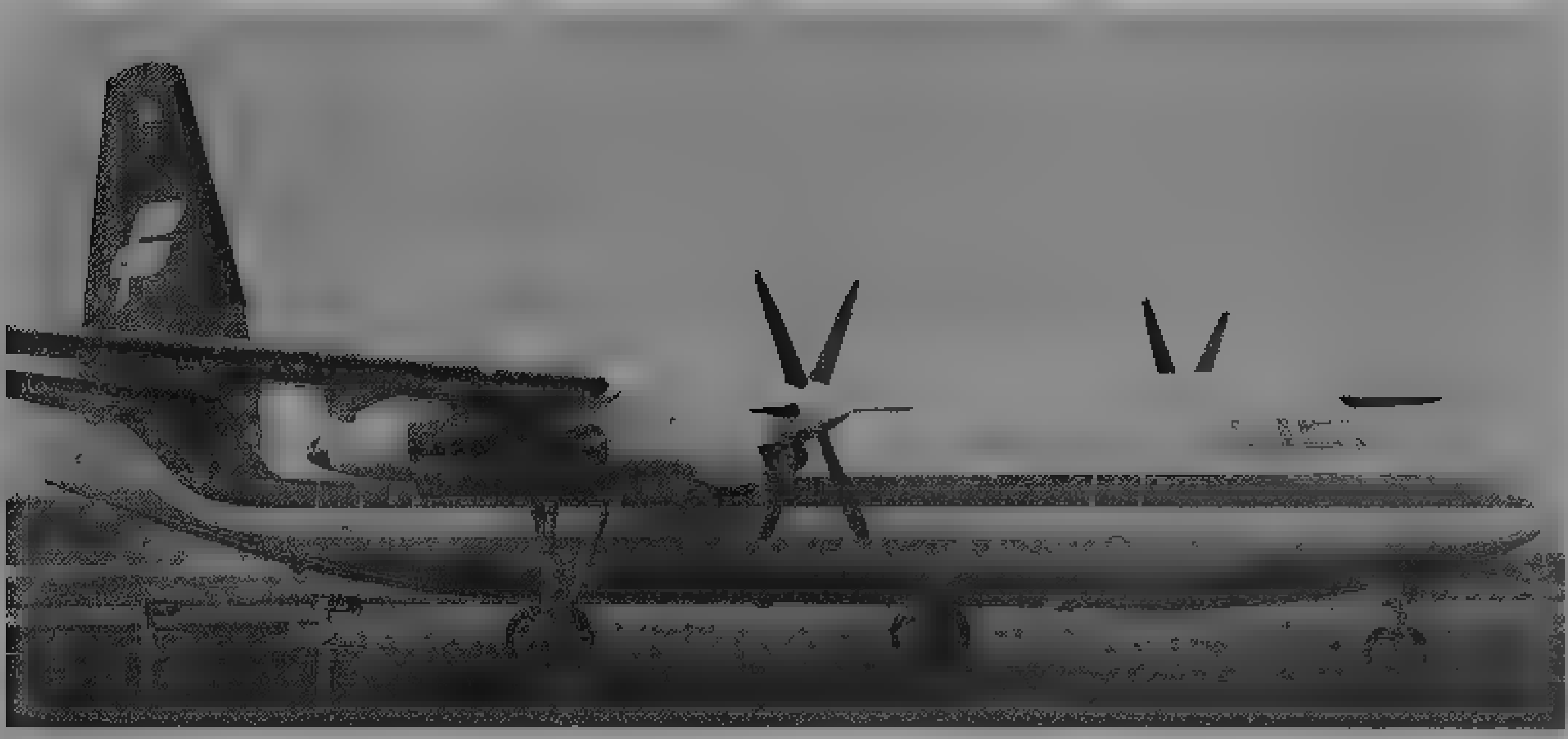
FLYING CONTROLS. Mechanically (cable) actuated ailerons, with inboard spring tab and outboard geared tab (starboard geared tab acting also as electrically actuated trim tab), mechanically interconnected elevators, with starboard trim tab, rudder has trim tab, geared tab and horn balance, hydraulically actuated, mechanically interconnected single-slotted trailing-edge flaps with electrical back up

STRUCTURE. Primary structure is all-metal riveted and metal-bonded stressed skin, detachable AFRP wing leading edges; composite wing trailing-edge skins supported by composite or metal ribs, bonded skin/stringer ailerons have composites leading edges; metal flaps; fin and fixed incidence tailplane have metal primary structure; wingtip 'Foklets' are of metal reinforced composites; composites also for nosecone, fairings, nosewheel doors, access doors, cabin floor, engine air intakes and nacelle cowlings, tail unit leading-edges and part of dorsal fin. Subcontractors include Dassault (centre and rear fuselage), Fuji (rudder and elevators), Daimler-Benz Aerospace Airbus (wing trailing-edge and control surfaces, tailcone and dorsal fin), Sabca (outer wing skins and wingtips), HAL (horizontal stabiliser) and Dowty Aerospace (propellers and landing gear)

LANDING GEAR: Dowty retractable tricycle type with twin wheels on each unit Main units attached to wings, retracting rearward hydraulically into rear extension of engine nacelle, nose unit retracts forward Long-stroke oleo-pneumatic shock-absorber in each unit (single stage on nose unit, double-acting on main units). Goodyear wheels and tyres on all units. Standard mainwheel tyres size 34 × 10.75-R16, nosewheel tyres 24 × 7.7-10. Goodyear hydraulic brakes, incorporating anti-skid system. Hydraulic nosewheel steering (±73°). Free-castoring angle of ±130° available for towing. Minimum ground turning radius 18.07 m (59 ft 3½ in)

POWER PLANT: Standard Fokker 50 powered by two Pratt & Whitney Canada PW125B turboprops, each flat rated at 1,864 kW (2,500 shp) up to 30°C ambient at S/L. Fokker 50 High Performance and Fokker 60 powered by P&WC PW127Bs flat rated at 2,050 kW (2,750 shp) up to 30.8°C at S/L. All have specifically designed Dowty Aerospace propellers, with six all-composite blades and Beta control, precise propeller rpm control, plus phase synchronisation of ±2°, reduces aircraft noise. A digital blade matching system eliminates all propeller-induced vibration in the cabin. Fuel in two integral tanks located between two spars of wing box outboard of nacelles, with total capacity of 5,136 litres (1,357 US gallons, 1,130 Imp gallons). Optional centre wing tanks increase total capacity to 7,450 litres (1,968 US gallons; 1,639 Imp gallons). Single-point pressure refuelling, overwing gravity points

ACCOMMODATION: Crew of two and observer seat on flight deck, one or two cabin attendants, depending on configuration. Dedicated door concept (every ground handling activity has its own door) gives choice of a four door configuration, three-door configuration, or three-door with optional multipurpose door. All configurations have a four abreast layout and 46 cm (18 in) aisle width. Passenger



Fokker 50 of the Taiwanese carrier Formosa Airlines

1995

door, with electrically actuated integral airstairs, at front on port side. Four-door Fokker 50 has forward and rear baggage/cargo compartments and rear galley, each serviced/loaded via a dedicated adjacent door enabling turnaround time to be cut to 10 minutes, as Type III emergency exits are not required, layout is flexible from 46 seats at 86 cm (34 in) pitch to 58 seats at 76 cm (30 in), stowage area and lavatory at front of cabin.

Fokker 50 three-door configuration allows number of seats or cargo volume to be increased without detriment to passenger comfort. In this configuration, port rear galley service door is deleted and two Type III emergency exits introduced, galley is at front of cabin and baggage/cargo compartment at rear; cargo wall can be placed at one of four set positions, allowing number of seats and cargo volume to be adjusted. This configuration allows up to 58 seats at 76 cm (30 in) pitch.

SYSTEMS: Hamilton Standard air conditioning system. AiResearch digital cabin pressure control system. Maximum pressure differential 0.38 bar (5.46 lb/sq in). Hydraulic system, operating at 207 bars (3,000 lb/sq in) pressure via two engine-driven Abex pumps, for landing gear actuation, brakes, nosewheel steering and flap drive. De-icing of wing, fin and tailplane leading-edges, uses engine bleed air. Engine air intakes, propeller blades and spinners de-iced electrically. Primary electrical system powered by Sundstrand 30/40 kVA integrated drive generator mounted on propeller gearbox of each engine, supplying 115/200 V three-phase AC at 400 Hz, with two 300 A transformer-rectifiers and two 43 Ah Ni/Cd batteries for 28 V DC power. Auxiliary Power International Corporation (APIC) APS 1000 APU optional. Configured for ground use, APU (combined with Sundstrand 115 V 20 kVA oil-cooled generator, accessory controls and provisions) provides AC self-sufficiency during turnaround cycles, servicing and maintenance. APU also provides air supply for flight deck and cabin air conditioning and is fitted to fireproof bulkhead aft of wheel bay in starboard nacelle.

AVIONICS: *Comms:* Dual Bendix/King Series II VHF com, Series III ATC transponder with provision for second. Fairchild A100 (ARINC 557) cockpit voice recorder; Collins 346-2B (ARINC 560) PA system, provision for single Collins 628T-2A HF com to ARINC 559A2.

Radar: Honeywell Primus P-650 weather radar with dual presentation on EFIS.

Flight: Dual Bendix/King Series III VHF nav with VOR/ILS and marker beacon receiver; single Bendix/King Series III ADF and DME (latter including frequency hold facility), with provision for second of each. TRT AHV-530A (ARINC 552A) radio altimeter with dual presentation on EFIS, dual Litton LTR 81 01 AHRS, Sundstrand Mk II GPWS (ARINC 549). Honeywell SPZ-9000 AFCS with Cat I landing (Cat II optional); dual Honeywell FZ-500 flight director systems, Honeywell AZ-800 air data computer, VLF-Omega or Bendix/King KNS 660 nav system; Teledyne Model 70-275 flight data acquisition unit; Sundstrand 980-4100 DXUS (ARINC 573) flight data recorder, including underwater locator beacon, Dorne & Margolin ELT.

Instrumentation: Dual Honeywell EDZ-806 electronic flight instrument system (EFIS) with CRT displays for primary flight and navigation information, and space provisions for central multifunction display.

DIMENSIONS, EXTERNAL (Fokker 50):
Wing span 29.00 m (95 ft 1¾ in)
Wing chord, at root 3.46 m (11 ft 4½ in)
at tip 1.40 m (4 ft 7 in)
Wing aspect ratio 12.0
Length overall 25.25 m (82 ft 10 in)
Fuselage: Max width 2.70 m (8 ft 10¼ in)
Height overall (static) 8.32 m (27 ft 3½ in)
Tailplane span 9.75 m (31 ft 11¾ in)
Wheel track 7.20 m (23 ft 7½ in)
Wheelbase 9.70 m (31 ft 10 in)
Propeller diameter 3.66 m (12 ft 0 in)
Propeller ground clearance 1.16 m (3 ft 9¾ in)
Propeller fuselage clearance 0.59 m (1 ft 11¼ in)
Passenger door (fwd, port): Height 1.78 m (5 ft 10 in)
Width 0.76 m (2 ft 6 in)
Service door (rear, port) and cargo door (fwd, stbd), each
Height 1.27 m (4 ft 2 in)
Width 0.61 m (2 ft 0 in)
Standard cargo door (rear, stbd)
Height 1.27 m (4 ft 2 in)
Width 0.86 m (2 ft 9¾ in)
Optional multipurpose door (rear, port)
Height 1.65 m (5 ft 5 in)
Width 1.30 m (4 ft 3¼ in)

DIMENSIONS, INTERNAL:
Cabin, excl flight deck: Length 15.96 m (52 ft 4 in)
Width at floor 2.11 m (6 ft 11 in)
Max width 2.50 m (8 ft 2½ in)
Max height 1.96 m (6 ft 5¼ in)
Floor area (excl toilet) 30.20 m² (325.00 sq ft)
Baggage/cargo volume (standard commuter version)
Main compartments 7.38 m³ (260.60 cu ft)
Wardrobe compartment 0.82 m³ (29.00 cu ft)
Overhead bins 2.22 m³ (78.40 cu ft)

AREAS:
Wings, gross 70.00 m² (753.50 sq ft)
Ailerons (total) 3.66 m² (39.40 sq ft)
Trailing-edge flaps (total) 17.15 m² (184.60 sq ft)
Fin, incl dorsal fin 17.60 m² (189.44 sq ft)
Rudder, incl tab 3.17 m² (34.12 sq ft)
Tailplane 16.00 m² (172.22 sq ft)
Elevators (total, incl tabs) 3.17 m² (34.12 sq ft)

WEIGHTS AND LOADINGS (Fokker 50):
Typical operating weight empty 12,520 kg (27,602 lb)
Max fuel load: standard 4,123 kg (9,090 lb)
optional 5,980 kg (13,184 lb)
Max payload 6,080 kg (13,404 lb)
Max ramp weight: standard 19,990 kg (44,070 lb)
optional 20,865 kg (46,000 lb)
Max T-O weight: standard 19,950 kg (43,980 lb)
optional 20,820 kg (45,900 lb)
Max landing weight: standard 19,500 kg (42,990 lb)
optional 19,730 kg (43,500 lb)
Max zero-fuel weight 18,600 kg (41,000 lb)
Max wing loading: standard 285.0 kg/m² (58.37 lb/sq ft)
optional 297.4 kg/m² (60.92 lb/sq ft)
Max power loading
Fokker 50: standard 5.35 kg/kW (8.80 lb/shp)
optional 5.59 kg/kW (9.18 lb/shp)
Fokker 50 High Performance:
standard 4.89 kg/kW (8.00 lb/shp)
optional 5.08 kg/kW (8.35 lb/shp)

WEIGHTS AND LOADINGS (Fokker 50 Utility):
Typical operating weight empty 11,760 kg (25,926 lb)
Max fuel load: standard 4,123 kg (9,090 lb)
optional* 5,980 kg (13,184 lb)
Max payload 6,840 kg (15,079 lb)
Max ramp weight, standard 19,990 kg (44,070 lb)
optional I 20,865 kg (46,000 lb)
optional II 21,590 kg (47,600 lb)
Max T-O weight: standard 19,950 kg (43,980 lb)
optional I 20,820 kg (45,900 lb)
optional II 21,545 kg (47,500 lb)
Max landing weight, standard 19,500 kg (42,990 lb)
optional 19,730 kg (43,500 lb)
Max zero-fuel weight 18,600 kg (41,000 lb)
Max wing loading: standard 285.0 kg/m² (58.37 lb/sq ft)
optional I 297.4 kg/m² (60.92 lb/sq ft)
optional II 307.8 kg/m² (63.06 lb/sq ft)
Max power loading
PW125B: standard 5.35 kg/kW (8.80 lb/shp)
optional I 5.59 kg/kW (9.18 lb/shp)
optional II 5.78 kg/kW (9.50 lb/shp)
PW127B: standard 4.89 kg/kW (8.00 lb/shp)
optional I 5.08 kg/kW (8.35 lb/shp)
optional II 5.25 kg/kW (8.64 lb/shp)

**including optional centre-wing tanks; operating weight empty increased by 165 kg (364 lb)*

PERFORMANCE (Fokker 50 with PW125B engines):
Max operating Mach number (MMO) 0.507
Typical cruising speed 282 kts (522 km/h, 325 mph)
Typical climb speed
170 kts (315 km/h, 196 mph) CAS
Typical descent speed
227 kts (421 km/h; 261 mph) CAS
Max operating altitude 7,620 m (25,000 ft)
Service ceiling, OEI, typical mission weight of 17,770 kg (39,176 lb), ISA 4,300 m (14,100 ft)
Runway LCN (51 cm, 20 in flexible pavement), 34 × 10.75 R16 tyres at 5.86 bars (85 lb/sq in)
AUW of 19,050 kg (42,000 lb) 16.9
AUW of 20,820 kg (45,900 lb) 18.4
T-O field length for typical mission T-O weight at S/L, ISA, 15° flap 890 m (2,920 ft)
Landing field length for typical mission landing weight at S/L, ISA, 35° flap 1,017 m (3,337 ft)
Range with 50 passengers and baggage, reserves for 45 min continued cruise at long range schedule and 87 n miles (161 km; 100 mile) diversion
at standard MTOW
high-speed procedure
1,109 n miles (2,054 km, 1,276 miles)
min fuel procedure
1,216 n miles (2,252 km, 1,399 miles)
at optional max T-O weight
high-speed procedure
1,535 n miles (2,843 km, 1,766 miles)
min fuel procedure
1,665 n miles (3,083 km, 1,916 miles)

OPERATIONAL NOISE LEVELS:
T-O 81.0 EPNdB
Approach 96.7 EPNdB
Sideline 85.0 EPNdB

PERFORMANCE (Fokker 50 Utility):
Range: 50 passengers
1,818 n miles (3,366 km, 2,092 miles)
5,000 kg (11,023 lb) cargo
1,865 n miles (3,454 km, 2,146 miles)
48 troops 1,348 n miles (2,496 km, 1,551 miles)
27 stretchers 2,013 n miles (3,728 km, 2,316 miles)

PERFORMANCE (Fokker 50 High Performance (PW127B engines):
Max operating Mach number (MMO) 0.507
Typical cruising speed 284 kts (526 km/h; 327 mph)
Typical climb speed
170 kts (315 km/h, 196 mph) CAS
Max descent speed
227 kts (421 km/h, 261 mph) CAS
Max operating altitude 7,620 m (25,000 ft)
Service ceiling OEI, typical mission weight 17,830 kg (39,308 lb), ISA 4,970 m (16,305 ft)
T-O field length for typical mission T-O weight at S/L, ISA, flap 15° 850 m (2,788 ft)
Landing field length for typical mission landing weight at S/L, ISA, flap 35° 1,015 m (3,330 ft)
Range with 50 passengers and baggage, reserves for 45 min continued cruise at long-range schedule and 87 n miles (161 km, 100 mile) diversion
at standard max T-O weight
high-speed procedure
1,097 n miles (2,031 km, 1,262 miles)
min fuel procedure
1,186 n miles (2,196 km, 1,365 miles)
at optional max T-O weight
high-speed procedure
1,521 n miles (2,817 km; 1,750 miles)
min fuel procedure
1,628 n miles (3,015 km, 1,873 miles)

OPERATIONAL NOISE LEVELS:
T-O 81.5 EPNdB
Approach 96.7 EPNdB
Sideline 85.0 EPNdB

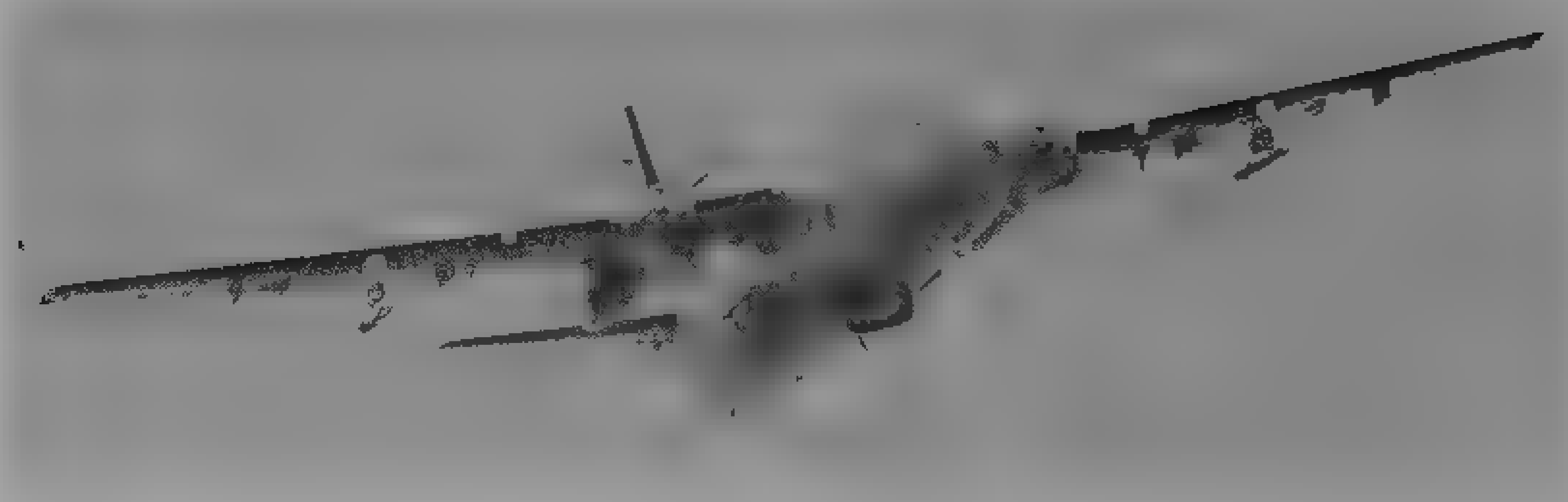
FOKKER 50 SPECIAL MISSION VERSIONS

TYPE: Twin-turboprop special missions aircraft.

CURRENT VERSIONS: **Fokker Maritime Mk 2**: Basic unarmed coastguard/maritime patrol version, duties include coastal surveillance, search and rescue and environmental control, airframe heavily treated with anti-corrosion measures; crew of up to six. Texas Instruments AN/APS-134 search radar in ventral radome, plus IR detection system for night viewing.

Fokker Maritime Enforcer Mk 2: Maritime patrol aircraft equipped for armed surveillance, anti-submarine and anti-ship warfare; advanced mission systems (see under Avionics) and provisions for external stores, typical mission endurance of 10 hours. Five ordered by Singapore Navy, initial production aircraft (PH LXX; RSN 714) made its first flight on 10 December 1992, delivered 12 September 1994; two more delivered by end of 1994, remaining two in 1995.

Fokker KingBird Mk 2: Airborne early warning and airborne command/control version, with Ericsson Erieye phased-array surveillance radar, IFF interrogator and ESM among standard sensors, can search for and track multiple airborne intruders (including cruise missiles) and monitor seaborne and land-based targets; typical on-station time of 8 hours at 300 n miles (556 km; 345 miles) from base.



First production Fokker 50 Maritime Enforcer Mk 2 with containers on two of the underwing pylons, weapon carriers on the sides of the centre-fuselage and 360° radome and FLIR turret underneath the forward fuselage

1995

Fokker Sentinel Mk 2 Border surveillance and reconnaissance version, capable of more than 2,000 n miles (3,704 km, 2,301 miles) per mission, Motorola AN/APS-135(V) SLAR or Texas Instruments AN/APS-134(V)7 synthetic aperture radar (latter also with ship detection capability) plus E-O imaging system

Fokker Black Crow Mk 2 Communications/electronic intelligence version; applications include search interception, direction finding, locating, analysis and recording of radar signals and communications transmissions from airborne, shipborne and land-based sources, maximum endurance 12 hours

Details generally as Fokker 50 except as follows.

POWER PLANT The Fokker 50 Special Mission Aircraft is normally powered by PW125B engines, but PW127B engine is optional Additional centre-wing fuel tank of 2,310 litres (610 US gallons, 508 Imp gallons) capacity, and two 938 litre (248 US gallon, 206 5 Imp gallon) tanks on underwing pylons, give overall total fuel capacity of 9,322 litres (2,463 US gallons, 2,051 Imp gallons).

ACCOMMODATION: Crew of two, with folding seat for third member if required. Main cabin is fitted out as tactical compartment (for two to five operators) containing advanced avionics, galley, toilet and crew rest area. The Fokker Maritime Enforcer Mk 2 accommodates crew of eight including two pilots, tactical co-ordinator (TACCO) responsible for off-airways navigation and overall efforts of mission crew, acoustic sensor operator (ASO) to handle active and passive sonobuoys, acoustic receiver and processor display system, sensor operators (SENSO) controlling search radar and electronic surveillance subsystem, and two observers Large windows for observers at front of main cabin

SYSTEMS. Oxygen system includes individual supply for each tactical crew member Methyl bromide fire extinguishing [illegible]

AVIONICS (Maritime Enforcer Mk 2): *Comms*: Two Collins AN/ARC-21[illegible] VHF/UHF transceivers, two Collins AN/ARC-217(V) HF transceivers, interphone, crew address system

Radar: Honeywell P-650 weather radar Texas Instruments AN/APS-134(V)7 in ventral radome

Flight: Dual Bendix King VNS-41 VOR/ILS/marker beacon receivers, Bendix/King DFS-43 ADF, Collins DF 301E VHF/UHF direction-finder, Collins Tacan Dual Litton LTN-92 inertial/GPS navigation systems, dual Honeywell AZ-800 air data computers. Dual TRT AHV 530 radio altimeters; Sundstrand Mk VII low-altitude warning system

Mission. 360° search radar, as above. Fokker TSH-250(V) central tactical computer and display system on-top position indicator receiver; CDC AN/UYS-503 sonobuoy processing system with Allant M101E acoustic signal recorder and Flightline AN/ARR-502 sonobuoy signal receiver; electronic surveillance and monitoring equipment to detect radar transmissions, which can be classified and recorded and their bearings transferred to tactical display. GEC-Marconi VOO-1069 TICM II infra-red detection system (IRDS), CAE AN/ASQ-504(V) MAD

EQUIPMENT: NGL sonobuoy launchers, 60 sonobuoys in rear of cabin

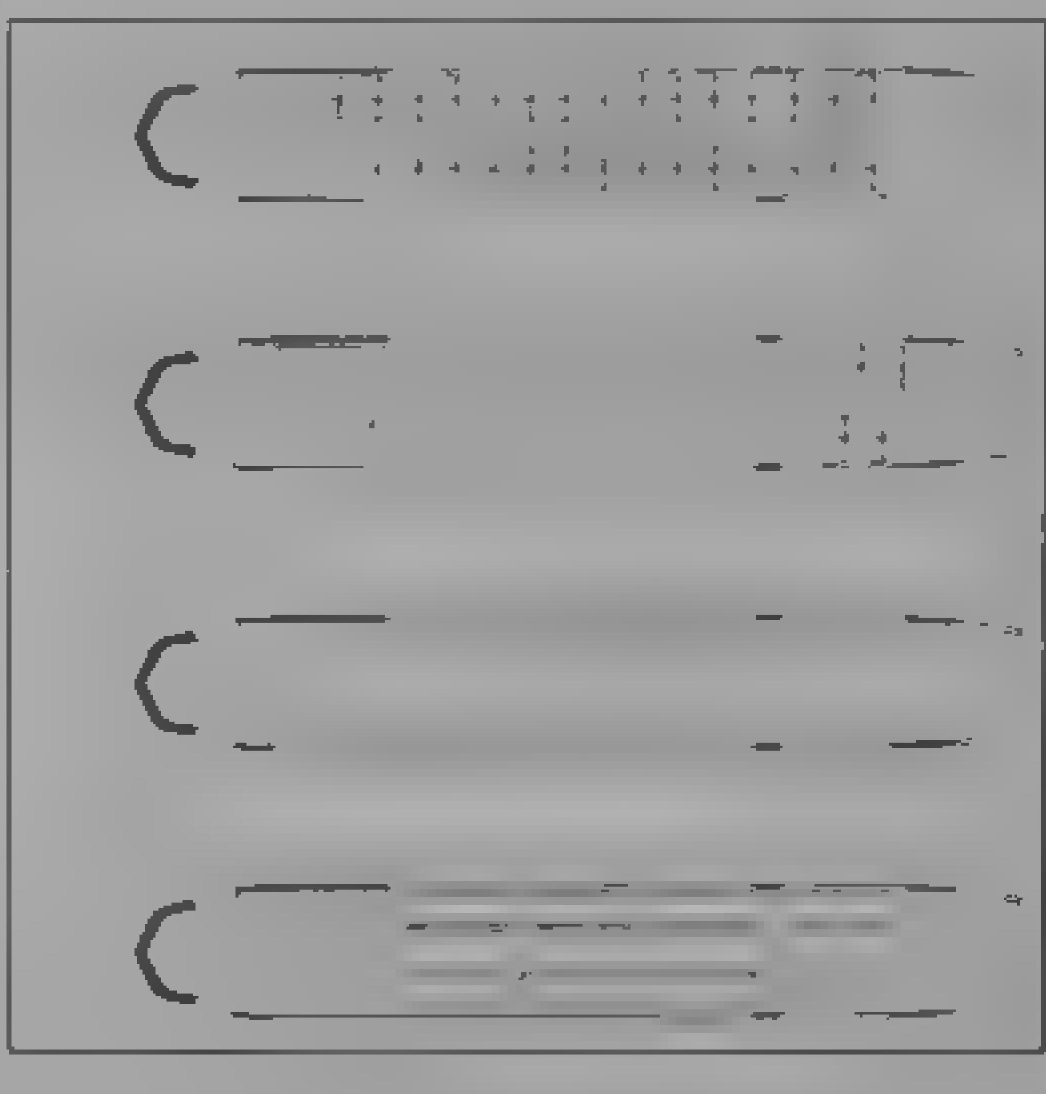
ARMAMENT (Maritime Enforcer Mk 2): Two 907 kg (2,000 lb) stores attachments on fuselage and three under each wing (capacities 295 kg, 650 lb inboard, 680 kg, 1,500 lb in centre, and 113 kg, 250 lb outboard). Typical ASW armament can include two or four Mk 44, Mk 46, Sting Ray or A244/S torpedoes and/or depth bombs, up to four AGM 84D Harpoon anti ship missiles

WEIGHTS AND LOADINGS (A Maritime Mk 2, B Maritime Enforcer Mk 2):

Operating weight empty A	13,560 kg (29,895 lb)
B	14,796 kg (32,620 lb)
Max fuel (incl pylon tanks): A	7,511 kg (16,560 lb)
Normal T-O weight A, B	20,820 kg (45,900 lb)
Max T-O weight A, B	21 545 kg (47,500 lb)
Max landing weight A, B	19 730 kg (43,500 lb)
Max zero-fuel weight A, B	18,600 kg (41,000 lb)
Max wing loading A, B	307 8 kg/m² (62 0 lb/sq ft)
Max power loading	
standard engine A, B	5 78 kg/kW (9 50 lb/shp)
optional engine A, B	5.25 kg/kW (8 64 lb/shp)

PERFORMANCE

Max operating Mach number: A, B	0 507
Normal cruising speed	
A	259 kts (480 km/h, 298 mph)
Typical search speed at 610 m (2,000 ft)	
A, B	150 kts (277 km/h, 172 mph)
Service ceiling: A, B	7,620 m (25,000 ft)
Service ceiling, OEI A	3,565 m (11,700 ft)
Runway LCN (42 per cent tyre deflection) at 15,875 kg (35,000 lb) AUW A	
rigid pavement, L 76.2 cm (30 in)	10 4
flexible pavement, h 25 4 cm (10 in)	11.4
flexible pavement, h 12 7 cm (5 in)	9 0
Runway LCN (42 per cent tyre deflection) at 20,410 kg (45,000 lb) AUW A	
rigid pavement, L 76.2 cm (30 in)	16 [illegible]
flexible pavement, h 25 4 cm (10 in)	14 8
flexible pavement, h 12 7 cm (5 in)	[illegible]
Runway CBR, unpaved soil, h 25 4 cm (10 in), 3 000 passes A	
AUW of 15 875 kg (35,000 lb)	6 2%
AUW of 20,410 kg (45,000 lb)	7 5%



Potential Fokker 60 internal configurations (top to bottom). Staff transport, logistic transport, troop transport and medical evacuation

1995

FAR 25 T-O run at S/L, AUW of 18,500 kg (40,785 lb): A	
ISA	940 m (3,084 ft)
ISA + 20°C	1,100 m (3,609 ft)
Landing distance (unfactored, ISA at S/L), landing weight of 15,000 kg (33,069 lb): A	548 m (1 800 ft)
Max radius of action with reserves for 45 min holding: A	
without pylon tanks	1 450 n miles (2,685 km, 1 668 miles)
with pylon tanks	1,700 n miles (3,148 km; 1,956 miles)
Max time on station at 5,000 ft with reserves for 45 min holding A	
without pylon tanks	11 h 30 min
with pylon tanks	14 h 20 min

UPDATED

FOKKER 60

TYPE: Twin turboprop transport; stretched version of Fokker 50.

PROGRAMME: RNethAF order for four placed February 1994 launched full development, mainly for non-airline customers; first deliveries in first half of 1996.

CURRENT VERSIONS: **Fokker 60:** Baseline aircraft *Details refer mainly to this version, but where indicated to Fokker 60 Utility*

Fokker 60 Utility: A 1 62 m (5 ft 3¾ in) stretched version of the Fokker 50 three-door configuration, normally equipped with upward-opening, starboard front large cargo door (height 1.78 m, 5 ft 10 in, width 3 05 m, 10 ft 0 in) and a heavy-duty floor; multipurpose door available as an option. Fokker 60 Utility launched February 1994. Applications include

Staff transport: As a (corporate) shuttle the Fokker 60 can carry up to 68 passengers, depending on cabin layout The aircraft is equipped with passenger seats, overhead bins (including PSUs), carpet, toilet, galley and a rear cabin wall **Logistics transport:** The Fokker 60 offers 34 4 m² (370 sq ft) floor area and is equipped with the large cargo door This door allows loading of large outsize items, including LD3 containers. Both aircraft can be equipped with a roller track and ballmat system **Convertible transport:** Both the Fokker 50 Utility and Fokker 60 Utility can be changed from a passenger layout into an all-cargo aircraft The aircraft is equipped with a removable aft cargo wall, removable overhead bins (including PSUs), passenger seats, galley and toilet. **Tactical transport.** The tactical transport version is normally equipped with the multipurpose door. The aircraft can be used for (para)troop transport, supply dropping and medical evacuation (medevac) operations For (para)troop transport and supply dropping the aircraft is equipped with seat/litter modules (Fokker 50 Utility, 48 seats, Fokker 60 Utility, 55 seats), para/supply-dropping gear and adaptations (lighting and communication). For medevac operations the aircraft is equipped with stretchers (Fokker 50 Utility, 27 stretchers, Fokker 60 Utility, 30 stretchers)

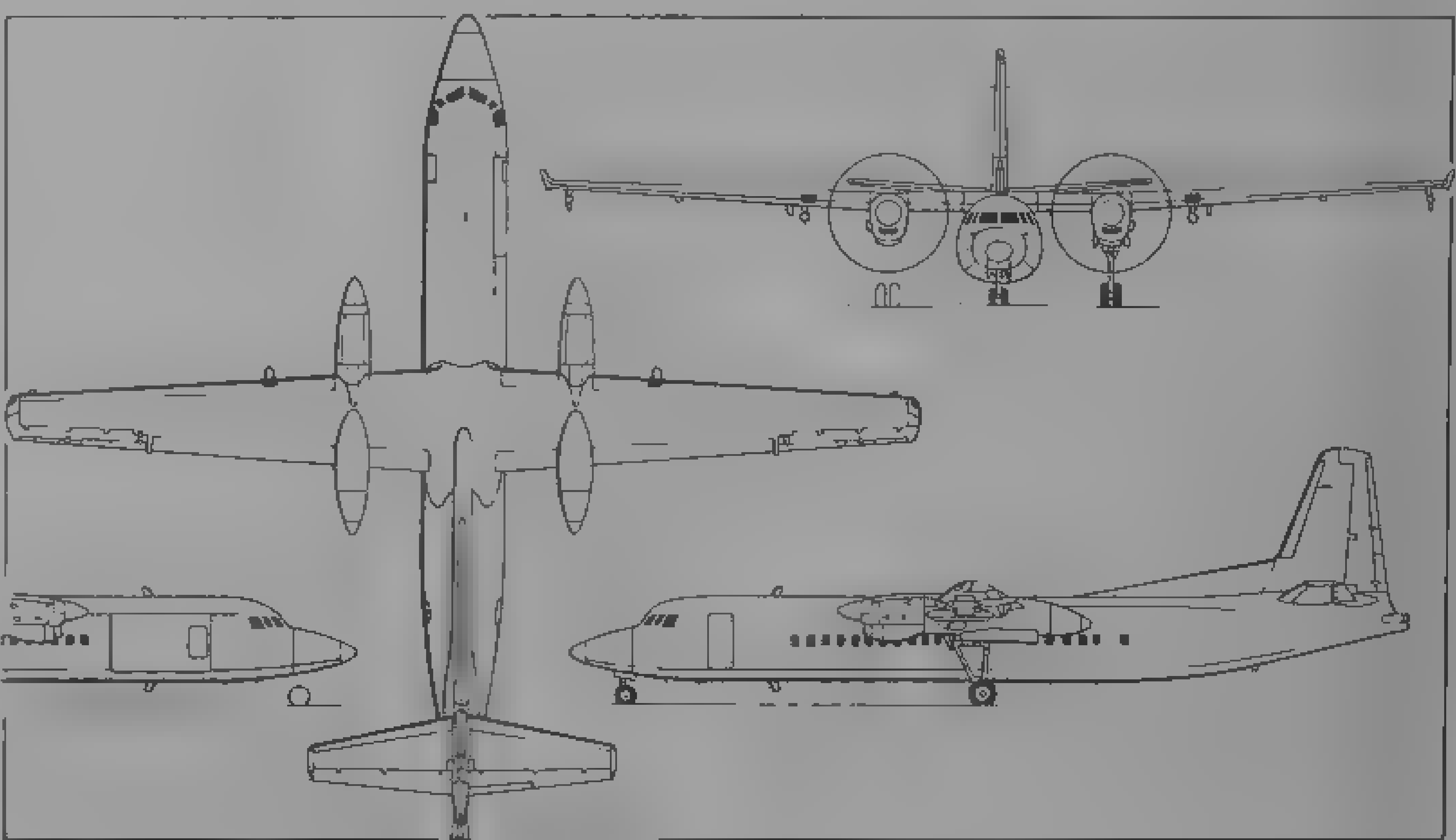
Fokker passenger transport: Passenger version for 60 passengers for official or commercial use being studied.

CUSTOMERS: RNethAF ordered four Fokker 60 Utility in February 1994 for No. 334 Squadron at Eindhoven First flight planned September 1995; initial delivery on 1 May 1996

POWER PLANT: Two 2 050 kW (2,750 shp) Pratt & Whitney Canada PW127B

DIMENSIONS, EXTERNAL: As for Fokker 50 except

Length overall	26.87 m (88 ft 2 in)
Height overall	8 34 m (27 ft 4¼ in)
Wheelbase	10 72 m (35 ft 2 in)



Fokker 60 Utility with defensive aids under wings and in the tail, plus scrap view of large door on starboard side of forward fuselage (*Jane's/Mike Keep*)

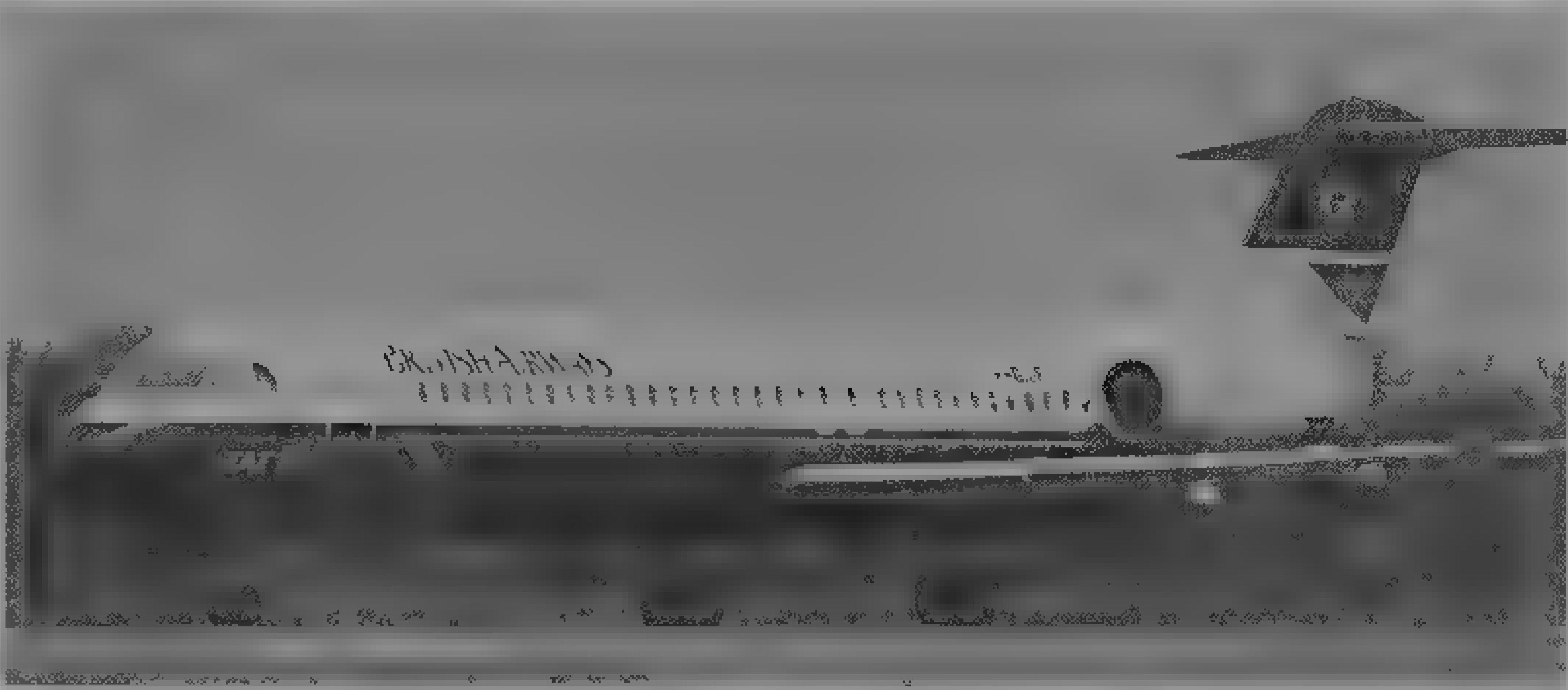
1995

DIMENSIONS, INTERNAL: As for Fokker 50 except:
Cabin, excl flight deck:
Length 17.58 m (57 ft 8 in)
Floor area (excl toilet) 36.62 m² (361.75 sq ft)
Baggage/cargo volume (standard commuter version):
Main compartment 10.94 m³ (386.30 cu ft)
Overhead bins 2.58 m³ (91.17 cu ft)
AREAS: As for Fokker 50
WEIGHTS AND LOADINGS (Fokker 60):
Typical operating weight empty 13,328 kg (29,383 lb)
Max fuel load 4,123 kg (9,090 lb)
Max payload 7,372 kg (16,252 lb)
Max ramp weight: standard 21,995 kg (48,490 lb)
optional 22,995 kg (50,695 lb)
Max T-O weight: standard 21,950 kg (48,391 lb)
optional 22,950 kg (50,596 lb)
Max landing weight 21,750 kg (47,950 lb)
Max zero-fuel weight 20,700 kg (45,653 lb)
Max wing loading:
standard 313.6 kg/m² (64.31 lb/sq ft)
optional 327.9 kg/m² (67.24 lb/sq ft)
Max power loading:
standard 5.35 kg/kW (8.80 lb/shp)
optional 5.60 kg/kW (9.20 lb/shp)
WEIGHTS AND LOADINGS (Fokker 60 Utility):
Typical operating weight empty 12,648 kg (27,884 lb)
Max fuel load: standard 4,123 kg (9,090 lb)
*optional 5,980 kg (13,184 lb)
Max payload 8,052 kg (17,751 lb)
Max ramp weight 22,955 kg (50,607 lb)
Max T-O weight 22,950 kg (50,596 lb)
Max landing weight 21,750 kg (47,950 lb)
Max zero-fuel weight 20,700 kg (45,653 lb)
Max wing loading 327.9 kg/m² (67.24 lb/sq ft)
Max power loading 5.60 kg/kW (9.20 lb/shp)
*including optional centre-wing tanks, OWE increased by 165 kg (364 lb)
PERFORMANCE:
Max operating Mach number (MMO) 0.507
Typical cruising speed 280 kts (519 km/h; 332 mph)
Typical climb speed 170 kts (315 km/h; 196 mph)
Typical descent speed 250 kts (463 km/h; 288 mph)
Max operating altitude 7,620 m (25,000 ft)
Service ceiling OEI, typical mission, AUW of 19,554 kg (43,109 lb), ISA 4,080 m (13,385 ft)
T-O field length for typical mission T-O weight at S/L, ISA, 15° flap 1,054 m (3,458 ft)
Landing field length for typical mission landing weight at S/L, ISA, 35° flap 1,118 m (3,668 ft)
Range with 60 passengers and baggage, reserves for 45 min continued cruise at long-range schedule and 87 n miles (161 km; 100 mile) diversion:
at standard max T-O weight:
high-speed procedure 1,108 n miles (2,052 km; 1,275 miles)
min fuel procedure 1,188 n miles (2,200 km; 1,367 miles)
at optional MTOW:
high-speed procedure 1,488 n miles (2,757 km; 1,712 miles)
min fuel procedure 1,596 n miles (2,956 km; 1,836 miles)
Range (Fokker 60 Utility):
60 passengers or 50 troops 1,600 n miles (2,963 km; 1,841 miles)
7,000 kg (15,432 lb) 1,050 n miles (1,944 km; 1,208 miles)
27 stretchers 1,700 n miles (3,148 km; 1,956 miles)
OPERATIONAL NOISE LEVELS:
Comply with ICAO Annex 16, Chapter 3/FAR Pt 36 Stage 3

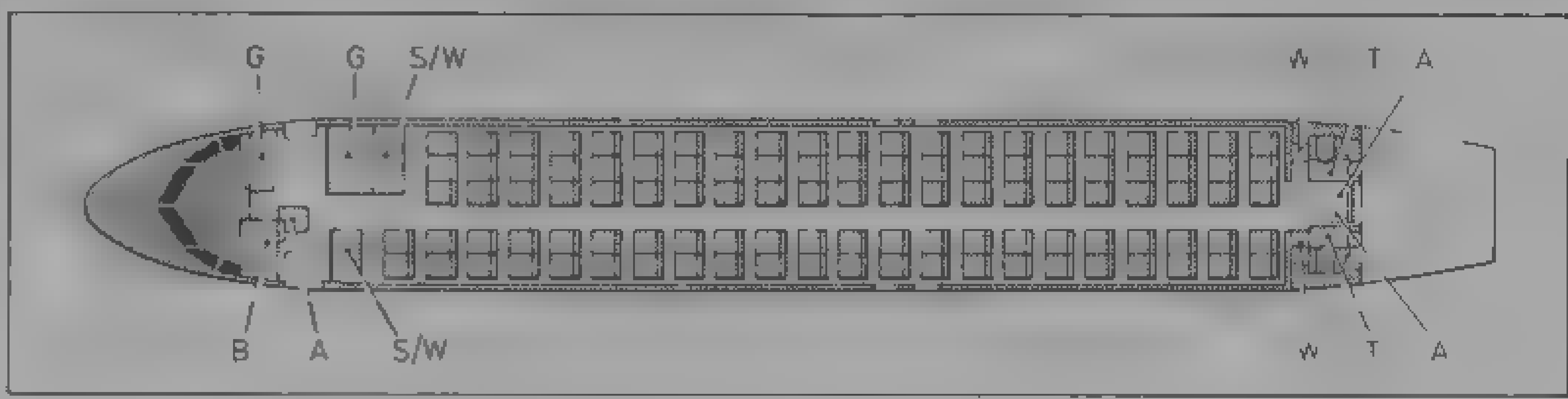
UPDATED


Computer image of Fokker 60 Utility for the Royal Netherlands Air Force

1995


Fokker 100 operated by British Airways/TAT

1995



Fokker 100 standard configuration (107 seats at 81 cm, 32 in pitch) *(Jane's/Mike Keep)*
A: attendant's seat; B: baggage; C: cargo; G: galley; S: stowage; T: toilet; W: wardrobe

1994

FOKKER 100

TYPE: Twin-turbofan short/medium haul airliner.

PROGRAMME: Announced simultaneously with Fokker 50 on 24 November 1983; derived from F28 Mk 4000, which it superseded in production; built in collaboration with Deutsche Aerospace Airbus and Shorts; first flights (PH-MKH) 30 November 1986 and (PH-MKC) 25 February 1987; complies with FAR Pt 36 Stage 3 noise requirements; Dutch RLD certification to JAR Pt 25 20 November 1987, followed by Cat IIIb autoland certificate June 1988.

First aircraft delivered to Swissair 29 February 1988; FAA type approval granted 30 May 1989; certification of version with the higher rated Tay Mk 650 (first flown on PH-MKH on 8 June 1988) received on 1 July 1989; first delivery of Tay Mk 650 version same day to USAir.

CURRENT VERSIONS: **Fokker 100**: Standard airliner; *description applies to this version.*

Fokker 100QC: Quick-change version to be manufactured as standard Fokker 100 and modified to QC specification by a subcontractor; 20 minute changeover by three-person ground crew claimed. Modifications include large (3.40 × 1.93 m; 11 ft 2 in × 6 ft 4 in) cargo door at front on port side, 11 seat pallets (interchangeable with cargo containers). Capacity in all-cargo role for five LD9/LD7 containers plus one half size container, or up to 11 LD3 containers. Maximum structural payload 11,500 kg (25,353 lb); range with typical 10,000 kg (22,046 lb) cargo load estimated at more than 1,600 n miles (2,963 km; 1,841 miles). All-passenger version seats 88 with smaller overhead bins and additional side bins.

Fokker 70: Shortened version, described separately.

Fokker Executive Jet 100: VIP/Corporate Shuttle version, extended range optionally available with belly tanks, interior to be custom-built.

CUSTOMERS: Firm orders totalled 276 Fokker 100s by June 1995, of which 250th was delivered June 1994; 111 on option by latter date.

Operators include (*leased from GPA Fokker 100, †leased form ILFC, ‡leased from TAT European Airlines): Air Inter (five), Air Ivoire (two), Air Littoral (four); Air UK (four, plus five†), American Airlines (75), Aviacsa* (four), British Airways‡ (four), British Midland (four), China Eastern Airlines (seven), Corse Mediterranee‡ (two), Deutsche BA‡ (five), Garuda Indonesia (12), Iran Air (six), Ivory Coast Government (one), Jiangsu Aviation Company (three); KLM Royal Dutch Airlines (six), Korean Air (12), Mexicana (four, plus six*), Midway Airlines (eight), Palair Macedonian (two), Pelita Air Service (one), Portugalia* (six), Royal Swazi National Airways Corporation (one); Sempati Air* (seven), Swissair (10), TABA (two), TAM Brazil (seven, plus eight*), TAT European Airlines† (2), Transwede Airways (seven), USAir (40), plus four undisclosed.

DESIGN FEATURES: Compared to F28 Mk 4000, Fokker 100 has stretched fuselage, extended and redesigned wings, Rolls-Royce Tay Mk 620 turbofans, completely new CRT and digital ARINC 700 flight deck, standard Cat IIIa automatic landing, lowest OWE/seat in its class, new cabin interior, and extensively modernised systems, considerable use of composite materials.

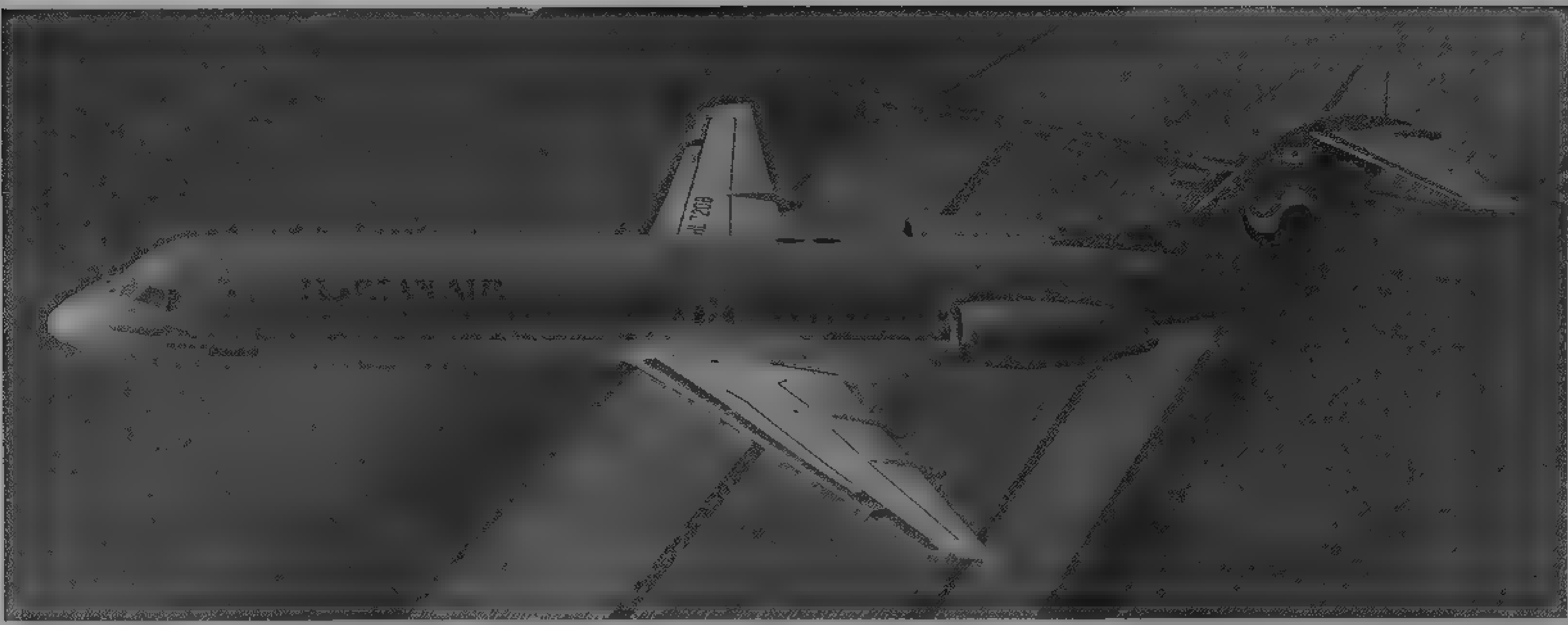
Major options include intermediate (44,450 kg; 98,000 lb) and high (45,810 kg; 101,000 lb) maximum T-O weights, higher thrust Tay Mk 650 engines, Cat IIIb autoland, higher capacity air conditioning system, forward toilet. Moving belt loading system. Polished outer skin available to customer requirement.

Fokker designed transonic wing sections, offering substantially improved aerodynamic efficiency, especially at high speed; thickness/chord ratio up to 12.3 per cent on inner panels, 9.6 per cent at tip; dihedral 2° 30'; sweepback at quarter-chord 17° 27'.

FLYING CONTROLS: Hydraulically actuated fully powered ailerons (in third mode, both ailerons driven manually with assistance of unlockable servo tabs), boosted elevators with manual back-up, and powered rudder with manual third mode; variable incidence tailplane (third mode is electric operation); double-slotted Fowler flaps with electrical alternative extension; five-panel lift dumpers in front of flaps on each wing; sideways-opening airbrakes form rear end of fuselage.

STRUCTURE: Light alloy, fail-safe, hot-bonded for 45,000-cycle crack-free life and 90,000-cycle economic repair life, except for CFRP ailerons and flaps, AFRP wing/fuselage fairing panels, honeycomb sandwich/multiple spar fin, AFRP dorsal fin, CFRP rudder, and CFRP/GFRP with Nomex core quickly detachable sandwich floor panels. Nacelles manufactured from composite materials. Daimler-Benz Aerospace Airbus builds large fuselage sections and tail section, wings by Shorts, engine nacelles and thrust reversers by Northrop Grumman.

LANDING GEAR: Hydraulically retractable tricycle type, with twin wheels on each unit. Main units, by Menasco, retract inward into wing/body fairing; nosewheels, by Dowty, retract forward; shock absorber in each unit. Goodyear tyres, size H40 × 14-19 on main units (pressure 9.38 bars



Fokker 100 twin-turbofan short/medium-range transport in the insignia of Korean Air

1995

136 lb/sq in), size 24 × 7 7-10 (pressure 6 21 bars, 90 lb/sq in) on nose unit, Loral multiple disc carbon brakes, with anti-skid system, steerable nose unit (effective angle about 76°), minimum pavement width for 180° turn, 22.2 m (72 ft 10 in)

POWER PLANT: Two 61.6 kN (13,850 lb st) Rolls-Royce Tay Mk 620 turbofans, fitted with thrust reversers and pylon-mounted on sides of rear fuselage; option of 67 2 kN (15,100 lb st) Tay Mk 650 turbofans. Fuel in 4,820 litre (1 274 US gallon; 1,060 Imp gallon) main tank in each wing as standard From 1993, at same time as 45,810 kg (101,000 lb) MTOW option, an integral centre-wing tank with capacity of 3,725 litres (984 US gallons, 819 Imp gallons), became standard, and replaced original bag tanks, bringing total capacity to 13,365 litres (3,531 US gallons 2,940 Imp gallons) Refuelling point under starboard wing, near wing/fuselage belly fairing. Oil capacity (two engines) 41 kg (90 lb)

ACCOMMODATION: Crew of two on flight deck, three cabin attendants Standard accommodation for 107 passengers, in five-abreast seating at 81 cm (32 in) pitch Optional layouts include 12 first class seats (four-abreast) at 91 cm (36 in) pitch plus 85 economy class (five-abreast) at 81 cm (32 in), 55 business class at 88 cm (34 in) plus 50 economy class, 109 all economy class at 79/81 cm (31/32 in), all at five-abreast. Standard layout includes two galleys two toilets, two wardrobes, two other stowages/wardrobe compartments, offering a total of 8.15 m³ (288 cu ft) of carry on baggage space, including overhead bins Oxygen system for crew and passengers. Outward- and forward opening passenger door at front of cabin on port side. Outward and forward-opening service/emergency door opposite on starboard side. Optional downward-opening passenger door with integral stairs Two overwing emergency exits (inward-opening plug type) on each side. Two underfloor baggage/cargo holds (one forward of wing, one aft), with three identical, upward-opening cargo doors on starboard side. Option for a moving belt loading system

SYSTEMS. AiResearch air conditioning and pressurisation system (maximum differential 0.52 bar; 7 45 lb/sq in). Two fully independent hydraulic systems for actuation of flight control surfaces, landing gear, brakes and nosewheel steering AiResearch pneumatic system, Sundstrand integrated drive generator electrical supply system. All micro-switches now replaced by proximity switches AiResearch thermal anti-icing system for wings and tail unit Electric anti icing of flight deck windows, pitot tubes, static vents angle of attack vanes and ice detector probe

AlliedSignal GTCP36-150RR APU standard, with digital control, can be operated up to 10,670 m (35,000 ft)

AVIONICS. *Comms.* Standard equipment includes dual VHF com (ARINC 716) with third optional single ATC transponder (ARINC 718) with second optional, cockpit voice recorder (ARINC 557), digitally controlled audio management system (ARINC 736), PA system (ARINC 715) music reproducer Dual HF com (ARINC 719) optional Selcal (ARINC 714) optional, datalink (optional)

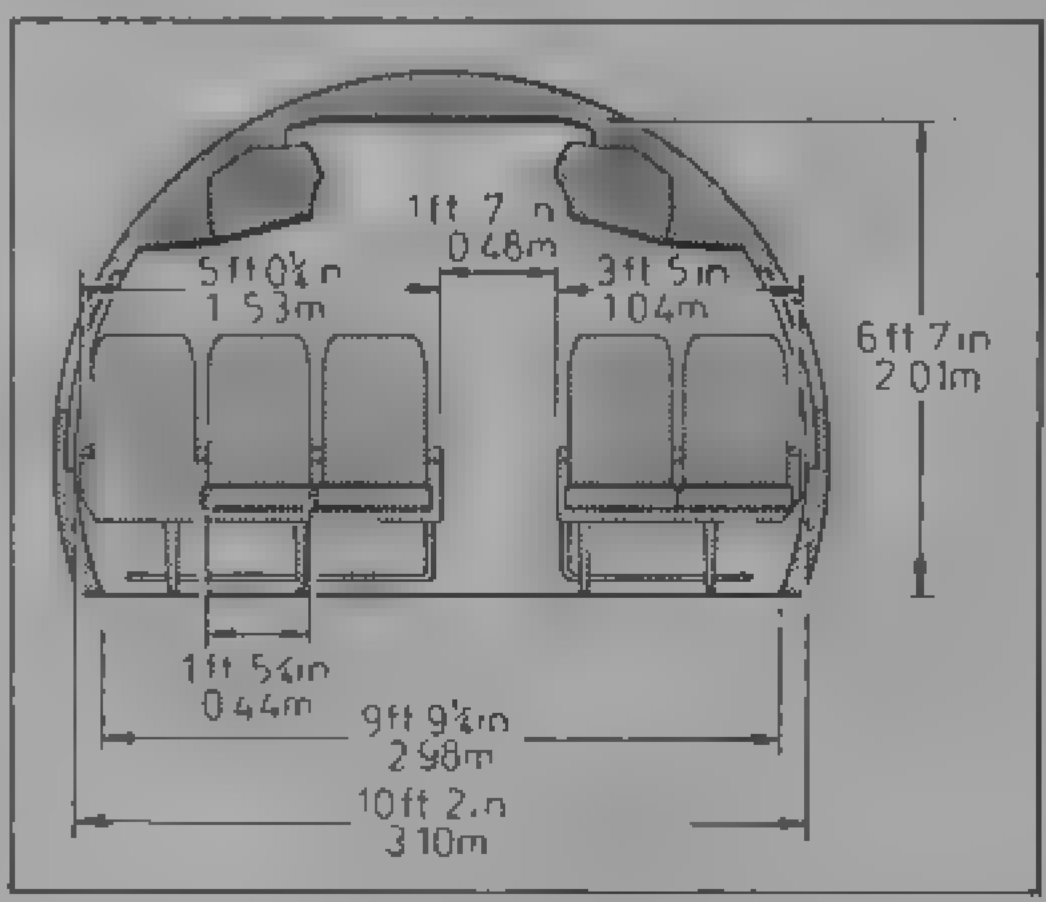
Radar ARINC 708 weather radar

Flight: Standard navigation equipment includes dual VOR with marker beacon receiver (ARINC 711); dual ILS (ARINC 710); dual DME (ARINC 709); single ADF (ARINC 712); dual radio altimeters (ARINC 707) Collins digital aircraft flight control and augmentation system (AFCAS) for Cat. IIIa automatic landing plus dual-channel full flight regime autothrottle system, dual Honeywell flight management system (ARINC 702); triple AHRS (ARINC 705); dual digital air data systems (ARINC 706); digital flight acquisition unit (ARINC 717); flight data recorder (ARINC 717), ground proximity warning system (ARINC 723) flight warning computer system (ARINC 726) with full flight envelope protection Options include aircraft condition monitoring system (ARINC 717); ACARS (ARINC 724); TCAS (ARINC 735), wind-shear warning system; Cat. IIIb autoland capability; and noise abatement profile addition to AFCS

Instrumentation. Collins EFIS electronic flight instrument system with primary flight display (PFD) for each pilot, and multifunction display system (MFDS), consisting of two CRTs on centre flight instrument display panel, PFDs and MFDSs identical in size; dark cockpit philosophy emphasised in every system

DIMENSIONS, EXTERNAL

Wing span	28 08 m (92 ft 1½ in)
Wing chord: at root	5 28 m (17 ft 4 in)
at tip	1 26 m (4 ft 1½ in)
Wing aspect ratio	8 43
Length overall	35 53 m (116 ft 6¾ in)
Fuselage: Length	32.50 m (106 ft 7½ in)
Max diameter	3 30 m (10 ft 10 in)
Height overall	8 51 m (27 ft 10½ in)
Tailplane span	10.04 m (32 ft 11¼ in)
Wheel track (c/l of shock struts)	5 04 m (16 ft 6½ in)
Wheelbase	14 01 m (45 ft 11½ in)



Cabin cross-section of standard Fokker 100

1994

Passenger door (fwd, port): Height	1.82 m (6 ft 1 in)
Width	0.78 m (2 ft 6¾ in)
Service door (fwd, stbd): Height	1 30 m (4 ft 3 in)
Width	0 63 m (2 ft 1 in)
Cargo compartment doors (fwd and rear, stbd)	
Height (each)	1 43 m (4 ft 8¼ in)
Width (each)	1 44 m (4 ft 8¾ in)
Height to sill (MTOW)	
fwd hold, fwd door	1 20 m (3 ft 10¾ in)
fwd hold, rear door	1 27 m (4 ft 2¼ in)
aft hold door	1 36 m (4 ft 6 in)
Overwing emergency exits (four)	
Height (each)	0 91 m (3 ft 0 in)
Width (each)	0 51 m (1 ft 8 in)

DIMENSIONS, INTERNAL

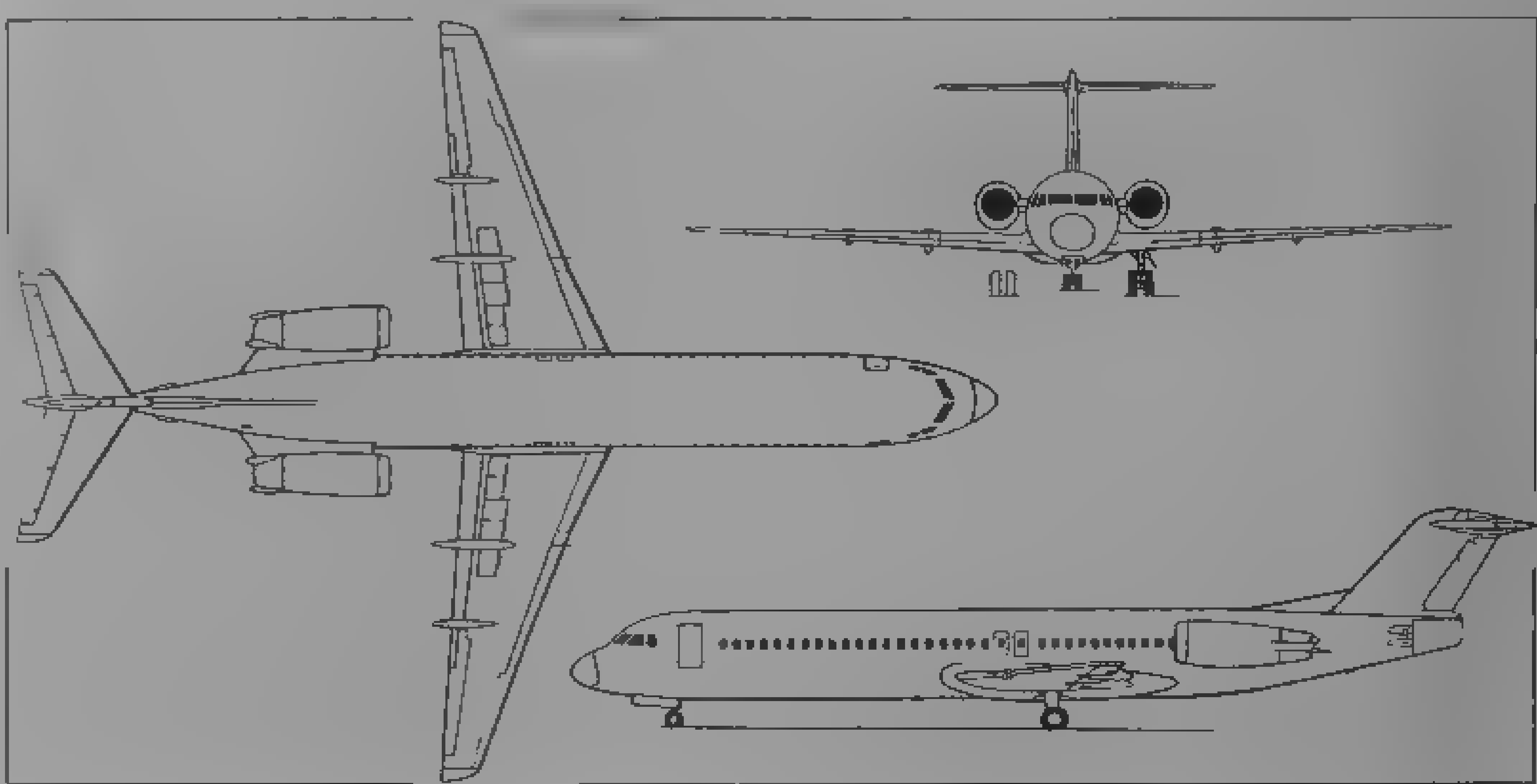
Cabin, excl flight deck: Length	21 19 m (69 ft 6¼ in)
Max length of seating area	18.80 m (61 ft 8¼ in)
Max width	3 10 m (10 ft 2 in)
Width at floor	2 89 m (9 ft 5¾ in)
Max height	2 01 m (6 ft 7¼ in)
Max floor area	58.48 m² (629 5 sq ft)
Max volume	107 58 m³ (3,799 cu ft)
Overhead stowage bins (total)	5 15 m³ (182.0 cu ft)
Additional baggage space (total)	3 00 m³ (106 cu ft)
Underfloor compartment volume	
fwd	9 48 m³ (335 cu ft)
aft	7.24 m³ (256 cu ft)

AREAS

Wings, gross	93 50 m² (1,006.4 sq ft)
Ailerons, total	3.53 m² (37 98 sq ft)
Trailing-edge flaps (total)	17 08 m² (183 85 sq ft)
Lift dumpers, total	5 30 m² (57 05 sq ft)
Fins, excl rudder	10 00 m² (107 64 sq ft)
Rudder	2 30 m² (24.76 sq ft)
Tailplane, excl elevators	17.76 m² (191.20 sq ft)
Elevators, total	3 96 m² (42 63 sq ft)
Airbrakes, total	3.62 m² (38 97 sq ft)

WEIGHTS AND LOADINGS (A: standard weights, Tay 620, B intermediate gross weight and Tay 650, C: high gross weight and Tay 650)

Typical operating weight empty	
A	24,593 kg (54,217 lb)
B	24,727 kg (54,514 lb)
C	24,747 kg (54,558 lb)



Fokker 100 short/medium-haul transport (two Rolls-Royce Tay turbofans) *(Jane's/Dennis Punnett)*

1984

Max payload (weight limited): A	[illegible]
B	[illegible]
C	[illegible]
Max ramp weight: A	[illegible]
B	[illegible]
C	46,040 kg (101,500 lb)
Max T-O weight: A	43,090 kg (95,000 lb)
B	44,450 kg (98,000 lb)
C	45,810 kg (101,000 lb)
Max landing weight: A	38,780 kg (85,500 lb)
B, C	39,915 kg (88,000 lb)
Max zero-fuel weight: A	35,830 kg (78,990 lb)
B, C	36,740 kg (81,000 lb)
Max wing loading: A	460.8 kg/m² (94.39 lb/sq ft)
B	475.4 kg/m² (97.37 lb/sq ft)
C	489.9 kg/m² (100.35 lb/sq ft)
Max power loading: A	350.0 kg/kN (3.43 lb/lb st)
B	331 kg/kN (3.25 lb/lb st)
C	341 kg/kN (3.34 lb/lb st)

PERFORMANCE (A, B and C as in Weights and Loadings):

Max operating Mach number	0.77
Max operating speed at 7,770 m (25,500 ft), ISA: A, B, C	462 kts (856 km/h; 532 mph)
Approach speed at max landing weight: A	128 kts (237 km/h; 147 mph)
B, C	130 kts (241 km/h; 150 mph)
Service ceiling	10,670 m (35,000 ft)
FAR T-O field length at S/L, ISA, at max T-O weight: A	1,855 m (6,086 ft)
B	1,720 m (5,643 ft)
C	1,825 m (5,988 ft)
FAR landing field length at S/L, ISA, at max landing weight: A	1,320 m (4,330 ft)
B, C	1,350 m (4,420 ft)
Range with 107 passengers and baggage: A	1,290 n miles (2,389 km; 1,484 miles)
B	1,550 n miles (2,870 km; 1,784 miles)
C	1,680 n miles (3,111 km; 1,933 miles)

OPERATIONAL NOISE LEVELS: Comply with FAR Pt 36 Stage 3, ICAO Annex 16 Chapter 3, Washington National night time limits and Orange County (SNA) Class E exempt. (A, B and C as for Weights and Loadings):

T-O, flyover, actual: A	83.4 EPNdB
B	81.8 EPNdB
C	82.7 EPNdB
T-O, flyover, margin to Pt 36, St 3: A	−5.6 EPNdB
B	−7.2 EPNdB
C	−6.3 EPNdB
T-O, sideline, actual: A	89.3 EPNdB
B	91.7 EPNdB
C	91.6 EPNdB
T-O, sideline, margin to Pt 36, St 3: A	−3.4 EPNdB
B	−3.2 EPNdB
C	[illegible]
Approach, actual: A	[illegible]
B	[illegible]
C	93.0 EPNdB
Approach, margin to Pt 36, St 3: A	−5.6 EPNdB
B	−5.8 EPNdB
C	−5.9 EPNdB

UPDATED

FOKKER 70

TYPE: Twin turbofan short/medium-haul airliner.

PROGRAMME: Authorisation to proceed given November 1992, programme launched June 1993 with orders for 15 aircraft (see Customers); fuselage structure derived from Fokker 100 by removing two fuselage plugs (one forward and one aft of wing), assembled on same production line as Fokker 100; built in collaboration with Daimler-Benz Aerospace Airbus (fuselage sections) and Shorts (wings); modification of second Fokker 100 prototype into Fokker 70 configuration started 9 October 1992, first flight (PH-MKC) 2 April 1993, final assembly of first production aircraft started February 1994, first flight (PH-MKS) 12 July 1994, RLD and FAA certification granted 14 October 1994; first delivery (N322K ex PH-MKS to Ford Motor Company) 25 October 1994; UK CAA certification April 1995.

CURRENT VERSIONS: **Fokker 70**: Standard airliner; *description applies to this version.*

Fokker 70A: Dedicated US version for regional operators, with an additional main deck cargo hold limiting seating capacity to 70 seats; MZFW and MLW 1,361 kg (3,000 lb) lower than standard weights.

Fokker Executive Jet 70: VIP/corporate shuttle version, extended range available optionally with belly tanks, interior custom built. First delivery 25 October 1994 to Ford Motor Company.

Fokker 70ER: Long-range executive version with increased fuel capacity extending range to 3,237 n miles (6,000 km; 3,728 miles); first order 1994 from Kenyan government, deliveries from early 1996.

CUSTOMERS: Firm orders totalled 54 by June 1995. Customers comprise Air Littoral (five), Alitalia (15, for operation by regional carrier Avianova); Austrian Airlines (four); British Midland (five); Ford Motor Company (two executive); MALEV Hungarian Airlines (three leased from ILFC); Mesa (America West Express) (two); Netherlands government (one); Pelita Air Service (five); Sempati Air (10); SilkAir (two); Tyrolean Airways (three); Kenyan government (one); plus one undisclosed.

DESIGN FEATURES: Fuselage 4.62 m (15 ft 2 in) shorter than Fokker 100; one pair of overwing emergency exits removed. Rolls-Royce Tay Mk 620 turbofans; downward opening passenger door with integral stairs, digital ARINC 700 CRT flight deck, Cat. II capability.

Major options include intermediate (38,100 kg; 84,000 lb) and high (39,915 kg; 88,000 lb) maximum T-O weights, forward-opening passenger door, Cat. IIIa autoland capability, integral centre-wing tank, second rear toilet, forward toilet. Polished outer skin available to customer request.

Fokker 70 features Fokker 100's transonic wing, offering substantially improved aerodynamic efficiency, especially at high speed; thickness/chord ratio up to 12.3 per cent on inner panels, 9.6 per cent at tip; dihedral 2° 30′; sweepback at quarter-chord 17° 27′.

FLYING CONTROLS: As Fokker 100. Full-time autothrottle; autopilot protection of minimum speed, maximum alpha and maximum speed.

STRUCTURE: As Fokker 100. Deutsche Aerospace Airbus builds large fuselage sections and tail section, Shorts the wings, Northrop Grumman is subcontractor for engine nacelles and thrust reversers.

LANDING GEAR: Dunlop tyres size H40 × 14-19 on main units (pressure 9.1 bars; 132 lb/sq in), size 24 × 7.7-10 on nose unit (pressure 6.34 bars; 92 lb/sq in); brakes applied on alternate pairs of wheels unless pedals fully depressed; minimum pavement width for 180° turn: 18.87 m (61 ft 10 in); steering unlocks after nosewheel is deflected more than 76°, tiller used while taxying and rudder pedals during take-off/landing.

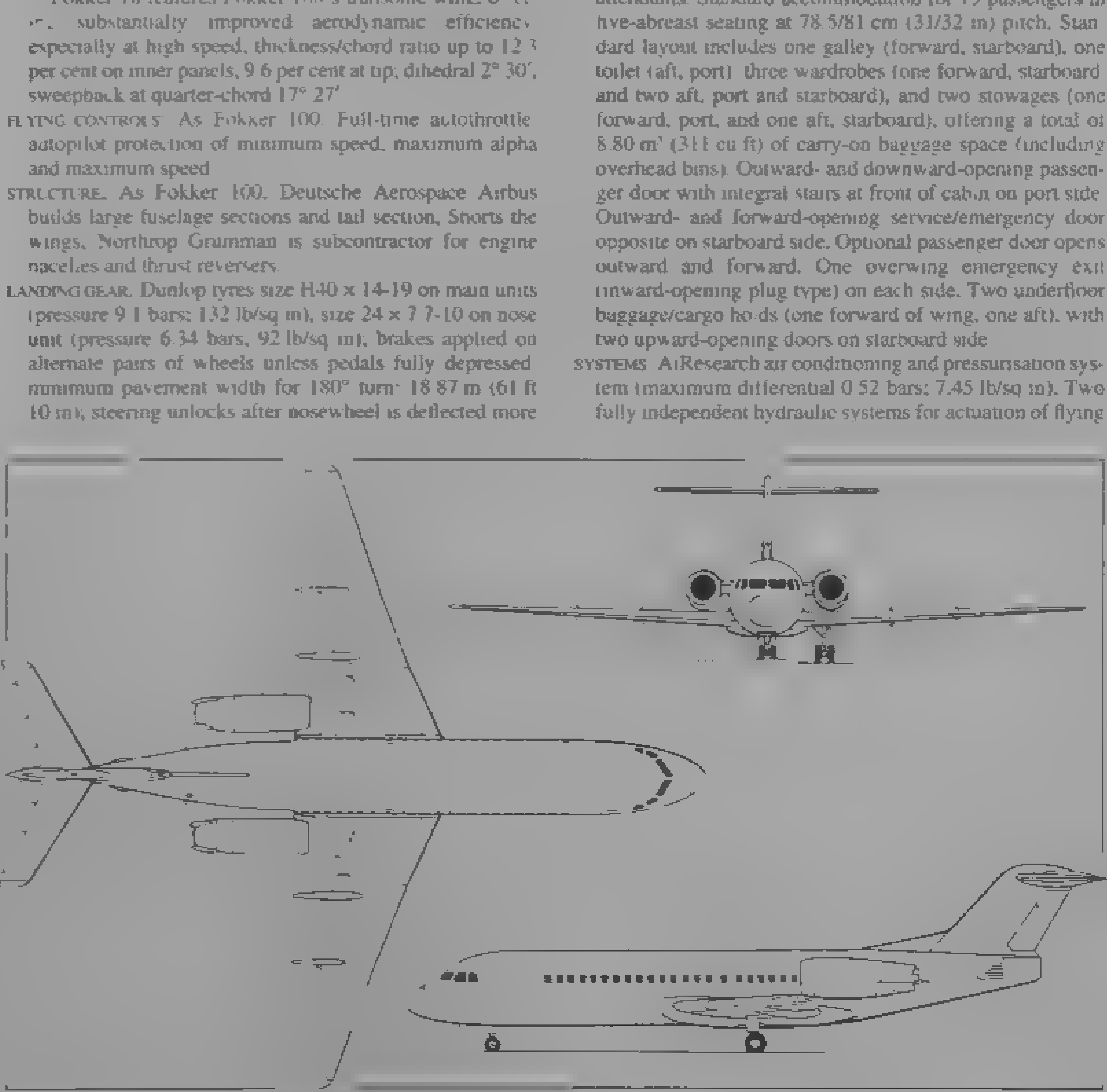
POWER PLANT: Two 61.6 kN (13,850 lb st) Rolls-Royce Tay Mk 620 turbofans, fitted with thrust reversers and pylon-mounted on sides of rear fuselage. Fuel in 4,820 litre (1,274 US gallon; 1,060 Imp gallon) main tank in each wing as standard. Optional integral centre-wing tank of 3,725 litres (984 US gallons; 819 Imp gallons) brings total capacity to 13,365 litres (3,531 US gallons; 2,940 Imp gallons). Refuelling point under starboard wing, near wing/fuselage belly fairing. Oil capacity (two engines) 41 kg (90 lb).

ACCOMMODATION: Crew of two on flight deck, two cabin attendants. Standard accommodation for 79 passengers in five-abreast seating at 78.5/81 cm (31/32 in) pitch. Standard layout includes one galley (forward, starboard), one toilet (aft, port), three wardrobes (one forward, starboard and two aft, port and starboard), and two stowages (one forward, port, and one aft, starboard), offering a total of 8.80 m³ (311 cu ft) of carry-on baggage space (including overhead bins). Outward- and downward-opening passenger door with integral stairs at front of cabin on port side. Outward- and forward-opening service/emergency door opposite on starboard side. Optional passenger door opens outward and forward. One overwing emergency exit (inward-opening plug type) on each side. Two underfloor baggage/cargo holds (one forward of wing, one aft), with two upward-opening doors on starboard side.

SYSTEMS: AiResearch air conditioning and pressurisation system (maximum differential 0.52 bars; 7.45 lb/sq in). Two fully independent hydraulic systems for actuation of flying

Fokker 100 flight deck showing large-screen EFIS, control systems displays and two flight management control and display panels on centre console. Autopilot controls are just beneath the glareshield

1994



Fokker 70, shortened version of the Fokker 100 (*Jane's/Dennis Punnett*)

1994

First production Fokker 70, an Executive Jet model for Ford Motor Company

1995

First Fokker 70 twin-turbofan short/medium-haul airliner to be delivered to a commercial operator, April 1995

1995

control surfaces, landing gear, brakes and nosewheel steering. AiResearch pneumatic system. Sundstrand integrated drive generator electrical supply system. All microswitches replaced by proximity switches for higher reliability. Oxygen system for flight crew and passengers. AiResearch thermal anti-icing system for wings and tail unit. Electric anti-icing of flight deck windows, pitot tubes, static vents, angle of attack vanes and ice detector probe.

AlliedSignal GTCP36-150RR APU standard, with digital control, can be operated up to 10,670 m (36,000 ft).

AVIONICS: *Comms*: Standard equipment includes dual VHF com (ARINC 716) with third optional, single ATC transponder (ARINC 718) with second optional, cockpit voice recorder (ARINC 557), digitally controlled audio management system (ARINC 736), PA system (ARINC 715), music reproducer. Options include single or dual HF com (ARINC 719), Selcal (ARINC 714); and data link.

Radar: ARINC 708 weather radar.

Flight: Standard equipment includes dual VOR with marker beacon receiver (ARINC 711), dual ILS (ARINC 710), dual DME (ARINC 709), single ADF (ARINC 712), dual radio altimeters (ARINC 707) with third optional, Collins digital aircraft flight control and augmentation system (AFCAS) for Cat II automatic landing, plus dual channel full flight regime autothrottle system, dual AHRS + YRS (ARINC 705), digital flight acquisition unit (ARINC 717), flight data recorder (ARINC 717); ground proximity warning system (ARINC 723); and flight warning computer system (ARINC 726) with full flight envelope protection. Options include dual Honeywell flight management system (ARINC 702), aircraft condition monitoring system (ARINC 717), ACARS (ARINC 724), TCAS (ARINC 735), windshear warning system, Cat IIIa autoland system, single LNAV; and noise abatement profile addition to AFCS.

Instrumentation: Collins EFIS electronic flight instrument system with primary flight display (PFD) for each pilot, and multifunction display system (MFDS), consisting of two CRTs on centre flight instrument display panel, PFDs and MFDSs identical in size, dark cockpit philosophy emphasised in every system.

DIMENSIONS, EXTERNAL: As for Fokker 100 except:

Length overall	30.91 m (101 ft 4¾ in)
Fuselage: Length	27.88 m (91 ft 5½ in)
Wheelbase	11.54 m (37 ft 10½ in)
Passenger door (fwd, port): Height	1.91 m (6 ft 3¼ in)
Width	0.86 m (2 ft 9¾ in)
Cargo compartment door (fwd)	
Height	1.43 m (4 ft 8¼ in)
Width	1.44 m (4 ft 8¾ in)
Cargo compartment door (aft)	
Height	1.22 m (4 ft 0 in)
Width	0.97 m (3 ft 2¼ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	16.57 m (54 ft 4¼ in)
Max length of seating area	13.31 m (43 ft 8 in)
Max width	3.10 m (10 ft 2 in)
Max width at floor	2.89 m (9 ft 5½ in)
Max floor area	45.07 m² (485 sq ft)
Max volume	84.02 m³ (2,967 cu ft)
Overhead stowage bins (total)	3.77 m³ (133 cu ft)
Additional baggage space	5.03 m³ (178 cu ft)
Fwd cargo hold	8.11 m³ (286 cu ft)
Aft cargo hold	4.64 m³ (164 cu ft)

AREAS: As for Fokker 100

WEIGHTS AND LOADINGS (A: standard weights and fuel capacity, B: intermediate gross weight and optional fuel capacity, C: high gross weight and optional fuel capacity; all with Tay 620):

Typical operating weight empty	22,784 kg (50,230 lb)
Max payload (weight limited): A	9,190 kg (20,260 lb)
B	9,870 kg (21,760 lb)
C	10,780 kg (23,766 lb)
Max ramp weight: A	36,965 kg (81,500 lb)
B	38,325 kg (84,500 lb)
C	40,140 kg (88,500 lb)
Max T-O weight: A	36,740 kg (81,000 lb)
B	38,100 kg (84,000 lb)
C	39,915 kg (88,000 lb)
Max landing weight: A (normal)	34,020 kg (75,000 lb)
A (optional), B (normal)	35,830 kg (79,000 lb)
B (optional), C	36,740 kg (81,000 lb)
Max zero-fuel weight: A	31,975 kg (71,500 lb)
B	32,655 kg (72,000 lb)
C	33,365 kg (74,000 lb)
Max wing loading: A	392.9 kg/m² (80.48 lb/sq ft)
B	407.5 kg/m² (83.47 lb/sq ft)
C	426.9 kg/m² (87.44 lb/sq ft)
Max power loading: A	298.2 kg/kN (2.92 lb/lb st)
B	309.3 kg/kN (3.03 lb/lb st)
C	324.0 kg/kN (3.18 lb/lb st)

PERFORMANCE (A, B, C as in Weights and Loadings):

Max operating Mach number	0.77
Max operating speed at 7,770 m (25,500 ft), ISA	
A, B, C	462 kts (856 km/h; 532 mph)
Approach speed at max landing weight	
A	118 kts (219 km/h; 136 mph)
B	121 kts (224 km/h; 139 mph)
C	122 kts (226 km/h; 140 mph)
Service ceiling	10,670 m (35,000 ft)
T-O field length at S/L, ISA, at max T-O weight	
A	1,391 m (4,564 ft)
B	1,469 m (4,820 ft)
C	1,573 m (5,161 ft)
Landing field length at S/L, ISA, at max landing weight	
A	1,208 m (3,963 ft)
B	1,251 m (4,106 ft)
C	1,274 m (4,180 ft)
Range with 79 passengers and baggage	
A	1,080 n miles (2,000 km; 1,243 miles)
B	1,415 n miles (2,620 km; 1,628 miles)
C	1,840 n miles (3,407 km; 2,117 miles)

OPERATIONAL NOISE LEVELS: Comply with FAR Pt 36 Stage 3, ICAO Annex 16 Chapter 3 (A, B, C as in Weights and Loadings) (preliminary estimates):

T-O (flyover): A	78.9 EPNdB
B	79.9 EPNdB
C	81.2 EPNdB
T-O (sideline): A	89.9 EPNdB
B	89.9 EPNdB
C	89.6 EPNdB
Approach: A	91.9 EPNdB
B	92.4 EPNdB
C	92.6 EPNdB

UPDATED

FOKKER 130

Development of this stretched Fokker 100 was suspended in 1994 and consideration given to the alternative 140-seat FA-X ('Experimental'). By mid-1995, Fokker (with DASA) in preliminary talks with China and South Korea on planned 120-seat jet transport, although also seeking to join similar European consortium if Far East project fails to materialise.

UPDATED

'Jetline Interior' of Fokker 70 in five-abreast configuration

1995

NEW ZEALAND

PAC

PACIFIC AEROSPACE CORPORATION LIMITED

Private Bag HN 3027, Hamilton Airport, Hamilton
Telephone: 64 (7) 843 6144
Fax: 64 (7) 843 6134
CEO: David Eagles
MARKETING MANAGER: John Scott
SALES MANAGER: Alan Thoresen

Pacific Aerospace Corporation formed 1982 following acquisition of assets and undertakings of New Zealand Aerospace Industries, now wholly owned by AeroSpace Technologies of Australia (75.1 per cent) and Lockheed Martin USA (24.9 per cent). Operating as a subsidiary of ASTA, PAC maintains production and support facilities for its own aircraft, the CT4 Airtrainer series, Fletcher FU24 series and Cresco 08-600 and 08-750. Manufacturing facility also produces items for Boeing 747/777, Airbus A330/340, McDonnell Douglas MD-11, Aermacchi MB-326, GAF Nomad and Jindivik aerial target.

UPDATED

Cresco 08-750 multirole aircraft (P&WC PT6A-34AG turboprop)

1994

PAC FLETCHER FU24-954

TYPE: Agricultural and general purpose aircraft.

PROGRAMME: First flight of US built FU24 prototype July 1954, first flight of first US production aircraft five months later; type certificate granted 22 July 1955, all manufacturing and sales rights transferred to New Zealand 1964, factory refurbishment/upgrade programme offered by PAC for earlier FU24 series aircraft. No further sales since 1992 but aircraft remains available.

CURRENT VERSIONS: **FU24-954**: Current standard model.

CUSTOMERS: Total of 286 FU24 series aircraft built by 1983, returned to production in 1989 to build six, including five for Thai Ministry of Agriculture, further batch of five for Syrian Ministry of Agriculture early 1992, final aircraft (ZK-FZN) flown June 1992. Total 297 produced, comprising 204 for New Zealand customers, 77 for Australia, five each for Pakistan, Syria and Thailand, and one for Turkey. *Abbreviated data follow, full details in 1994-95 and earlier Jane's*

DESIGN FEATURES: Primary configuration as agricultural aircraft, with appropriate hopper base, can also be used for firefighting.

STRUCTURE: Conventional light alloy, two-spar wing, cockpit area stressed for 25 g impact.

LANDING GEAR: Non-retractable tricycle type, steerable nosewheel.

POWER PLANT: One 298 kW (400 hp) Textron Lycoming IO-720-A1A or A1B flat-eight engine.

ACCOMMODATION: Two-seat cockpit with sliding canopy. 1,211 litre (320 US gallon, 266 Imp gallon) liquid or 1 066 kg (2,350 lb) dry hopper.

DIMENSIONS, EXTERNAL:
Wing span 12.81 m (42 ft 0 in)
Length overall 9.70 m (31 ft 10 in)
Height overall 2.84 m (9 ft 4 in)

AREAS:
Wings, gross 27.31 m² (294.0 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 1,188 kg (2,620 lb)
Max disposable load (Agricultural) 1 275 kg (2,810 lb)
Normal max T-O weight 2 204 kg (4,860 lb)
Max Agricultural T-O weight 2,463 kg (5,430 lb)

PERFORMANCE (at Normal max T-O weight):
Never-exceed speed (VNE) 143 kts (265 km/h, 165 mph)
Max level speed at S/L 126 kts (233 km/h, 145 mph)
Max cruising speed (75% power) 113 kts (209 km/h, 130 mph)
Max rate of climb at S/L 264 m (805 ft)/min
T-O run 244 m (800 ft)
T-O to 15 m (50 ft) 500 m (1,640 ft)
Landing from 15 m (50 ft) 390 m (1 280 ft)
Landing run 207 m (680 ft)

UPDATED

PAC CRESCO

TYPE: Turboprop-powered agricultural and multirole aircraft.

PROGRAMME: Design began 1977, first flight of prototype (ZK-LTP) 28 February 1979, first flight of production aircraft early 1980; entered service January 1982. First flight of PT6A-34AG version (ZK-TMN, c/n 10) 18 November 1992. Out of production, but available to order. *Abbreviated data follow; full details in 1994-95 and earlier Jane's*

CURRENT VERSIONS: **Cresco 08-600**: Initial version, with AlliedSignal LTP 101-700A-1A turboprop, flat rated at 447 kW (599 shp). Remains available.

Cresco 08-750: With higher powered PT6A-34AG engine, launched 1992 (first delivery 23 December) as 08-600-34AG.

CUSTOMERS: Nine 08-600s (six for New Zealand operators, three for Bangladesh) completed by January 1994, two 08-750s built for Taumaranui Aerial Co-operative (1992) and Farmers Air (completed October 1994), no further orders.

DESIGN FEATURES: Turboprop development of FU24, approximately 60 per cent commonality of components with FU24, but markedly different in many other respects: larger hopper (capacity 1,847 litres, 488 US gallons, 406 Imp gallons).

POWER PLANT (08-750): One 559 kW (750 shp) Pratt & Whitney Canada PT6A-34AG turboprop. Dual flush side intakes with reusable air filters. Four integral fuel tanks in wing centre-section, total capacity 545.5 litres (144 US gallons, 120 Imp gallons). Two refuelling points in upper surface of each wing. Oil capacity 5.7 litres (1.5 US gallons, 1.25 Imp gallons). Chin-mounted engine air intake fitted with Centrisep filter panel.

DIMENSIONS, EXTERNAL:
Wing span 12.81 m (42 ft 0 in)
Wing chord, constant 2.13 m (7 ft 0 in)
Wing aspect ratio 6.00
Length overall 11.07 m (36 ft 4 in)
Height overall 3.63 m (11 ft 10¾ in)

DIMENSIONS, INTERNAL:
Hopper volume 1.77 m³ (62.5 cu ft)

AREAS:
Wings, gross 27.31 m² (294.0 sq ft)

WEIGHTS AND LOADINGS (08-750):
Weight empty, equipped 1,315 kg (2,900 lb)
Max fuel 435 kg (960 lb)
Typical payload: Normal 1,438 kg (3,170 lb)
Agricultural (Restricted) 2,257 kg (4,976 lb)
Max disposable load (fuel + hopper):
Normal 1,524 kg (3,360 lb)
Agricultural (Restricted) 2,429 kg (5,356 lb)
Max T-O weight: Normal 2,925 kg (6 450 lb)
Agricultural (Restricted) 3,745 kg (8,256 lb)
Max landing weight 2,925 kg (6,450 lb)
Wing loading at Normal max T-O weight 107.12 kg/m² (21.94 lb/sq ft)
Wing loading at Agricultural (Restricted) max T-O weight 137.1 kg/m² (28.08 lb/sq ft)
Power loading at Normal max T-O weight 5.23 kg/kW (8.60 lb/shp)
Power loading at Agricultural (Restricted) max T-O weight 6.70 kg/kW (11.01 lb/shp)

PERFORMANCE (08-750 at max Normal T-O weight, ISA except where indicated):
Never-exceed speed (VNE) 177 kts (328 km/h, 204 mph)
Max level speed at S/L 157 kts (291 km/h, 181 mph)
Max cruising speed (75% power) at 305 m (1,000 ft) 141 kts (261 km/h, 162 mph)
Stalling speed, flaps down, power off 56 kts (103 km/h, 64 mph)
Max rate of climb at S/L 505 m (1 657 ft)/min
Absolute ceiling 7,925 m (26,000 ft)
T-O run 227 m (745 ft)
T-O run at 1 406 kg (3,100 lb) AUW 45 m (148 ft)
T-O to 15 m (50 ft) 412 m (1 350 ft)
Landing from 15 m (50 ft) 427 m (1,398 ft)
Landing run at 1,406 kg (3,100 lb) AUW with propeller pitch reversal 86 m (283 ft)
Range (75% power) with standard fuel, no reserves 392 n miles (726 km, 451 miles)
Range as above with fuel in hopper 1 933 n miles (3,580 km, 2 224 miles)
Endurance with standard fuel:
75% power 2 h 40 min
60% power 3 h 5 min

UPDATED

PAC AIRTRAINER CT4

TYPE: Two/three-seat aerobatic basic trainer.

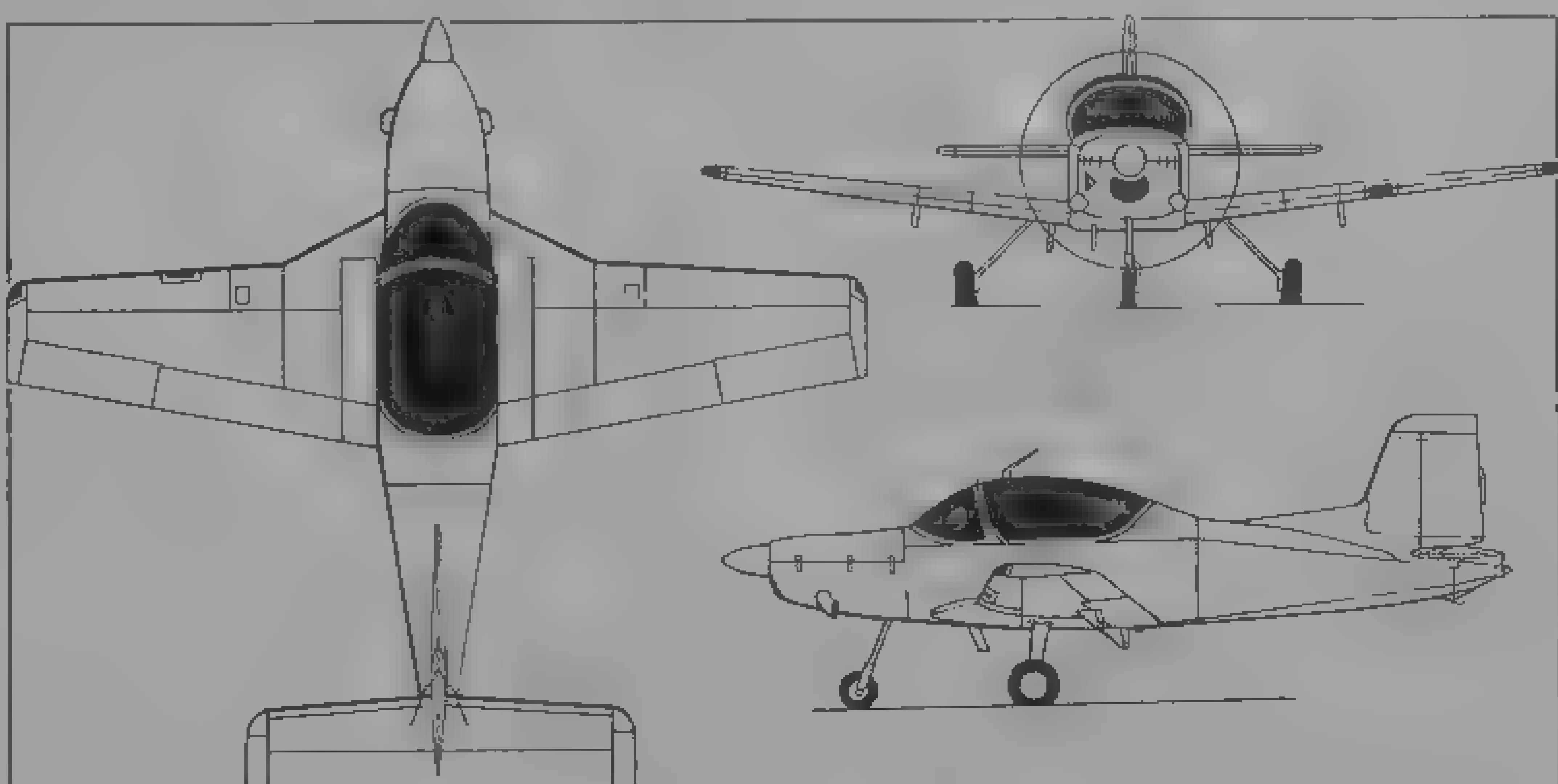
PROGRAMME: New Zealand redesign of Australian Victa Aircruiser, which itself was redesign of Airtourer, first flight 23 February 1972, total 94 (plus two prototypes) built before production ended 1977, production line reopened 1991 to build 12 civil CT4Bs for Ansett Flying College (first two delivered June 1991), production continued with six more for Thailand, last completed August 1992, no further orders. First flight of CT4C turboprop prototype (ZK-FXM, converted RNZAF CT4B) 21 January 1991.

CURRENT VERSIONS: **CT4B**: With 157 kW (210 hp) Teledyne Continental IO-360-HB9 flat-six engine.

CT4C: Turboprop version, with 313 kW (420 shp) Allison 250-B17D (throttle limited to 224 kW, 300 shp) in lengthened nose. Performance objectives attained, prototype sold to Syria July 1992, no further orders.

CT4CR: As CT4C but with retractable landing gear. Design completed, further development awaits a launch customer.

CT4E: Developed version of CT4B with more powerful engine (Textron Lycoming AEIO-540-L1B5: 224 kW, 300 hp at 2 600 rpm) and three-blade Hartzell constant-speed metal propeller, wing mounted slightly farther forward than on CT4B, first flight (ZK-EUN, converted from



PAC Airtrainer CT4C turboprop conversion of the CT4B (*Jane's/Mike Keep*)

1989

RAAF CT4A) 14 December 1991. NZ certification (FAR Pt 23 Amendment 36) 8 May 1992.

CUSTOMERS: Total of 114 CT4As and Bs produced by January 1994, comprising two prototypes, 94 CT4As (Royal Australian Air Force 51, Royal Thai Air Force 24 and RNZAF 19) and 18 CT4Bs (RTAF six, BAe/Ansett Flying College 12)

Abbreviated data follow, full details in 1994-95 and earlier Jane's.

STRUCTURE: Light alloy stressed skin except for Kevlar/GFRP wingtips and engine cowling.

LANDING GEAR: Tricycle type, non-retractable on CT4B, C and E, with cantilever spring steel main legs; steerable (±25°) nosewheel carried on telescopic strut and oleo shock-absorber.

POWER PLANT: See under Current Versions.

ACCOMMODATION: Two seats side by side under hinged, fully transparent Perspex canopy. Space to rear for optional third seat or 52 kg (115 lb) of baggage or equipment (77 kg; 170 lb in CT4E). Dual controls standard.

DIMENSIONS, EXTERNAL (all versions, except where indicated):	
Wing span	7.92 m (26 ft 0 in)
Wing aspect ratio	5.25
Length overall: B	7.06 m (23 ft 2 in)
C	7.14 m (23 ft 5 in)
E	7.26 m (23 ft 9¾ in)
Height overall	2.59 m (8 ft 6 in)
AREAS (all versions):	
Wings, gross	11.98 m² (129.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped: E	780 kg (1,720 lb)
Max fuel weight: E	149 kg (328 lb)
Max T-O weight: B, C	1,202 kg (2,650 lb)
E	1,179 kg (2,600 lb)
PERFORMANCE (B at AUW of 1,088 kg, 2,400 lb, C at 1,111 kg, 2,450 lb, E at 1,179 kg, 2,600 lb):	
Never exceed speed (VNE):	
E	230 kts (426 km/h; 264 mph)

Prototype of PAC CT4C Airtrainer, with turboprop engine *1995*

Max level speed at S/L:	
B	144 kts (267 km/h; 166 mph)
C	205 kts (380 km/h; 236 mph)
E	163 kts (302 km/h; 188 mph)
Cruising speed, 75% power:	
B	140 kts (259 km/h; 161 mph)
E at 2,590 m (8,500 ft)	158 kts (293 km/h; 182 mph)
Stalling speed at S/L:	
flaps up: C	57 kts (106 km/h; 66 mph)
flaps down: B, C, E	44 kts (82 km/h; 51 mph)
Max rate of climb at S/L, ISA:	
B	381 m (1,250 ft)/min
C	843 m (2,765 ft)/min
E	558 m (1,830 ft)/min
Range with max fuel (75% power), ISA, no reserves, at S/L: B	600 n miles (1,112 km; 691 miles)
C	464 n miles (860 km; 534 miles)
E	520 n miles (963 km; 599 miles)

UPDATED

NIGERIA

AIEP

AERONAUTICAL INDUSTRIAL ENGINEERING AND PROJECT MANAGEMENT COMPANY LTD

General Aviation Service Centre, PO Box 5662, Old Kaduna Airport, Kaduna
Telephone: 234 (62) 236676 and 233391
Fax: 234 (62) 237325 and 237088
Telex: 71327 AIE P NG
MANAGING DIRECTOR: Klaus Gloege

AIEP (established 1979) has technical partnership agreement with Dornier Luftfahrt of Germany for Air Beetle programme, enabling it to draw upon German company's expertise.

VERIFIED

AIEP AIR BEETLE

TYPE: Two-seat military trainer, extensively modified from Van's RV-6A homebuilt (see US section).

PROGRAMME: Three prototypes built, construction starting 1988, ending October 1991, first flight 1989; all three flown (1,750 hours total by end of 1993), first aircraft (672 hours) also used for static testing, third for evaluation and testing by Nigerian Air Force leading to acceptance as replacement for BAe Bulldog trainer; second aircraft continuing flying to test systems/components. Series production started 1993.

CURRENT VERSIONS: **T 16**: Planned future version with 119 kW (160 hp) engine.

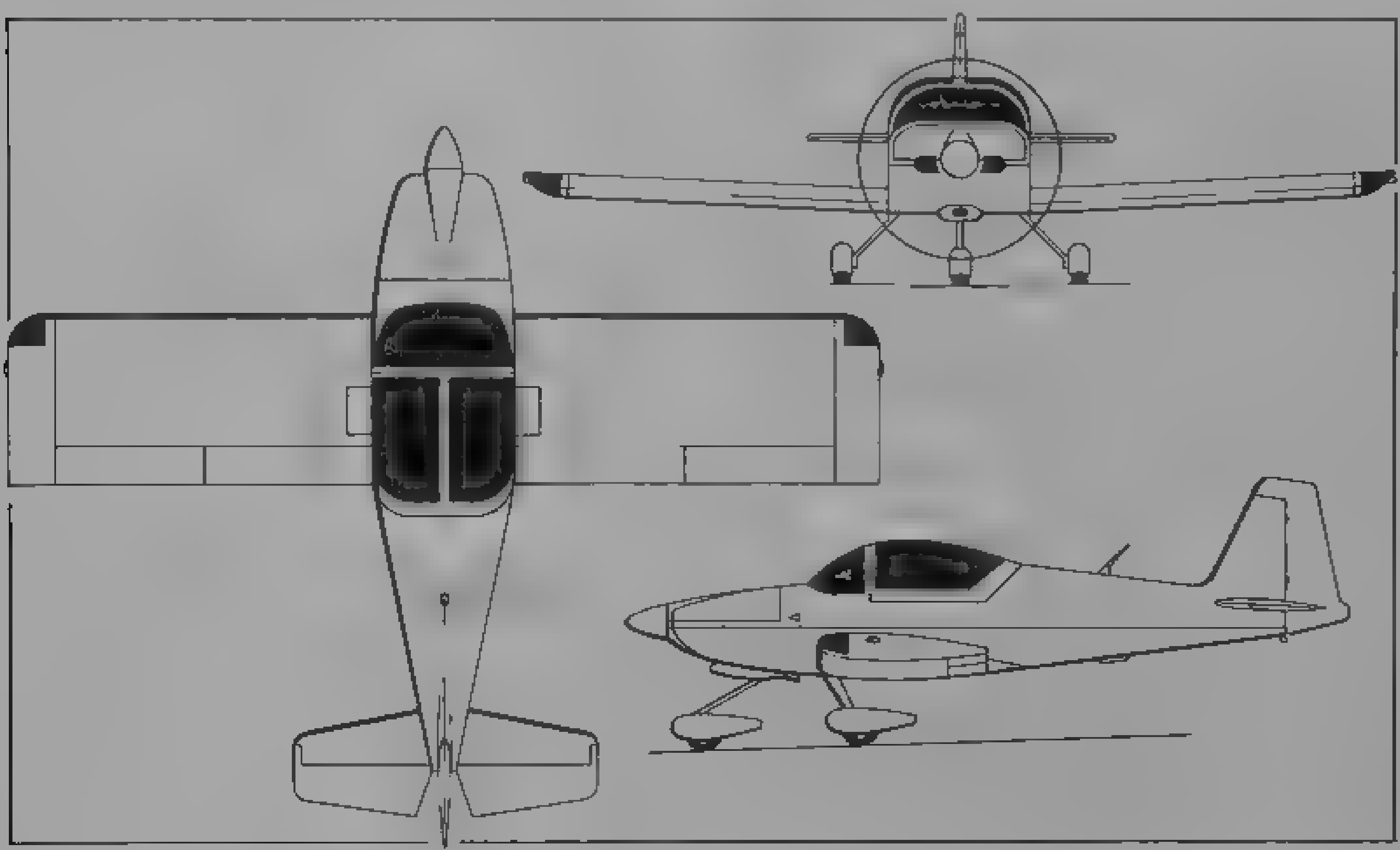
T 18: Standard version, with mogas-driven 134 kW (180 hp) engine for normal training operations. In production. *Description applies to this version except where indicated.*

T 20: Increased performance version, with avgas-driven 149 kW (200 hp) fuel-injection engine.

CUSTOMERS: Nigerian Air Force (60 T 18s) initial customer; interest from other countries, to be marketed outside Nigeria once production established at three per month.

DESIGN FEATURES: Conventional fixed-gear, low-wing light plane, fully aerobatic piston-powered military/civil primary trainer able to use either mogas or avgas fuel, constant chord wings (VAN 135 modified NACA 23013.5 section) with 3° dihedral and 1° incidence; no sweep or twist.

FLYING CONTROLS: Manual/mechanical mass balanced elevators, rudder and differential ailerons, all having electric trim with position indicator; trim tab in rudder and port elevator. Three-position (0/20/40°) plain trailing-edge flaps and underfuselage speedbrake both actuated electrically.



AIEP Air Beetle side by side two-seat primary trainer *(Jane's/Mike Keep)* *1994*

STRUCTURE: Main structure metal (Alclad aluminium alloy); special alloy, stainless steel and GFRP used where advantageous, two-spar wings and tail unit.

LANDING GEAR: Non-retractable tricycle type, with cantilever mainwheel and nosewheel legs of spring steel. Castoring nosewheel. Single Cleveland wheel on each unit, with McCreary 5.00-5 (main) and Lamb 4.00-4 (nose) tyres; tyre pressure 2.76 bars (40 lb/sq in) on all units. Cleveland single-disc hydraulic mainwheel brakes and parking brake. All wheels have GFRP speed fairing. Minimum ground turning radius 1.77 m (5 ft 9⅔ in).

POWER PLANT: One Textron Lycoming O-360-A1A flat-four engine (134 kW, 180 hp at 2,700 rpm) in T 18, driving a Hartzell HC-M2YR-1BF two-blade constant-speed metal propeller; 149 kW (200 hp) Textron Lycoming AEIO-360-A flat-four, with same propeller, in T 20. Integral fuel tank in each wing, combined usable capacity 140 litres (37 US gallons; 30.8 Imp gallons); electric boost pump feeds from either tank, fuel selector; gravity fuelling point in top of each tank. Oil capacity 7.6 litres (2 US gallons, 1.7 Imp gallons). Inverted fuel and oil system. Computerised engine instrumentation.

ACCOMMODATION: Side by side seats for pilot and pupil/passenger; seats have variable height, four-way adjustable backs and removable back cushions. Baggage compartment aft of seats. Windscreen with roll-over bar; rearward-sliding one-piece jettisonable canopy. Full dual controls and dual quadrant-type engine controls. Five-point harness with lockable inertia reel shoulder strap for each seat. Cockpit ventilation system provides windscreen demisting.

SYSTEMS: Hydraulic system for brakes only. Electrical system (28 V DC) supplied by 40 A alternator and two 12 V 17 Ah batteries.

AVIONICS: Bendix/King Silver Crown IFR package standard.
Comms: KX 155 radio standard, KY 196 com transceiver and KT 76A transponder optional.
Flight: KN 62A DME, KR 87 ADF, KMA 244 VOR/glide slope indicator and ADF indicator standard. KI 525A HSI instead of VOR and direction indicators, and Garmin GPS 100, optional.

DIMENSIONS, EXTERNAL:	
Wing span	7.01 m (23 ft 0 in)
Length overall	6.15 m (20 ft 2¼ in)
Fuselage: Max width	1.04 m (3 ft 5 in)
Height overall	2.30 m (7 ft 6½ in)
Tailplane span	2.54 m (8 ft 4 in)
Propeller diameter	1.85 m (6 ft 0¾ in)
Propeller ground clearance	0.26 m (10¼ in)
DIMENSIONS, INTERNAL:	
Cockpit: Max width	1.06 m (3 ft 5¾ in)
Height (seat cushion to canopy)	1.07 m (3 ft 6 in)
Baggage compartment volume	0.44 m³ (15.5 cu ft)
AREAS:	
Wings, gross	10.20 m² (109.8 sq ft)
Ailerons (total)	0.71 m² (7.64 sq ft)
Trailing-edge flaps (total)	0.848 m² (9.13 sq ft)

Fin	0.38 m² (4.09 sq ft)
Rudder	0.41 m² (4.41 sq ft)
Tailplane	1.97 m² (21.20 sq ft)
Elevators (total)	2.10 m² (22.60 sq ft)
WEIGHTS AND LOADINGS	
Weight empty, equipped: T 18	499 kg (1,100 lb)
T 20	512 kg (1,130 lb)
Max fuel weight: T 18	106 kg (233 lb)
T 20	100 kg (220 lb)
Max baggage weight: both	30 kg (66 lb)
Max T-O and landing weight: both	839 kg (1,850 lb)
Max wing loading: both	82.3 kg/m² (16.85 lb/sq ft)
Max power loading: T 18	6.26 kg/kW (10.28 lb/hp)
T 20	5.63 kg/kW (9.25 lb/hp)
PERFORMANCE (at max T-O weight, estimated for T 20)	
Never-exceed speed (V_{NE}):	
both	185 kts (343 km/h, 213 mph)
Max level speed at S/L:	
T 18	150 kts (278 km/h, 173 mph)
T 20	160 kts (296 km/h, 184 mph)
Max cruising speed, 75% power at 3,050 m (10,000 ft):	
T 18	155 kts (287 km/h, 178 mph)
T 20	165 kts (306 km/h, 190 mph)
Econ cruising speed, 55% power at 2,440 m (8,000 ft):	
T 18	135 kts (250 km/h, 155 mph)
Stalling speed:	
T 18, flaps up	52 kts (97 km/h, 60 mph)
T 18, flaps down	50 kts (93 km/h, 58 mph)
T 20, flaps down	53 kts (99 km/h, 61 mph)
Max rate of climb at S/L: T 18	610 m (2,000 ft)/min
T 20	670 m (2,200 ft)/min
Service ceiling: T 18	6,100 m (20,000 ft)
T-O run: T 18	145 m (476 ft)
T 20	130 m (427 ft)
T-O to 15 m (50 ft): T 18	225 m (739 ft)
T 20	205 m (673 ft)
Landing from 15 m (50 ft): T 18	300 m (985 ft)
T 20	310 m (1,017 ft)
Landing run: T 18	220 m (722 ft)
T 20	225 m (739 ft)
Range with max fuel, 65% power at 2,440 m (8,000 ft), incl allowances for start, taxi, T-O, climb, and 45 min reserves at 45% power:	
T 18	525 n miles (973 km, 605 miles)
T 20	440 n miles (815 km, 506 miles)
Endurance at optimum econ power setting, allowances for start, taxi, T-O and climb, no reserves:	
T 18	7 h 0 min
T 20	5 h 30 min
g limits: both	+6/-3

Third prototype AIEP Air Beetle primary trainer in Nigerian Air Force markings

1994

UPDATED

NORWAY

LUNDS TEKNISKE

LUNDS TEKNISKE

Vikaveien 2, N-8600 Mo
Telephone: 47 (87) 52 100
Fax: 47 (87) 55 065
OWNER/MANAGER: Arne Lund

LUNDS TEKNISKE SILHOUETTE

TYPE: Single-seat sport/recreational homebuilt and motor glider, designed and tested to FAR Pt 23 standards.

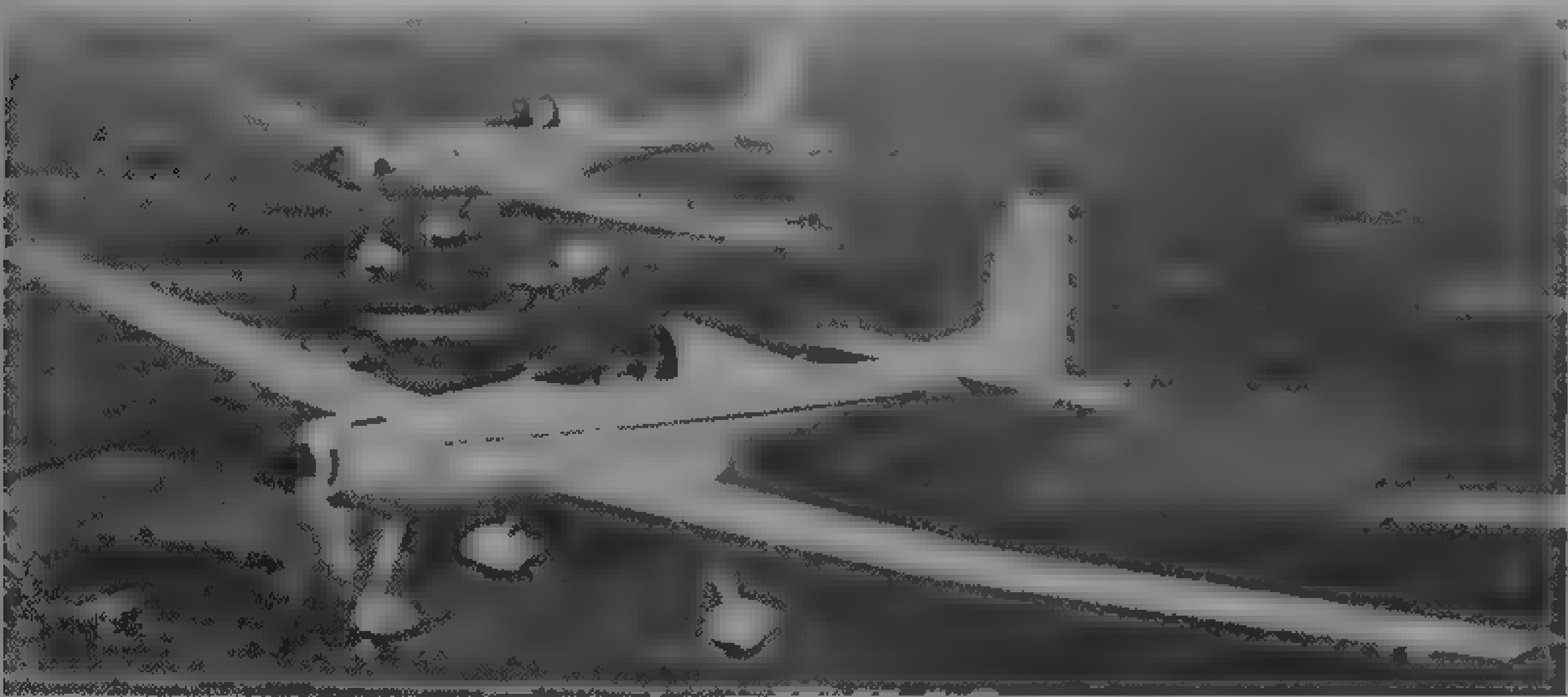
PROGRAMME: Rights to Silhouette homebuilt purchased from US Silhouette Aircraft Inc, Lunds Tekniske offers kits, original prototype first flew in USA on 3 July 1984, demonstrator (LN-GIO), Model SA 60, built by Lunds mid-1992.

CUSTOMERS: Over 40 kits sold prior to 1992.

COSTS: Kit: $13,000 in sport version, including engine, propeller, spinner, hydraulics, brakes and instruments, $13,775 in motor glider form, including above components.

DESIGN FEATURES: Composites airframe, high aspect ratio wings, provision for bolt-on wingtip extensions for use as motor glider; non-retractable tricycle landing gear.

FLYING CONTROLS: Half-span ailerons, flaps to be available; centreline dive brake optional.



Long-wing Lunds Tekniske Silhouette motor glider (foreground) and version with standard wings (rear) *(Howard Levy)*

1992

STRUCTURE: Wings have glassfibre spars, precut Styrofoam cores, glassfibre/epoxy skins and premoulded wingtips, Styrofoam/glassfibre ailerons. Fuselage of glassfibre and Nomex honeycomb, premoulded in halves with integral tailfin, around plywood/Styrofoam/glassfibre bulkheads. Tail surfaces of foam and glassfibre.

POWER PLANT: One 30 kW (40 hp) Rotax 447 or 37.3 kW (50 hp) Rotax 503. Fuel capacity with standard wing 45 litres (12 US gallons; 10 Imp gallons).

DIMENSIONS, EXTERNAL:	
Wing span: standard	9.75 m (32 ft 0 in)
with optional extensions	12.50 m (41 ft 0 in)
Wing aspect ratio: standard	13.46
with extensions	18.69
Length overall	5.87 m (19 ft 3 in)
Height overall	2.03 m (6 ft 8 in)
Propeller diameter	1.47 m (4 ft 10 in)
AREAS:	
Wings, gross: standard	7.06 m² (76.0 sq ft)
with extensions	8.36 m² (90.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, standard wings	262 kg (578 lb)
Max T-O weight	374 kg (824 lb)
Max wing loading:	
standard wings	52.97 kg/m² (10.85 lb/sq ft)
with extensions	44.74 kg/m² (9.16 lb/sq ft)
PERFORMANCE (standard wings):	
Max level speed	122 kts (225 km/h, 140 mph)
Cruising speed	104 kts (193 km/h, 120 mph)
Stalling speed	45 kts (84 km/h, 52 mph)
Max rate of climb at S/L	244 m (800 ft)/min
Service ceiling	4,265 m (14,000 ft)
T-O run	244 m (800 ft)
Landing run	183 m (601 ft)
Range with max fuel, no reserves	390 n miles (724 km, 450 miles)
g limits	+4.2/-2

UPDATED

PAKISTAN

PAC

PAKISTAN AERONAUTICAL COMPLEX

Kamra, District Attock
WORKS: F-6 Rebuild Factory, Mirage Rebuild Factory, Kamra Avionics and Radar Factory; Aircraft Manufacturing Factory (all at Kamra)
Telephone: 92 (51) 580290/5
Fax: 92 (51) 584162
Telex: 5601 PAC KAMRA PK
DIRECTOR GENERAL: Air Vice-Marshal Rahim Yousef Zai
MANAGING DIRECTORS:
Air Cdre Muhammad Younas (AMF)
Air Cdre Muhammad Idrees Malik (F-6RF)
Air Cdre Niaz Husain (MRF)
Air Cdre Azfar Ali Khan (KARF)

Pakistan Aeronautical Complex is organ of Pakistan Ministry of Defence; consists of four factories, as follows:

Aircraft Manufacturing Factory (AMF) came into operation mid-1981, as licence production centre for Saab Safari/Supporter (Pakistani name Mushshak), major facilities include equipment for all Mushshak GFRP component manufacture, 1994 workforce approximately 1,000. Collaborating with NAMC in China in developing Karakorum 8 jet trainer.

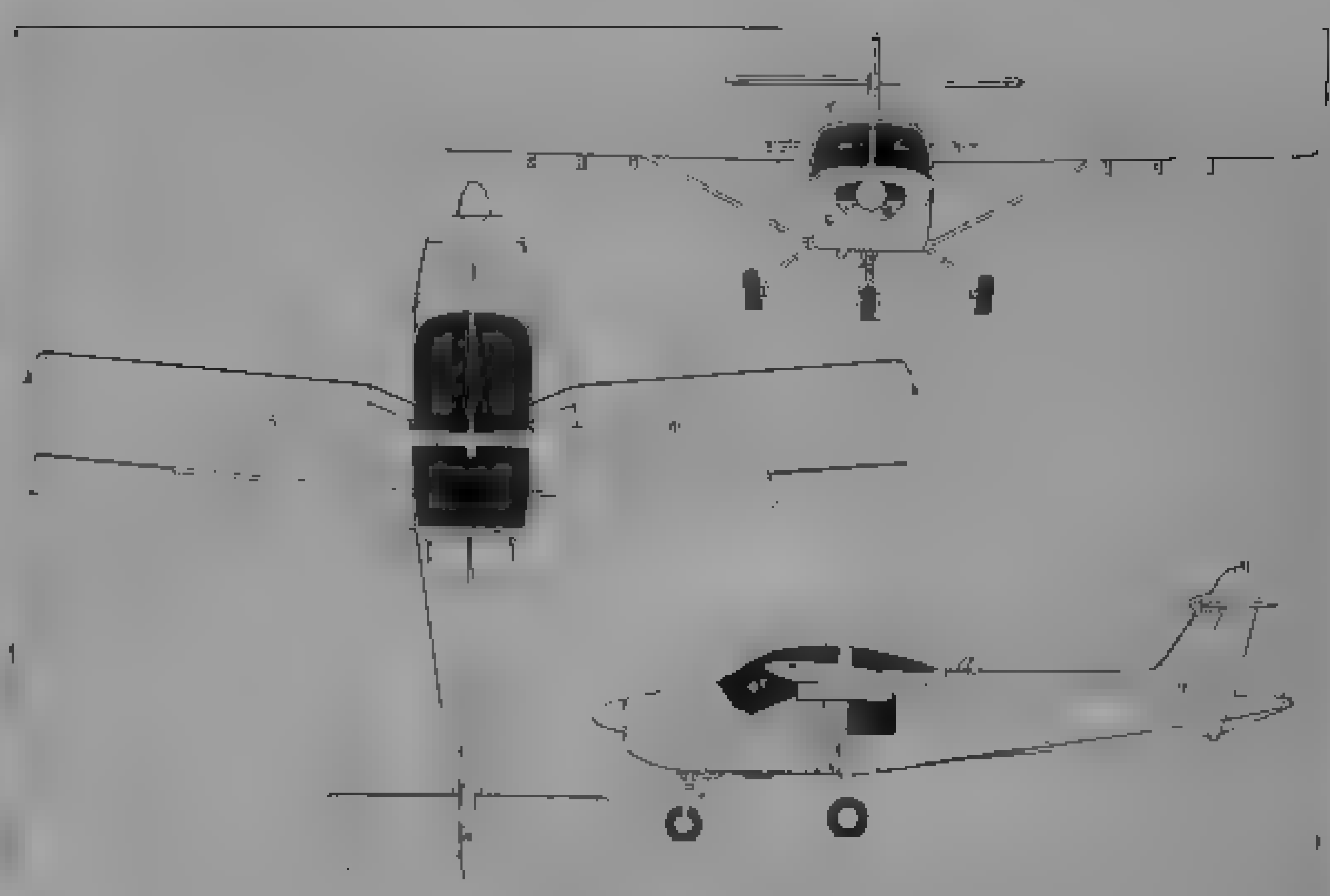
F-6 Rebuild Factory, or F-6RF, established 1980 primarily for overhauling Pakistan's Shenyang F-6s and their accessories; has expanded its role by undertaking overhaul of FT-5, F-6, FT-6 and A-5C aircraft and their accessories. Rebuild and overhaul of Chinese F/FT-7s and accessories began May 1992.

F-6RF authorised to manufacture over 7,000 spare parts for FT-5, F/FT-6 and A-5C aircraft and 1,140 litre (301 US gallon, 250 Imp gallon) F-6 auxiliary fuel tanks, production of 500 and 800 litre (132 and 211 US gallon, 110 and 176 Imp gallon) supersonic drop tanks for F-7P began mid-1991; 1994 workforce approximately 2,500.

F-6RF possesses modern technical facilities for various engineering processes such as surface treatment, heat treatment, forging, casting, non-destructive testing, and machine tools required to manufacture items from raw materials. As well as conventional machines, modern machines such as CNC lathe, EDM die-sinking and EDM wire-cutting are utilised for various engineering processes. Precision casting facility and advanced metrological centre being established.

Mirage Rebuild Factory (MRF) began operating 1978, has site area of over 81 ha (200.15 acres) and nearly 2,000 engineers and technicians, can accomplish complete overhaul of Mirage III/5, Atar 9C engine, and all associated

AMF Mushshak (top) and Shahbaz built by PAC *1995*



Pakistan Aeronautical Complex Mushshak two/three-seat light aircraft *(Jane's/Dennis Punnett)* *1993*

aircraft components and engine accessories, current overhaul capacity 8 to 10 aircraft and over 50 engines each year; can overhaul/rebuild third country Mirage III/5s, engines, components and accessories; overhauled eight United Arab Emirates Air Force Mirages; overhaul of 42 Dassault/Commonwealth Mirage IIIOAs and eight IIIDs bought from Australia, first IIID received January 1991. Structural repair of Mirage fuselages has been established and is being upgraded to undertake wing repairs.

Facility has been upgraded to undertake increased life core (ILC) modification, overhaul and upgrade of Pratt & Whitney F100-PW-220E turbofans and F-16 engine jet fuel starters, and will soon have limited capability to service and overhaul F100 engine accessories.

Kamra Avionics and Radar Factory (KARF) began operating 1987; employs over 250 engineers and technicians. At present (1995) rebuilding Siemens MPDR-45E radars, complex components and electronics modules, and Caterpillar/Siemens power generators. Has modern, environmentally controlled and ASD equipped electronics workshops, environmental test chambers, sophisticated test, measurement and diagnostic equipment including [illegible] ATE. Shortly undertaking rebuilding of Siemens control and reporting centre. Involved in co-production of airborne radars and RWRs for fighters.

UPDATED

PAC (AMF) MUSHSHAK (PROFICIENT) and SHAHBAZ (FALCON)

TYPE: Two/three-seat training and observation light aircraft.

PROGRAMME: 15 Mushshaks supplied complete from Sweden, 92 then assembled from CKD kits at Risalpur between 1975 and 1981; completely indigenous production followed, with 149 delivered by December 1994, 81 rebuilt at Kamra 1980 to 1994; engines, instruments, electrical equipment and radios imported, but most other items manufactured locally. Shahbaz (prototype 86-5147 first flight July 1987) received US FAR Pt 23 certification 1989.

CURRENT VERSIONS: **Mushshak**: Standard production version.
Description applies to this version except where indicated.

Shahbaz: Similar to Mushshak; 156.6 kW (210 hp) Teledyne Continental TSIO-360-MB turbocharged engine; four completed by September 1993, no further examples by early 1995.

CUSTOMERS: See table. Total of 256 Mushshaks acquired/produced by December 1994: 90 for PAF, 34 for other countries and rest for Pakistan Army. Six supplied to Syria and three to Oman in 1994; deliveries to Iran in 1988-91.

DESIGN FEATURES: Based on Swedish Saab Safari/Supporter armament option, higher powered Shahbaz has take-off run at 1,402 m (4,600 ft) ASL in +41°C (106°F) reduced by 25 to 30 per cent to 290 m (590 ft).

Wing thickness/chord ratio 10 per cent, dihedral 1° 30'; incidence 2° 48', sweepforward 5° from roots.

FLYING CONTROLS: Mass balanced ailerons with servo tab in starboard unit, rudder with trim tab, and one-piece mass balanced tailplane with large anti-servo and trimming tab, electrically actuated plain sealed flaps.

STRUCTURE: All-metal, except for GFRP tailcone, engine cowling panels, wing strut/landing gear attachment fairings and fin tip.

LANDING GEAR: Non-retractable tricycle type. Cantilever composite spring main legs. Goodyear 6.00-6 mainwheels and 5.00-5 steerable nosewheel. Cleveland disc brakes on main units.

POWER PLANT: One 149 kW (200 hp) Textron Lycoming IO-360-A1B6 flat-four engine, driving a Hartzell HC-C2YK-4F/FC7666A-2 two-blade constant speed metal propeller. Two integral wing fuel tanks, total capacity 190 litres (50.2 US gallons; 41.8 Imp gallons). Oil capacity 7.5 litres (2.0 US gallons; 1.6 Imp gallons). From 10 to 20 seconds inverted flight (limited by oil system) permitted.

ACCOMMODATION: Side by side adjustable seats, with provision for back type or seat type parachutes, for two persons beneath fully transparent upward-hinged canopy. Dual controls standard. Space aft of seats for 100 kg (220 lb) of baggage (with external access on port side) or, optionally, a rearward facing third seat. Upward-hinged door, with window, beneath wing on port side. Cabin heated and ventilated.

SYSTEMS: 28 V 50 A DC electrical system.

AVIONICS: Provision for full blind flying instrumentation and radio.

ARMAMENT: Provision for six underwing attachment points, inner two stressed to carry up to 150 kg (330 lb) each and outer four up to 100 kg (220 lb) each. Possible armament loads include two 7.62 mm or 5.56 mm machine gun pods, two pods each with seven 75 mm or 2.75 in air-to-surface rockets, four pods each with seven 68 mm rockets, eighteen 75 mm rockets, or six Bofors Bantam wire guided anti-tank missiles.

EQUIPMENT: Options include ULV cropspraying kit, target towing kit, or underwing supply/relief containers.

DIMENSIONS, EXTERNAL:

Wing span	8.85 m (29 ft 0½ in)
Wing chord (outer panels, constant)	1.36 m (4 ft 5½ in)
Length overall: Mushshak	7.00 m (22 ft 11½ in)
Shahbaz	7.169 m (23 ft 6¼ in)
Height overall	2.60 m (8 ft 6½ in)
Tailplane span	2.80 m (9 ft 2¼ in)
Wheel track	2.20 m (7 ft 2½ in)
Wheelbase	1.61 m (5 ft 3½ in)
Propeller diameter	1.88 m (6 ft 2 in)
Cabin door (port): Height	0.78 m (2 ft 6¾ in)
Width	0.52 m (1 ft 8½ in)

DIMENSIONS, INTERNAL:

Cabin: Max width	1.10 m (3 ft 7¼ in)
Max height (from seat cushion)	1.00 m (3 ft 3¼ in)

AREAS:

Wings, gross	11.90 m² (128.1 sq ft)
Ailerons (total)	0.98 m² (10.55 sq ft)
Flaps (total)	1.55 m² (16.68 sq ft)
Fin	0.77 m² (8.29 sq ft)
Rudder, incl tab	0.73 m² (7.86 sq ft)
Tailplane, incl tab	2.10 m² (22.6 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility, N: Normal category):

Weight empty, equipped: Mushshak	646 kg (1,424 lb)
Shahbaz	760 kg (1,675 lb)
Max external stores load	300 kg (661 lb)
Max T-O weight (Mushshak): A	900 kg (1,984 lb)
U	1,000 kg (2,205 lb)
N	1,200 kg (2,645 lb)
Max T-O weight (Shahbaz): A	1,010 kg (2,227 lb)
U	1,235 kg (2,723 lb)
N	1,310 kg (2,888 lb)
Max wing loading (Mushshak):	
A	75.63 kg/m² (15.49 lb/sq ft)
U	84.03 kg/m² (17.21 lb/sq ft)
N	100.84 kg/m² (20.65 lb/sq ft)
Max wing loading (Shahbaz):	
A	84.87 kg/m² (17.38 lb/sq ft)
U	103.78 kg/m² (21.26 lb/sq ft)
N	110.08 kg/m² (22.55 lb/sq ft)
Max power loading (Mushshak):	
A	6.04 kg/kW (9.92 lb/hp)
U	6.71 kg/kW (11.02 lb/hp)
N	8.05 kg/kW (13.23 lb/hp)
Max power loading (Shahbaz):	
A	6.45 kg/kW (10.60 lb/hp)
U	7.89 kg/kW (12.97 lb/hp)
N	8.37 kg/kW (13.75 lb/hp)

PERFORMANCE (at max T-O weight, Utility category):

Never-exceed speed (VNE):	
Mushshak	197 knots (365 km/h; 227 mph)
Shahbaz	196 knots (363 km/h; 225 mph)
Max level speed at S/L:	
Mushshak	128 knots (238 km/h; 148 mph)
Shahbaz	120 knots (222 km/h; 138 mph)
Cruising speed at S/L:	
Mushshak	113 knots (210 km/h; 130 mph)
Shahbaz	115 knots (213 km/h; 132 mph)
Stalling speed, power off:	
Mushshak, flaps up	60 knots (111 km/h; 69 mph)
Shahbaz, flaps up	65 knots (121 km/h; 75 mph)
Mushshak, flaps down	54 knots (100 km/h; 63 mph)
Shahbaz, flaps down	55 knots (102 km/h; 64 mph)
Max rate of climb at S/L:	
Mushshak	312 m (1,024 ft)/min
Shahbaz	335 m (1,100 ft)/min
Time to 1,830 m (6,000 ft): Mushshak	7 min 30 s
Shahbaz	8 min 54 s
Service ceiling: Mushshak	4,800 m (15,750 ft)
Shahbaz	6,100 m (20,000 ft)
T-O run: Mushshak	150 m (493 ft)
Shahbaz	140 m (460 ft)
T-O to 15 m (50 ft): Mushshak	305 m (1,000 ft)
Shahbaz	250 m (821 ft)
Landing from 15 m (50 ft):	
Mushshak, Shahbaz	350 m (1,149 ft)
Landing run: Mushshak, Shahbaz	140 m (460 ft)
Max endurance (65% power) at S/L, 10% reserves:	
Mushshak	5 h 10 min
Shahbaz	4 h 0 min
g limits (both): A	+6/−3
U	+5.4/−2.7
N	+4.8/−2.4

UPDATED

MUSHSHAK PRODUCTION

	Qty
At Risalpur	
PAF/Army	92[1]
At Kamra	
PAF/Army	115[2]
Iran	25
Oman	3
Syria	6
Total	**241[3]**

[1]Saab CKD kits
[2]To 31 December 1994: first aircraft 83-5116 (numbers 5200-5299 not allocated)
[3]Plus complete aircraft from Saab to PAF (15 according to PAC; 25 according to Saab)

OTHER AIRCRAFT

Refer to NAMC entry in Chinese section for description of **Karakorum 8** jet trainer.

NEW ENTRY

PHILIPPINES

PACI

PHILIPPINE AIRCRAFT COMPANY INC

RPMCI Hangar, Manila Domestic Airport, PO Box 7633, Airport Airmail Exchange, 1300 Pasay City, Metro Manila
Telephone: 63 (2) 832 2777 and 832 3375
Fax: 63 (2) 833 0605
Telex: 66621 WPAC PN
PRESIDENT: Brig Gen Rudolfo G Hautea (Retd)
CHAIRMAN AND CEO: Rolando P Moscardon

PACI builds and markets SkyStar Kitfox (see US section) as Skyfox in Western Pacific area, and supports these, also manufactures parts and components for other US companies.

PACI SKYFOX

TYPE: Two-seat light aircraft.

PROGRAMME: PACI agreement with SkyStar Corporation (then Denney Aerocraft) of USA (see US section) announced November 1987, local production, as Skyfox, began early 1988, first two certificated and had flown over 140 hours by late 1990. First prototype, with Rotax 532 engine, fitted with Louisiana Agrilite spraygear, Mk II type certification was expected by end of 1993, with production certification to start six months later, but no recent news received.

CURRENT VERSIONS: **Skyfox I:** Initial version, with 47.7 kW (64 hp) Rotax 532 single-ignition engine.

Skyfox II: Improved version, with Rotax 582 engine, dual ignition, dual brakes, cabin doors with extended transparencies for enhanced field of views and venturi driven artificial horizon. Future improvement modifications to wings and tail planned. *Description applies to this version.*

CUSTOMERS: Including prototypes, total of seven (three Skyfox I, four Skyfox II) completed by March 1993, with two more Skyfox II then nearing completion. Skyfox II prototype evaluated 1990-91 by Philippine Integrated Police Force (PIPF).

DESIGN FEATURES: Airframe description generally as for Kitfox in US section.

POWER PLANT: One 47.7 kW (64 hp) Rotax Bombardier 582 UL two-cylinder two-stroke dual ignition engine, with electric starter, driving a three-blade fixed-pitch wooden propeller. Fuel capacity (two wing tanks) 45.5 litres (12 US gallons; 10 Imp gallons). Gravity refuelling.

DIMENSIONS, EXTERNAL:

Wing span	9.55 m (31 ft 4 in)
Wing chord, constant	1.07 m (3 ft 6 in)
Wing aspect ratio	7.65
Length overall	5.41 m (17 ft 9 in)
wings folded	6.40 m (21 ft 0 in)
Width, wings folded	2.39 m (7 ft 10 in)
Height overall	2.29 m (7 ft 6 in)
Wheel track	1.45 m (4 ft 9 in)
Wheelbase	3.86 m (12 ft 8 in)
Propeller ground clearance	0.56 m (1 ft 10 in)

AREAS:

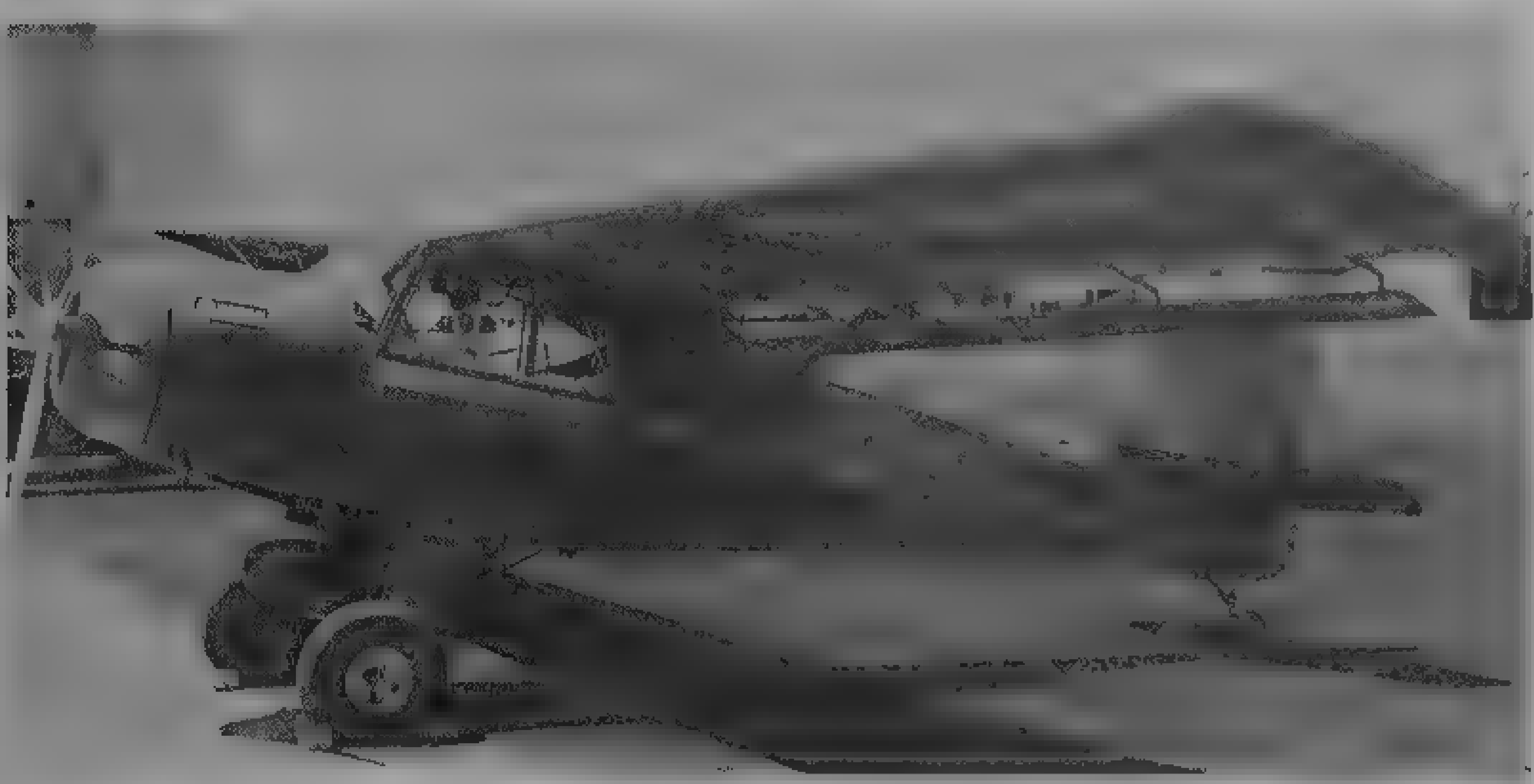
Wings, gross (incl flaperons)	11.92 m² (128.3 sq ft)
Tailplane	1.46 m² (15.72 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	230.5 kg (508 lb)
Max T-O weight	431 kg (950 lb)
Max zero fuel weight	398 kg (878 lb)
Max wing loading	36.15 kg/m² (7.40 lb/sq ft)
Max power loading	9.03 kg/kW (14.84 lb/hp)

PERFORMANCE (A: single-seat at 363 kg; 800 lb AUW, B: two-seat at 431 kg; 950 lb):

Max level speed at S/L:	
A, B	86 kts (160 km/h; 100 mph)
Max cruising speed (75% power) at S/L:	
A	78 kts (145 km/h; 90 mph)
B	74 kts (137 km/h; 85 mph)
Stalling speed, power off, flaps up:	
A	28 kts (52 km/h; 32 mph)
B	33 kts (62 km/h; 38 mph)
Stalling speed, power on, flaps down:	
A	22 kts (41 km/h; 25 mph)
B	27 kts (49 km/h; 30 mph)
Max rate of climb at S/L: A	183 m (600 ft)/min
B	153 m (500 ft)/min
Service ceiling (approx): A	2,895 m (9,500 ft)
B	2,745 m (9,000 ft)
T-O run: A	83 m (270 ft)
B	118 m (385 ft)
T-O to 15 m (50 ft): A	150 m (490 ft)
B	196 m (641 ft)
Landing from 15 m (50 ft): A	199 m (650 ft)
B	249 m (816 ft)
Landing run: A	51 m (166 ft)
B	97 m (316 ft)
Range at 65% power:	
A	252 n miles (467 km; 290 miles)
B	221 n miles (410 km; 255 miles)



PACI Skyfox II demonstrator with ventral cargo pod (*Anglo Philippine Aviation*)
1995

UPDATED

PADC

PHILIPPINE AEROSPACE DEVELOPMENT CORPORATION

PO Box 7395, Domestic Airport Post Office, Lock Box, 1300 Domestic Road, Pasay City, Metro Manila
Telephone: 63 (2) 832 2741/49
Fax: 63 (2) 832 2568
Telex: 66019 PADC PN
PRESIDENT: Prudencio M Reyes Jr
EXECUTIVE VICE-PRESIDENT: Antonio S Duarte
SENIOR VICE-PRESIDENT: Teresita R Payaoan
SUBSIDIARIES:

Philippine Helicopter Services Inc (PHSI)
PRESIDENT: Margaret S Defensor
Maintenance and overhaul centre for in-country BO 105 helicopters, including all inspections from 50 to 2,500 hours overhaul and repair of McDonnell Douglas (Hughes) helicopter rotor blades, capability to repair and overhaul power steering units, hydraulic pumps and other components of MAN commercial vehicles, overhaul and repair of Zahnradfabrik Friedrichshafen AG products.

Philippines East Asia Cargo Airlines Inc (PEAC)
Formed 1990 (as Air Philippines Corporation) as joint venture with Transnational Transport Ltd (TNT) of Australia to undertake international air freight services.

PADC established 1973 as government arm for development of Philippine aviation industry, is now an attached agency of Department of Transportation and Communication (DOTC) and has technical workforce of about 200. Main activities are aircraft manufacturing and assembly; maintenance engineering; aircraft and spare parts sales; service centres for Pilatus Britten-Norman Islander. Recently completed programmes included licence assembly of 67 Islanders (including 22 for Philippine Air Force) and 44 BO 105s.

Assembly of initial 18 S 211 jet trainers under subcontract to Agusta of Italy completed 1991; further six S 211s delivered to Philippine Air Force 1994. First four (of 18) SF 260 TP trainers delivered by end of 1993, remaining 14 kits now completed and 16 of these 18 aircraft delivered to Philippine Air Force. Six Lancair 320 Es and two Lancair 4s assembled from PAI kits for 1995 delivery to Philippine National Police. Local assembly of Agusta SF 600 Canguro expected to begin in 1995 (two Italian built SF 600s already delivered to PADC and two retractable-gear SF 600As expected to arrive by mid-1995.

PADC has maintenance/repair/overhaul centre for Allison 250 series turbine engines and for Textron Lycoming and Teledyne Continental piston engines of up to 298 kW (400 hp). Its Maintenance and Engineering Department is appointed as Allison AMOC (authorised maintenance and overhaul centre) by Hawker Pacific of Australia (regional distributor for Allison) and undertakes FMS work on 250-C30 engines for Sikorsky helicopters and 250-B17 turboprops and propellers for Philippine Air Force (PAF) Nomads.

PADC is Eurocopter International's Philippine agent for government and military sales, and service centre for in-country Eurocopter helicopters; has supplied two Ecureuils, including one as dedicated water bomber, to Philippine National Police Force, and may assemble this type locally later.

First of follow-on batch of six SIAI-Marchetti S 211s assembled by PADC for the Philippine Air Force (*Anglo Philippine Aviation*)
1995

UPDATED

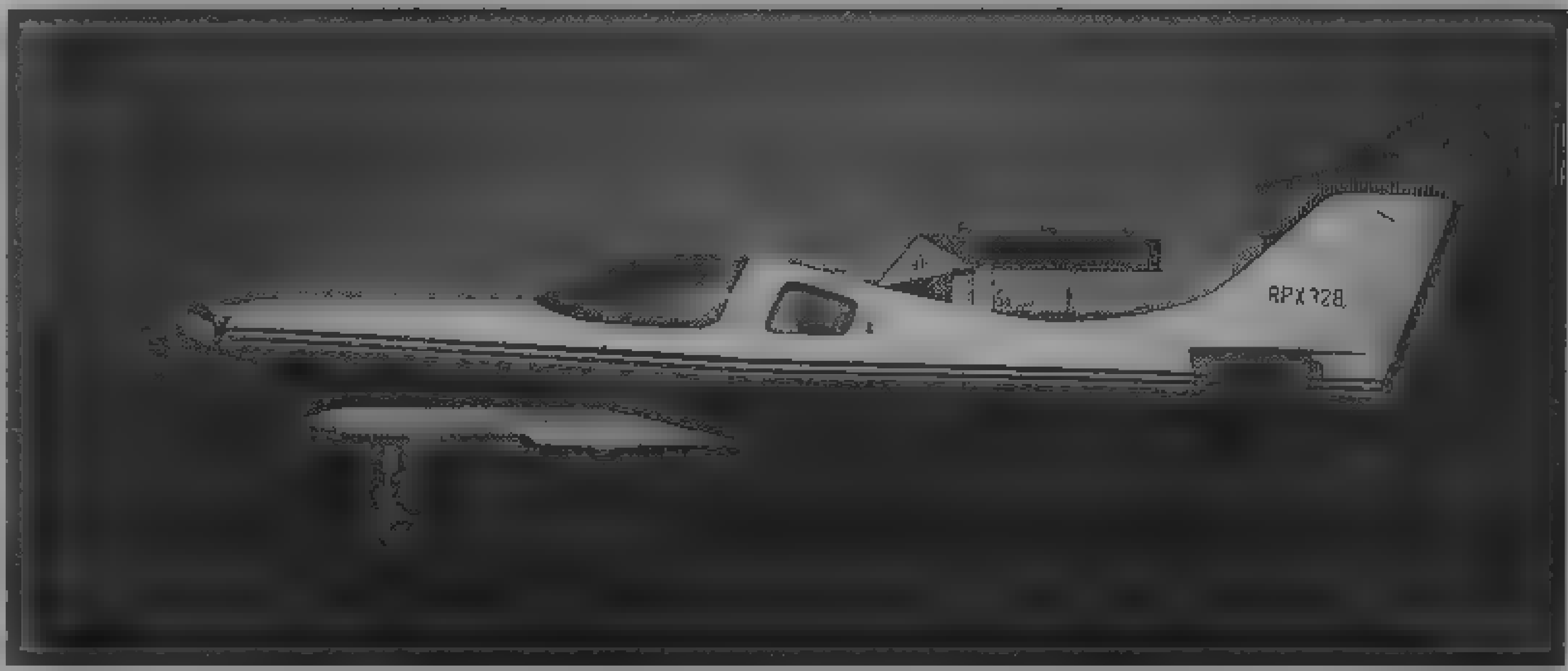
PAI

PACIFIC AERONAUTICAL INC

25 First Avenue, Mactan Export Processing Zone, Lapu Lapu City 6015
Telephone: 63 (32) 400 386
Fax: 63 (32) 400 285

PAI produces kits of Lancair designs (see US section), primarily for shipment to the US company. It also recently supplied kits to PADC (which see) of six Lancair 320 fixed-gear two-seaters and two retractable-gear Lancair 4s, for completion and delivery to the Philippine National Police Force.

NEW ENTRY



Lancair 320 completed by PAI for a private owner in Manila *(Anglo Philippine Aviation)* *1995*

SEFA ASIA

SOCIETE D'ETUDES ET DE FABRICATIONS AERONAUTIQUES

No news of progress with the SEFA Sea-Bird two-seat light amphibian has been received since early 1993. See 1994-95 *Jane's* for description and illustration.

UPDATED

POLAND

PEZETEL

PEZETEL FOREIGN TRADE ENTERPRISE LTD

Aleja Stanów Zjednoczonych 61, PL-04-028 Warsaw 50
Telephone: 48 (22) 135265
Fax: 48 (22) 132356 and 132835
Telex: 814651
GENERAL MANAGER: Włodzimierz Skrzypiec
MANAGER OF AVIATION DEPARTMENT: Kazimierz Niepsuj
MANAGER OF PUBLICITY DEPARTMENT:
Wojciech Kowalczyk, MA

Panstwowe Zaklady Lotnicze (State Aviation Works) formed by industrial syndicate in 1928 from existing factories to produce aircraft for domestic use and export, until 1981 aviation industry organised under ZPLS-PZL (Aircraft and Engine Industry Union) control, activities came under Bureau of Ministers control 1982 (see earlier *Jane's*). Aviation and diesel engine industry encompassed 19 factories and other establishments in early 1992, with combined workforce of approximately 50,000; currently undergoing further reorganisation following democratisation and dissolution of USSR, with aviation industry grouped from 1991 under council of factories headed by Pezetel. Aviation Holding, a consortium formed by PZL Mielec/Swidnik/Okecie (aircraft), PZL Rzeszów (aero-engines) and PZL Hydral Wroclaw (hydraulics) concerns, is being assisted by Polish Industrial Development Agency in attempt to raise new investment capital. PZL Swidnik, which has made the most progress towards privatisation, will serve as the model for the other member companies. Eventual plan is to privatise entire aviation industry.

Polish aviation industry has relied substantially on aircraft engines (see Aero-Engines section) and equipment (military, propellers, and ground equipment for agricultural aircraft and helicopters) of its own design, as well as on co-operation and co-production with manufacturers from East and West, also undertakes component manufacture for Russian Il-96 airliner. Pezetel handles export sales of Polish aviation products.

UPDATED

AGROLOT

WYPOSAŻEŃ AGROLOTNICZYCH (Agrolot Foundation)

Aleja Krakowska 110/114, PL-00-971 Warsaw
Telephone: 48 (22) 466350
CHAIRMAN: Andrzej Slocinski

This foundation (established 1990) is responsible for PZL-126P Mrówka programme previously listed under PZL Warszawa-Okecie.

NEW ENTRY

PZL-126P MRÓWKA (ANT)

TYPE: Single-seat light agricultural and ecological support aircraft.

PROGRAMME: See under PZL Warszawa-Okecie in 1993-94 and previous editions for early history. PZL-126 prototype (SP-PMA) made first flight 20 April 1990; this aircraft now used (1994) to test modified 44.7 kW (60 hp) PZL-F2A 120 C1 two-cylinder engine driving two-blade fixed-pitch propeller. PZL-126P is planned operational version, being designed and developed at Warszawa-Okecie factory; funded by Agrolot Foundation, chief designer Andrzej Slocinski.

CURRENT VERSIONS: **PZL-126P:** Under construction 1995. Increased wing span and area, more powerful engine, larger fuel tanks and increased payload compared with PZL-126 prototype. Intended as economical carrier of airborne systems for forestry protection (for example, combating pests, identifying diseased vegetation, detecting/controlling forest fires, spreading non-toxic small-volume selective-action agents for plant protection such as Trichogramma parasitic wasp eggs laid in eggs of host insect). Other applications include air pollution monitoring and pipeline patrol. *Description applies to PZL-126P except where indicated.*

DESIGN FEATURES: Single-engined low wing monoplane with rectangular tail surfaces, meets requirements of FAR Pt 23. Semi-monocoque fuselage with equipment bay in lower portion aft of cockpit, accessible through hatch, upswept rear fuselage facilitates access to this bay. Quick-fastening lock beneath each wingtip for attachment of integral spraypod. Aircraft can be dismantled quickly for towing on own landing gear by light all-terrain vehicle. Wing aerofoil section NASA GA(W)-1, dihedral 3°.

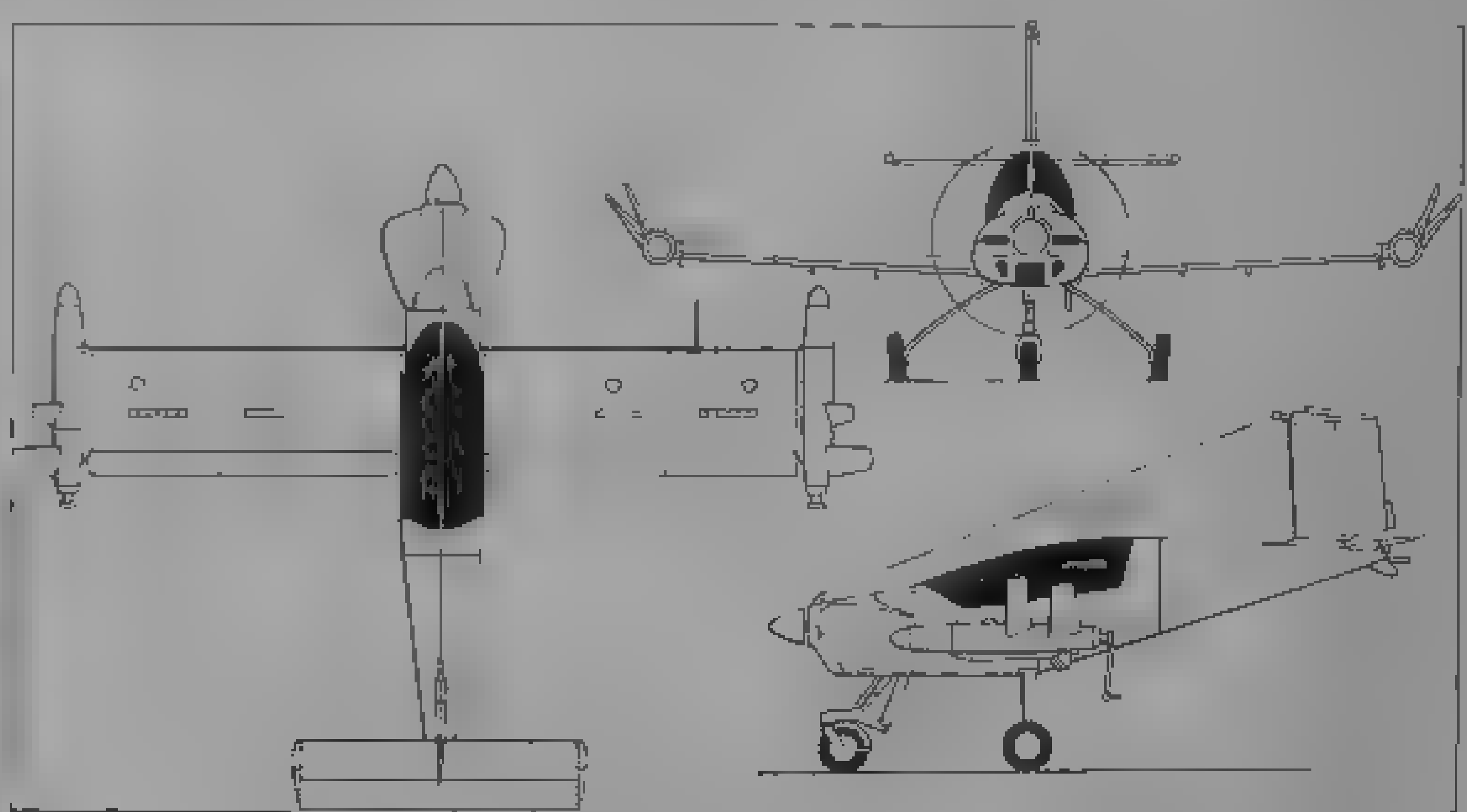
FLYING CONTROLS: Area-increasing flaps and flaperons, actuated by pushrods and interconnected by single central system located under cockpit floor, elevator actuated by pushrods, rudder by cables from adjustable rudder pedals. trim tab on elevator, ground adjustable tab on rudder.

STRUCTURE: All-metal except for GFRP/epoxy engine cowling, laminated wingtips and fairings. Single-spar wings and fixed tail surfaces, wings mounted on fuselage mandrels and offset spars connected with single pin, front part of fusetage has two 'tusks' for engine and nosewheel mounting.

LANDING GEAR: Non-retractable tricycle type. Self-springing cantilever mainwheel legs of duralumin; castoring nosewheel with oleo-pneumatic shock absorber. Wheel and tyre size 350 × 135 mm on all three units. Hydraulic differential mainwheel disc brakes.

POWER PLANT: One 74.6 kW (100 hp) Teledyne Continental O-200A flat-four engine, driving a McCauley 1A100MCM6950 two-blade metal propeller. Integral fuel

First prototype PZL-126 Mrówka agricultural aircraft, without wingtip pods *1994*



PZL 126 Mrówka light agricultural aircraft *(Jane's/Mike Keep)* *1987*

tank in each wing, combined capacity 200 litres (52.8 US gallons, 44 Imp gallons)

ACCOMMODATION: Single-seat cockpit, fitted with airbag enabling in-flight seat adjustment. One-piece organic glass moulded canopy, opening sideways to starboard

SYSTEMS: Hydraulic system for mainwheel brakes only, 24 V electrical system, hand pump to inflate seat cushion

AVIONICS: *Comms:* 720-channel UHF radio and 10-channel radiotelephone.

Instrumentation: Basic version fitted with VFR instrumentation. Electronic engine monitoring instruments are up to seven times lighter than standard. Instrument panel, with cover, can be lifted up for access to instruments and front part of cockpit

EQUIPMENT: Spraypod can be fitted to each wingtip. Pod is an integral unit with all necessary attachments for spraying, attached to wingtips by quick fastening locks, electric multiplug socket supplying power to atomisers, and electric valve controlling outflow of liquid from tank. Optional third spray unit can be mounted under fuselage. Up to 35 ha (86.5 acres) can be sprayed in one flight with 70 litres (18.5 US gallons, 15.4 Imp gallons) of pesticide delivered at rate of 2 litres (0.53 US gallon, 0.44 Imp gallon)/ha

Special biological spreader developed for dosing and spreading eggs of Trichrogramma wasp, eggs are carried in capsules in reel of tape covered with thin paper, spreader holding four such reels. Spreader is powered by electric motor and activated or stopped by push-button on throttle lever; 3 kg (6.6 lb) load of capsules is sufficient, at typical dispersal rate of four capsules every 50 m (164 ft) in rows 50 m apart, to seed an area of 800 ha (1,977 acres). Rotational mounting of spreader allows for full deflection and easy replacement of egg reels.

Aircraft can also carry miniaturised equipment such as photographic, video, thermal or other systems, coupled to satellite navigation system, monitoring and recording pictures or other signals from space

DIMENSIONS, EXTERNAL:

Wing span excl pods: 126	6.00 m (19 ft 8¼ in)
126P	7.66 m (25 ft 1½ in)
Wing span incl pods: 126	6.30 m (20 ft 8 in)
126P	8.46 m (27 ft 9 in)
Wing chord, constant (both)	
excl external flaps/flaperons	0.75 m (2 ft 5½ in)
incl external flaps/flaperons	0.92 m (3 ft 0¼ in)
Length overall: 126	4.66 m (15 ft 3½ in)
126P	5.25 m (17 ft 2¾ in)
Height overall: 126	2.53 m (8 ft 3½ in)
126P	2.80 m (9 ft 2¼ in)
Tailplane span: 126	2.00 m (6 ft 6¾ in)
126P	2.20 m (7 ft 2½ in)
Wheel track: 126	1.94 m (6 ft 4½ in)
126P	2.15 m (7 ft 0¾ in)
Wheelbase: 126	1.34 m (4 ft 4¾ in)
126P	1.352 m (4 ft 5¼ in)
Propeller diameter: 126	1.40 m (4 ft 7 in)
126P	1.75 m (5 ft 9 in)
Propeller ground clearance: 126	0.18 m (7 in)
126P	0.05 m (2 in)

AREAS:

Wings, gross, excl pods: 126	5.35 m² (57.59 sq ft)
126P	6.87 m² (73.95 sq ft)
Wings, gross, incl pods: 126	5.32 m² (57.26 sq ft)
126P	7.27 m² (78.25 sq ft)
Flaperons (total): 126	0.414 m² (4.46 sq ft)
126P	0.48 m² (5.17 sq ft)
Trailing-edge flaps (total): 126	0.57 m² (6.14 sq ft)
126P	0.97 m² (10.44 sq ft)
Vertical tail surfaces (total): 126	0.68 m² (7.32 sq ft)
126P	0.73 m² (7.86 sq ft)
Horizontal tail surfaces (total): 126	1.02 m² (10.98 sq ft)
126P	1.08 m² (11.63 sq ft)

WEIGHTS AND LOADINGS:

Max T-O and landing weight: 126	420 kg (926 lb)
126P	575 kg (1,267 lb)
Max wing loading without pods	
126	78.5 kg/m² (16.08 lb/sq ft)
126P	83.7 kg/m² (17.14 lb/sq ft)
Max wing loading with pods	
126	78.9 kg/m² (16.16 lb/sq ft)
126P	79.1 kg/m² (16.20 lb/sq ft)
Max power loading: 126	9.39 kg/kW (15.43 lb/hp)
126P	7.72 kg/kW (12.68 lb/hp)

PERFORMANCE (126P estimated):

Operating speed: 126	75 kts (140 km/h, 87 mph)
126P (agricultural)	75 kts (140 km/h, 87 mph)
Max endurance: 126P	13 h

UPDATED

IL

INSTYTUT LOTNICTWA (Aviation Institute)

Al. Krakowska 110/114, PL-02-256 Warsaw-Okecie
Telephone: 48 (22) 460011 and 46080
Fax: 48 (22) 464432 and 464232
Telex: 813537 ILOT PL

GENERAL MANAGER: Dr Eng Witold Wisniowski

CHIEF CONSULTANT FOR SCIENTIFIC AND TECHNICAL CO-OPERATION: Jerzy Grzegorzewski, MScEng

Founded 1926; directly subordinate to Ministry of Heavy and Machine Building Industry and responsible for most research and development work in Polish aviation industry; conducts scientific research, including investigation of problems associated with low-speed and high-speed aerodynamics, static and fatigue tests, development and testing of aero-engines, flight instruments, space science instrumentation, and other equipment, flight tests, and materials technology, also responsible for construction of aircraft and aero-engines.

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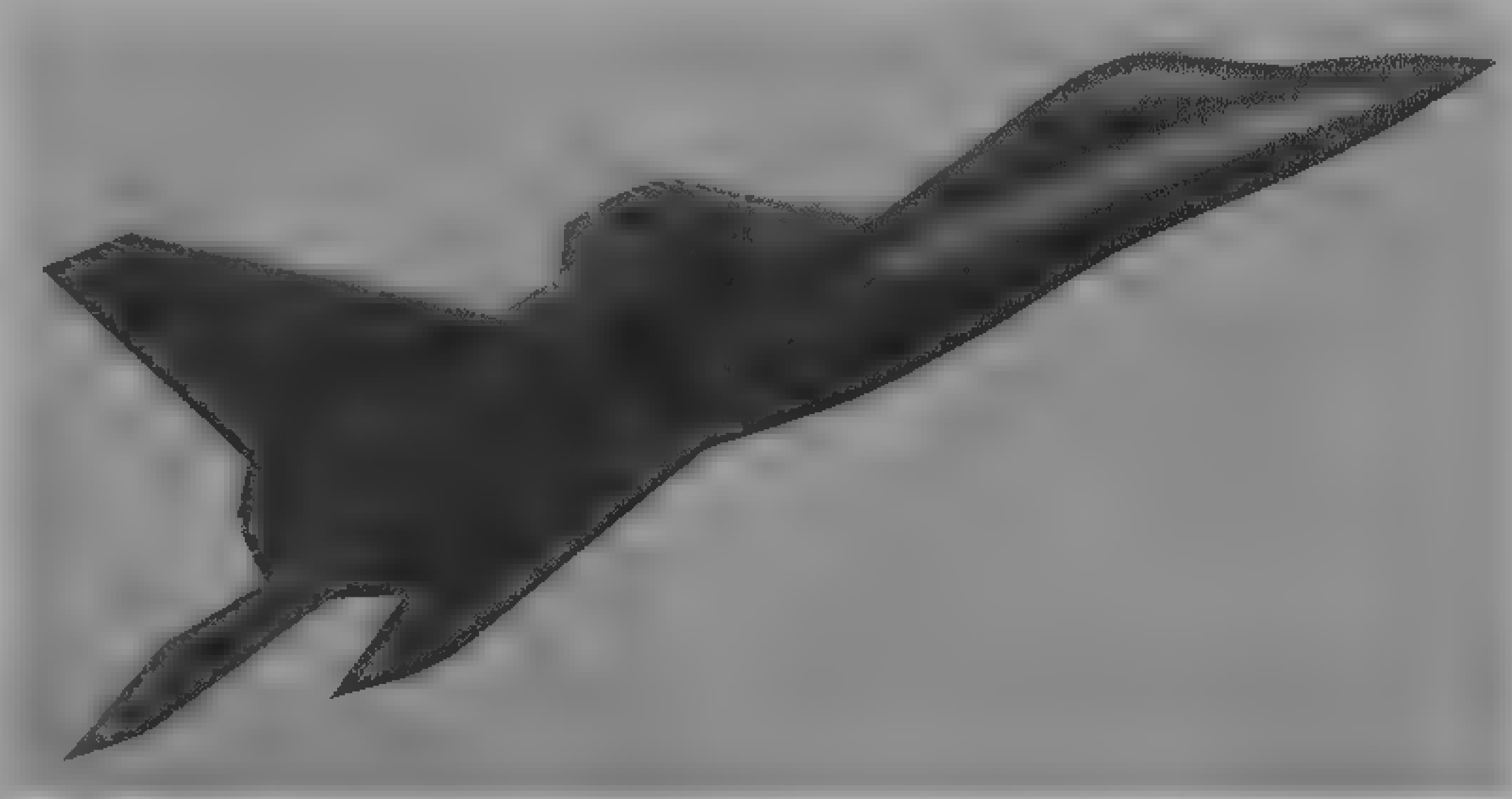

Aerodynamic model of the IL Kobra 2000 light attack aircraft *1995*

IL KOBRA 2000

TYPE: Battlefield light attack aircraft.

PROGRAMME: Revealed publicly 11 September 1993; first flight late 1990s.

CURRENT VERSIONS: Proposed in single- and two-seat versions

CUSTOMERS: Candidate for Polish Air Force requirement (60 to 100 reportedly wanted) for service entry by 2005. Competitors are PZL Mielec M-99 Orkan and PZL Warszawa-Okecie PZL-230F Skorpion (which see)

DESIGN FEATURES: Sweptback mid-wing configuration; dorsal air intake, large vertical fin; tailplane halves carried on twin underfins. Chief designer Wlodzimierz Gnarowski

LANDING GEAR: Retractable tricycle type, twin wheels on each unit

POWER PLANT: Twin turbofans (27.0 kN, 6,063 lb st IL D-28 or 26.2 kN; 5,900 lb st Rolls-Royce Turbomeca Adour Mk 871), mounted side by side in rear fuselage, combined dorsal intake aft of cockpit

DIMENSIONS, EXTERNAL:

Wing span	11.00 m (36 ft 1 in)
Length overall	13.70 m (44 ft 11½ in)
Height overall	5.20 m (17 ft 0¾ in)

WEIGHTS AND LOADINGS:

Weight empty	4,430 kg (9,766 lb)
Max external stores load	3,350 kg (7,385 lb)
Max T-O weight	10,690 kg (23,567 lb)

PERFORMANCE (estimated):

Max level speed at S/L	567 kts (1,050 km/h; 652 mph)
Max rate of climb at S/L	6,000 m (19,685 ft)/min
Service ceiling	18,000 m (59,050 ft)
T-O run	380 m (1,247 ft)
Combat radius	189-216 n miles (350-400 km, 217-248 miles)

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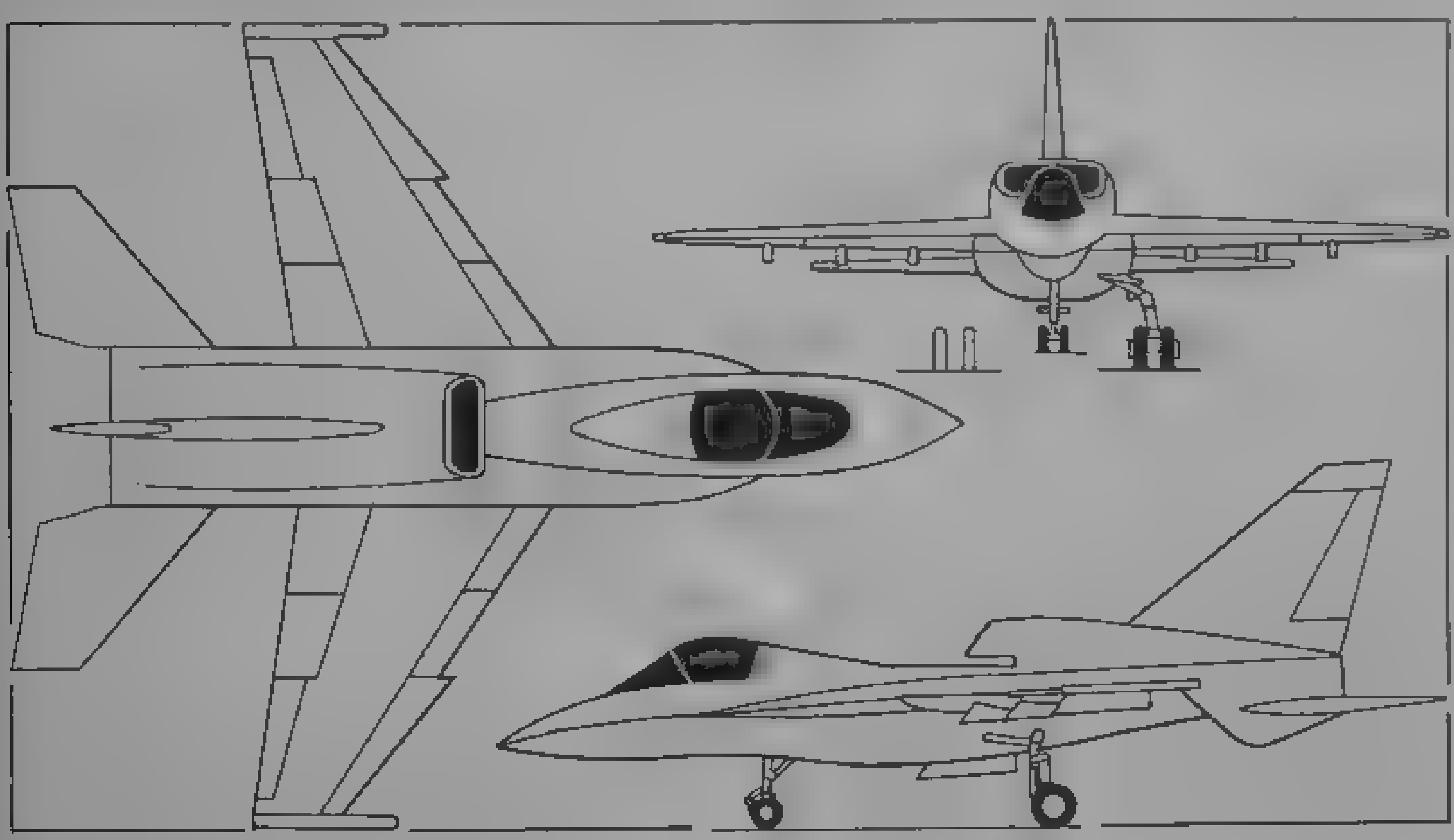


Provisional drawing of IL Kobra 2000 ***(Jane's/Paul Jackson)*** *1995*

IL I-23

TYPE: Four-seat light aircraft

PROGRAMME: Launched June 1992, construction started January 1994 of one static test and two flying prototypes, first flight scheduled for August 1995; series production planned to begin January 1996, followed by certification (to Normal and Utility category JAR Pt 23) in September 1996, first flight of production I-23 in October 1996 and first customer delivery 1997. Output of 100 per year foreseen by 1999

COSTS: $4 million for development programme, standard aircraft $100,000 (1994)

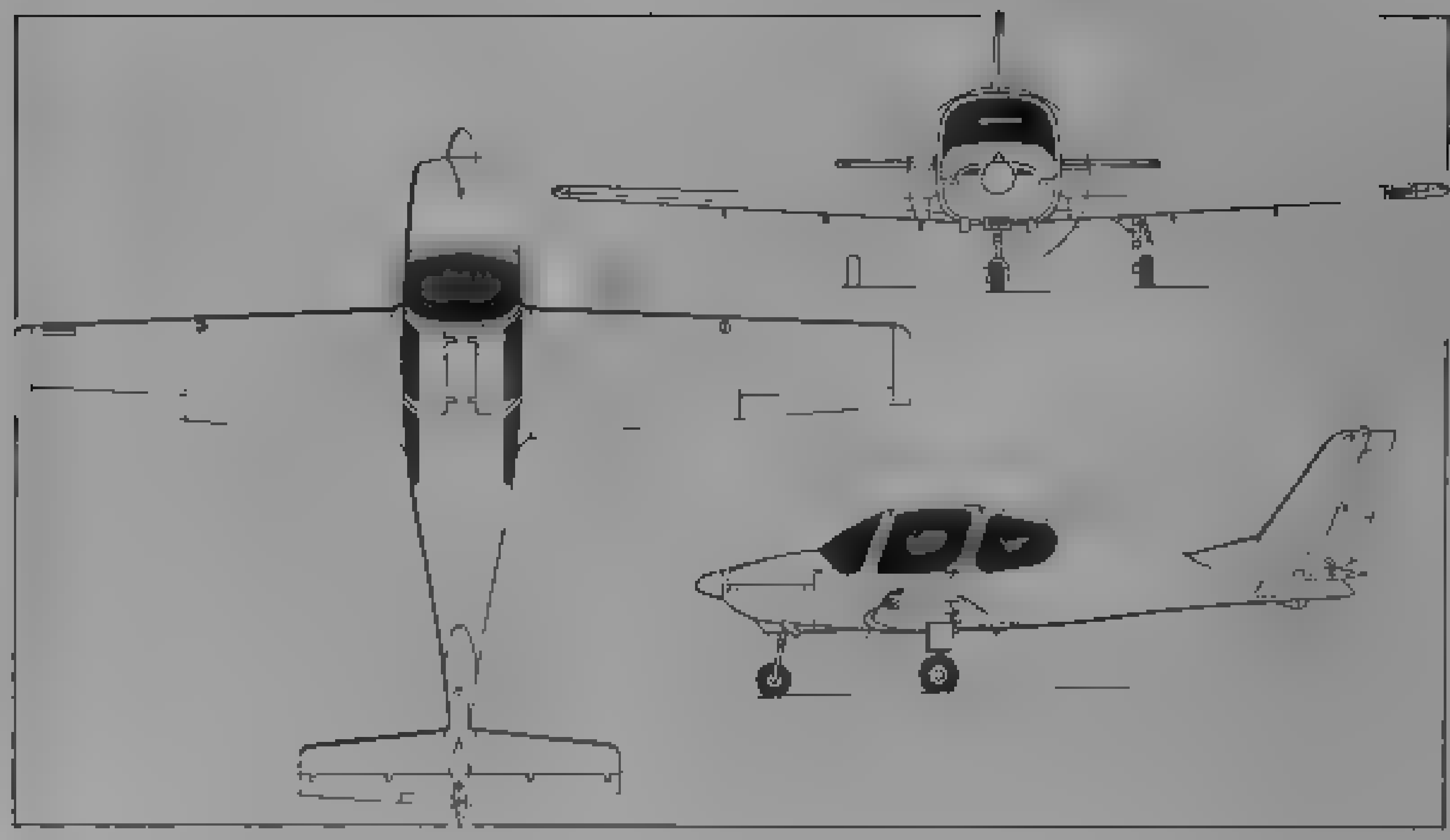
DESIGN FEATURES: Intended as safe, low-cost, low fuel consumption private owner aircraft. Conventional low-wing, tricycle-gear design with fully enclosed cabin. Wing has ILL-217 (root) and ILL-213 (tip) aerofoil sections, 2° 30′ leading-edge sweepback, 4° dihedral, 2° incidence and -1° 30′ twist.

Design permits use of any Textron Lycoming flat-four engine from 86 to 149 kW (115 to 200 hp), option for fixed or retractable landing gear, and equipment to customer's specifications.

FLYING CONTROLS: Manual/mechanical primary surfaces, single-slotted flaps

STRUCTURE: Mainly composites (GFRP/CFRP/epoxy), with sandwich skins

Model of the Instytut Lotnictwa I-23 (119 kW, 160 hp O-320 engine) *1994*



Instytut Lotnictwa I-23 four-seat light aircraft (*Jane's/Mike Keep*) *1994*

LANDING GEAR: Electrohydraulically retractable tricycle type with oleo-pneumatic shock absorbers; mainwheels retract inward, nosewheel rearward. Goodrich tyres 360 × 125 mm (main) and 336 × 128 mm (nose) tyres; tyre pressure 2.4 bars (34.8 lb/sq in) on all units. Non-retractable gear optional.

POWER PLANT: Standard engine is a Textron Lycoming O-320-D1A flat-four (119 kW; 160 hp at 2,700 rpm), driving a Hartzell two-blade constant-speed propeller. Higher or lower powered alternatives optional (see Design Features). Integral fuel tank in each wing, combined capacity 150 litres (39.6 US gallons; 33 Imp gallons); provision for eventual increase to 200 litres (52.8 US gallons; 44 Imp gallons). Pressure refuelling. Oil capacity 7.5 litres (1.98 US gallons; 1.65 Imp gallons).

ACCOMMODATION: Pilot and three passengers in side by side pairs. Upward-opening cabin door each side. Cabin heated and ventilated.

SYSTEMS: Electrohydraulic system for landing gear actuation; hydraulic system for mainwheel brakes only. Electrical power from 12 V 60 A alternator and 12 V 32 Ah battery. Liquid (spirit) windscreen de-icing. Heated pitot head.

AVIONICS: *Comms*: Bendix/King com transceiver and ATC transponder standard.

Flight: Bendix/King nav transceiver, ADF and KCS 55A HSI standard, optional full IFR system with KNS 81 integrated nav/RNav, DME and GPS. Two-axis autopilot with altitude/vertical speed preselect also optional.

DIMENSIONS, EXTERNAL:

Wing span	8.94 m (29 ft 4 in)
Wing chord: at root	1.312 m (4 ft 3½ in)
at tip	0.838 m (2 ft 9 in)
Wing aspect ratio	7.99
Length: overall	6.76 m (22 ft 2¼ in)
fuselage	5.70 m (18 ft 8½ in)
Height overall	2.40 m (7 ft 10½ in)
Tailplane span	3.20 m (10 ft 6 in)
Wheel track	2.60 m (8 ft 6½ in)
Wheelbase	1.65 m (5 ft 5 in)
Propeller diameter	1.80 m (5 ft 10¾ in)
Propeller ground clearance	0.20 m (7¾ in)

AREAS:

Wings, gross	10.00 m² (107.6 sq ft)
Ailerons (total)	0.72 m² (7.75 sq ft)
Trailing-edge flaps (total)	1.54 m² (16.58 sq ft)
Fin	0.85 m² (9.15 sq ft)
Rudder	0.48 m² (5.17 sq ft)
Tailplane	2.08 m² (22.39 sq ft)
Elevators (total)	0.39 m² (4.20 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	552 kg (1,217 lb)
Max standard fuel weight	80 kg (176 lb)
Max T-O and landing weight	950 kg (2,094 lb)
Max wing loading	95.0 kg/m² (19.46 lb/sq ft)
Max power loading	7.98 kg/kW (13.09 lb/hp)

PERFORMANCE (estimated, at max T-O weight):

Never-exceed speed (V_{NE})	183 kts (340 km/h; 2.1 mph)
Max level speed	162 kts (300 km/h; 186 mph)
Max cruising speed at 2,400 m (7,875 ft)	151 kts (280 km/h; 174 mph)
Econ cruising speed at 2,400 m (7,875 ft)	135 kts (250 km/h; 155 mph)
Stalling speed, flaps up, power off	59 kts (109 km/h; 68 mph)
Max rate of climb at S/L	306 m (1,004 ft)/min
Service ceiling	4,400 m (14,435 ft)
T-O run	165 m (542 ft)
T-O to 15 m (50 ft)	327 m (1,073 ft)
Landing from 15 m (50 ft)	330 m (1,083 ft)
Landing run	122 m (401 ft)
Range: with max fuel	809 n miles (1,500 km; 932 miles)
with max payload	499 n miles (925 km; 575 miles)

UPDATED

PW

POLITECHNIKA WARSZAWSKA (Warsaw University of Technology)

Institute of Aeronautics and Applied Mechanics, ul. Nowowiejska 22/24, PL-00-665 Warsaw
Telephone: 48 (2) 10 7 0965
Telex: 813307 PW P
DIRECTOR: Dr Roman Świtkiewicz

VERIFIED

POLITECHNIKA WARSZAWSKA PW-4

TYPE: Two-seat motor glider.

PROGRAMME: Based on PW-3 sailplane (see 1992-93 *Jane's*) but rear fuselage boom lower to permit mounting of engine at wing trailing-edge; first flight 23 December 1990.

DESIGN FEATURES: Strut-braced high wing, pod and boom fuselage.

FLYING CONTROLS: Mechanical for conventional primary surfaces; airbrakes in wing upper surfaces.

STRUCTURE: Mainly GFRP/epoxy except for fabric covering on wings and rudder.

LANDING GEAR: Non-retractable tricycle type, with self-sprung mainwheel legs. Mainwheel tyres size 350 × 150 mm; steerable tailwheel, size 300 × 125 mm. Mainwheel disc brakes.

POWER PLANT: One 59.7 kW (80 hp) Limbach L 2000 EC1 flat-four engine, driving a Hoffmann two-blade fixed-pitch pusher propeller. Fuel capacity 40 litres (10.6 US gallons; 8.8 Imp gallons).

ACCOMMODATION: Two tandem seats.

Politechnika Warszawska PW-4 tandem two-seat motor glider *1994*

DIMENSIONS, EXTERNAL:

Wing span	16.20 m (53 ft 1¾ in)
Wing aspect ratio	13.95
Length overall	8.00 m (26 ft 3 in)
Height overall	2.40 m (7 ft 10½ in)

AREAS:

Wings, gross	18.80 m² (202.4 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	500 kg (1,102 lb)
Max T-O weight	720 kg (1,587 lb)
Max wing loading	38.30 kg/m² (7.84 lb/sq ft)
Max power loading	12.07 kg/kW (19.83 lb/hp)

PERFORMANCE, UNPOWERED (at max T-O weight):

Stalling speed	38 kts (70 km/h; 44 mph)
Min rate of sink at 46 kts (86 km/h; 53 mph)	1.20 m (3.94 ft)/s
Best glide ratio at 51 kts (95 km/h; 59 mph)	20
Design g limits	+5.3/−2.65

UPDATED

PZL MIELEC

WYTWÓRNIA SPRZETU KOMUNIKACYJNEGO (Transport Equipment Corporation) PZL MIELEC SA (Holding company)

ul. Wojska Polskiego 3, PL-39-300 Mielec
Telephone: 48 (196) 7010
Fax: 48 (14) 214785
Telex: 0632293 C WSK PL
PRESIDENT: Wiesław Pastuła
AVIATION DIVISION:
PZL Mielec Aircraft Company Ltd (address as above)
Telephone: 48 (196) 87901 and 87819
Fax: 48 (196) 87639
MANAGING DIRECTOR: Zdzisław Klonowski
TECHNICAL DIRECTOR: Piotr Rudny
COMMERCIAL DIRECTOR: Ryszard Migryt

WSK PZL Mielec is largest and best equipped aircraft factory in Poland; founded 1938, had produced over 15,000 aircraft by 1 January 1995. R&D department is responsible for aircraft design, modification and development.

In addition to production of aircraft of its own and foreign design, Mielec manufactures components for Boeing 757 and Ilyushin Il-96, began manufacture and subassembly March 1991 of components for Socata TB series light aircraft (see French section).

UPDATED

PZL MIELEC I-22 IRYDA (IRIDIUM)

TYPE: Two-seat basic and advanced jet trainer.

PROGRAMME: Launched 1977, leading to 1980 Polish Ministry of National Defence 'Iskra-22' requirement for combat capable jet trainer, designed by OBR SK/IL/PZL Warszawa team led initially by Dr Eng Alfred Baron and from

1987 by Dr Eng W Gnarowski construction began 1982, static test aircraft completed 1983, five flying prototypes, all with PZL-5 turbojets, of which first one (c/n 1ANP01-02) made first flight 3 March 1985 but lost in crash 31 January 1987; first flights of remaining four 26 June 1988 (SP-PWB, c/n 1ANP01-03), 13 May 1989 (SP-PWC, c/n 1ANP01-04), 22 October 1989 (SP-PWD, c/n AN001-01) and 4 July 1991 (SP-PWE, c/n AN001-02); fatigue test aircraft completed 1990, factory and state tests (1,040 flights totalling 900 hours) completed by end March 1992, followed by award of state test certificate 14 April 1992

First order (for nine preproduction aircraft) announced during Poznan air show September 1991, first of these (serial number 103) made first flight 5 May 1992, handed over to Polish Air Force (with second aircraft 105) 24 October, entering service 27 November 1992; next three aircraft delivered February 1994

CURRENT VERSIONS: **I-22**: Initial two-seat training version with PZL-5 engines. *Detailed description applies to this version.*

M-93, M-95, M-97 and M-99: Developed versions, described separately

CUSTOMERS: Polish Air Force (58th Lotniczy Pulk Szkolny: Air School Regiment)

COSTS: Development programme Zł 5 billion (1991); I-22 approximately $3.5 million (1993).

DESIGN FEATURES: Intended to replace TS-11 Iskra and LiM-6 with Polish Air Force, covers full spectrum of pilot, navigation, air combat, reconnaissance and ground attack training, with day/night and bad weather capability, able to operate from unprepared airstrips and carry variety of ordnance; airframe designed to be tolerant of battle damage, capable of quick and inexpensive repair, and stressed to permit use of more powerful engines and carriage of greater weapons load without jeopardising permissible load factors, service life calculated on basis of 2,500 flying hours or 10,000 take-offs and landings

Laminar flow aerofoil section (NACA 64A-010 at root, 64A-210 at tip), with 0° incidence and 1° 43′ 48″ geometric twist sweepback 18° 58′ 12″ on leading edges, 14° 27′ 36″ at quarter-chord, no sweep on trailing edges, anhedral from roots 3° on wings, 6° on tailplane

FLYING CONTROLS: Mechanically (rod) actuated mass balanced, differentially operable ailerons (with hydraulic boost and manual reversion), elevators and rudder, ground adjustable tab on rudder and each aileron, hydraulically actuated single-slotted trailing-edge flaps (25° for T-O and landing), with emergency pneumatic operation, variable incidence tailplane (0°/−7.5°) and twin airbrakes (maximum deflection 62°) in upper rear fuselage also actuated hydraulically

STRUCTURE: All-metal light alloy (aluminium/magnesium/steel) stressed skin, with limited use of glassfibre (for example, fuselage/fin fairing); two-spar wing, built as one unit with centre and inboard portions forming integral fuel tanks. Titanium heatshields in engine bays. Elevator trailing-edges of honeycomb sandwich from third preproduction aircraft onward

LANDING GEAR: Retractable tricycle type, with oleo-pneumatic shock-absorber, single wheel and tubeless tyre on each unit. Hydraulic extension and retraction, nose unit retracts forward, main units forward and upward into engine nacelles. Auxiliary pneumatic system for emergency extension. Mainwheel tyres size 670 × 210 mm, pressure 7.06 bars (102.4 lb/sq in), nosewheel tyre 430 × 170 mm, pressure 5.78 bars (84 lb/sq in). Nosewheel steerable ±45°. Hydraulic disc brakes on mainwheels, auxiliary mainwheel parking brake serves also as emergency brake. Maximum rate of descent 220 m (722 ft)/min at AUW of 6,600 kg (14,550 lb). SH 21U 1 brake-chute (area 15 m², 161.5 sq ft, drag coefficient 0.45) in fuselage tailcone. Small tail bumper under rear of fuselage

POWER PLANT: Two 10.79 kN (2,425 lb st) PZL-5 (formerly SO-3W22) non-afterburning turbojets, pod-mounted on lower sides of centre-fuselage. Fuel in three integral wing tanks (combined capacity 1,090 litres, 288 US gallons, 240 Imp gallons) and two rubber tanks and two header tanks in fuselage (combined capacity 1,340 litres, 354 US gallons, 295 Imp gallons), to give total internal capacity of 2,430 litres (642 US gallons, 535 Imp gallons)

Fuel system permits up to 30 seconds of inverted flight. Single-point pressure refuelling (at front of port engine nacelle), plus four gravity filling points (two in upper fuselage, one on each wing). Oil capacity 10 litres (2.6 US gallons, 2.2 Imp gallons) per engine

ACCOMMODATION: Pressurised, heated and air conditioned cockpit, with tandem seating for pupil (in front) and instructor; rear seat elevated 400 mm (15.7 in). For solo flying, pilot occupies front seat. Back-type parachute, oxygen bottle and emergency pack for both occupants. Individual framed canopies, each hinged at rear and opening upward pneumatically. Rearview mirror in front cockpit. VS1 BRI/P rocket-assisted ejection seats, fitted with canopy breakers, can be operated at zero altitude and at speeds down to 81 knots (150 km/h, 94 mph). Dual controls standard, front cockpit equipped for IFR flying. Windscreen anti-iced by electric heating, supplemented by alcohol spray. Remaining transparencies anti-iced and demisted by hot engine bleed air

SYSTEMS: Cockpits pressurised (maximum differential 0.185 bar; 2.68 lb/sq in) and air conditioned by engine bleed air. Air from air conditioning system also used to pressurise crew's g suits. Main hydraulic system, pressure 210 bars (3,045 lb/sq in), actuates landing gear extension and retraction, wing flaps, airbrakes, tailplane incidence, brake-chute deployment, differential braking of mainwheels, and nosewheel steering. Auxiliary hydraulic system for aileron control boost. Pneumatic system comprises three separate circuits, each supplied by a nitrogen bottle pressurised at 150 bars (2,175 lb/sq in): one powers emergency extension of wing flaps for landing, one the emergency extension of landing gear; third is for canopy opening, closing and sealing, windscreen fluid anti-icing system, and hydraulic reservoir pressurisation. All three bottles charged simultaneously through a common nozzle

Electrical system, powered by two 9 kW PR-9 DC starter/generators, supplies 115 V single-phase AC (via two 1 kVA LUN 2458.8 static converters) and 36 V three-phase AC (via two 500 VA PT-500C converters), both at 400 Hz; two 24 V 25 Ah 20NKBN-25 batteries provide DC power in event of a double failure. Each AC voltage supplied by one main converter and one standby, latter automatically assuming full load if a main converter fails. Crew oxygen system, capacity 9 litres (549 cu in). Engine intakes anti-iced by engine bleed air; fire detection and extinguishing system (two Freon bottles in rear fuselage). Electronic control system for gun firing and weapon release

AVIONICS: *Comms*: Unimor RS-6113 VHF/UHF multichannel com radio and SRO-2 IFF.

Flight: ARK-15M ADF; RW-5 radio altimeter, ORS-2M marker beacon receiver (from third preseries aircraft onward), SOD-57M ILS, SARPP-12WM flight data recorder in dorsal fin fillet

Instrumentation: Blind-flying instrumentation standard.

Mission: Integrated analog weapon delivery control system

Self defence: SPO-1 RWR

ARMAMENT: One 23 mm GSz-23L twin-barrel gun in ventral pack, with up to 200 rounds in fuselage (normal load 50 rounds on training missions), ASP-PFD-I22 gyro gunsight, S-13-100 nose-mounted gun camera and (optionally) SSz-45-1-100-05 firing effect monitor camera. Four UBP I-22 underwing multiple stores carriers normally, each stressed for load of up to 500 kg (1,102 lb) (but maximum external stores load 1,100 kg, 2,425 lb); on these can be carried various bombs of 50, 100, 250 or 500 kg size (alternative MBD2-67U carriers for 50 and 100 kg bombs), from 32 to 128 57 mm S-5 unguided rockets in Mars-2, Mars-4, UB-16-57U or UB-32A-1 launchers, or R-60 air-to-air homing missiles on APU-60IM launch rails. Alternative underwing loads can include 23 mm UPK-23-250 gun pods, Zeus-1 7.62 mm gun pods, ZK-300 Kisajno cluster bombs, a ZR-8MB bomblet dispenser, Saturn-2 and Fobos-3 camera pods, 80 mm S-8 rockets in B-8M launchers, drop tanks or other weapons

DIMENSIONS, EXTERNAL:

Wing span	9.60 m (31 ft 6 in)
Wing chord, at root	2.90 m (9 ft 6¼ in)
at tip	1.25 m (4 ft 1¼ in)
Wing aspect ratio	4.63
Length overall	13.22 m (43 ft 4½ in)
Height overall	4.30 m (14 ft 1¼ in)
Tailplane span	4.20 m (13 ft 9¼ in)
Wheel track	2.71 m (8 ft 10¾ in)
Wheelbase	4.91 m (16 ft 1¼ in)

AREAS:

Wings, gross	19.92 m² (214.4 sq ft)
Ailerons (total)	1.362 m² (14.66 sq ft)
Trailing-edge flaps (total)	3.22 m² (34.66 sq ft)
Airbrakes (total)	0.40 m² (4.31 sq ft)
Fin	2.705 m² (29.12 sq ft)
Rudder, incl tab	0.975 m² (10.49 sq ft)
Tailplane	3.57 m² (38.43 sq ft)
Elevators (total)	1.26 m² (13.56 sq ft)

WEIGHTS AND LOADINGS:

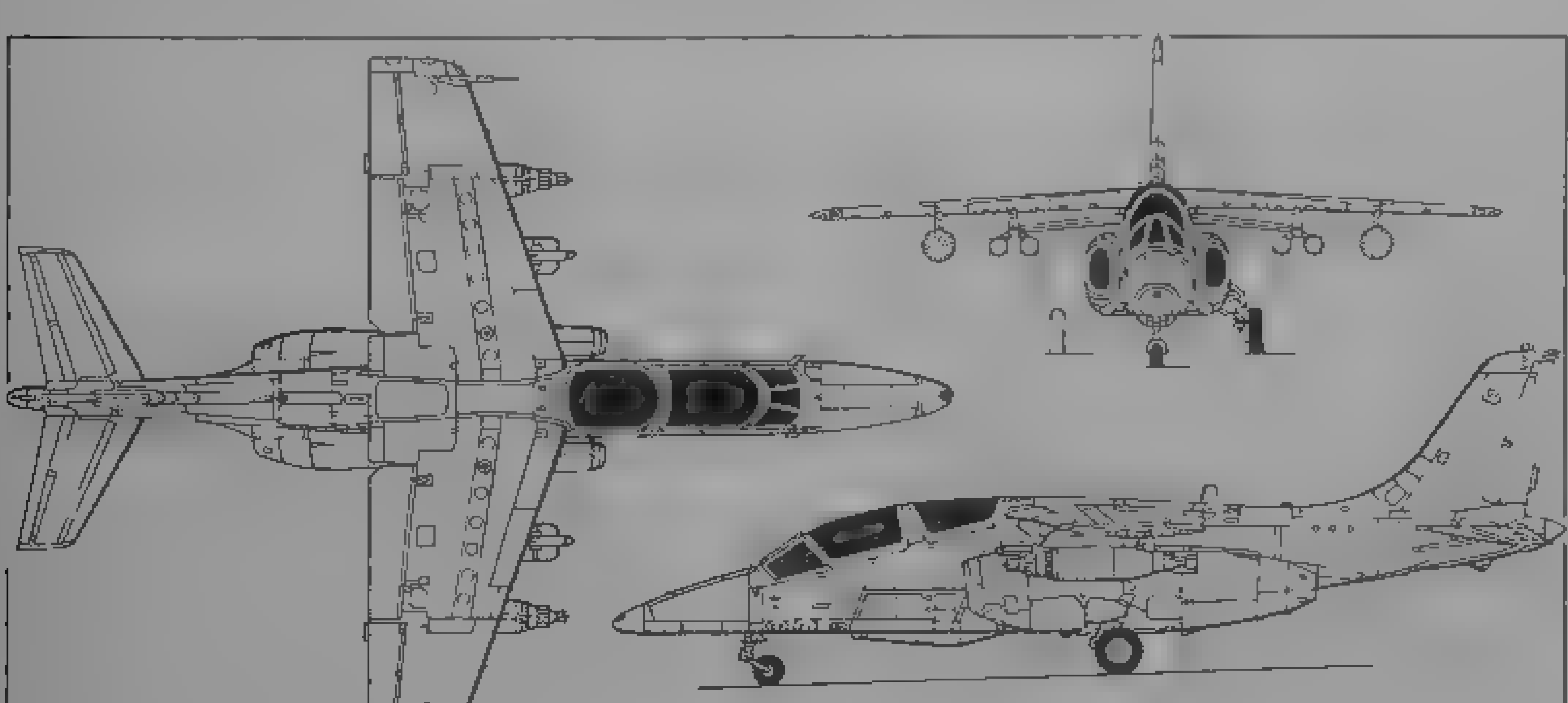
Weight empty, equipped	4,560 kg (10,053 lb)
Max internal fuel	1,895 kg (4,178 lb)
Max external stores load	1,100 kg (2,425 lb)
Max T-O weight: clean	6,620 kg (14,594 lb)
with external stores	6,900 kg (15,212 lb)
Max landing weight	6,600 kg (14,550 lb)
Max wing loading: clean	332.3 kg/m² (68.06 lb/sq ft)
with external stores	346.4 kg/m² (70.95 lb/sq ft)
Max power loading: clean	306.77 kg/kN (3.01 lb/lb st)
with external stores	319.8 kg/kN (3.14 lb/lb st)

PERFORMANCE (A: clean aircraft at 5,850 kg, 12,897 lb T-O weight, B: with 820 kg, 1,808 lb of external stores comprising four 50 kg bombs and two 16-round 57 mm rocket launchers for T-O weight of 6,600 kg, 14,550 lb, except where indicated):

Max limiting Mach number: A	0.80
B	0.70
Max permissible diving speed	
A	512 kts (950 km/h, 590 mph)
B	445 kts (826 km/h, 513 mph)
Max level speed at S/L	
A	424 kts (785 km/h, 488 mph)
B	369 kts (684 km/h, 425 mph)
Max level speed at height	
A at 5,000 m (16,400 ft)	450 kts (835 km/h, 519 mph)
B at 4,000 m (13,125 ft)	374 kts (694 km/h, 431 mph)
Stalling speed, flaps down	
A	110 kts (203 km/h, 126 mph)
B	118 kts (218 km/h, 136 mph)
Max rate of climb at S/L: A	1,500 m (4,925 ft)/min
B	1,008 m (3,305 ft)/min

Early production I-22 Iryda of the Polish Air Force (*R. J. Malachowski*)

1995



PZL Mielec I-22/M-93 Iryda tandem-seat advanced trainer with external armament (*Jane's/Mike Keep*)

1993

SP-PWE, the prototype for the Viper-engined M 93V Iryda *(Paul Jackson)*

1995

Rate of climb at S/L, OEI: A — 300 m (985 ft)/min
Time to 5 000 m (16,400 ft): A — 4 min 24 s
B — 6 min 48 s
Service ceiling: A — 12,000 m (39,375 ft)
B — 9,500 m (31,175 ft)
Service ceiling, OEI: A — 5 000 m (16,400 ft)
T-O run: A — 730 m (2,395 ft)
B — 1,250 m (4 100 ft)
T-O to 15 m (50 ft): A — 1 200 m (3,940 ft)
B — 2 200 m (7,220 ft)
Landing from 15 m (50 ft)
A with brake-chute — 1 340 m (4 400 ft)
A without brake-chute — 2 160 m (7 090 ft)
B with brake-chute — 1,570 m (5,150 ft)
B without brake-chute — 2 240 m (7,350 ft)
Landing run: A with brake-chute — 640 m (2,100 ft)
A without brake-chute — 1,400 m (4 595 ft)
B with brake-chute — 760 m (2,495 ft)
B without brake-chute — 1,570 m (5,150 ft)
Combat radius at 500 m (1,640 ft)
B — 108 n miles (200 km, 124 miles)
Range at 5,000 m (16,400 ft)
A at 6,650 kg (14,660 lb) T-O weight — 620 n miles (1,150 km; 714 miles)
B at 6,900 kg (15,211 lb) T-O weight — 326 n miles (605 km, 376 miles)
Endurance at 5 000 m (16,400 ft), weights as for ranges above: A — 2 h 33 min
B — 1 h 32 min
g limits
clean, AUW below 5 865 kg (12,930 lb) — +8/−4
clean, AUW above 5 865 kg (12,930 lb) — +7.3/−4
with external stores — +6/−3

UPDATED

PZL MIELEC M 93 IRYDA

TYPE: Two-seat basic and advanced jet trainer, increased capability development of I-22

PROGRAMME: Initiated (originally under designation M-92) when fourth I-22 prototype (SP-PWD) refitted with II K-15 turbojets, making new 'first' flight 22 December 1992, fifth I-22 prototype (SP-PWE), refitted with Viper engines, flew 25 April 1994. These variants, now known as M 93K and M 93V respectively (see Current Versions) also incorporate other changes (see Design Features and later paragraphs); either can be fitted with SAGEM Maestro (Modular Avionics Enhancement System Targeted for Retrofit Operations), first test-flown in SP-PWD on 24 May 1994

CURRENT VERSIONS: **M-93K**: As I 22 but with K 15 engines and other improvements First flight of production M 93K (SP-PWF/0204), 6 July 1994; state qualification board type certificate January 1995, seven production aircraft (retaining I-22 avionics) due for delivery to Polish Air Force by end of 1995, six to eight more to follow in 1996

M-93V Viper-engined equivalent of M 93K, intended mainly for export, also type certificated January 1995

M-93R. Proposed two-seat reconnaissance version specialised mission equipment in fuselage and/or external pods, modified systems and equipment

M-93M: Proposed maritime attack and overwater reconnaissance version

CUSTOMERS. Polish Air Force (M-93K); two delivered by end of April 1995

DESIGN FEATURES: Generally as for I 22 except for different power plants, new design airbrakes, modified systems and equipment and some minor changes

FLYING CONTROLS As for I-22

STRUCTURE. As for I-22.

LANDING GEAR Mainwheel units have automatic braking system and 8 83 bars (128 lb/sq in) tyre pressure, otherwise as for I-22

POWER PLANT: Two turbojets: 14.71 kN (3,307 lb st) Instytut Lotnictwa K-15s in M-93K, 14.71 kN (3,307 lb st) Rolls-Royce Viper 545s (modified 535) in M 93V Internal fuel as for I-22 Provision for one 380 litre (100 US gallon, 83 6 Imp gallon) auxiliary fuel tank under each wing.

ACCOMMODATION: Martin-Baker PL10LR zero/zero ejection seats, otherwise as for I-22

SYSTEMS: As for I-22

AVIONICS (initial production M 93K): As for I 22 except

Flight RW 5 radio altimeter replaced by Instytut Lotnictwa RWL-750; SARPP 12WM flight data recorder replaced by Polish S2-3 recorder

AVIONICS (optional for any M-93 variant): SAGEM Maestro nav/attack suite, operated with MIL-STD-1553B databus and comprising

Flight: 12-channel INS/GPS hybrid nav and mission computers integrated with nav/attack unit

Instrumentation: Wide-angle (26°) HUD in front cockpit, second HUD in rear cockpit, video recorder; camera recording of HUD symbology; air data sensor; EFIS indicators (EHSI and EADI), magnetic bubble memory

ARMAMENT: As for I-22

DIMENSIONS EXTERNAL As for I-22

AREAS: As for I 22

WEIGHTS AND LOADINGS
Weight empty, equipped — 4,650 kg (10,251 lb)
Max fuel weight: internal — 1,895 kg (4,178 lb)
external — 608 kg (1,340 lb)
Max external stores load — 1,800 kg (3,968 lb)
Max T-O weight: clean — 6,700 kg (14,771 lb)
with external stores — 8,700 kg (19,180 lb)
Max landing weight — 6,600 kg (14,550 lb)
Max wing loading: clean — 336 3 kg/m² (68 89 lb/sq ft)
with external stores — 436.7 kg/m² (89 45 lb/sq ft)
Max power loading: clean — 227.7 kg/kN (2.23 lb/lb st)
with external stores — 295.7 kg/kN (2 90 lb/lb st)

PERFORMANCE (M-93K and M-93V at clean T-O weight of 5,900 kg; 13,007 lb except where indicated)
Max limiting Mach number — 0 83
Max level speed at 5,000 m (16,400 ft) — 513 kts (950 km/h, 590 mph)
Stalling speed, flaps down — 110 kts (203 km/h, 127 mph)
Max rate of climb at S/L — 2,520 m (8,268 ft)/min
Rate of climb at S/L, OEI — 732 m (2,401 ft)/min
Time to climb to 5 000 m (16,400 ft) — 2 min 30 s
Service ceiling — 13,700 m (44 950 ft)
Service ceiling, OEI — 9 000 m (29,520 ft)
T-O run at max clean T-O weight — 670 m (2,199 ft)
T-O to 15 m (50 ft) at max clean T-O weight — 1,060 m (3,478 ft)
Landing from 15 m (50 ft) at MLW
without brake-chute — 1,400 m (4,594 ft)
with brake-chute — 1,150 m (3,773 ft)
Landing run at MLW
without brake-chute — 670 m (2,199 ft)
with brake-chute — 420 m (1 378 ft)
Tactical radius at 500 m (1,640 ft) at max T-O weight with max external stores — 135 n miles (250 km, 155 miles)

NEW ENTRY

Front cockpit of the M 93K *(R. J. Malachowski)*

1995

PZL MIELEC M 95 IRYDA

TYPE Proposed multipurpose combat aircraft; development of M-93

CURRENT VERSIONS **M-95T** Combat trainer

M-95R: Reconnaissance version, expanded combat and reconnaissance capability compared with M-93R

M-95M Maritime reconnaissance/attack version, more capable than M-93M

M-95MS: As M-95M, with capability comparable with Hawk 200 or Alpha Jet 3

DESIGN FEATURES Based on M-93, but with sweptback, supercritical section wing and wider choice of power plants Wing swept 20° at quarter-chord and fitted with Fowler flaps; all-moving tailplane with 26° 30′ quarter-chord sweepback

POWER PLANT: Two K-15 or Viper 545 turbojets, as in M-93; or two Viper 632 (each 17 70 kN, 3,980 lb st) or 680; or two Larzac 04-V3 turbofans (each 16 18 kN, 3,637 lb st), or other 17 8 kN (4,000 lb st) class engines

AVIONICS More sophisticated than in M-93, including modern nav/attack and self-defence systems

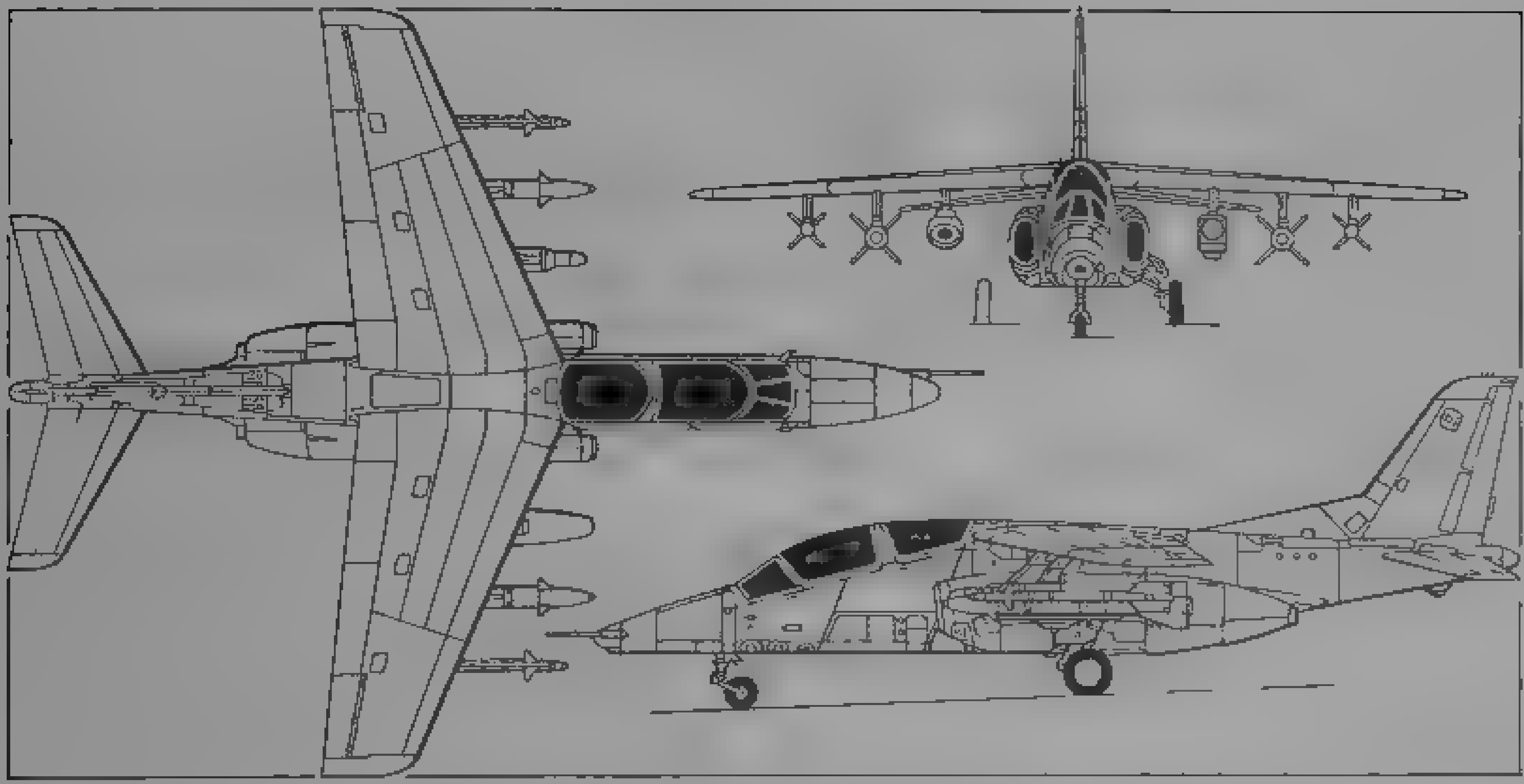
ARMAMENT: Fuselage-mounted gun (existing 23 mm or new 30 mm), range of externally mounted weapons expanded to include conventional or guided bombs, smart ammunition pods, guided and/or unguided air-to-air and air-to-surface (including anti-ship) weapons

WEIGHTS AND LOADINGS (A: K-15 or Viper 545 engines, B Larzac 04-V3s, C Viper 632s)
Max external stores load A, B — 2,500 kg (5,511 lb)
C — 3,000 kg (6,614 lb)
Max T-O weight: A — 9,500 kg (20,944 lb)
B — 10,000 kg (22,046 lb)
C — 10,700 kg (23,589 lb)

PERFORMANCE (estimated, at clean T-O weight of 5,900 kg, 13,007 lb except where indicated; A, B and C as above)
Max level speed at S/L
A — 513 kts (950 km/h; 590 mph)
B — 524 kts (970 km/h, 603 mph)
C — 540 kts (1,000 km/h, 621 mph)
Stalling speed, flaps down
A, B, C — 87 kts (160 km/h; 100 mph)

0204 (formerly SP-PWF), the first production M 93K for the Polish Air Force *(R. J. Malachowski)*

1995



Proposed M-95 reconnaissance and close support derivative of the I-22, with sweptback wings, revised nose/tail contours and other modifications *(Jane's/Mike Keep)*

1993

Max rate of climb at S/L: A 2,520 m (8,268 ft)/min
B 2,820 m (9,252 ft)/min
C 3,600 m (11,811 ft)/min
Service ceiling: A 13,000 m (42,650 ft)
B 12,300 m (40,350 ft)
C 14,000 m (45,930 ft)
Time to climb at 10,000 m (32,800 ft): A 6 min 40 s
B 8 min 0 s
C 4 min 40 s
T-O to 15 m (50 ft) at AUW of 6,700 kg (14,771 lb)
A 750 m (2,461 ft)
B 650 m (2,133 ft)
C 570 m (1,870 ft)
Landing from 15 m (50 ft) at AUW of 6,600 kg (14,550 lb), brake-chute deployed
A, B, C 800 m (2,625 ft)
Tactical radius at 500 m (1,640 ft), depending upon mission profile and external load configuration
A, C 135-189 n miles (250-350 km, 155-217 miles)
B 162-243 n miles (300-450 km, 186-279 miles)

NEW ENTRY

PZL MIELEC M-97 IRYDA

TYPE: Proposed single-seat development of M-95.

CURRENT VERSIONS: **M-97S**: Attack version.
M-97MS: Dual-role attack/fighter.

DESIGN FEATURES: As M-95 except for deletion of second cockpit and incorporation of mission-specific armament and equipment.

WEIGHTS AND LOADINGS: As for M-95 except:
Max external stores load: A 2,500 kg (5,511 lb)
B 2,800 kg (6,173 lb)
C 3,500 kg (7,716 lb)

NEW ENTRY

PZL MIELEC M-99 ORKAN (EAGLE)

TYPE: Proposed single-seat attack aircraft, further development of M-95/-97.

PROGRAMME: Announced 1994, in competition with IL Kobra 2000 and PZL Warsaw Skorpion (which see) to fulfil Polish Air Force requirement.

CURRENT VERSIONS: **M-99A**: With two 26.77 kN (6,018 lb st) Rolls-Royce/SNECMA Adour Mk 871 turbofans.
M-99S: With two 21.58 kN (4,850 lb st) Slovak PS DV-2 turbofans.
M-99SA: With two 25.01 kN (5,622 lb st) PS DV-2A turbofans.

DESIGN FEATURES: Generally similar to M-95/-97 except for minor engine nacelle differences, limited use of composites, longer landing gear legs, expanded armament and equipment.

DIMENSIONS, EXTERNAL:
Wing span, excl wingtip launch rails 10.83 m (35 ft 6½ in)
Length overall 13.22 m (43 ft 4½ in)
Height overall 4.62 m (15 ft 2 in)

AREAS:
Wings, gross 23.00 m² (247.6 sq ft)

WEIGHTS AND LOADINGS:
Weight empty: A 5,410 kg (11,927 lb)
S, SA 5,170 kg (11,398 lb)
Max fuel weight: internal 2,800 kg (6,173 lb)
external 1,880 kg (4,144 lb)
Max external stores load: all 4,000 kg (8,818 lb)
Max T-O weight, clean: A 8,300 kg (18,298 lb)
S, SA 8,060 kg (17,769 lb)

PERFORMANCE (estimated, at max clean T-O weight except where indicated):
Max level speed at S/L:
A 389 kts (720 km/h, 447 mph)
S 504 kts (935 km/h, 581 mph)
SA 545 kts (1,010 km/h, 627 mph)
Max rate of climb at S/L: A 4,740 m (15,551 ft)/min
S 2,400 m (7,874 ft)/min
SA 3,900 m (12,795 ft)/min
Rate of climb at S/L, OEI: A 1,440 m (4,724 ft)/min
S 780 m (2,559 ft)/min
SA 1,200 m (3,937 ft)/min
Time to climb to 10,000 m (32,800 ft):
A 4 min 0 s
S 4 min 40 s
SA 4 min 20 s
Service ceiling: A 14,500 m (47,570 ft)
S, SA 14,400 m (47,245 ft)
Service ceiling, OEI: A 10,000 m (32,800 ft)
S, SA 10,100 m (33,140 ft)
T-O to 15 m (50 ft): A 420 m (1,378 ft)
S 530 m (1,739 ft)
SA 450 m (1,477 ft)
Landing from 15 m (50 ft): A 650 m (2,133 ft)
S, SA 600 m (1,969 ft)
Tactical radius at 500 m (1,640 ft), depending upon mission profile and external load configuration:
A 162-324 n miles (300-600 km; 186-372 miles)
S, SA 162-351 n miles (300-650 km; 186-404 miles)
g limits (all): clean +9/−4
with external stores +7/−3

NEW ENTRY

PZL MIELEC (ANTONOV) An-28

NATO reporting name: Cash
Polish Air Force name: Bryza

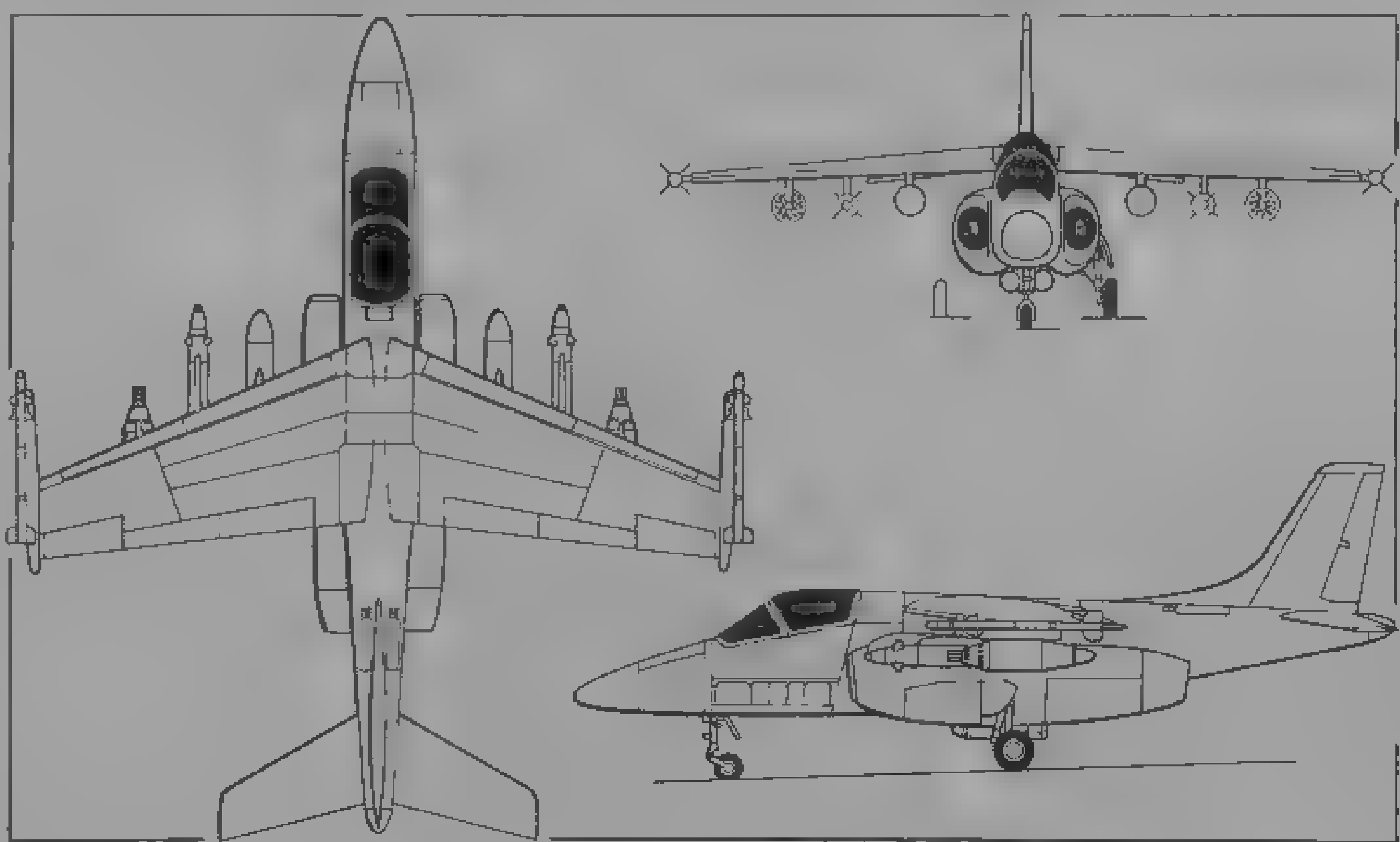
TYPE: Twin turboprop short-range transport.

PROGRAMME: Developed by Antonov in former USSR for service on Aeroflot's shortest routes, particularly those operated by An-2s into places relatively inaccessible to other fixed-wing aircraft; official Soviet flight testing completed 1972; first preproduction An-28 (SSSR-19723) originally retained same engines as prototype, but re-registered SSSR-19753 April 1975 when flown with current engines; production assigned to PZL Mielec 1978; temporary Soviet NLGS-2 type certificate awarded 4 October 1978 to second Soviet-built preproduction aircraft. Polish manufacture started with initial batch of 15, first flight of Polish An-28 (SSSR-28800) 22 July 1984; version received full Soviet type certificate 7 February 1986. Polish production now for domestic use only; current marketing effort concentrated on M-28 Skytruck derivative (which see). See 1994-95 and earlier *Jane's* for full An-28 description.

CURRENT VERSIONS: **An-28RM Bryza 1RM** (Ratowh ctwa Morskiego: maritime reconnaissance, search and rescue

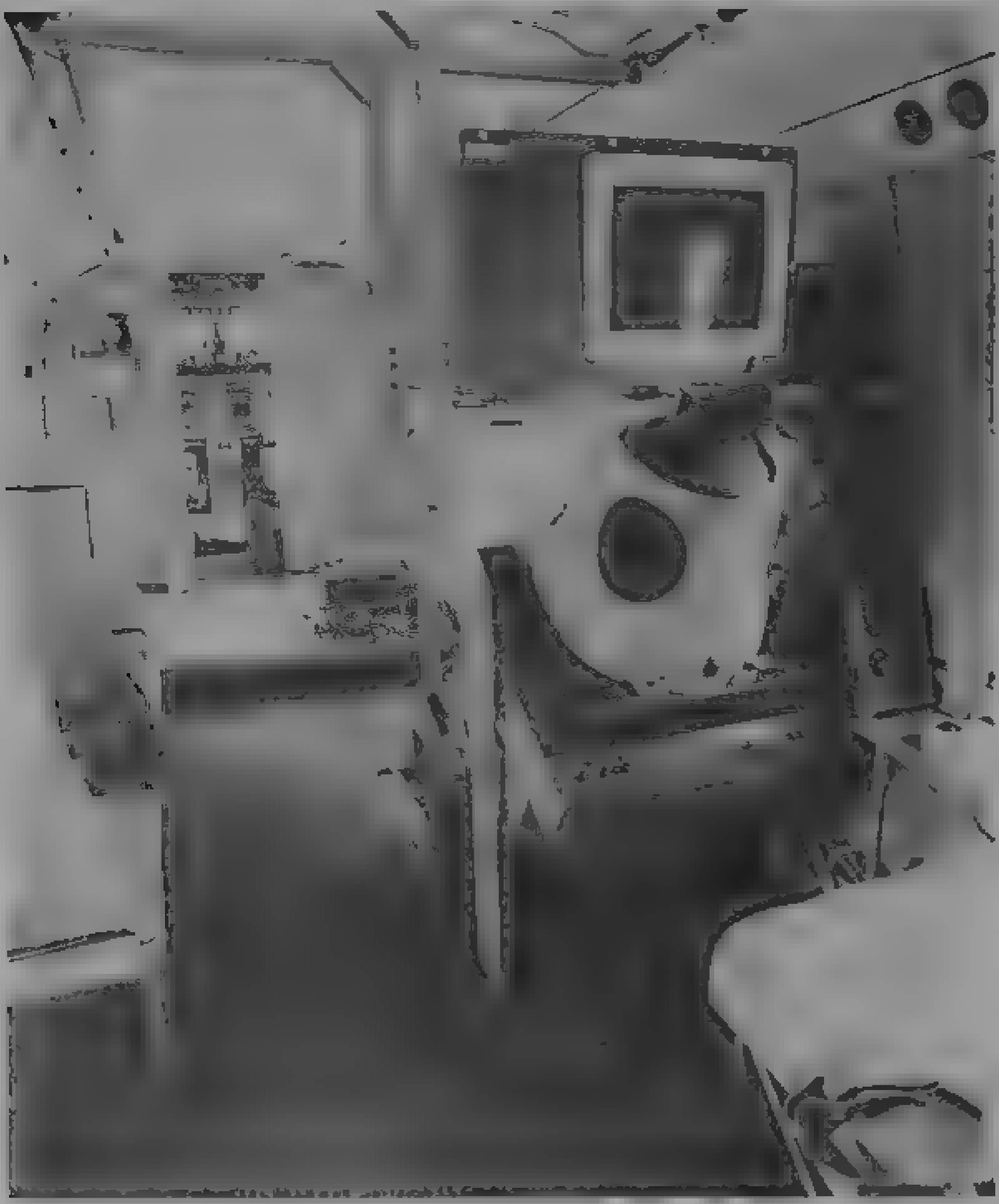
Single-seat proposed developments of the I-22 include the ground attack M-97S (main drawing) and fighter/ground attack M-97MS (upper side view) *(Jane's/Mike Keep)*

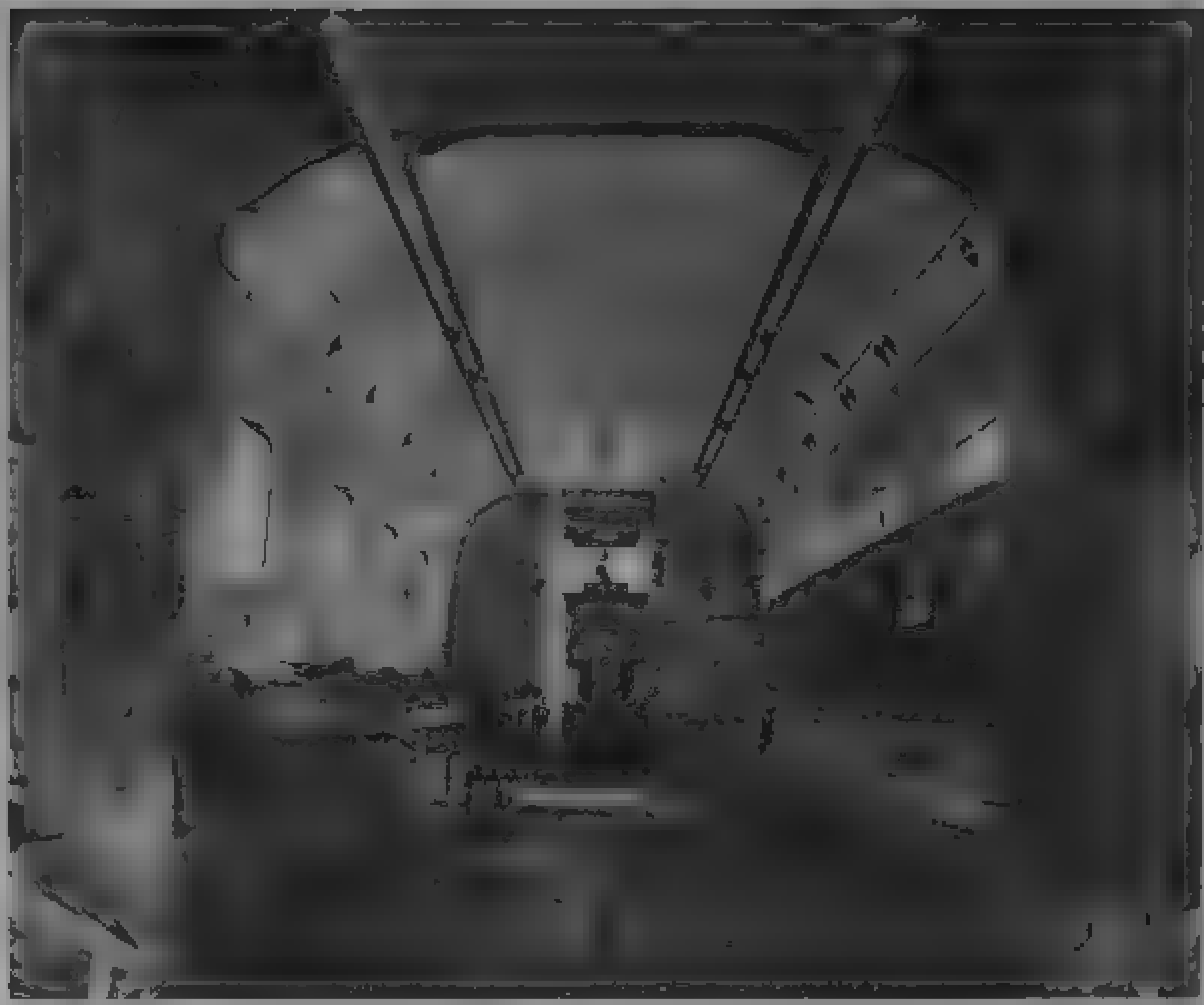
1993



M-99 Orkan proposed single-seat attack aircraft *(Jane's/James Goulding)*

1995





Foldaway seating in the An-28 cabin

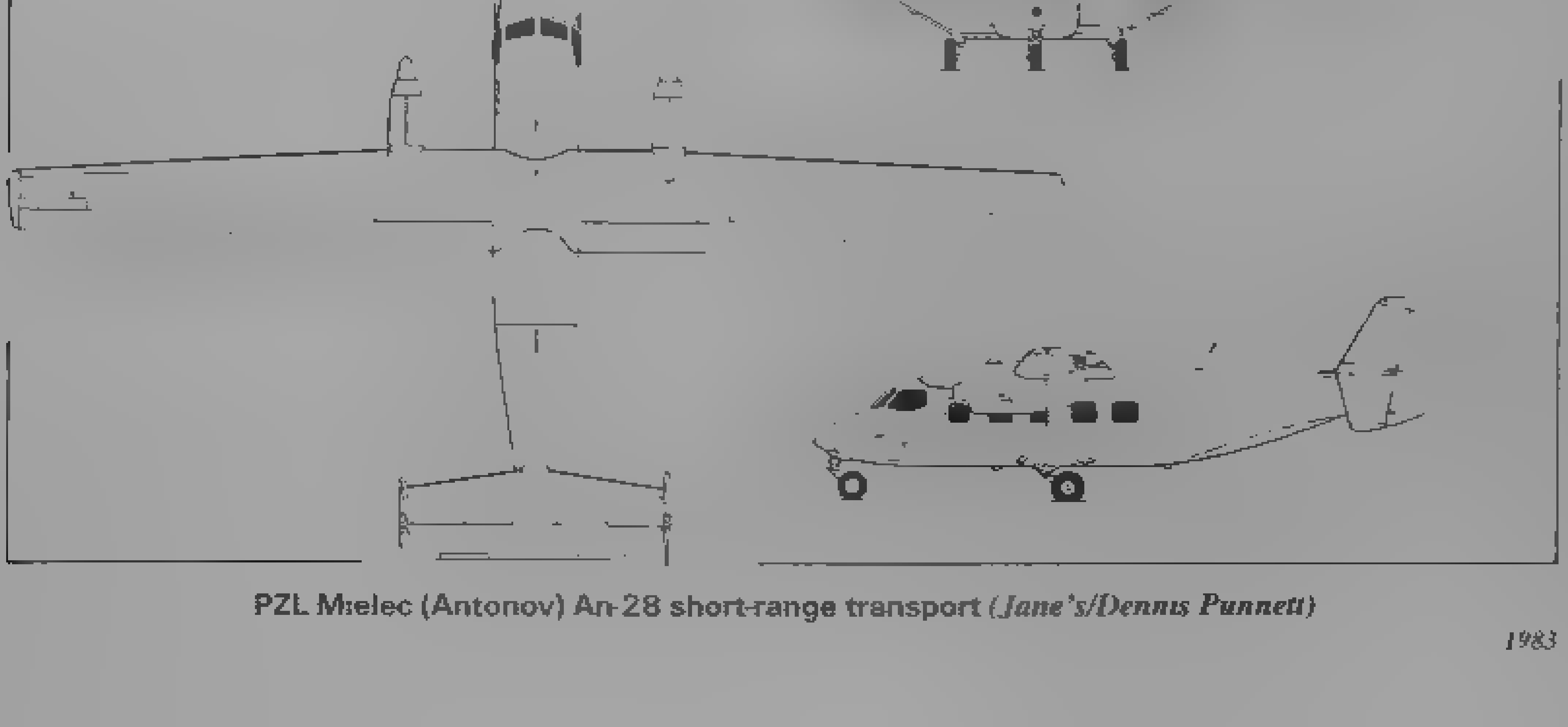
1993

Cabin interior of the Bryza 1RM *(R. J.Malachowski)*

1995

Bryza 1RM (An 28RM) with ventral SAR radar bulge *(R J Malachowski)*

1995



PZL Mielec (Antonov) An-28 short-range transport *(Jane's/Dennis Punnett)*

1983

version (formerly An-28B1R) for use by Polish agencies for SAR missions in Baltic; improved avionics include Chelton DF-707-1 radio search system, GPS receiver, Doppler navigation, Bendix/King RDS-81 weather radar Polish Radwar SRN-441XA search radar in ventral radome, two 100 kg illumination bombs, rescue dinghy, stretchers, automatic datalink and other specialist equipment. Prototype (SP-PDC) completed 1992 and delivered to Polish Air Force 1993

An-28TD Bryza 1TD (Transportowa Desantowy cargo airdrop): Adapted for airdrop operations, with clamshell rear doors replaced by single door sliding forward under fuselage, similar to that of An-26 (which see). Previously known as An-28B1T First use may be to transport and drop firefighting teams. Prototype (SP-PDE) converted 1992

CUSTOMERS: See 1994-95 and earlier *Jane's*. Recent deliveries to Polish Air Force include two Bryza 1RMs and one 1TD, respectively to the 7th Special Regiment at Siemirowice and the 13th Transport Regiment at Krakow. Further orders for these models are expected if defence budget permits

UPDATED

PZL MIELEC M-28 SKYTRUCK

TYPE: Twin-turboprop short-range transport

PROGRAMME: Westernised development of An-28, with Polish power plant and avionics replaced by P&WC PT6A-65B turboprops, Hartzell five-blade propellers and Bendix/King nav/com, weather radar and other equipment. Prototype conversion (SP-PDF) begun early 1991; first flight July 1993. Polish temporary type certificate to FAR Pt 23 Amendment 34 granted March 1994, permanent certificate expected early 1995

CUSTOMERS: Customer deliveries due to begin in first quarter 1995 after permanent type certificate obtained

DESIGN FEATURES: Braced wings, will not stall because of action of automatic slats; if an engine fails, patented upper surface spoiler forward of aileron on opposite wing is opened automatically, resulting in wing bearing dead engine dropping only 12° in 5 seconds instead of 30° without spoiler; patented fixed tailplane slat improves handling during high angle of attack climb-out; under icing conditions, if normal anti-icing system fails, ice collects on slat rather than tailplane, to retain controllability; short stub-wing extends from lower fuselage to carry main landing gear and support wing bracing struts, curving forward and downward at front to serve as mudguards; underside of rear fuselage upswept, incorporating clamshell doors for passenger/cargo loading, twin fins and rudders, mounted on inverted-aerofoil no-dihedral fixed incidence tailplane.

Wing section TsAGI R II 14 thickness/chord ratio 14 per cent, constant chord, non-swept, no-dihedral centre section, with 4° incidence; tapered outer panels with 2° dihedral, negative incidence and 2° sweepback at quarter-chord

FLYING CONTROLS: Unpowered single-slotted mass and aerodynamically balanced ailerons (port aileron has trim tab),

Bryza 1TD (An-28TD), showing the slide-under door which replaces the normal clamshell pair *(R. J. Malachowski)*

1995

designed to droop with large, hydraulically actuated, two segment double-slotted flaps, elevators with electrically actuated trim tabs, twin rudders each with electrically actuated trim tab, automatic leading-edge slats over full span of wing outer panels, slab type spoiler forward of each aileron and each outer flap segment at 75 per cent chord, fixed slat under full span of tailplane leading-edge

STRUCTURE: Mostly metal, duralumin ailerons with fabric covering, duralumin slats with CFRP skins, CFRP spoilers and trim tabs. Air intakes lined with epoxy laminate

LANDING GEAR: Non-retractable tricycle type, with single wheel and PZL oleo-pneumatic shock absorber on each unit. Main units, mounted on small stub-wings, have wide tread balloon tyres, size 720 × 320 mm, pressure 3.5 bars (51 lb/sq in). Steerable (±50°) and self-centring nosewheel, with size 595 × 185 × 280 mm Stomil (Poland) tyre, pressure 3.5 bars (51 lb/sq in). Multidisc hydraulic brakes on main units, and inertial anti-skid units. Minimum ground turning radius 16.00 m (52 ft 6 in). Ski gear under development

POWERPLANT: Two 820 kW (1,100 shp) Pratt & Whitney Canada PT6A-65B turboprops, each driving a Hartzell HC-B5MP-3M10876ASK five-blade propeller. Two centre-section and two outer-wing integral fuel tanks in wing spar boxes, with total capacity of 2,440 litres (645 US gallons; 537 Imp gallons). Refuelling point on each tank. Oil capacity 16 litres (4.2 US gallons; 3.5 Imp gallons) per engine

ACCOMMODATION: Pilot and co-pilot on flight deck, which has bulged side windows and electric anti-icing for windscreens, and is separated from main cabin by bulkhead with connecting door. Dual controls standard. Jettisonable emergency door on each side. Standard cabin layout of passenger version has seats for 18 people, with six single seats on port side and six double seats on starboard side of aisle, at 72 cm (28 in) pitch. All seats easily foldable or removable for carriage of cargo. Aisle width 34.5 cm (13.5 in). Five passenger windows each side of cabin. Seats fold back against walls when aircraft is operated as a freighter or in mixed passenger/cargo role, seat attachments providing cargo tiedown points. Hoist of 500 kg (1,102 lb) capacity able to deposit cargo in forward part of cabin. Entire cabin heated, ventilated and soundproofed. Outward/downward-opening clamshell double door, under upswept rear fuselage, for passenger and cargo loading. Emergency exit at rear of cabin on each side.

SYSTEMS: No air conditioning, pressurisation or pneumatic systems. Hydraulic system, pressure 150 bars (2,175 lb/sq in), for flap and spoiler actuation, mainwheel brakes and nosewheel steering, with emergency back-up system for spoiler extension and mainwheel braking.

Primary electrical system is three-phase AC, with two engine-driven alternators providing 200/115 V power for heating systems, engine operation monitoring, fuel pump, radio, recorders and instrument lights. Transformer-rectifiers on this system provide 36 V AC power for pressure gauges, artificial horizon, navigation and recording equipment, and 27 V DC for control systems and signalling, internal and external lighting, firefighting system, propeller pitch control and feathering, radio, and engine starting and monitoring systems. In emergency, single-phase 115 V AC can be provided by PO-250A converter, 36 V AC by a static inverter and 27 V DC by two 25 Ah 20NKBN-25 batteries.

Thermal (engine bleed air) anti-icing of outer-wing, fin and tailplane leading-edges and engine air intakes. Electric anti-icing of flight deck windscreens, propellers, spinners and pitot heads. Oxygen system (for crew plus two passengers) optional. No APU

AVIONICS: Standard avionics suite by Bendix/King

Comms: KY 196 VHF-AM and KX 165 HF radios, KMA 24H-70/71 audio selector panel and intercom, KT 79 transponder, dual emergency VHF

Radar: RDS 81 digital weather radar

Flight: VOR/ILS (dual), DME, ADF, marker beacon receiver, RMI and dual KCS 55A pictorial nav system, KNS 81 digital area nav and GC 381A radar graphics computer, radar altimeter; KFC 275 or KFC 325 AFCS

DIMENSIONS, EXTERNAL:

Wing span	22.063 m (72 ft 4½ in)
Wing chord: at root	2.20 m (7 ft 2½ in)
mean aerodynamic	1.886 m (6 ft 2¼ in)
at tip	1.10 m (3 ft 7¼ in)
Wing aspect ratio	12.25
Length overall	13.10 m (42 ft 11¾ in)
Fuselage: Length	12.68 m (41 ft 7¼ in)
Max width	1.90 m (6 ft 2¾ in)
Max depth	2.14 m (7 ft 0¼ in)
Height overall	4.90 m (16 ft 1 in)
Tailplane span	5.14 m (16 ft 10¼ in)
Wheel track	3.405 m (11 ft 2 in)
Wheelbase	4.40 m (14 ft 5¼ in)
Propeller diameter	2.82 m (9 ft 3 in)
Distance between propeller centres	5.20 m (17 ft 0¾ in)
Rear clamshell doors: Length	2.40 m (7 ft 10½ in)
Total width: at top	1.00 m (3 ft 3¼ in)
at sill	1.40 m (4 ft 7 in)
Emergency exits (rear, each): Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	5.26 m (17 ft 3 in)
Max width	1.74 m (5 ft 8½ in)
Max height	1.72 m (5 ft 7¾ in)
Floor area	approx 7.5 m² (80.73 sq ft)
Volume	approx 14.0 m³ (494.4 cu ft)

AREAS:

Wings, gross	39.72 m² (427.5 sq ft)
Ailerons (total)	4.33 m² (46.61 sq ft)
Trailing-edge flaps (total)	7.986 m² (85.96 sq ft)
Spoilers (total)	1.667 m² (17.94 sq ft)
Fins (total)	10.00 m² (107.64 sq ft)
Rudders (total, incl tabs)	4.00 m² (43.06 sq ft)
Tailplane	8.85 m² (95.26 sq ft)
Elevators (total, incl tabs)	2.56 m² (27.56 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	3,917 kg (8,635 lb)
Max fuel load	1,520 kg (3,351 lb)
Max payload	2,000 kg (4,409 lb)
Fuel with max payload	870 kg (1,918 lb)
Payload with max fuel	1,350 kg (2,976 lb)
Max T-O weight	7,000 kg (15,432 lb)
Max landing weight	6,650 kg (14,660 lb)
Max zero-fuel weight	5,850 kg (12,897 lb)
Normal wing loading	53.5 kg/m² (31.5 lb/sq ft)
Max power loading:	
PZL-10S	4.64 kg/kW (7.62 lb/shp)
PT6A-65B	3.96 kg/kW (6.51 lb/shp)

PERFORMANCE (standard M-28 at max T-O weight):

Max operating speed (VMO)	189 kts (350 km/h; 217 mph)
Econ cruising speed at 3,000 m (9,840 ft)	156 kts (290 km/h; 180 mph)
Unstick speed	73 kts (135 km/h; 84 mph)
Approach speed	70 kts (130 km/h; 81 mph)
Landing speed, flaps down	76 kts (140 km/h; 87 mph)
Max rate of climb at S/L	546 m (1,791 ft)/min
Time to 3,000 m (9,840 ft):	
de-icing off	6 min
de-icing on	9 min
Service ceiling (oxygen system limited)	4,200 m (13,780 ft)

Prototype/demonstrator for the PZL Mielec M-28 Skytruck *(R. J. Malachowski)*

1995

The M-18B latest production version of the Dromader agricultural aircraft *(R J Malachowski)*

1995

T-O run	250 m (821 ft)
T-O to 10.7 m (35 ft)	420 m (1,378 ft)
Landing from 15 m (50 ft)	350 m (1,149 ft)
Landing run	200 m (657 ft)
Range	
max payload, no reserves	302 n miles (560 km, 348 miles)
max fuel and 1,000 kg (2,205 lb) payload, 30 min reserves	736 n miles (1,365 km, 848 miles)
g limits	+3/-1

NEW ENTRY

PZL MIELEC M-18 DROMADER (DROMEDARY)

TYPE: Agricultural and firefighting aircraft.

PROGRAMME: Designed to meet requirements of FAR Pt 23; prototype first flights 27 August and 2 October 1976, M-18 awarded Polish type certificate 27 September 1978; 10 pre-production aircraft built, of which eight used for operational trials, later certificated in Australia, Brazil, Canada, Czech Republic, France, Germany, Poland, USA and former Yugoslavia; series production began 1979.

CURRENT VERSIONS: **M-18**: Initial single-seat agricultural version (see 1988-89 *Jane's*), production ended 1984 but available to order.

M-18A: Two-seat agricultural version, for operators requiring to transport mechanic/loader to improvised air strip, production began 1984, following Polish supplementary type certification 14 February 1984; FAA type certificate for M-18 extended to M-18A September 1987, production continuing 1995. *Detailed description applies to M-18A except where indicated.*

M-18AS: Two-seat training version, with smaller hopper to make space for instructor's cockpit aft of pilot; rear cockpit installation readily interchangeable with that of M-18A; first flown 21 March 1988; five built by 1 January 1992, remains available.

M-18B: Improved performance development of M-18A, awarded extension of Polish type certificate 15 April 1994; FAA certification applied for May 1994. Elevators horn balanced and have smaller, centrally located trim tabs, spring interconnect between elevators and flaps, and between ailerons and rudder; flaps-down deflection increased from 15° to 30°; normal and overload MTOW increased to 5,300 kg (11,684 lb); Normal category landing run reduced to 170 to 190 m (558 to 624 ft) and flaps-up stalling speed to 59 knots (108 km/h, 68 mph), lower control stick force values, enhanced static and dynamic longitudinal stability. Power plant and hopper as for M-18A.

Design work of future subvariants continuing: **M-18B/AW 2** with larger (3.60 m, 11 ft 9¾ in) diameter propeller for shorter T-O and higher climb rate, and **M-18B/AW 2/K9** with same propeller and 872 kW (1,170 hp) K9 engine.

T45 Turbine Dromader: Turboprop version, 895 kW (1,200 shp) Pratt & Whitney Canada PT6A-45AG with Hartzell propeller; developed by James Mills in co-operation with Melex USA Inc (see Melex entry).

Firefighter: Prototype first flown 11 November 1978; **amphibious water bomber floatplane** variant under consideration.

CUSTOMERS: Total of 660 built (all versions) by 1 January 1995, 90 per cent for export, sold to operators in Australia, Brazil, Bulgaria, Canada, Chile, China, Cuba, Czech Republic, Germany, Greece (30 for firefighting), Hungary, Iran, Morocco, Nicaragua, Poland, Portugal, Spain, Swaziland, Trinidad, Turkey, USA, Venezuela and former Yugoslavia. Total includes 24 new or modified M-18Bs operating in Poland and three M-18Bs sold to Italy by 1 January 1995.

The M-18AS version of the Dromader has an extra cockpit at the rear for an instructor

1991

DESIGN FEATURES: Emphasis on crew safety, all parts exposed to chemical contact treated with polyurethane or epoxy enamels, or manufactured of stainless steel; detachable fuselage side panels for airframe inspection and cleaning; braced tailplane.

Wing sections NACA 4416 at root, NACA 4412 at end of centre-section and on outer panels, incidence 3°.

FLYING CONTROLS: Mechanically actuated, mass and aerodynamically balanced slotted ailerons with trim tabs, using pushrods, aerodynamically and mass balanced rudder and elevators with trim tabs, actuated by cables and pushrods respectively, hydraulically actuated two-section trailing-edge slotted flaps.

STRUCTURE: All metal, stainless steel capped duralumin wing spar, fuselage mainframe of helium-arc welded chromoly steel tube, oiled internally against corrosion, duralumin fuselage side panels and stainless steel bottom covering, corrugated tail unit skins.

LANDING GEAR: Non-retractable tailwheel type. Oleo-pneumatic shock-absorber in each unit. Main units have tyres size 800 × 260 mm, and are fitted with hydraulic disc brakes, parking brake and wire cutters. Fully castoring tailwheel, lockable for take-off and landing, with size 380 × 150 mm tyre.

POWER PLANT: One PZL Kalisz ASz-621R nine-cylinder radial air-cooled supercharged engine (721 kW, 967 hp at 2,200 rpm), driving a PZL Warszawa AW-2-30 four-blade constant-speed aluminium propeller. Integral fuel tank in each outer wing panel, combined usable capacity 400 or 712 litres (105.7 or 188 US gallons; 88 or 156.6 Imp gallons). Gravity feed header tank in fuselage.

ACCOMMODATION: Single adjustable seat in fully enclosed, sealed and ventilated cockpit stressed to withstand 40 *g* impact. Additional cabin located behind cockpit and separated from it by a wall. Latter equipped with rigid seat with protective padding and safety belt, port-side jettisonable door, windows (port and starboard), fire extinguisher, and ventilation valve. Communication with pilot provided via window in dividing wall, and by intercom. In M-18AS, standard hopper is replaced by smaller one, permitting installation of bolt-on instructor's cabin. Second cockpits of M-18A and M-18AS quickly interchangeable. Glassfibre cockpit roof and rear fairing, latter with additional small window each side. Rear cockpit of M-18AS has more extensive glazing. Adjustable shoulder type safety harness. Adjustable rudder pedals. Quick-opening door on each side of front cockpit, port door jettisonable.

SYSTEMS: Hydraulic system, pressure 98 to 137 bars (1,421 to 1,987 lb/sq in), for flap actuation, disc brakes and dispersal system. Electrical system powered by 28.5 V 100 A generator, with 24 V 25 Ah Ni/Cd battery and overvoltage protection relay.

AVIONICS: *Comms:* RS-6102 (Polish built), Bendix/King KX 175B or KY 195B com transceiver.

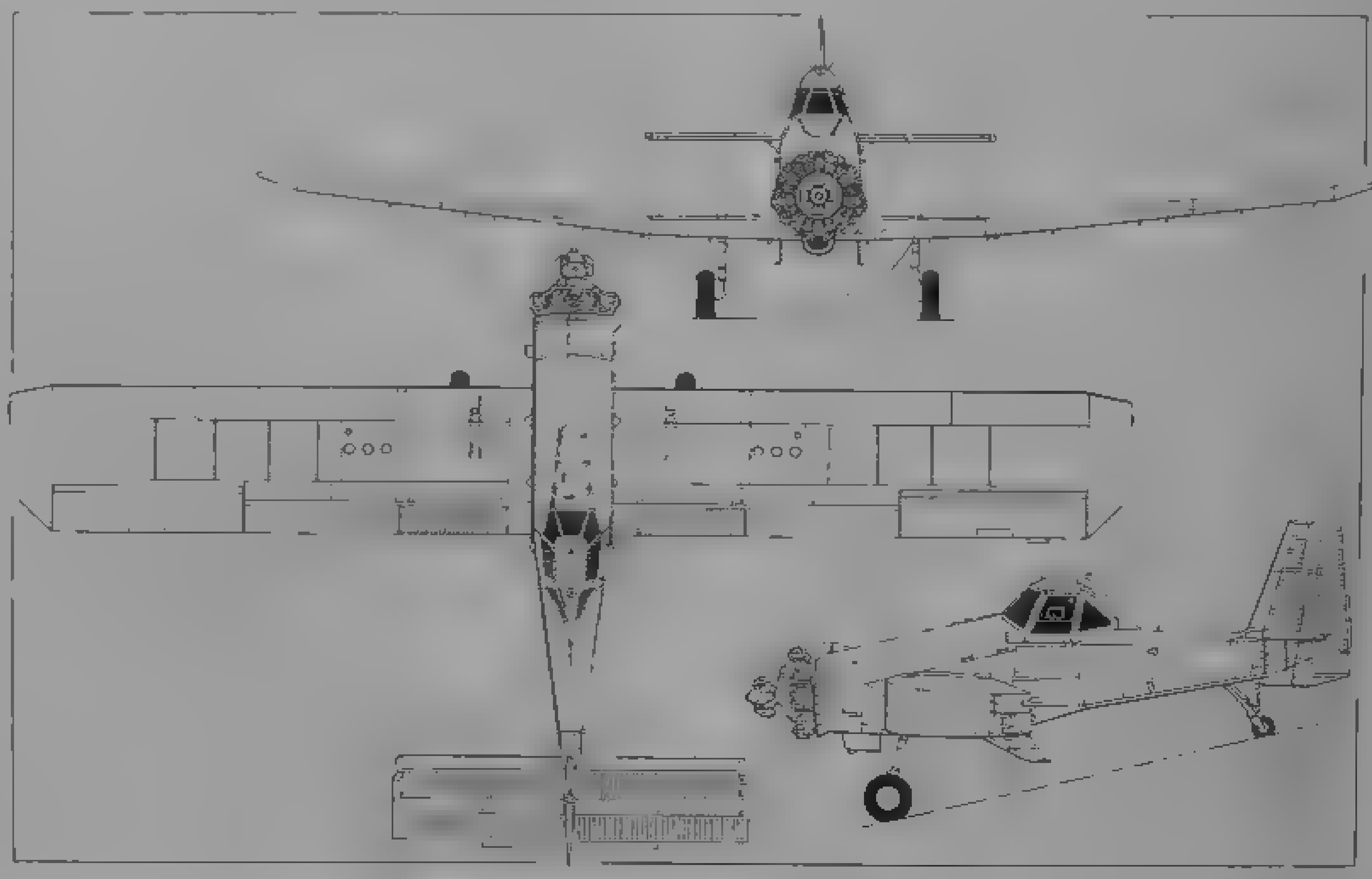
Flight: KI 201C nav receiver, VOR/OBS indicator, gyro-compass, radio compass and stall warning.

EQUIPMENT: Glassfibre epoxy hopper, with stainless steel tube bracing, forward of cockpit, capacity (M-18A) 2,500 litres (660 US gallons, 550 Imp gallons) of liquid or 1,350 kg (2,976 lb) of dry chemical (1,850 kg, 4,078 lb under CAM 8 conditions). Smaller hopper in M-18AS. Deflector cable from cabin roof to fin.

M-18 variants can be fitted optionally with several different types of agricultural and firefighting systems, as follows: spray system with 54/96 nozzles on spraybooms, dusting system with standard, large or extra large spreader; atomising system with six atomisers, water bombing installation, and fire bombing installation with foaming agents. Aerial application roles can include seeding, fertilising, weed or pest control, defoliation, forest and bush firefighting, and patrol flights. Special wingtip lights permit agricultural flights at night, and aircraft can operate in both temperate and tropical climates. Navigation lights, cockpit light, instrument panel lights and two rotating beacons standard. Landing lights, taxi light and night working light optional. Built-in jacking and tiedown points in wings and rear fuselage, towing lugs on main landing gear. Cockpit fire extinguisher and first aid kit.

DIMENSIONS, EXTERNAL:

Wing span	17.70 m (58 ft 0¾ in)
Wing chord, constant	2.286 m (7 ft 6 in)
Wing aspect ratio	7.83
Length overall	9.47 m (31 ft 1 in)
Height: over tailfin	3.70 m (12 ft 1¾ in)
overall (flying attitude)	4.60 m (15 ft 1 in)
Tailplane span	5.60 m (18 ft 4½ in)
Wheel track	3.48 m (11 ft 5 in)
Propeller diameter	3.30 m (10 ft 10 in)
Propeller ground clearance (tail up)	0.23 m (9 in)



PZL Mielec M-18A Dromader *(Jane's/Dennis Punnett)*

1983

DIMENSIONS, INTERNAL
Hopper volume 2.50 m³ (88.3 cu ft)
AREAS
Wings, gross 40.00 m² (430.5 sq ft)
Ailerons (total) 3.84 m² (41.33 sq ft)
Trailing-edge flaps (total) 5.69 m² (61.25 sq ft)
Vertical tail surfaces (total) 2.65 m² (28.5 sq ft)
Horizontal tail surfaces (total) 6.50 m² (70.0 sq ft)
WEIGHTS AND LOADINGS (M-18A):
Basic weight empty 2,710 kg (5,975 lb)
Weight empty, equipped 2,750-2,860 kg (6,063-6,305 lb)
Payload: FAR 23 1,050-1,350 kg (2,315-2,976 lb)
CAM 8 1,550-1,850 kg (3,417-4,078 lb)
Max T-O weight: FAR 23 4,200 kg (9,259 lb)
Restricted 4,700 kg (10,362 lb)
CAM 8 (max) 5,300 kg (11,684 lb)
Max landing weight 4,200 kg (9,259 lb)
Max wing loading (FAR 23) 105.0 kg/m² (21.51 lb/sq ft)
Max power loading (FAR 23) 5.83 kg/kW (9.58 lb/hp)
PERFORMANCE (M-18A at 4,200 kg; 9,259 lb T-O weight, ISA. A: without agricultural equipment, B: with spreader equipment)
Never-exceed speed (VNE)
A 151 kts (280 km/h; 174 mph)
Max level speed: A 138 kts (256 km/h; 159 mph)
B 128 kts (237 km/h; 147 mph)
Cruising speed at S/L:
A 110 kts (205 km/h; 127 mph)
B 102 kts (190 km/h; 118 mph)
Normal operating speed
A 124 kts (230 km/h; 143 mph)
B 92 kts (170 km/h; 106 mph)
Stalling speed, power off, flaps up
A, B 65 kts (119 km/h; 74 mph)
Stalling speed, power off, flaps down
A, B 59 kts (109 km/h; 68 mph)
Max rate of climb at S/L: A 414 m (1,360 ft)/min
B 340 m (1,115 ft)/min
Service ceiling: A 6,500 m (21,325 ft)
T-O run: A 180-200 m (590-656 ft)
B 210-245 m (689-805 ft)
Landing run: A, B 260-300 m (853-984 ft)
Max range, no reserves
A, 400 litres (105.7 US gallons, 88 Imp gallons) fuel 291 n miles (540 km; 335 miles)
A, 712 litres (188 US gallons, 156.6 Imp gallons) fuel 523 n miles (970 km; 602 miles)
g limits: FAR 23 +3.4/−1.4
CAM 8 +3/−1.2

UPDATED

PZL MIELEC M-20 MEWA (GULL)

TYPE: Six/seven-seat executive transport, liaison, survey and ambulance aircraft.

PROGRAMME: Developed from PA-34-200T Seneca II light twin under 1977 agreement with Piper Aircraft Corporation, USA; nine Piper kits supplied to Pezetel 1978-80; adapted to accept PZL-F (Polish Franklin) engines 1978 and made first flight (SP-PKA) 25 July 1979; first four completed as M-20 00 and next five as M-20 01 (first flight by SP-PKE, 22 September 1982); Polish certification of 00/01 22 September 1983; fifth M-20 01 converted as M-20 02 prototype, making first flight in this form 10 October 1985, but non-availability of production PZL-F engines resulted in switch to Teledyne Continental power plant in current M-20 03 model, which made first flight (SP-DMA) 13 October 1988 and received Polish certification 12 December same year; 03 since certificated by Germany (2 October 1991), Australia (3 March 1992) and US FAA (16 July 1993).

CURRENT VERSIONS: See 1987-88 and earlier *Jane's* for M-20 00/01/02, no longer in production.

M-20 03: Current production version, with Polish built airframe and Teledyne Continental engines. Marketed as **Gemini** for export. *Detailed description applies to this version.*

M-20 04: Under development for first flight in 1995, strengthened wing with new main spar; maximum T-O weight increase to 2,156 kg (4,753 lb), Bendix/King avionics and 28 V electrical system.

CUSTOMERS: Four M-20 00 and five M-20 01 built 1979-80 and 1983-84 respectively (one 01 converted to M-20 02). 12 M-20 03 completed by early 1993, at which time orders for up to 60 more, including customers in USA.

DESIGN FEATURES: Can be operated from concrete runways or grass strips. Wing section NACA 65_2-415 (constant chord); 7° dihedral from roots, 2° incidence, leading-edges sweptforward at root.

FLYING CONTROLS: Frise differential ailerons, aerodynamically and mass balanced rudder with anti-servo tab, and slab type all-moving tailplane with trim tab, single-slotted trailing-edge flaps.

STRUCTURE: Safe-life aluminium alloy.

LANDING GEAR: Electrohydraulically retractable tricycle type, with single wheel and oleo-pneumatic shock-strut on each unit. Mainwheels retract inward into wings, nosewheel forward. Size 6.00-6 wheels on all three units (McCreary main, Air Hawk nose), tyre pressures 3.79 bars (55 lb/sq in) on main units, 2.76 bars (40 lb/sq in) on nose unit. Nosewheel steerable ±27°. Emergency gravity extension. Cleveland disc brakes; parking brake. Minimum ground turning radius about nosewheel 5.00 m (16 ft 5 in).

POWER PLANT: Two 164 kW (220 hp) Teledyne Continental TSIO/LTSIO-360-KB turbocharged, contrarotating flat six engines, each driving a Hartzell BHC-2CYF-2CK three-blade constant-speed propeller. Two 92 litre (24.3 US gallon, 20.3 Imp gallon) fuel tanks in each wing leading-edge, total standard fuel capacity 368 litres (97.2 US gallons, 81 Imp gallons). Optional auxiliary tank in each leading-edge can increase this total to 480 litres (127 US gallons, 105.5 Imp gallons). Gravity fuelling points in top of each wing. Oil capacity 7.6 litres (2 US gallons; 1.7 Imp gallons) per engine.

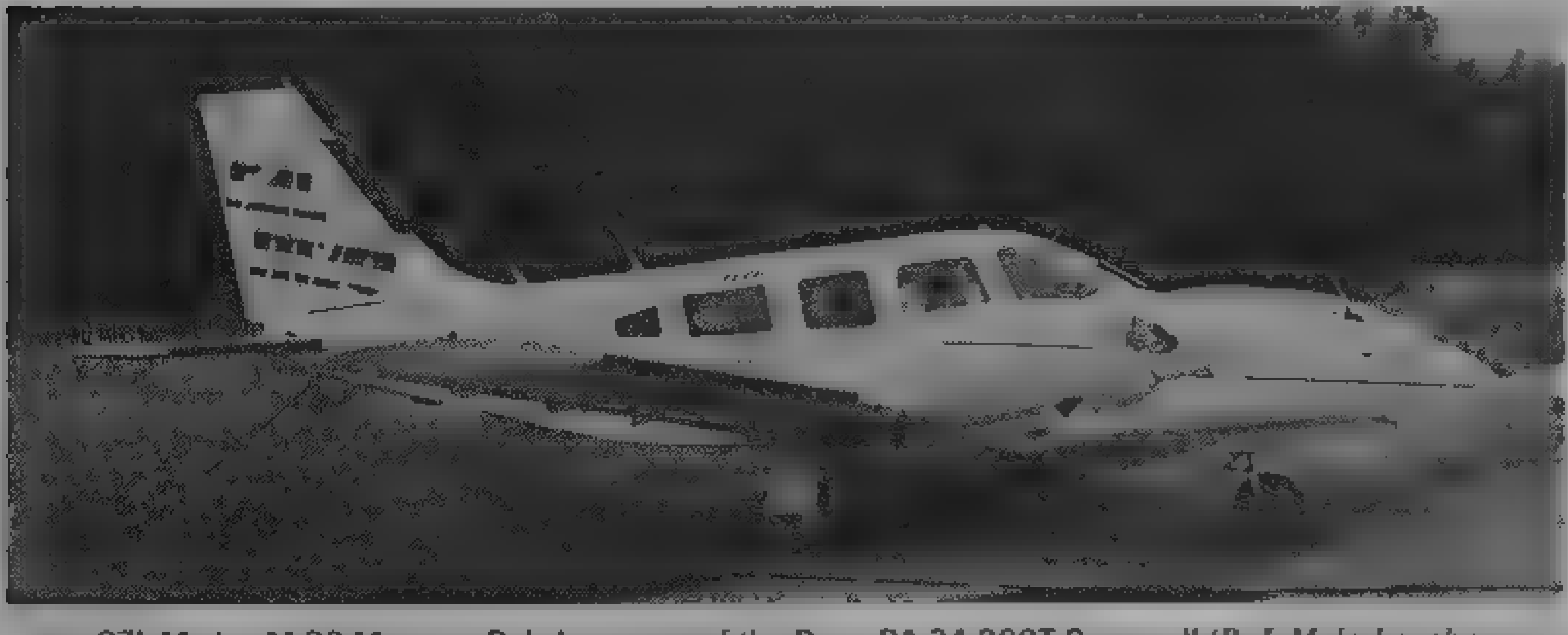
ACCOMMODATION: Passenger version seats one or two pilots plus five or four passengers, with optional seventh seat. Forward-opening door at front (starboard) and rear (port). Space for 68 kg (150 lb) of baggage in nose and 91 kg (200 lb) aft of rear seats. Ambulance version can carry one stretcher patient, two medical attendants and one other person in addition to pilot. Stretcher rack replaces right hand centre seat and, like seat, can be quickly and easily removed. Rack has special guides which can be connected to door threshold to facilitate stretcher loading; they can be folded back when stretcher is on board and locked. Hooks in cabin ceiling for suspending transfusion set, oxygen installation for patient. Doctor's seat (centre, left) has ear phone and microphone, enabling him to contact ground for assistance; nurse's seat at rear. Modified electrical system permits incubator to be installed.

SYSTEMS: Two independent hydraulic systems, one operating at 154 bars (2,233 lb/sq in) for landing gear extension/retraction and one at 103.5 bars (1,500 lb/sq in) for wheel braking. Electrical system powered by two 24 V 55 A alternators and a 24 V 25 Ah battery. Pneumatic wing, tailplane and fin leading-edge anti-icing, and electric de-icing of propeller blades, optional.

AVIONICS: *Comms*: RS-6102 VHF transceiver, SSA-1 audio control panel and multichannel VOR/LOC radio standard.
Flight: Polish ARL-1601 ADF, CG-121 slaved gyro and MRP-66 marker transceiver standard. DME, marker beacon receiver, radio compass and three-axis autopilot optional.
Bendix/King Silver Crown package optional.

DIMENSIONS, EXTERNAL
Wing span 11.86 m (38 ft 11 in)
Wing chord: at root 1.88 m (6 ft 2 in)
at tip 1.60 m (5 ft 3 in)
Wing aspect ratio 7.33
Length overall 8.72 m (28 ft 7¼ in)
Height overall 3.02 m (9 ft 11 in)
Tailplane span 4.13 m (13 ft 6¾ in)
Wheel track 3.37 m (11 ft 0¾ in)
Wheelbase 2.13 m (7 ft 0 in)
Propeller diameter 1.93 m (6 ft 4 in)
DIMENSIONS, INTERNAL
Cabin: Length 3.17 m (10 ft 4¾ in)
Max width 1.24 m (4 ft 0¾ in)
Max height 1.07 m (3 ft 6¼ in)
Volume 5.53 m³ (195.3 cu ft)
AREAS
Wings, gross 19.18 m² (206.5 sq ft)
Ailerons (total) 1.17 m² (12.59 sq ft)
Trailing-edge flaps (total) 1.94 m² (20.88 sq ft)
Fin 1.96 m² (21.10 sq ft)
Rudder 0.89 m² (9.58 sq ft)
Tailplane, incl tab 3.60 m² (38.75 sq ft)
WEIGHTS AND LOADINGS
Weight empty (standard) 1,320 kg (2,910 lb)
Max T-O weight 2,070 kg (4,563 lb)
Max landing weight 1,970 kg (4,343 lb)
Max zero-fuel weight 1,810 kg (3,990 lb)
Max wing loading 107.9 kg/m² (22.10 lb/sq ft)
Max power loading 6.86 kg/kW (11.13 lb/hp)
PERFORMANCE (at max T-O weight)
Never-exceed speed (VNE) 194 kts (360 km/h; 223 mph)
Max level speed at 4,500 m (14,765 ft) 194 kts (360 km/h; 223 mph)
Max cruising speed at 7,560 m (24,800 ft) 173 kts (320 km/h; 199 mph)
Econ cruising speed (45% power) at 7,560 m (24,800 ft) 168 kts (311 km/h; 193 mph)
Stalling speed: flaps up 67 kts (124 km/h; 77 mph)
flaps down 61 kts (112 km/h; 70 mph)
Max rate of climb at S/L 456 m (1,496 ft)/min
Rate of climb at S/L, OEI 135 m (443 ft)/min
Service ceiling 7,620 m (25,000 ft)
Service ceiling, OEI 2,375 m (7,800 ft)
T-O run 400 m (1,313 ft)
T-O to 15 m (50 ft) 444 m (1,457 ft)
Landing from 15 m (50 ft) 715 m (2,346 ft)
Landing run 600 m (1,969 ft)
Range, 45 min reserves
with max standard fuel 669 n miles (1,240 km; 770 miles)
with max standard and auxiliary fuel 989 n miles (1,833 km; 1,139 miles)

UPDATED



PZL Mielec M-20 Mewa, a Polish version of the Piper PA-34-200T Seneca II *(R. J. Malachowski)* 1995

PZL MIELEC M-26 ISKIERKA (LITTLE SPARK)

TYPE: Tandem two-seat primary training aircraft, for civil pilot training and military pilot selection.

PROGRAMME: Designed to FAR Pt 23, two versions being developed; first flight of first prototype (SP-PIA) with PZL-F engine 15 July 1986, first flight of Textron Lycoming-engined prototype (SP-PIB) 24 June 1987; flight testing completed, Polish certification obtained 26 October 1991; production of M-26 01 launched Spring 1994 with initial 20-aircraft order from US distributor Melex (which see), US FAA certification and first Melex deliveries expected 1995.

CURRENT VERSIONS: **M-26 00**: PZL-F engine and Polish avionics.

M-26 01: Textron Lycoming AEIO-540 engine and Bendix/King avionics.

CUSTOMERS: Melex USA Inc (20); "more than 70" claimed ordered by undisclosed Latin American government in early 1995.

COSTS: $180,000 in civilian configuration, $220,000 military (1995).

DESIGN FEATURES: Selected parts and assemblies of M-20 Mewa used in design of wings, tail unit, landing gear, power plant, and electrical and power systems. Wing section NACA 65_2-415 (constant chord); 7° dihedral from roots, 2° incidence, leading edges sweptforward at root. Fixed incidence tailplane.

FLYING CONTROLS: Frise ailerons, balanced rudder, and elevators with starboard trim tab; single-slotted trailing-edge flaps.

STRUCTURE: Safe-life aluminium alloy.

LANDING GEAR: Retractable tricycle type, actuated hydraulically, with single wheel and oleo strut on each unit. Main wheels retract inward into wings, nosewheel rearward. Size 6.00-6 wheels on all three units; tyre pressures 3.43 bars (50 lb/sq in) on main units, 2.16 bars (31 lb/sq in) on nose unit. PZL Hydral hydraulic disc brakes on mainwheels. Parking brake.

POWER PLANT (M-26 00): One 153 kW (205 hp) PZL-F 6A-350CA flat-six engine, driving a PZL Warszawa-Okecie US 142 three-blade constant speed propeller, or a two-blade Hartzell BHC-C2YF 2CKUF constant-speed propeller. One 92 litre (24.3 US gallon, 20.2 Imp gallon) fuel tank in each wing leading edge, plus a 9 litre (2.4 US gallon, 2.0 Imp gallon) fuselage tank, to give total capacity of 193 litres (51 US gallons, 42.4 Imp gallons). Gravity fuelling point in top of each wing tank. Oil capacity 10 litres (2.6 US gallons; 2.2 Imp gallons).

POWER PLANT (M-26 01): One 224 kW (300 hp) Textron Lycoming AEIO-540-L1B5D flat-six engine, driving a Hoffmann HO-V123K-V/200AH-10 three-blade constant speed propeller. Second tank in each wing. Total fuel capacity 377 litres (99.6 US gallons; 82.8 Imp gallons). Gravity fuelling point in top of each outer wing tank. Oil capacity 15 litres (4.0 US gallons, 3.3 Imp gallons).

PZL Mielec M-26 01 Iskierka registered in USA *(Geoffrey P. Jones)*

1995

ACCOMMODATION: Tandem seats for pupil (in front) and instructor, under framed canopy which opens sideways to starboard. Rear seat elevated. Baggage compartment aft of rear seat. Both cockpits heated and ventilated.

SYSTEMS: Two independent hydraulic systems, one operating at 154 bars (2,233 lb/sq in) for landing gear extension/retraction and one at 103 bars (1,494 lb/sq in) for wheel braking. DC electrical power supplied by 24 V alternator (50 A in M-26 00, 100 A in M-26 01) and 25 Ah battery.

AVIONICS: *Comms*: RS-6102 VHF transceiver and SSA-1 audio control panel.

Flight: Polish ARL-1601 ADF, CG-121 slaved gyro and ORS-2M marker beacon receiver standard.

Bendix/King avionics optional.

ARMAMENT: Up to 120 kg (265 lb) of ordnance on each of two underwing hardpoints, total 240 kg (529 lb). Melex offers a simulated air combat package of smoke, video guns and laser guns.

EQUIPMENT: Landing light in port wing leading-edge.

DIMENSIONS, EXTERNAL:

Wing span	8.60 m (28 ft 2½ in)
Wing chord: at root	1.88 m (6 ft 2 in)
at tip	1.60 m (5 ft 3 in)
Wing aspect ratio	5.28
Length overall	8.30 m (27 ft 2¾ in)
Height overall	2.96 m (9 ft 8½ in)
Tailplane span	3.80 m (12 ft 5½ in)
Wheel track	2.93 m (9 ft 7¼ in)
Wheelbase	1.93 m (6 ft 4 in)
Propeller diameter	1.90 m (6 ft 2¾ in)

DIMENSIONS, INTERNAL:

Cockpits: Total length	2.91 m (9 ft 6½ in)
Max width	0.88 m (2 ft 10½ in)
Max height	1.30 m (4 ft 3¼ in)

AREAS:

Wings, gross	14.00 m² (150.7 sq ft)
Ailerons (total)	1.17 m² (12.59 sq ft)
Trailing-edge flaps (total)	1.06 m² (11.41 sq ft)
Fin	1.96 m² (21.10 sq ft)
Rudder	0.89 m² (9.58 sq ft)
Tailplane	3.30 m² (35.52 sq ft)
Elevators (total, incl tab)	1.15 m² (12.38 sq ft)

WEIGHTS AND LOADINGS (M-26 01):

Weight empty	940 kg (2,072 lb)
Max fuel weight	271 kg (597 lb)
Max T-O and landing weight	1,400 kg (3,086 lb)
Max wing loading	100.0 kg/m² (20.5 lb/sq ft)
Max power loading	6.26 kg/kW (10.29 lb/hp)

PERFORMANCE (M-26 01 at max T-O weight except where indicated):

Never-exceed speed (VNE)	215 kts (400 km/h; 248 mph)
Max level speed at S/L	178 kts (330 km/h; 205 mph)
Stalling speed, flaps down	60 kts (110 km/h; 69 mph)
Max rate of climb at S/L	420 m (1,378 ft)/min
T-O to 15 m (50 ft)	570 m (1,870 ft)
Landing from 15 m (50 ft)	685 m (2,248 ft)
Range with max fuel, 30 min reserves	874 n miles (1,620 km; 1,006 miles)
g limits	+7/–3.5 at 1,100 kg (2,425 lb) AUW
	+4/–1.72 at max T-O weight

UPDATED

PZL MIELEC (ANTONOV) An-2 ANTEK

NATO reporting name: Colt

TYPE: Single-engined general purpose biplane.

PROGRAMME: First flight of An-2 prototype, designed to specification of USSR Ministry of Agriculture and Forestry, 31 August 1947; went into production in USSR 1948, with 746 kW (1,000 hp) ASh-62 engine; over 5,000 built in USSR by 1960; licence rights granted to China, where first Y-5 completed December 1957 and limited production continues (see SAF heading in that section); since 1960, apart from few dozen Soviet built An-2Ms (see 1971-72 *Jane's*), continued production primarily by PZL Mielec; original licence agreement provided for An-2T and An-2R versions; first flight of Polish An-2 on 23 October 1960. Further details of Geofiz, LW, PK, P-Photo, PR, S and TD specialised versions in 1983-84 and earlier *Jane's*. Polish production now drastically reduced.

CURRENT VERSIONS: **An-2P**: Passenger version, 12 adult passengers and two children; improved cabin layout and comfort, better soundproofing, new propeller and spinner, weight-saving instruments and equipment compared with Soviet model; entered production 1968. *Detailed description applies to this version.*

An-2R: Agricultural version, 1,350 kg (2,976 lb) capacity GFRP reinforced epoxy resin hopper or 1,400 litre (370 US gallon, 308 Imp gallon) capacity tank for dry or liquid chemicals; 7,782 built by Mielec up to end of 1991 (latest figure supplied).

An-2T: General purpose transport version; 12 passengers plus baggage or 1,500 kg (3,306 lb) of cargo.

An-2TP: Passenger version, similar to An-2T but with higher cabin standard.

CUSTOMERS: Over 11,950 An-2s built by Mielec for domestic use and export to USSR/CIS (10,440), Bulgaria, former Czechoslovakia, Egypt, France, former East Germany, Hungary, Iraq, North Korea, Mongolia, Netherlands, Nicaragua, Romania, Sudan, Tunisia, Turkey, the UK, Venezuela and former Yugoslavia; in 1989, AICSA of Colombia assembled two An-2s from kits supplied via Pezetel.

DESIGN FEATURES: Unequal span single-bay biplane, braced wings and tail, fuselage circular section forward, rectangular in cabin section, oval in tail section; fin integral with rear fuselage. RPS wing section, thickness/chord ratio 14 per cent (constant); dihedral, both wings, approximately 2° 48′.

FLYING CONTROLS: Dual controls and blind-flying instrumentation standard. Mechanically actuated differential ailerons, elevators and rudder, using cables and push/pull rods, electric trim tab in port aileron, rudder and port elevator; full-span automatic leading-edge slots on upper wings, electrically actuated slotted trailing-edge flaps on both wings.

STRUCTURE: All metal, with fabric covering on wings aft of main spar and on tailplane.

LANDING GEAR: Non-retractable split axle type, with long stroke oleo-pneumatic shock-absorbers. Mainwheel tyres size 800 × 260 mm, pressure 2.25 bars (32.7 lb/sq in). Pneumatic shoe brakes on main units. Fully castoring and self-centring PZL Krosno tailwheel, size 470 × 210, with electropneumatic lock. For rough field operation shock-absorbers can be charged from compressed air cylinder installed in rear fuselage. Interchangeable ski landing gear available optionally.

POWER PLANT: One 746 kW (1,000 hp) PZL Kalisz ASz-621R nine-cylinder radial air-cooled engine, driving an AW-2 four-blade variable-pitch metal propeller. Six fuel tanks in upper wings, with total capacity of 1,200 litres (317 US gallons, 264 Imp gallons). Fuel consumption 120 to 170 litres (31.7 to 45.0 US gallons, 26.4 to 37.4 Imp gallons)/h. Oil capacity 120 litres (31.7 US gallons, 26.4 Imp gallons).

ACCOMMODATION: Crew of two on flight deck, with access via passenger cabin. Standard accommodation for 12 passengers, in four rows of three with single aisle. Two foldable seats for children in aisle between first and second rows, and infant's cradle at front on starboard side. Toilet at rear on starboard side. Overhead racks for up to 160 kg (352 lb) of baggage, with space for coats and additional 40 kg (88 lb) of baggage between rear pair of seats and toilet. Emergency exit on starboard side at rear. Walls of cabin lined with glass-wool mats and inner facing of plywood to reduce internal noise level. Cabin floor carpeted. Cabin heating and starboard windscreen de-icing by engine bleed air; port and centre windscreens electrically de-iced. Cabin ventilation by ram air intakes on underside of top wings.

SYSTEMS: Compressed air cylinder, of 8 litres (0.28 cu ft) capacity, for pneumatic charging of shock-absorbers and operation of tailwheel lock at 49 bars (711 lb/sq in) pressure and operation of mainwheel brakes at 9.80 bars (142 lb/sq in). Contents of cylinder maintained by AK-50P engine-driven compressor, with AD-50 automatic relief device to prevent overpressure. DC electrical system supplied with basic 27 V power (and 36 V or 115 V where required) by engine-driven generator and storage battery. CO_2 fire extinguishing system with automatic fire detector.

AVIONICS: *Comms*: R-842 HF and RS-6102 or Bak an-5 VHF lightweight radio transceivers and SPU-7 intercom.

Flight: A-037 radio altimeter (RW-UM before April 1989), ARK-9 radio compass, MRP-56P marker beacon receiver, GIK-1 gyro compass and GPK-48 gyroscopic direction indicator.

DIMENSIONS, EXTERNAL:

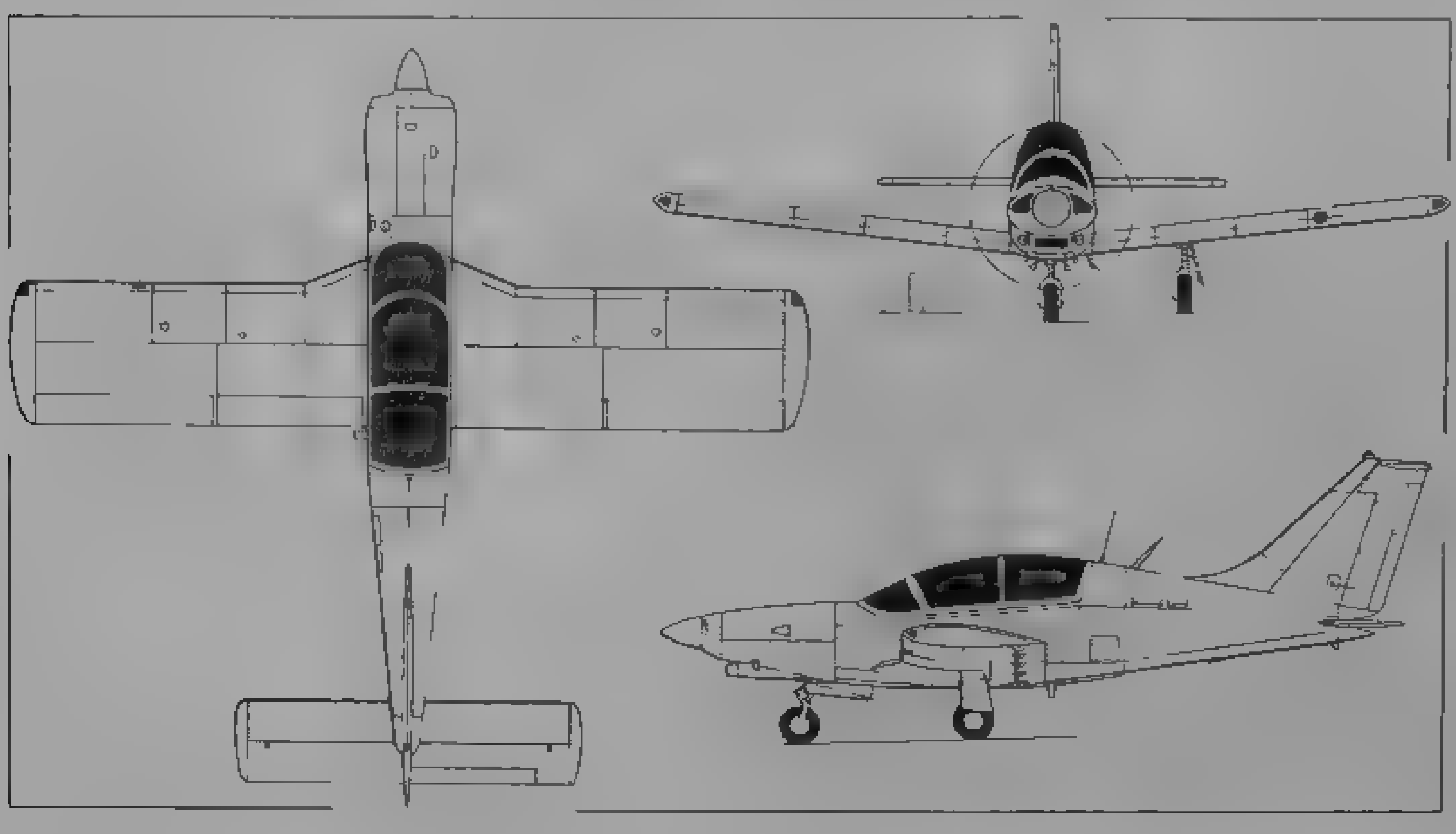
Wing span: upper	18.18 m (59 ft 7¾ in)
lower	14.24 m (46 ft 8½ in)
Wing chord, constant: upper	2.45 m (8 ft 0½ in)
lower	2.00 m (6 ft 6¾ in)
Wing aspect ratio: upper	7.59
lower	7.25
Wing gap	2.17 m (7 ft 1½ in)
Length overall: tail up	12.74 m (41 ft 9½ in)
tail down	12.40 m (40 ft 8¼ in)
Height overall: tail up	6.10 m (20 ft 0 in)
tail down	4.01 m (13 ft 2 in)
Tailplane span	7.20 m (23 ft 7½ in)
Wheel track	3.36 m (11 ft 0¼ in)
Wheelbase	8.19 m (26 ft 10½ in)
Propeller diameter	3.60 m (11 ft 9¾ in)
Propeller ground clearance	0.69 m (2 ft 3¼ in)
Cargo door (port): Mean height	1.55 m (5 ft 1 in)
Mean width	1.39 m (4 ft 6¾ in)
Emergency exit (stbd, rear): Height	0.65 m (2 ft 1½ in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cargo compartment: Length	4.10 m (13 ft 5½ in)
Max width	1.60 m (5 ft 3 in)
Max height	1.80 m (5 ft 10¾ in)

AREAS:

Wings, gross: upper	43.54 m² (468.7 sq ft)
lower	27.98 m² (301.2 sq ft)
Ailerons (total)	5.90 m² (63.5 sq ft)
Trailing-edge flaps (total)	9.60 m² (103 sq ft)
Fin	3.20 m² (34.4 sq ft)



PZL Mielec M-26 Iskierka tandem two-seat primary trainer *(Jane's/Dennis Punnett)*

1985

Rudder, incl tab	2.65 m² (28.52 sq ft)
Tailplane	7.56 m² (81.4 sq ft)
Elevators (total, incl tab)	4.72 m² (50.81 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	3,450 kg (7,605 lb)
Max fuel weight	900 kg (1,984 lb)
Max T-O weight	5,500 kg (12,125 lb)
Max landing weight	5,250 kg (11,574 lb)
Max zero-fuel weight	4,800 kg (10,582 lb)
Max wing loading	76.82 kg/m² (15.7 lb/sq ft)
Max power loading	7.38 kg/kW (12.13 lb/hp)

PERFORMANCE (at AUW of 5,250 kg, 11,574 lb):

Max level speed at 1,750 m (5,740 ft)	139 kts (258 km/h, 160 mph)
Econ cruising speed	100 kts (185 km/h, 115 mph)
Min flying speed	49 kts (90 km/h, 56 mph)
T-O speed	43 kts (80 km/h, 50 mph)
Landing speed	46 kts (85 km/h, 53 mph)
Max rate of climb at S/L	210 m (689 ft)/min
Service ceiling	4,400 m (14,425 ft)
Time to 4,400 m (14,425 ft)	30 min
T-O run: hard runway	150 m (492 ft)
grass	170 m (558 ft)
T-O to 15 m (50 ft): hard runway	475 m (1,558 ft)
grass	495 m (1,624 ft)
Landing from 15 m (50 ft): hard runway	427 m (1,401 ft)
grass	432 m (1,417 ft)
Landing run: hard runway	170 m (558 ft)
grass	185 m (607 ft)
Range at 1,000 m (3,280 ft) with 500 kg (1,102 lb) payload	485 n miles (900 km, 560 miles)

UPDATED

PZL Mielec An-2P passenger transport biplane *(R. J. Malachowski)*

1995

PZL SWIDNIK SA

ZYGMUNTA PULAWSKIEGO-PZL SWIDNIK (Zygmunt Pulawski Transport Equipment Manufacturing Centre, Swidnik)

Al. Lotników Polskich 1, PL-21-045 Swidnik k/Lublina
Telephone: 48 (81) 12061, 13071 and 13249
Fax: 48 (81) 13505 and 12173
Telex: 0642301 WSK PL
GENERAL MANAGER: Mieczyslaw Majewski, MScEng
DIRECTOR OF RESEARCH AND DEVELOPMENT:
Ryszard Kochanowski, MScEng
MARKETING MANAGER: Andrzej Stachyra

Swidnik factory established 1951, engaged initially in manufacturing components for LiM-1 (MiG-15) jet fighter, began licence production of Soviet Mi-1 helicopter in 1955 building some 1,700 as SM-1s, followed by 450 Swidnik developed SM-2s, design office formed at factory to work on variants/developments of SM-1 and original projects such as SM-4 Latka.

Swidnik works named after famous pre-war PZL designer, Zygmunt Pulawski, currently employs about 4,800 persons production concentrates on W-3A Sokol, Kania and SW-4; also manufactures PW-5 composites sailplane and large components for ATR 72.

UPDATED

PZL SWIDNIK (MIL) Mi-2

NATO reporting name: Hoplite

TYPE: Twin-turbine general purpose light helicopter.

PROGRAMME: Designed in USSR by Mikhail L. Mil and first flown September 1961; January 1964 agreement assigned further development, production and marketing exclusively to Polish industry; first flight of Polish example 4 November 1965, series production began 1965 and exceeds 5,400. Has undergone continuous development and upgrading, with versions for new applications developed to meet specific customers' requirements (see list in 1984-85 and earlier *Jane's*). Production now continuing only on very limited basis. See 1994-95 and earlier *Jane's* for detailed description.

UPDATED

PZL SWIDNIK KANIA/KITTY HAWK

TYPE: Twin turboshaft multipurpose light helicopter.

PROGRAMME: Modification of Mi-2 (1994-95 *Jane's*), developed in collaboration with Allison in USA, two prototypes produced by converting Mi-2 airframes, first flight of first prototype (SP-PSA) 3 June 1979; Polish supplementary type certificate to Mi-2 on 1 October 1981, full type certificate as FAR Pt 29 (Transport Category B) day and night VFR multipurpose utility helicopter with Category A engine isolation on 21 February 1986 as considerably improved Kania Model 1.

CURRENT VERSIONS: **Kania Model 1**: Intended for passenger transport (with standard, executive or customised interiors), cargo transport (internal or sling load), agricultural (LV and ULV spraying spreading/dusting), medevac, training, rescue, and aerial surveillance configurations.

CUSTOMERS: Four prototypes and several production aircraft in service in Cyprus (two) and Poland. Further four in production for Polish Ministry of Interior in early 1995.

DESIGN FEATURES: Three-blade fully articulated main rotor with hydraulic dampers. Main rotor blade section NACA 230-12M. Main rotor shaft driven via gearbox on each engine; three-stage WR-2 main gearbox, intermediate gearbox and tail rotor gearbox, main gearbox provides drive for auxiliary systems and oil-take for rotor brake; pitch change centrifugal loads on tail rotor carried by ribbon type steel torsion elements.

FLYING CONTROLS: Hydraulic system for cyclic and collective pitch control boosters, variable incidence horizontal stabiliser, controlled by collective pitch lever.

STRUCTURE: Main and tail rotor blades of glassfibre/epoxy, pod and boom fuselage of sheet duralumin, in three main assemblies (nose including cockpit, central section and tailboom).

LANDING GEAR: Non-retractable tricycle type, plus tailskid. Twin-wheel nose unit, single wheel on each main unit. Oleo-pneumatic shock absorbers in all units. Mainwheel tyres size 600 × 180; nosewheel tyres size 400 × 125. Pneumatic brakes on mainwheels. Metal ski landing gear optional.

POWER PLANT: Two 317 kW (425 shp) Allison 250-C20 turboshafts, mounted side by side above cabin. Fuel in single rubber tank, capacity 600 litres (158.5 US gallons, 131 Imp gallons), under cabin floor; 238 litre (63 US gallon, 52.4 Imp gallon) external tank on each side of cabin. Oil capacity 25 litres (6.6 US gallons, 5.4 Imp gallons).

ACCOMMODATION: Normal accommodation for one pilot on flight deck. Seats for up to nine passengers in air conditioned cabin; all seats removable for carrying up to 800 kg (1,763 lb) of internal cargo. Access to cabin via forward-hinged doors on each side at front of cabin and aft on port side. Windows jettisonable in emergency. Cabin heating and air conditioning standard.

SYSTEMS: Hydraulic system, pressure 65 bars (940 lb/sq in), for cyclic and collective pitch control boosters. Pneumatic system, pressure 49 bars (710 lb/sq in), for mainwheel brakes. Optional electric de-icing for main and tail rotor blades and windscreen; engine air intake de-icing by engine bleed air.

AVIONICS: *Comms*: Two transceivers (MF and HF) and intercom standard.

Flight: Gyrocompass, radio compass, radio altimeter and blind-flying panel standard.

Instrumentation: Bendix/King Silver Crown or Gold Crown IFR avionics optional.

EQUIPMENT: Search and rescue version can be equipped with Lucas electric hoist, FLIR, and special medical and communications systems. Automatically activated Freon fire extinguishing system for engine bays and gearbox compartments.

ARMAMENT: See Current Versions.

DIMENSIONS, EXTERNAL:

Main rotor diameter	14.50 m (47 ft 6¾ in)
Tail rotor diameter	2.70 m (8 ft 10¼ in)
Length: overall, rotors turning	17.42 m (57 ft 2 in)
fuselage	11.40 m (37 ft 4¾ in)
Height to top of rotor head	3.75 m (12 ft 3¾ in)
Stabiliser span	1.85 m (6 ft 0¾ in)
Wheel track	3.05 m (10 ft 0 in)
Wheelbase	2.71 m (8 ft 10¾ in)

DIMENSIONS, INTERNAL:

Cabin, incl flight deck: Length	4.07 m (13 ft 4¼ in)
Mean width	1.20 m (3 ft 11¼ in)
Mean height	1.40 m (4 ft 7 in)

AREAS:

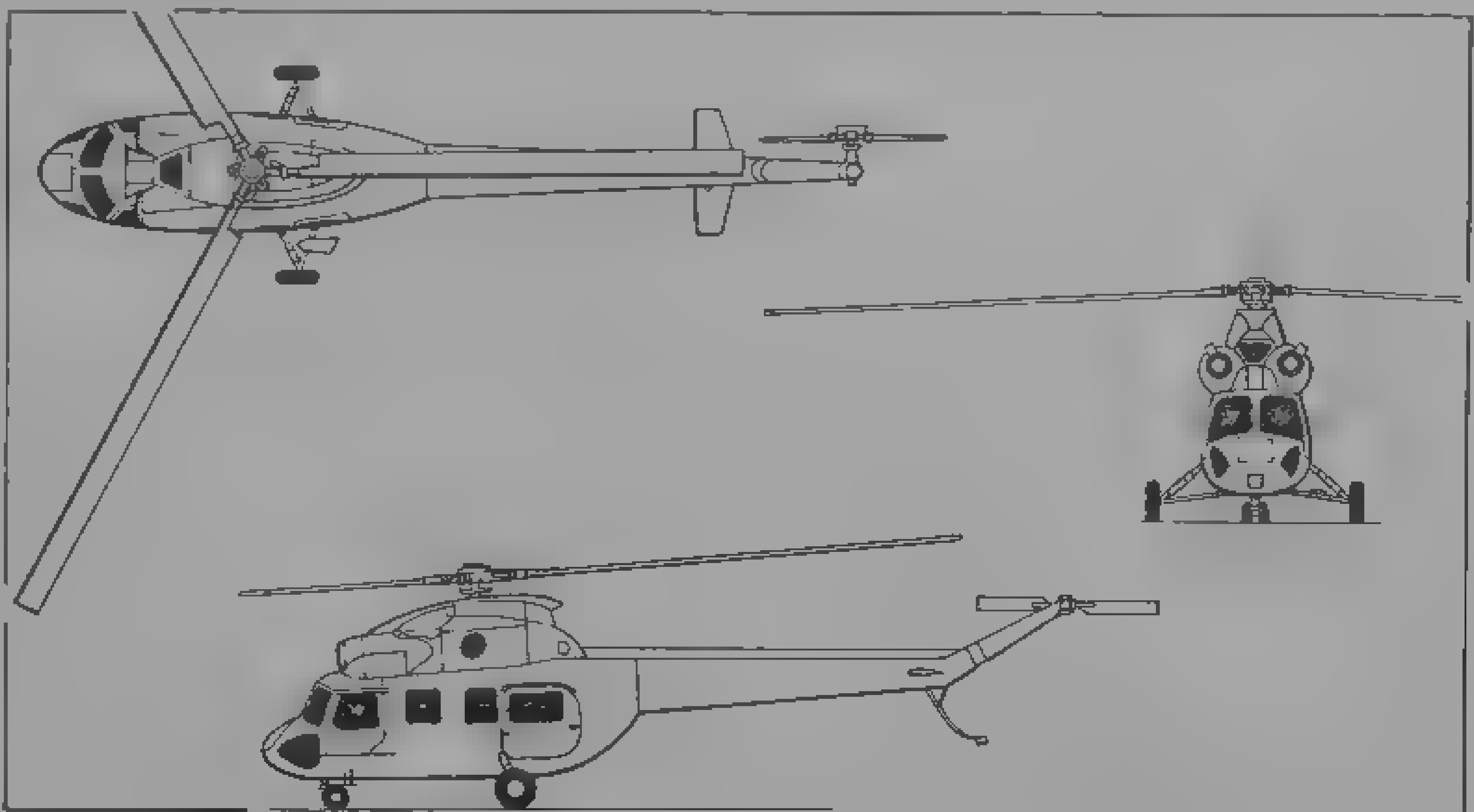
Main rotor disc	166.4 m² (1,791.11 sq ft)
Tail rotor disc	5.73 m² (61.68 sq ft)

WEIGHTS AND LOADINGS:

Basic operating weight empty	2,077 kg (4,579 lb)
Max payload	800 kg (1,763 lb)
Max external load	1,200 kg (2,645 lb)
Max T-O weight	3,550 kg (7,826 lb)
Max disc loading	21.3 kg/m² (4.4 lb/sq ft)

PERFORMANCE (at 3,550 kg, 7,826 lb T-O weight):

Never-exceed speed (VNE) at 500 m (1,640 ft)	113 kts (210 km/h, 130 mph)
Econ cruising speed at 500 m (1,640 ft)	102 kts (190 km/h, 118 mph)
Max rate of climb at S/L	594 m (1,949 ft)/min
Service ceiling	4,000 m (13,125 ft)
Hovering ceiling: IGE	2,005 m (6,575 ft)
OGE	850 m (2,790 ft)
Range at 500 m (1,640 ft): max internal fuel, no reserves	259 n miles (480 km, 298 miles)
max internal and auxiliary fuel, reserves	451 n miles (835 km, 519 miles)



PZL Swidnik Kania (two Allison 250-C20 turboshafts) *(Jane's/James Goulding)*

1995

PZL Swidnik Kania twin-turboshaft derivative of the Mi-2

1995

Endurance

max internal and auxiliary fuel 4 h

UPDATED

PZL SWIDNIK W-3 SOKÓL (FALCON)

TYPE: Twin-turboshaft medium weight multipurpose helicopter

PROGRAMME: Developed in second half of 1970s; static/fatigue ground test airframe followed by five flying prototypes, first of which (SP-PSA) made first flight 16 November 1979, and used in subsequent tiedown tests, remaining prototypes embodied changes resulting from tests, manufacturer's flight trials resumed 6 May 1982 with second prototype (SP-PSB), third, fourth and fifth prototypes ad made first flights in 1984, on 24 July (SP-PSC), 4 June (SP-PSD) and 26 November (SP-PSE) respectively, certification trials carried out in wide range of operating conditions, including heavy icing and extreme temperatures of –60°C and +50°C, certification to Russian NLGW regulations received by early 1993, production started 1985 and continuing in 1995 US FAA and German certification of W-3A received 1993

CURRENT VERSIONS: **W-3 Sokól**: Standard civil and military version *Detailed description applies to this model except where indicated*

W-3A Sokól: Improved version for Western certification, redesign started 1989, first flight 30 July 1992, FAA type approval to FAR Pt 29 received 31 May 1993, German LBA certification 6 December 1993 Dual hydraulic systems, new de-icing system, Western instrumentation First delivery, to Saxony Police Department, Germany, 20 December 1993, Marketed in the Americas and Pacific Rim by Piasecki Aircraft Corporation, USA

W-3RM Anakonda: Offshore search and rescue version, watertight cabin, six inflatable flotation bags, additional window in lower part of each flight deck door

W-3U Salamandra: Armed version with undernose 23 mm GSh-23L gun cabin-side weapon outriggers, roof-mounted sight with TV and FLIR cameras; Mars-2 16-round rocket launchers and Grot anti-tank missiles standard, ZR-8 submunition dispensers, Gad launchers each for two 9M32M Strela anti-aircraft missiles, laser rangefinder and helmet sight optional Development halted due to problems with Russian equipment. No longer produced

W-3W: Armed version (W for Wielozadaniowy multipurpose) with starboard-mounted 23 mm GSz-23 twin-barrel gun, Mars-2 launchers for sixteen 57 mm S-5 or 80 mm S-8 unguided rockets, ZR-8 bomblet dispensers, Platan minelaying packs, and six cabin window-mounted AK 47, 5.45 mm Tantal or PKM machine guns. Ten delivered by July 1994 to Polish Air Force 47 Szkolny Pulk Smiglowcow (Helicopter School Regiment) at Nowe Miasto

W-3WB Huzar: Armed prototype similar to W-3W but with mainly South African Rooivalk type weapons fit including 20 mm Denel GA-1 undernose gun, roof-mounted weapon aiming system (thermal imaging camera and laser designator), ZT-35 127 mm laser-guided anti-tank missiles, and Polish Mars-2 rocket launchers, air-to-air missiles and bomblet dispensers. First flight August 1993. One only; armament deleted and reverted to W-3, 1994.

ECR version: Electronic reconnaissance and ECM variant, being developed to meet Polish MoD requirement, Polish designation not yet known

CUSTOMERS: In service by early 1995 with Polish Army (15 W-3s), Navy (two W-3s and five Anakondas), Air Force (one VIP and six general purpose W-3s plus 10 W-3Ws) and Ministry of Interior (one W-3, one W-3RM); Myanma (12 W-3Us); and Saxony Police, Germany (one W-3A of two on order). Additional order for W-3A (one) from unidentified customer. Eighteen W-3s leased via Swidnik subsidiary Heliseco for firefighting missions in Spain.

Total production (excluding prototypes) 80 by mid-1995, including 34 for export

COSTS: Basic W-3A $2.5 million (1994)

DESIGN FEATURES: Four-blade fully articulated main rotor and three-blade tail rotor; main rotor has pendular Salomon type vibration absorber for smooth flight and low vibration levels. Transmission driven via main, intermediate and tail rotor gearboxes. Tailfin integral with tailboom, fixed incidence horizontal stabiliser, not interconnected with main rotor control system

Main rotor blades have NACA 23012M aerofoil section and optional manual folding. Rotor brake standard. Rotor rpm 268.5 (main) and 1,342 (tail), main rotor blade tip speed 220.7 m/s (494 mph)

FLYING CONTROLS: Three hydraulic boosters for longitudinal, lateral and collective pitch control of main rotor, one booster for tail rotor control. Constant-speed rpm control for continuous operation (manual rpm control also available). Two-axis stability augmentation system with pitch and roll hold. Three- and four-axis AFCS available from late 1994

STRUCTURE: Rotor blades (main and tail) and single-spar horizontal stabiliser of laminated GFRP impregnated with epoxy resin, tail rotor driveshaft of duralumin tube with splined couplings, duralumin fuselage, GFRP fin trailing-edge

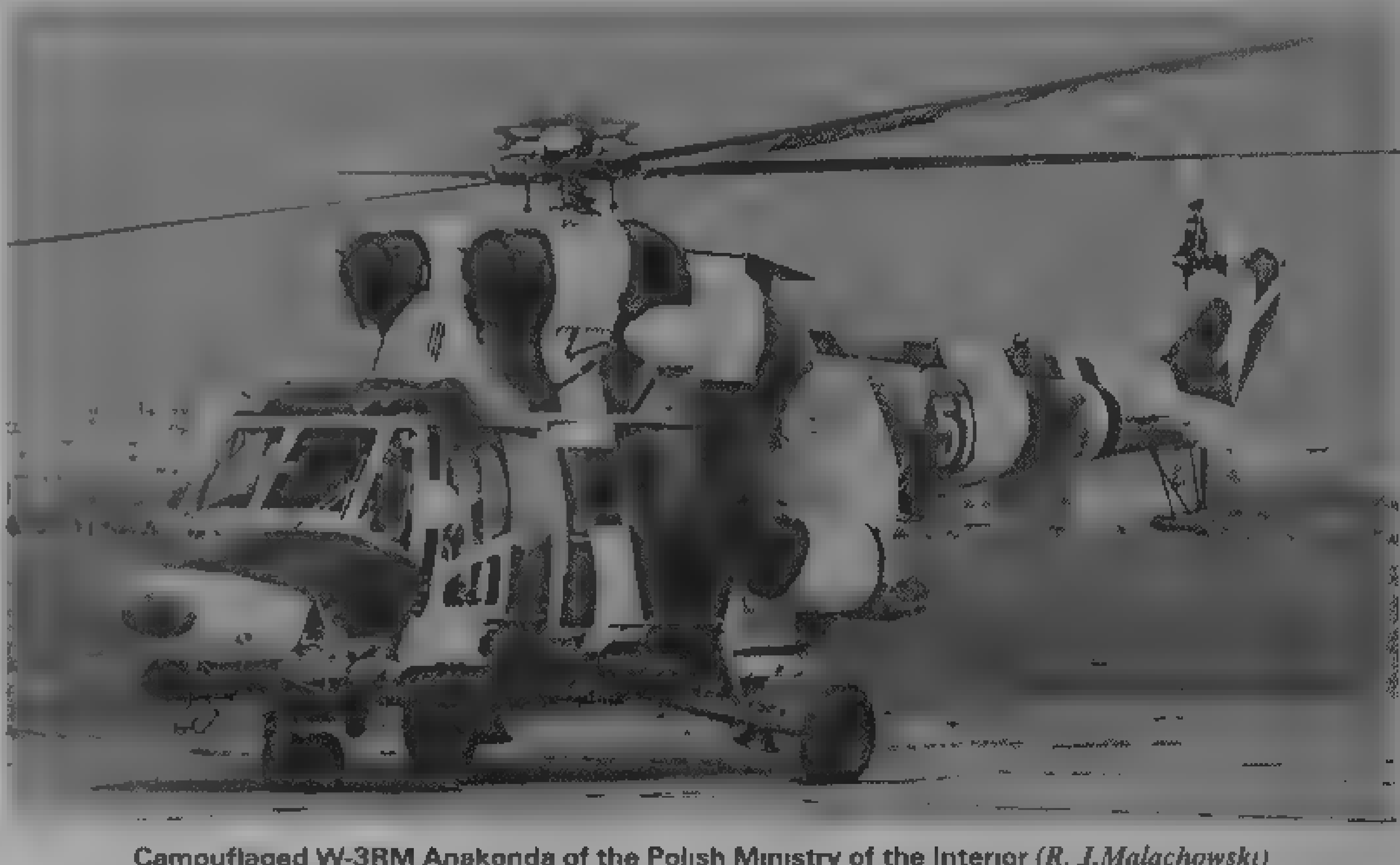
LANDING GEAR (W-3): Non-retractable tricycle type, plus tailskid beneath tailboom. Twin-wheel castoring and self-centring nose unit, single wheel on each main unit. Oleo-pneumatic shock absorber in each unit. Mainwheel tyres size 500 × 250 mm, nosewheel tyres size 400 × 150 mm. Pneumatic disc brakes on mainwheels. Metal ski landing gear optional. Six inflatable flotation bags on Anakonda

LANDING GEAR (W-3A): As W-3 but with IL gas/hydraulic shock absorption, Stomil Poznań tyres, sizes 700 × 250 mm (main) and 400 × 140 mm (nose), tyre pressures 4.9 and 4.4 bars (71.06 and 63.81 lb/sq in) respectively

POWER PLANT: Two WSK PZL Rzeszów PZL-10W turboshafts, each with rating of 671 kW (900 shp) for T-O and emergency ratings of 746 kW (1,000 shp) and 858 kW (1,150 shp) for 30 and 2½ minutes OEI respectively

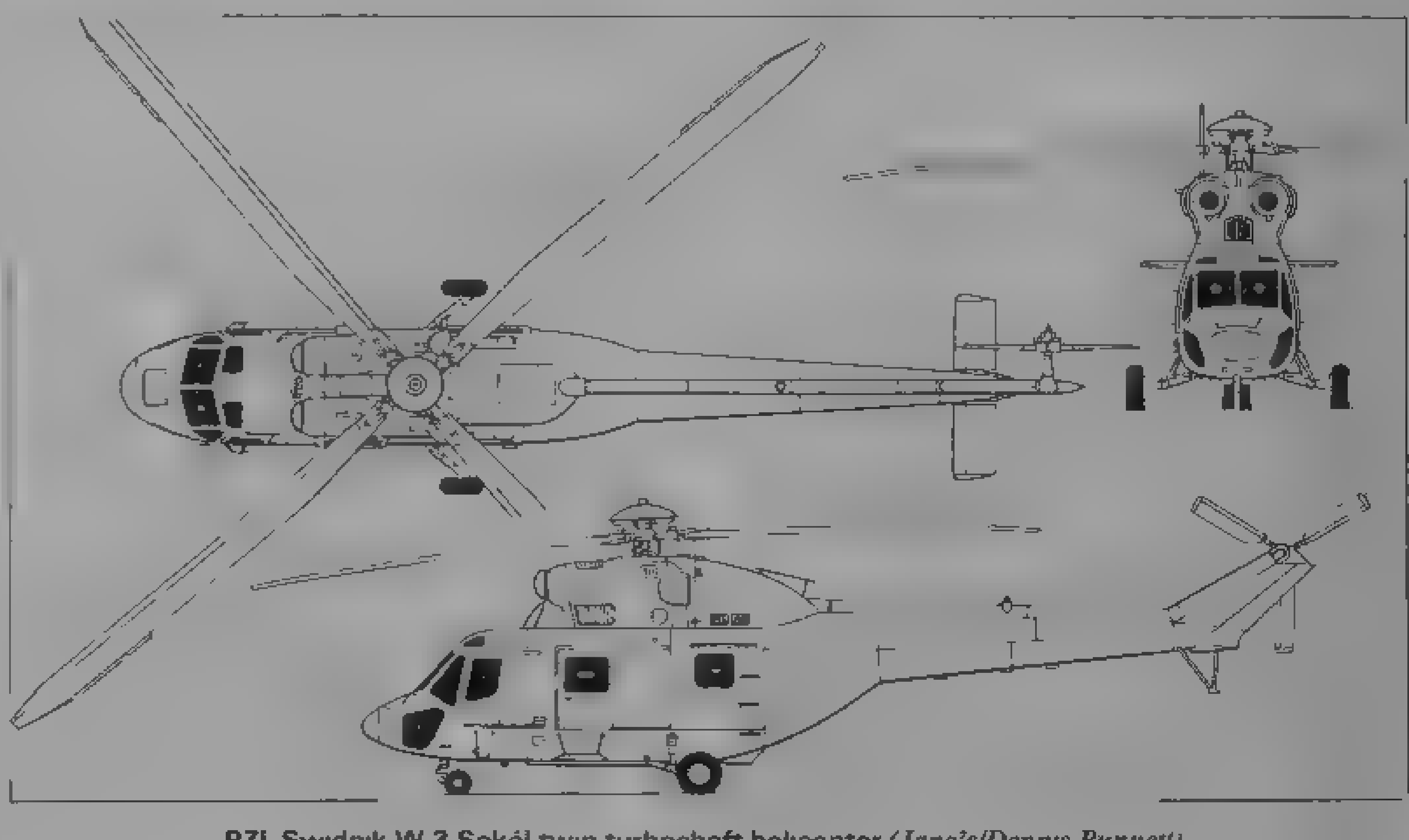
Particle separators on engine intakes, and inlet de-icing, standard. Power plant equipped with advanced electronic fuel control system for maintaining rotor speed at pilot-selected value amounting to ±5 per cent of normal rpm, and also for torque sharing as well as for supervising engine limits during start-up and normal or OEI operation. Engines and main rotor gearbox mounted on bed frame, eliminating drive misalignment due to deformations of fuselage. Transmission rating 1,342 kW (1,800 shp) maximum for T-O, 1,163 kW (1,560 shp) maximum continuous and 857 kW (1,150 shp) OEI. Engine input rpm 23,615.

Four bladder fuel tanks beneath cabin floor, with combined capacity of 1,720 litres (454.4 US gallons, 378.4 Imp gallons). Auxiliary tank, capacity 1,100 litres (290.5 US



Camouflaged W-3RM Anakonda of the Polish Ministry of the Interior *(R. J.Malachowski)*

1995



PZL Swidnik W-3 Sokól twin-turboshaft helicopter *(Jane's/Dennis Punnett)*

1993

gallons; 242 Imp gallons), optional (not FAA approved). Oil capacity 14 litres (3.7 US gallons; 3.1 Imp gallons) per engine.

ACCOMMODATION: Pilot (port side), and co-pilot or flight engineer, side by side on W-3 flight deck, on adjustable seats with safety belts. W-3A can be flown by single pilot in VFR, with extra passenger in co-pilot seat. Dual controls and dual flight instrumentation optional. Accommodation for 12 passengers in main cabin or up to eight survivors plus two-person rescue crew and doctor in Anakonda SAR version. Seats removable for carriage of internal cargo. Ambulance version can carry four stretcher cases and medical attendant. Baggage space at rear of cabin.

Door with bulged window on each side of flight deck, large sliding door for passengers and/or cargo loading on port side at forward end of cabin, second sliding door at rear of cabin on starboard side. Optically flat windscreens, improving view and enabling wipers to sweep a large area. Accommodation soundproofed, heated (by engine bleed air) and ventilated.

SYSTEMS: Two independent hydraulic systems, working pressure 90 bars (1,300 lb/sq in), for controlling main and tail rotors, unlocking collective pitch control lever, and feeding damper of directional steering system. Flow rate 11 litres (2.9 US gallons, 2.4 Imp gallons)/min in each system. Vented gravity feed reservoir, at atmospheric pressure. Pneumatic system for actuating hydraulic mainwheel brakes. Electrical system providing both AC and DC power. Electric anti-icing of rotor blades. Fire detection/extinguishing system. Air conditioning and oxygen systems optional. Neutral gas system optional, for inhibiting fuel vapour explosion.

AVIONICS: Standard IFR nav/com avionics permit adverse weather operation by day or night.

Comms: Chrom (NATO 'Pin Head') IFF transponder in military versions.

Radar: Bendix/King RDS-82 weather radar in W-3A. SA-813 radar in W-3RM.

Flight: Stability augmentation system standard. AP Decca navigator in W-3RM.

Mission: SPOR search and detection system in W-3RM.

Self-defence: Modified Syrena RWR in military versions.

EQUIPMENT: Cargo version equipped with 2,100 kg (4,630 lb) capacity external hook and 150 kg (331 lb) capacity rescue hoist. W-3RM has 267 kg (589 lb) capacity electric hoist, stretchers, two-person rescue basket, rescue belts, liferafts for six people, rope ladder, portable oxygen equipment, electric blankets and vacuum flasks, various types of buoy (light, smoke and radio) and marker, binoculars, flare pistol and searchlights.

ARMAMENT: As described under Current Versions.

DIMENSIONS, EXTERNAL:
Main rotor diameter 15.70 m (51 ft 6 in)
Tail rotor diameter 3.03 m (9 ft 11¼ in)
Main rotor blade chord 0.44 m (1 ft 5¼ in)
Distance between rotor centres 9.50 m (31 ft 2 in)
Length: overall, rotors turning 18.85 m (61 ft 10¼ in)
fuselage 14.21 m (46 ft 7½ in)
Height: to top of rotor head 3.80 m (12 ft 5½ in)
overall, rotors turning 4.20 m (13 ft 9½ in)
Stabiliser span 3.45 m (11 ft 3¾ in)
Wheel track 3.15 m (10 ft 4 in)
Wheelbase 3.55 m (11 ft 7¾ in)
Passenger/cargo doors:
Height (each): 1.20 m (3 ft 11¼ in)
Width: port 0.95 m (3 ft 1½ in)
starboard 1.25 m (4 ft 1¼ in)
Height to sill 0.86 m (2 ft 10 in)

Polish Air Force W-3W armed version of the Sokól *(Grzegorz Holdanowicz)*

1995

DIMENSIONS, INTERNAL:
Cabin: Length 3.20 m (10 ft 6 in)
Max width 1.56 m (5 ft 1½ in)
Max height 1.40 m (4 ft 7 in)
Floor area 4.80 m² (51.7 sq ft)
Volume 6.30 m³ (222.5 cu ft)

AREAS:
Main rotor blades (each) 2.90 m² (31.22 sq ft)
Tail rotor blades (each) 0.28 m² (3.01 sq ft)
Main rotor disc 193.6 m² (2,083.8 sq ft)
Tail rotor disc 7.21 m² (77.6 sq ft)
Fin 1.00 m² (10.76 sq ft)
Elevator 2.16 m² (23.25 sq ft)

WEIGHTS AND LOADINGS:
Min basic weight empty 3,300 kg (7,275 lb)
Basic operating weight empty (multipurpose versions):
W-3 3,630 kg (8,002 lb)
W-3A 3,850 kg (8,488 lb)
Max fuel weight 1,326 kg (2,923 lb)
Max payload, internal or external 2,100 kg (4,630 lb)
Normal T-O weight 6,100 kg (13,448 lb)
Max T-O weight 6,400 kg (14,110 lb)
Max disc loading 33.06 kg/m² (6.77 lb/sq ft)
Max power loading 4.77 kg/kW (7.84 lb/shp)

PERFORMANCE (at normal T-O weight at 500 m, 1,640 ft, ISA, except where indicated):
Never-exceed speed (VNE):
W-3 145 kts (270 km/h; 167 mph)
W-3A 140 kts (260 km/h; 161 mph)
Max level speed: W-3 138 kts (255 km/h; 158 mph)
Max cruising speed: W-3 127 kts (235 km/h; 146 mph)
W-3A at 1,000 m (3,280 ft) 128 kts (238 km/h; 148 mph)
Econ cruising speed: W-3 119 kts (220 km/h; 137 mph)
W-3A at 1,000 m (3,280 ft) 121 kts (225 km/h; 140 mph)
Touchdown speed for power-off landing:
W-3A 33 kts (60 km/h; 38 mph)
Max rate of climb at S/L:
W-3, W-3A 510 m (1,673 ft)/min
Rate of climb at S/L, OEI:
W-3 at 30 min rating 96 m (315 ft)/min
W-3 at 2½ min emergency rating 186 m (610 ft)/min
W-3A at 2½ min emergency rating 171 m (561 ft)/min
Vertical rate of climb at S/L:
W-3A at max T-O weight 74 m (243 ft)/min
W-3A at normal T-O weight 219 m (718 ft)/min
Service ceiling:
W-3, W-3A at normal T-O weight 5,100 m (16,725 ft)
W-3, W-3A at T-O weight below normal up to 6,000 m (19,680 ft)
Service ceiling, OEI:
W-3 at 30 min rating 1,800 m (5,905 ft)
W-3 at 2½ min emergency rating approx 2,300 m (7,545 ft)
W-3A at 2½ min emergency rating 2,600 m (8,530 ft)
Hovering ceiling IGE:
W-3 3,000 m (9,850 ft)
W-3A at max T-O weight 2,700 m (8,860 ft)
Hovering ceiling OGE:
W-3 2,100 m (6,890 ft)
W-3A at max T-O weight 2,100 m (6,890 ft)
Range:
standard fuel, 5% reserves 367 n miles (680 km; 422 miles)
standard fuel, no reserves:
W-3 386 n miles (715 km; 444 miles)
W-3A 410 n miles (760 km; 472 miles)

PZL Swidnik W-3A Sokól (two PZL-10W turboshafts)

1995

with auxiliary fuel, 5% reserves
W-3: 626 n miles (1,160 km; 721 miles)
with auxiliary fuel, no reserves
W-3: 661 n miles (1,225 km; 761 miles)
W-3A: 696 n miles (1,290 km; 801 miles)
with max payload, no reserves
W-3A: 108 n miles (200 km; 124 miles)

Endurance:
standard fuel, 5% reserves: 3 h 50 min
standard fuel, no reserves: 4 h 5 min
with auxiliary fuel, 5% reserves: 6 h 41 min
with auxiliary fuel, no reserves: 7 h 5 min

PERFORMANCE (W-3RM at max T-O weight of 6,400 kg, 14,110 lb at 500 m, 1,640 ft except where ind cated):
Max level speed: 124 kts (230 km/h; 143 mph)
Cruising speed:
max continuous power: 118 kts (218 km/h; 135 mph)
econ cruise power: 111 kts (206 km/h; 128 mph)
Max rate of climb at S/L: 492 m (1,615 ft)/min
Rate of climb at S/L, OEI: 60 m (197 ft)/min
Service ceiling: 4,650 m (15,250 ft)
Hovering ceiling: IGE: 2,500 m (8,200 ft)
OGE: 660 m (2,165 ft)
Range, 30 min reserves:
standard fuel: 334 n miles (620 km; 385 miles)
with auxiliary fuel: 574 n miles (1,065 km; 662 miles)

UPDATED

Prototype of the SW-4 four/five-seat light helicopter

1995

PZL SWIDNIK SW-4

TYPE: Four/five-seat, single-engined multipurpose light helicopter.

PROGRAMME: Development began 1985, full-scale mockup completed 1987 (see description and illustrations in 1991-92 and earlier *Jane's*); major redesign undertaken 1989-90, now using Allison 250 engine in more streamlined fuselage with modified tail unit. Prototype (c/n 600102), rolled out December 1994, is 'iron bird' for ground and equipment tests; '101 is static test airframe, '103 and '104 are flying prototypes. First flight now rescheduled for November 1995, with FAR/JAR Pt 27 certification planned for July 1997. Series production expected to be initiated in early 1996. Option of 462 kW (620 shp) P&WC PW206 to be offered on later production aircraft; twin-engined version also being studied.

CURRENT VERSIONS: Intended applications include passenger and cargo transport, medevac, border patrol, armed scout, training and agricultural use.

DESIGN FEATURES: Three-blade main rotor; arrowhead tailfin on port side, with two-blade tail rotor to starboard; narrow tailplane with small endplate fins; skid landing gear.

STRUCTURE: GFRP for approximately 20 per cent of airframe.

POWER PLANT: One 335 kW (450 shp) Allison 250-C20R/2 turboshaft. Transmission rating 335 kW (450 shp) for T-O, 283 kW (380 shp) maximum continuous, 30 minute run dry capability. Standard fuel capacity 500 litres (132 US gallons; 110 Imp gallons).

ACCOMMODATION: Pilot and up to four passengers or one stretcher patient and two medical attendants. One front-hinged and one rearward-sliding door on each side of cabin.

AVIONICS: *Instrumentation:* Bendix/King VFR in first prototype, IFR optional in production aircraft.

DIMENSIONS, EXTERNAL:
Main rotor diameter: 9.00 m (29 ft 6½ in)
Tail rotor diameter: 1.50 m (4 ft 11 in)
Distance between rotor centres: 5.25 m (17 ft 2¾ in)
Length:
overall, both rotors turning: 10.55 m (34 ft 7½ in)
fuselage: 8.238 m (27 ft 0¼ in)
Fuselage max width: 1.515 m (4 ft 11¾ in)
Height overall: 2.939 m (9 ft 7¾ in)
Tail unit span (over endplates): 1.831 m (6 ft 0 in)
Skid track: 2.00 m (6 ft 6¾ in)

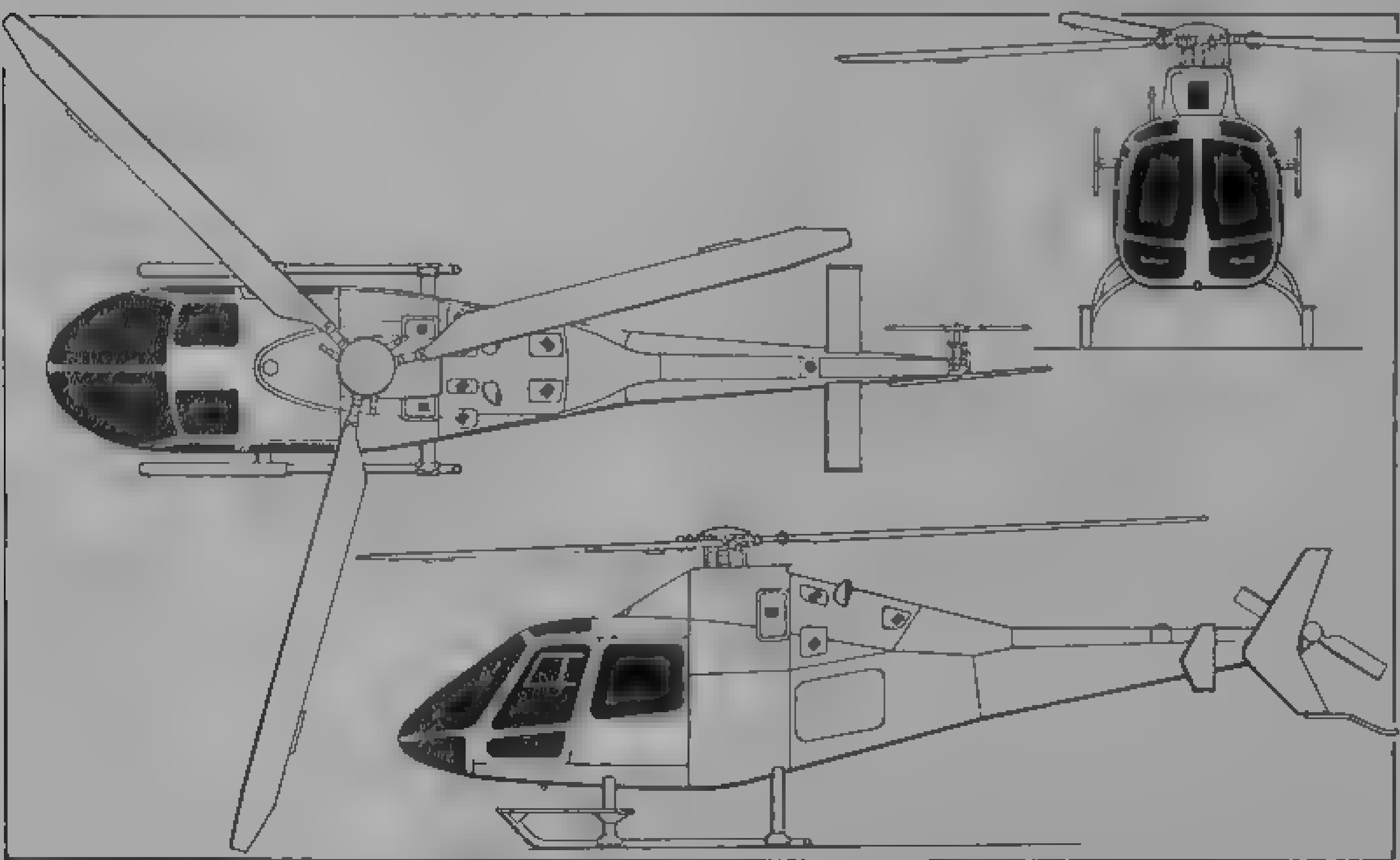
DIMENSIONS, INTERNAL:
Cabin: Length: 2.14 m (7 ft 0¼ in)
Max width: 1.415 m (4 ft 7¾ in)
Max height: 1.27 m (4 ft 2 in)

AREAS:
Main rotor disc: 63.62 m² (684.8 sq ft)
Tail rotor disc: 1.77 m² (19.05 sq ft)

WEIGHTS AND LOADINGS:
Weight empty: 730 kg (1,609 lb)
Max payload: internal: 400 kg (882 lb)
on external sling: 750 kg (1,653 lb)
Normal T-O weight (internal payload): 1,512 kg (3,333 lb)
Max T-O weight with sling load: 1,700 kg (3,748 lb)
Max disc loading: 26.72 kg/m² (5.47 lb/sq ft)
Max power loading: 5.07 kg/kW (8.33 lb/shp)

PERFORMANCE (estimated, at normal T-O weight, ISA):
Never-exceed speed (VNE): 155 kts (288 km/h; 179 mph)
Max level speed at 500 m (1,640 ft): 132 kts (245 km/h; 152 mph)
Max cruising speed, 70% power at 500 m (1,640 ft): 129 kts (240 km/h; 149 mph)
Max rate of climb at S/L: 600 m (1,968 ft)/min
Service ceiling: 6,500 m (21,325 ft)
Hovering ceiling: IGE: 3,500 m (11,480 ft)
OGE: 2,900 m (9,515 ft)
Range, standard fuel, no reserves: 323 n miles (600 km; 373 miles)
with auxiliary fuel tank: 486 n miles (900 km; 559 miles)
Endurance: 5 h 30 min

UPDATED



PZL Swidnik SW-4 (Allison 250-C20R/2 turboshaft) *(Jane's/Mike Keep)*

1994

PZL WARSZAWA-OKECIE

PANSTWOWE ZAKŁADY LOTNICZE WARSZAWA-OKECIE (State Aviation Works, Warsaw-Okecie)

Aleja Krakowska 110/114, PL-00-971 Warsaw
Telephone: 48 (22) 460031/465061
Fax: 48 (22) 466192/462701/465479
Telex: 817735/814649/813465
GENERAL MANAGER: Ryszard Leja, MSc
GENERAL DESIGNER: Andrzej Frydrychewicz, MScEng
SALES MANAGER: Maciej Kozlowski, MScEng

Okecie factory founded in 1928, responsible for light air craft development and production, and for design and manufacture of associated agricultural equipment for its own aircraft and those built at other Polish factories; has produced over 3,700 aircraft since 1945.

Light Aircraft and Agricultural Equipment Pilot Plant

DIRECTOR: Wladyslaw Skorski, MScEng

Main function of this PZL Warszawa-Okecie plant is to develop and perform research tasks, build and flight test prototypes.

PZL-130 ORLIK

TYPE: Tandem-seat basic and advanced turboprop trainer.

PROGRAMME: Development of piston-engined Orlik (Spotted Eaglet: see 1989-90 *Jane's*) discontinued 1990. Development of turboprop derivative began 1985 with collaboration of Airtech Canada by refitting third Orlik prototype (SP-PCC, c/n 004) with P&WC PT6A-25A; this aircraft made first flight 13 July 1986 but lost in crash January 1987. Test programme continued with two further Turbo-Orliks: c/n 007 and 008, former with 560 kW (750 shp) Walter M 601 E engine and latter with 410 kW (550 shp) PT6A-25A, these prototypes designated **PZL-130TM** and **PZL-130TP** respectively. All turboprop variants now known simply as Orlik.

Modifications resulting from Polish Air Force trials and overseas demonstration flights included provision for ejection seats, plans for M 601 in Polish Air Force aircraft (PZL-130TB) and PT6A for export (PZL-130TC/TD/TE), extensive nav/com avionics, and strengthened landing gear to cater for increased MTOW; c/n 010 static test aircraft for TC version, and c/n 011 first flying TC prototype. First deliveries, to Polish Air Force Academy at Deblin, were two PZL-130TMs (c/n 005 and 006) in October 1992, followed by first two PZL-130TBs (c/n 012 and 013) December 1992.

Intended TC/TD/TE export versions (see 1994-95 *Jane's*) suspended due to poor response; instead, TC designation subdivided 1994 into TC, TC-1 and TC-2 to indicate firm and potential upgrading of aircraft for Polish Air Force (see Current Versions below).

CURRENT VERSIONS: **PZL-130TB**: For Polish Air Force. Differences from TM include greater wing span, increased wing incidence (to lower nose in flight), double-slotted flaps, redesigned ventral fin, Polish ejection seats, revised

canopy, new cockpit layout, more powerful brakes, steerable nosewheel, six (instead of four) underwing hardpoints, and higher maximum T-O weight. Standard engine is fully aerobatic M 601 T. First example (c/n 009) rolled out May 1991, making first flight 18 September 1991. Nine delivered, of which 013 became TC-1 demonstrator and 021 lost on 30 April 1994, remainder in service with 1 Eskadra/60 Lotniczy Pulk Szkolny (1 Squadron/60th Air School Regiment) at Radom. To be retrofitted to TC-1 standard by June 1995. *Detailed description applies to TB and TC-1 except where otherwise indicated.*

PZL-130TC: Advanced version, with 708 kW (950 shp) P&WC PT6A-62 engine, Bendix/King avionics, Martin-Baker Mk PL11B ejection seats and Flight Vision HUD, c/n 011 completed as prototype/demonstrator SP-PCE and made first flight 2 June 1993.

PZL-130TC-1: Upgraded version of PZL-130TB, first flown (converted 013/SP-PCF) 9 July 1994. Power plant as for TB, but Martin-Baker Mk PL11B zero/zero seats, Bendix/King GPS, multifunction flight data recorder and servo-tabbed control surfaces. Eleven in production at March 1995; 18 earlier TBs to be brought up to same standard by June 1995.

PZL-130TC-2: Alternative version; same equipment as TC but lower powered 559 kW (750 shp) PT6A-25C engine. First flight scheduled for June 1995.

CUSTOMERS: Polish Air Force 31. Two PZL-130TMs and 18 PZL-130TBs in service at end March 1995, with 11 PZL-130TC-1s then in production. All TBs in service to be upgraded to TC-1s, and all 11 new TC-1s delivered by June 1995.

DESIGN FEATURES: Two seats in tandem, modular installation of instruments and displays, wings have detachable leading-edges and raked tips; shallow underfin beneath tailcone; fixed incidence tailplane.

Wing section NACA 64_2215 (modified), 6° (±3°) twist, 5° dihedral from roots.

FLYING CONTROLS: Frise differential ailerons, elevators and rudder all aerodynamically and mass balanced and actuated mechanically (ailerons by pushrods and torque tube, elevators by rods and cables, rudder by cables); electrically actuated trim tabs on port aileron, port elevator and rudder. Three-position double-slotted trailing-edge flaps, also actuated electrically.

New trim system flight tested early 1995, with Lear Astronics computer controlling a movable undertail fin.

STRUCTURE: All-metal, except for GFRP/epoxy wingtips. One-piece light alloy multispar wing box, stiffened by riveted omega formers, forms integral fuel tanks; wing trailing-edges and fuselage skin panels stiffened by L formers, electrically spot-welded, fin integral with fuselage.

LANDING GEAR: Hydraulically retractable tricycle type, all three units retracting into fuselage (mainwheels inward, steerable nosewheel rearward). PZL Warszawa-Okecie oleo-pneumatic shock-absorber in each unit. All three wheels same size, with 500 × 200 mm tubeless tyres. Differential hydraulic multidisc brakes, parking brakes for main and nosewheels. No anti-skid system.

POWER PLANT: One 560 kW (750 shp) Walter M 601 E turboprop, driving a five-blade propeller. Fuel in four integral wing tanks, total usable capacity 540 litres (142.7 US gallons; 118.8 Imp gallons). Overwing refuelling point for each tank. Fuel and oil systems permit up to 30 seconds of inverted flight. Provision for two 340 litre (90 US gallon; 74.8 Imp gallon) underwing drop tanks.

ACCOMMODATION: Tandem seating for pupil (in front) and instructor under one-piece canopy which opens sideways to starboard. Rear seat elevated 65 mm (2.6 in). Polish LFK-K1 ejection seats in PZL-130TB (zero height/70 to 323 knots, 130 to 600 km/h, 81 to 373 mph), Martin-Baker Mk PL11B zero/zero seats in TC/TC-1/TC-2. Baggage space aft of rear seat. Full dual controls standard. Cockpit heating and ventilation, canopy demisting.

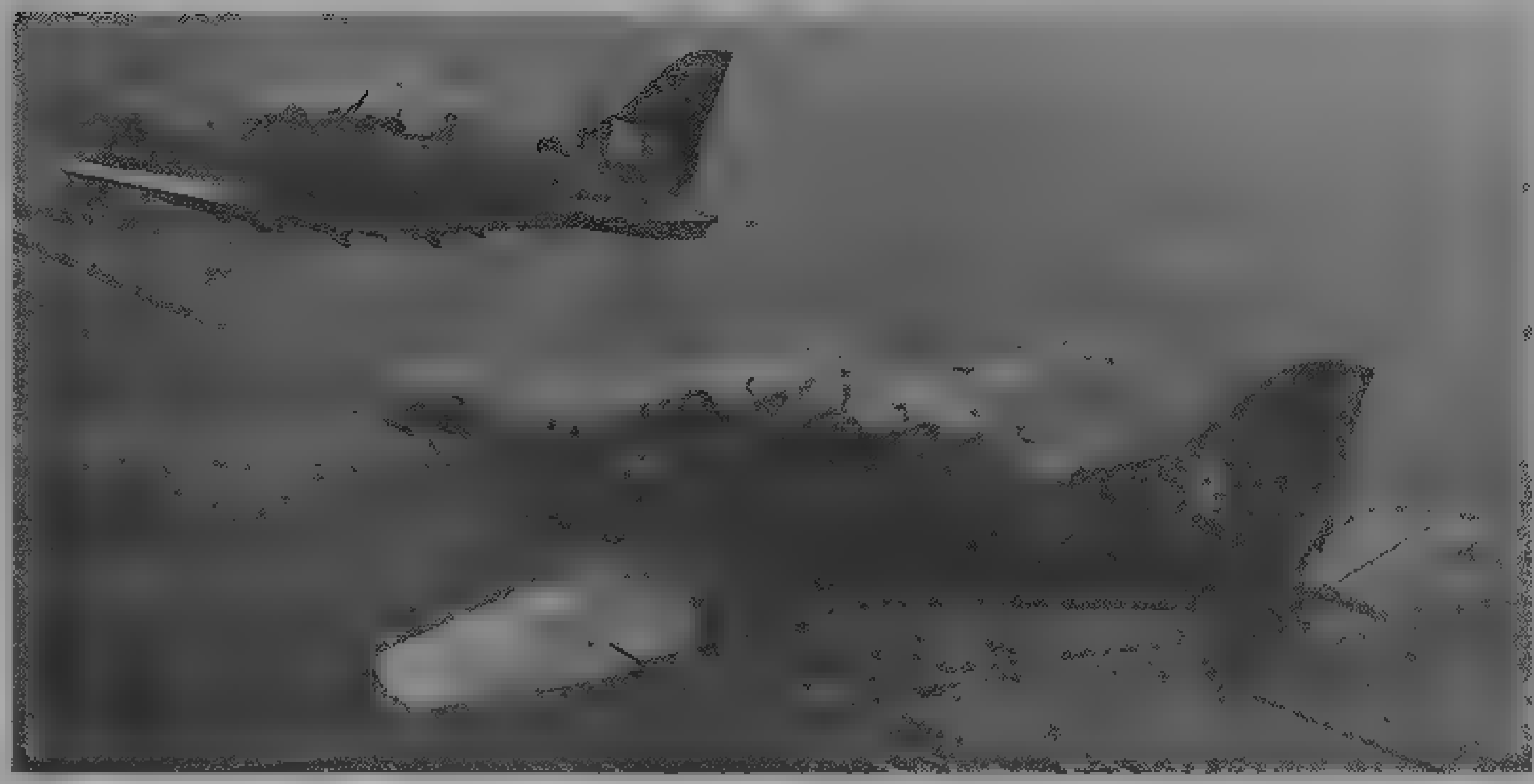
SYSTEMS: Cockpit ventilation, cooling, heating and canopy demisting provided by integral system utilising air cycle unit and engine bleed air. Engine-driven hydraulic pump provides power for landing gear actuation and wheel brakes, with hydraulic accumulator for emergency braking and pneumatic (nitrogen bottle) power for emergency landing gear extension. Lear Siegler 6 kW starter/generator and two 24 V 15 Ah Ni/Cd batteries provide power for 27.5 V DC electrical system, with solid state inverter for 115/26 V AC power; ground power receptacle fitted. Diluter demand oxygen system, capacity 2.716 litres (166 cu in).

AVIONICS (PZL-130TC): *Comms:* Bendix/King KTR 908 VHF and KXP 756 transponder.

Flight: Bendix/King KNR 634 nav with glide slope, KPI 525 HSI, KDF 806 ADF, KDM 706 DME, KTU 709 Tacan and Omega long-range nav system.

See also TC/TC-1/TC-2 under Current Versions.

ARMAMENT: Three hardpoints under each wing, inboard and centre ones stressed for loads of 160 kg (353 lb) each and outboard stations for 80 kg (176 lb) each. Typical external loads for PZL-130TB include free fall bombs of up to 100 kg, Tejsy and Mokrzycko bomb canisters, Zeus gun pods each with two 7.62 mm machine guns, launchers for 57 mm or 80 mm rockets, or Strela IR air-to-air missiles, plus S-17 gunsight and S-13 gun camera. Export versions can be equipped with Alkan or FN Herstal pylons and armament to customer's requirements.



All PZL-130TB Turbo-Orliks (illustrated) were due to be upgraded to TC-1 standard by mid-1995

1995

PZL 130 DEVELOPMENT AND PRODUCTION

c/n	Identity	Version	First flight	Engine	Remarks
001	n/a	130	n/a	n/a	Static test
002	SP-PCA	130	12 Oct 84	M-14 Pm	Piston-engined prototype
003	SP-PCB	130	14 Jan 85	M-14 Pm	Became 130T mockup
004	SP-PCC	130	29 Dec 84	M-14 Pm	Re-engined with PT6A-25A by Airtech as 130T/SP-RCC, flew 13 Jul 86 but lost Jan 87
005	005	130	19 Feb 88	M-14 Pm	Re-engined with M 601E as 130TM, to Deblin Oct 92
006	006	130	19 Mar 88	K8-AA	Re-engined with M 601E as 130TM, to Deblin Oct 92
007	007	130TM	12 Jan 89	M 601 E	First TM, to Deblin Oct 92, now instructional airframe
008	SP-WCA	130TP	early 90	PT6A-25A	Overseas demonstrator; to Deblin Dec 92
009	SP-PRF	130TB	18 Sep 91	M 601 T	Comparative engine trials, now 009
010	n/a	130TC	n/a	n/a	Static test
011	SP-PCE	130TC	2 Jun 93	PT6A-62	Prototype/demonstrator; now 011
012, 013	012, 013	130TB/TC-1	?	M 601 T	First production TBs, delivered Dec 92
014	014	130TC-2	mid-95	PT6A-25C	TC-2 prototype
015-021	015-021	130TB/TC-1	—	M 601 T	To 60 LPS 1993-94
022-036*	022-036*	130TB/TC-1	—	M 601 T	To 60 LPS and 23 LES 1994-95

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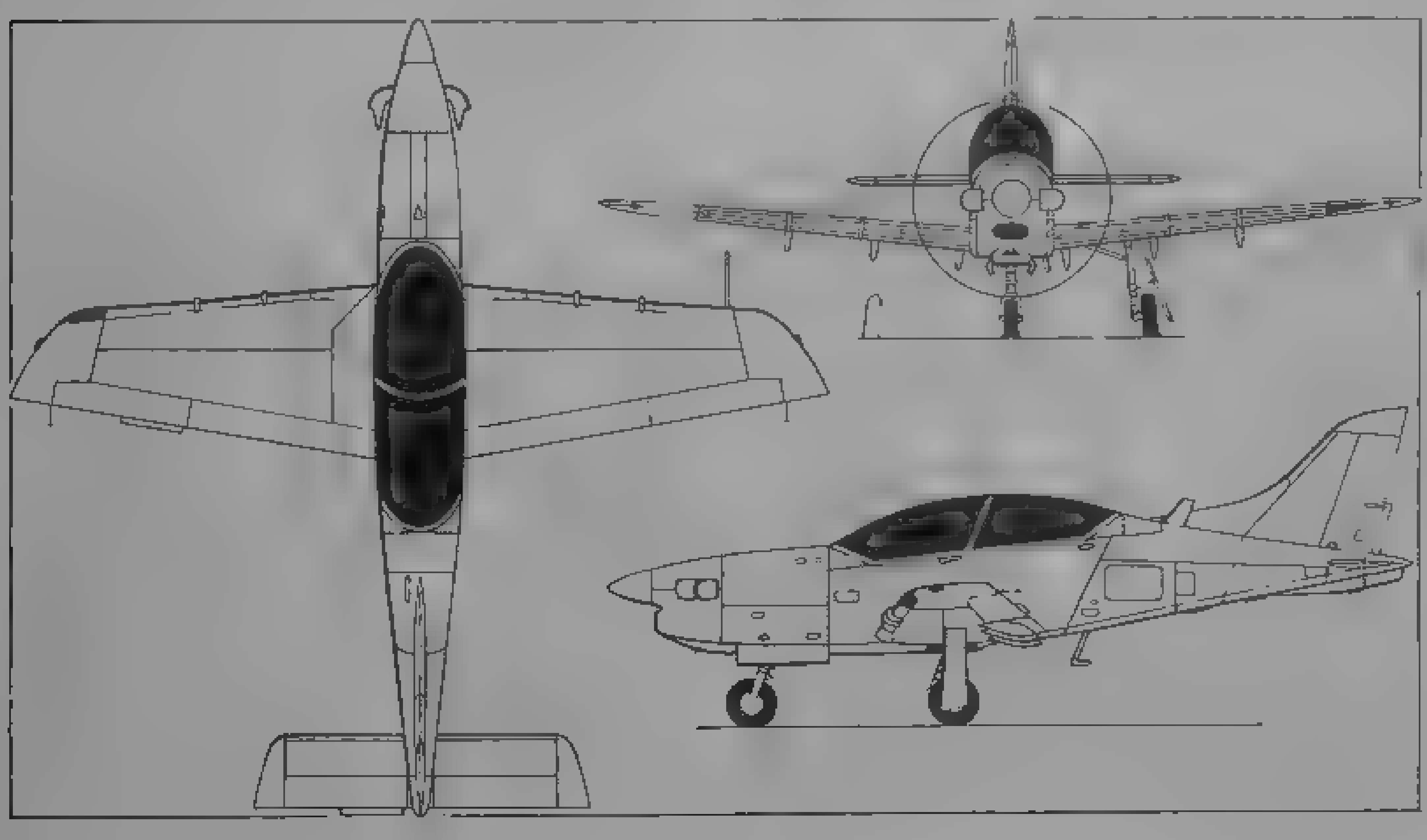


PZL Warszawa-Okecie PZL-130TC Orlik tandem-seat trainer *(Jane's/Mike Keep)*

1993

DIMENSIONS, EXTERNAL:

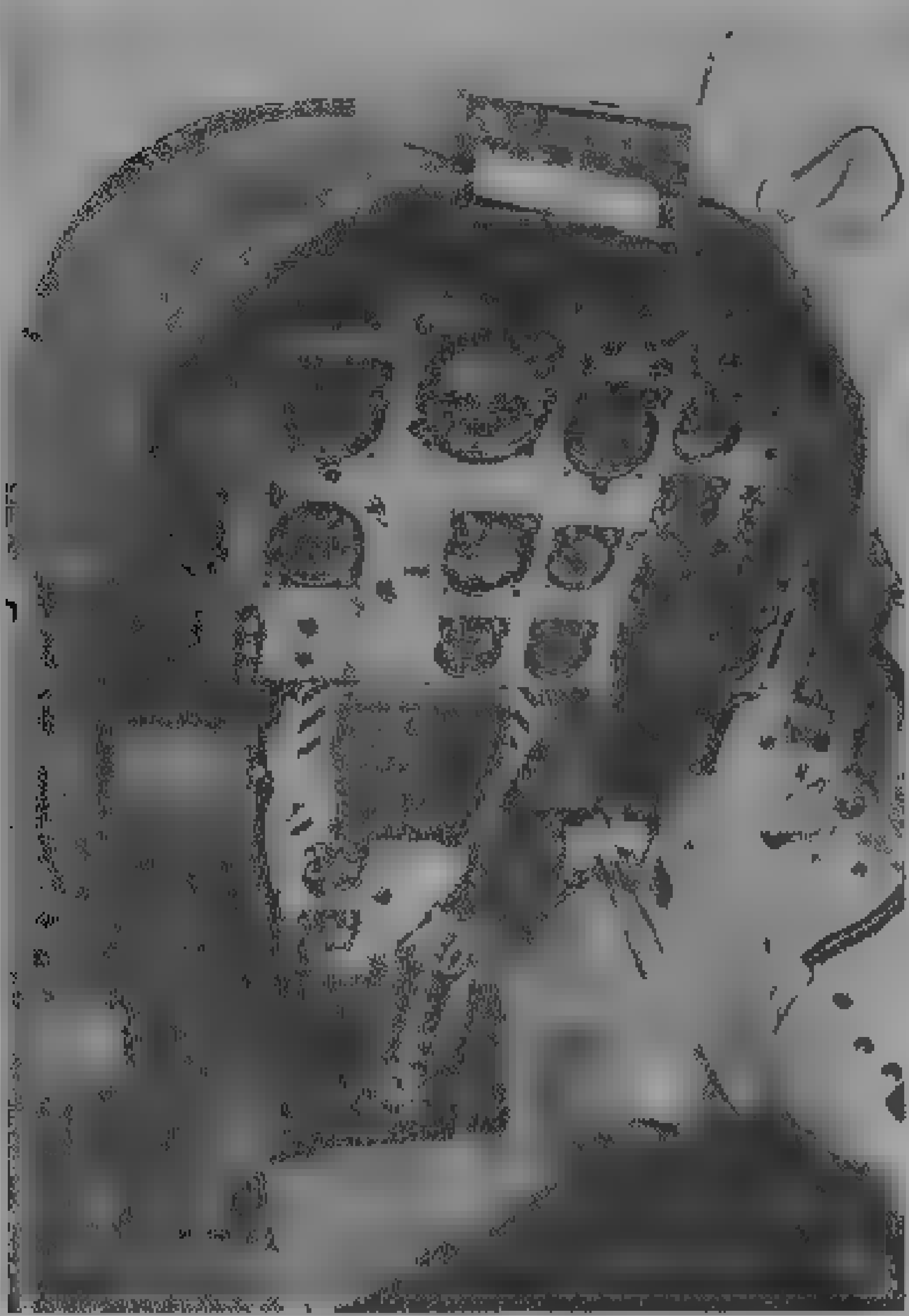
Wing span	9.00 m (29 ft 6¼ in)
Wing aspect ratio	6.23
Length overall	9.00 m (29 ft 6¼ in)
Fuselage: Max width	0.90 m (2 ft 11½ in)
Height overall	3.53 m (11 ft 7 in)
Wheel track	3.10 m (10 ft 2 in)
Wheelbase	2.90 m (9 ft 6¼ in)
Propeller diameter: TB, TC-1	2.30 m (7 ft 6½ in)

AREAS:

Wings, gross	13.00 m² (139.93 sq ft)
Ailerons (total, incl tab)	1.16 m² (12.49 sq ft)
Trailing-edge flaps (total)	2.34 m² (25.19 sq ft)
Fin	0.82 m² (8.83 sq ft)
Rudder, incl tab	0.81 m² (8.72 sq ft)
Tailplane	1.63 m² (17.55 sq ft)
Elevators (total, incl tab)	3.05 m² (32.83 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: TC	1,450 kg (3,197 lb)
TC-1	1,600 kg (3,527 lb)
TC-2	1,380 kg (3,042 lb)
Max external stores load: all	800 kg (1,764 lb)
Max T-O weight:	
Aerobatic: all	2,000 kg (4,409 lb)
Utility: all	2,700 kg (5,952 lb)
Max wing loading:	
Aerobatic: all	153.8 kg/m² (31.50 lb/sq ft)
Utility: all	207.7 kg/m² (42.54 lb/sq ft)
Max power loading:	
Aerobatic: TC	2.82 kg/kW (4.64 lb/shp)
TC-1, TC-2	3.58 kg/kW (5.88 lb/shp)
Utility: TC	3.81 kg/kW (6.27 lb/shp)
TC-1, TC-2	4.83 kg/kW (7.94 lb/shp)



Front (above) and rear cockpits of the PZL-130TB *(Piotr Butowski)*

1994

PERFORMANCE (at max Aerobatic T-O weight, clean configuration, except where indicated):

Max level speed at S/L	
TC	274 kts (508 km/h, 316 mph)
TC-1, TC-2	245 kts (454 km/h, 282 mph)
Max level speed at 6,000 m (19,685 ft)	
TC	302 kts (560 km/h, 348 mph)
TC-1, TC-2	270 kts (501 km/h, 311 mph)
Max rate of climb at S/L	
TC	1,236 m (4,055 ft)/min
TC-1, TC-2	798 m (2,620 ft)/min
Service ceiling: all	10,060 m (33,000 ft)
T-O run at S/L: TC	172 m (565 ft)
TC-1, TC-2	222 m (729 ft)
T-O to 15 m (50 ft): TC	266 m (873 ft)
TC-1	280 m (919 ft)
TC-2	342 m (1,122 ft)
Landing run: TC	184 m (604 ft)
Range with max fuel	
TC	501 n miles (930 km, 577 miles)
TC-1	523 n miles (970 km, 602 miles)
TC-2	620 n miles (1,150 km, 714 miles)
Range at 3,000 m (9,840 ft), clean configuration, no reserves	
TC	593 n miles (1,100 km, 683 miles)
TC-1	620 n miles (1,150 km; 714 miles)
TC-2	745 n miles (1,380 km, 857 miles)
Range with two 340 litre (90 US gallon, 74.8 Imp gallon) drop tanks, no reserves	
TC	1,242 n miles (2,300 km; 1,429 miles)

UPDATED

Prototype of the PZL-130TC Orlik, with PT6A-62 engine

1995

PZL-230F SKORPION

TYPE: Single-seat small agile battlefield attack (SABA) aircraft.

PROGRAMME: Preliminary PZL-230 design revealed late 1990 with twin turbofan power plant, changed to twin pusher PT6A-67A turboprops 1991 (see 1991-92 *Jane's*), further redesign (PZL-230F) reverted to turbofans and slimmer profile, as illustrated in 1993-94 *Jane's*, further extensive redesign since then, as shown in accompanying new illustrations, by 1995, PZL assessing comparative merits of V tail and alternative twin vertical fins plus all-moving tailplanes. Proposed for Polish Air Force requirement, to enter service after 2000. In competition with IL Kobra 2000 and PZL Mielec M-97/M-99 (which see); rejected Spring 1994 by Polish MoD, but continuing with company funding. *All details provisional.*

DESIGN FEATURES: Double-delta main wings, outer portions of which all-moving, working with close-coupled all-moving canards for simultaneous pitch and roll control as well as conventional T-O/landing function, claimed to make possible flight at 50° angle of attack and ability to make 180° turn in only 5 seconds, outward canted tailfins (narrow and wide angles both being evaluated). Intended for battlefield support close to FLOT, able to use unprepared airstrips.

FLYING CONTROLS: Lear Astronics electronic fly-by-wire system.

STRUCTURE: Mainly composites.

LANDING GEAR: Retractable tricycle type. All wheels remain partly exposed when retracted.

POWER PLANT: Twin rear-mounted AlliedSignal 27.8 kN (6,250 lb st) LF507 turbofans. Integral fuel tank in wing centre-section, capacity 3,500 litres (925 US gallons, 770 Imp gallons).

ACCOMMODATION: Pilot only, under rear-hinged, upward-opening canopy. Martin-Baker Mk 10L zero/zero ejection seat, inclined at 34° from perpendicular. Armoured cockpit to protect pilot against rounds of up to 12.7 mm calibre.

AVIONICS: By Bendix/King.

ARMAMENT: Internally mounted 25 mm Lockheed Martin GAU-12/U five-barrel gun, with 220 rounds, plus a 30 mm GAU-8 gun in ventral pod. Up to 11 external weapon stations (five on fuselage and centre-section, three under each outer wing).

DIMENSIONS, EXTERNAL:	
Wing span	10.00 m (32 ft 9¾ in)
Length overall: V tail	9.30 m (30 ft 6¼ in)
conventional tail	12.10 m (39 ft 8½ in)
Height overall	4.20 m (13 ft 9¼ in)
WEIGHTS AND LOADINGS:	
Weight empty	3,600 kg (7,937 lb)
Max external stores load	4,000 kg (8,818 lb)
Max T-O weight	10,000 kg (22,046 lb)
Max wing loading	393.7 kg/m² (80.6 lb/sq ft)
Max power loading	179.8 kg/kN (1.76 lb/lb st)
PERFORMANCE (estimated):	
Max level speed	561 kts (1,040 km/h, 646 mph)
Service ceiling	12,000 m (39,370 ft)
T-O run	370 m (1,214 ft)
Combat radius	162 n miles (300 km, 186 miles)
g limit	+9

UPDATED

PZL-104 WILGA (ORIOLE) 35 and 80

TYPE: Single-engined general purpose light aircraft.

PROGRAMME: First flight of prototype Wilga 1, 24 April 1962 (see 1968-69 *Jane's*), first flight of improved Wilga 35, 28 July 1967, production of Wilga 35 and 32 began 1968, both received Polish type certificate 31 March 1969 (Wilga 32 described in 1974-75 *Jane's*; see 1975-76 edition for Lipnur Gelatik Indonesian modified Wilga 32), first flight of Wilga 80, 30 May 1979.

CURRENT VERSIONS: **Wilga 35 and 80**: Currently built versions; meet requirements of British BCAR and US FAR Pt 23 respectively; 80 has carburettor air intake further aft, *details below apply to these versions except where indicated.*

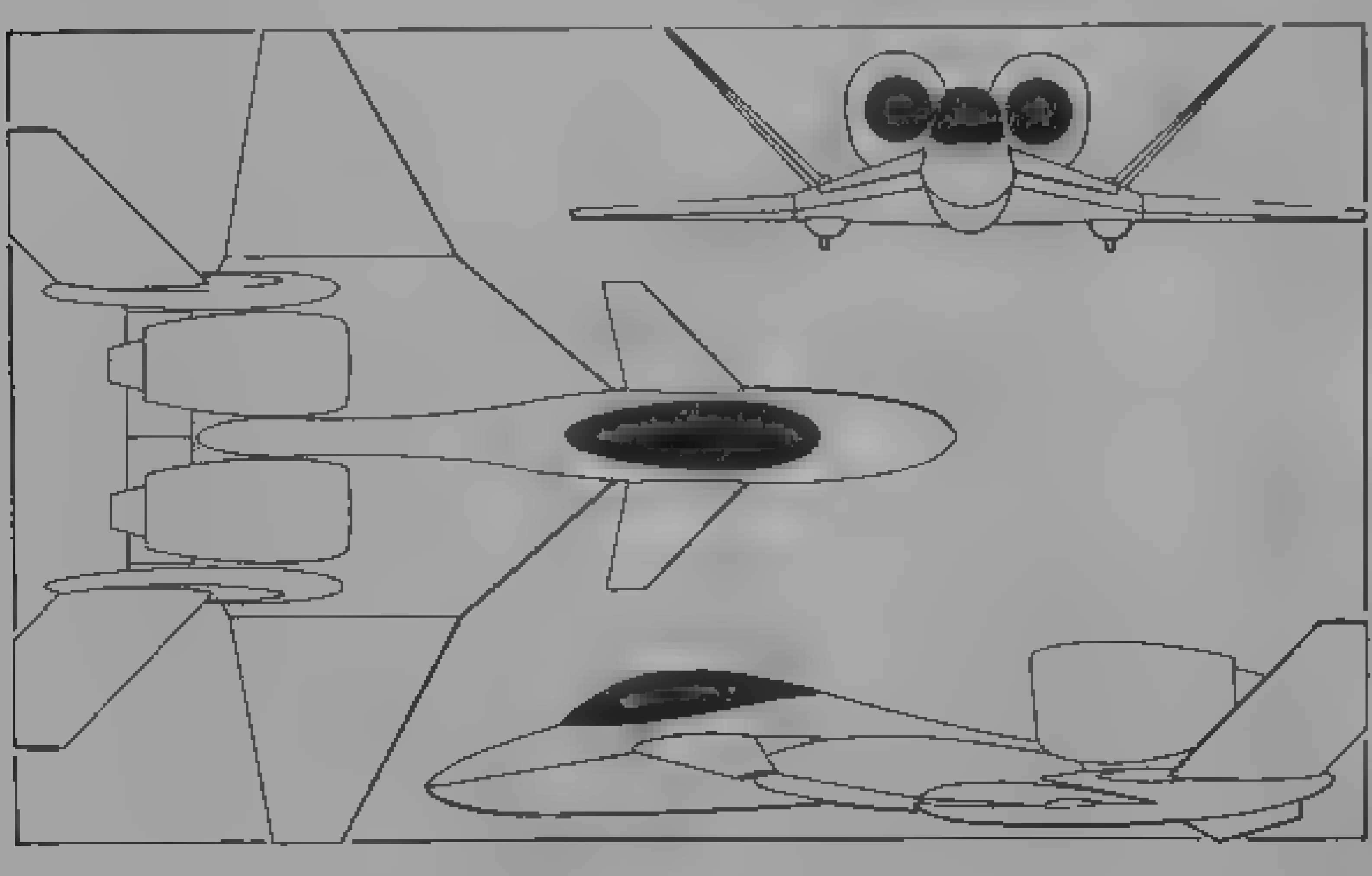
Wilga 35A and 80A: Aeroclub versions, with glider towing hook.

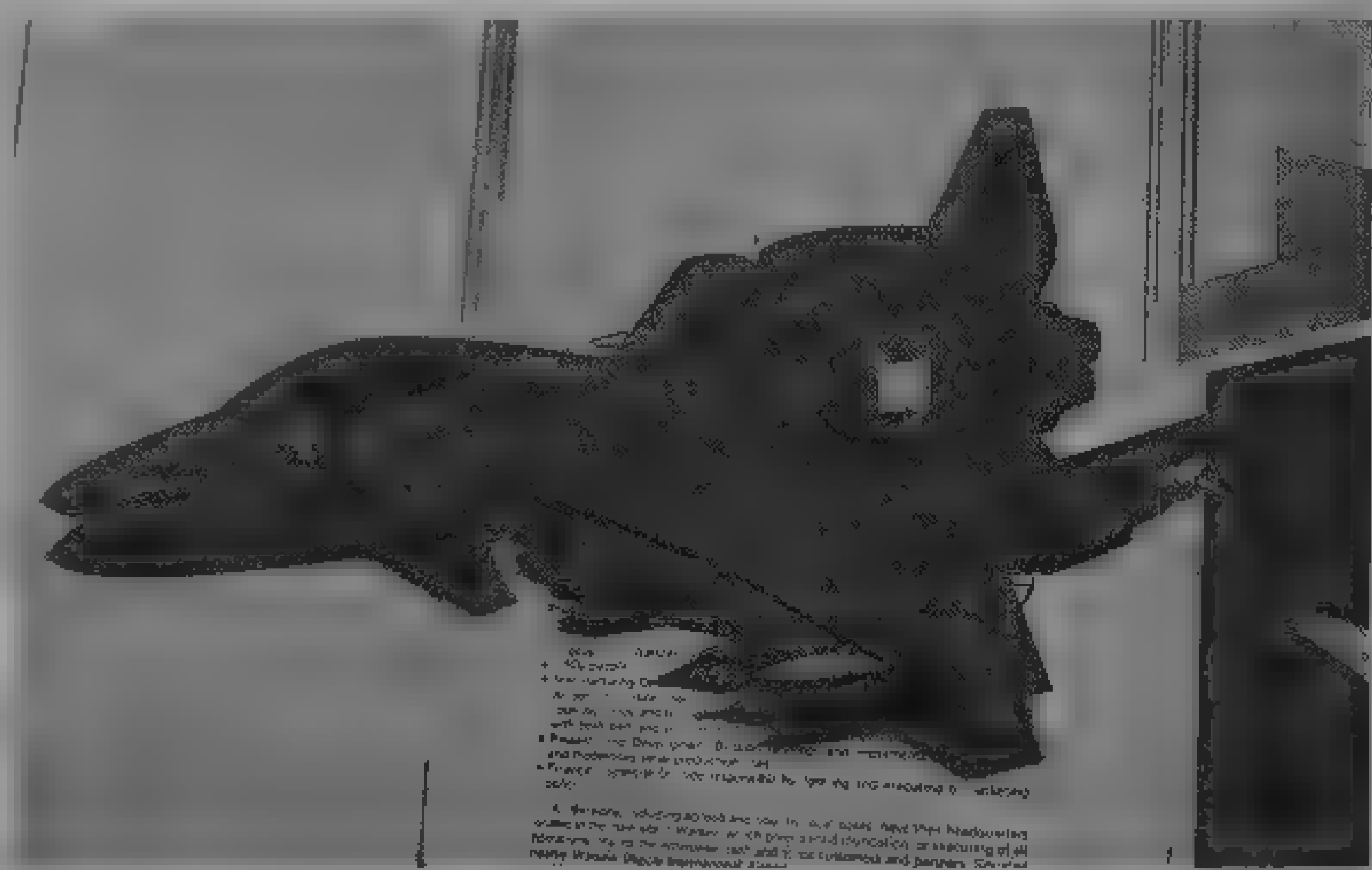
Wilga 35H and 80H: With Airtech (Canada) LAP-3000 floats.

Wilga 35M: Projected multipurpose variant of Wilga 35A (see 1994-95 *Jane's*), programme suspended.

Wilga 35R and 80R: Agricultural versions.

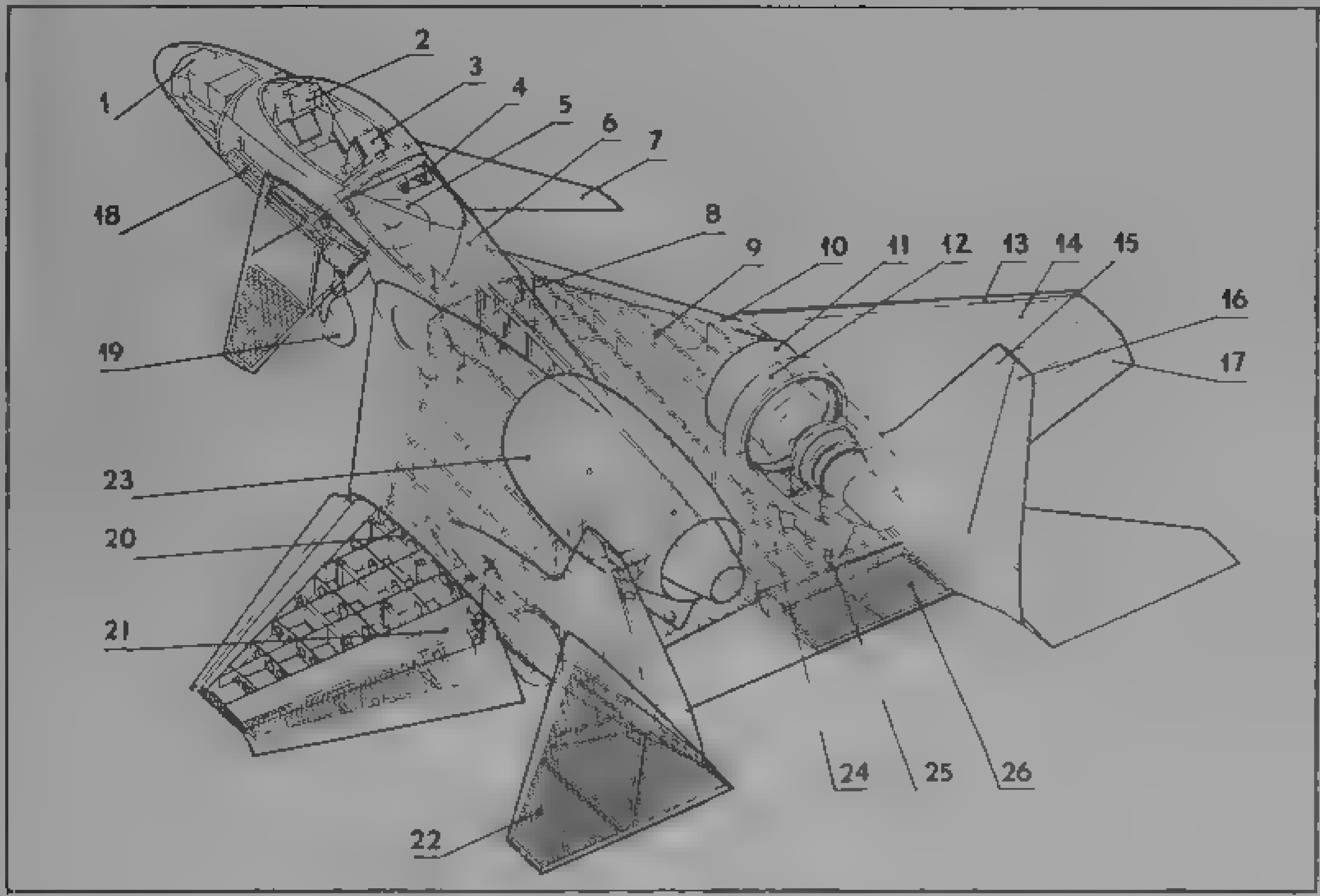
Wilga 80-550: Version for Western markets, with 224 kW (300 hp) Teledyne Continental IO-550 flat-six engine; see under Melex heading in US section.





General arrangement drawing ***(Jane's/Paul Jackson)*** **and model photograph** ***(Paul Jackson)*** **of V tailed configuration for PZL-230F Skorpion**

1995



Cutaway drawing of alternative (twin fin and all-moving tailplane) configuration for PZL-230F Skorpion

1 Pulse-Doppler radar—Thomson-CSF Phantom, 2: Head-up (HUD) and multifunction (EFIS) displays, 3: Martin-Baker Mk 10L ejection seat, 4: Forward control surface (canard) spigot mounting and actuation, 5: 25 mm ammunition drum—250 rounds, 6: Navigational equipment and fly-by-wire system compartment, 7: All-moving forward control surface (canard)—destabiliser, 8: Mid-wing to fuselage joint—four bolts, 9: Mid-wing/eight chamber fuel tank—capacity 3,500 litres (925 US gallons; 770 Imp gallons), 10: Control system compartment, 11: AlliedSignal LF 507 turbofan jet engine, 12: Engine supporting frame, 13: Automatically controlled leading-edge slat, 14: Outer wing (removable), 15: Vertical fin and landing gear bay, 16: Rudder, 17: Double slotted flap on trailing edge of outer wing, 18: GAU-12 25 mm multibarrel cannon, 19: Front landing gear (low-pressure tyre), 20: Quick-disconnect wing joint, 21: Main landing gear (low-pressure tyre), 22: All-moving tailplane (stabilator/taileron), 23: LF 507 engine nacelle, 24: Mid-wing aft part-power systems compartment-servicing deck, 25: Quick-disconnect engine-airframe joint, 26: Central elevator

1995

CUSTOMERS: Total of 951 (all versions) sold by 1 January 1995 to customers in Argentina, Australia, Austria, Belgium, Bulgaria, Canada, Cuba, Czech Republic, Denmark, Egypt, Finland, France, Germany, Hungary, Indonesia, Italy, North Korea, New Zealand, Poland, Romania, Slovakia, South Africa, Spain, Sweden, Switzerland, Turkey, UK, USA, former USSR (more than 380), Venezuela and former Yugoslavia.

DESIGN FEATURES: Used for wide variety of general aviation and flying club duties; high-mounted cantilever wings; braced tail unit, tall landing gear legs. Wing section NACA 2415, dihedral 1°.

FLYING CONTROLS: Aerodynamically and mass balanced slotted ailerons can be drooped to supplement flaps during landing, tab on starboard aileron, aerodynamically, horn and mass balanced one-piece elevator and rudder; trim tab in centre of elevator; manually operated slotted flaps, fixed slat on wing leading-edge along full span.

STRUCTURE: All-metal, with beaded skins; single-spar wings, with leading-edge torsion box, fuselage in two portions, forward incorporating main wing spar carry-through structure; rear section is tailcone, cabin floor of metal sandwich, with paper honeycomb core, covered with foam rubber, aluminium tailplane bracing strut.

LANDING GEAR: Non-retractable tailwheel type. Semi-cantilever main legs, of rocker type, have oleo-pneumatic shock-absorbers. Low-pressure tyres size 500 × 200 mm on mainwheels. Hydraulic brakes. Steerable tailwheel, tyre size 255 × 110 mm, carried on rocker frame with oleo-pneumatic shock absorber. Metal ski landing gear and Airtech Canada LAP-3000 twin-float landing gear optional.

POWER PLANT: One 194 kW (260 hp) PZL AI-14RA nine-cylinder supercharged radial air-cooled engine (AI-14RA KAF in Wilga 80), driving a PZL US-122000 two-blade constant-speed wooden propeller. Two removable fuel tanks in each wing, with total capacity of 195 litres (51.5 US gallons, 43 Imp gallons). Refuelling point on each side of fuselage, at junction with wing. For longer range operation, additional 90 litre (23.8 US gallon, 19.8 Imp gallon) fuel tank can be installed in place of rear pair of seats. Oil capacity 16 litres (4.2 US gallons, 3.5 Imp gallons).

ACCOMMODATION: Passenger version accommodates pilot and three passengers, in pairs, with adjustable front seats. Baggage compartment aft of seats, capacity 35 kg (77 lb). Rear seats can be replaced by additional fuel tank for longer range operation. Upward-opening door on each side of cabin, jettisonable in emergency. In parachute training version, starboard door is replaced by two tubular uprights with central connecting strap, and starboard front seat is rearward-facing. Jumps are facilitated by step on starboard side and by parachute hitch. Controllable towing hook can be attached to tail landing gear permitting Wilga, in this role, to tow single glider of up to 650 kg (1,433 lb) weight or two or three gliders with combined weight of 1,125 kg (2,480 lb).

SYSTEMS: Hydraulic system pressure 39 bars (570 lb/sq in). Engine started pneumatically by compressed air stored in 7 litre (0.25 cu ft) capacity bottle at pressure of 49 bars (710 lb/sq in) charged by engine. Electrical system powered by DC generator and 24 V 10 Ah battery.

AVIONICS: *Comms:* Polish R-860 II, R-860 IIM or RS-6102, Bendix/King KY 195 or other VHF transceiver standard. ARL-1601 VHF optional.

Flight: ARK-9, Bendix/King KR 85 or AV-200 ADF, GB-1 gyrocompass and K2-715 airspeed and altitude recorder optional.

Instrumentation: Blind-flying instrumentation standard.

EQUIPMENT: Sun visors, exhaust silencer and windscreen wiper optional.

DIMENSIONS, EXTERNAL:

Wing span: 35	11.12 m (36 ft 5¾ in)
80	11.13 m (36 ft 6¼ in)
Wing chord, constant	1.40 m (4 ft 7 in)
Wing aspect ratio	7.98
Length overall: 35	8.10 m (26 ft 6¾ in)
80	8.03 m (26 ft 4¼ in)
Height overall	2.96 m (9 ft 8½ in)
Tailplane span	3.70 m (12 ft 1¾ in)
Wheel track	2.75 m (9 ft 0¼ in)
Wheelbase	6.70 m (21 ft 11¾ in)
Propeller diameter	2.65 m (8 ft 8 in)
Passenger doors (each): Height	1.00 m (3 ft 3¼ in)
Width	1.50 m (4 ft 11 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.20 m (7 ft 2⅝ in)
Max width	[illegible]20 m (3 ft 1[illegible] in)
Max height	[illegible]50 m (4 ft 11 [illegible])
Floor area	2.20 m² (23.8 sq ft)
Volume	2.40 m³ (85 cu ft)
Baggage compartment	0.50 m³ (17.5 cu ft)

AREAS:

Wings, gross	15.50 m² (166.8 sq ft)
Ailerons (total)	1.57 m² (16.90 sq ft)
Trailing-edge flaps (total)	1.97 m² (21.20 sq ft)
Fin	0.97 m² (10.44 sq ft)
Rudder	0.92 m² (9.90 sq ft)
Tailplane	3.16 m² (34.01 sq ft)
Elevator, incl tab	1.92 m² (20.67 sq ft)

WEIGHTS AND LOADINGS (Wilga 35A and 80):

Weight empty, equipped	870 kg (1,918 lb)
Max T-O and landing weight	1,300 kg (2,866 lb)
Max wing loading	83.9 kg/m² (17.18 lb/sq ft)
Max power loading	6.70 kg/kW (11.02 lb/hp)

PERFORMANCE (Wilga 35A, at max T-O weight):

Never exceed speed (VNE)	150 kts (279 km/h, 173 mph)
Max level speed	105 kts (194 km/h, 120 mph)
Cruising speed (75% power)	85 kts (157 km/h, 97 mph)
Cruising speed for max range	74 kts (137 km/h; 85 mph)
Stalling speed: flaps up	35 kts (65 km/h, 41 mph)
flaps down	30 kts (56 km/h, 35 mph)
Max rate of climb at S/L	276 m (905 ft)/min
Time to 1,000 m (3,280 ft)	3 min
Service ceiling	4,040 m (13,250 ft)
T-O run (grass)	121 m (397 ft)
Landing run	106 m (348 ft)
Range with max fuel, 30 min reserves	275 n miles (510 km, 317 miles)

UPDATED

PZL-105L FLAMING (FLAMINGO)

TYPE: Single-engined general purpose light aircraft (passenger or cargo transport, sport and aero club flying, glider towing, parachute training, air ambulance, patrol, geophysical survey, agricultural and other uses).

PROGRAMME: Originally referred to as Wilga 88, but entirely new design. Static test airframe and two flying prototypes built; first prototype (SP-PRC), with M-14P engine (PZL-105M), made first flight 19 December 1989; second aircraft (SP-PRD), with IO-720 engine, made first flight 27 July 1991 as prototype for PZL-105L, this version was intended to gain FAR Pt 23 certification in Normal category, but status of programme currently unclear and no further aircraft had been produced by early 1995.

CURRENT VERSIONS: **PZL-105L:** Textron Lycoming IO-720 flat-six engine. Second prototype completed to this configuration. *Description applies to this version.*

PZL-105M: VMKB (Vedeneyev) M-14P radial engine. Development suspended. Details in 1993-94 *Jane's*.

DESIGN FEATURES: Braced high wings (single strut each side), cantilever tail unit, STOL characteristics combined with better speed range and payload than Wilga, choice of landing gears; operable from unprepared airstrips. Wing section (constant) similar to NASA GA W-1, dihedral 1°, incidence 4°, no twist.

FLYING CONTROLS: Mechanically actuated (by push/pull rods and cables) single slotted flaperons, rudder and elevators, fixed tab on port flaperon, ground adjustable tab on rudder, electrically actuated trim tab on port elevator, rudder and elevators horn balanced, electrically operated single-slotted Fowler trailing-edge flaps.

STRUCTURE: All-metal except for glassfibre wing/rudder/elevator tips and spinner; two-spar wing box, entire structure

PZL-104 Wilga 80 general purpose light aircraft

1995

protected against weather, corrosion and abrasion and finished in polyurethane paint

LANDING GEAR: Non-retractable type, with single mainwheels on glassfibre spring cantilever legs and steerable tailwheel with oleo-pneumatic shock absorption. Tyre sizes 500 × 200 mm (main) and 250 × 125 mm (tail), pressure 3.5 bars (50.75 lb/sq in) on all units. Single-disc hydraulic brake on each mainwheel. Optional gear includes floats, skis (with snow brakes) and wheel/skis.

POWER PLANT: One 298 kW (400 hp) Textron Lycoming IO-720-A1B flat-eight engine and Hartzell three-blade constant-speed metal propeller. Fuel in integral tanks in wings, total capacity 270 litres (71.3 US gallons, 59.4 Imp gallons). Gravity fuelling point in upper surface of each wing.

ACCOMMODATION: Fully enclosed, heated and ventilated cabin, with seats for up to six persons including pilot (four individual seats in two rows and two-place rear bench seat). All passenger seats and bench can be quickly removed to provide space for up to 450 kg (992 lb) of cargo. Cabin has flat floor, flush with door sill. Large door each side, with upward opening top half; lower halves open downward and incorporate steps. Doors are non-structural. Dual controls optional.

SYSTEMS: Hydraulic system for brakes only. Electrical system (28 V DC) supplied by 24 V 70 A alternator and 24 V 15 Ah Ni/Cd battery.

AVIONICS: *Comms*: ARL-1601 VHF and RS-6102 radio in prototypes.

Flight: GB 1 gyrocompass in prototypes.

Provision for Bendix/King Silver Crown avionics in production aircraft.

EQUIPMENT: Navigation/anti-collision/cabin/landing lights standard.

DIMENSIONS, EXTERNAL:

Wing span	12.98 m (42 ft 7 in)
Wing chord, constant	1.35 m (4 ft 5¼ in)
Wing aspect ratio	9.97
Length overall	8.70 m (28 ft 6½ in)
Tailplane span	4.108 m (13 ft 5½ in)
Height overall (tail down)	2.755 m (9 ft 0½ in)
Wheel track	3.085 m (10 ft 1½ in)
Wheelbase	6.08 m (19 ft 11½ in)
Propeller diameter	2.18 m (7 ft 1¾ in)
Cabin doors (two, each): Height	1.00 m (3 ft 3¼ in)
Width	1.60 m (5 ft 3 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.80 m (9 ft 2¼ in)
Max width	1.19 m (3 ft 11 in)
Max height	1.20 m (3 ft 11¼ in)

AREAS:

Wings, gross	16.90 m² (181.9 sq ft)

WEIGHTS AND LOADINGS:

Standard weight empty, equipped	1,150 kg (2,535 lb)
Max T-O weight	1,850 kg (4,078 lb)
Max wing loading	109.5 kg/m² (22.43 lb/sq ft)
Max power loading	6.21 kg/kW (10.20 lb/hp)

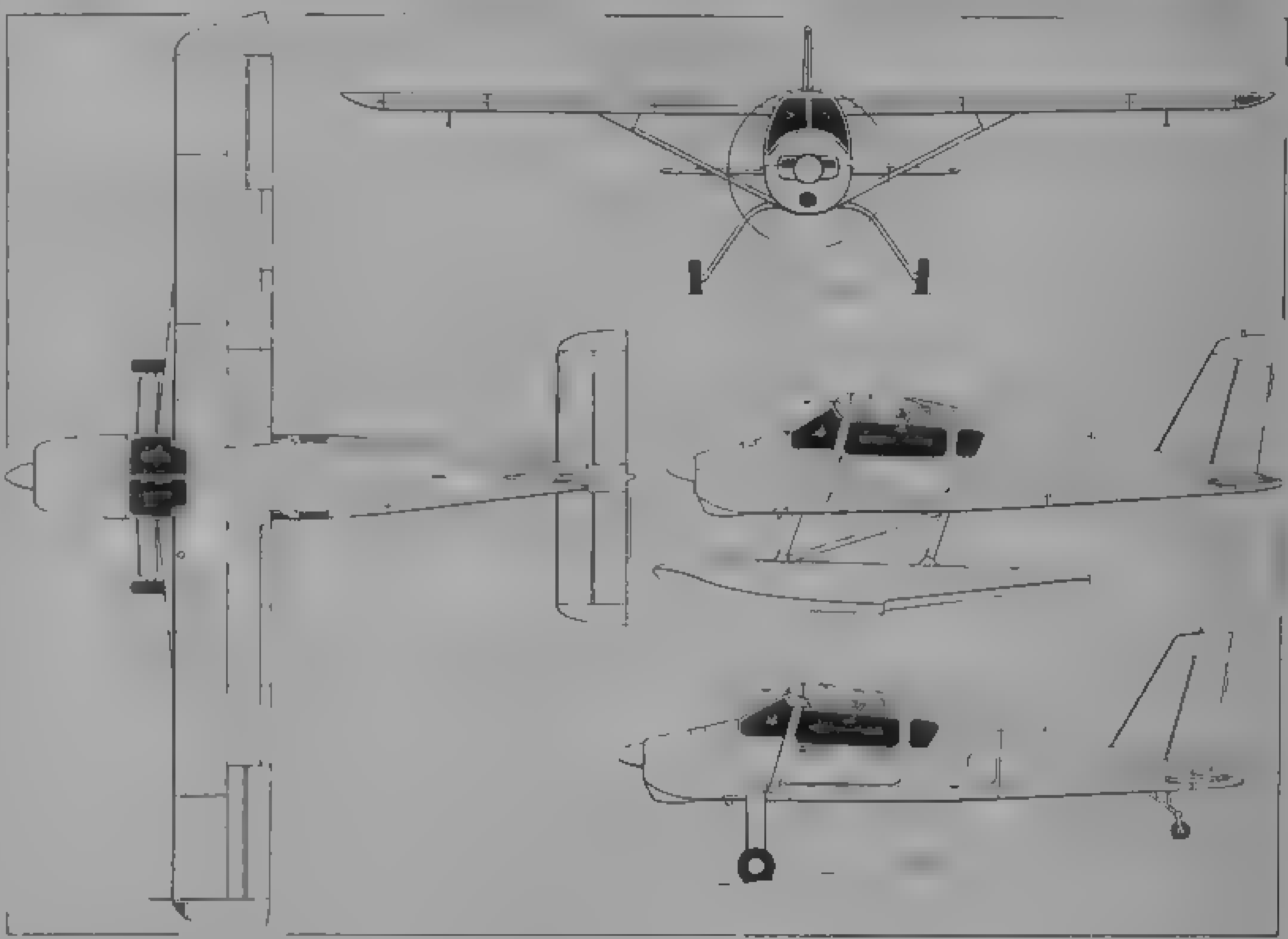
PERFORMANCE (estimated, at max T-O weight):

Never-exceed speed (V_{NE})	165 kts (306 km/h; 190 mph)
Max level speed	140 kts (260 km/h; 162 mph)
Max cruising speed	134 kts (248 km/h; 154 mph)
Econ cruising speed, 50% power	111 kts (205 km/h; 127 mph)
Stalling speed, flaps down, engine idling	55 kts (102 km/h; 64 mph)
Max rate of climb at S/L	336 m (1,100 ft)/min
Service ceiling	4,660 m (15,290 ft)
T-O run	189 m (620 ft)
T-O to 15 m (50 ft)	351 m (1,152 ft)
Landing from 15 m (50 ft)	330 m (1,083 ft)
Landing run	157 m (515 ft)
Range with max fuel: at max cruising speed	461 n miles (854 km; 530 miles)
at econ cruising speed	563 n miles (1,043 km; 648 miles)
g limits	+3.8/−1.52

UPDATED

Second Flaming, with IO-720 engine as prototype for PZL-105L

1995



PZL Warszawa-Okecie PZL-105L (Textron Lycoming IO-720 flat-six engine), with additional side view of optional floatplane version *(Jane's/Dennis Punnett)*

1992

PZL-106B KRUK (RAVEN)

TYPE: Single-engined agricultural aircraft.

PROGRAMME: Original PZL-106 designed early 1972; first flight of first prototype (SP-PAS), with IO-720 engine, 17 April 1973, five further prototypes, latter four with PZL-3S engine, superseded by current B series from early 1980s. Production at standstill since early 1992, but expected to resume eventually with new option of larger hopper. Full description in 1993-94 and earlier editions, shortened version in 1994-95 *Jane's*.

CURRENT VERSIONS: Details of PZL-106A, AR, AT and B in 1985-86 and earlier *Jane's*; PZL-106AS in 1991-92 and earlier editions.

PZL-106BR: Geared PZL-3SR engine, first flown 8 July 1983; tested with wingtip vanes (three at each tip). 64 built so far.

PZL-106BS: Uprated version, with PZL (Shvetsov) ASz-62IR engine, for Restricted category operation, with higher maximum T-O weight and increased chemical load; prototype first flown 8 March 1982. 15 built so far.

PZL-106BT: Turboprop version (marketed in West as **Turbo Javelin**), described separately.

CUSTOMERS: Manufactured initially for member countries of CMEA (Council for Mutual Economic Aid); total of 248 (all versions, including Turbo-Kruk) built and sold so far, including 144 PZL-106As produced 1976-81. Currently in service mainly in Africa, Argentina, the Middle East and USA.

UPDATED

PZL-106BT Turbo-Kruk agricultural aircraft

1995

PZL-106BT TURBO-KRUK

TYPE: Turboprop version of Kruk agricultural aircraft.

PROGRAMME: First flight of prototype (SP-PAA) 18 September 1985; FAR Pt 23 certification early 1994.

CURRENT VERSIONS: **Turbo-Kruk**: Standard version, marketed in West as **Turbo Javelin**.

CUSTOMERS: 21 built by 1 January 1992; six built 1994 but unsold at 1 January 1995. Operated mainly in Argentina, Egypt and Iran.

DESIGN FEATURES: Compared with Kruk, has turboprop engine, 6° sweepback at quarter-chord, 6° dihedral, taller fin and larger chemical load.

Description as for piston-engined Kruk except as follows:

POWER PLANT: One 544 kW (730 shp) Walter M 601 D turboprop; Avia V 508 D three-blade propeller.

DIMENSIONS, EXTERNAL:

Wing span	15.00 m (49 ft 2½ in)
Wing aspect ratio	7.10
Length overall	10.24 m (33 ft 7¼ in)
Height overall	3.82 m (12 ft 6½ in)
Propeller diameter	2.50 m (8 ft 2½ in)

WEIGHTS AND LOADINGS:

Weight empty, equipped	1,680 kg (3,704 lb)
Max chemical payload	1,300 kg (2,866 lb)

Max T-O weight	3,500 kg (7,716 lb)
Max landing weight	3,000 kg (6,614 lb)
Max wing loading	110.44 kg/m² (22 62 lb/sq ft)
Max power loading	6 07 kg/kW (9 97 lb/shp)
PERFORMANCE (at max T-O weight):	
Never-exceed speed (VNE)	145 kts (270 km/h; 167 mph)
Max level speed at S/L:	
without agricultural equipment	135 kts (250 km/h, 155 mph)
with agricultural equipment	116 kts (215 km/h, 134 mph)
Operating speed with max chemical load	81 92 kts (150-170 km/h; 93-106 mph)
Stalling speed at S/L	49 kts (90 km/h, 56 mph)
Max rate of climb at S/L (with agricultural equipment)	360 m (1,180 ft)/min
T-O run (with agricultural equipment)	230 m (755 ft)
Landing run (with agricultural equipment)	130 m (427 ft)
Range with max standard fuel	485 n miles (900 km, 559 miles)

UPDATED

PZL-110 KOLIBER (HUMMING BIRD)

TYPE: Two/four-seat training and multipurpose light aircraft, licence-built and uprated version of Socata Rallye 100 ST.

PROGRAMME: First PZL-110, modified to receive 86 5 kW (116 hp) PZL-F (Franklin) engine, first flown 18 April 1978; first flight of Koliber 150 prototype (SP-PHA) 27 September 1988. Polish type certificate for 150 awarded January 1989, FAA certificate for 150A February 1995.

CURRENT VERSIONS: **Koliber**: See 1991-92 and earlier *Jane's* for details of initial **Series I/II/III** with 93 2 kW (125 hp) PZL-Franklin engines; production (total of 40 built) ended December 1989 and included 675 sets of spare fuselage/wing/aileron/flap/control surface assemblies, some of them exported to France.

Koliber 150: Current production version, *as described below*, higher powered Textron Lycoming engine and detail improvements. Currently (1995) certificated in Australia, Denmark, Germany, Netherlands, Norway, Poland, Sweden, UK and USA.

Koliber 150A: Export version of 150 (known in USA as **Koliber II**), same power plant but with Western avionics, for night/IFR flying, improved (24 V) electrical system. Performance differs slightly from that of Koliber 150. Certification to FAR Pt 23 Amendment 23 awarded February 1995. Cadmus Corporation of Northfield, Illinois, is sole distributor for USA.

Koliber 235 (PZL-111): More powerful version, described separately.

CUSTOMERS: Koliber 150s sold to Denmark, Germany, Netherlands, Sweden and UK. Total of 14 Koliber 150s sold in 1994, including 150As to US and Canadian customers.

COSTS: Koliber II/150A, $89,500 basic (1995).

DESIGN FEATURES: Wing section NACA 63A-416 (modified); dihedral 7° 7' 30"; incidence 4°.

FLYING CONTROLS: Mechanically (pushrod) actuated, aerodynamically and mass balanced ailerons with ground adjustable tabs, aerodynamically and mass balanced elevator with control tab, rudder with ground adjustable tab; full-span automatic leading-edge slats, electrically actuated Fowler flaps.

STRUCTURE: All-metal, flaps, elevators and rudder have corrugated skins; wing torsion box and trailing-edge segments electrically spot-welded.

LANDING GEAR: Non-retractable tricycle type, with leg fairings and oleo-pneumatic shock-absorption. Castoring nosewheel, size 330 × 130 mm, mainwheels size 380 × 150 mm. Tyre pressures 1 4 and 1 8 bars (20 3 and 26.1 lb/sq in) respectively. Hydraulic disc brakes.

POWER PLANT: One 112 kW (150 hp) Textron Lycoming O-320-E2A flat four engine, driving a Sensenich 74DM6-054, -056 or -058 two blade constant speed metal propeller. Fuel in two metal tanks in wings, with total capacity of 105 or 177 litres (27 7 or 46.8 US gallons, 23 1 or 38 9 Imp gallons). Refuelling points above wings. Oil capacity 7 litres (1 85 US gallons; 1 54 Imp gallons).

ACCOMMODATION: Two side by side seats, plus two-person bench seat at rear, under large rearward-sliding canopy. Dual controls. Heating and ventilation standard.

SYSTEMS: 12 V electrical system, with 70 A alternator and 30 Ah battery.

AVIONICS: *Comms*: Bendix/King KX 155 or Narco Mk 12D 1 HF transceiver.

Flight: ADF, VOR, electrically powered gyro attitude indicator, turn and bank indicator, and directional gyro.

EQUIPMENT: For training role, includes pupil's window blinds for instrument training, front seat backrests suitable for use with back type parachutes, safety belts, and accelerometers.

PZL 110 Koliber 150, Polish built version of the Socata Rallye *1995*

DIMENSIONS, EXTERNAL:	
Wing span	9.75 m (31 ft 11¾ in)
Wing chord, constant	1 30 m (4 ft 3 in)
Wing aspect ratio	7 50
Length overall	7 37 m (24 ft ? in)
Height overall	2 80 m (9 ft 2¼ in)
Tailplane span	3.67 m (12 ft 0½ in)
Wheel track	2.01 m (6 ft 7¼ in)
Wheelbase	1.71 m (5 ft 7¼ in)
Propeller diameter	1 78 m (5 ft 10 in)
AREAS:	
Wings, gross	12 68 m² (136 5 sq ft)
Ailerons (total)	1 56 m² (16 79 sq ft)
Trailing-edge flaps (total)	2 40 m² (25 83 sq ft)
Vertical tail surfaces (total)	1.74 m² (18 73 sq ft)
Horizontal tail surfaces (total)	3 48 m² (37 50 sq ft)
WEIGHTS AND LOADINGS (U Utility, N Normal category):	
Weight empty, equipped	548 kg (1,208 lb)
Max T-O weight: U	770 kg (1,697 lb)
N	850 kg (1,874 lb)
Max wing loading: U	60.72 kg/m² (12 44 lb/sq ft)
N	67.03 kg/m² (13 73 lb/sq ft)
Max power loading: U	8 90 kg/kW (14 63 lb/hp)
N	7 60 kg/kW (12 49 lb/hp)
PERFORMANCE (Koliber 150 at max T-O weight):	
Never-exceed speed (VNE):	
U	145 kts (270 km/h; 167 mph)
N	134 kts (250 km/h, 155 mph)
Max level speed at S/L:	
U, N	108 kts (200 km/h, 124 mph)
Max cruising speed at S/L:	
U, N	92 kts (170 km/h, 106 mph)
Econ cruising speed:	
U, N	75 kts (140 km/h, 87 mph)
Stalling speed:	
U, N, flaps up	50 kts (92 km/h, 58 mph)
U, N, flaps down	45 kts (82 km/h, 51 mph)
Max rate of climb at S/L: U	264 m (866 ft)/min
N	216 m (708 ft)/min
Service ceiling: U, N	3,700 m (12,140 ft)
T-O run at S/L: U	140 m (459 ft)
N	167 m (548 ft)
T-O to 15 m (50 ft) at S/L: U	340 m (1,116 ft)
N	397 m (1,303 ft)
Landing from 15 m (50 ft) at S/L: U	290 m (952 ft)
N	320 m (1,050 ft)
Landing run at S/L: U	125 m (411 ft)
N	138 m (453 ft)
Range at 500 m (1,640 ft) with max fuel, no reserves	324 n miles (600 km; 373 miles)
g limits	+4 4/−1 76 (ultimate)
PERFORMANCE (Koliber 150A):	
Max cruising speed	102 kts (190 km/h, 118 mph)
Econ cruising speed	92 kts (170 km/h; 105 mph)
Stalling speed, flaps up	48 kts (89 km/h, 56 mph)
Max rate of climb at S/L	203 m (666 ft)/min
Service ceiling	3,700 m (12,140 ft)
T-O to 15 m (50 ft)	400 m (1,313 ft)
Landing from 15 m (50 ft)	300 m (985 ft)
Range with max fuel	448 n miles (830 km, 515 miles)

UPDATED

PZL-111 KOLIBER

TYPE: Higher powered versions of Koliber 150.

PROGRAMME: Construction of first prototype began August 1990; static testing completed March 1993.

CURRENT VERSIONS: **Koliber 235**: With 175 3 kW (235 hp) Textron Lycoming engine. First prototype is of this version, first flight was expected in 1995. *Details apply to this version.*

Koliber 200: Alternative version with 149 kW (200 hp) Lycoming.

Koliber 180: Second alternative version with 134 kW (180 hp) Lycoming.

Koliber 160: Third alternative; 119 kW (160 hp) Lycoming engine.

DESIGN FEATURES: Designed at PZL Warszawa-Okecie Pilot Plant (project engineer Ryszard Kaczkowski); approximately 40 per cent commonality with PZL-110 series. Intended for basic, navigation and general training, glider towing, sport flying, touring, executive flights; and special missions.

POWER PLANT: One 175 3 kW (235 hp) Textron Lycoming O-540-B4B5 flat-six engine, Hartzell HC-C2YK-13F/F8468A4 two-blade metal propeller. Fuel capacity 170 litres (45 US gallons; 37 4 Imp gallons).

SYSTEMS: 12 V electrical system with 22 Ah battery.

DIMENSIONS, EXTERNAL: As Koliber 150 except:	
Length overall	7.32 m (24 ft 0¼ in)
Propeller diameter	2 03 m (6 ft 8 in)
WEIGHTS AND LOADINGS (U Utility, N Normal category):	
Weight empty	650 kg (1,433 lb)
Max T-O weight: U	1,000 kg (2,204 lb)
N	1,150 kg (2,535 lb)
Max wing loading: U	77 52 kg/m² (15 88 lb/sq ft)
N	89 15 kg/m² (18 26 lb/sq ft)
Max power loading: U	5 70 kg/kW (9 38 lb/hp)
N	6 56 kg/kW (10 79 lb/hp)
PERFORMANCE (estimated):	
Max level speed	130 kts (240 km/h, 149 mph)
Econ cruising speed	108 kts (200 km/h, 124 mph)
Stalling speed, flaps down	44 kts (80 km/h, 50 mph)
Max rate of climb at S/L	360 m (1,180 ft)/min
Service ceiling	4,500 m (14,775 ft)
Range with max fuel	539 n miles (1,000 km, 621 miles)

UPDATED

PZL-126P MRÓWKA

This aircraft now described under Agrolot heading elsewhere in Polish section.

NEW ENTRY

PZL-140 ORZEL (EAGLE)

TYPE: Proposed seven-seat twin-turboprop business transport.

PROGRAMME: Begun 1993 as single-engined derivative of PZL-130T, but much redesigned subsequently; go-ahead dependent upon funding being sought by Cadmus Corporation, Okecie's US marketing associate.

COSTS: Estimated at $3 million to $4 million per unit.

DESIGN FEATURES: Forward swept wings, canard control surfaces, pressurised fuselage, twin-tailboom configuration with inward-canted fins and rudders, combiner gearbox to single pusher propeller.

STRUCTURE: Mainly metal.

POWER PLANT: Two Pratt & Whitney Canada PT6A turboprops in Soloy Dual Pac installation.

PERFORMANCE (estimated):	
Max cruising Mach number	0 7
Max cruising altitude	13,700 m (45 000 ft)
Max range	2,700 n miles (5,000 km, 3,106 miles)

NEW ENTRY

PORTUGAL

OGMA

OFICINAS GERAIS DE MATERIAL AERONÁUTICO (General Aeronautical Material Workshops)

No complete aircraft are currently being produced by OGMA. Details of the company's extensive overhaul and support activities appear in *Jane's Aircraft Upgrades*

UPDATED

ROMANIA

IAROM

SC IAROM SA

39 Aerogarii Boulevard, Sector 1, R-71547 Bucharest
Telephone: 40 (1) 666 7709
Fax: 40 (1) 312 8733
Telex: 11648 AEROM R
GENERAL MANAGER: Dan Gozia

New holding company for Romanian aircraft industry replacing former CNIAR (1991-92 and earlier *Jane's*). Aircraft and aero-engine companies and R&D institutes given full autonomy from 1990, when all became joint stock companies as prelude to privatisation. Current shareholding divided between State Ownership Fund (70 per cent) and Private Ownership Funds (30 per cent); objective is full privatisation by end of 1990s. Total of 18 companies/institutes comprised Romania aeronautical industry in 1994, with combined workforce of nearly 19,000.

Following overthrow of Ceaucescu regime, industry continues to operate, but at very reduced rate; is looking for opportunities to work for or with Western companies and projects.

Tehnoimportexport SA
2 Doamnei Street (PO Box 110), Bucharest
Telephone: 40 (1) 312 1039
Fax: 40 (1) 312 1038
Telex: 10254 TEHIE R
GENERAL DIRECTOR: Mircea Bortes
EXECUTIVE DIRECTOR, AIRCRAFT DIVISION: Tudorel Harabagiu
CONTRACT MANAGER, AIRCRAFT DIVISION: Mirela Franciu

Tehnoimportexport deals, on a non-exclusive basis, with sales and purchase of aircraft and related equipment, aircraft marketing and consultancy

Centrul de Incercari in Zbor SA
1 Aeroportului Street, R-1100 Craiova
Telephone: 40 (941) 24557

Official ground and flight test establishment for military and civil prototypes and upgraded aircraft

UPDATED

AEROSTAR

SC AEROSTAR SA

9 Condorilor Street, R-5500 Bacău
Telephone: 40 (34) 141885
Fax: 40 (34) 170513
Telex: 21339 IRAV R
DIRECTOR GENERAL: Dipl Eng Ioan Florin Vornicelu
PRODUCTION DIRECTOR: Dipl Eng Constantin Prescură
TECHNICAL DIRECTOR: Dipl Eng Ioan Prescură
COMMERCIAL DIRECTOR: Dipl Eng Dan Onică

Factory founded 1953 as URA (later IRAv, then IAv Bacau), originally as repair centre for Romanian Air Force Yak-17/23, MiG-15/17/19/21 and Il-28/H-5 front-line military aircraft and Aero L-29/L-39 jet trainers, built first Romanian prototype of IAR-93 between 1972 and 1974. Five other specialised work sections: (1) landing gears, hydraulic and pneumatic equipment, (2) special production, (3) light aircraft, (4) engines and reduction gears; (5) avionics. Site area 3.45 ha (8.53 acres), including 143,000 m² (1,539,250 sq ft) of covered workshop space. Workforce in 1994 totalled 5,500.

Aerostar factory's main product is Iak-52 trainer; other products include microlight aircraft. Company now involved in MiG-21 upgrade with Israeli firms; also intends to align Iak-52 manufacturing process to meet requirements of Western standards.

Landing gears and/or hydraulic/pneumatic equipment have been produced for IAR-316B (Alouette III), IAR 330 (Puma), IAR-93, IAR-99, Romaero (BAC) One-Eleven and Iak-52. Engines include M-14P for Iak-52, M-14V26 for Ka-26 and RU-19A-300 APU for An-24; reduction gears include R-26. Avionics factory produces radio altimeters, radio compasses, marker beacon receivers, IFF and other radio/radar items.

UPDATED

Aerostar (Yakovlev) Iak-52 tandem two-seat primary trainer *(Jane's/Dennis Punnett)*

1983

AEROSTAR (YAKOVLEV) Iak-52

TYPE: Tandem two-seat piston-engined primary trainer (licence version of former Soviet Yak 52).

PROGRAMME: Design in USSR began 1975, series production assigned to Comecon programme (Council for Mutual Economic Assistance), following Romanian USSR intergovernmental agreement of 1974 construction began 1977 and first Romanian prototype made first flight May 1978, series production began 1979; first deliveries (to DOSAAF, USSR, 1979; production continuing.

CURRENT VERSIONS: **Iak-52**. Romanian designation of standard Yak-52. *Detailed description applies to this version*

CUSTOMERS: More than 1,700 produced by early 1995, mainly for USSR and Romanian Air Force but also for West European and American markets, Hungarian Air Force received 12 in early months of 1994

DESIGN FEATURES: Tandem cockpit variant of Yak 50, with unchanged span and length, but with semi-retractable landing gear to reduce damage in wheels-up landing, straight-tapered wings, 'glasshouse' canopy. Wing section Clark YN with thickness/chord ratios of 14.5 per cent at root and 9 per cent at tip, dihedral 2° from roots, incidence 2° at root, no sweep

FLYING CONTROLS: Mechanical actuation of mass balanced slotted ailerons (by rods), mass balanced elevators (rods/cables) and horn balanced rudder (cables), manually operated trim tab in port elevator, ground adjustable tab on rudder and each aileron. Ailerons deflect 22° up/16° down, elevators 25° up/down, rudder 27° left/right. Pneumatically actuated trailing-edge split flaps (maximum deflection 45°).

STRUCTURE: All-metal (D-16 and AK-6 aluminium alloy) stressed skin, with 30 HGSA steel reinforcement in high-stress areas, except for fabric covered primary control surfaces, single-spar wings

LANDING GEAR: Semi-retractable tricycle type, with single wheel on each unit. Pneumatic actuation, nosewheel retracting rearward, main units forward. All three wheels remain fully exposed to air flow, against undersurface of fuselage and wings respectively, to offer greater safety in event of wheels-up emergency landing. Aerostar oleo-pneumatic shock-absorbers. Mainwheel tyres size 500 × 150 mm; nosewheel tyre size 400 × 150 mm. Tyre pressure (all units) 3.0 bars (43 lb/sq in). Pneumatic mainwheel brakes, operated differentially from pedals. Minimum ground turning radius 6.22 m (20 ft 5 in). Non-retractable plastic coated duralumin skis, with shock-struts, can be fitted in place of wheels for Winter operations.

POWER PLANT: One 268 kW (360 hp) Aerostar built VMKB (Vedeneyev) M-14P nine-cylinder air-cooled radial, driving a V 530TA D35 two-blade constant speed wooden propeller. Adjustable louvres in front of cowling to regulate cooling. Two-part cowling, split on horizontal centreline. Two aluminium alloy fuel tanks, in wingroots forward of spar, each with capacity of 61 litres (16.1 US gallons, 13.5 Imp gallons). Collector tank in fuselage of 5.5 litres (1.45 US gallons, 1.25 Imp gallons) capacity supplies engine during inverted flight. Total internal fuel capacity 122 litres (32.2 US gallons; 27 Imp gallons). Gravity fuelling point in upper surface of each wing. Oil capacity 20 litres (5.3 US gallons, 4.4 Imp gallons)

ACCOMMODATION: Tandem seats for pupil (at front) and instructor under long 'glasshouse' canopy, with separate rearward-sliding hood over each seat. Dual controls standard. Seats and rudder pedals adjustable. Heating and ventilation standard. Optional 0.20 m³ (7.06 cu ft) baggage compartment, accessible from rear seat

SYSTEMS: No hydraulic system. Independent main and emergency pneumatic systems, pressure 50 bars (725 lb/sq in), for flap and landing gear actuation, engine starting and brake control. Pneumatic systems supplied by 11 litre (main) and 3 litre (emergency) compressed air bottles (671 and 183 cu in), mounted behind rear seat and recharged in flight by an AK-50T engine-driven compressor. Electrical system (27 V DC) supplied by 3 kW engine-driven generator and (in port wing) 12 V 23 Ah ASAM battery; two static inverters in fuselage for 36 V AC power at 400 Hz. Heated pitot tube and stall speed sensor. Oxygen system available optionally

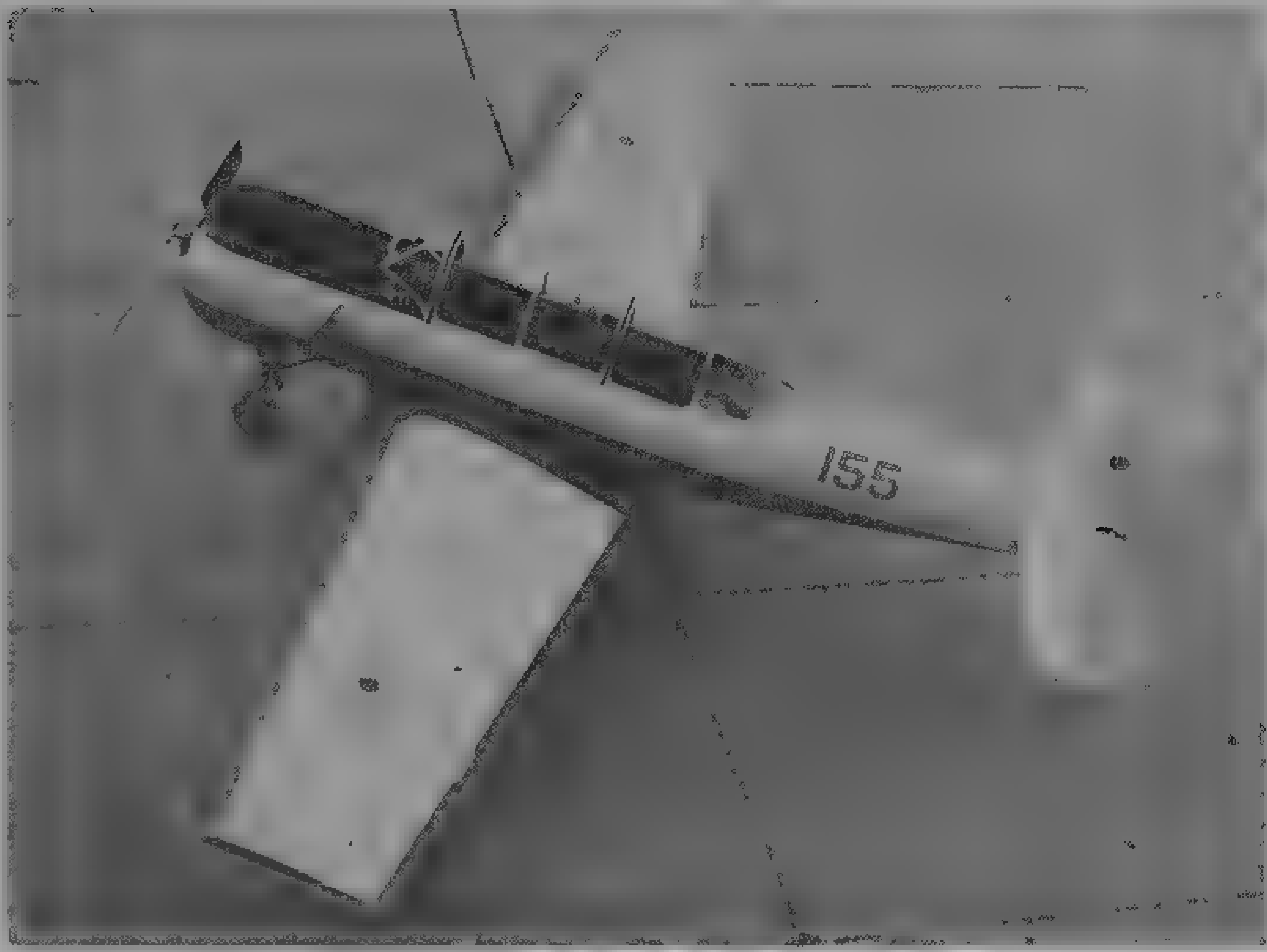
AVIONICS: *Comms*: Balkan 5 VHF radio and SPU-9 intercom

Flight: ARK-15M automatic radio compass and GMK-1A gyrocompass.

DIMENSIONS, EXTERNAL	
Wing span	9.30 m (30 ft 6¼ in)
Wing chord: at root	1.997 m (6 ft 6¾ in)
mean	1.64 m (5 ft 4½ in)
at tip	1.082 m (3 ft 6½ in)
Wing aspect ratio	5.77
Length overall	7.745 m (25 ft 5 in)
Fuselage: Max width	0.90 m (2 ft 11½ in)
Height overall	2.70 m (8 ft 10¼ in)
Tailplane span	3.16 m (10 ft 4½ in)
Wheel track	2.715 m (8 ft 10¾ in)
Wheelbase	1.86 m (6 ft 1¼ in)
Propeller diameter	2.40 m (7 ft 10½ in)
Propeller ground clearance	0.36 m (1 ft 2¼ in)
DIMENSIONS, INTERNAL	
Cockpit: Max width	0.736 m (2 ft 4¾ in)
Max height	1.12 m (3 ft 8 in)
AREAS	
Wings, gross	15.00 m² (161.5 sq ft)
Ailerons (total)	1.98 m² (21.31 sq ft)
Trailing-edge flaps (total)	1.03 m² (11.09 sq ft)

Fin	0.609 m² (6.55 sq ft)
Rudder	0.871 m² (9.37 sq ft)
Tailplane	1.325 m² (14.26 sq ft)
Elevators (total, incl tab)	1.535 m² (16.52 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	1,015 kg (2,238 lb)
Max fuel load	100 kg (220 lb)
Max T-O weight	1,305 kg (2,877 lb)
Max wing loading	87.0 kg/m² (17.82 lb/sq ft)
Max power loading	4.86 kg/kW (7.99 lb/hp)
PERFORMANCE (at max T-O weight):	
Never-exceed speed (VNE)	194 kts (360 km/h, 223 mph)
Max level speed: at S/L	154 kts (285 km/h, 177 mph)
at 1,000 m (3,280 ft)	145 kts (270 km/h, 167 mph)
Econ cruising speed at 1,000 m (3,280 ft)	103 kts (190 km/h, 118 mph)
Landing speed	60 kts (110 km/h, 69 mph)
Stalling speed, flaps down, engine idling	46-49 kts (85-90 km/h, 53-56 mph)
Max rate of climb at S/L	420 m (1,378 ft)/min
Service ceiling	4,000 m (13,125 ft)
Time to 4,000 m (13,125 ft)	15 min
T-O run	170 m (558 ft)
T-O to 15 m (50 ft)	200 m (656 ft)
Landing from 15 m (50 ft)	350 m (1,149 ft)
Landing run	300 m (985 ft)
Range at 500 m (1,640 ft), max fuel, 20 min reserves	296 n miles (550 km, 341 miles)
g limits	+7/−5

UPDATED



Aerostar (Yakovlev) Iak-52 primary trainer of the Romanian Air Force

1993

AVIOANE

SC AVIOANE SA

1 Aeroportului Street, R-1100 Craiova
Telephone: 40 (51) 124170
Fax: 40 (51) 124382
Telex: 41290 COCOR R
MANAGING DIRECTOR: Nicolae Deneanu
MARKETING MANAGER: Ion Tomescu

Founded 1 February 1972 as IAv Craiova, changing to present name 29 March 1991, a major domestic and international aviation enterprise, producing wide range of products and services for both military and civil aviation. Activities include aircraft and equipment design and manufacture, repair and overhaul, life cycle management and integrated logistics support. Site area 1.70 ha (4.20 acres), including 47,500 m² (511,275 sq ft) shop floor area. Principal military programmes are IAR-93 and IAR-99.

UPDATED

AVIOANE IAR-99 ŞOIM (HAWK)

TYPE: Advanced jet trainer and light ground attack aircraft.

PROGRAMME: Existence revealed at 1983 Paris Air Show; designed by INAv (Institutul de Aviatie) at Bucharest; three prototypes built at Craiova, including one for structural testing; first flight 21 December 1985.

CURRENT VERSIONS: **IAR-99**: Standard version for Romanian Air Force; *detailed description applies to this version.*

IAR-109 Swift: Upgraded version, described separately.

CUSTOMERS: Initial 20 delivered to Romanian Air Force from 1987, further 30 reportedly on order, of which six delivered by mid-1991. No subsequent update received.

DESIGN FEATURES: Tandem cockpits (rear seat elevated); straight wings. Wing section NACA 64_1A-214 (modified) at centreline, 64_1A-212 (modified) at tip; dihedral 3° from roots, quarter-chord sweepback 6° 35', incidence 1° at root.

FLYING CONTROLS: Statically balanced ailerons hydraulically actuated, with manual reversion; horn balanced elevators and statically balanced rudder actuated mechanically by push/pull rods; servo tab in port aileron, trim tabs in rudder and each elevator, all operated electrically; ailerons deflect 15° up/15° down, elevators 20° up/10° down, rudder 25° to left and right. Hydraulically actuated single-slotted flaps, deflecting 20° for T-O and 40° for landing, retract gradually when airspeed reaches 162 knots (300 km/h, 186 mph); twin hydraulically actuated airbrakes under rear fuselage.

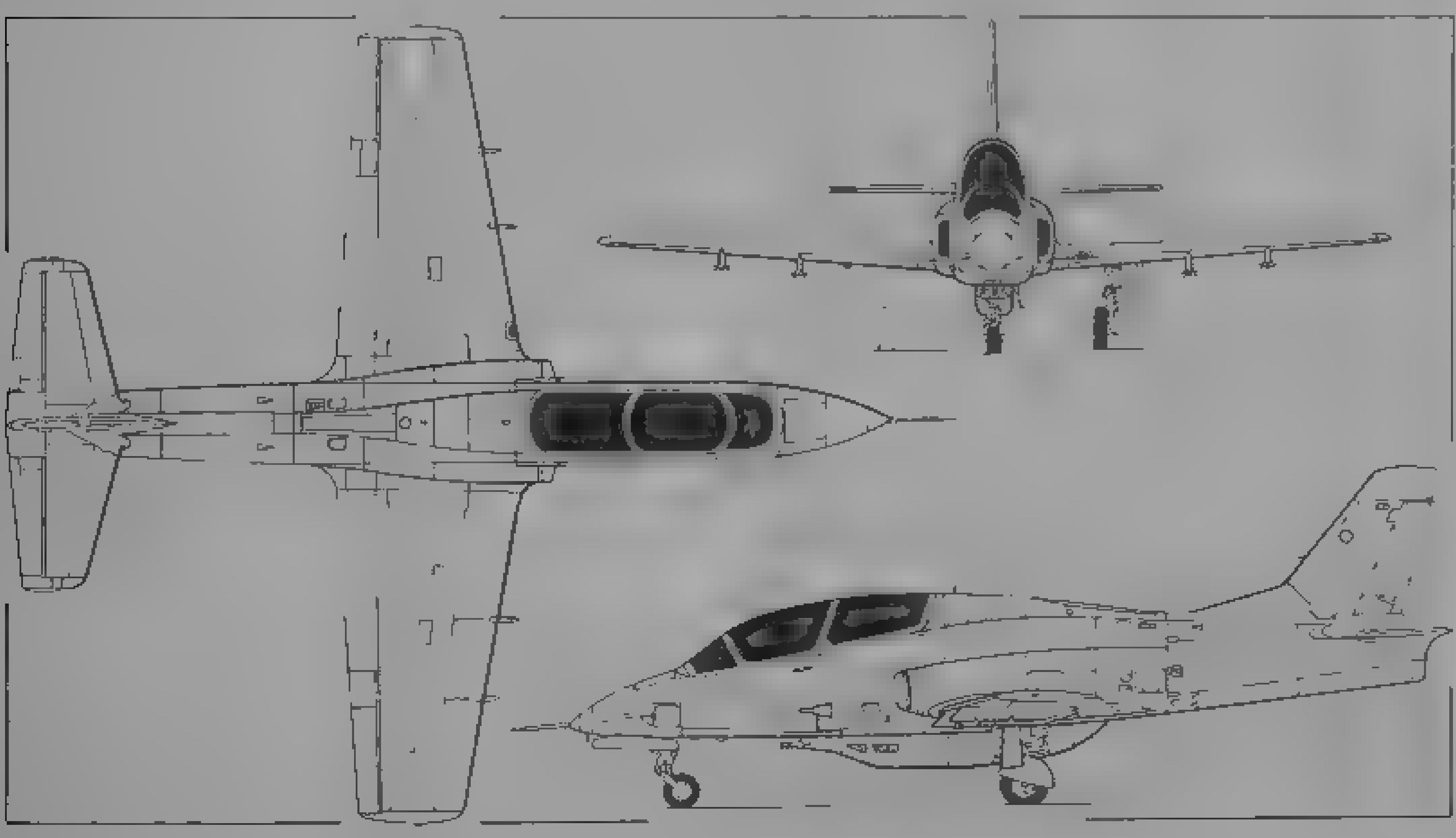
STRUCTURE: All-metal, aluminium honeycomb ailerons/elevators/rudder; semi-monocoque fuselage includes honeycomb panels for fuel tank compartments; machined wing skin panels form integral fuel tanks.

LANDING GEAR: Retractable tricycle type, with single wheel and oleo-pneumatic shock absorber on each unit. Main wheels retract inward, castoring nosewheel forward, all being fully enclosed by doors when retracted. Landing light in port wingroot leading-edge. Mainwheels fitted with tubeless tyres, size 552 × 164-10, pressure 7.5 bars (108.8 lb/sq in), and hydraulic disc brakes with anti-skid system. Nosewheel has tubeless tyre size 445 × 150-6, pressure 4.0 bars (58.0 lb/sq in).

POWER PLANT: One Turbomecanica Romanian built Rolls-Royce Viper Mk 632-41M turbojet, rated at 17.79 kN (4,000 lb st). Fuel in two flexible bag tanks in centre-fuselage, capacity 900 litres (238 US gallons, 198 Imp gallons), and four integral tanks between wing spars, combined capacity 470 litres (124 US gallons, 103 Imp gallons). Total internal fuel capacity 1,370 litres (362 US gallons, 301 Imp gallons). Gravity refuelling point on top of fuselage. Provision for two drop tanks, each of 225 litres (59.5 US gallons; 49.5 Imp gallons) capacity, on inboard underwing stations. Maximum internal/external fuel capacity 1,820 litres (481 US gallons, 400 Imp gallons).

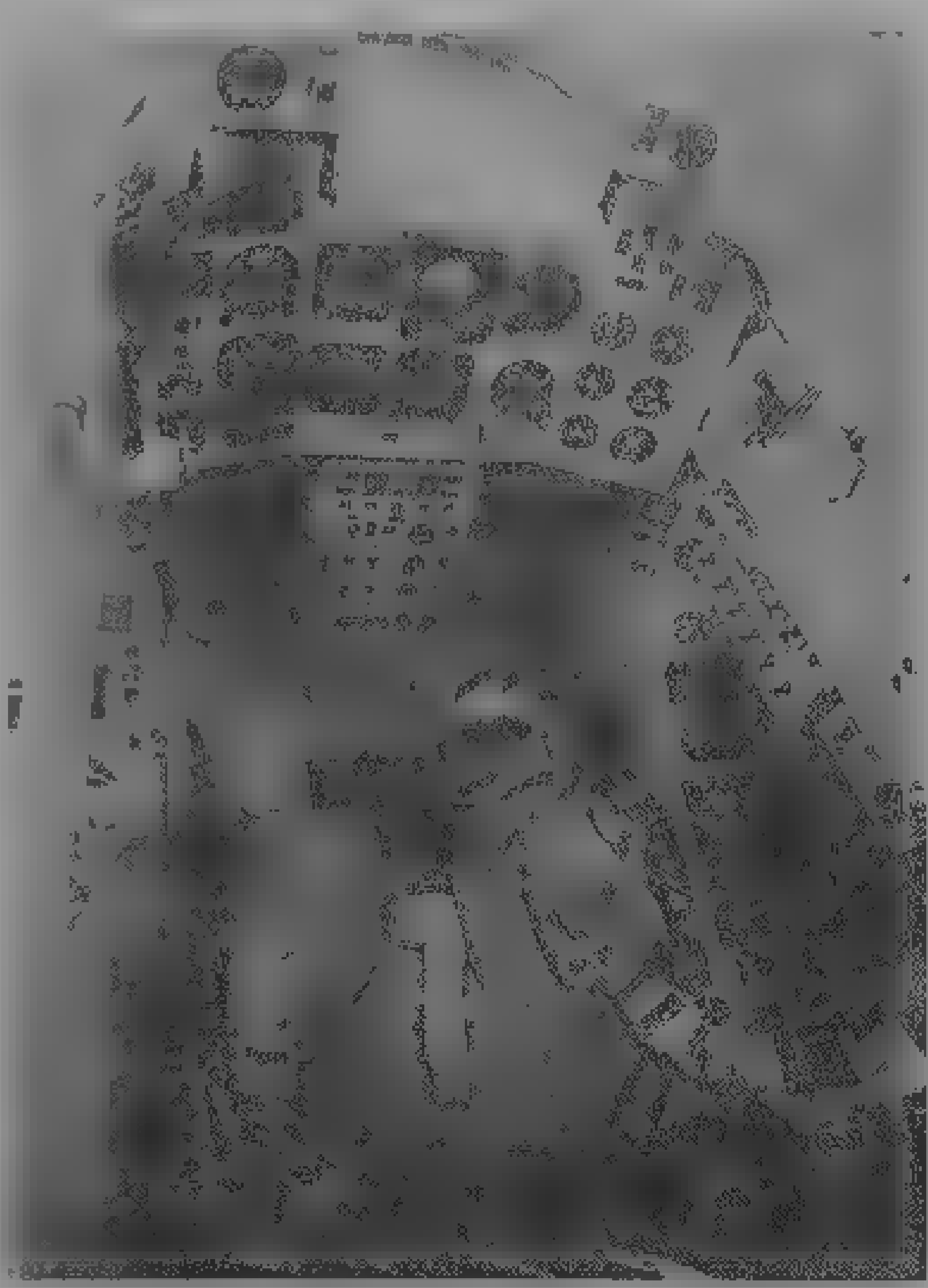
ACCOMMODATION: Crew of two in tandem, on zero/zero ejection seats in pressurised and air conditioned cockpit. Rear seat elevated 35 cm (13.8 in). Dual controls standard. One piece canopy with internal screen (trainer), or (in ground attack version) individual canopies, all opening sideways to starboard.

SYSTEMS: Engine compressor bleed air for pressurisation, air conditioning, anti-g suit and windscreen anti-icing system, and to pressurise fuel tanks. Hydraulic system, operating at pressure of 206 bars (2,990 lb/sq in), for actuation of landing gear and doors, flaps, airbrakes, ailerons and mainwheel brakes. Emergency hydraulic system for operation



Avioane IAR-99 Şoim advanced jet trainer *(Jane's/Dennis Punnett)*

1985



IAR-99 front cockpit *(Brian M. Service)*

1995

Internal structural detail of the Avioane IAR-99 jet trainer

Avioane IAR-99 Soim tandem-seat jet trainers of the Romanian Air Force

1993

of landing gear, doors, flaps and wheel brakes. Main electrical system, supplied by 9 kW 28 V DC starter/generator with 28.5 V 36 Ah Ni/Cd battery, ensures operation of main systems, in case of emergency, and engine starting. Two 750 VA static inverters supply two secondary AC networks: 115 V/400 Hz and 26 V/400 Hz. Oxygen system for two crew for 2 hours 30 minutes.

AVIONICS: *Comms:* Include VHF/UHF com radio, SRR-2 IFF and intercom.

Flight: Include radio altimeter, marker beacon receiver, ADF, gyro platform and flight recorder.

ARMAMENT: Removable ventral gun pod containing 23 mm GSh-23 gun with 200 rounds. Gun/rocket firing and weapon release controls, including electrically controlled AA-1F gyroscopic gunsight and AFCT-1 gun camera, in front cockpit only. Four underwing hardpoints stressed for loads of 250 kg (551 lb) each. Typical underwing stores can include four 250 kg bombs, four triple carriers each for three 50 kg bombs (or two 100 kg and one 50 kg), four L16-57 launchers each containing sixteen 57 mm air-to-surface rockets; four L 32-42 launchers each containing thirty-two 42 mm air-to-surface rockets; infra-red air-to-air missiles (inner pylons only); two twin 7.62 mm machine gun pods with 800 rds/pod (inboard pylons only) and auxiliary fuel tanks (see under Power Plant) on inboard pylons.

DIMENSIONS, EXTERNAL:

Wing span	9.85 m (32 ft 3¾ in)
Wing chord: at root	2.305 m (7 ft 6¾ in)
mean	1.963 m (6 ft 5¼ in)
at tip	1.30 m (4 ft 3¼ in)
Wing aspect ratio	5.19
Length overall	11.009 m (36 ft 1½ in)
Height overall	3.898 m (12 ft 9½ in)
Elevator span	4.12 m (13 ft 6¼ in)
Wheel track	2.686 m (8 ft 9¾ in)
Wheelbase	4.378 m (14 ft 4½ in)

AREAS:

Wings, gross	18.71 m² (201.4 sq ft)
Ailerons (total)	1.56 m² (16.79 sq ft)
Flaps (total)	2.54 m² (27.34 sq ft)
Fin, inc dorsal fin	1.919 m² (20.66 sq ft)
Rudder	0.629 m² (6.77 sq ft)
Tailplane	3.123 m² (33.62 sq ft)
Elevators (total)	1.248 m² (13.43 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	3,200 kg (7,055 lb)
Max fuel weight: internal	1,100 kg (2,425 lb)
external	350 kg (772 lb)
Max T-O weight: trainer	4,400 kg (9,700 lb)
ground attack	5,560 kg (12,258 lb)
Max wing loading: trainer	235.2 kg/m² (48.17 lb/sq ft)
ground attack	297.2 kg/m² (60.86 lb/sq ft)
Max power loading: trainer	247.5 kg/kN (2.42 lb/lb st)
ground attack	312.7 kg/kN (3.06 lb/lb st)

PERFORMANCE:

Max Mach number	0.76
Max level speed at S/L: trainer	467 kts (865 km/h; 537 mph)
Max rate of climb at S/L	2,100 m (6,890 ft)/min
Service ceiling	12,900 m (42,325 ft)
Min air turning radius	330 m (1,083 ft)
T-O run: trainer	450 m (1,477 ft)
ground attack	960 m (3,150 ft)
T-O to 15 m (50 ft): trainer	750 m (2,461 ft)
ground attack	1,350 m (4,430 ft)
Landing from 15 m (50 ft): trainer	740 m (2,428 ft)
ground attack	870 m (2,855 ft)
Landing run: trainer	550 m (1,805 ft)
ground attack	600 m (1,969 ft)

Typical combat radius (one pilot, ventral gun, internal fuel only):

lo-lo-hi, four 16-round rocket pods, AUW 5,000 kg (11,023 lb) — 189 n miles (350 km; 217 miles)

hi-lo-hi, two 16-round rocket pods, two 50 kg and four 100 kg bombs, AUW 5,280 kg (11,640 lb) — 186 n miles (345 km; 214 miles)

hi-hi-hi, four 250 kg bombs, AUW 5,480 kg (12,081 lb) — 208 n miles (385 km; 239 miles)

Max range with internal fuel:

trainer	593 n miles (1,100 km; 683 miles)
ground attack	522 n miles (967 km; 601 miles)
Max endurance with internal fuel: trainer	2 h 40 min
ground attack	1 h 46 min
g limits	+7/−3.6

UPDATED

AVIOANE IAR-109 SWIFT

TYPE: All-through jet trainer and close support aircraft (upgraded IAR-99).

PROGRAMME: Announced Autumn 1992, at which time development aircraft (modified IAR-99, serial number 712) under test. New demonstrator (715) made first flight November 1993 in Israel after fitment of Israeli avionics suite; had made 50 flights totalling 60 hours by mid-February 1994.

CURRENT VERSIONS: **IAR 109T:** Tandem-seat trainer.

IAR 109TF: Combat trainer and close support/COIN version.

DESIGN FEATURES: Same airframe and power plant as IAR-99; upgraded and expanded avionics and enhanced weapons delivery capability; steerable nosewheel.

ACCOMMODATION: Martin-Baker Mk 10L lightweight zero/zero ejection seats.

AVIONICS (IAR-109TF): *Comms:* Com radio(s) and IFF transponder to customer's requirements.

Flight: Ring laser gyro INS, Astronautics digital ADC; radio altimeter; ADI, HSI, nav radio(s); full ILS package.

Instrumentation: Multiplex 1553B integrated databus system with high-capacity Astronautics mission display processor, El-Op HUD, up-front control panel, cockpit TV centre and video tape recorder, laser rangefinder and HOTAS.

ARMAMENT: Underwing pylons adaptable for Eastern or Western weapons, of types generally similar to those listed for IAR-99, plus capability for infra-red air-to-air missiles, precision guided munitions and larger (300 litre, 79 US gallon, 66 Imp gallon) drop tanks.

WEIGHTS AND LOADINGS: As for IAR-99 except:

Max T-O weight: trainer	4,800 kg (10,582 lb)

PERFORMANCE: As for IAR-99 except:

Unstick speed: T	108 kts (200 km/h; 124 mph)
Approach speed: T	127 kts (235 km/h; 146 mph)
Landing speed: T	103 kts (190 km/h; 118 mph)
Stalling speed: T	93 kts (172 km/h; 107 mph)
Max turn rate at 915 m (3,000 ft)	22°/s
Time to 6,100 m (20,000 ft): T	5 min
T-O run: T	500 m (1,640 ft)
Landing from 15 m (50 ft): T	900 m (2,953 ft)
Landing run: T	600 m (1,969 ft)

Typical combat radius with c/l gun, two rocket pods, two 225 litre drop tanks and max internal fuel, 10% reserves:

TF, lo-lo-lo	151 n miles (280 km; 174 miles)
TF, hi-lo-hi	178 n miles (330 km; 205 miles)

UPDATED

OTHER AIRCRAFT

See International section under Soko/Avioane for description of **IAR-93**.

IAR-109 Swift demonstrator with Israeli upgraded avionics

1994

Advanced cockpit layout of the IAR 109 Swift

1994

CPCA

CENTRUL DE PROIECTARE SI CONSULTING PENTRU AVIATIE SA (Aviation Design and Consulting Centre)

1 Aeroportului Street, R-1100 Craiova, Dolj
Telephone/Fax: 40 (51) 123059
Telex: 41290 COCOR R
GENERAL MANAGER: Marian Marinescu
DEPUTY MANAGER: Vali Bribie

NEW ENTRY

CPCA DK-10 DRACULA

TYPE: Side by side two-seat trainer

PROGRAMME: Revealed at ILA '94 in May 1994. Design started February 1992, prototype to begin construction October 1995 and make first flight May 1996, intended for Normal category FAR Pt 23 certification

COSTS: Development programme $355 230; standard civil aircraft $78,000 (1995)

DESIGN FEATURES: To have short-field capability and be highly manoeuvrable. NACA wing aerofoil sections (23,023 at root, 23 012 at tip); 4° leading-edge sweepback, 5° dihedral, 2° 30' incidence

FLYING CONTROLS: Conventional surfaces, actuated mechanically; electrically actuated trim tab in port aileron, rudder and each elevator. Slotted trailing-edge flaps

STRUCTURE: All-metal (aluminium alloy and steel); fuselage conventional semi monocoque; two-spar wings and tail surfaces with ribs and sheet metal skins

LANDING GEAR: Hydraulically retractable tricycle type with inward-retracting mainwheels and rearward-retracting, ±30° steerable nosewheel. Cleveland 5.00-5 wheels (Type 40-77B main, 40-78 nose) and Goodyear tyres, pressure 2.2 bars (31.9 lb/sq in) on main units, 1.9 bars (27.6 lb/sq in) on nose unit. Cleveland type 30-9 hydraulic mainwheel brakes. Minimum ground turning radius 2.20 m (7 ft 2½ in)

POWER PLANT: One 112 kW (150 hp) Textron Lycoming O-320-A1A flat-four engine, driving a Hartzell two-blade constant-speed propeller. Fuel tank in each wing combined capacity 92 litres (24.3 US gallons, 20.2 Imp gallons), of which 88 litres (23.2 US gallons, 19.4 Imp gallons) are usable. Gravity refuelling point on top of each wing. Oil capacity 7 litres (1.8 US gallons, 1.5 Imp gallons)

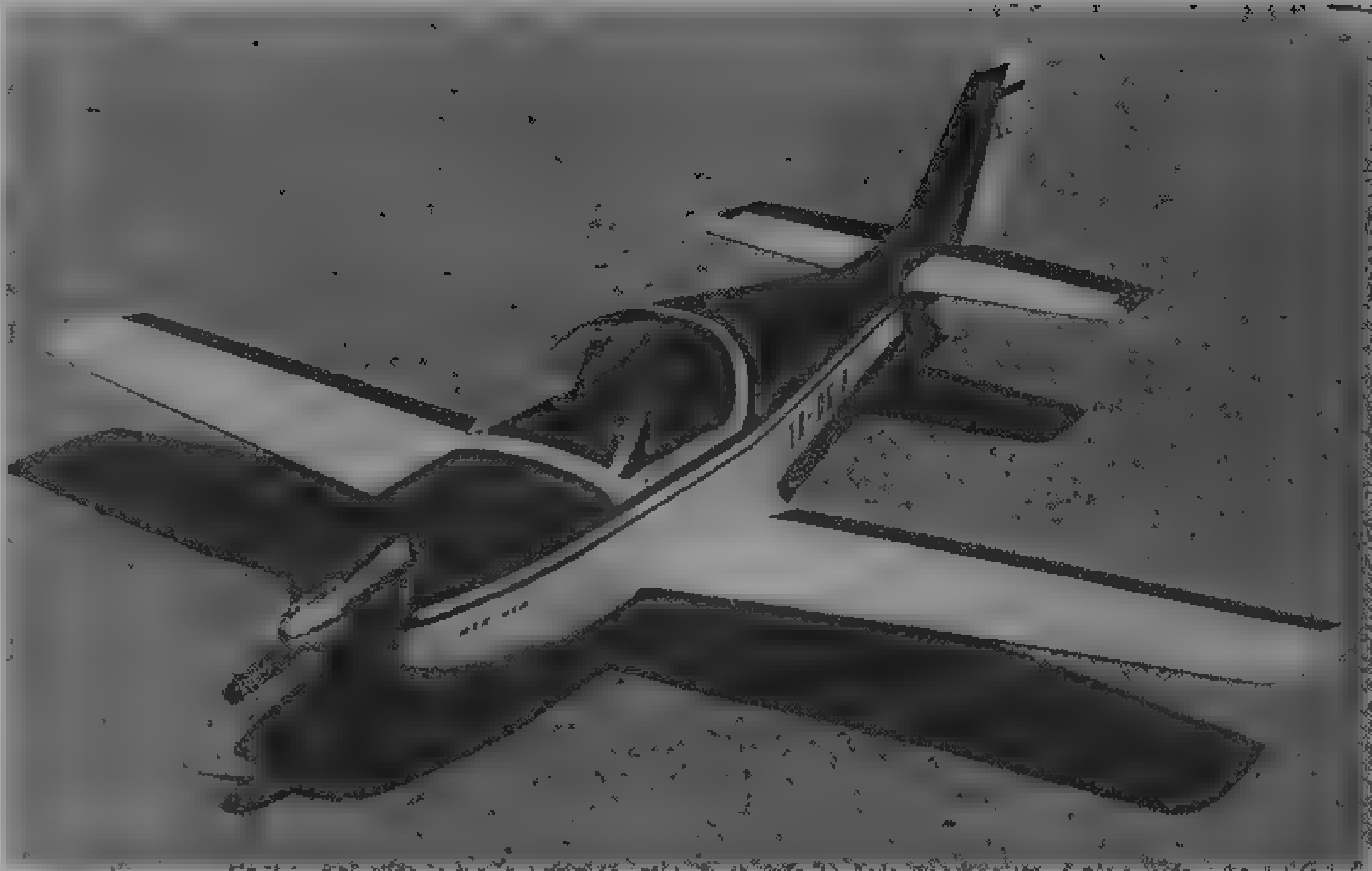
ACCOMMODATION: Seats for two persons side by side, with 0.17 m³ (6.0 cu ft) of baggage space behind. One-piece rearward-sliding bubble canopy. Cockpit heated and ventilated

SYSTEM: Single hydraulic system for landing gear and flap actuation, pressure 210 bars (3,045 lb/sq in), flow rate at 1,000 rpm 36 litres (9.5 US gallons; 7.9 Imp gallons)/min. Electrical system 28 V DC) supplied by 28 V engine-driven starter/generator and 24 V 37 Ah battery

AVIONICS: *Comms:* Bendix/King VHF radio, intercom and transponder

Flight: Bendix/King VOR/ILS, DME and marker beacon receiver

Instrumentation: Conventional analog type

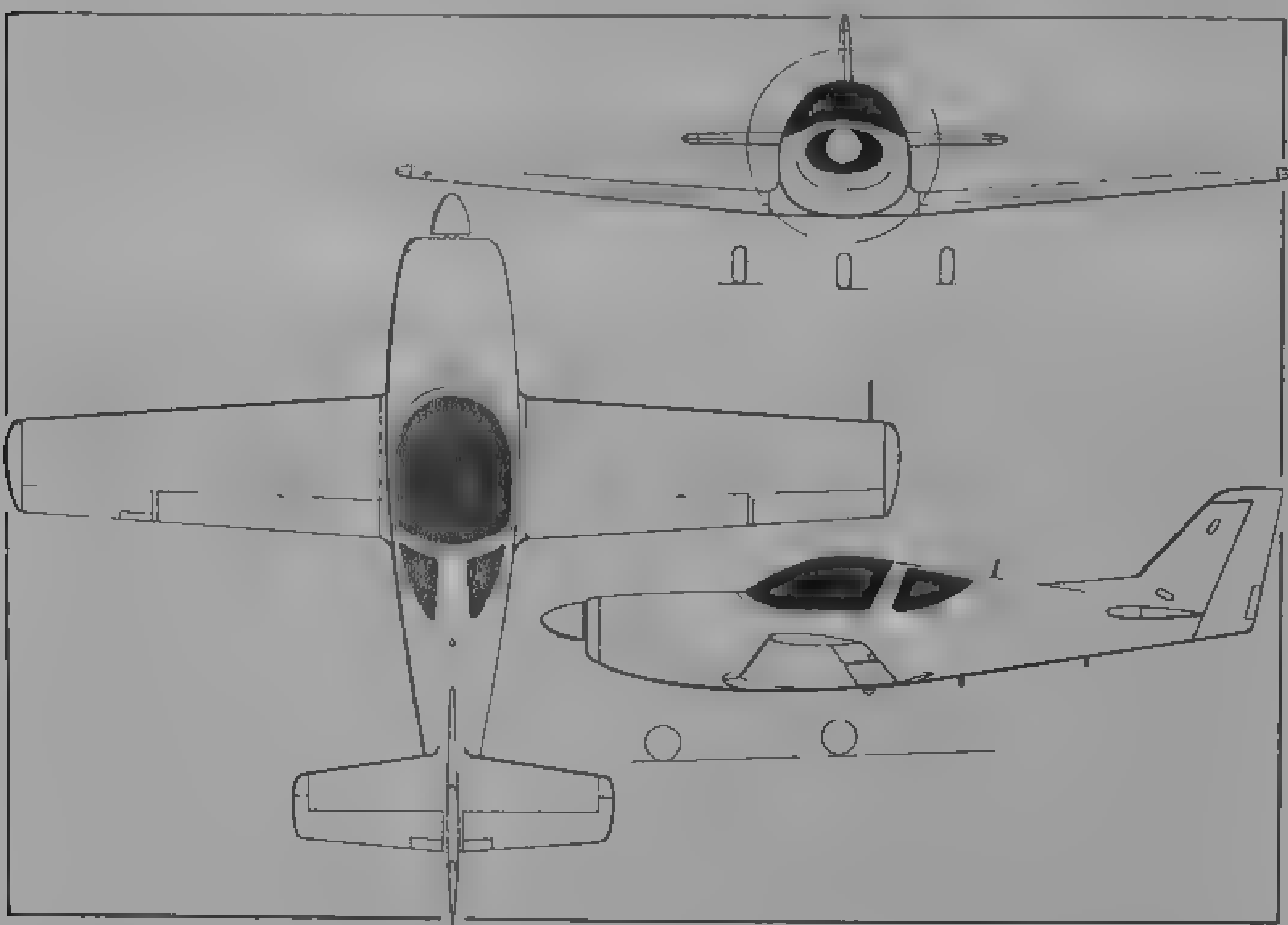


Model of the DK 10 Dracula two-seat trainer

1995

DIMENSIONS, EXTERNAL:	
Wing span	8.38 m (27 ft 6 in)
Wing chord: at root	1.50 m (4 ft 11 in)
at tip	0.887 m (2 ft 11 in)
Wing aspect ratio	7.02
Length overall	6.98 m (22 ft 10¾ in)
Fuselage: Length	5.98 m (19 ft 7½ in)
Max width	1.20 m (3 ft 11¼ in)
Max depth	1.335 m (4 ft 4½ in)
Height overall	2.10 m (6 ft 10¾ in)
Tailplane span	3.00 m (9 ft 10 in)
Wheel track	1.755 m (5 ft 9 in)
Wheelbase	2.64 m (8 ft 8 in)
Propeller diameter	1.82 m (5 ft 11¾ in)
Propeller ground clearance	0.26 m (10¼ in)
Baggage door: Height	0.90 m (2 ft 11¼ in)
Width	1.20 m (3 ft 11¼ in)
Height to sill	0.30 m (11¾ in)
DIMENSIONS, INTERNAL:	
Cockpit: Length	1.18 m (3 ft 10½ in)
Max width	1.10 m (3 ft 7¼ in)
Max height	1.225 m (4 ft 0¼ in)
Floor area	1.15 m² (12.38 sq ft)
Volume	0.95 m³ (33.5 cu ft)
AREAS:	
Wings, gross	10.00 m² (107.6 sq ft)
Ailerons (total, incl tab)	0.727 m² (7.82 sq ft)
Trailing-edge flaps (total)	1.458 m² (15.69 sq ft)
Fin	1.31 m² (14.10 sq ft)
Rudder, incl tab	0.562 m² (6.05 sq ft)
Tailplane	2.325 m² (25.03 sq ft)
Elevator (total,incl tabs)	0.939 m²(10.11 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	490 kg (1,080 lb)
Max payload	184 kg (405 lb)
Max T-O and landing weight	750 kg (1,653 lb)
Max zero-fuel weight	674 kg (1,486 lb)
Max wing loading	75.0 kg/m² (15.36 lb/sq ft)
Max power loading	6.71 kg/kW (11.02 lb/hp)
PERFORMANCE (estimated, at max T-O weight):	
Max level speed at S/L	163 kts (302 km/h; 188 mph)
Max cruising speed at S/L	151 kts (280 km/h; 174 mph)
Econ cruising speed at 3 000 m (9,840 ft)	124 kts (230 km/h; 143 mph)
Stalling speed, power off:	
flaps up	58 kts (107 km/h, 67 mph)
flaps down	52 kts (96 km/h, 60 mph)
Max rate of climb at S/L	228 m (748 ft)/min
Service ceiling	5,000 m (16,400 ft)
T-O run	273 m (896 ft)
T-O to 15 m (50 ft)	364 m (1,195 ft)
Landing from 15 m (50 ft)	383 m (1 257 ft)
Landing run	250 m (821 ft)
Range with max fuel	540 n miles (1,000 km; 621 miles)

NEW ENTRY



CPCA Dracula (O-320 flat four engine) *(Jane's/James Goulding)*

1995

IAR

SC IAR SA (formerly ICA)

1 Aeroportului Street, PO Box 198, R-2200 Brasov
Telephone: 40 (68) 150015
Fax: 40 (68) 151304
Telex: 61266 ICAER R
MANAGING DIRECTOR: Dipl Eng Neculai Banea

Factory, created 1968, continues work begun in 1926 by IAR Brasov and undertaken 1950-59 as URMV 3 Brasov; occupies 1.26 ha (3.11 acre) site, including 160,000 m² (1,722,225 sq ft) factory area, and had 1995 workforce of 2,930. Currently manufactures Romanian designed light aircraft and (under licence from Eurocopter France) Puma helicopter; IS-28/29/35 series sailplanes (see 1992-93 and earlier *Jane's*), spares for IAR 316B Alouette III helicopter; aircraft components and equipment.

UPDATED

IAR (EUROCOPTER FRANCE) IAR-330L PUMA

TYPE: Twin-turboshaft medium transport helicopter

PROGRAMME: Agreement for licence production of AS 330 Puma in Romania concluded 1977, 100 initially covered, since expanded, current production rate about 10 a year. Romania sole producer of Puma, see IAR entry in 1991-92 *Jane's* for details of earlier French and other production

CURRENT VERSIONS: **Civil:** For oil platform, police security and patrol, casevac, aerial photography, drug interdiction, power/pipeline patrol, surveillance and other duties.

Coastguard: Customs and Excise patrol, search and rescue, sea survey and emergency missions.

Military: Artillery observation, troop transport, medevac, cargo/sling transport, border security, anti-armour attack and air-to-air defence

Oryx: South African developed version, described under Atlas heading in that section.

Naval: Anti-submarine, air-to-surface attack, reconnaissance, personnel transport and air ambulance.

VIP/Executive: 8/15-seat VIP transport or airborne command post.

Puma 2000. Upgraded version; described in *Jane's Aircraft Upgrades*.

CUSTOMERS: 165 built by mid-1991, most for Romanian Air Force but 60 to 70 exported to Pakistan, South Africa (50), Sudan and others. No updated total received since then, but IAR reports Romanian Air Force order for six. United Arab Emirates Air Force received 10 second-hand aircraft in 1993-94, and has option for 10 new built Pumas.

DESIGN FEATURES: Four-blade main rotor, with fully articulated hub and integral hydraulically actuated rotor brake (on main gearbox, stopping rotor 15 seconds after engine shutdown), blade cuffs, with horns, connected by link rods to swashplate articulated by three hydraulic twin-cylinder servo-control units, each blade attached to sleeve by two quick-disconnect pins for rapid folding. Starboard five-blade tail rotor with flapping hinges.

Mechanical shaft and gear drive, five-stage main gearbox, atop cabin behind engines, has two separate inputs from engines; first stage drives (from each engine) intermediate shaft directly driving alternator and ventilation fan and indirectly two hydraulic pumps; at second stage, action of both units synchronises on single main driveshaft by freewheeling spur gears – if one or both engines stops, gears rotated by remaining turbine or autorotating rotor, maintaining drive to ancillary systems.

Drive to tail rotor via shafting and intermediate angle gearbox, terminating at right-angle tail rotor gearbox. Turbine output 23,000 rpm, main rotor shaft 265 rpm; tail rotor shaft 1,278 rpm. Engine installation outside main fuselage shell, port horizontal stabiliser at tail.

FLYING CONTROLS: Fully powered dual hydraulic with full-time yaw damper operating series hydraulic servo in control runs; autopilot, with provision for coupling to self-contained navigation and microwave landing systems (see Avionics).

STRUCTURE: Moulded main blades have GFRP roving spar, GFRP/CFRP fabric skins and Moltoprene/honeycomb filler, with stainless steel covered leading-edges; titanium leading-edge shielding of heating mat if optional blade de-icing fitted on either rotor. Tail rotor blades metal. All-metal airframe structure, local use of titanium alloy under engines.

LANDING GEAR: Messier-Bugatti semi-retractable tricycle type, with twin wheels on each unit. Main units retract upward hydraulically into fairings on sides of fuselage, self-centring nose unit retracts rearward. When landing gear is down, nosewheel jack is extended and mainwheel jacks are telescoped. Dual-chamber oleo-pneumatic shock-absorbers. All tyres same size (7.00-6), of tubeless type, pressure 6.0 bars (85 lb/sq in) on all units. Hydraulic differential disc brakes, controlled by foot pedals. Lever-operated parking brake. Emergency pop-out flotation units can be mounted on rear landing gear fairings and forward fuselage.

POWER PLANT: Two Turbomecanica Romanian built Turbomeca Turmo IVCA turboshafts, each rated at 1,184 kW (1,588 shp) (S/L, ISA) for maximum emergency power, 1,114 kW (1,494 shp) for T-O, 1,029 kW (1,380 shp) intermediate emergency power and 941 kW (1,262 shp) maximum continuous. Intake anti-icing. Engines mounted side by side above cabin forward of main rotor and separated by firewall. They are coupled to main rotor transmission box, with shaft drive to tail rotor, and form a completely independent system from fuel tanks up to main gearbox inputs.

Fuel in four flexible tanks and one auxiliary tank beneath cargo compartment floor, total capacity 1,544 litres (408 US gallons; 339.5 Imp gallons). External auxiliary tanks (two, each 350 litres, 92.5 US gallons, 77 Imp gallons capacity) available. For long-range missions (mainly offshore) one or two special internal tanks (each 215 litres; 56.8 US gallons, 47.25 Imp gallons) can be fitted in cabin. Each engine supplied normally by two interconnected primary tanks, lower halves of which have self-sealing walls for protection against small calibre projectiles. Refuelling point on starboard side of main cabin. Oil capacity 22 litres (5.8 US gallons; 4.8 Imp gallons) for engines, 25.5 litres (6.7 US gallons, 5.6 Imp gallons) for transmission.

ACCOMMODATION: Crew of one (VFR) or two (IFR) side by side on anti-crash seats on flight deck, with jump-seat for third crew member if required. Door on each side of flight deck. Internal doorway connects flight deck to cabin, with folding seat in doorway for extra crew member or cargo supervisor. Dual controls standard.

Accommodation in main cabin for 16 individually equipped troops, six stretchers and seven seated patients, or equivalent freight; number of troops can be increased to 20 in high-density version. Alternative 17/20-seat civil passenger or 8/15 seat executive interiors (including toilet) available. Strengthened floor for cargo-carrying, with lashing points. Jettisonable sliding door on each side of main cabin. Removable panel on underside of fuselage, at rear of main cabin, permits longer loads to be accommodated and also serves as emergency exit. Hatch in floor below centreline of main rotor for carrying up to 3,200 kg (7,055 lb) on internally mounted cargo sling. Fixed or retractable rescue hoist (capacity 275 kg, 606 lb) can be mounted externally on starboard side of fuselage. Cabin and flight deck heated, ventilated and soundproofed. Demisting, de-icing, washers and wipers for pilots' windscreens. Air conditioning system optional.

IAR-330L Puma in Romanian Air Force camouflage

1995

SYSTEMS: Two independent hydraulic systems, each 172 bars (2,500 lb/sq in), supplied by self regulating pumps driven by main gearbox. Each system supplies one set of servo unit chambers, left-hand system also supplying autopilot, landing gear, rotor brake and wheel brakes. Freewheels in main gearbox ensure that both systems remain in operation, for supplying servo-controls, if engines are stopped in flight. Other hydraulically actuated systems can be operated on ground from main gearbox, or through ground power receptacle. Independent auxiliary system, fed through hand pump, can be used in emergency to lower landing gear and pressurise accumulator for parking brake on ground.

Three-phase 200 V AC electrical power supplied by 20 kVA 400 Hz alternator, driven by port side intermediate shaft from main gearbox and available on ground under same conditions as hydraulic ancillary systems. Second 20 kVA alternator optional. 28.5 V 10 kW DC power provided from AC system by two transformer-rectifiers. Main aircraft battery used for self-starting and emergency power in flight. For latter purpose, emergency 400 VA inverter can supply essential navigation equipment from battery, permitting at least 20 minutes continued flight in event of main power failure.

Optional electric de-icing of main and tail rotor blades, with heating mat protected by titanium shielding on leading-edge of each blade. De-icing of engines and engine air intakes by warm air bled from compressor. Anti-snow shield for Winter operations.

AVIONICS: *Comms:* Optional VHF, UHF, tactical HF and HF/SSB com radio and intercom.

Radar: Nose-mounted Bendix/King RDR 1400 or Honeywell Primus 40 or 50 search radar in SAR versions.

Flight: Radio compass, radio altimeter, GPS, VLF Omega, Decca navigator and flight log, Doppler, and VOR/ILS with glide path optional. Autopilot, with provision for coupling to self contained navigation and microwave landing systems. SAR version has full IFR instrumentation optional. Doppler and Decca self-contained navigation system, including navigation computer, polar indicator, roller-map display, hover indicator, route mileage indicator and ground speed and drift indicator.

Instrumentation: Full IFR panel optional. Roof-mounted sight for missiles.

Self-defence: Laser/radar warning system, chaff/flare dispensers and smoke launchers optional in armed version.

ARMAMENT: Armed version equipped with two forward firing 23 mm guns in streamline pods attached to lower sides of fuselage at front, steel tube carriers attached to sides of main cabin can each carry two or four unguided air-to-ground rocket pods (sixteen or thirty two 57 mm or two 122 mm), plus two wire-guided or four laser-guided anti-tank missiles, or two or four infra-red air-to-air missiles, anti-infantry mines or anti-submarine mines. 12.7 mm machine gun pintle-mounted in each cabin doorway. Alternative loads on cabin outriggers can include two or four 7.62 mm GMP 2 machine gun pods (550 rds/pod) or four 100 kg bombs.

DIMENSIONS, EXTERNAL:
- Main rotor diameter: 15.08 m (49 ft 5⅜ in)
- Tail rotor diameter: 3.04 m (9 ft 11¾ in)
- Distance between rotor centres: 9.20 m (30 ft 2¼ in)
- Main rotor blade chord: 0.60 m (1 ft 11½ in)
- Tail rotor ground clearance: 2.10 m (6 ft 10¾ in)
- Length
  - overall, both rotors turning: 18.22 m (59 ft 9¼ in)
  - fuselage: 14.06 m (46 ft 1½ in)
  - main blades folded, tail rotor turning: 14.82 m (48 ft 7½ in)
- Height
  - overall, tail rotor turning: 5.14 m (16 ft 10½ in)
  - to top of rotor head: 4.54 m (14 ft 10¾ in)
- Width, blades folded: 3.62 m (11 ft 10½ in)
  - over wheel fairings: 3.00 m (9 ft 10 in)
- Wheel track: 2.38 m (7 ft 10¼ in)
- Wheelbase: 4.045 m (13 ft 3 in)
- Tail rotor ground clearance: 2.10 m (6 ft 10¾ in)
- Passenger cabin doors, each
  - Height: 1.35 m (4 ft 5 in)
  - Width: 1.35 m (4 ft 5 in)
  - Height to sill: 1.00 m (3 ft 3¼ in)
- Floor hatch, rear of cabin
  - Length: 0.98 m (3 ft 2¾ in)
  - Width: 0.70 m (2 ft 3½ in)

DIMENSIONS, INTERNAL:
- Cabin: Length: 6.05 m (19 ft 10 in)
  - Max width: 1.80 m (5 ft 10¾ in)
  - Max height: 1.55 m (5 ft 1 in)
  - Floor area: 7.80 m² (84 sq ft)
  - Usable volume: 11.40 m³ (403 cu ft)

AREAS:
- Main rotor blades (each): 4.00 m² (43.06 sq ft)
- Tail rotor blades (each): 0.28 m² (3.01 sq ft)
- Main rotor disc: 176.7 m² (1,902.1 sq ft)
- Tail rotor disc: 7.26 m² (78.13 sq ft)
- Horizontal stabiliser: 1.34 m² (14.42 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty, standard aircraft: 3,615 kg (7,970 lb)
- Max fuel load: standard internal: 1,220 kg (2,690 lb)
  - external auxiliary tanks: 552 kg (1,217 lb)
- Max cargo sling load: 3,200 kg (7,055 lb)
- Max T-O and landing weight: 7,400 kg (16,315 lb)
- Max disc loading: 41.88 kg/m² (8.58 lb/sq ft)

PERFORMANCE (A: at 6,000 kg; 13,230 lb AUW, B: at max T-O weight):
- Never-exceed speed (VNE)
  - A: 158 kts (294 km/h; 182 mph)
  - B: 142 kts (263 km/h, 163 mph)
- Max cruising speed: A: 146 kts (271 km/h, 168 mph)
  - B: 139 kts (258 km/h, 160 mph)
- Normal cruising speed: B: 134 kts (248 km/h, 154 mph)
- Max rate of climb at S/L: A: 552 m (1,810 ft)/min
  - B: 366 m (1,200 ft)/min
- Service ceiling (30 m, 100 ft/min rate of climb)
  - A: 6,000 m (19,680 ft)
  - B: 4,800 m (15,750 ft)
- Hovering ceiling IGE: A, ISA: 4,400 m (14,435 ft)
  - A, ISA +20°C: 3,700 m (12,135 ft)
  - B, ISA: 2,300 m (7,545 ft)
  - B, ISA +20°C: 1,600 m (5,250 ft)
- Hovering ceiling OGE: A, ISA: 4,250 m (13,940 ft)
  - A, ISA +20°C: 3,600 m (11,810 ft)
  - B, ISA: 1,700 m (5,575 ft)
  - B, ISA +20°C: 1,050 m (3,445 ft)
- Max range at normal cruising speed, no reserves
  - A: 309 n miles (572 km; 355 miles)
  - B: 297 n miles (550 km; 341 miles)
- Max endurance at 70 kts (130 km/h, 81 mph), no reserves: 3 h 9 min

UPDATED

IAR (BELL) AH-1F HUEYCOBRA

Reported in mid-1995 that agreement signed between Romanian government and Bell Helicopter Textron for licence production of up to 96 AH-1F HueyCobras (airframes by IAR, engines and transmission system by Turbomecanica), deliveries to begin 1999.

NEW ENTRY

IAR IS-28M2A

TYPE: Two-seat motor glider

PROGRAMME: Two motor glider versions originally developed from IS-28B2 sailplane, of which tandem-seat IS-28M1 (later redesignated IAR-34) last described in 1981-82 *Jane's*; principal version is side by side IS-28M2 (M2A with strengthened wings from c/n 41 onwards); prototype (YR-1013) made first flight 26 June 1976; 50.7 kW (68 hp) engine in earlier aircraft, but 59.7 kW (80 hp) now standard, certificated in Australia, Japan, Norway, Portugal and UK. Small-scale production believed continuing. Two prototypes with Rotax 912 engine (**IS-28 M2RS**) completed in 1993

CUSTOMERS: Sold in Argentina, Australia, Canada, Denmark, Hungary, India, Israel, Norway, Philippines, Spain, Sweden, Switzerland, UK and USA. Present production total not known

DESIGN FEATURES: Low-mounted wing, redesigned forward fuselage/canopy/main landing gear, otherwise similar to IS-28B2 sailplane (1992-93 *Jane's*). T tailplane with anhedral

Wortmann wing sections (root FX-61-163, tip FX-60-126), dihedral 2°, sweepforward 2° 30' at quarter-chord

FLYING CONTROLS: Mechanical for ailerons/elevators/rudder, two-segment Hütter airbrakes in each wing upper surface, trim tab in each elevator. Optional split flaps, capable of negative setting

STRUCTURE: Mainly aluminium alloy. Single-spar wing, with metal ribs and skin, all-metal flaps (when fitted) and air brakes, ailerons, and elevator/rudder trailing-edges, are fabric covered. Front fuselage has metal longerons and frames with glassfibre fairings and engine cowling panels, centre-fuselage is metal monocoque, rear fuselage metal frames and skin

LANDING GEAR: Two retractable mainwheels side by side under centre-fuselage, with rubber disc shock-absorbers and mechanical drum brakes. Steerable, non-retractable tailwheel, also with shock-absorber

POWER PLANT: One 59.7 kW (80 hp) Limbach L 2000 EO1 flat-four engine, driving a Hoffmann HO-V62R/L160T two-blade adjustable-pitch fully feathering propeller. Single fuel tank aft of cockpit, capacity 40 litres (10.6 US gallons, 8.8 Imp gallons) standard, 60 litres (15.8 US gallons, 13.2 Imp gallons) optional

ACCOMMODATION: Two seats side by side under rearward-sliding canopy. Dual controls standard

DIMENSIONS, EXTERNAL:

Wing span	17.00 m (55 ft 9¼ in)
Wing aspect ratio	15.84
Length overall	7.00 m (22 ft 11½ in)
Height over tail	2.15 m (7 ft 0 [illegible] in)
Wheel track	1.36 m (4 ft 5 [illegible] in)

AREAS:

Wings, gross	18.24 m² (196.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	560 kg (1,234 lb)
Max T-O weight	760 kg (1,675 lb)
Max wing loading	41.67 kg/m² (8.54 lb/sq ft)
Max power loading	12.75 kg/kW (20.94 lb/hp)

PERFORMANCE, POWERED (at max T-O weight):

Never-exceed speed (VNE)	113 kts (210 km/h; 130 mph)
Max level speed	100 kts (185 km/h; 115 mph)
Max cruising speed	92 kts (170 km/h; 106 mph)
Econ cruising speed	70 kts (130 km/h; 81 mph)
Stalling speed, flaps down, power on or off	36 kts (66 km/h; 41 mph)
Max rate of climb at S/L	138 m (453 ft)/min
Service ceiling	5,000 m (16,400 ft)
T-O run (grass)	250 m (820 ft)
T-O to 15 m (50 ft) (grass)	430 m (1,410 ft)
Landing run	90 m (295 ft)
Range with max fuel, no reserves	243 n miles (450 km; 280 miles)
g limits	+5.3/−2.65

PERFORMANCE, UNPOWERED (at max T-O weight):

Max speed: smooth air	113 kts (210 km/h; 130 mph)
rough air	95 kts (177 km/h; 110 mph)
Min rate of sink at 43 kts (80 km/h; 50 mph)	1.20 m (3.94 ft)/s
Best glide ratio at 54 kts (100 km/h; 62 mph)	27

UPDATED

IAR IS-28M2A two-seat motor glider *(Brian M. Service)* 1994

IAR-46

TYPE: Two-seat Utility category very light aircraft

PROGRAMME: Definition phase and marketing studies started early 1991; detail design began late 1991, development phase initiated mid-1992, first of two prototypes (YR-1037) shown at Paris Air Show June 1993, but no evidence of production since then. Intended for JAR VLA certification

DESIGN FEATURES: High-aspect ratio low-wing monoplane with raked tips and T tail. Dihedral 2° from flat centre-section, incidence 4° at root, no twist

FLYING CONTROLS: Conventional mechanical, trim tab in each elevator. Plain trailing-edge flaps

STRUCTURE: All-metal except fabric covering on elevators and rudder and GFRP for non-stressed fairings

LANDING GEAR: Semi-retractable single mainwheels with rubber in compression shock-absorption and toe operated brakes, non-retractable tailwheel

POWER PLANT: One 59 kW (79 hp) Rotax 912A flat four engine, driving a Mühlbauer MTV-1 A/170-08 two-blade variable-pitch propeller with composite blades. Fuel in single tank in fuselage, capacity 78 litres (20.6 US gallons, 17.2 Imp gallons)

ACCOMMODATION: Two adjustable seats side by side, dual controls standard. Fixed windscreen and rearward-sliding canopy. Baggage compartment aft of seats. Cockpit ventilated, heating optional

AVIONICS: *Instrumentation*: Standard VFR instrumentation to JAR 22.1303 and JAR 22.1305. Options include horizon and directional gyros, and turn co-ordinator

EQUIPMENT: Optional anti-collision and position lights

DIMENSIONS, EXTERNAL:

Wing span	11.42 m (37 ft 5½ in)
Wing chord: at root	1.40 m (4 ft 7 in)
at tip	0.929 m (3 ft 0½ in)
Wing aspect ratio	9.40
Length overall	7.85 m (25 ft 9 in)
Height overall	2.15 m (7 ft 0½ in)
Propeller diameter	1.70 m (5 ft 7 in)

DIMENSIONS, INTERNAL:

Cockpit: Length	1.54 m (5 ft 0½ in)
Max width	1.04 m (3 ft 5 in)
Max height (from seat cushion)	0.85 m (2 ft 9½ in)

AREAS:

Wings, gross	13.87 m² (149.30 sq ft)
Ailerons (total)	0.82 m² (8.83 sq ft)
Trailing-edge flaps (total)	1.36 m² (14.64 sq ft)
Vertical tail surfaces (total)	1.50 m² (16.15 sq ft)
Horizontal tail surfaces (total)	2.73 m² (29.39 sq ft)

WEIGHTS AND LOADINGS:

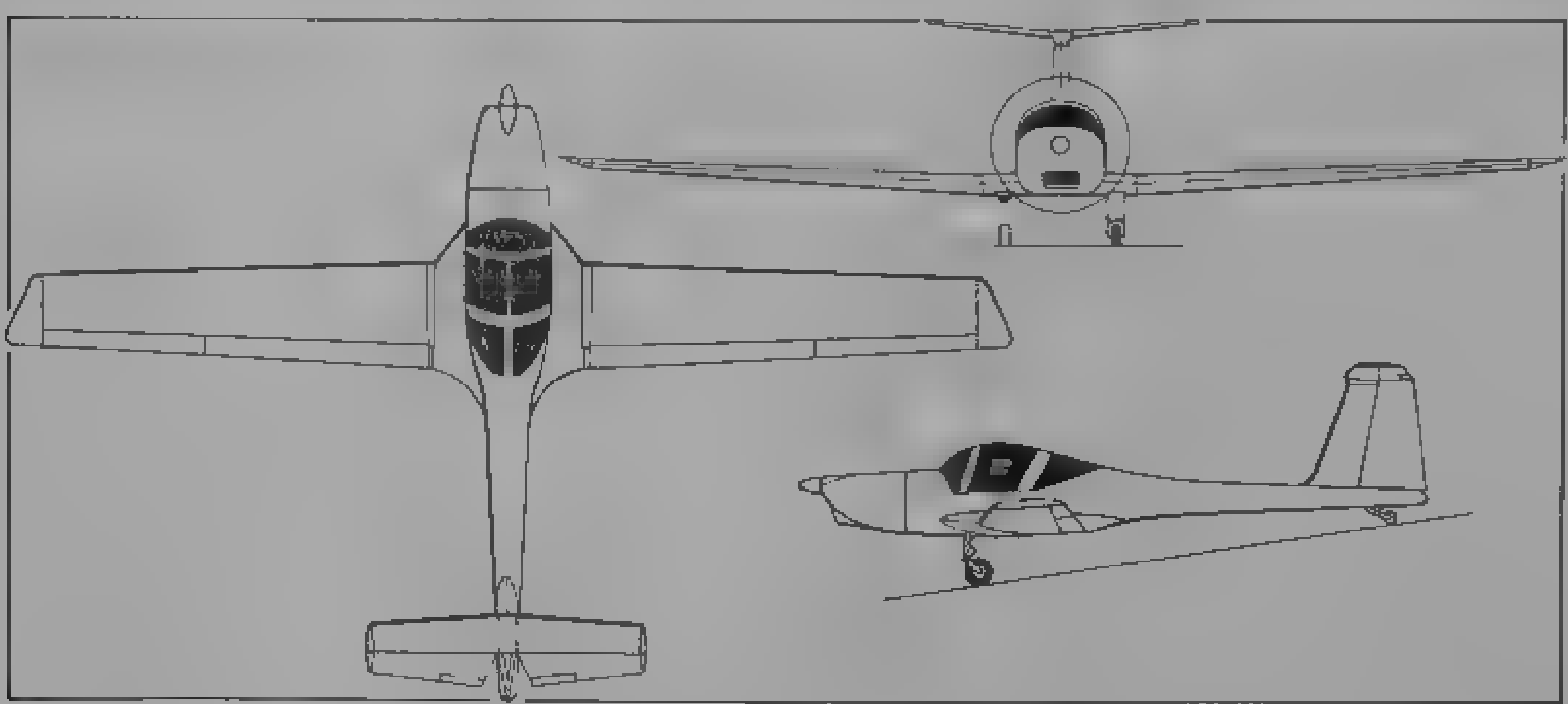
Weight empty	500-530 kg (1,102-1,168 lb)
Max T-O weight	750 kg (1,653 lb)
Max wing loading	54.07 kg/m² (11.08 lb/sq ft)
Max power loading	12.74 kg/kW (20.93 lb/hp)

PERFORMANCE (estimated, at max T-O weight at S/L, ISA):

Never-exceed speed (VNE)	151 kts (280 km/h; 174 mph)
Max level speed	110 kts (204 km/h; 127 mph)
Max cruising speed	97 kts (180 km/h; 112 mph)
Econ cruising speed	89 kts (165 km/h; 102 mph)
Speed for best rate of climb	54 kts (100 km/h; 62 mph)
Stalling speed, flaps up	43 kts (78 km/h; 49 mph)
Max rate of climb	604 m (1,982 ft)/min
Service ceiling	5,000 m (16,400 ft)
T-O run	235 m (771 ft)
T-O to 15 m (50 ft)	450 m (1,477 ft)
Landing run	100 m (328 ft)
Max range, no reserves	459 n miles (850 km; 528 miles)

UPDATED

Prototype IAR-46 two-seat light aircraft developed from the IS-28M2A motor glider *(Kenneth Munson)* 1993



IAR-46 side by side two-seat very light aircraft *(Jane's/Mike Keep)* 1994

OTHER AIRCRAFT

Partner in **AEDECO/IAR Noga VI** business jet project, see International section

NEW ENTRY

INAV

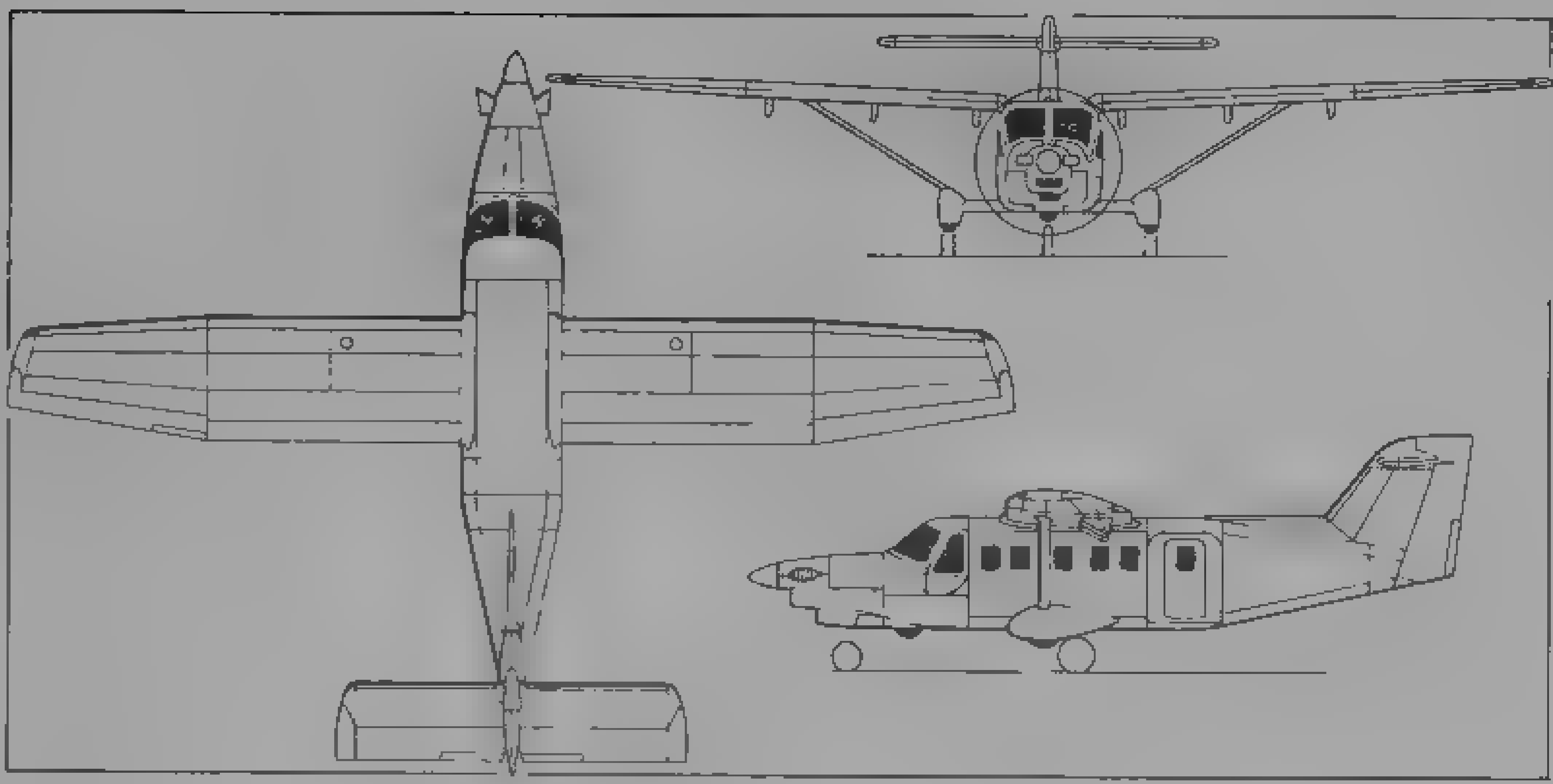
SC INSTITUTUL DE AVIATIE SA (Aviation Institute SA)

44A Ficusului Boulevard, R-70544 Bucharest
Telephone 40 (1) 6655980
Fax 40 (1) 3128563
Telex: 11767 ITAVI R
DIRECTOR GENERAL Ilie Hrenţuc

INAV is one of several institutes resulting from separation of the former INCREST, which designed Romanian share of Soko/Avioane IAR-93/Orao (see International section) and IAR-99 Şoim jet trainer (see entry for Avioane). INAV designed AG-6 agricultural biplane (see under Aerostar in 1993-94 *Jane's*) and IAR 705 transport (see Avioane in 1993-94 edition); its latest design is AMTU light transport. IAR 503A trainer programme (1993-94 edition) has been suspended

UPDATED

INAV IAR-707 AMTU



INAV IAR-707 AMTU single-turboprop utility transport *(Jane's/Mike Keep)*
1995

TYPE: Single-turboprop multipurpose utility light transport

PROGRAMME: AMTU programme (Avion Multifunctional Pentru Transport Uşor) launched 1993 as potential An-2 replacement; construction of prototype not started by January 1995

CURRENT VERSIONS: Designed for rapid conversion from freighter to passenger transport and adaptability to wide variety of missions such as parachuting, search and rescue ambulance, aerial survey photography, border patrol and supply dropping

COSTS: About $1 million

DESIGN FEATURES: For speed range 65 to 183 knots (120 to 340 km/h; 75 to 211 mph), short field capability, 1,500 kg (3,307 lb) payload and 755 n mile (1,400 km; 870 mile) range. Braced high-wing monoplane with small stub-wings at cabin floor level supporting main landing gear fairings. Non-swept wings have constant chord inboard and tapered outer panels; wing section NACA 23015 on constant chord portion, NACA 23012 (mod) at tip; dihedral 3° from roots; incidence 3°; no twist. Sweptback fin and rudder with long dorsal fin and fixed incidence high-mounted tailplane. STOL characteristics permit operation from unprepared strips under harsh environmental conditions

FLYING CONTROLS: Primary surfaces manual/mechanical (ailerons by cables and pushrods, elevators by pushrods, rudder by cables); all surfaces horn balanced, trim tab in rudder and starboard elevator, anti-servo tab in port elevator; electrically operated trim tab in port aileron. Electrically operated double-slotted flaps; ailerons can be drooped to supplement flaps. Autopilot optional

STRUCTURE: Riveted airframe of 2000 series aluminium alloys. Two-spar wing with intermediate spanwise stringers and chordwise ribs. Tail unit two-spar fixed surfaces, single-spar mass balanced control surfaces. Conventional non-pressurised stressed skin fuselage.

LANDING GEAR: Semi-retractable tricycle type. Electromechanical actuation (with manual emergency back-up), mainwheels retracting forward into streamline fairings; rearward retracting single steerable nosewheel. All wheels remain partly exposed when retracted. Oleo-pneumatic shock-absorber in each unit. Parker Hannifin wheels, size 8.50-10 (main) and 7.00-8 (nose), tyre pressures 3.0 bars (43.5 lb/sq in) on all units. Single-disc hydraulic mainwheel brakes

POWER PLANT: One Pratt & Whitney Canada PT6A-42 turboprop, rated at 634 kW (850 shp) at 2,000 rpm at 41°C. Hartzell three-blade constant-speed fully feathering propeller with reversible pitch. Integral fuel tank in each wing, combined capacity 1,280 litres (338 US gallons, 281.5 Imp gallons), of which 1,250 litres (330 US gallons, 275 Imp gallons) are usable. Two gravity fuelling points in upper surface of each wing. Oil capacity 15 litres (4 US gallons, 3.3 Imp gallons)

ACCOMMODATION: Pilot only, or crew of two side by side. Cabin has flat floor with continuous track for seats and cargo attachments, permitting rapid rearrangement to suit alternative loads. Up to nine passengers (14 with FAR Pt 23 waiver), in two/three-abreast seating at 79 cm (31 in) pitch with single aisle. Alternative layouts include 10 to 14 paratroops plus jumpmaster; or 12 to 14 fully equipped troops, on fold-up seats along cabin sides; or six stretchers plus four seated patients or medical attendants. Forward-opening door to flight deck each side. Airstair door for passengers at rear of cabin on starboard side. Upward hinged cargo door at rear of cabin on port side, with inset rearward-hinged door for parachutist dropping. Flight deck and passenger cabin heated and ventilated

SYSTEMS: Hydraulic system for brakes only. Electrical system powered by 28 V 200 A starter/generator and 24 V 40 Ah Ni/Cd battery. Heated pitot/static probe and stall warning system. Heating and ventilation by Janitrol combustion heater. Cabin air conditioning, pneumatic-boot wing/wing strut/tail unit de-icing and 3.31 m³ (116.9 cu ft) passenger cabin oxygen system optional

AVIONICS: Bendix/King Silver Crown nav/com package standard.

Comms: KY 196 VHF com, KMA 24H audio console and KT 79 transponder standard

Radar: RDS-82 colour weather radar optional (in pod on starboard wing leading-edge)

Flight: KX 165 VHF [illegible], KR 87 ADF, KCS 55 compass system with HSI for pilot, sensitive altimeter, attitude gyro, ASI, VSI, turn and bank indicator and magnetic compass standard. KEA 130 encoding altimeter, KRA 10A radio altimeter, second KCS 55 with co-pilot's HSI, GPS and ELT optional

DIMENSIONS, EXTERNAL:
Wing span 17.85 m (58 ft 6¾ in)
Wing chord: at root 2.20 m (7 ft 2½ in)
at tip 1.40 m (4 ft 7 in)
Wing aspect ratio 8.85
Length overall 12.70 m (41 ft 8 in)
Fuselage: Max width 1.80 m (5 ft 10¾ in)
Max depth 1.97 m (6 ft 5½ in)
Height overall 4.16 m (13 ft 7¾ in)
Tailplane span 6.16 m (20 ft 2½ in)
Wheel track 3.60 m (11 ft 9¾ in)
Wheelbase 4.05 m (13 ft 3½ in)
Propeller diameter 2.56 m (8 ft 4¾ in)
Flight deck doors (each): Height 1.13 m (3 ft 8½ in)
Width 0.70 m (2 ft 3½ in)
Height to sill 1.33 m (4 ft 4½ in)
Passenger door (stbd, rear): Height 1.38 m (4 ft 6¼ in)
Width 0.65 m (2 ft 1½ in)
Height to sill 0.95 m (3 ft 1½ in)
Cargo door (port, rear): Height 1.58 m (5 ft 2¼ in)
Width 1.30 m (4 ft 3¼ in)
Height to sill 0.95 m (3 ft 1½ in)
Paratroop door: Height 1.38 m (4 ft 6¼ in)
Width 0.70 m (2 ft 3½ in)

DIMENSIONS, INTERNAL:
Flight deck: Length 1.50 m (4 ft 11 in)
Max height 1.28 m (4 ft 2½ in)
Cabin, excl flight deck: Length 4.40 m (14 ft 5¼ in)
Max width 1.65 m (5 ft 5 in)
Max height 1.65 m (5 ft 5 in)
Floor area 6.51 m² (70.1 sq ft)
Volume 11.36 m³ (401.2 cu ft)

AREAS:
Wings, gross 36.00 m² (387.5 sq ft)
Ailerons (total) 3.06 m² (32.94 sq ft)
Trailing-edge flaps (total) 5.88 m² (63.29 sq ft)
Fin, incl dorsal fin 3.46 m² (37.24 sq ft)
Rudder, incl tab 2.06 m² (22.17 sq ft)
Tailplane 4.93 m² (53.07 sq ft)
Elevators (total, incl tabs) 3.47 m² (37.35 sq ft)

WEIGHTS AND LOADINGS:
Basic weight empty 1,910 kg (4,211 lb)
Operating weight empty, two pilots 2,170 kg (4,784 lb)
Max fuel weight 1,030 kg (2,271 lb)
Max payload 1,800 kg (3,968 lb)
Max T-O weight 4,200 kg (9,259 lb)
Max landing weight 4,000 kg (8,818 lb)
Max zero-fuel weight 3,948 kg (8,704 lb)
Max cargo floor loading 900 kg/m² (184.3 lb/sq ft)
Max wing loading 116.7 kg/m² (23.89 lb/sq ft)
Max power loading 6.63 kg/kW (10.89 lb/shp)

PERFORMANCE (estimated, at max T-O weight except where indicated):
Never-exceed speed (V_{NE}) 192 kts (356 km/h; 221 mph) IAS
Max cruising speed:
at S/L 177 kts (328 km/h; 204 mph)
at 4,000 m (13,125 ft) 193 kts (357 km/h; 222 mph)
Stalling speed, power off, AUW of 4,000 kg (8,818 lb):
flaps up 66 kts (121 km/h; 76 mph)
flaps down 57 kts (105 km/h; 66 mph)
Max rate of climb at S/L, AUW of 4,000 kg (8,818 lb) 468 m (1,535 ft)/min
Service ceiling 9,500 m (31,170 ft)
T-O run 220 m (722 ft)
T-O to 15 m (50 ft) 530 m (1,739 ft)
Landing from 15 m (50 ft) 330 m (1,083 ft)
Landing run 225 m (739 ft)
Range at 55% power at 3,050 m (10,000 ft), allowances for T-O, climb, descent and 30 min reserves 1,080 n miles (2,000 km; 1,242 miles)
g limits (clean) +3.43/−1.37

UPDATED

ROMAERO

SC ROMAERO SA

44 Ficusului Boulevard, Sector 1 (PO Box 18), R-71544 Bucharest
Telephone 40 (1) 6335082
Fax 40 (1) 6794456
Telex 11691 IAvB R
CHAIRMAN AND CEO: Dumitru Cucu
EXECUTIVE DIRECTOR, SALES AND MARKETING:
Constantin Dinischiotu
CHIEF OF PUBLIC RELATIONS: Carmen Gheorghiu

Established 1951 and operated successively under several names (see 1991-92 *Jane's* for details); became commercial company under present name 20 November 1990; manufactures One-Eleven and Islander, and components for Boeing 737/757; repairs and overhauls various large and small aircraft, agent and repair centre for Textron Lycoming engines; manufactures aircraft equipment. Romaero's 3.38 ha (8.35 acre) site includes 100,370 m² (1,080,375 sq ft) of covered space

UPDATED

ROMAERO (BAC/BAe) ONE-ELEVEN and AIRSTAR 2500

TYPE: Twin-turbofan short/medium-range transport

PROGRAMME: Romaero is Romanian prime contractor for licence manufacture of BAC/BAe One-Elevens (see UK section of 1974-75 and 1981-82 *Jane's*), under technology transfer programme known as Rombac 1-11; corresponding programme covers Romanian production of Rolls-Royce Spey 512-14DW engines. One BAe built Srs 487 freighter and two Srs 525/1s delivered 1981-82, industrial transfer to Romania completed 1986, Romanian assembled Srs 560 first flight 18 September and certification November 1982 (entered service with Tarom January 1983). Future programme now concentrating on Tay-engined Airstar 2500 version

CURRENT VERSIONS: **One-Eleven Series 495**: Combines standard fuselage and accommodation of British built One-Eleven Srs 400 with wings and power plant of Srs 560 and modified landing gear (using low pressure tyres to permit operation from secondary low-strength runways with poorer grade surfaces); 10th One-Eleven, long delayed but due for completion in 1995, is first convertible passenger/cargo **Model 497** (equivalent to BAC/BAe Srs 475 but redesigned by Romaero and approved by BAe using components from Srs 487 and 560)

One-Eleven Series 560 (Model 561RC): Stretched version, derived from British Series 300/400; lengthened fuselage (2.54 m, 8 ft 4 in forward of wings, 1.57 m, 5 ft 2 in aft), accommodates up to 109 passengers; wing extensions increase span by 1.52 m (5 ft), main landing gear

strengthened, heavier wing planks to cater for increased AUW. Nine built; production completed. Details in 1994-95 and earlier *Jane's*

Airstar 2500: Basically as Series 560, seating 96 to 115 passengers, but re-engined with Rolls-Royce Tay 650 turbofans to meet current noise and environmental pollution requirements, first example due to fly late 1996. *Description applies to Airstar 2500, except where indicated*

CUSTOMERS: Options for Airstar 2500 from Tarom, which plans to have seven converted to Tay engines from One-Eleven Srs 560s; Kiwi International Airlines (USA) has placed firm order for 11 new Airstar 2500s with five more on option.

DESIGN FEATURES: Modified NACA cambered wing section, thickness/chord ratio 12.5 per cent at root, 11 per cent at tip; dihedral 2°; incidence 2° 37′ (2° 30′ on Srs 495); sweepback 20° at quarter chord.

FLYING CONTROLS: Autopilot and provision for automatic throttle control (see Avionics). Manually actuated ailerons, with servo tabs (port tab used for trimming). Hydraulically actuated variable incidence T tailplane (controlled through duplicated hydraulic units), elevators and rudder (using tandem jacks), Fowler flaps, spoiler/airbrakes on upper surface of wings, and lift dumpers (inboard of spoilers). In Airstar 2500, elevators and rudder incorporate independent hydraulic feel simulation; rudder is offset to effect directional trim; electrically actuated trim tab in port elevator can be used instead of tailplane trim in manual flight. Elevators and rudder can be operated manually in the event of hydraulic failure.

STRUCTURE: Mostly all-metal fail-safe, mainly of copper based aluminium alloy. Three-shear-web wing torsion box with integrally machined skin/stringer panels. Redux bonded light alloy honeycomb ailerons; Srs 495 flaps have GFRP coating; fuselage uses continuous frames and stringers.

LANDING GEAR: Retractable tricycle type, with twin wheels on each unit. Hydraulic retraction, nose unit forward, main units inward. Oleo-pneumatic shock-absorbers. Hydraulic nosewheel steering. Wheels have tubeless tyres, five-plate heavy duty hydraulic disc brakes, and anti-skid units. Mainwheel tyres size 40 × 12 on Airstar 2500, pressure 11.79 bars (171 lb/sq in); size 44 × 16 on Srs 495, pressure 5.72 bars (83 lb/sq in). Nosewheel tyres size 24 × 7.25 on Airstar 2500, pressure 8.27 bars (120 lb/sq in); size 24 × 7.7 on Srs 495, pressure 7.24 bars (105 lb/sq in). Minimum ground turning radius (nosewheel to outer wingtip) 15.24 m (50 ft 0 in) for Srs 495, 17.07 m (56 ft 0 in) for Airstar 2500.

POWER PLANT (Airstar 2500): Two 67.2 kN (15,100 lb st) Rolls-Royce Tay Mk 650-14 turbofans with hydraulically actuated target type thrust reversers. Fuel tank capacities are 10,182 litres (2,690 US gallons; 2,240 Imp gallons) in main wing tanks, 3,982 litres (1,052 US gallons; 876 Imp gallons) in centre-section, and 1,562 litres (412.5 US gallons; 344 Imp gallons) in auxiliary tank. Total fuel capacity thus 15,726 litres (4,154.5 US gallons; 3,460 Imp gallons), of which 15,593 litres (4,119 US gallons; 3,430 Imp gallons) are usable. Oil capacity 8 litres (2.1 US gallons; 1.8 Imp gallons).

POWER PLANT (Srs 495): Two Rolls-Royce Spey Mk 512-14DW turbofans, each rated at 55.8 kN (12,550 lb st), pod mounted on sides of rear fuselage. Fuel in integral wing tanks with usable capacity of 10,160 litres (2,684 US gallons; 2,235 Imp gallons) and centre-section tank of 3,968 litres (1,048 US gallons; 873 Imp gallons) usable capacity; total usable fuel 14,129 litres (3,732 US gallons; 3,108 Imp gallons). Executive versions can be fitted with auxiliary fuel tanks of up to 5,791 litres (1,530 US gallons; 1,274 Imp gallons) usable capacity. Pressure refuelling point in fuselage forward of wing on starboard side. Provision for gravity refuelling. Oil capacity (total engine oil) 13.66 litres (3.6 US gallons; 3 Imp gallons) per engine. Engine hush kits standard.

ACCOMMODATION (Airstar 2500): Flight deck crew of two, plus one supernumerary (check pilot or observer); three cabin attendants. Standard seating in main cabin for 104 economy class passengers at 76 cm (30 in) pitch. Structural provision for four galleys. Toilet on each side at rear of cabin. Overhead modular baggage bins each side throughout passenger area. Ventral entrance with hydraulically operated airstair. Forward passenger door on port side incorporates optional power operated airstair. Galley service door forward on starboard side. Two overwing emergency exits on each side. Two pressurised and air conditioned, freight holds under floor, fore and aft of wings, with outward-opening plug-type doors on starboard side.

ACCOMMODATION (Srs 495): Generally as for Airstar 2500 except maximum passenger capacity 89; single overwing emergency exit each side; optional upward-opening forward freight door. Single class or mixed class layout, with movable divider bulkhead to permit any first/tourist ratio. Typical mixed class layout has 16 first class (four-abreast) and 49 tourist (five-abreast) seats. Galley units normally at front on starboard side. Coat space available on port side aft of flight deck.

SYSTEMS: Fully duplicated air conditioning and pressurisation systems. Maximum pressure differential 0.52 bar (7.5 lb/sq in). Thermal (engine bleed air) de-icing of wing, fin and tailplane leading-edges. Two independent hydraulic systems, pressure 207 bars (3,000 lb/sq in), operate flaps, spoilers, lift dumpers, thrust reversers, rudder, elevators, tailplane, landing gear, brakes, nosewheel steering, ventral and forward airstairs and windscreen wipers. Pneumatic system provides air at correct pressure and temperature for air conditioning, pressurisation and airframe anti-icing.

Electrical 115/200 V power supply from two 40 kVA three-phase 400 Hz constant-frequency AC generators, additional 40 kVA generator mounted on APU for ground operation or emergency use; 28 V DC power from transformer-rectifier units, 24 V 37 Ah battery for selected ground functions and as in-flight back-up. Gas-turbine APU in tailcone to provide ground electric power, air conditioning and engine starting, also some system checkout capability.

Visual and automatic ice detection systems: vulnerable areas heated electrically or by hot air supplied by pneumatic system, all flying control surfaces remain fully operative under icing conditions. Separate gaseous oxygen systems for passengers and crew.

AVIONICS (Airstar 2500): EFIS CRT displays for ADI, HSI and MFD. Standard ARINC interface with radio nav system allows choice of radio equipment.

Comms: Dual VHF; single HF; ATC transponder; PA system; CVR.

Radar: Weather radar.

Flight: AFCS with integral altitude alert, dual VHF nav, ADF; DME, TCAS II Cat. II landing, integrated alerting system; radio altimeter; GPWS, flight data recorder. Options include equipment for Cat. III operation.

DIMENSIONS, EXTERNAL:

Wing span	28.50 m (93 ft 6 in)
Wing chord: at root	5.00 m (16 ft 5 in)
at tip	1.61 m (5 ft 5 in)
Wing aspect ratio	8.48
Length:	
overall: Srs 495	28.50 m (93 ft 6 in)
Airstar 2500	32.61 m (107 ft 0 in)
fuselage: Srs 495	25.55 m (83 ft 10 in)
Airstar 2500	29.67 m (97 ft 4 in)
Fuselage max diameter	3.40 m (11 ft 2 in)
Height overall	7.47 m (24 ft 6 in)
Tailplane span	8.99 m (29 ft 6 in)
Wheel track	4.34 m (14 ft 3 in)
Wheelbase: Srs 495	10.08 m (33 ft 1 in)
Airstar 2500	12.62 m (41 ft 5 in)
Passenger door (fwd, port): Height	1.73 m (5 ft 8 in)
Width	0.84 m (2 ft 9 in)
Height to sill	2.08 m (6 ft 10 in)
Ventral entrance, bulkhead door:	
Height	1.83 m (6 ft 0 in)
Width	0.61 m (2 ft 0 in)
Height to sill	2.08 m (6 ft 10 in)
Freight door (fwd, starboard):	
Height (projected)	0.79 m (2 ft 7 in)
Width	0.91 m (3 ft 0 in)
Height to sill	1.04 m (3 ft 5 in)
Freight door (rear, starboard):	
Height (projected)	0.71 m (2 ft 4 in)
Width	0.91 m (3 ft 0 in)
Height to sill	1.17 m (3 ft 10 in)
Freight door, main deck (optional, fwd, Srs 495):	
Height	1.85 m (6 ft 1 in)
Width	3.05 m (10 ft 0 in)
Galley service door (fwd, starboard):	
Height (projected)	1.22 m (4 ft 0 in)
Width	0.69 m (2 ft 3 in)
Height to sill	2.08 m (6 ft 10 in)
Emergency exits (each):	
Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL (Airstar 2500):

Cabin, excl flight deck: Length	21.44 m (70 ft 4 in)
Total floor area	59.5 m² (640 sq ft)
Freight holds (total volume)	9.25 m³ (680 cu ft)

DIMENSIONS, INTERNAL (Srs 495):

Cabin, excl flight deck: Length	17.32 m (56 ft 10 in)
Max width	3.15 m (10 ft 4 in)
Max height	1.98 m (6 ft 6 in)
Floor area	47.4 m² (510 sq ft)
Freight hold: fwd	10.02 m³ (354 cu ft)
rear	4.42 m³ (156 cu ft)

AREAS (Srs 495, Airstar 2500):

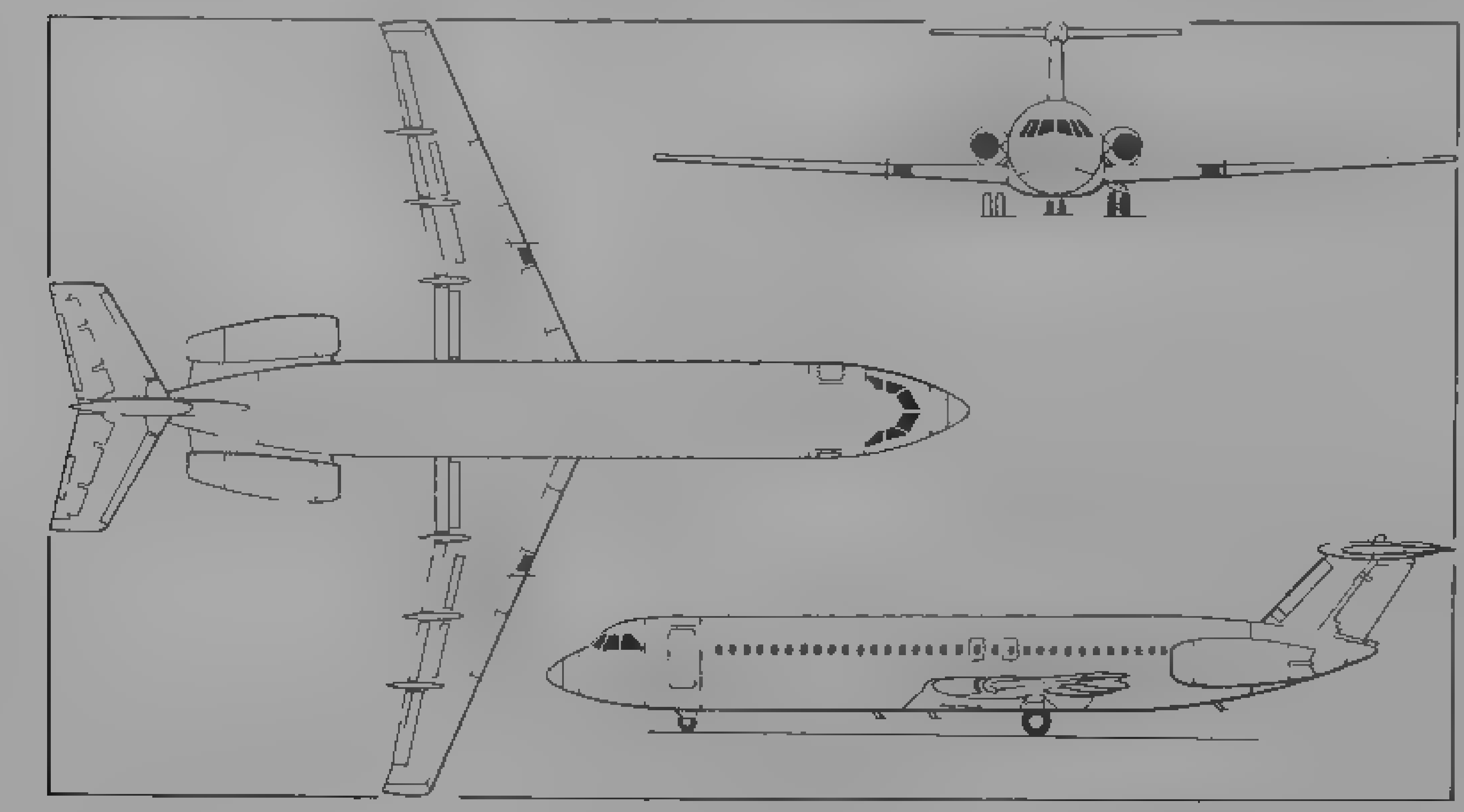
Wings, gross	95.78 m² (1,031.0 sq ft)
Ailerons (total)	2.86 m² (30.8 sq ft)
Flaps (total)	16.26 m² (175.0 sq ft)
Spoilers (total)	2.30 m² (24.8 sq ft)
Fin	7.86 m² (84.6 sq ft)
Rudder, incl tab	3.05 m² (32.8 sq ft)
Tailplane	17.43 m² (187.6 sq ft)
Elevators, incl tab	6.54 m² (70.4 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty, typical:	
Srs 495 (89 seats)	23,286 kg (51,339 lb)
Airstar 2500	27,170 kg (59,900 lb)
Max payload, typical: Srs 495	10,733 kg (23,661 lb)
Airstar 2500	10,931 kg (24,100 lb)
Max fuel weight: Airstar 2500	12,582 kg (27,738 lb)
Max T-O weight:	
Srs 495: standard	41,730 kg (92,000 lb)
optional	44,680 kg (98,500 lb)
Airstar 2500	47,400 kg (104,500 lb)
Max ramp weight:	
Srs 495: standard	41,955 kg (92,500 lb)
optional	44,905 kg (99,000 lb)
Airstar 2500	47,625 kg (105,000 lb)
Max landing weight:	
Srs 495: standard	38,100 kg (84,000 lb)
optional	39,465 kg (87,000 lb)
Airstar 2500	40,823 kg (90,000 lb)
Max zero-fuel weight:	
Srs 495: standard	33,110 kg (73,000 lb)
optional	34,020 kg (75,000 lb)
Airstar 2500	38,101 kg (84,000 lb)
Max wing loading: Srs 495	466.3 kg/m² (95.5 lb/sq ft)
Airstar 2500	495.1 kg/m² (101.4 lb/sq ft)
Max power loading: Srs 495	400.2 kg/kN (3.92 lb/lb st)
Airstar 2500	353.1 kg/kN (3.46 lb/lb st)

PERFORMANCE (at standard max T-O weights; Airstar 2500 estimated):

Design diving speed (S/L)	410 kts (760 km/h; 472 mph) EAS
Max level and max cruising speed:	
Srs 495 at 6,400 m (21,000 ft)	470 kts (870 km/h; 541 mph)
Airstar 2500 at 7,620 m (25,000 ft)	459 kts (850 km/h; 528 mph)
Econ cruising speed:	
Srs 495 at 10,670 m (35,000 ft)	410 kts (760 km/h; 472 mph)
Airstar 2500 at 7,620 m (25,000 ft)	432 kts (800 km/h; 497 mph)
Stalling speed (landing flap setting, at standard max landing weight):	
Srs 495	98 kts (182 km/h; 113 mph) EAS
Rate of climb at S/L at 300 kts (555 km/h; 345 mph) EAS:	
Srs 495	786 m (2,580 ft)/min
Max rate of climb at S/L:	
Airstar 2500	625 m (2,050 ft)/min
Max cruising altitude (both)	10,670 m (35,000 ft)
Runway LCN, rigid pavement (1.30): Srs 495	32
T-O run at S/L, ISA: Srs 495	1,676 m (5,500 ft)
Airstar 2500	2,210 m (7,250 ft)



Romaero Airstar 2500 (two Rolls-Royce Tay 650 turbofans) *(Jane's/James Goulding)* *1995*

Balanced T-O to 10.7 m (35 ft) at S/L, ISA
Srs 495 1,798 m (5,900 ft)
T-O to 15 m (50 ft): Airstar 2500 2,256 m (7,400 ft)
Landing distance (BCAR) at S/L, ISA, at standard max landing weight: Srs 495 1,440 m (4,725 ft)
Landing from 15 m (50 ft):
Airstar 2500 1,464 m (4,800 ft)
Max range, ISA, reserves for 200 n mile (370 km; 230 mile) diversion and 45 min hold:
Srs 495 1,933 n miles (3,580 km; 2,224 miles)
Range, Srs 495, with typical capacity payload, ISA, reserves as above
at 44,680 kg (98,500 lb)
1,454 n miles (2,693 km; 1,673 miles)
executive aircraft with 10 passengers and additional 5,602 litres (1,479 US gallons; 1,232 Imp gallons) fuel 2,875 n miles (5,324 km; 3,308 miles)
Range, Airstar 2500:
with max fuel 1,850 n miles (3,426 km; 2,129 miles)
with max payload
1,400 n miles (2,593 km; 1,611 miles)
OPERATIONAL NOISE LEVELS (Airstar 2500, estimated):
Approach 92 EPNdB
Sideline 93 EPNdB

UPDATED

ROMAERO (PILATUS BRITTEN-NORMAN) ISLANDER

TYPE: Twin-engined feederliner.
PROGRAMME: First flight of Romanian built Islander (built by former IRMA) 4 August 1969.
CUSTOMERS: Initial commitment to build 215 completed 1976; total of 496 delivered to Pilatus Britten-Norman by December 1994, further 14 on order for 1995. Production rate one and a half per month.

UPDATED

RUSSIA

Several 'new' aircraft manufacturing organisations appear for the first time in this section, reflecting recent changes in the Russian aerospace industry. In former times, aircraft were identified by the design bureau of their origin (MiG, Sukhoi and others) and built in State Aircraft Factories (GAZ) which had no fixed relationship with any one bureau.

The factories are now financially accountable and are assuming greater prominence in the aerospace industry. Accordingly, they appear in *Jane's* for the first time. Stronger ties are being forged between bureaux and factories but, for the moment, the Russian section remains hybrid, including both freelance design teams with no production capability and factories without a design office.

Tradition and geography have been responsible for some design/production tie-ups, such that the Kazan Helicopters Production Association (the former GAZ 22) is synonymous with the longer established name of M L Mil. Conversely, the Moscow Aircraft Production Organisation is currently building aircraft bearing the name of MiG, Ilyushin and the newer Aeroprogress and Aviatika - even though most Ilyushins are produced by the former GAZ 40 at Voronezh. Illustrating what may be a developing trend, the last-mentioned was renamed Ilyushin Aircraft Production Association in July 1994, linking design and manufacture under a single name.

AEROPRACT

PO Box 9863, 443008 Samara
Telephone: 7 (8462) 63 82 91
Fax: 7 (8462) 27 15 68, 32 51 66

NEW ENTRY

AEROPRACT A-21M SOLO

TYPE: Single-seat sporting aircraft.
PROGRAMME: Developed over 10 year period, originally with 22.4 kW (30 hp) RMZ-640 engine; available for export.
DESIGN FEATURES: Conventional cantilever low-wing monoplane, with marked dihedral from roots, constant chord and no sweep; sweptback vertical tail surfaces, high and extensive glazed canopy.
FLYING CONTROLS: Three-axis.
LANDING GEAR: Non-retractable tricycle type, single wheel on each unit, steerable and faired nosewheel, cantilever mainwheel legs.
POWER PLANT: One 34.3 kW (46 hp) Rotax 503 piston engine, two-blade propeller.
ACCOMMODATION: Single seat under side-hinged (to starboard) canopy.
DIMENSIONS, EXTERNAL:
Wing span 6.65 m (21 ft 9¾ in)
Wing chord (constant) 0.90 m (2 ft 11½ in)
Length overall 4.73 m (15 ft 6¼ in)
Height overall 1.79 m (5 ft 10½ in)
Tailplane span 1.96 m (6 ft 5¼ in)
Wheel track 1.42 m (4 ft 8 in)
AREAS:
Wings, gross 6.00 m² (64.6 sq ft)
WEIGHTS AND LOADINGS:
Max fuel 22 kg (48.5 lb)
Max T-O weight 280 kg (617 lb)

Aeropract A-21M Solo single-seat sporting aircraft *(David Stephens)*

1995

Max wing loading 46.7 kg/m² (9.55 lb/sq ft)
Max power loading 8.16 kg/kW (13.4 lb/hp)
PERFORMANCE:
Max level speed 102 kts (190 km/h; 118 mph)
Nominal cruising speed 81 kts (150 km/h; 93 mph)
Min flying speed 43 kts (80 km/h; 50 mph)
Max rate of climb at S/L 300 m (985 ft)/min
T-O run 100 m (328 ft)
Range with max fuel 116 n miles (215 km; 133 miles)
g limits +6/-3

NEW ENTRY

AEROPROGRESS/ROKS-AERO

AEROPROGRESS CORPORATION

Ulansky Al 16, Office 521, 101849 Moscow
Telephone: 7 (095) 207 05 51, 155 67 82, 491 74 33
Fax: 7 (095) 207 03 41
PRESIDENT AND GENERAL DESIGNER: Evgeny P. Grunin
DEPUTY GENERAL DESIGNER: Arnold I. Andrianov
DEPUTY GENERAL DESIGNER, FOREIGN ECONOMIC RELATIONS: Alexander V. Andreev
DESIGN BUREAU MANAGER: Sergei M. Zhiganov

Known initially as ROS-Aeroprogress, and listed in the 1993-94 *Jane's* as ROKS-Aero Corporation, this organisation was founded in 1990, to design and manufacture utility, commuter, amphibian, aerobatic, agricultural, firefighting, training and attack aircraft, WIG (wing in ground effect) vehicles, replicas and other vehicles. ROKS-Aero is the design bureau of Aeroprogress, which is a member of the Business Aviation Association, together with Moscow Aviation Production Organisation, Yakovlev's Skorost factory, the Myasishchev experimental plant, and aviation works in Komsomolsk-on-Amur, Smolensk, Novosibirsk, Ulan-Ude and Lukhovitsy. Its divisions are:

Utility Aircraft Division
DIRECTOR: Yuri I. Polavsky
CHIEF DESIGNER: Mikhail M. Vasyuk
Amphibian and Special Aircraft Division
DIRECTOR AND CHIEF DESIGNER: Mikhail S. Remizov
Business and Touring Aircraft Division
DIRECTOR AND CHIEF DESIGNER: Leonard A. Tarasevich
Trainer and Aerobatics Division
DIRECTOR: Valentin A. Fomin
Replica Division
DIRECTOR: Mikhail V. Korenkov

Washington Aeroprogress Inc of Seattle (which see) manufactures and markets this organisation's designs in the USA.

UPDATED

AEROPROGRESS/ROKS-AERO T-101 GRATCH (ROOK)

TYPE: Turboprop-powered general utility aircraft.
PROGRAMME: Design started by Utility Aircraft Division in September 1991, as monoplane successor to Antonov An-2/3 biplane; construction of first of five prototypes started April 1992; manufacture of production aircraft by Moscow Aviation Production Organisation (MAPO) initiated January 1993; first flight 7 December 1994.
CURRENT VERSIONS: **T-101**: Basic passenger/cargo transport. *Detailed description applies specifically to T-101.*

T-101E: As basic T-101 but with 917 kW (1,230 shp) P&WC PT6A-65AR turboprop, driving Hartzell propeller. AlliedSignal TPE331-14 turboprop also being considered. Maximum T-O weight 5,670 kg (12,500 lb), maximum cargo payload 2,000 kg (4,409 lb), maximum cruising speed 172 knots (320 km/h; 198 mph), range, 1 hour fuel reserve, 561 n miles (1,040 km; 646 miles).

T-101V: As basic T-101 but with amphibious float landing gear. Described separately.

T-101P: Firefighting version, on non-amphibious floats.

T-101L: As basic T-101 but with ski landing gear.

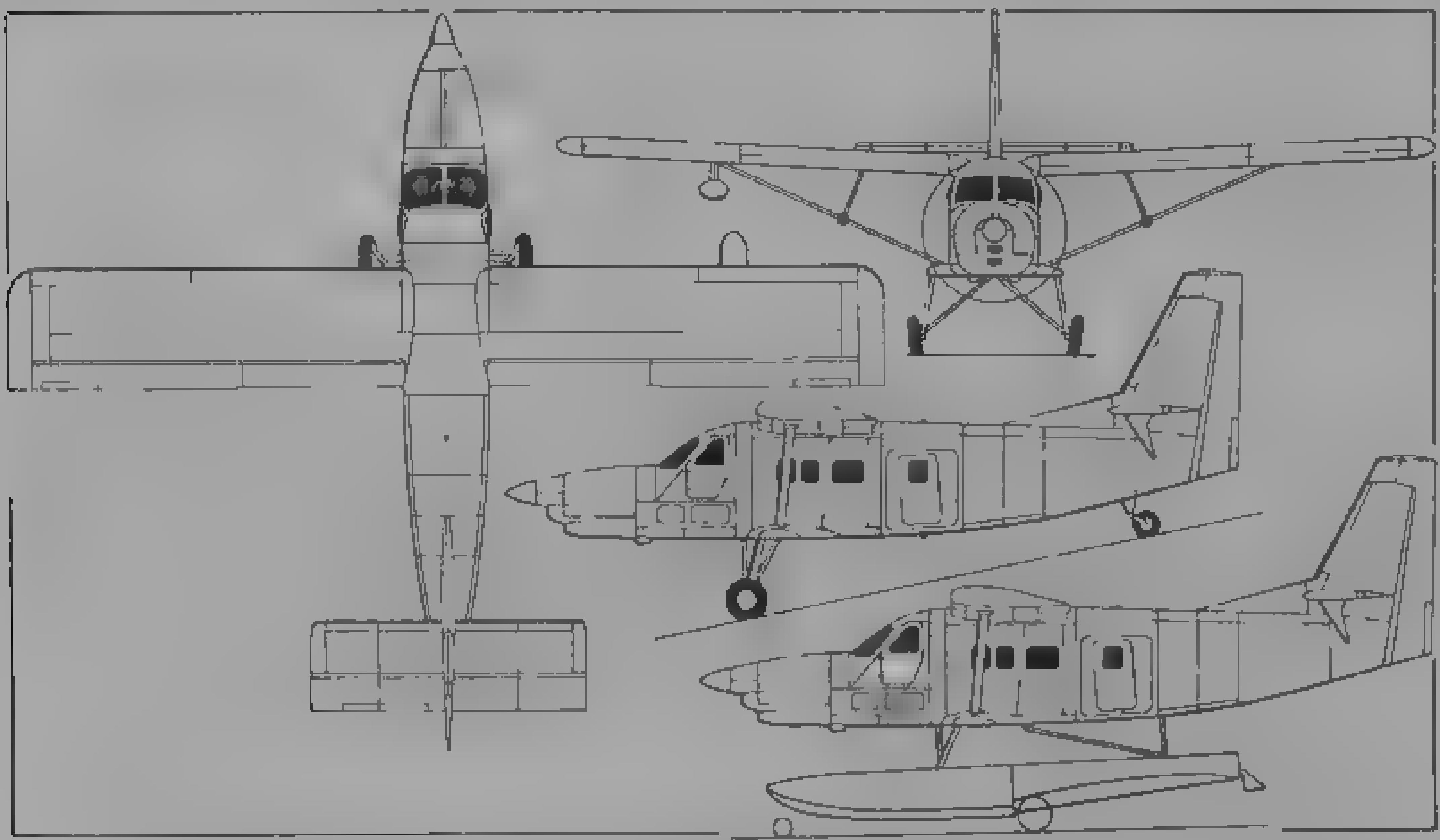
T-101Skh: Redesigned agricultural aircraft, fuselage and tail unit as basic T-101, strut braced low wings with considerable dihedral, each mainwheel on strut braced oleo, spraybars under wings, new cockpit with large flat windscreen and large side windows.

T-101S: Military version of basic T-101, small sweptback winglets, two stores pylons under each wing, added small stub-wings, each with a weapon pylon and wingtip mount for a gun pod or other store.

Further developments, with tricycle landing gear, increased wing span, more powerful engines and other changes, will be designated **T-102**, **T-103** and **T-104**.
CUSTOMERS: In January 1995, orders included 50 transports for air forces, 50 agricultural aircraft, 25 for Contingency Ministry, and 150 for airborne forces. Austrian Air Force claimed to be negotiating for 50 freighters.
DESIGN FEATURES: Single-turboprop aircraft for Normal category passenger/cargo transportation and utility applications

Aeroprogress/ROKS-Aero T-101 Gratch on an early test flight

1995



Aeroprogress/ROKS-Aero T-101 Gratch turboprop utility aircraft, with additional side view of T-101V floatplane ***(Jane's/Mike Keep)***

1995

landing gear and unpressurised cabin, STOL capable, with wide CG range; large passenger/freight door. Unswept, constant chord wings, P-11-14 wing section dihedral 3°, incidence 3° constant, sweptback fin and rudder with large dorsal fin braced constant chord tailplane and elevators

FLYING CONTROLS: Conventional mechanical control (rods and cables). Aileron deflection 30° up, 14° down, elevator deflection 42° up, 22.5° down, rudder deflection ±28 Trim tabs on port aileron, port elevator and rudder. Electrically actuated single-section slotted trailing-edge flap and two-section automatic leading-edge slats on each wing flap deflection 25° for take-off 40° for landing

STRUCTURE: All-metal (aluminium alloy and high tensile steel) structure, two-spar wings, metal skinned with integral stringers, and ribs, two-spar fin and tailplane, semi-monocoque fuselage, with frames, stringers and stressed skin

LANDING GEAR: Non-retractable tailwheel type with single wheel on each unit. Main legs of tripod type, with oleo-pneumatic shock-absorption, KT-135D mainwheels, with tyres size 720 × 320 mm, pressure 3.43 bars (50 lb/sq in) K-392 tailwheel, with tyre size 380 × 200 mm, pressure 3.43 bars (50 lb/sq in), hydraulic brakes and anti skid units on mainwheels. Skis and floats optional

POWER PLANT: One 754 kW (1,011 shp) Mars (Omsk) TVD-10B turboprop, driving AV-24AN three-blade constant-speed propeller with reverse pitch and full feathering. Three fuel tanks in each wing, each 200 litres (52.8 US gallons, 44 Imp gallons), total fuel capacity 1,200 litres (317 US gallons, 264 Imp gallons). Oil tank capacity 30 litres (7.9 US gallons, 6.6 Imp gallons)

ACCOMMODATION: Crew of one or two and nine passengers or equivalent freight. Forward-opening door each side of flight deck, large upward-opening freight door aft of wing on port side, with integral inward-opening passenger door, door between flight deck and cabin, starboard emergency exit. Cabin ventilated and heated by engine bleed air

SYSTEMS: Hydraulic system for brakes, maximum flow 4 litres (1.05 US gallons, 0.88 Imp gallons)/min, at 147 bars (2,135 lb/sq in). Three-phase 120/208 V 400 Hz AC electrical system, supplied by 6 kVA 200 A BU6BK brushless alternator, with emergency DC power supply and 24 V 40 Ah Ni/Cd battery. Electric de-icing of propeller blades and spinner, engine air intake de-iced by heated oil

AVIONICS: *Comms.* R-855A emergency locator beacon and ARB-NK emergency radio buoy

Flight: Comnav equipment for VFR and IFR operations by day and night over all terrain; PNP-72-14 nav; A-723 long-range radio nav; ARK-M ADF, GRAN low-altitude radio altimeter, GROM satellite nav, A-611 marker beacon receiver, AP-93 autopilot

Instrumentation: Air data system with digital airspeed and altitude indication, VBM IPB standby altimeter, KC-MC compact compass system, AGB-96 gyro horizon

DIMENSIONS, EXTERNAL:

Wing span	18.18 m (59 ft 8 in)
Wing chord: at root	2.40 m (7 ft 10½ in)
at tip	2.45 m (8 ft 0½ in)
Wing aspect ratio	7.58
Length overall	15.04 m (49 ft 4 in)
Fuselage: Max width	1.80 m (5 ft 10¾ in)
Max height	2.52 m (8 ft 3¼ in)
Height overall	6.67 m (21 ft 10½ in)
Tailplane span	5.80 m (19 ft 0¼ in)
Wheel track	3.24 m (10 ft 7½ in)
Wheelbase	8.30 m (27 ft 3 in)
Propeller diameter	2.80 m (9 ft 2¼ in)
Propeller ground clearance	0.97 m (3 ft 2¼ in)
Flight deck door (each): Height	1.20 m (3 ft 11¼ in)
Width at top	0.43 m (1 ft 4¾ in)
Width at bottom	0.67 m (2 ft 2¼ in)
Passenger door: Height	1.42 m (4 ft 8 in)
Width	0.81 m (2 ft 7¾ in)
Freight door: Height	1.53 m (5 ft 0¼ in)
Width	1.46 m (4 ft 9½ in)
Emergency exit: Height	0.54 m (1 ft 9 in)
Width	0.87 m (2 ft 10¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length	4.20 m (13 ft 9¼ in)
Max width	1.60 m (5 ft 3 in)
Max height	1.80 m (5 ft 10¾ in)
Floor area	6.72 m² (72.3 sq ft)
Volume	12.10 m³ (427.3 cu ft)
Flight deck/cabin door: Height	1.35 m (4 ft 5 in)
Width	0.51 m (1 ft 8 in)

AREAS:

Wings, gross	43.63 m² (469.65 sq ft)
Ailerons (total)	5.66 m² (60.93 sq ft)
Trailing-edge flaps (total)	4.02 m² (43.27 sq ft)
Leading-edge slats (total)	5.98 m² (64.37 sq ft)
Fin incl dorsal fin	5.455 m² (58.72 sq ft)
Rudder incl tab	2.955 m² (31.81 sq ft)
Tailplane	6.34 m² (68.25 sq ft)
Elevator, incl tab	4.10 m² (44.13 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	3,330 kg (7,342 lb)
Max payload	1,600 kg (3,527 lb)
Max fuel	950 kg (2,095 lb)
Max T-O and landing weight	5,500 kg (12,125 lb)
Max wing loading	126 kg/m² (25.8 lb/sq ft)
Max power loading	7.30 kg/kW (12.00 lb/shp)

PERFORMANCE (estimated):

Max level speed at 3,000 m (9,840 ft)	164 kts (305 km/h, 190 mph)
Max cruising speed at 3,000 m (9,840 ft)	161 kts (298 km/h, 185 mph)
Econ cruising speed at 3,000 m (9,840 ft)	127 kts (235 km/h, 146 mph)
Service ceiling	3,600 m (11,800 ft)
T-O run	454 m (1,490 ft)
T-O to 15 m (50 ft)	615 m (2,020 ft)
Landing from 15 m (50 ft)	370 m (1,215 ft)
Range with max fuel	712 n miles (1,320 km, 820 miles)

UPDATED

AEROPROGRESS/ROKS-AERO T-101V GRATCH (ROOK)

TYPE: Floatplane version of T-101

PROGRAMME: Design started January 1991, full-scale mockup exhibited at MosAeroshow '92; prototype scheduled for completion May 1995. Licensed production of US floats in Russia under discussion

DESIGN FEATURES: As for T-101, but with amphibious float landing gear

FLYING CONTROLS: As for T-101

STRUCTURE: As for T-101, but strengthened at float landing gear attachment points

LANDING GEAR: Twin float amphibious type, strut-mounted to fuselage, nosewheel and mainwheel on each float, retracting rearward into float, mainwheel tyre size 510 × 150 mm, nosewheel tyre size 325 × 145 mm no shock-absorbers or brakes; hydraulic retraction, minimum ground turning radius 7.0 m (23 ft). Water rudder, towing point and tie-down fitting on each float

POWER PLANT: One 1,029 kW (1,380 shp) Mars (Omsk) TVD-20 turboprop, driving AV-17 three-blade constant speed propeller with reverse pitch. Six fuel tanks in wings, capacity 1,240 litres (327 US gallons, 272 Imp gallons). Oil capacity 8 litres (2.1 US gallons, 1.75 Imp gallons)

ACCOMMODATION: Two crew and 12 passengers, doors as for T-101

DIMENSIONS, EXTERNAL:

Wing span	18.50 m (60 ft 8½ in)
Wing chord (constant)	2.40 m (7 ft 10½ in)
Wing aspect ratio	8.14
Length overall	15.23 m (49 ft 11½ in)
Fuselage: Length	15.04 m (49 ft 4¼ in)
Max width	1.80 m (5 ft 10¾ in)
Max height	2.52 m (8 ft 3¼ in)
Height overall	6.77 m (22 ft 2½ in)
Tailplane span	5.80 m (19 ft 0¼ in)
Wheel track	3.70 m (12 ft 1¾ in)
Wheelbase	4.90 m (16 ft 0¾ in)
Propeller diameter	3.60 m (11 ft 9¾ in)
Propeller water clearance	1.00 m (3 ft 3¼ in)

DIMENSIONS, INTERNAL: As for T-101

AREAS: As for T-101, except

Wings, gross	42.02 m² (452.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	3,700 kg (8,157 lb)
Max payload	1,500 kg (3,307 lb)
Max fuel	920 kg (2,028 lb)
Max T-O weight	5,715 kg (12,600 lb)
Max wing loading	136 kg/m² (27.85 lb/sq ft)
Max power loading	5.55 kg/kW (9.13 lb/shp)

PERFORMANCE (estimated):

Max level speed at 4,000 m (13,125 ft)	151 kts (280 km/h, 174 mph)
Econ cruising speed at 3,000 m (9,840 ft)	130 kts (240 km/h, 149 mph)
Min stalling speed: flaps up	89 kts (165 km/h, 103 mph)
Max rate of climb at S/L	360 m (1,180 ft)/min
T-O run	350 m (1,150 ft)
T-O to 15 m (50 ft)	550 m (1,805 ft)
Landing from 15 m (50 ft)	500 m (1,640 ft)
Landing run	300 m (985 ft)
Range, 30 min reserves: with max payload	324 n miles (600 km, 373 miles)
with max fuel	647 n miles (1,200 km, 745 miles)

UPDATED

AEROPROGRESS/ROKS-AERO T-106

TYPE: Twin-engined development of T-101 Gratch

PROGRAMME: At initial design stage 1993; included in National Programme of Aviation Development to year 2000, Komsomolsk-on-Amur preparing for manufacture

DESIGN FEATURES: Basic configuration and many components similar to T-101 series, nose faired, with provision for radar and equipment or baggage; wings braced to short stub-wings carrying mainwheels of landing gear; engines under inner wings. Intended for passenger/freight transport, ambulance, offshore patrol of 200 mile economic

Full-scale mockup of Aeroprogress/ROKS-Aero T-106 twin-engined development of T-101 Gratch *(Piotr Butowski)* *1994*

Full-scale mockup of Aeroprogress/ROKS-Aero T-101V Gratch floatplane *1993*

zones, aerial photography, geological survey, agricultural and other general duties

FLYING CONTROLS: Mechanical control. High-lift wings, with slotted aileron, two-segment double-slotted flaps and three-section leading-edge slats on each wing spoiler forward of each aileron; trim tab in each aileron, each half of tailplane, and rudder

LANDING GEAR: Non-retractable tricycle type, single wheel on each trailing link leg, tyre size 720 × 320 mm on mainwheels, 595 × 185 mm on nosewheel

POWER PLANT: Two Mars (Omsk) TVD-10B or Pratt & Whitney Canada PT6A turboprops

ACCOMMODATION: Two crew on flight deck door on each side and in rear bulkhead to cabin, as T-101; large passenger/freight door on port side of main cabin Mixed passenger/freight configurations planned

DIMENSIONS, EXTERNAL

Wing span	19.90 m (65 ft 3½ in)
Length overall	15.56 m (51 ft 0¾ in)
Height overall	6.42 m (21 ft 0¾ in)
Wheel track	3.37 m (11 ft 0½ in)
Wheel base	4.53 m (14 ft 10¼ in)
Propeller diameter (three-blade)	2.80 m (9 ft 2¼ in)
Distance between propeller centres	5.70 m (18 ft 8½ in)

DIMENSIONS, INTERNAL

Cabin: Length	5.75 m (18 ft 10¼ in)
Max width	1.65 m (5 ft 5 in)
Max height	1.85 m (6 ft 0¾ in)
Volume	15.00 m³ (530 cu ft)

WEIGHTS AND LOADINGS

Max payload	2,000 kg (4,409 lb)
Max fuel	920 kg (2,028 lb)
Max T-O weight	5,950 kg (13,117 lb)

PERFORMANCE (estimated)

Max level speed	189 kts (350 km/h, 217 mph)
Service ceiling	4,000 m (13,125 ft)
Range:	
with max payload	189 n miles (350 km, 217 miles)
with max fuel	647 n miles (1,200 km, 745 miles)

UPDATED

AEROPROGRESS/ROKS-AERO T-130 FREGAT (FRIGATE)

TYPE: Twin-engined multipurpose amphibian

CURRENT VERSIONS: Designed for light passenger/cargo, ambulance, search and rescue, and forest surveillance missions, with capability to airdrop firefighters. Passenger/cargo version with single turboprop being studied

PROGRAMME: Design started April 1993. In January 1995, programme under revision to meet requirements of Frontier Forces for weapon carriage. Prototype scheduled to fly November 1996

CUSTOMERS: Arrangements being made to manufacture T-130 in China

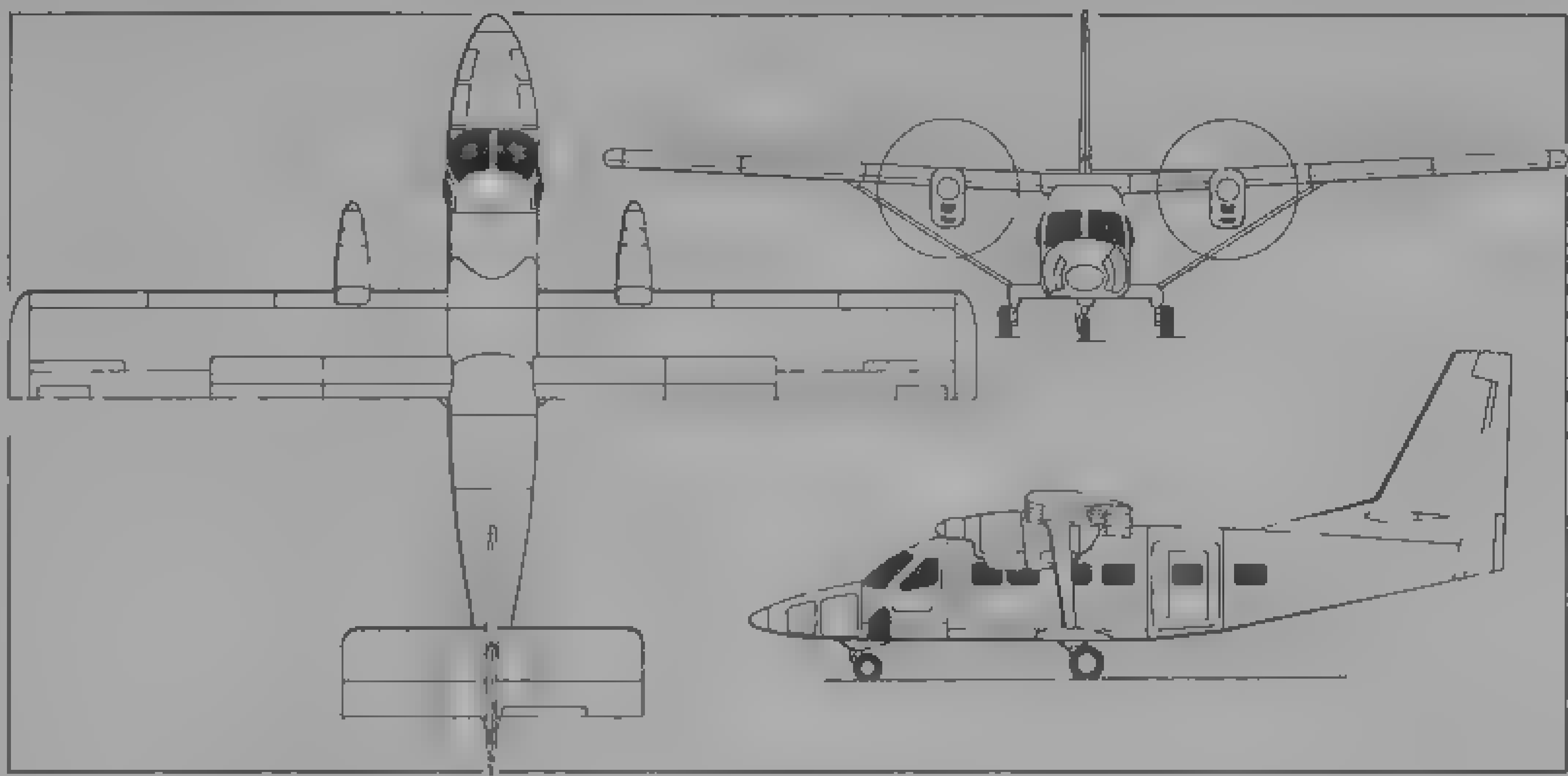
DESIGN FEATURES: Strut-braced high-wing monoplane amphibian with engines pylon-mounted above wing centre-section Unswept constant-chord wing of P-11 section, thickness/chord ratio 14 per cent, dihedral 1° 30′, incidence 2°. Flying boat hull with two steps and long-chord sponsons. Sweptback vertical tail surfaces with dorsal fin; unswept strut-braced constant-chord horizontal surfaces, horn balanced elevators and rudder Water rudder aft of rear step

FLYING CONTROLS: Mechanically controlled ailerons, rudder and elevators, via cables and rods, electrically operated trim tab in starboard elevator, single-slotted wing trailing-edge flaps.

STRUCTURE: Aluminium alloy construction. Semi-monocoque fuselage with lower portion divided into watertight and pressure-tight compartments

LANDING GEAR: Retractable tricycle type, single wheel on each unit; hydraulic retraction, nosewheels forward into hull, mainwheels forward into sponsons. Oleo-pneumatic shock-absorbers. Hydraulic shoe brakes. Mainwheel tyres size 720 × 320 mm, nosewheel tyre size 470 × 210 mm, pressure (all) 2.95 bars (43 lb/sq in). Minimum turning circle 6.0 m (19 ft 8¼ in). Nosewheel steerable ±45°

POWER PLANT: Two 560 kW (751 shp) Walter M 601 E or P&WC PT6A turboprops, driving V510 five-blade



Aeroprogress/ROKS-Aero T-106 twin-turboprop multipurpose aircraft *(Jane's/Mike Keep)* *1993*

variable-pitch propellers, tandem-mounted in single pod Three metal fuel tanks in each wing, total capacity 2,000 litres (528 US gallons, 440 Imp gallons). Overwing gravity fuelling Oil capacity 20 litres (5.3 US gallons, 4.4 Imp gallons).

ACCOMMODATION: Two crew and up to 15 passengers or equivalent freight. Door each side of flight deck, horizontally split two-part upward/downward-opening cargo/passenger door on port side aft of wings, lower portion with built-in airstairs, passage from flight deck to main cabin Cargo lashing points in floor and sides, maximum floor loading 400 kg/m² (82 lb/sq ft). Interior heated with engine bleed air and ventilated

SYSTEMS: Hydraulic system pressure 152 bars (2,200 lb/sq in) flow rate 5 litres (1.3 US gallons, 1.1 Imp gallons)/min Electrical system 27 V DC, with two 3 kW generators and two 40 Ah batteries, for flight nav, radio nav/com and lighting systems, and flap actuation. Wing leading-edges tail surfaces, and windscreen de-iced by engine bleed air, propeller leading-edges and pitot heated electrically

AVIONICS: *Comms*: Two com/nav radios and transponder standard

Flight: ADF and radio altimeter

DIMENSIONS, EXTERNAL

Wing span	18.20 m (59 ft 8½ in)
Length overall	15.50 m (50 ft 10¼ in)
Height overall	4.60 m (15 ft 1 in)

DIMENSIONS, INTERNAL

Cabin, excl flight deck: Length	4.50 m (14 ft 9 in)
Max width	1.60 m (5 ft 3 in)
Max height	1.85 m (6 ft 0¾ in)

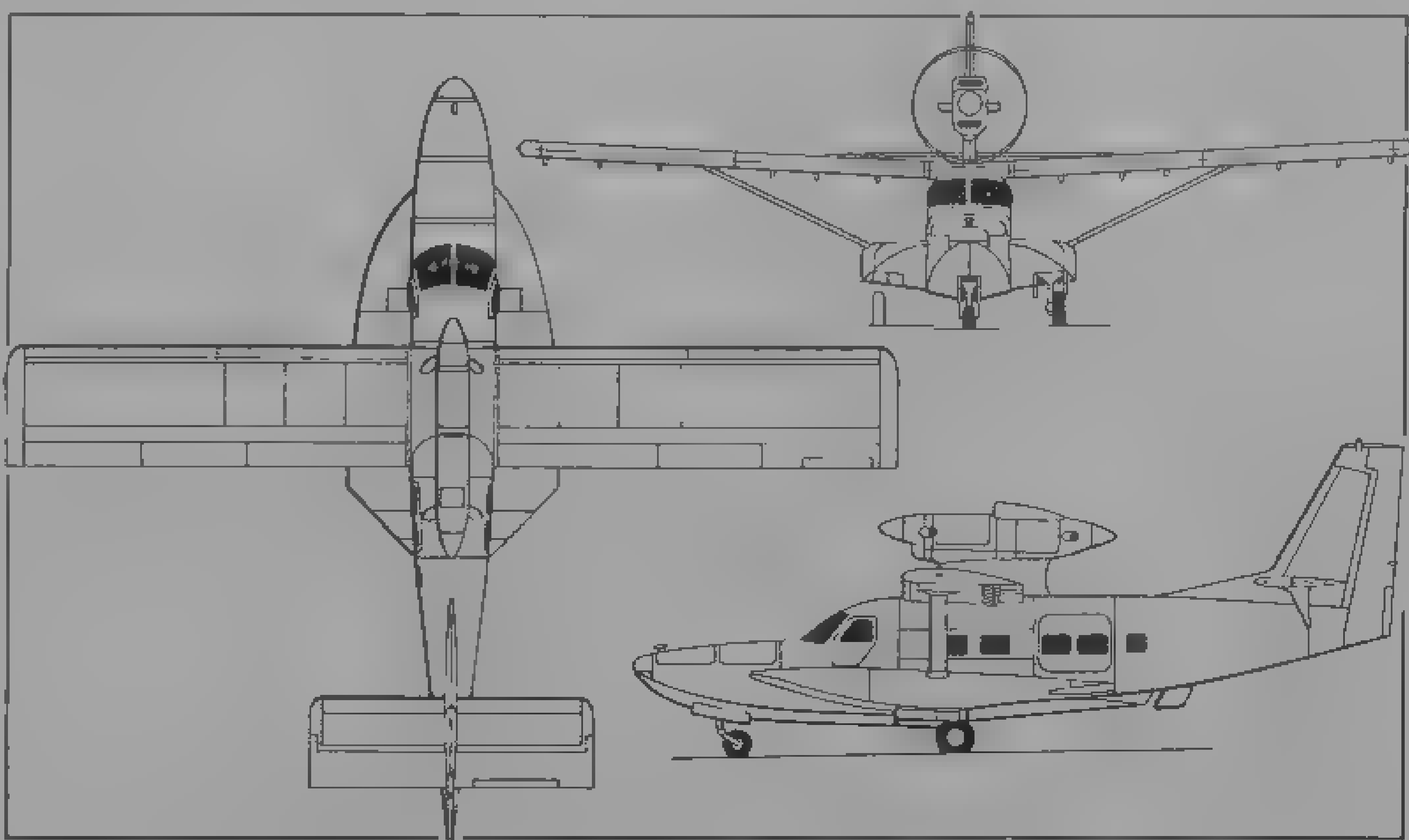
WEIGHTS AND LOADINGS (M 601 E engines)

Max payload	1,500 kg (3,307 lb)
Max fuel	1,600 kg (3,527 lb)
Max ramp, T-O and landing weight	5,850 kg (12,895 lb)
Max power loading	5.22 kg/kW (8.58 lb/shp)

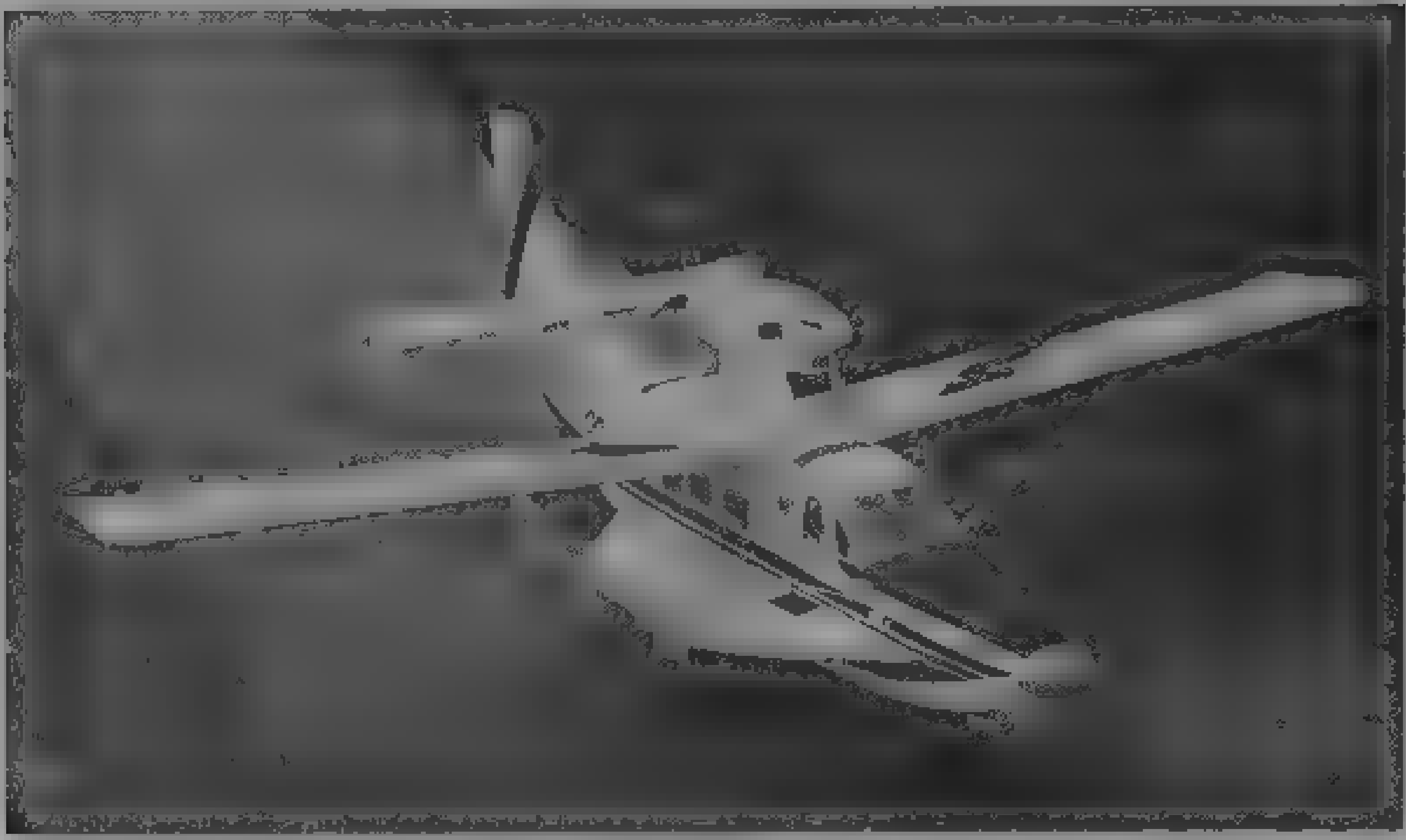
PERFORMANCE (estimated, M 601 E engines)

Max level speed	215 kts (400 km/h, 248 mph)
Max cruising speed	189 kts (350 km/h, 217 mph)
T-O run: on land	240 m (788 ft)
on water	285 m (935 ft)
Landing run with thrust reverse	
on land	180 m (590 ft)
on water	220 m (722 ft)
Range, 30 min reserve	
with max payload	296 n miles (550 km, 341 miles)
with max fuel and 500 kg (1,102 lb) payload	982 n miles (1,820 km, 1,131 miles)

UPDATED

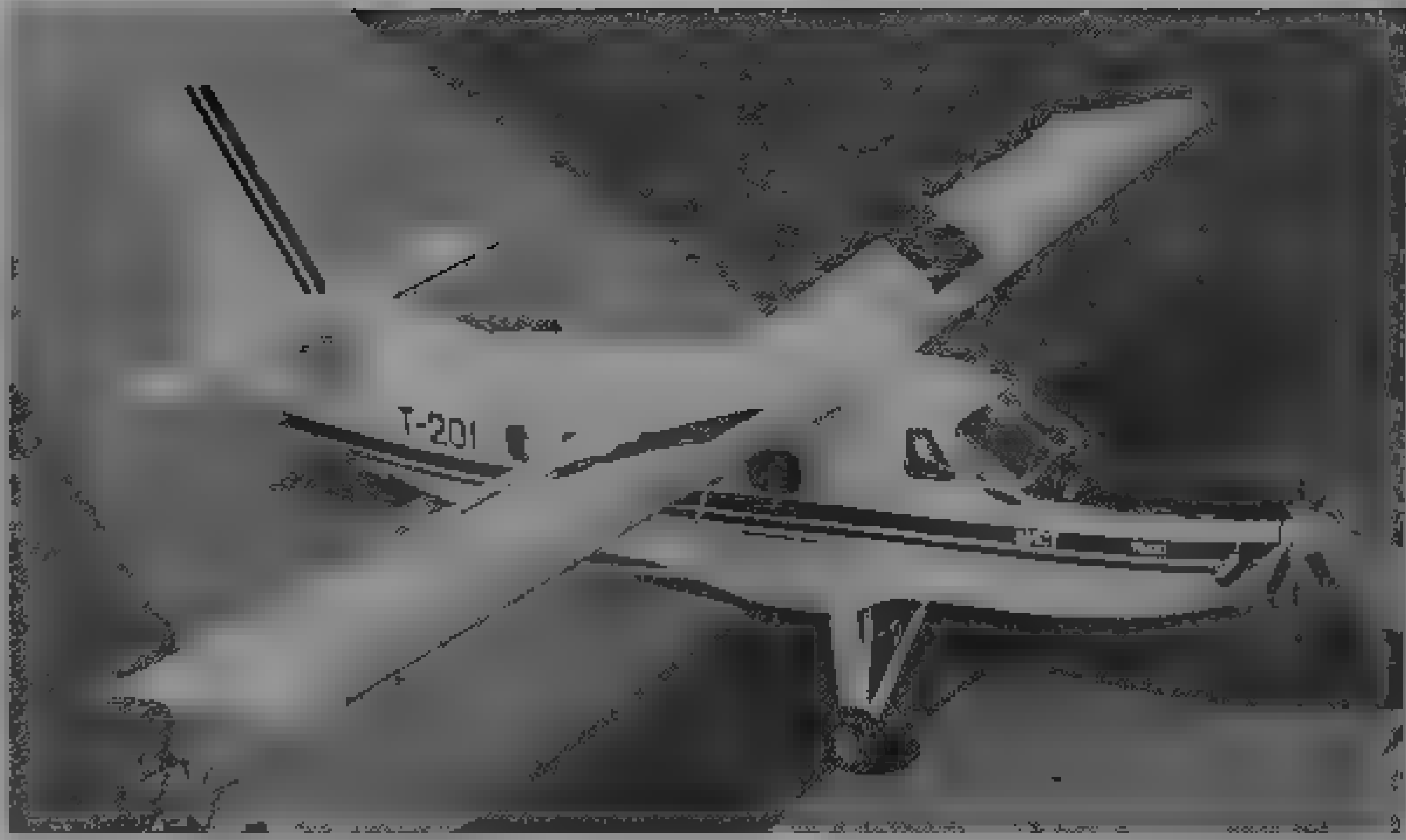


Aeroprogress/ROKS-Aero T-130 Fregat twin-turboprop multipurpose light amphibian *(Jane's/Mike Keep)* *1994*



Mockup of Aeroprogress/ROKS-Aero T-130 Fregat (two Walter M 601 E turboprops)

1994



Full-scale mockup of Aeroprogress/ROKS-Aero T-201 Aist turboprop-powered general utility aircraft

1994

AEROPROGRESS/ROKS-AERO T-201 AIST (STORK)

TYPE: Turboprop-powered general utility aircraft

PROGRAMME: Design started April 1993, decision to change engine (from Mars (Omsk) TVD-20) delayed scheduled first flight until mid-1995

CURRENT VERSIONS: Designed for military and civil passenger/cargo, paratroop and cargo airdropping, ambulance, search and rescue, forest surveillance and firefighting, agricultural and aerial photography missions

DESIGN FEATURES: Configuration similar to T-101 Grach, but considerably refined and upgraded, with new high-lift wings, more powerful turboprop, and enhanced avionics. STOL wings have four-section spoilers forward of double slotted flaps on each wing, P-301 wing section with 15 per cent thickness/chord ratio, no dihedral, 1° incidence

FLYING CONTROLS: As T-101, except for spoilers and double-slotted flaps and leading-edge slats

STRUCTURE: Generally as T-101

LANDING GEAR: Generally as T-101. Tailwheel tyre size 480 × 200 mm, hydraulic disc brakes and anti-skid units on mainwheels, floats and skis not currently optional

POWER PLANT: One P&WC PT6A-67K turboprop. One integral fuel tank in each wing, total capacity 1,400 litres (370 US gallons, 308 Imp gallons), overwing gravity fuelling. Oil capacity 60 litres (15.85 US gallons, 13.2 Imp gallons)

ACCOMMODATION: Crew of two and nine passengers standard; up to 12 passenger seats optional. Forward-opening door each side of flight deck, large upward-opening freight door aft of wing on port side, with integral inward-opening passenger door; starboard emergency exit. Up to 2,000 kg (4,409 lb) of cargo can be carried in lieu of passengers; maximum floor loading 400 kg/m² (82 lb/sq ft), cargo lashings in floor and sides of cabin. Baggage compartment and toilet aft of cabin. Accommodation heated (by engine bleed air) and ventilated

SYSTEMS: No details of hydraulic system. Electrical system 27 V DC, with 12 kW generator and 40 Ah batteries, main and emergency AC inverters for flight nav, radio nav/com and lighting systems. Oxygen system optional. Hot air airframe de-icing, using engine bleed air

AVIONICS: *Comms:* Com/nav and identification radios, transponder

Radar: Optional A-813 weather radar

Flight: ADF and radio altimeter, optional satellite nav

DIMENSIONS, EXTERNAL:

Wing span	19.90 m (65 ft 3½ in)
Wing chord (constant)	2.20 m (7 ft 2¾ in)
Length overall	15.10 m (49 ft 6[illegible] in)
Fuselage: Max width	1.80 m (5 ft 10¾ in)
Max height	2.52 m (8 ft 3¼ in)
Tailplane span	5.82 m (19 ft 1¼ in)
Wheel track	3.36 m (11 ft 0[illegible] in)
Wheelbase	8.25 m (27 ft 1 in)
Propeller diameter	3.60 m (11 ft 9¾ in)
Passenger door: Height, width	1.42 m (4 ft 8 in)
Cargo door: Height	1.80 m (5 ft 10¾ in)
Width	1.65 m (5 ft 5 in)
Passage between flight deck and cabin:	
Height	1.40 m (4 ft 7 in)
Width	0.50 m (1 ft 7½ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck, baggage compartment and toilet:	
Length	4.20 m (13 ft 9¼ in)
Max width	1.60 m (5 ft 3 in)
Max height	[illegible] m (5 ft [illegible] in)
Floor area	6.72 m² (72.3 sq ft)
Volume	12.10 m³ (427.3 cu ft)

AREAS:

Wings, gross	43.78 m² (471.25 sq ft)
Ailerons (total)	3.16 m² (34.02 sq ft)
Trailing-edge flaps (total)	9.24 m² (99.46 sq ft)
Spoilers (total)	3.72 m² (40.04 sq ft)
Fin (total)	3.37 m² (36.28 sq ft)
Rudder, incl tab	2.52 m² (27.13 sq ft)
Tailplane	6.16 m² (66.31 sq ft)
Elevators, incl tab	4.31 m² (46.40 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty	3,400 kg (7,495 lb)
Max fuel	1,100 kg (2,425 lb)
Max ramp, T-O and landing weight	5,700 kg (12,566 lb)
Max zero-fuel weight	5,400 kg (11,905 lb)
Max wing loading	130.20 kg/m² (26.66 lb/sq ft)
Max power loading	5.54 kg/kW (9.10 lb/shp)

PERFORMANCE (estimated):

Never-exceed speed	210 kts (390 km/h, 242 mph)
Max level speed at 4,000 m (13,125 ft)	175 kts (325 km/h, 202 mph)
Max cruising speed at 1,000 m (3,280 ft)	154 kts (285 km/h, 177 mph)
Econ cruising speed at 1,000 m (3,280 ft)	105 kts (195 km/h, 121 mph)
Stalling speed, at 1,000 m (3,280 ft), flaps up, engine off	61 kts (113 km/h, 71 mph)
at S/L, flaps down, engine off	57 kts (105 km/h, 66 mph)
Max rate of climb at S/L	420 m (1,380 ft)/min
Service ceiling	4,000 m (13,125 ft)
T-O run	295 m (970 ft)
T-O to 15 m (50 ft)	450 m (1,477 ft)
Landing from 15 m (50 ft)	600 m (1,970 ft)
Landing run	160 m (525 ft)
Range, 45 min reserve, at 3,000 m (9,850 ft):	
with max payload	97 n miles (180 km; 112 miles)
with max fuel	740 n miles (1,370 km, 850 miles)

UPDATED

AEROPROGRESS/ROKS-AERO T-203 PCHEL (BEE)

TYPE: Turboprop-powered heavy-duty agricultural aircraft

PROGRAMME: Design started May 1993; intended for AP-23 certification; prototypes under construction; first flight scheduled for October 1995

DESIGN FEATURES: Strut-braced low-wing monoplane; single aerofoil-section strut each side with jury strut. Fuselage, tail unit, landing gear and power plant generally as T-201 Aist. New all-metal two-spar high-lift wings, with full-span automatic slats; no wing sweep, wing section R-2-14, thickness/chord ratio 14 per cent, dihedral 3° from roots, incidence 3°

FLYING CONTROLS: Mechanically actuated ailerons, elevators and rudder, via cables and rods, automatic leading-edge slats, simple flaps. Electrically actuated trim tab in each elevator

STRUCTURE: All metal, primarily aluminium alloy

POWER PLANT: As T-201 Aist, except three fuel tanks in each wing, total capacity 1,200 litres (317 US gallons; 264 Imp gallons)

ACCOMMODATION: Normally pilot only; provision for mechanic or loader. Chemical tank, capacity 2,200 litres (581 US gallons, 484 Imp gallons), in mid-fuselage; spraybars under wings. Some cargo can be carried with empty tank in place. Flight deck hermetically sealed from chemical tank. Jettisonable flight deck doors

SYSTEMS: As T-201 Aist, except oxygen system standard. Protective items include deflector cable from top of flight deck to fin tip

DIMENSIONS, EXTERNAL:

As for T-201 Aist, except

Wing chord (constant, slight increase over ailerons)	2.40 m (7 ft 10½ in)

DIMENSIONS, INTERNAL: As for T-201 Aist

AREAS (Tail unit as for T-201 Aist):

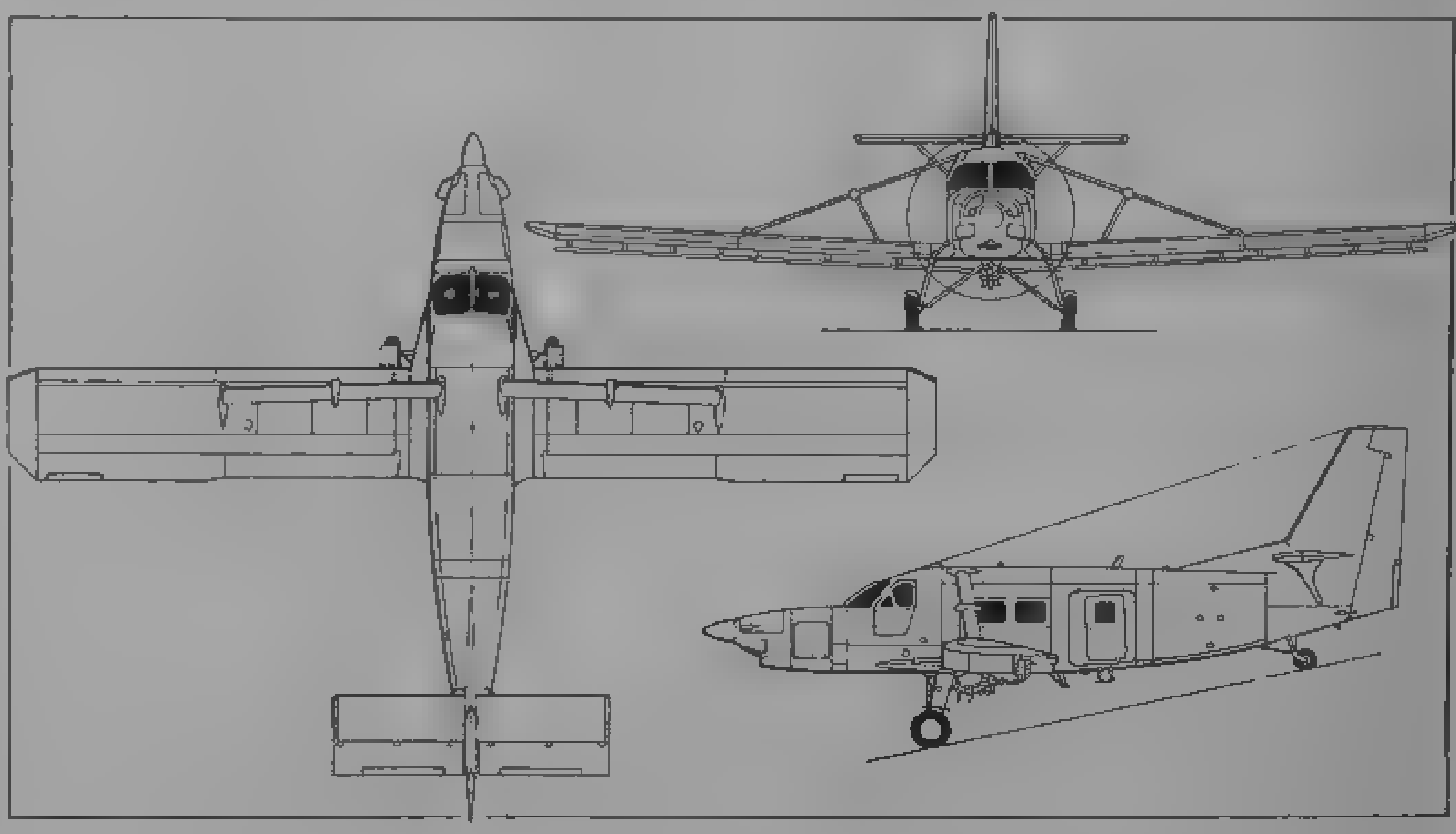
Wings, gross	47.67 m² (513.13 sq ft)
Ailerons (total)	5.66 m² (60.93 sq ft)
Trailing-edge flaps (total)	4.09 m² (44.03 sq ft)
Leading-edge slats (total)	4.90 m² (52.75 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	3,370 kg (7,430 lb)
Max payload	2,300 kg (5,070 lb)
Max fuel	900 kg (1,985 lb)
Max ramp, T-O and landing weight	5,700 kg (12,566 lb)
Max zero-fuel weight	5,400 kg (11,905 lb)
Max wing loading	119.5 kg/m² (24.49 lb/sq ft)
Max power loading	5.54 kg/kW (9.11 lb/shp)

PERFORMANCE (estimated, at 5,300 kg; 11,685 lb T-O weight):

Never-exceed speed	205 kts (380 km/h, 236 mph)
Max level speed at 4,000 m (13,125 ft)	170 kts (315 km/h; 195 mph)
Max cruising speed at 1,000 m (3,280 ft)	148 kts (275 km/h, 171 mph)
Econ cruising speed at 1,000 m (3,280 ft)	129 kts (240 km/h, 149 mph)
Agricultural spraying speed	81-108 kts (150-200 km/h, 94-124 mph)
Stalling speed, at 1,000 m (3,280 ft), flaps up, engine off	61 kts (113 km/h, 71 mph)
at S/L, flaps down, engine off	59 kts (108 km/h, 67 mph)
Max rate of climb at S/L	420 m (1,378 ft)/min
Service ceiling	4,000 m (13,125 ft)



Aeroprogress/ROKS-Aero T-203 Pchel heavy-duty agricultural aircraft *(Jane's/Mike Keep)*

1994

T O run	295 m (968 ft)
T O to 15 m (50 ft)	450 m (1,477 ft)
Landing from 15 m (50 ft)	600 m (1,970 ft)
Landing run	160 m (525 ft)
Range at 3,000 m (9,840 ft), 45 min reserve:	
with max payload	97 n miles (180 km, 112 miles)
with max fuel	739 n miles (1,370 km, 851 miles)

UPDATED

AEROPROGRESS/ROKS-AERO T-204 GRIFFON

TYPE: Twin-engined STOL transport and utility aircraft

PROGRAMME: Design started 1993

DESIGN FEATURES: Configuration reminiscent of Dornier 128-6 of 1980s (see three-view drawing), but larger and with retractable landing gear. Cantilever high-lift wings, R-P-14 wing section, thickness/chord ratio 14 per cent; no dihedral, incidence 3°

LANDING GEAR: Retractable tailwheel type: twin wheels on main units, which retract rearward into engine nacelles

POWER PLANT: Two 559 kW (750 shp) P&WC PT6A 34AC turboprops, each driving a five-blade constant-speed propeller. Fuel capacity 1,200 litres (317 US gallons, 264 Imp gallons)

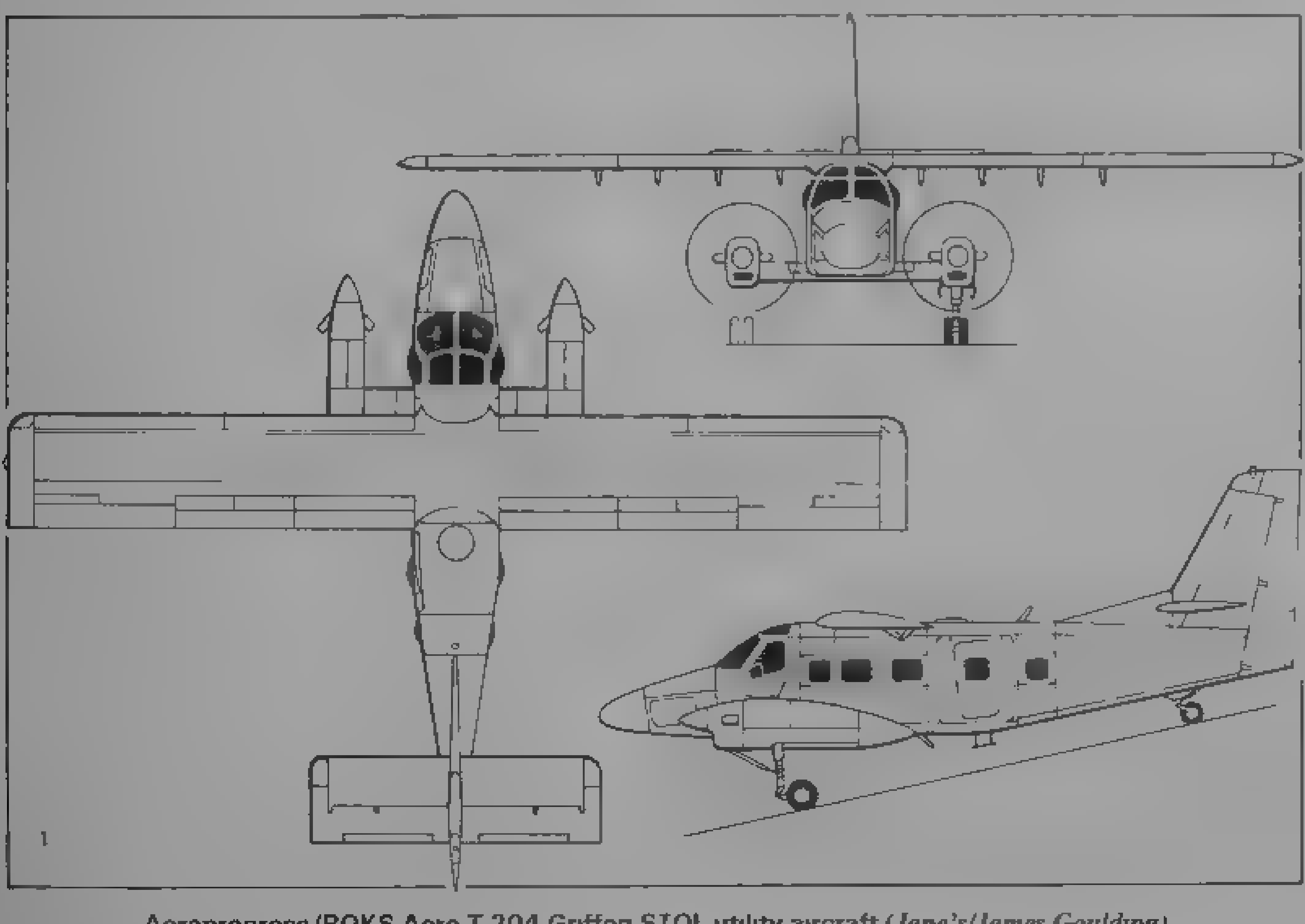
ACCOMMODATION: Two crew side by side on flight deck, standard seats for nine passengers; maximum 12; large freight door, with inset passenger door, on port side of cabin; provision for 1,300 kg (2,865 lb) freight with seats removed. Baggage compartment in nose

SYSTEMS: Electrical system 27 V DC, with 40 Ah battery

DIMENSIONS, EXTERNAL:	
Wing span	18.20 m (59 ft 8½ in)
Wing chord (constant)	2.40 m (7 ft 10½ in)
Length overall	13.65 m (44 ft 9½ in)
Fuselage: Width	1.80 m (5 ft 10¾ in)
Depth	2.52 m (8 ft 3 in)
Height overall	4.76 m (15 ft 7 in)
Tailplane span	5.82 m (19 ft 1¼ in)
Wheel track	4.40 m (14 ft 5¼ in)
Wheelbase	8.24 m (27 ft 0½ in)
Propeller diameter	2.30 m (7 ft 6½ in)
Propeller ground clearance	1.06 m (3 ft 5¾ in)
Distance between propeller centres	4.40 m (14 ft 5¼ in)
Cargo door: Height	1.80 m (5 ft 10¾ in)
Width	1.65 m (5 ft 5 in)
Inset passenger door: Height	1.42 m (4 ft 8 in)
Width	0.81 m (2 ft 8 in)
DIMENSIONS, INTERNAL:	
Cabin: Length excl flight deck	4.20 m (13 ft 9¼ in)
Width	1.60 m (5 ft 3 in)
Height	1.80 m (5 ft 10¾ in)
Floor area	6.72 m² (72.3 sq ft)
Volume	12.10 m³ (427.3 cu ft)
AREAS:	
Wings, gross	43.63 m² (469.65 sq ft)
Ailerons (total)	2.91 m² (31.32 sq ft)
Trailing-edge flaps (total)	7.52 m² (80.95 sq ft)
Leading-edge slats (total)	4.91 m² (52.85 sq ft)
Spoilers (total)	2.93 m² (31.54 sq ft)
Fin, incl dorsal fin	3.37 m² (36.28 sq ft)
Rudder	2.52 m² (27.13 sq ft)
Tailplane	6.16 m² (66.31 sq ft)
Elevators (total)	4.31 m² (46.40 sq ft)
WEIGHTS AND LOADINGS:	
Max operating weight, empty	3,600 kg (7,936 lb)
Max payload	1,300 kg (2,865 lb)
Max fuel	1,100 kg (2,425 lb)
Max ramp, T-O and landing weight	5,740 kg (12,655 lb)
Max zero-fuel weight	4,640 kg (10,230 lb)
Max wing loading	131.6 kg/m² (26.94 lb/sq ft)
Max power loading	5.13 kg/kW (8.44 lb/shp)
PERFORMANCE (estimated at 5,500 kg; 12,125 lb T-O weight):	
Never-exceed speed at 3,000 m (9,840 ft)	190 kts (352 km/h, 218 mph)
Max cruising speed at 3,000 m (9,840 ft)	172 kts (320 km/h, 199 mph)
Service ceiling	6,000 m (19,685 ft)
T-O to 15 m (50 ft)	450 m (1,475 ft)
Landing from 15 m (50 ft)	700 m (2,300 ft)
Landing run	260 m (855 ft)
Range at 3,000 m (9,840 ft), 45 min reserve:	
with max payload	205 n miles (380 km, 236 miles)
with max fuel and 940 kg (2,072 lb) payload	415 n miles (770 km, 478 miles)

NEW ENTRY

Model of Aeroprogress/ROKS Aero T-205 turboprop-powered multirole transport *1995*



Aeroprogress/ROKS-Aero T-204 Griffon STOL utility aircraft (*Jane's/James Goulding*) *1995*

AEROPROGRESS/ROKS-AERO T-205

TYPE: Turboprop-powered, light multirole transport

PROGRAMME: Airframe embodies maximum practicable commonality with that of T-101 Grach, major changes include tricycle landing gear, lengthened fuselage forward of wings, and different power plant. Options include hinging to starboard of entire rear fuselage aft of upward-hinged freight door, or loading ramp in bottom of standard rear fuselage, to provide direct access to hold, and float landing gear

POWER PLANT: One P&WC PT6A-67K turboprop; Hartzell five-blade constant-speed propeller; or Saturn AL-34 turboprop

ACCOMMODATION: One or two persons side by side on flight deck, nine to 15 passengers in pairs, or equivalent freight or combi payload, in main cabin. Freight door, with inset passenger door, at rear of cabin on port side, with removable steps, forward hinged door each side of flight deck. Optional front-hinged ramp/door forming bottom of rear fuselage

AVIONICS: *Comms*: AlliedSignal KX 155 09 radio

WEIGHTS AND LOADINGS:	
Max payload	1,600 kg (3,527 lb)
Max fuel	1,100 kg (2,425 lb)
Max T-O weight	5,700 kg (12,566 lb)
PERFORMANCE (estimated):	
Max level speed at 3,000 m (9,840 ft)	183 kts (340 km/h; 211 mph)
Nominal cruising speed at 3,000 m (9,840 ft)	165 kts (305 km/h, 190 mph)
Stalling speed	52 kts (95 km/h, 59 mph)
Service ceiling	4,000 m (13,125 ft)
T-O run	330 m (1,085 ft)
Landing run	295 m (970 ft)
Balanced field length	600 m (1,970 ft)
Range:	
with max payload	215 n miles (400 km, 248 miles)
with max fuel	701 n miles (1,300 km, 807 miles)

NEW ENTRY

AEROPROGRESS/ROKS-AERO T-274 TITAN

TYPE: Four-turboprop STOL transport

PROGRAMME: Announced early 1994; prototypes under construction, first flight scheduled for 1996, manufacture of civil and military versions planned at Polyot plant, Omsk, in co-operation with Khrunichev plant. Major production anticipated

DESIGN FEATURES: High-wing monoplane, constant-chord centre-section without dihedral or anhedral, approximately 10° anhedral and 17° sweepback on outer panels, with winglets. Fuselage of circular section, upswept rear fuselage, with undersurface formed by ramp/door that can hinge downward conventionally or slide forward under cabin to permit direct loading from truck, one-piece bottom section of 'beaver tail' drops and moves backward slightly to release ramp. Wide-chord sweptback vertical tail surfaces with T tailplane

FLYING CONTROLS: Hydraulically actuated ailerons, variable incidence tailplane, leading-edge and triple-slotted trailing-edge flaps; double-hinged rudder; four section spoilers forward of flaps on each wing. Rudder tab in lower portion of two-section aft panel, tab in port aileron, two tabs in each elevator

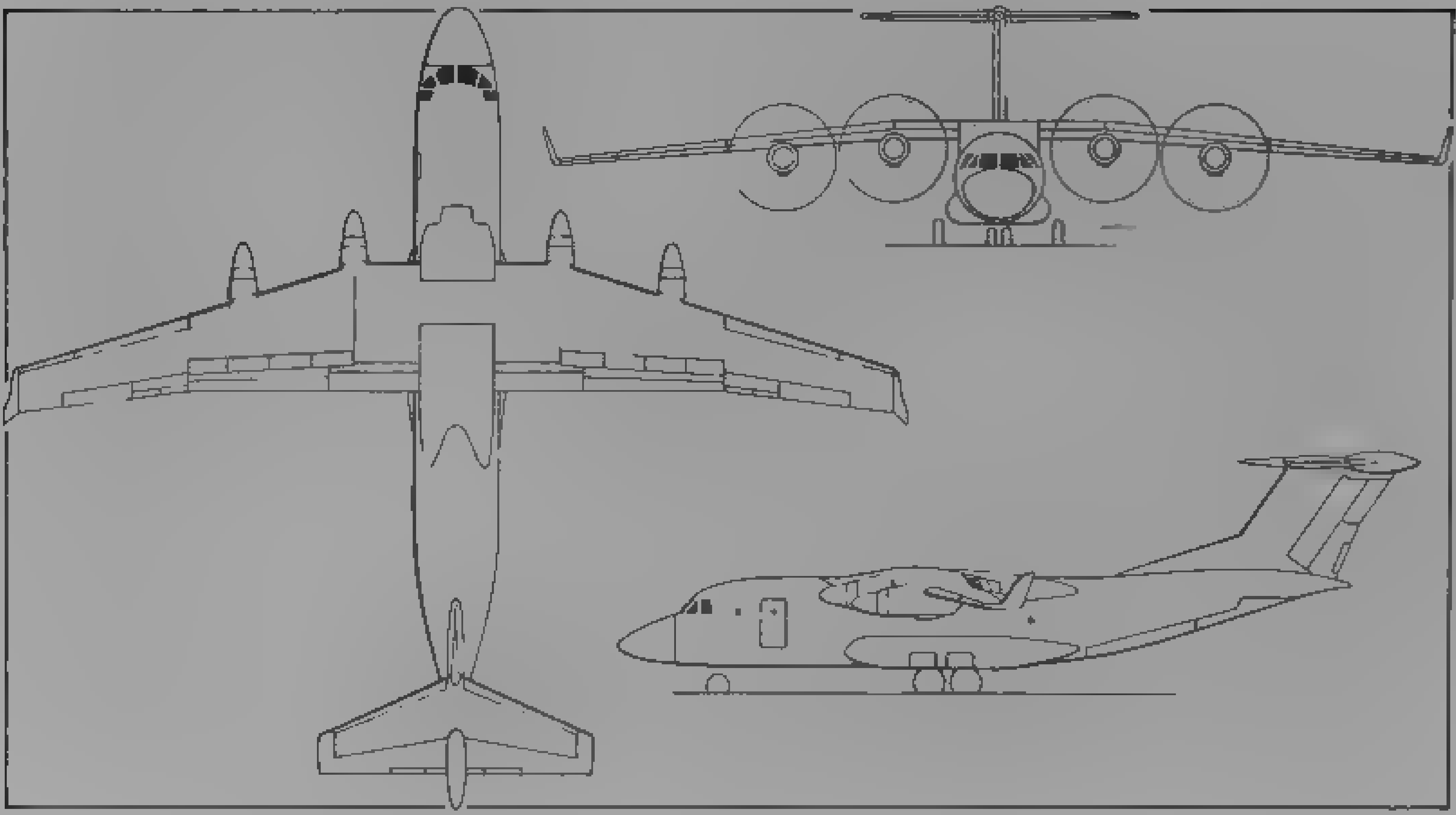
STRUCTURE: All-metal multispar wings, conventional semi-monocoque fuselage

LANDING GEAR: Hydraulically retractable tricycle type, twin wheels on rearward-retracting steerable nose unit, each main unit has two trailing link legs in tandem, each with single wheel retracting inward through 90° so that wheels lie horizontally in bottom of large fairings, outside fuselage pressure cell. Oleo-pneumatic shock-absorbers. Low pressure tyres, size 720 × 310 mm on nosewheels, 1 050 × 400 mm on mainwheels. Hydraulic disc brakes

POWER PLANT: Four Klimov TV7 117 turboprops, each driving six-blade propeller with spinner. Interspar integral fuel tanks in outer wings

ACCOMMODATION: Two crew on flight deck; payloads include containers up to 1.9 × 2.44 × 1.46 m (6 ft 3 in × 8 ft × 4 ft 9½ in), loaded with aid of mobile winch, capacity 2,500 kg (5,511 lb). Door on port side at front of cabin, emergency exit and servicing door at rear on starboard side, hydraulically actuated rear-loading ramp/door. All accommodation pressurised and air conditioned

SYSTEMS: Air conditioning system maintains comfortable environment to 10,000 m (32,800 ft), independent temperature control on flight deck and in main cabin. Electrical system powers auxiliary systems, flight deck equipment, lighting and mobile winch. Hot air de-icing system for leading-edges of wings and tail unit, engine air intakes and



Aeroprogress/ROKS-Aero T-274 Titan four-turboprop STOL transport ***(Jane's/Mike Keep)***

1994

flight deck windows. Provision for APU in starboard landing gear fairing.

AVIONICS: *Comms*: HF com and VHF com/nav.

Radar: Nav/weather radar in nose.

Flight: Doppler-based automatic nav system, with map display. ADF.

DIMENSIONS, EXTERNAL:

Wing span	31.89 m (104 ft 7½ in)
Length overall	28.07 m (92 ft 1¼ in)
Fuselage diameter	3.10 m (10 ft 2 in)
Height overall	8.65 m (28 ft 4½ in)
Wheel track	4.15 m (13 ft 7½ in)
Wheelbase	8.12 m (26 ft 7¾ in)
Propeller diameter	3.60 m (11 ft 9¾ in)
Rear-loading door: Length	7.10 m (23 ft 3½ in)
Width	2.40 m (7 ft 10½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	10.50 m (34 ft 5 in)
Width at floor level	2.15 m (7 ft 0½ in)
Height	2.20 m (7 ft 2½ in)

AREAS:

Wings, gross	98.62 m² (1,062 sq ft)

WEIGHTS AND LOADINGS:

Max payload	13,000 kg (28,660 lb)
Max ramp weight	36,500 kg (80,465 lb)
Max T-O weight	36,000 kg (79,365 lb)
Max wing loading	365.0 kg/m² (74.73 lb/sq ft)

PERFORMANCE (estimated):

Max level speed at 6,000 m (19,685 ft)	340 kts (630 km/h; 391 mph)
Nominal cruising speed at 8,000 m (26,250 ft)	323 kts (600 km/h; 372 mph)
Service ceiling	9,300 m (30,500 ft)
T-O run	750 m (2,460 ft)
FAA T-O field length	1,250 m (4,100 ft)
FAA landing field length	1,150 m (3,775 ft)
Range, 60 min reserves: with max payload	485 n miles (900 km; 560 miles)
with max fuel	3,560 n miles (6,600 km; 4,100 miles)

UPDATED

AEROPROGRESS/ROKS-AERO T-401 SOKOL (FALCON)

TYPE: Single-engined light multipurpose aircraft.

CURRENT VERSIONS: Designed for passenger/freight transport, ambulance, offshore patrol, primary training and agricultural applications.

PROGRAMME: Project design started 1990; detail design, with piston engine, under way 1993; alternative turboprop engine being studied January 1995, to meet request of most potential customers for operation on kerosene fuel. First flight scheduled for October 1995.

CUSTOMERS: Initial requirement 200 aircraft.

DESIGN FEATURES: Conventional cantilever high-wing monoplane, sweptback vertical tail surfaces, non-retractable tricycle landing gear, with fairing over each wheel; wing section MS (1)-3M, dihedral 1° 30', incidence 2°. Small auxiliary fin on each side of tailplane on floatplane version.

FLYING CONTROLS: Conventional three-axis mechanical control. Trim tabs in port elevator and rudder. Large flap and aileron occupy full span of each wing trailing-edge.

STRUCTURE: All metal. Conventional two-spar wing; square-section semi-monocoque fuselage.

LANDING GEAR: Non-retractable tricycle type, single wheel on each unit; mainwheel tyres size 500 × 150 mm, nosewheel tyre size 400 × 150 mm. Minimum ground turning radius 4 m (13 ft 1½ in). Maximum steering angle of nosewheel ±40°. Optional floats and skis.

POWER PLANT: One 265 kW (355 hp) VOKBM M-14PR nine-cylinder air-cooled radial engine; alternatives include a Textron Lycoming piston engine; V530TA-D35 three-blade constant-speed propeller. Turboprop alternative, probably Allison 250-B17C, under consideration early 1995. Fuel capacity 350 litres (92.5 US gallons; 77 Imp gallons).

ACCOMMODATION: Six persons in pairs, including one or two pilots in basic version. All passenger seats removable for freight carrying. Ambulance version carries one stretcher patient, one or two medical attendants, and medical equipment including optionally An-8 narcosis apparatus, KI-4 oxygen supply or Voga MT automatic respirator, Ambu manual breathing apparatus, Salut electrocardiographic equipment and EKSN electrocardiostimulator. Provision for photographic and video equipment, PZS-68 public address system and various workstations. Forward-hinged door each side of front seats, large forward-hinged door on port side at rear of cabin.

DIMENSIONS, EXTERNAL:

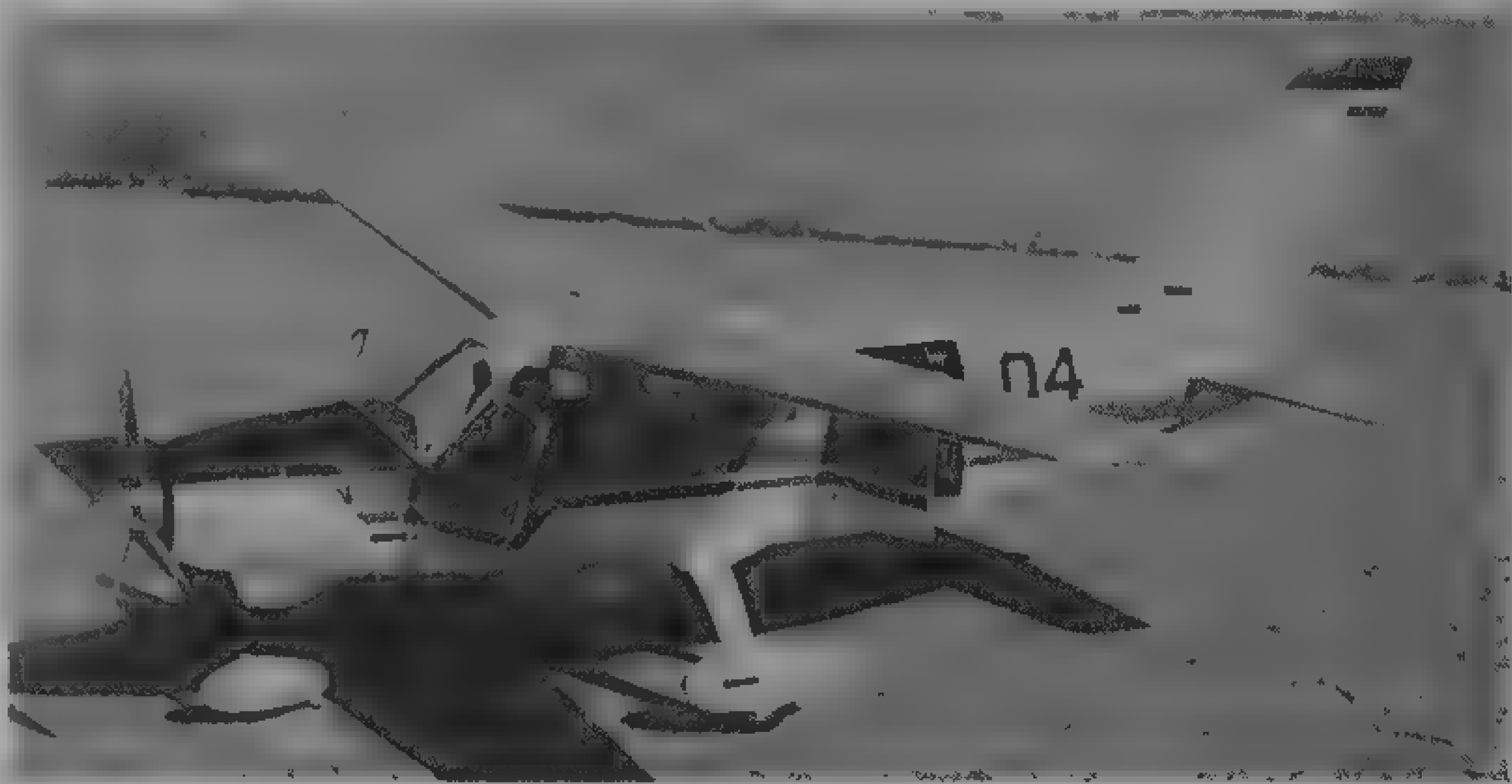
Wing span	13.66 m (44 ft 9¾ in)
Wing chord: at centreline	1.88 m (6 ft 2 in)
at wingtip	1.05 m (3 ft 5¼ in)
Wing aspect ratio	9.33
Length overall	8.90 m (29 ft 2½ in)
Fuselage: Max width	1.50 m (4 ft 11 in)
Max height	1.65 m (5 ft 5 in)
Height overall	4.39 m (14 ft 4¾ in)
Tailplane span	5.10 m (16 ft 9 in)
Wheel track	3.30 m (10 ft 10 in)
Wheelbase	2.67 m (8 ft 9¼ in)
Propeller diameter	2.40 m (7 ft 10½ in)
Propeller ground clearance	0.34 m (1 ft 1½ in)
Flight deck door (each side): Height	1.10 m (3 ft 7¼ in)
Width at top	0.47 m (1 ft 6½ in)
Width at bottom	0.78 m (2 ft 6½ in)
Cabin door: Height	1.18 m (3 ft 10½ in)
Width	1.02 m (3 ft 4 in)

DIMENSIONS, INTERNAL:

Cabin, incl flight deck: Length	4.41 m (14 ft 5½ in)
Max width	1.34 m (4 ft 4¾ in)
Max height	1.25 m (4 ft 1¼ in)
Floor area	4.94 m² (53.2 sq ft)
Volume	6.175 m³ (218 cu ft)
Baggage space, passenger version	1.0 m³ (35 cu ft)
Volume of hold, freighter	4.76 m³ (168 cu ft)

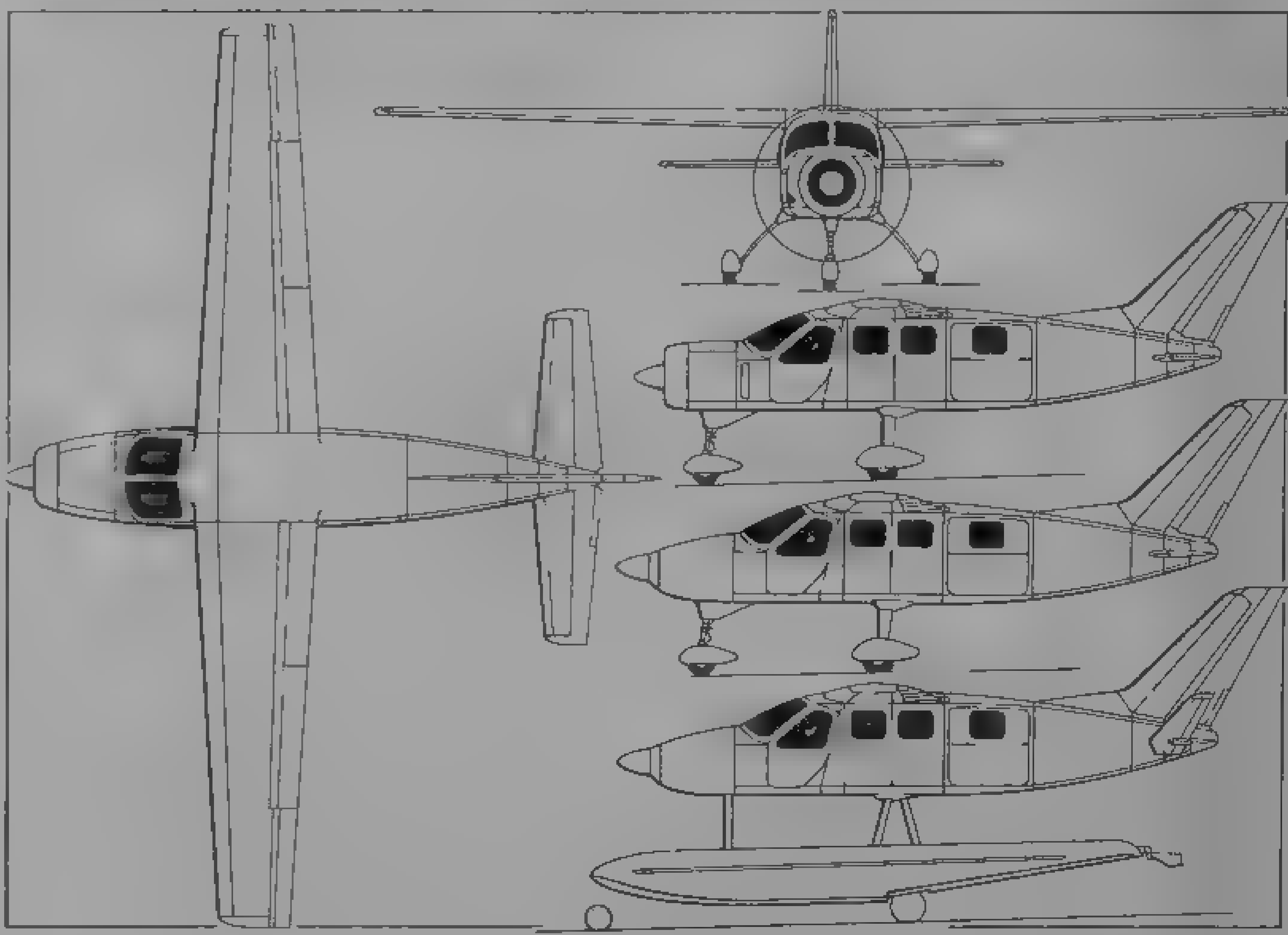
AREAS:

Wings, gross	20.00 m² (215.3 sq ft)
Ailerons (total)	1.142 m² (12.29 sq ft)



Model of Aeroprogress/ROKS-Aero T-401 Sokol with M-14PR engine

1995



Aeroprogress/ROKS-Aero T-401 Sokol light multipurpose aircraft, with additional side views showing versions with Textron Lycoming piston engine and float landing gear ***(Jane's/Mike Keep)***

1993

Trailing-edge flaps (total)	4.345 m² (46.77 sq ft)
Fin, incl dorsal fin	2.33 m² (25.08 sq ft)
Rudder	1.24 m² (13.35 sq ft)
Tailplane	2.48 m² (26.68 sq ft)
Elevators (total)	1.856 m² (19.98 sq ft)
WEIGHTS AND LOADINGS (M-14PR engine):	
Weight empty, equipped	1,430 kg (3,153 lb)
Max payload	450 kg (992 lb)
Max fuel	320 kg (705 lb)
Max T-O and landing weight	2,030 kg (4,475 lb)
Max wing loading	101.5 kg/m² (20.50 lb/sq ft)
Max power loading	7.66 kg/kW (12.6 lb/hp)
PERFORMANCE (estimated, with M-14PR engine):	
Max level speed at 3,000 m (9,840 ft)	156 kts (290 km/h; 180 mph)
Max cruising speed at 3,000 m (9,840 ft)	145 kts (270 km/h; 167 mph)
Econ cruising speed at 3,000 m (9,840 ft)	116 kts (215 km/h; 134 mph)
Stalling speed, flaps down	68 kts (125 km/h; 78 mph)
Max rate of climb at S/L	260 m (855 ft)/min
Service ceiling	4,000 m (13,125 ft)
T-O run	255 m (837 ft)
T-O to 15 m (50 ft)	430 m (1,410 ft)
Landing from 15 m (50 ft)	545 m (1,790 ft)
Landing run	233 m (765 ft)
Range: with max payload, 30 min reserves	420 n miles (780 km; 485 miles)
with max fuel	880 n miles (1,630 km; 1,012 miles)

UPDATED

AEROPROGRESS/ROKS AERO T-407 SKBORETS (STARLING)

TYPE: Single-engined light multipurpose aircraft.

PROGRAMME: Design began early 1993, full-scale mockup of M-14P version exhibited MosAeroshow '93; prototype being constructed at Khrunichev plant, for July 1995 first flight. Teledyne Continental piston engine and Allison turboprop to be installed in prototypes.

DESIGN FEATURES: Conventional strut-braced high-wing monoplane of extremely simple design; constant-chord wings and tailplane, unswept vertical tail surfaces, square section fuselage. Wing section P-II, dihedral 1° 30', incidence 2°.

FLYING CONTROLS: Conventional mechanical control. Slotted aileron and slotted flap on full span of each wing trailing edge. Horn balanced elevators and rudder. Trim tab in starboard tailplane.

STRUCTURE: All-metal, with steel-tube engine mounting and rear fuselage truss structure.

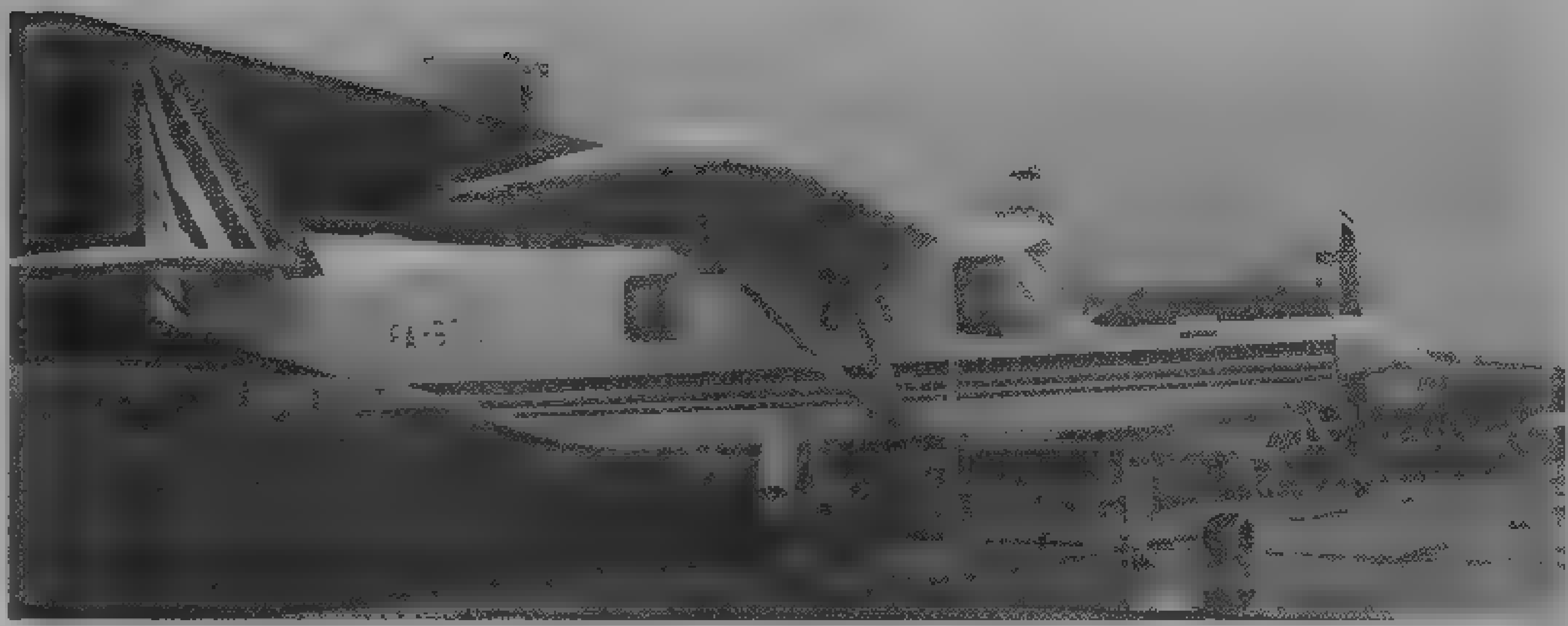
LANDING GEAR: Non-retractable tricycle type; single wheel on each unit. Each mainwheel on tripod mounting, with oleo-pneumatic shock-absorber. Mainwheel tyres size 500 × 150 mm, nosewheel tyre size 400 × 150 mm.

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial piston engine; V530TA-D35 three-blade propeller. Alternative Teledyne Continental piston engine and Allison turboprop. Fuel tanks in inner wings, capacity 380 litres (100 US gallons, 83.5 Imp gallons).

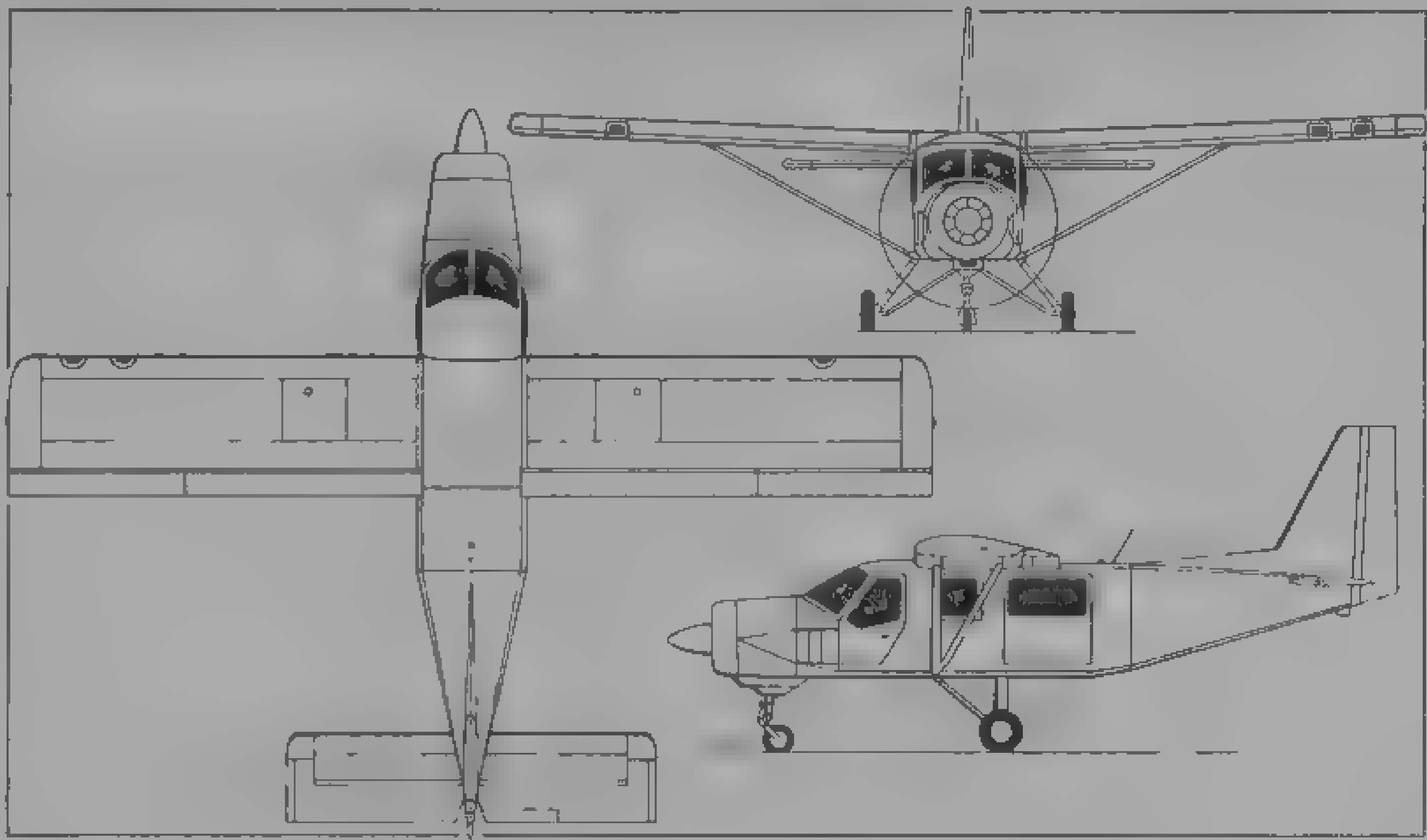
ACCOMMODATION: Basic seating for one or two persons on flight deck, up to five in cabin on two rearward-facing seats and rear bench seat. Baggage space behind rear seats. Alternative cabin configurations for freight carrying, ambulance, agricultural, offshore patrol and other utility duties. Forward-opening door each side of flight deck. Large horizontally divided two-piece door at rear of cabin, port side.

DIMENSIONS, EXTERNAL:	
Wing span	12.12 m (39 ft 9¼ in)
Wing chord (constant)	2.00 m (6 ft 6¾ in)
Wing aspect ratio	5.84
Length overall	10.00 m (32 ft 9¾ in)
Height overall	4.40 m (14 ft 5¼ in)
Wheel track	2.72 m (8 ft 11 in)
Wheelbase	3.05 m (10 ft 0 in)
DIMENSIONS, INTERNAL:	
Cabin, excl flight deck: Length	2.60 m (8 ft 6¼ in)
Max width	1.34 m (4 ft 4¾ in)
Max height	1.30 m (4 ft 3 in)
Volume	4.50 m³ (159 cu ft)
AREAS:	
Wings, gross	25.14 m² (270.6 sq ft)
Ailerons (total)	2.43 m² (26.16 sq ft)
Trailing-edge flaps (total)	3.10 m² (33.37 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,250 kg (2,755 lb)
Max fuel	300 kg (661 lb)
Fuel with max payload	150 kg (331 lb)
Max payload	600 kg (1,322 lb)
Payload with max fuel	450 kg (992 lb)
Max T-O weight	2,080 kg (4,585 lb)
Max wing loading	82.74 kg/m² (16.94 lb/sq ft)
Max power loading	7.85 kg/kW (12.91 lb/hp)
PERFORMANCE (estimated):	
Max cruising speed	116 kts (215 km/h; 133 mph)
Nominal cruising height	2,000 m (6,560 ft)
T-O run	480 m (1,575 ft)
T-O to 15 m (50 ft)	600 m (1,970 ft)
Landing from 15 m (50 ft)	410 m (1,345 ft)
Landing run	290 m (952 ft)
Range, 45 min reserves:	
with max payload	410 n miles (760 km; 472 miles)
with max fuel	960 n miles (1,780 km; 1,105 miles)

UPDATED



Full-scale mockup of Aeroprogress/ROKS-Aero T-407 light multipurpose aircraft with M-14P engine *(Mike Jerram)* *1994*



Aeroprogress/ROKS-Aero T-407 (M-14P radial piston engine) *(Jane's/Mike Keep)* *1993*

AEROPROGRESS/ROKS-AERO T-411 AIST-2 (STORK-2)

TYPE: Four-seat multipurpose light aircraft with STOL capability.

PROGRAMME: Design started November 1992, construction of prototype began April 1993, first flight 10 November 1993 in standard form, 15 March 1994 with ski landing gear, 250 flying hours by beginning of 1995, programme bought by Khrunichev plant, series production started November 1994.

DESIGN FEATURES: Conventional strut-braced high-wing monoplane. Constant-chord unswept wings with fixed leading-edge slat, slotted ailerons and single-slotted trailing-edge flaps, wing section NACA 23011, dihedral 2° from root, incidence 3° 30', V bracing struts. Rectangular-section fuselage. Unswept tail unit with dorsal fin, constant chord horizontal tail surfaces.

FLYING CONTROLS: Mechanically actuated ailerons, elevators and rudder, via cables and rods, electrically controlled trim tab in each elevator; fixed full-span leading-edge slats, slotted flaps. Optional autopilot.

STRUCTURE: Primary structure of aluminium alloy and alloy steel, part covered with high strength synthetic fabric. Two-spar wings, fabric covered between spars except for metal skin over fuel tanks at root. Metal tail unit structure, fabric covered.

LANDING GEAR: Non-retractable tailwheel type; single wheel on each unit with fairings on mainwheels. Side V and half-axle mainwheel legs; castoring tailwheel. Tyres size 500 × 150 mm on mainwheels, 300 × 135 mm on tailwheel. Pneumatic brakes on mainwheels. Optional skis.

Aeroprogress/ROKS-Aero T-411 Aist-2 (VOKBM M-14P air-cooled radial engine) *1994*

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial engine, driving V-530-TA-D35 two-blade variable-pitch propeller. Fuel in two wingroot tanks, total capacity 200 litres (53 US gallons, 44 Imp gallons), gravity fuelling. Oil capacity 25 litres (6.6 US gallons, 5.5 Imp gallons).

ACCOMMODATION: Pilot and three passengers in pairs, or pilot, one stretcher patient, one seated casualty and medical attendant. Alternative configurations for primary training, cargo/passenger, agricultural, patrol, aerial photography, ecological monitoring and glider towing missions. Baggage compartment aft of cabin, with large upward-opening door on port side, used also for loading freight or stretcher. Forward-hinged jettisonable door on each side of cabin. Cabin heated with air flow from oil radiator.

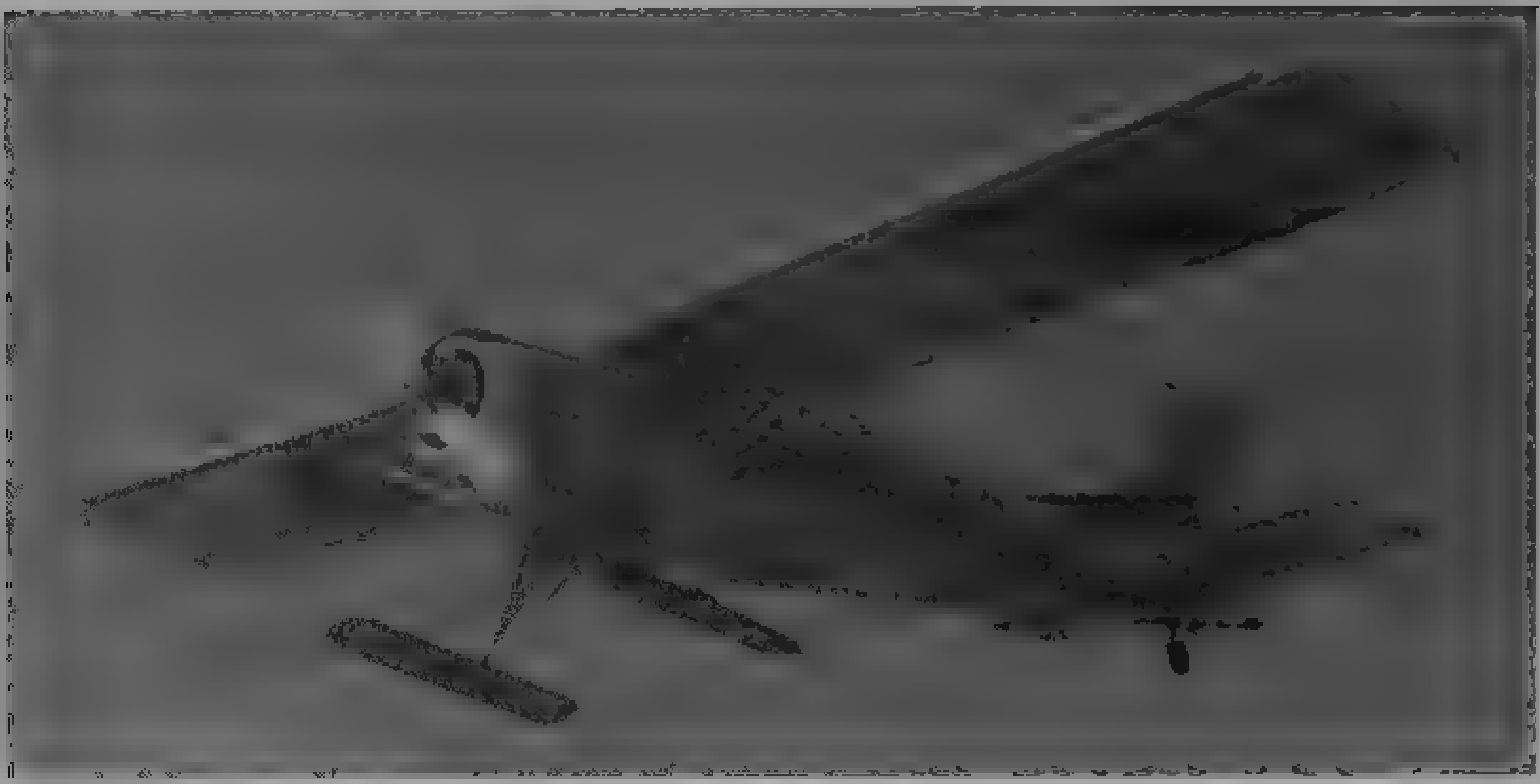
SYSTEMS: No hydraulics. Main and emergency pneumatic systems, main system for engine starting, flap control and wheel brakes, emergency system for wheel brakes and to extend flaps 20°; system pressure 50 bars (735 lb/sq in). GSR 3000M electrical generator supplies 27 V DC, PTS 250BM inverter supplies 115/200 V AC at 400 Hz, 12SAM-28 battery.

AVIONICS: *Comms:* Briz-1 com radio, R-855A1 emergency radio.

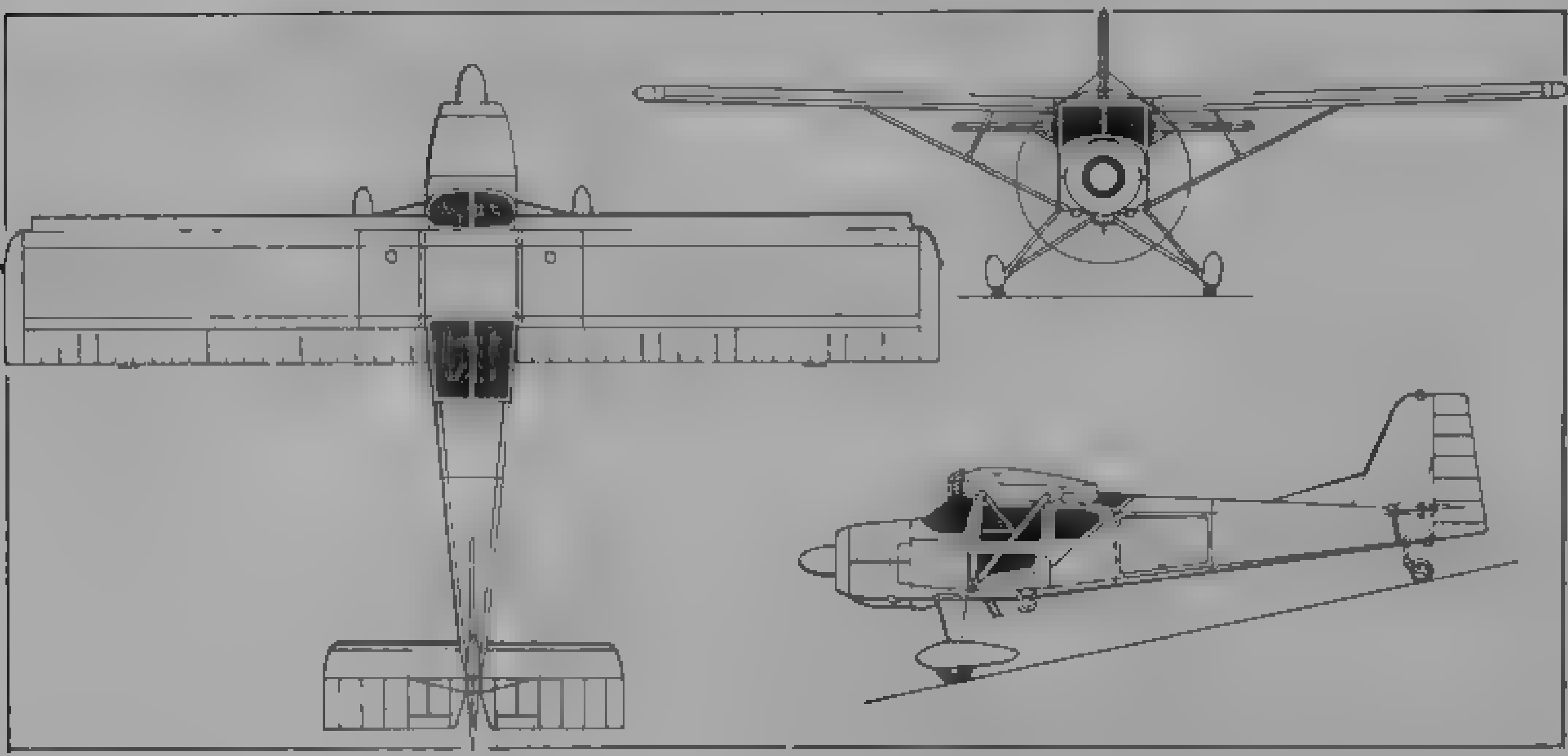
Flight: Greben-1 directional system, ARK-25 ADF, marker radio receiver; satellite nav system.

Instrumentation: IFR, includes AGB-96R gyro horizon and INP R nav indicator.

DIMENSIONS, EXTERNAL:	
Wing span	12.60 m (41 ft 4 in)
Wing chord (constant)	1.91 m (6 ft 3¼ in)
Length overall	9.36 m (30 ft 8½ in)
Fuselage: Max width	1.23 m (4 ft 0½ in)
Max depth	1.59 m (5 ft 2½ in)
Height overall	2.56 m (8 ft 4¾ in)
Tailplane span	4.03 m (13 ft 2¾ in)
Wheel track	3.00 m (9 ft 10¼ in)
Wheelbase	6.48 m (21 ft 3 in)
Propeller diameter	2.40 m (7 ft 10½ in)
Propeller ground clearance	0.78 m (2 ft 6¾ in)
Cabin doors (each): Height	1.02 m (3 ft 4¼ in)
Width	0.96 m (3 ft 1¾ in)
Baggage door: Max height	0.80 m (2 ft 7½ in)
Width	1.20 m (3 ft 11¼ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	1.60 m (5 ft 3 in)



Aeroprogress/ROKS-Aero T-411 with skis *1995*



Aeroprogress/ROKS-Aero T-411 Aist-2 four-seat multipurpose light aircraft (*Jane's/Mike Keep*) *1994*

Max width	1.15 m (3 ft 9¼ in)
Max height	1.25 m (4 ft 1¼ in)
Floor area	1.26 m² (13.56 sq ft)
Volume	2.52 m³ (89.00 cu ft)
Baggage hold: Floor area	1.05 m² (11.30 sq ft)
Volume	0.95 m³ (33.5 cu ft)
Freight hold (Cargo variant, rear seats removed):	
Floor area	2.04 m² (21.96 sq ft)
Volume	1.63 m³ (57.56 cu ft)
AREAS:	
Wings, gross	24.05 m² (258.9 sq ft)
Ailerons (total)	2.36 m² (25.40 sq ft)
Trailing-edge flaps (total)	2.82 m² (30.36 sq ft)
Leading-edge slats (total)	2.29 m² (24.65 sq ft)
Fin, incl dorsal fin	0.99 m² (10.65 sq ft)
Rudder	1.08 m² (11.63 sq ft)
Tailplane	2.04 m² (21.96 sq ft)
Elevators (total)	2.80 m² (30.14 sq ft)
WEIGHTS AND LOADINGS:	
Operating weight empty	1,100 kg (2,425 lb)
Max payload	363 kg (800 lb)
Max fuel	150 kg (330 lb)
Max T-O and landing weight	1,600 kg (3,527 lb)
Max zero-fuel weight	1,450 kg (3,197 lb)
Max wing loading	66.53 kg/m² (13.62 lb/sq ft)
Max power loading	6.04 kg/kW (9.94 lb/hp)
PERFORMANCE:	
Max level speed and max cruising speed at 500 m (1,640 ft)	105 kts (195 km/h; 121 mph)
Econ cruising speed at 500 m (1,640 ft)	71 kts (132 km/h; 82 mph)
Stalling speed	38 kts (70 km/h; 44 mph)
Max rate of climb at S/L	300 m (985 ft)/min
Service ceiling	3,000 m (9,850 ft)
T-O run	105 m (345 ft)
T-O to 15 m (50 ft)	252 m (827 ft)
Landing from 15 m (50 ft)	290 m (952 ft)
Landing run	122 m (400 ft)
Range, no reserve:	
with max payload	270 n miles (500 km; 310 miles)
with max fuel	442 n miles (820 km; 510 miles)

UPDATED

AEROPROGRESS/ROKS-AERO T-433 FLAMINGO

TYPE: Single-engined light multipurpose amphibian.

PROGRAMME: Design started May 1991, initially with M-14P piston engine, prototype with Allison turboprop scheduled to fly mid-1995.

CURRENT VERSIONS: Passenger/cargo transport; civil variants for economic zone patrol and fish survey, search and rescue, ecology monitoring and training, military patrol and reconnaissance.

DESIGN FEATURES: Conventional light amphibian, with boat hull, mid-mounted wings; tailplane mounted high on sweptback fin, wide-track retractable tricycle landing gear, stabilising float under each outer wing, engine pod on pylon above centre-fuselage; unpressurised cabin. Wing section P301, dihedral 4°, incidence 3° at root, 0° at tip.

FLYING CONTROLS: Conventional mechanical control, via rods. Trim tab in each aileron, port elevator and rudder. Single-slotted Fowler type flap in two sections on each wing.

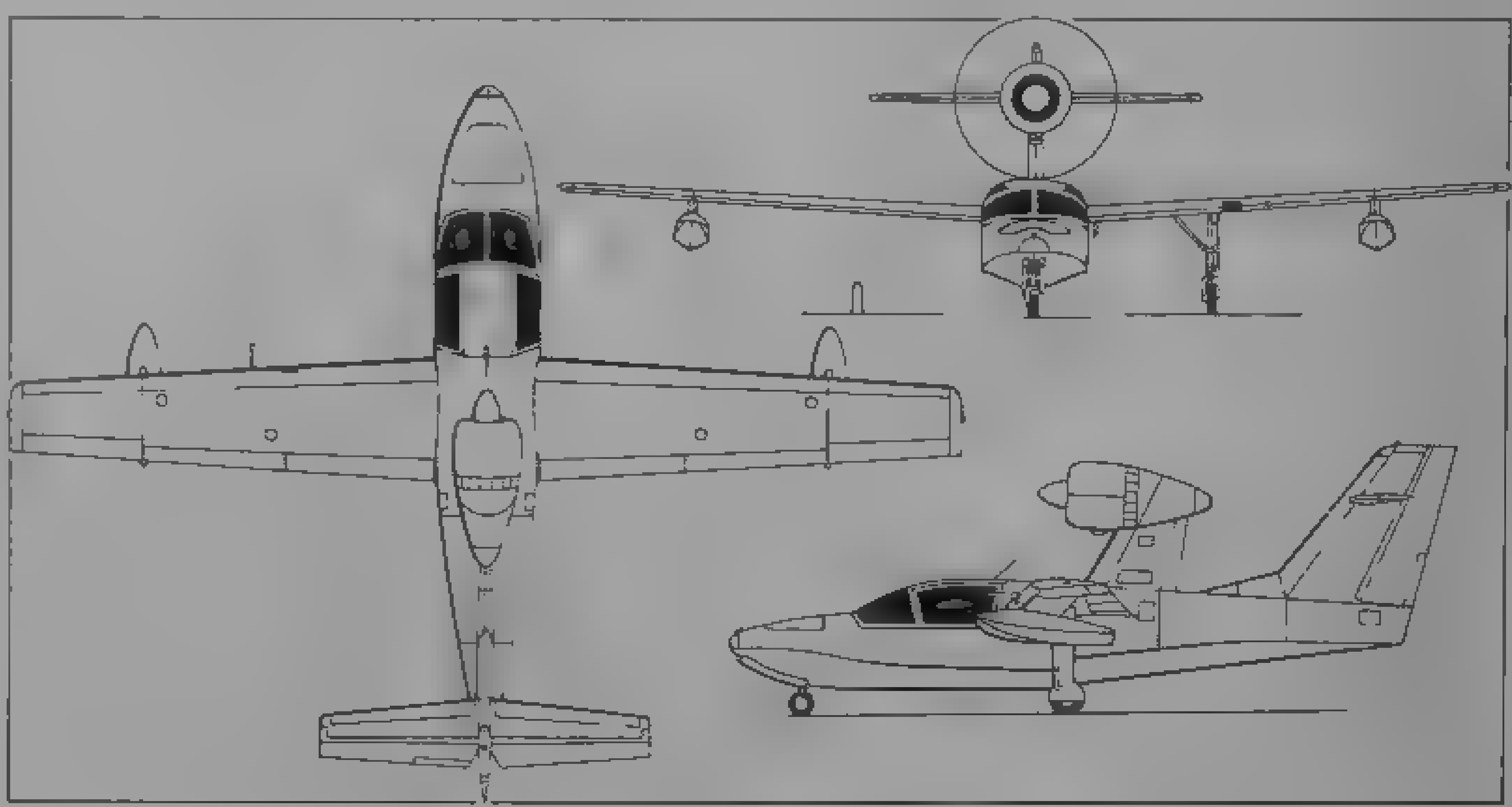
STRUCTURE: All-metal (aluminium alloy and high-tensile steel). Two-spar wing with ribs, stringers and metal skin, semi-monocoque fuselage with single-step planing bottom.

LANDING GEAR: Retractable tricycle type, single wheel on each unit, hydraulic retraction, mainwheels inward into wingroots, nosewheel forward into wheelbay in hull, oleo-pneumatic shock absorber in each unit, mainwheel tyres size 500 × 150 mm, nosewheel tyre size 400 × 150 mm, pneumatic brakes on mainwheels. Minimum ground turning radius 8.0 m (26 ft 3 in). Nosewheel steering angle ±35°.

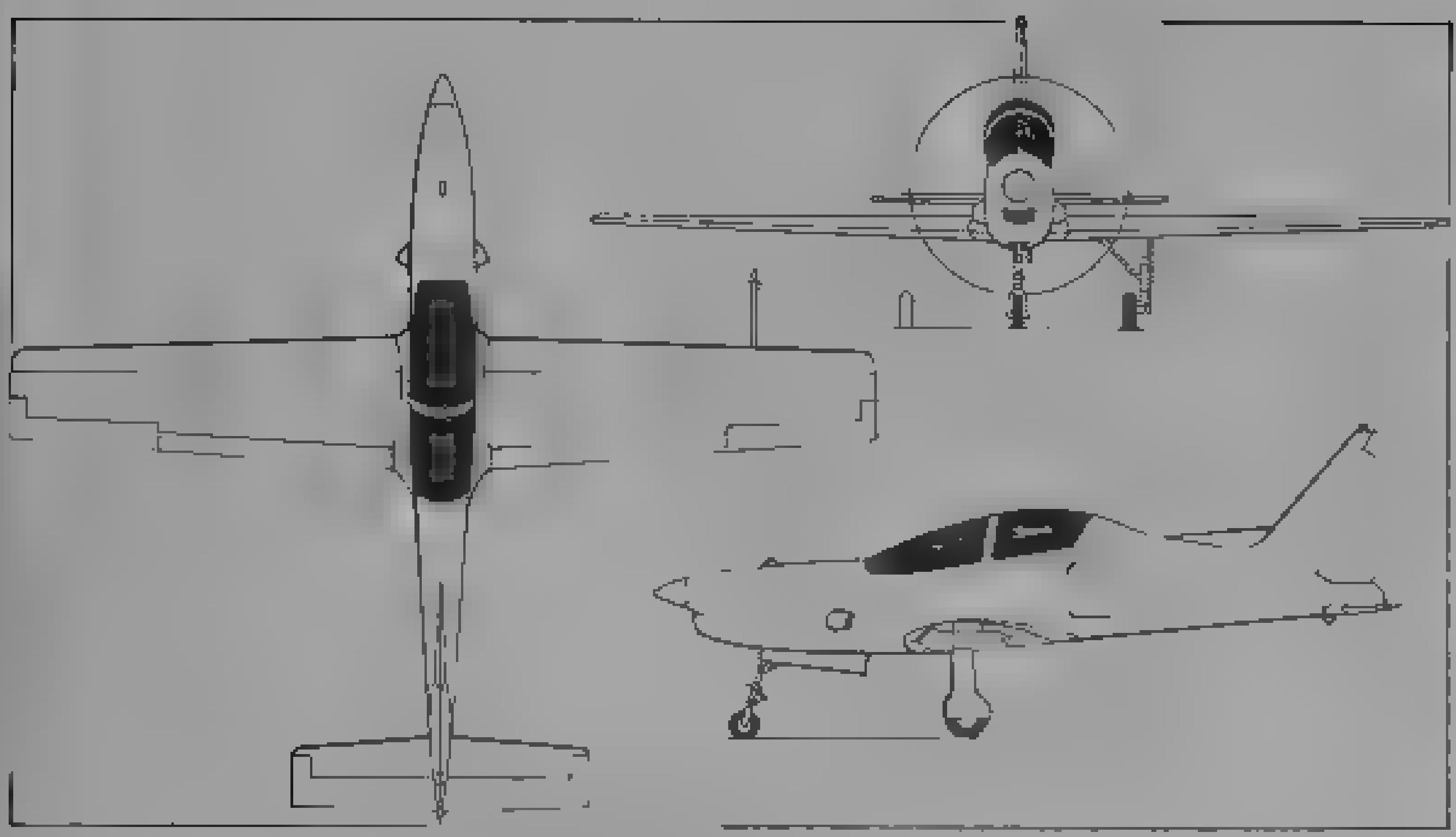
POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial piston engine; V530 two-blade constant-speed propeller. Alternative Allison turboprop. Two wing fuel tanks, total capacity 300 litres (79 US gallons; 66 Imp gallons); refuelling points above wings. Oil capacity 30 litres (7.9 US gallons; 6.6 Imp gallons).

ACCOMMODATION: Pilot and passenger on individual front seats, three-place rear bench seat, passenger seats removable for other duties. Baggage hold behind rear seats. Upward-opening canopy door each side. Cabin heated by engine bleed air and ventilated.

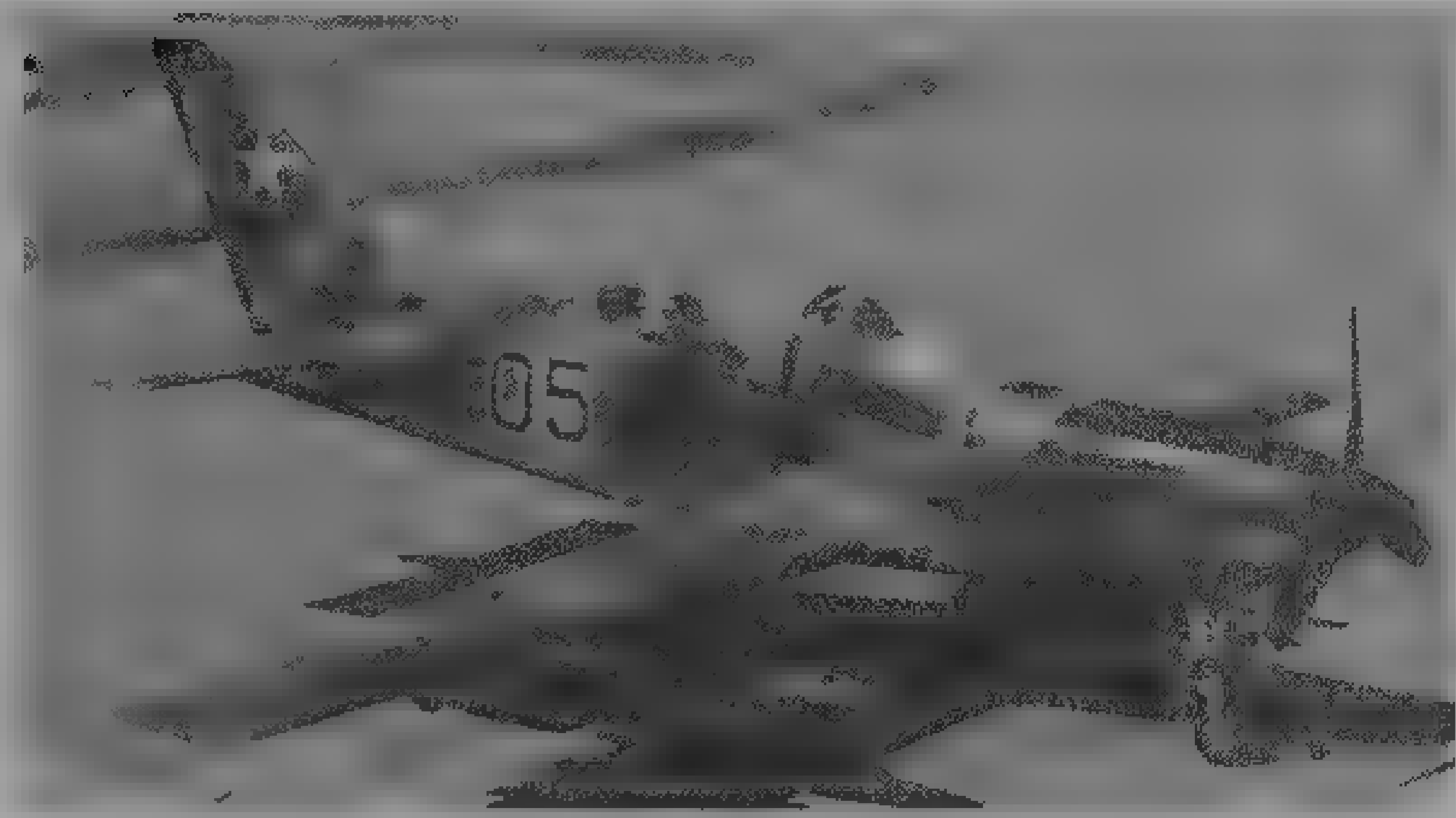
DIMENSIONS, EXTERNAL:	
Wing span	14.20 m (46 ft 7 in)
Wing chord: at root	1.89 m (6 ft 2½ in)
at tip	1.02 m (3 ft 4¼ in)
Wing aspect ratio	9.75
Length overall	10.62 m (34 ft 10¼ in)
Fuselage: Max width	1.60 m (5 ft 3 in)
Max height	1.65 m (5 ft 5 in)
Height overall	3.93 m (12 ft 10¾ in)
Tailplane span	4.96 m (16 ft 3¼ in)
Wheel track	5.25 m (17 ft 2¾ in)
Wheelbase	3.99 m (13 ft 1 in)
Propeller diameter	2.40 m (7 ft 10½ in)
Canopy doors (each): Height	0.65 m (2 ft 1½ in)
Width at top	1.30 m (4 ft 3 in)
Width at bottom	1.00 m (3 ft 3¼ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	2.50 m (8 ft 2½ in)
Max width	1.50 m (4 ft 11 in)
Max height	1.20 m (3 ft 11¼ in)
Floor area	3.60 m² (38.75 sq ft)
Volume	4.10 m³ (145 cu ft)
Baggage hold: Volume	0.60 m³ (21 cu ft)
Freight volume, seats removed	2.50 m³ (88 cu ft)
AREAS:	
Wings, gross	20.68 m² (222.6 sq ft)
Ailerons (total)	1.044 m² (11.24 sq ft)
Trailing-edge flaps (total)	4.36 m² (46.93 sq ft)
Fin, incl dorsal fin	2.67 m² (28.74 sq ft)
Rudder	1.56 m² (16.79 sq ft)
Tailplane	2.49 m² (26.80 sq ft)
Elevators (total)	1.65 m² (17.76 sq ft)
WEIGHTS AND LOADINGS (M-14P engine):	
Weight empty, equipped	1,470 kg (3,240 lb)
Max payload	370 kg (815 lb)
Max fuel	220 kg (485 lb)
Max T-O and landing weight	2,050 kg (4,520 lb)
Max wing loading	99.13 kg/m² (20.31 lb/sq ft)
Max power loading	7.74 kg/kW (12.73 lb/hp)
PERFORMANCE (estimated, at max T-O weight, with M-14P engine):	
Max level speed at S/L	132 kts (245 km/h; 152 mph)
Max cruising speed at 3,000 m (9,840 ft)	124 kts (230 km/h; 143 mph)
Econ cruising speed at 3,000 m (9,840 ft)	97 kts (180 km/h; 112 mph)
Stalling speed, flaps up at S/L	62 kts (115 km/h; 72 mph)
Max rate of climb at S/L	255 m (835 ft)/min
Service ceiling	5,900 m (19,350 ft)
T-O run: on land	205 m (675 ft)
on water	300 m (985 ft)
T-O to 15 m (50 ft): on land	365 m (1,200 ft)
on water	500 m (1,640 ft)
Landing from 15 m (50 ft): on land	445 m (1,460 ft)
on water	475 m (1,560 ft)
Landing run: on land	225 m (740 ft)
on water	270 m (885 ft)



Aeroprogress/ROKS-Aero T-433 Flamingo light multipurpose amphibian with M-14P engine (*Jane's/Mike Keep*) *1993*



Aeroprogress/ROKS-Aero T-501 turboprop military basic trainer (*Jane's/Mike Keep*) 1993



Model of Aeroprogress/ROKS-Aero T-501 with underwing armament 1994

Range with max payload, 30 min reserves	
at 3,000 m (9 840 ft)	340 n miles (630 km, 390 miles)
at S/L	237 n miles (440 km 273 miles)
Range with max fuel, 30 min reserves	
at 3,000 m (9,840 ft)	377 n miles (700 km, 435 miles)
at S/L	485 n miles (900 km, 560 miles)
Max range, no reserves	
at 3,000 m (9 840 ft)	500 n miles (930 km, 578 miles)
at S/L	595 n miles (1,100 km, 685 miles)

UPDATED

AEROPROGRESS/ROKS-AERO T-501 STRIZH (SWIFT)

TYPE: Tandem two-seat turboprop basic trainer.

PROGRAMME: Details released and model displayed March 1992, original programme abandoned after change of air force requirements; new schedule being negotiated with Russian Air Force, production assigned to Khrunichev plant.

DESIGN FEATURES: Conventional low-wing monoplane, unswept wings without dihedral or anhedral; sweptback vertical tail surfaces; unswept horizontal tail surfaces; retractable tricycle landing gear; conventional raised rear cockpit; for other details see accompanying three-view drawing.

POWER PLANT: One 754 kW (1,010 shp) Mars (Omsk) TVD-10B turboprop. Provision for drop tank under each wing.

ARMAMENT: Provision for underwing armament.

DIMENSIONS, EXTERNAL:	
Wing span	11 00 m (36 ft 1 in)
Wing aspect ratio	7 33
Length overall	9 66 m (31 ft 8½ in)
AREAS:	
Wings, gross	16.5 m² (177 6 sq ft)
WEIGHTS AND LOADINGS:	
Max fuel weight	500 kg (1,102 lb)
Max external load	500 kg (1,102 lb)
Max T-O weight	2,670 kg (5,886 lb)
Max wing loading	161 8 kg/m² (33 14 lb/sq ft)
Max power loading	3 50 kg/kW (5 74 lb/shp)
PERFORMANCE (estimated):	
Max level speed	285-307 kts (530-570 km/h, 330-354 mph)
T-O speed	73 kts (135 km/h, 84 mph)
Landing speed	65 kts (120 km/h, 75 mph)
Max rate of climb at S/L	1,260 m (4,135 ft)/min
T-O run	160 m (525 ft)
Landing run	190 m (625 ft)
Min turning radius	90 m (295 ft)
Min 360° turn time	11 s
Max range with external fuel	
at high altitude	970 n miles (1,800 km, 1,115 miles)
at low altitude	540 n miles (1,000 km, 620 miles)

UPDATED

AEROPROGRESS/ROKS-AERO T-602 OREL (EAGLE)

TYPE: Twin-engined light business aircraft.

PROGRAMME: Prototype under construction at MAPO plant, Moscow. Intended for production as **Khrunichev T-430 Sprinter** (which see for model illustration).

DESIGN FEATURES: Conventional low-wing monoplane, with twin wing-mounted engines, large two-section passenger/freight door aft of wing on port side; swept vertical tail surfaces; unswept horizontal tail surfaces on fuselage tailcone, unswept wings with slight dihedral; for other details see accompanying three-view drawing.

LANDING GEAR: Retractable tricycle type, single wheel on each main unit; rearward retracting twin nosewheels.

POWER PLANT: Two 265 kW (355 hp) VOKBM M 14 air cooled radial engines, each driving a three-blade propeller.

ACCOMMODATION: One or two pilots; nine passengers or freight in main cabin.

DIMENSIONS, EXTERNAL:	
Wing span	13.66 m (44 ft 9¾ in)
Length overall	12.12 m (39 ft 9 in)
WEIGHTS AND LOADINGS:	
Max fuel weight	720 kg (1,585 lb)
Max payload	800 kg (1,764 lb)
Max T-O weight	3,200 kg (7,055 lb)
PERFORMANCE (estimated):	
Max level speed	188 kts (350 km/h, 217 mph)
Max cruising speed	172 kts (320 km/h; 199 mph)
T-O run	380 m (1,247 ft)
Landing run	475 m (1,560 ft)
Range	
with max payload	852 n miles (1,580 km, 980 miles)
with auxiliary fuel	1,208 n miles (2,240 km; 1,390 miles)
Endurance: with max payload	7 h
with max fuel and 1,000 kg (2,205 lb) payload	10 h

AEROPROGRESS/ROKS-AERO T-610 VOYAGE

TYPE: Single-turboprop civil and military multipurpose aircraft.

PROGRAMME: Design started November 1991, construction of first prototype began October 1992 at Tushino plant, first flight scheduled March 1996.

CURRENT VERSIONS: Suitable for civil passenger/freight transport, forest patrol, aerial photography and ambulance missions; military transport and airdropping of paratroops, equipment and supplies.

DESIGN FEATURES: Conventional strut-braced high-wing monoplane; sweptback vertical tail surfaces; non-retractable landing gear; unpressurised accommodation, large freight door. STOL capable. Wide CG range. Wing section P301, dihedral 3°, incidence 1° 30′ at root, −1° 30′ at tip.

FLYING CONTROLS: Conventional mechanical control, via cables and rods, ailerons supplemented by small single-section upper-surface spoilers forward of outer flap sections, long-span two-section Fowler type flap on each wing; trim tab in each aileron, port elevator and rudder.

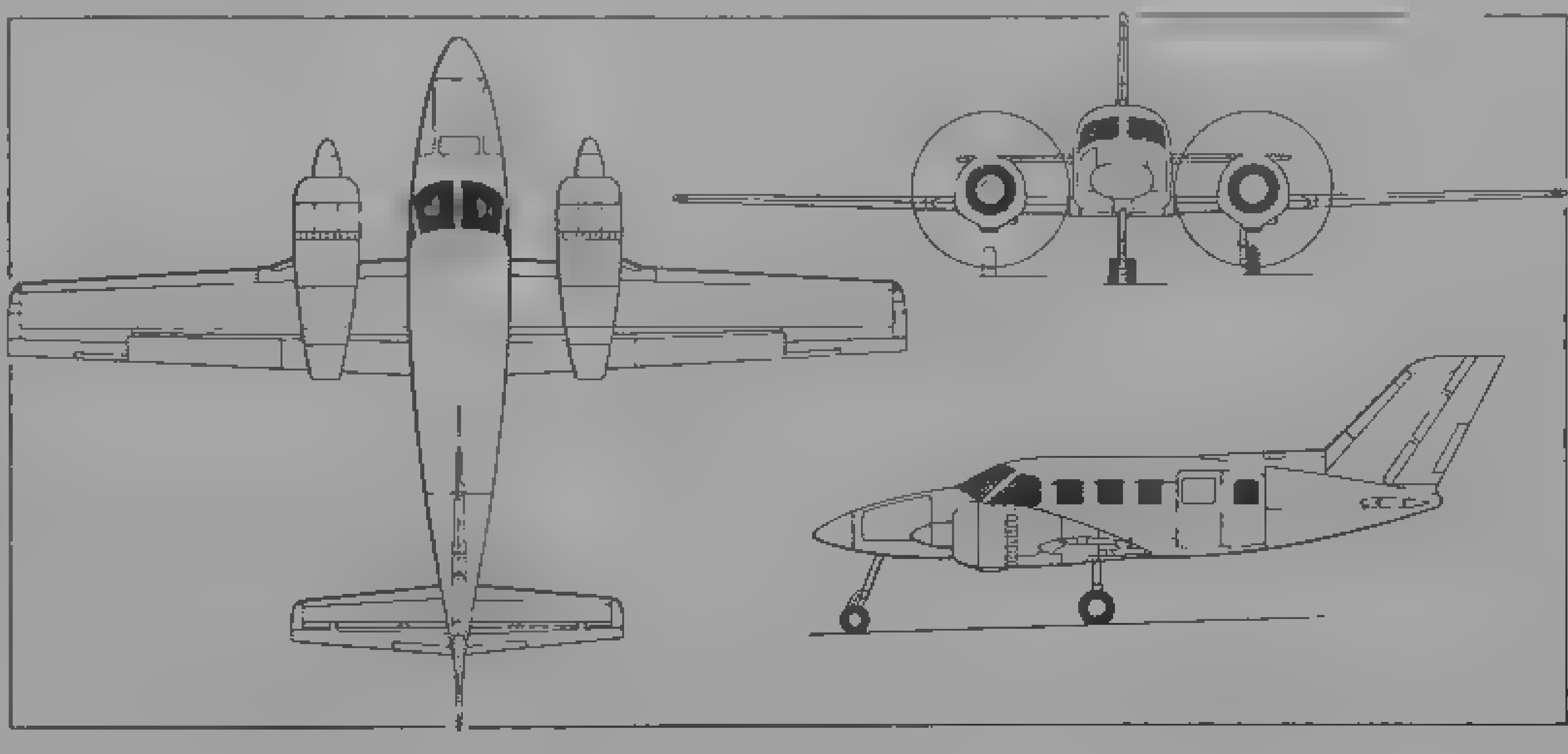
STRUCTURE: Two-spar wings, with single bracing strut each side, fuel tanks in wingroots; semi-monocoque fuselage. Basic structure aluminium alloy, with some high tensile steel.

LANDING GEAR: Non-retractable tricycle landing gear, with single wheel on each leg, mainwheels carried on cantilever steel leaf-springs; nosewheel on leaf-spring, with oleo damper; mainwheel tyres size 700 × 200 mm, nosewheel tyre size 480 × 200 mm; hydraulic brakes on mainwheels. Floats and skis optional. Minimum ground turning radius 6.5 m (21 ft 4 in). Nosewheel steering angle ±40°.

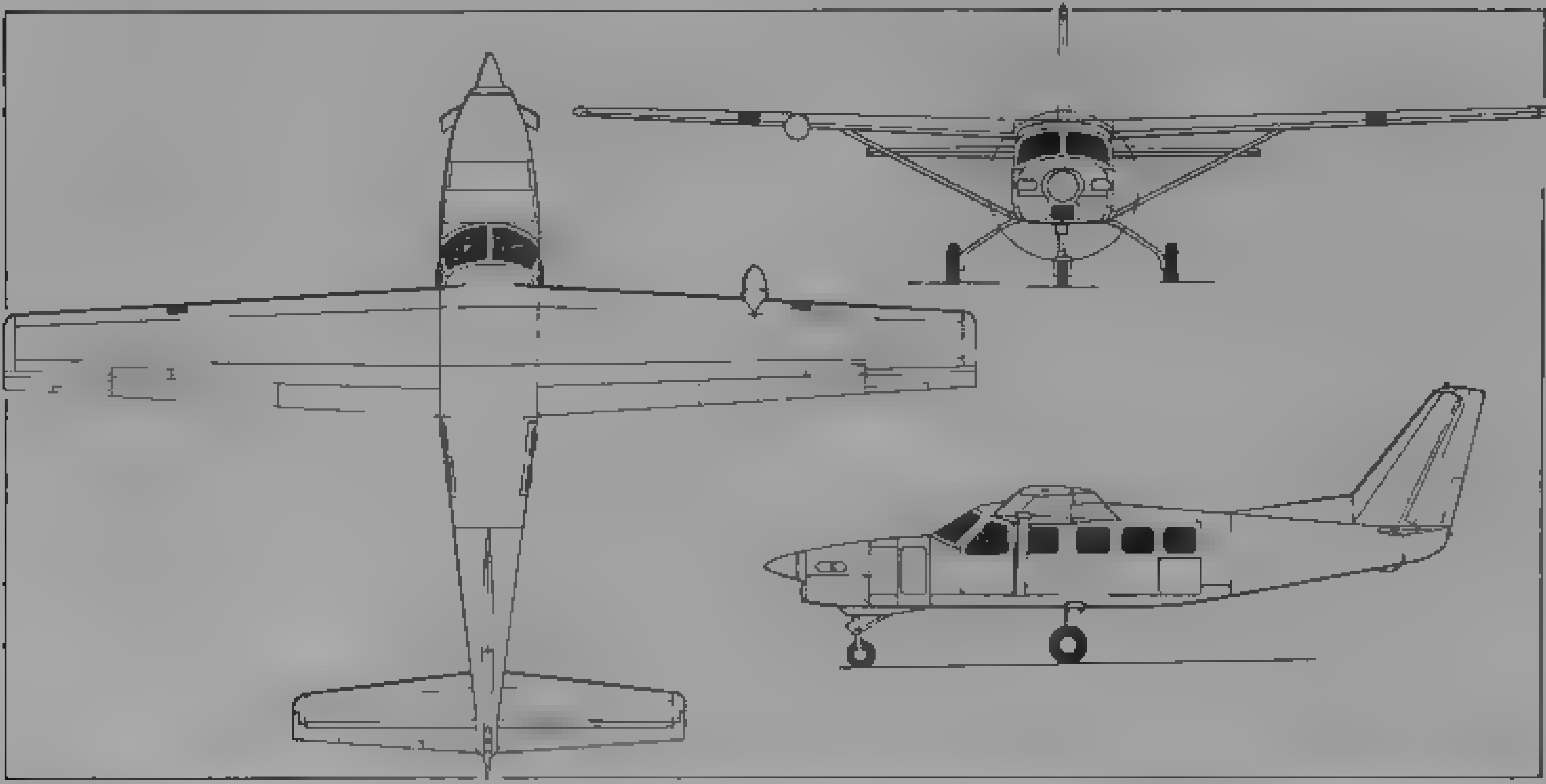
POWER PLANT: One 560 kW (751 shp) Motorlet M 601E turboprop in each prototype, one 529 kW (710 shp) Mars (Omsk) TV D-100, or one 610 kW (818 shp) Saturn AL-34, or one P&WC PT6A 114, in production aircraft. V510 five-blade constant-speed propeller with reverse thrust. Wing fuel tanks, total capacity 1,300 litres (343 US gallons, 286 Imp gallons).

ACCOMMODATION: Eleven seats, arranged 2-3-3-2-1, optional twelfth seat; front three passenger seats rearward-facing. Horizontally divided two-piece passenger door on port side at rear of cabin; airstairs in lower section; large rearward-sliding cargo door on starboard side; forward-hinged door each side of flight deck. Baggage/freight compartments forward of flight deck and at rear of cabin. Interior heated by engine bleed air and ventilated.

DIMENSIONS, EXTERNAL:	
Wing span	16 16 m (53 ft 0¼ in)
Wing chord: at root	2.23 m (7 ft 3¾ in)
at tip	1 24 m (4 ft 0¾ in)
Wing aspect ratio	9 33
Length overall	12 08 m (39 ft 7½ in)
Fuselage: Max width	1 72 m (5 ft 7¾ in)
Max height	1.70 m (5 ft 7 in)
Height overall	4.50 m (14 ft 9 in)
Tailplane span	6 52 m (21 ft 4¾ in)
Wheel track	3 64 m (11 ft 11½ in)
Wheelbase	3 48 m (11 ft 5 in)
Propeller diameter	2 30 m (7 ft 6½ in)
Propeller ground clearance	0 40 m (1 ft 3¾ in)
Crew doors (each): Height	1 20 m (3 ft 11¼ in)
Width at top	0 52 m (1 ft 8½ in)
Width at bottom	0 84 m (2 ft 9 in)
Cabin door, port: Height	1 20 m (3 ft 11¼ in)
Width	0.64 m (2 ft 1¼ in)
Cargo door, starboard: Height	1.20 m (3 ft 11¼ in)
Width	1 30 m (4 ft 3¼ in)
DIMENSIONS, INTERNAL:	
Cabin, incl flight deck and toilet	
Length	5 00 m (16 ft 4¾ in)
Max width	1 60 m (5 ft 3 in)
Max height	1 40 m (4 ft 7 in)
Floor area	7 00 m² (75 35 sq ft)
Volume	9 80 m³ (346 cu ft)
Baggage compartment volume	
Nose	0 50 m³ (17 65 cu ft)
Rear	0 70 m³ (24 72 cu ft)
Freight volume, seats removed	6 80 m³ (240 cu ft)
AREAS:	
Wings, gross	28.00 m² (301 4 sq ft)
Ailerons (total)	1 213 m² (13 06 sq ft)
Trailing-edge flaps (total)	6 38 m² (68 68 sq ft)



Aeroprogress/ROKS-Aero T-602 Orel light business transport (*Jane's/Mike Keep*) 1993



Aeroprogress/ROKS-Aero T-610 Voyage turboprop multipurpose aircraft *(Jane's/Mike Keep)*

1993

Model of Aeroprogress/ROKS Aero T 710 Anaconda counter insurgency combat aircraft

1995

Spoilers (total)	0 303 m² (3 26 sq ft)
Fin, incl dorsal fin	2 388 m² (25 71 sq ft)
Rudder	1.312 m² (14.12 sq ft)
Tailplane	4 28 m² (46 07 sq ft)
Elevators (total)	2 80 m² (30 14 sq ft)

WEIGHTS AND LOADINGS

Weight empty, equipped	1,955 kg (4,310 lb)
Max payload	1,100 kg (2,425 lb)
Max fuel	1,000 kg (2,205 lb)
Max T-O weight	3,850 kg (8,488 lb)
Max landing weight	3,540 kg (7,805 lb)
Max wing loading	137.5 kg/m² (28 16 lb/sq ft)
Max power loading (M 601E engine)	6 88 kg/kW (11 30 lb/shp)

PERFORMANCE (estimated)

Max level speed	178-188 kts (330-350 km/h, 205 217 mph)
Nominal cruising speed	145-156 kts (270-290 km/h, 168 180 mph)
Stalling speed, flaps up, at 3,000 m (9 840 ft)	81 kts (150 km/h, 93 mph)
Max rate of climb at S/L	336 m (1,102 ft)/min
Service ceiling	10,000 m (32 800 ft)
T-O run	278 m (912 ft)
T-O to 15 m (50 ft)	530 m (1,740 ft)
Landing from 15 m (50 ft):	
with reverse thrust	256 m (840 ft)
without reverse thrust	826 m (2,710 ft)
Range with max payload, 30 min reserves:	
at 3,000 m (9,840 ft)	647 n miles (1,200 km, 745 miles)
at 6,000 m (19,685 ft)	863 n miles (1,600 km, 995 miles)
Range with max fuel, 30 min reserves:	
at 3,000 m (9,840 ft)	998 n miles (1,850 km; 1,150 miles)
at 6,000 m (19 685 ft)	1 257 n miles (2,330 km; 1,447 miles)
Max range, no reserve: at 3,000 m (9,840 ft)	1,250 n miles (2,320 km 1,440 miles)
at 6,000 m (19 685 ft)	1,619 n miles (3 000 km, 1,864 miles)

UPDATED

AEROPROGRESS/ROKS-AERO T-710 ANACONDA

TYPE: Projected twin-turboprop counter-insurgency aircraft

DESIGN FEATURES: Twin-boom high-wing monoplane, with constant-chord wings, podded fuselage, high-set tailplane, retractable tricycle landing gear, with single wheel on each unit. Double-slotted flaps for STOL capability

POWER PLANT: Two 1,839 kW (2,466 shp) Klimov TV7-117M turboprops, contrarotating six-blade constant-speed propellers

ACCOMMODATION: Two in tandem, on stepped ejection seats

ARMAMENT: Six stores pylons under stub-wings and fuselage for bombs, torpedo, rocket packs and other weapons; four machine guns in stub-wings, four pylons under wingtips for air-to-air missiles; twin-barrel 23 mm gun under fuselage

DIMENSIONS: Not available, except

Propeller diameter	3 60 m (11 ft 9¾ in)

WEIGHTS AND LOADINGS

Weapon load: Normal	1,000 kg (2,205 lb)
Max	2,500 kg (5,510 lb)
Max fuel	1,500 kg (3,306 lb)
Max T-O weight	7,500 kg (16,535 lb)

PERFORMANCE (estimated)

Max level speed: at height	388 kts (720 km/h, 447 mph)
at S/L	367 kts (680 km/h, 422 mph)
Service ceiling	6,000 m (19 685 ft)
Balanced field length	500 m (1,640 ft)
Radius of action: normal weapon load	242 n miles (450 km 280 miles)
g limits	+5/−2 5

NEW ENTRY

AEROPROGRESS/ROKS-AERO T-910 KURYER (MESSENGER)

TYPE: Twin-turbofan six/10-passenger business transport

PROGRAMME: Design started January 1993, to FAR Pt 25 standards, announced at MosAeroshow '93, full-scale mockup under construction early 1995, financial production group then being formed to manage programme

DESIGN FEATURES: Conventional mid-wing monoplane, winglets added 1995, podded engines on sides of rear fuselage. Compound-sweep wing leading-edge, sweepback at quarter-chord 3°; P-204-14/P-196K wing sections, dihedral 2° 30'; incidence 3°. Circular section fuselage All-swept tail unit

FLYING CONTROLS: Mechanically actuated ailerons, elevators and rudder; electrically powered variable-incidence tailplane; electrohydraulically driven spoilers, one-piece trailing-edge flaps

STRUCTURE: Aluminium alloy construction, two-spar wings, pressurised semi-monocoque fuselage

LANDING GEAR: Hydraulically actuated tricycle type, single wheel on each unit, oleo-pneumatic shock-absorbers tyres size 800 × 200 mm on mainwheels, 500 × 180 mm on nosewheel, electronic brake anti-skid protection

POWER PLANT: Two ZMDB Progress AI-25TL turbofans, each 16.67 kN (3,750 lb st). Fuel tanks in wings and aft of cabin, total 4,550 litres (1,202 US gallons, 1,000 Imp gallons)

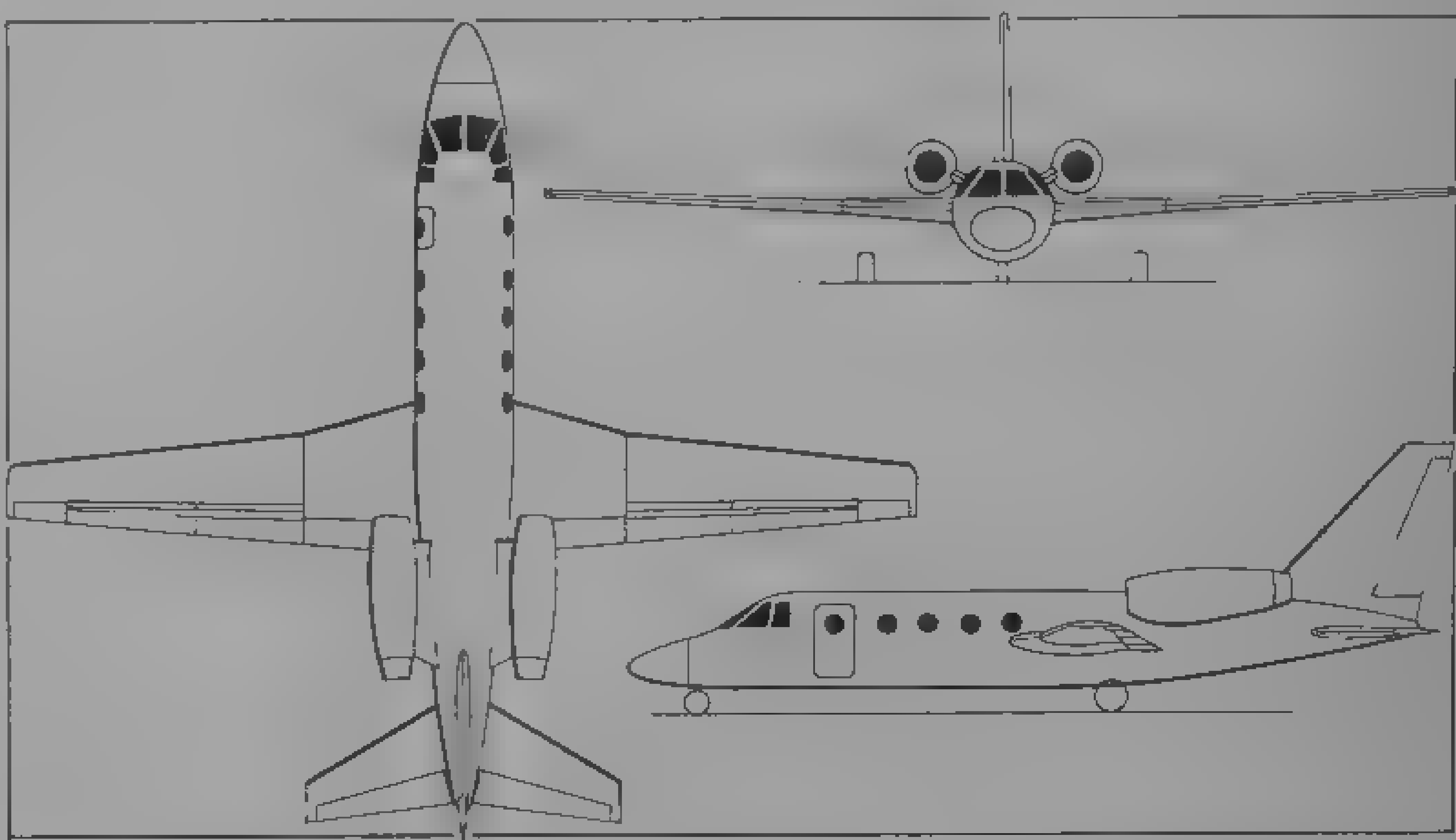
ACCOMMODATION: Two crew side by side on flight deck, six to 10 passengers: toilet at front, baggage compartment in rear fuselage; door on port side at front of cabin; overwing emergency exit on starboard side

SYSTEMS: Air conditioning and pressurisation by engine bleed air. Main and emergency hydraulic systems Electrical supply 115 V 400 Hz. Oxygen system standard ZMDB Progress AI-9 APU

AVIONICS: IFR avionics not yet selected

DIMENSIONS, EXTERNAL

Wing span	17 00 m (55 ft 9¾ in)



Aeroprogress/ROKS-Aero T 910 Kuryer in original form, without winglets *(Jane's/Mike Keep)*

1994

Wing chord: at root	2.85 m (9 ft 4¼ in)
at tip	1.00 m (3 ft 3½ in)
Length overall	15.24 m (50 ft 0 in)
Diameter of fuselage	1.85 m (6 ft 1 in)
Height overall	6.10 m (16 ft 9 in)
Tailplane span	5.90 m (19 ft 4¼ in)
Wheel track	5.40 m (17 ft 8½ in)
Wheelbase	7.20 m (23 ft 7½ in)
Cabin door: Height	1.40 m (4 ft 7 in)
Width	0.70 m (2 ft 3½ in)
Emergency exit: Height	0.65 m (2 ft 1½ in)
Width	0.60 m (1 ft 11½ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	5.30 m (17 ft 4½ in)
Max width and height	1.60 m (5 ft 3 in)
AREAS:	
Wings, gross	32.20 m² (346.6 sq ft)
Ailerons (total)	0.695 m² (7.48 sq ft)
Trailing-edge flaps (total)	7.54 m² (81.16 sq ft)
Spoilers (total)	1.40 m² (15.07 sq ft)
Fin	4.077 m² (43.88 sq ft)
Rudder	1.723 m² (18.55 sq ft)
Tailplane	6.55 m² (70.51 sq ft)
Elevators (total)	2.30 m² (24.75 sq ft)
WEIGHTS AND LOADINGS:	
Operating weight empty	5,700 kg (12,566 lb)
Max fuel	3,500 kg (7,715 lb)
Max T-O weight	9,700 kg (21,385 lb)
Max landing weight	8,300 kg (18,300 lb)
Max zero-fuel weight	6,600 kg (14,550 lb)
Max wing loading	301.25 kg/m² (61.70 lb/sq ft)
Max power loading	290.95 kg/kN (2.85 lb/lb st)

Model of Aeroprogress/ROKS-Aero T 910 Kuryer twin turbofan business aircraft

1995

PERFORMANCE (estimated):	
Max level speed at 8,000 m (26,250 ft)	420 kts (780 km/h, 484 mph)
Max cruising speed at 12,000 m (39,370 ft)	399 kts (740 km/h, 460 mph)
Econ cruising speed at 12,000 m (39,370 ft)	388 kts (720 km/h, 447 mph)
Stalling speed, flaps down	124 kts (230 km/h, 143 mph)
T-O run	500 m (1,640 ft)
T-O to and landing from 15 m (50 ft)	800 m (2,625 ft)
Landing run	400 m (1,313 ft)
Range at 12,000 m (39,370 ft), 1 hour reserves:	
with max payload	2,050 n miles (3,800 km, 2,360 miles)
with max fuel	2,428 n miles (4,500 km, 2,796 miles)

UPDATED

OTHER AIRCRAFT

Brief details of **T 121** and **T 720** designs appear under Washington Aeroprogress in the US section

NEW ENTRY

AERORIC

AERORIC RESEARCH AND PRODUCTION ENTERPRISE

2 Sibirskaya Street, 86, 603089 Nizhny Novgorod
Telephone/Fax: 7 (8312) 44 19 65
DIRECTOR AND CHIEF DESIGNER: Victor P. Morozov

AeroRIC designs light aircraft for production at the Sokol State Aircraft Building Plant, Nizhny Novgorod

VERIFIED

AERORIC DINGO

TYPE: Light multipurpose aircraft with air cushion landing gear

PROGRAMME: Design started 1991, first seen in mockup form at MosAeroshow '92, construction by MAPO of two flying prototypes and static test airframe began 1993, first flight scheduled 1995, construction of 13 preproduction aircraft to start 1995

COSTS: $1.5 million for standard civil aircraft (calculated FY93)

DESIGN FEATURES: Basically conventional low-wing twin-boom pusher engined configuration; unique air cushion landing system, permitting operation from any kind of ground surface, water, snow and ice; able to overcome hummocks and tussocks up to 30 cm (1 ft) high, ledges or projections up to 50 cm (1 ft 8 in) high, ditches up to 1.0 m (3 ft 3 in) wide and slopes of up to 7°, twin-fin tail unit with tailplane above fin tips. Wing section GA(W)-1, thickness/chord ratio 14 per cent; incidence 3° 30', no twist.

Mockup of AeroRIC Dingo with air cushion landing gear

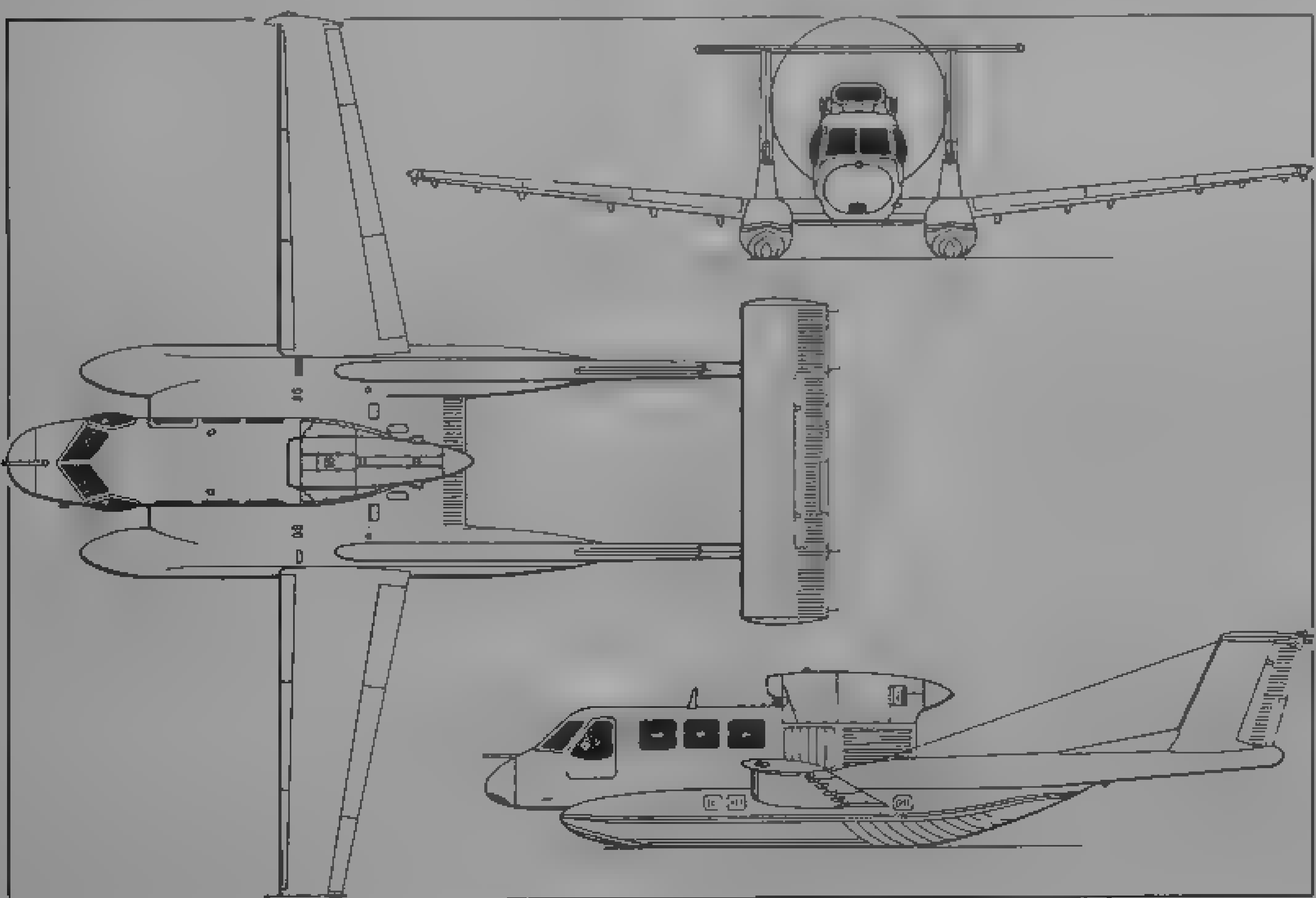
1994

FLYING CONTROLS: Manual control, ailerons 15° up/25° down, elevator 20° each way; rudders 25° each way, electrically controlled two-section Fowler flaps on each wing, 15° up/40° down; automatic leading-edge slats, 25° down, trim tab in elevator

STRUCTURE: Airframe primarily aluminium alloy

LANDING GEAR: Air cushion formed under wing, contained at sides by air bladders, at front and rear by flexible flat flaps attached to wing by hinges and retracted during flight. Bearing pressure on runway 0.035 kg/cm² (71.7 lb/sq ft)

POWER PLANT: One 820 kW (1,100 shp) Pratt & Whitney Canada PT6A-65B turboprop; three-blade Hartzell HC-B5MP-3/M10876B feathering controllable-pitch/reversible-pitch pusher propeller; built-in dust protection for engine air intake. Fuel in two main wing tanks, each 300 litres (79.25 US gallons, 66 Imp gallons); two wing tanks, each 200 litres (52.85 US gallons; 44 Imp gallons); one feeder tank in centre-section, 150 litres (39.5 US gallons; 33 Imp gallons). Total fuel capacity 1,150 litres (303.7 US gallons, 253 Imp gallons). Gravity fuelling, starboard side of fuselage



AeroRIC Dingo light multipurpose aircraft (P&WC PT6A-65B turboprop) *(Jane's/Mike Keep)*

1994

ACCOMMODATION: One or two pilots, seven or eight passengers (one optionally beside pilot, seven on inward-facing bench seats in cabin. Flight deck door on port side, passenger/cargo door on starboard side. Passenger cabin ventilated and heated

SYSTEMS: Air conditioning optional. No hydraulic system. Pneumatic system, pressure 2.5 kg/cm² (35.5 lb/sq in), inflates air bladders, pressurises fuel tanks, operates hot air anti-icing, engine dust protection and heating systems, and scavenges pitot. DC electrical generators on propulsion engine and APU, 25 Ah 28 V battery. One 186 kW (250 shp) TBA-200 turbofan APU generates air cushion

AVIONICS: To customer's requirements
Comms: Com/nav to ICAO/FAR Pt 23 standards.
Radar: Optional type 14A/813 weather radar

DIMENSIONS, EXTERNAL:	
Wing span over tip fairings	14.25 m (46 ft 9 in)
Wing chord: at root	2.48 m (8 ft 1¾ in)
at tip	1.00 m (3 ft 3¼ in)
Length overall	12.95 m (42 ft 6 in)
Fuselage: Length	6.93 m (22 ft 9 in)
Width	1.40 m (4 ft 7 in)
Height	1.65 m (5 ft 5 in)
Height overall	3.94 m (12 ft 11¼ in)
Tailplane span	5.80 m (19 ft 0½ in)
Propeller diameter	2.82 m (9 ft 3 in)
Propeller ground clearance	1.05 m (3 ft 5¼ in)
Passenger/cargo door: Height	0.95 m (3 ft 1¼ in)
Width	1.20 m (3 ft 11¼ in)
Emergency exit (port side):	
Height	0.90 m (2 ft 11½ in)
Width	0.96 m (3 ft 1¾ in)
DIMENSIONS, INTERNAL:	
Cabin, incl flight deck: Length	4.10 m (13 ft 5¼ in)
Max width	1.28 m (4 ft 2¼ in)
Max height	1.38 m (4 ft 6¼ in)
Floor area	5.02 m² (54.0 sq ft)
Volume	6.54 m³ (231 cu ft)
AREAS:	
Wings, gross	24.36 m² (262.2 sq ft)

Trailing-edge flaps (total)	3.80 m² (40.90 sq ft)
Fins (total)	5.46 m² (58.77 sq ft)
Horizontal tail surfaces (total)	7.83 m² (84.28 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	2,242 kg (4,943 lb)
Max payload	744 kg (1,640 lb)
Max fuel	1,000 kg (2,205 lb)
Max T-O and landing weight	3,700 kg (8,157 lb)
Max zero-fuel weight	3,100 kg (6,834 lb)
Max wing loading	151.9 kg/m² (31.1 lb/sq ft)
Max power loading	4.51 kg/kW (7.41 lb/shp)

PERFORMANCE (estimated):	
Max level speed at 2,000 m (6,560 ft)	167 kts (310 km/h; 192 mph)
Econ cruising speed at 2,000 m (6,560 ft)	148 kts (275 km/h; 170 mph)
Stalling speed	62 kts (115 km/h; 72 mph)
Time to 2,000 m (6,560 ft)	6 min
Service ceiling	3,500 m (11,500 ft)
T-O run: from land	350 m (1,150 ft)
from water	450 m (1,475 ft)
T-O to 15 m (50 ft)	570 m (1,870 ft)
Landing run: on land	265 m (870 ft)
on water	220 m (722 ft)
Range:	
with max payload	431 n miles (800 km; 497 miles)
with max fuel	810 n miles (1,500 km; 930 miles)

UPDATED

AVIA

AVIA LTD

Comintema Street 13-4, 127327 Moscow
Telephone/Fax: 7 (095) 184 43 77
CHIEF DESIGNERS:
Jury Lahtachev
Eugene Maslov

This company designed the Accord light twin-engined aircraft, manufactured by the Sokol plant, Nizhny Novgorod.

NEW ENTRY

AVIA ACCORD

TYPE: Twin-engined light multipurpose aircraft.

PROGRAMME: Developed to meet FAR Pt 23 requirements, for operation from land or water; first flight April 1994.

DESIGN FEATURES: High-wing monoplane with single bracing strut each side, pod and boom fuselage, cruciform tail surfaces with sweptback fin and rudder; mainwheels at tips of short stub-wings that support bracing struts. Constant chord main wing panels, with toed-out engines on leading edge; tapered outer panels. Operation practicable from unprepared surfaces.

FLYING CONTROLS: Conventional three-axis; slotted horn balanced ailerons and slotted flaps over full span, rudder and horn balanced elevators.

STRUCTURE: All-metal.

LANDING GEAR: Non-retractable tricycle type; single wheel on each unit. Optional electrically retractable (upward through 90°) floats outboard of wheels for amphibious operation.

POWER PLANT: Two 110 kW (148 hp) VAZ-4133A rotary (Wankel type) engines, two-blade propellers. Other types of engine optional.

ACCOMMODATION: Pilot and four passengers or equivalent freight; ambulance version for one stretcher patient, attendant behind pilot, and medical equipment. Large door each side and rear-loading hatch. Baggage compartment aft of rear seats.

AVIONICS: To customer's requirements, including three-CRT EFIS and GPS.

Avia Accord light multipurpose aircraft without optional floats *1995*

DIMENSIONS, EXTERNAL:	
Wing span	11.30 m (37 ft 1 in)
Length overall: on wheels	8.00 m (26 ft 3 in)
on floats	8.60 m (28 ft 2½ in)
Height overall: on wheels	3.20 m (10 ft 6 in)
on floats	3.60 m (11 ft 9¾ in)
Propeller diameter	2.00 m (6 ft 6¾ in)
AREAS:	
Wings, gross	15.00 m² (161.5 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty: on wheels	930 kg (2,050 lb)
on floats	1,070 kg (2,359 lb)
Max fuel	300 kg (661 lb)
Max T-O weight	1,740 kg (3,836 lb)

PERFORMANCE:	
Max cruising speed:	
on wheels	145 kts (270 km/h; 167 mph)
on floats	140 kts (260 km/h; 161 mph)
Econ cruising speed:	
on floats	97 kts (180 km/h; 112 mph)
T-O run: on land	175 m (575 ft)
on water	260 m (853 ft)
Range, 45 min reserve, with floats:	
200 kg (441 lb) fuel, at max cruising speed	540 n miles (1,000 km; 621 miles)
max fuel, at econ cruising speed	1,241 n miles (2,300 km; 1,429 miles)

NEW ENTRY

AVIASPETSTRANS

AVIASPETSTRANS CONSORTIUM

Zhukovsky 5, Moscow Region
Telephone: 7 (095) 556 59 93
Fax: 7 (095) 292 65 11
DIRECTOR GENERAL: Valentin A. Korchagin

Consortium formed 1990 by Russia's Arctic and Antarctic Research Institute, Scientific Research Institute for Civil Aviation, Gasprom gas enterprises, Institute of Oceangeology Engineering Centre, People of the North Foundation, Myasishchev Design Bureau and Promstroybank. These have a common interest in air transport infrastructure in remote regions of the north, Siberia and Far East. Aviaspetstrans will market services such as monitoring systems and navigation aids as well as aircraft of its own design. First aircraft project, headed by Chief Designer/Director General V. A. Korchagin is amphibious twin-turboshaft Yamal, capable of autonomous operation in regions with minimal transport infrastructure.

UPDATED

AVIASPETSTRANS YAMAL

TYPE: Twin-turboshaft cargo/passenger multipurpose amphibian.

PROGRAMME: Work performed by five scientific and research institutes and aviation design bureaux under Gosaviaregistr supervision, consistent with FAR requirements. Development delegated to Myasishchev OKB. Full-scale mockup exhibited at MosAeroshow '92; prototypes to be manufactured in Moscow; first flight scheduled early 1998.

Model of Aviaspetstrans Yamal exhibited at 1995 Paris Air Show *(Paul Jackson)* *1995*

DESIGN FEATURES: Basically conventional small amphibian. Unique power plant, two turboshafts side by side on top decking over wing centre-section, driving single pusher propeller mounted behind tail unit, through helicopter-like combining reduction gearbox; position of engine air intakes protects them from water and foreign object ingestion. Flying-boat hull and two fixed underwing stabilising floats. All between-flights servicing of systems and equipment possible from technical bay inside fuselage; access to engine inspection points is provided through access panels in technical bay ceiling, protecting engineer from low temperature, precipitation, mosquitoes and effects of waves on water. Similar access practicable to remedy in-flight failure.

LANDING GEAR: Retractable tailwheel type; twin wheels on each main unit, all units retract upward, main units into sponsons each side of hull. Optional nosewheel gear under development.

POWER PLANT: Two RKBM RD600S (TVD-1500) turboshafts, six-blade propeller, dimensions and aerodynamics similar to those of Il-114 propellers. Fuel tank, capacity 2,400 kg (5,291 lb), between spars in each wing.

ACCOMMODATION: Provision for 18 passengers from land, 15 from water; or freight, stretchers and medical equipment, cameras, equipment for variety of commercial and military duties.

AVIONICS: *Radar:* In nose thimble.

EQUIPMENT: Optional equipment being developed for ecological monitoring, forest protection and firefighting, ice and fish reconnaissance, 200 mile economic zone patrol, and air/sea rescue.

DIMENSIONS, EXTERNAL:	
Wing span	21.40 m (70 ft 2½ in)
Length overall	16.825 m (55 ft 2½ in)
Height overall	5.367 m (17 ft 7½ in)
DIMENSIONS, INTERNAL:	
Passenger cabin: Volume	23.4 m³ (826 cu ft)

AREAS
Wings, gross 51 9 m² (558 7 sq ft)
WEIGHTS AND LOADINGS
Max payload 2,000 kg (4,410 lb)
PERFORMANCE (estimated, at max T O weight)
Max cruising speed at 7,500 m (24,600 ft) 235 kts (435 km/h, 270 mph)
Econ cruising speed at 7,500 m (24,600 ft) 202 kts (375 km/h, 233 mph)
T O run: on land 225 m (740 ft)
on water 230 m (755 ft)
Range with max payload at max cruising speed 631 n miles (1,170 km, 727 miles)
at econ cruising speed 755 n miles (1,400 km, 870 miles)
with 500 kg (1,100 lb) payload at max cruising speed 2,212 n miles (4,100 km, 2 547 miles)
at econ cruising speed 2,374 n miles (4,400 km, 2,734 miles)

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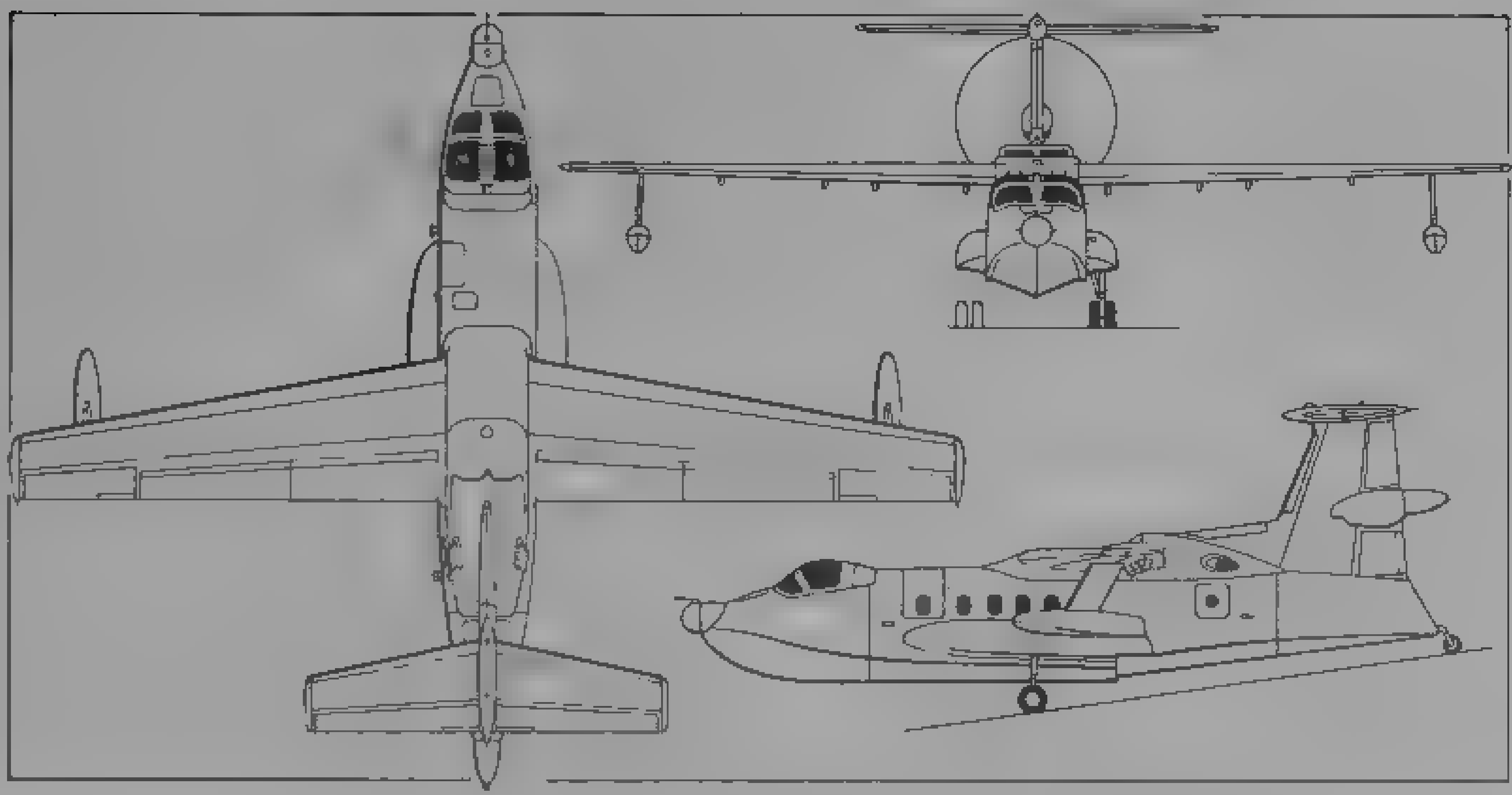


Aviaspetstrans Yamal twin turboshaft multipurpose amphibian (*Jane's/Mike Keep*) 1994

AVIATIKA

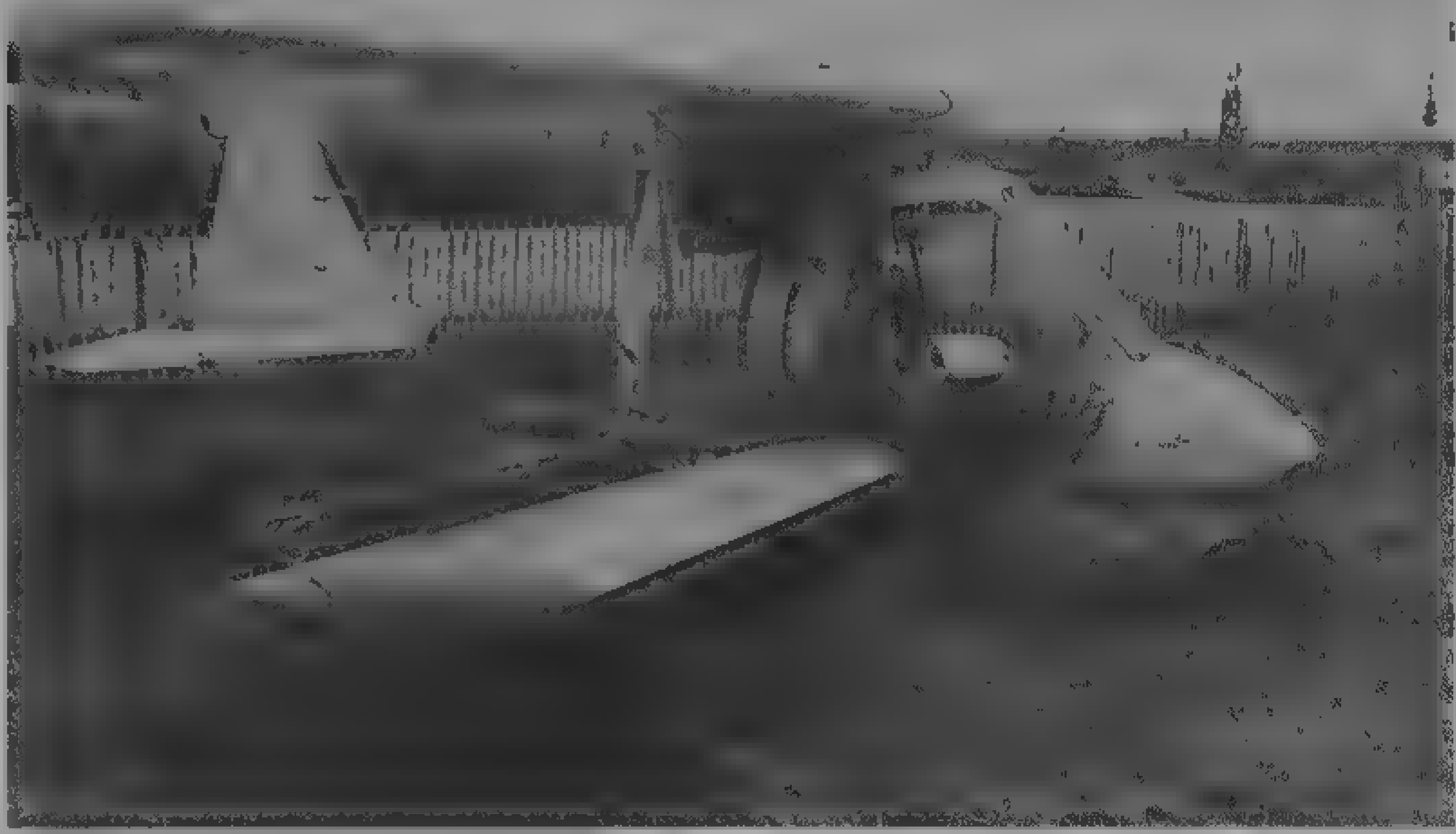
AVIATIKA JOINT STOCK COMPANY

33A Leningradsky Prospekt, 125284 Moscow
Telephone 7 (095) 945 56 54
Fax: 7 (095) 945 29 00
PRESIDENT: Igor B Pyankov
HEAD OF PATENT INFORMATION BUREAU: Vitaly Shtylkov

Aviatika Joint Stock Company was established in 1991 by Moscow Industrial Aviation Association named after Dementyev (MIAA), which is also responsible for MiG production, Gromov Flight Research Institute (FRI) and Moscow Aviation Institute (MAI). It began exporting its aircraft in 1992, delivering 90 to 12 countries in its first year

In addition to current production aircraft described, it is developing the Aviatika-910 enclosed-cockpit two-seat light plane, a twin-engined two/three-passenger and cargo carrying helicopter, and a six/eight-seat business jet with cruising speed of 460 kts (850 km/h, 528 mph) and 250 m (820 ft) runway requirement

VERIFIED



Aviatika-890 Farmer agricultural spraying aircraft (*Paul Jackson*) 1995

AVIATIKA-890

TYPE: Single- and two-seat light multipurpose biplane

PROGRAMME: Design began 1989, prototype construction 1990, first flights prototype and production aircraft 1991

CURRENT VERSIONS: **Aviatika-890** single-seater; **Aviatika-890U** two-seater, **Aviatika-890 Farmer**

DESIGN FEATURES: Strut- and wire-braced biplane; conventional tail surfaces carried on tubular boom, engine mounted under trailing edge of upper wing, slight sweepback on all wings, dihedral on lower wings only Semi-aerobatic and capable of flying in rough air conditions. Aviatika-890 Farmer has chemical tank under engine and spraybars aft of lower wings, weight of agricultural equipment 28 kg (62 lb), chemicals 60 kg (132 lb) maximum with Rotax 582 engine

FLYING CONTROLS: Full-span ailerons on lower wings, large-area rudder and elevators, each with ground adjustable tab

STRUCTURE: Aircraft grade aluminium and titanium alloys, alloy steels, fabric covering unaffected by sun's radiation or atmospheric precipitation Designed in accordance with FAR Pt 23

Aviatika-890U two-seat light biplane (*Paul Jackson*) 1995

LANDING GEAR: Non-retractable tricycle type, single wheel on each unit, cantilever spring main legs. Optional skis or floats

POWER PLANT: One 48 kW (64 hp) Rotax 582 piston engine standard, 59 6 kW (80 hp) Rotax 912 optional, two-blade pusher propeller Standard fuel 50 litres (13 2 US gallons, 11 Imp gallons), provision for 55 litre (14 5 US gallon, 12 Imp gallon) auxiliary tank on Aviatika-890

ACCOMMODATION: Open cockpit standard doors optional, one jettisonable seats side by side in Aviatika 890U, provision for backpack parachute(s), as alternative to BRS ballistically deployed parachute system for crew and aircraft

EQUIPMENT: Provision for up to 120 kg (265 lb) payload on four attachments, under engine mountings (60 kg; 132 lb), or underbelly (100 kg, 220 lb), or at lower wingtips (each 45 kg, 99 lb), including agricultural dusting and spraygear for Aviatika-890 Farmer

DIMENSIONS, EXTERNAL (A Aviatika 890 B 890U, C 890 Farmer all with Rotax 582)
Wing span, upper A, B, C 8 11 m (26 ft 7½ in)
Length overall, incl pitot A, C 5 32 m (17 ft 5½ in)
B 5 50 m (18 ft 0½ in)
Height overall A, B, C 2 25 m (7 ft 4⅝ in)
Wheel track A, B, C 1 52 m (5 ft 0 in)
Wheelbase A B, C 1 75 m (5 ft 9 in)
Propeller diameter: A, B, C 1 72 m (5 ft 7¾ in)
AREAS
Wings, gross, total A, B, C 14 29 m² (153 8 sq ft)
Ailerons (total) A, B, C 1 78 m² (19 16 sq ft)
Fin A B C 0 96 m² (10.33 sq ft)
Rudder A, B C 0 73 m² (7 86 sq ft)
Tailplane A, B, C 1 71 m² (18 40 sq ft)
Elevators: A B, C 1 27 m² (13 67 sq ft)
WEIGHTS AND LOADINGS
Weight empty: A, C 215 kg (474 lb)
B 235 kg (518 lb)
Max fuel A, B 40 kg (88 lb)
C 37 kg (81 lb)
Max T-O weight, A, B, C 450 kg (992 lb)
Max zero-fuel weight A, B 413 kg (910 lb)
Max wing loading A, B, C 31 47 kg/m² (6 45 lb/sq ft)
PERFORMANCE
Max level speed A 75 kts (140 km/h 87 mph)
B 67 kts (125 km/h; 77 mph)
C 59 kts (110 km/h, 68 mph)
Cruising speed A 48-65 kts (90-120 km/h, 56-74 mph)
B 48-59 kts (90-110 km/h; 56-68 mph)
C 48-54 kts (90-100 km/h; 56-62 mph)
T-O speed A 34 kts (63 km/h, 39 mph)
B 39 kts (72 km/h, 45 mph)
C 35 kts (65 km/h; 41 mph)

Landing speed: A	33 kts (60 km/h, 38 mph)
B	37 kts (68 km/h, 43 mph)
C	35 kts (65 km/h; 41 mph)
Max rate of climb at S/L: A	336 m (1 102 ft)/min
B	180 m (590 ft)/min
C	150 m (490 ft)/min
Service ceiling: A	5,500 m (18,045 ft)
B	4,000 m (13,125 ft)
T-O run: A	50 m (165 ft)
B, C	80 m (265 ft)
Landing run: A	85 m (280 ft)
B	110 m (360 ft)
Max range	
standard fuel: A, B	145 n miles (270 km, 167 miles)
with auxiliary tank	
A	295 n miles (550 km; 340 miles)
Endurance: C	3 h

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AVIATIKA-900 ACROBAT

TYPE: Single-seat aerobatic competition aircraft.

PROGRAMME: First flown 22 February 1993 at Ramenskoye; in production.

DESIGN FEATURES: Production development of MAI OSKB-1-3PM Kwant (1975-76 *Jane's*) which set five FAI-homologated records; all metal low wing monoplane, unswept-wings of symmetrical section without dihedral or anhedral, leading-edges sweptforward at root; unswept tail surfaces with strut-braced tailplane.

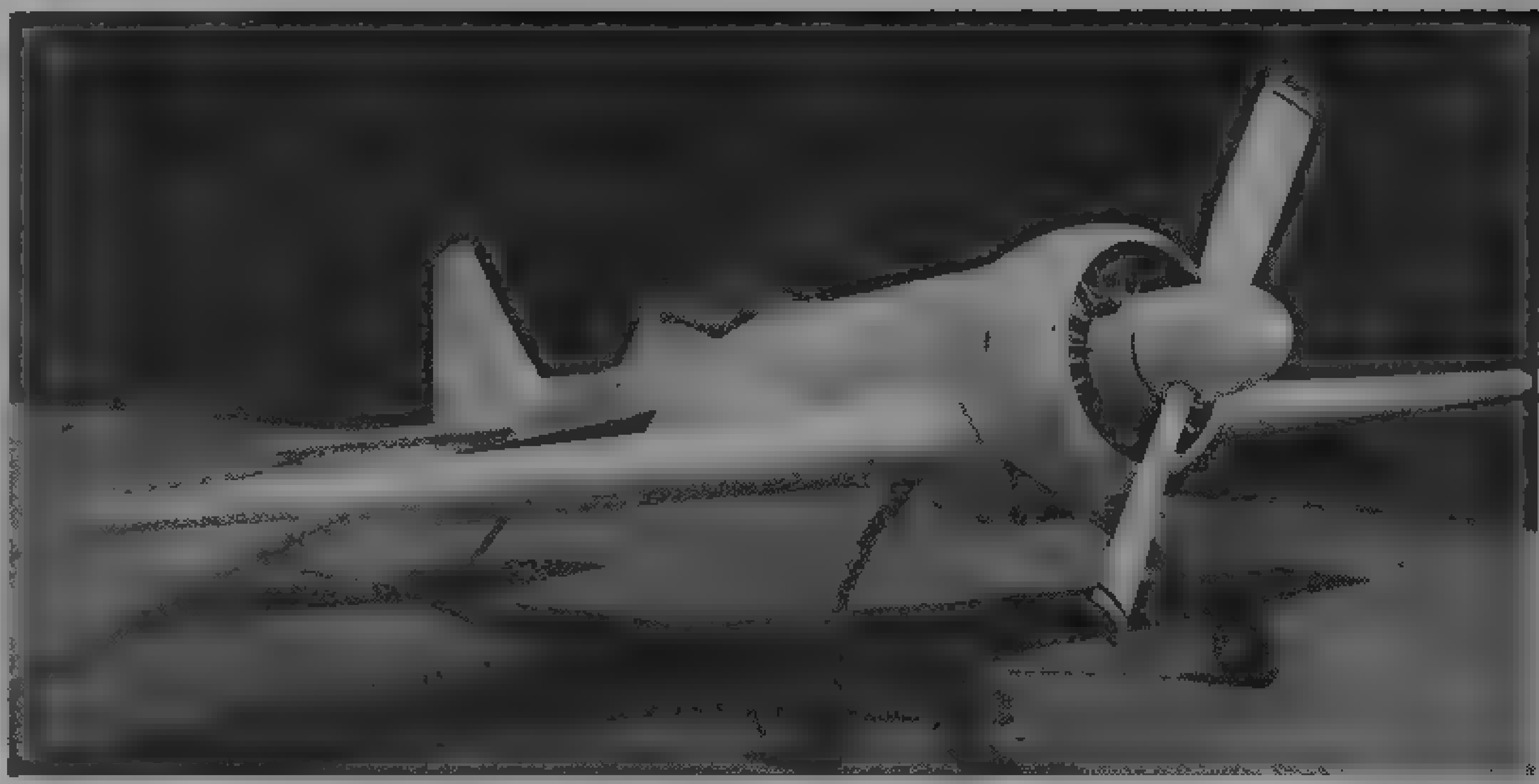
FLYING CONTROLS: Conventional three axis plus manoeuvring flaps for direct lift control, horn balanced rudder and elevators, ground adjustable tab on port aileron, rudder and starboard elevator.

LANDING GEAR: Non-retractable tailwheel type; single small wheel and tyre on each unit, arched cantilever spring mainwheel legs, steerable tailwheel.

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial engine, two-blade or three-blade propeller. Fuel tank in each wingroot leading-edge.

ACCOMMODATION: Pilot only, one-piece transparent blister canopy.

AVIONICS: *Comms:* Radio optional.



Aviatika-900 Acrobat aerobatic competition aircraft *1994*

DIMENSIONS, EXTERNAL:	
Wing span	7.15 m (23 ft 5½ in)
Wing chord: at root	2.38 m (7 ft 9½ in)
at tip	0.73 m (2 ft 4¾ in)
Length overall	5.70 m (18 ft 8½ in)
Height overall	3.00 m (9 ft 10 in)
Wheel track	2.00 m (6 ft 6¾ in)
Wheelbase	4.10 m (13 ft 5½ in)
Propeller diameter	2.50 m (8 ft 2½ in)
AREAS:	
Wings, gross	10.00 m² (107.6 sq ft)
Fin	0.48 m² (5.17 sq ft)
Rudder	0.64 m² (6.89 sq ft)
Tailplane	0.54 m² (5.81 sq ft)
Elevators	1.33 m² (14.32 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	590 kg (1,300 lb)
Max payload	120 kg (265 lb)
Max T-O and landing weight	715 kg (1,576 lb)
Max wing loading	71.5 kg/m² (14.65 lb/sq ft)
PERFORMANCE:	
Max level speed at S/L	202 kts (375 km/h, 233 mph)
T-O and landing speed	60 kts (110 km/h; 69 mph)
Stalling speed	58 kts (107 km/h; 67 mph)
Max rate of climb at S/L	1,380 m (4,525 ft)/min
T-O run	66 m (217 ft)
T-O to 15 m (50 ft)	160 m (525 ft)
Landing run	120 m (395 ft)
Range with max fuel	215 n miles (400 km; 248 miles)
g limits	±1.

VERIFIED

BERIEV (TANTK)

TAGANROG AVIATSIONNYI NAUCHNO-TEKHNICHESKIY KOMPLEKS IMIENI G M. BERIEVA (TANTK) (Taganrog Aviation Scientific-Technical Complex named after G. M. Beriev)

1 Aviatorov Square, 347928 Taganrog
Telephone: 7 (86344) 49839, 49901
Fax: 7 (86344) 41454

PRESIDENT AND GENERAL DESIGNER: Gennadv S. Panatov

This OKB founded by Georgy Mikhailovich Beriev (1902-1979) in 1932, except during Second World War, 1942-45, it has been based at Taganrog, in northeast corner of Sea of Azov; since 1948 has been primary centre for Russian sea plane development. In 1990 was redesignated as shown.

TANTK now includes the experimental design bureau experimental production facilities, a flight test complex economic, financial and logistics support services, with test bases and proving grounds at the Black Sea and Sea of Azov. Its products are experimental prototypes of amphibious aircraft and wing-in-ground-effect (WIG) vehicles, together with test reports and technical documentation for their series production. It undertakes design and development of unconventional aircraft in response to requests for proposals from other companies, testing of aircraft and assemblies in maritime conditions, and training of aircrew and ground personnel for seaplane operation.

UPDATED

BERIEV Be-32

NATO reporting name: Cuff

TYPE: Twin-turboprop unpressurised multipurpose light transport.

PROGRAMME: Development of Be-30, first flown in prototype form on 3 March 1967; eight Be-30s built, but programme terminated when Aeroflot ordered Let L-410As from Czechoslovakia. Hard currency shortage revived programme 1993, with modestly upgraded version known as Be-32, one of original Be-30s (RA 67205) exhibited at 1993 Paris Air Show, as Be-32 demonstrator with original Russian engines, certification scheduled 1995, production, with Canadian Pratt & Whitney engines, to be centred at Irkutsk Aviation Production Plant (IAPO).

CUSTOMERS: Order for 50 announced by Moscow Airways 1993.

DESIGN FEATURES: Conventional cantilever high-wing monoplane, three-section wings, with anhedral on outer panels wing section P-20, thickness/chord ratio 18 per cent at centre-section, 14 per cent at tip, 3° twist. Semi-monocoque fuselage of rectangular section; 42° sweptback vertical tail surfaces; engines at tip of centre section each side.

FLYING CONTROLS: Conventional three-axis; double-slotted flaps.

STRUCTURE: All-metal, spars and skin panels of wing torsion box are mechanically and chemically milled profile pressings, detachable bonded leading-edge, half of wings and most of tail unit covered with thin honeycomb panels stiffened with stringers, 70 per cent of fuselage made of adhesive-bonded panels, tips of wings and tail surfaces and wing/fuselage fillets of GFRP.

LANDING GEAR: Tricycle type; single wheel on each unit; nosewheel retracts forward, mainwheels rearward into engine nacelles, tyres size 720 × 320 mm on mainwheels, pressure 3.9 bars (57 lb/sq in), 500 × 150 mm on nosewheel, pressure 2.95 bars (43 lb/sq in); mainwheel brakes. Optional floats and skis.

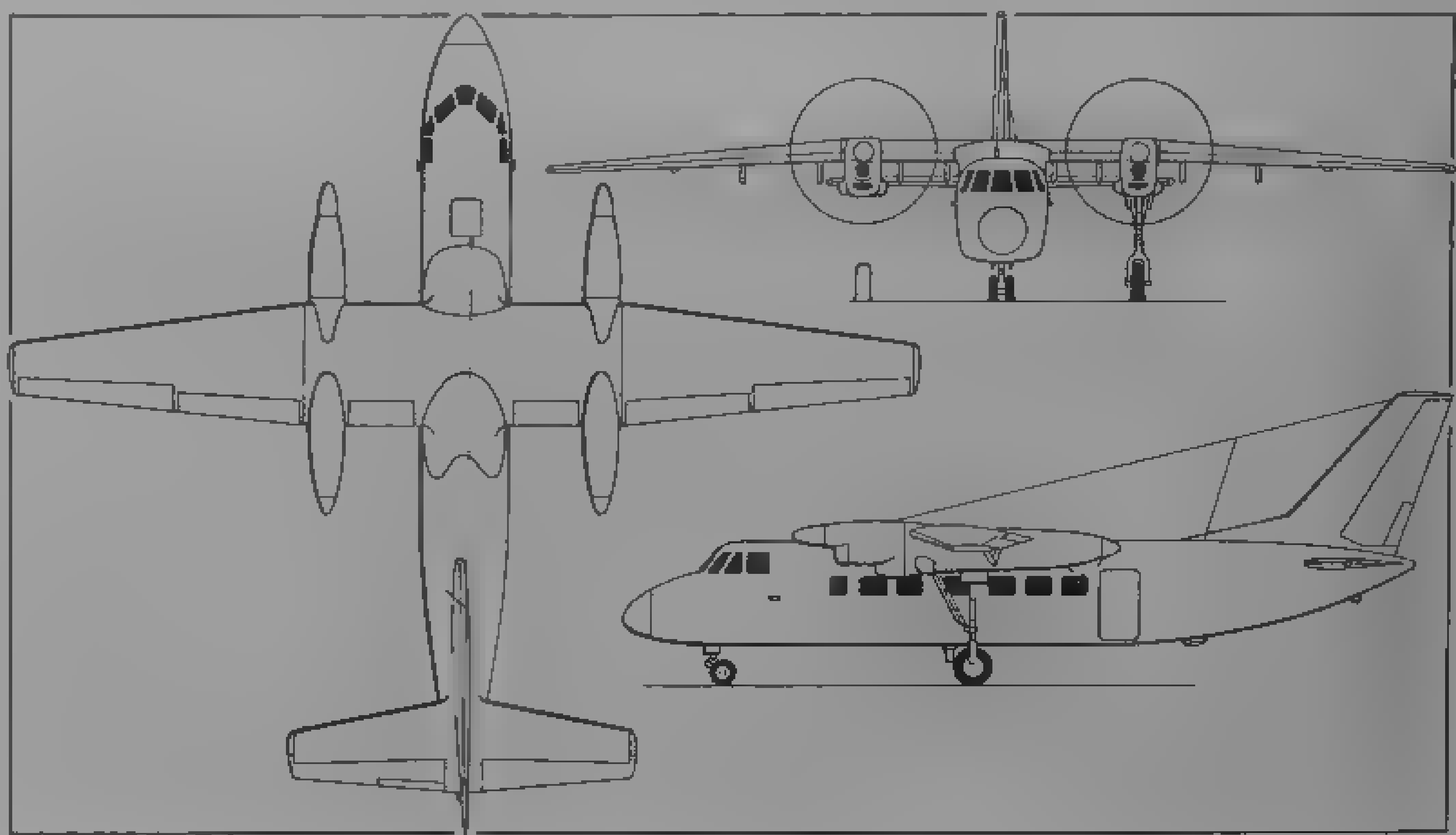
POWER PLANT: Two 820 kW (1,100 shp) P&WC PT6A-65B turboprops (754 kW; 1,011 shp Mars, Omsk, TVD-10Bs in demonstrator); three-blade propellers, six integral wing fuel tanks, total capacity 2,250 litres (594 US gallons, 495 Imp gallons).

ACCOMMODATION: Basic seating for two crew and 14 to 17 passengers in pairs, with centre aisle, other versions include a seven-passenger business transport, cargo version with 3.64 m² (39.2 sq ft) cargo floor for 2,000 kg (4,410 lb) freight, transport with sidewall seats for 12 para troops or 17 troops, and ambulance for nine stretcher patients, six seated casualties and attendant. Carry-on baggage compartment on starboard side, aft of cabin seating, opposite forward-hinged door and airstairs, toilet to rear.

SYSTEMS: Three-phase AC electrical system of 115/200 V 400 Hz, with two 16 kW GT16P48E alternators, DC supply via VU6SK 25.5 V 12 kW rectifiers. Hot air de-icing system for wing and tail unit leading-edges, engine air intakes and oil cooler; electrothermal system for propeller, spinner and windscreen anti-icing. Cabin and flight deck heated and ventilated. Portable oxygen bottles, masks and smoke protection goggles.

AVIONICS: *Comms:* Com/nav radio, emergency radio, radio beacon buoy.
Radar: Weather radar in nose.
Flight: Automatic flight control system, FON-BP type air data system.

DIMENSIONS, EXTERNAL:	
Wing span	17.00 m (55 ft 9¼ in)
Wing aspect ratio	9.03
Length overall	15.70 m (51 ft 6 in)
Fuselage width	1.70 m (5 ft 7 in)
Height overall	5.52 m (18 ft 1½ in)



Beriev Be-32 twin-turboprop multipurpose light transport (*Jane's/ Mike Keep*) *1994*

Prototype Beriev A-40 Albatross ASW/surveillance/minelaying amphibian *(Mike Jerram)*

1994

Tailplane span	6.36 m (20 ft 10¼ in)
Wheel track	5.20 m (17 ft 0¾ in)
Wheelbase	4.75 m (15 ft 7 in)
Cabin door: Height	1.30 m (4 ft 3 in)
Width	0.75 m (2 ft 5½ in)
Emergency exits (each): Height	0.92 m (3 ft 0¼ in)
Width	0.60 m (1 ft 11½ in)
DIMENSIONS, INTERNAL	
Cabin: Length	5.66 m (18 ft 7 in)
Height	1.81 m (5 ft 11¼ in)
Width	1.52 m (4 ft 11¾ in)
Volume	13.00 m³ (459 cu ft)
Cargo floor area	3.64 m² (39.18 sq ft)
Baggage hold, volume	0.96 m³ (33.9 cu ft)
AREAS	
Wings, gross	32.00 m² (344.45 sq ft)
Ailerons (total)	2.60 m² (28.00 sq ft)
Trailing-edge flaps (total)	5.80 m² (62.43 sq ft)
Fin	3.14 m² (33.80 sq ft)
Rudder	2.43 m² (26.16 sq ft)
Tailplane	6.28 m² (67.60 sq ft)
Elevators (total)	2.72 m² (29.28 sq ft)
WEIGHTS AND LOADINGS (TVD-10B engines)	
Weight empty	4,760 kg (10,495 lb)
Max payload	1,900 kg (4,190 lb)
Max fuel	1,700 kg (3,750 lb)
Max T-O weight	7,300 kg (16,090 lb)
Max landing weight	6,800 kg (14,990 lb)

Refurbished Beriev Be-30, displayed as Be-32 demonstrator *(Paul Jackson)*

1995

PERFORMANCE (with TVD-10B engines. PT6A-65B estimated data similar)

Never-exceed speed	Mach 0.48 (264 kts; 490 km/h; 304 mph)
Max cruising speed at 3,000 m (9,840 ft)	Mach 0.43 (237 kts; 440 km/h; 273 mph)
Econ cruising speed at 3,000 m (9,840 ft)	202 kts (375 km/h; 233 mph)
Min manoeuvring speed	79 kts (145 km/h; 90 mph)
Max rate of climb at S/L, 15° flaps	450 m (1,475 ft)/min
Rate of climb at S/L, 15° flaps, OEI	81 m (265 ft)/min
T-O to 10.7 m (35 ft)	600 m (1,970 ft)
Landing from 15 m (50 ft)	620 m (2,035 ft)
Range: with 17 passengers (1,150 kg; 2,535 lb)	323 n miles (600 km; 373 miles)
with 14 passengers	518 n miles (960 km; 596 miles)
with seven passengers	944 n miles (1,750 km; 1,087 miles)

UPDATED

BERIEV A-40 ALBATROSS

NATO reporting name: Mermaid

TYPE: Twin-turbofan maritime patrol amphibian.

PROGRAMME: Conceived as military amphibian to carry extensive avionics and operational systems in primary anti-submarine warfare form; design started 1983, prototype construction began 1985; first flight December 1986, construction of production aircraft started 1987, mentioned Spring 1988 by Rear Admiral William O Studeman, then US director of naval intelligence, as seaplane with provisional Western designation 'Tag-D' (implying fourth unidentified type photographed by US reconnaissance satellite over Taganrog), for possible ASW/surveillance/minelaying role, identified as A-40 Albatross, designed by Alexei K. Konstantinov "for search and rescue", when prototype flown over Tushino Airport during Aviation Day display, 20 August 1989; feature in *Krasnaya Zvezda*, 6 August 1989 stated that in this role A-40 will be confined to SAR missions near coast and next task confronting designers was to produce similar aircraft capable of operating anywhere in Pacific. A-40 prototype has set 128 records, on some of which it lifted a payload of 10,000 kg to 13,281 m (43,573 ft); second prototype has flown.

CURRENT VERSIONS: **A-40**: ASW/surveillance/minelaying version.

Be-40P Passenger: Projected transport for 105 passengers, five-abreast, aisle between three-seat (port) and two-seat units, two toilets at rear (port), other facilities fore and aft of passengers, three flight crew plus cabin staff. Range with maximum payload 2,160 n miles (4,000 km; 2,485 miles).

Be-40PT Cargo-passenger: Projected transport with maximum payload of 10,000 kg (22,045 lb), 37 or 70 passengers, five-abreast at front of cabin, freight to rear. Range with maximum payload 2,265 n miles (4,200 km; 2,610 miles).

Be-42: Search and rescue version, see separate entry.

CUSTOMERS: Initial order 20 A-40s for CIS Naval Aviation, manufacture delayed by lack of funding.

DESIGN FEATURES: Largest amphibian yet built. Swept wings of moderate aspect ratio, with high-lift devices, single-step hull of high length to beam ratio, with what Russian press describes as "the world's first development of a variable-rise bottom, providing a considerable improvement in stability and controllability in the water, as well as a reduction in *g* loads when landing and taking off at sea"; small wedge-shape boxes aft of step aid 'unsticking' from water in wave heights up to 2.2 m (7 ft 2½ in); all-swept T tail, high-mounted engines protected from spray by strakes on each side of nose and by wings (length of strakes extended considerably in 1993); large underwing pod each side of hull, faired into wingroot; wing leading-edge sweep 23° 13′, supercritical wing sections, thickness/chord ratio 14.5 per cent to 11.3 per cent, incidence 3° 23′ at root, wing twist 4° 30′, no dihedral or anhedral; large dorsal fin.

FLYING CONTROLS: Entire span of each wing trailing-edge occupied by aileron and two-section area-increasing double-slotted flaps; full span leading-edge slats, outer spoilers assist ailerons, variable incidence tailplane; conventional rudder and elevators. Powered controls, with spring feel and electric trim.

Beriev A-40 Albatross amphibian *(Paul Jackson)*

1995

STRUCTURE: All metal semi monocoque boat type fuselage with heavy gauge double-chine planing bottom forward of step, conventional two spar wings, honeycomb-core sandwich panels and composites used widely, water rudder at rear of hull

LANDING GEAR: Hydraulically retractable tricycle type, twin-wheel nose unit retracts rearward, main four wheel bogies retract rearward into large underwing pods, rotating round pivot to stow as tandem twin-wheels on each side, oleo-nitrogen shock-absorbers nosewheel tyres size 840 × 290 mm pressure 6.9 to 7.35 bars (100 to 106 lb/sq in), mainwheel tyres size 1 030 × 350 mm, pressure 9.3 to 9.8 bars (135 to 142 lb/sq in) multidisc brakes on mainwheels, with inertial anti-skid units Ground turning radius 19.25 m (63 ft 2 in) Nosewheel steering angle ±55°

POWER PLANT: Two Aviadvigatel D-30KPV turbofans, pylon-mounted above wingroot pods, with outward toed exhaust efflux; each 117.7 kN (26,455 lb st), RKBM RD-60K booster turbojet, rated at 24.5 kN (5,510 lb st), in fairing on each turbofan pylon, slightly aft and slightly inboard of D-30KPV nozzle, with vertically split eyelid jetpipe closure at rear D-30KPVs to be replaced later by two 147.1 kN (33,070 lb st) turbofans Fuel tanks in wing torsion box capacity 35,100 litres (9 272 US gallons, 7,721 Imp gallons) Total oil capacity 94.5 litres (25 US gallons, 20.75 Imp gallons) Flight refuelling probe above nose

ACCOMMODATION: Crew of eight two pilots, flight engineer, radio operator, navigator/observer and three observers Door on each side to rear of flight deck, port door outward-opening, starboard door inward-opening

SYSTEMS: Flight deck and crew quarters air conditioned and pressurised by engine bleed and APU. Four hydraulic systems at 207 bars (3,000 lb/sq in), 190 litres (50 US gallons; 42 Imp gallons) of AMG-10 fluid, flow rate 55 litres (14.5 US gallons, 12 Imp gallons)/min Pneumatic system pressure 207 bars (3,000 lb/sq in), capacity of bottles 95 litres (3.35 cu ft) Three-phase 115/220 V 400 Hz AC electrical system, single-phase 115 V 400 Hz AC system; 27 V DC system, supplied by two engine-driven 60 kVA AC generators and three static inverters, three batteries. Gaseous oxygen bottle, pressure 147 bars (2,135 lb/sq in). Provision for de-icing tail unit, slats, engine air intakes and windscreen TA-12 APU, operable up to 7,000 m (23,000 ft)

AVIONICS: *Comms* Com radio and IFF

Radar: Navigation, search, surveillance and wave height measurement radar

Flight INS

Instrumentation Conventional instruments

Mission Slim container, probably for ESM, above each wingtip float pylon. bombing equipment, optical/TV sight

ARMAMENT: Stores bay in bottom of hull, aft of step.

DIMENSIONS EXTERNAL	
Wing span	41 62 m (136 ft 6½ in)
Wing chord at root	7 28 m (23 ft 10¾ in)
at tip	2.24 m (7 ft 4¼ in)
Wing aspect ratio	8 6
Length overall, incl nose probe	43 84 m (143 ft 10 in)
Length of fuselage	38 92 m (127 ft 8 in)
Max diameter of fuselage	3 50 m (11 ft 6 in)
Height overall	11 07 m (36 ft 3¾ in)
Tailplane span	11 87 m (38 ft 11½ in)
Wheel track, c/l of oleos	4.96 m (16 ft 3¼ in)
Wheelbase	14.84 m (48 ft 8 in)
Crew doors, Height	1 10 m (3 ft 7¼ in)
Width	0.70 m (2 ft 3½ in)
Stores bay Length	6.50 m (21 ft 4 in)
Width	1 76 m (5 ft 9¼ in)
Emergency exits Height	1.10 m (3 ft 7¼ in)
Width	0 70 m (2 ft 3½ in)
DIMENSIONS INTERNAL	
Cabin, excl flight deck	
Length pressurised	7 90 m (25 ft 11 in)
unpressurised	13 9 m (45 ft 7¼ in)
Max width	3.25 m (10 ft 8 in)
Max height	2 10 m (6 ft 10½ in)
Floor area, pressurised	38 6 m² (415.5 sq ft)
Unpressurised cabin volume	58 0 m³ (2,048 cu ft)
AREAS	
Wings, gross	200 0 m² (2,152 8 sq ft)
Ailerons (total)	6 142 m² (66 11 sq ft)
Flaps (total)	36 55 m² (393 43 sq ft)
Slats (total)	23 00 m² (247 58 sq ft)
Spoilers (total)	6.25 m² (67 28 sq ft)
Fin	20.99 m² (225.94 sq ft)
Rudder	8 76 m² (94 30 sq ft)
Tailplane	28 086 m² (302 32 sq ft)
Elevators (total)	7 104 m² (76 47 sq ft)
WEIGHTS AND LOADINGS	
Max payload	6,500 kg (14,330 lb)
Max fuel weight	35,000 kg (77,160 lb)
Max T-O and ramp weight	86,000 kg (189 595 lb)
Max landing weight: on land	73,000 kg (160,935 lb)
on water	85,000 kg (187,390 lb)
Max wing loading	430 kg/m² (88 07 lb/sq ft)
Max power loading	365.3 kg/kN (3 58 lb/lb st)
PERFORMANCE (at max T-O weight):	
Max Mach number in level flight	0 79
Never-exceed speed (VNE)	350 kts (650 km/h, 404 mph) EAS
Max level speed at 6,000 m (19,700 ft)	410 kts (760 km/h, 472 mph)
Max cruising speed at 6,000 m (19,700 ft)	388 kts (720 km/h, 447 mph)
Stalling speed, flaps up	146 kts (270 km/h, 168 mph)
flaps down	99 kts (182 km/h, 113 mph)
Rate of climb at S/L, OEI	1,800 m (5,900 ft)/min
Service ceiling	9,700 m (31 825 ft)
T-O run	1,000 m (3,280 ft)
T-O to 15 m (50 ft)	1,100 m (3,610 ft)
Landing from 15 m (50 ft)	1,450 m (4,760 ft)
Landing run	900 m (2,955 ft)
Range: with max payload	2,212 n miles (4,100 km, 2,547 miles)
with max fuel	2,967 n miles (5,500 km, 3,417 miles)
OPERATIONAL NOISE LEVELS	
T-O	104 EPNdB
Climb	99 EPNdB
Landing	102 EPNdB

UPDATED

BERIEV Be-42

NATO reporting name Mermaid

TYPE: Twin-turbofan search and rescue amphibian

PROGRAMME: Design started 1988 Major components completed, assembly delayed by lack of funding

DESIGN FEATURES: As A-40, but specialised SAR equipment and no booster turbojets. No wingtip ESM containers.

ACCOMMODATION: Nine crew two pilots, flight engineer, radio operator, navigator, flight technician, senior medical attendant, two assistants. Provision for 54 survivors, who enter via side hatches, aided by mechanised ramps. Two outward-opening doors on port side, two inward-opening doors starboard

EQUIPMENT: Flares. Power boats, two LPS 6 liferafts, onboard equipment to combat hypothermia for 20 survivors, AT-2 transfusion equipment, DI-C-0.4 defibrillator, EK-1T-03M2 electrocardiograph, other resuscitation and surgical equipment and medicines Electro-optical sensors and searchlights to detect shipwreck survivors by day or night

DIMENSIONS EXTERNAL	
Forward cabin door, each side	
Height	1 80 m (5 ft 10¾ in)
Width	1 95 m (6 ft 4¾ in)
Rear cabin door, each side: Height	0 70 m (2 ft 3½ in)
Width	1 45 m (4 ft 9 in)
DIMENSIONS INTERNAL	
Cabin volume, unpressurised	69 0 m³ (2,436 cu ft)
Underfloor hold volume	6 3 m³ (222 cu ft)
WEIGHTS AND LOADINGS	
Max payload	5 000 kg (11,025 lb)
PERFORMANCE (estimated, at max T-O weight)	
Max level speed at 6,000 m (19,700 ft)	458 kts (850 km/h, 528 mph)
Max cruising speed at 5 000 m (16,400 ft)	431 kts (800 km/h, 497 mph)
Max rate of climb at S/L	840 m (2,755 ft)/min
Rate of climb at S/L, OEI	210 m (690 ft)/min
Service ceiling	10,000 m (32,800 ft)
Service ceiling, OEI	4,100 m (13,450 ft)
Range with max payload (54 survivors)	1 888 n miles (3,500 km, 2,175 miles)

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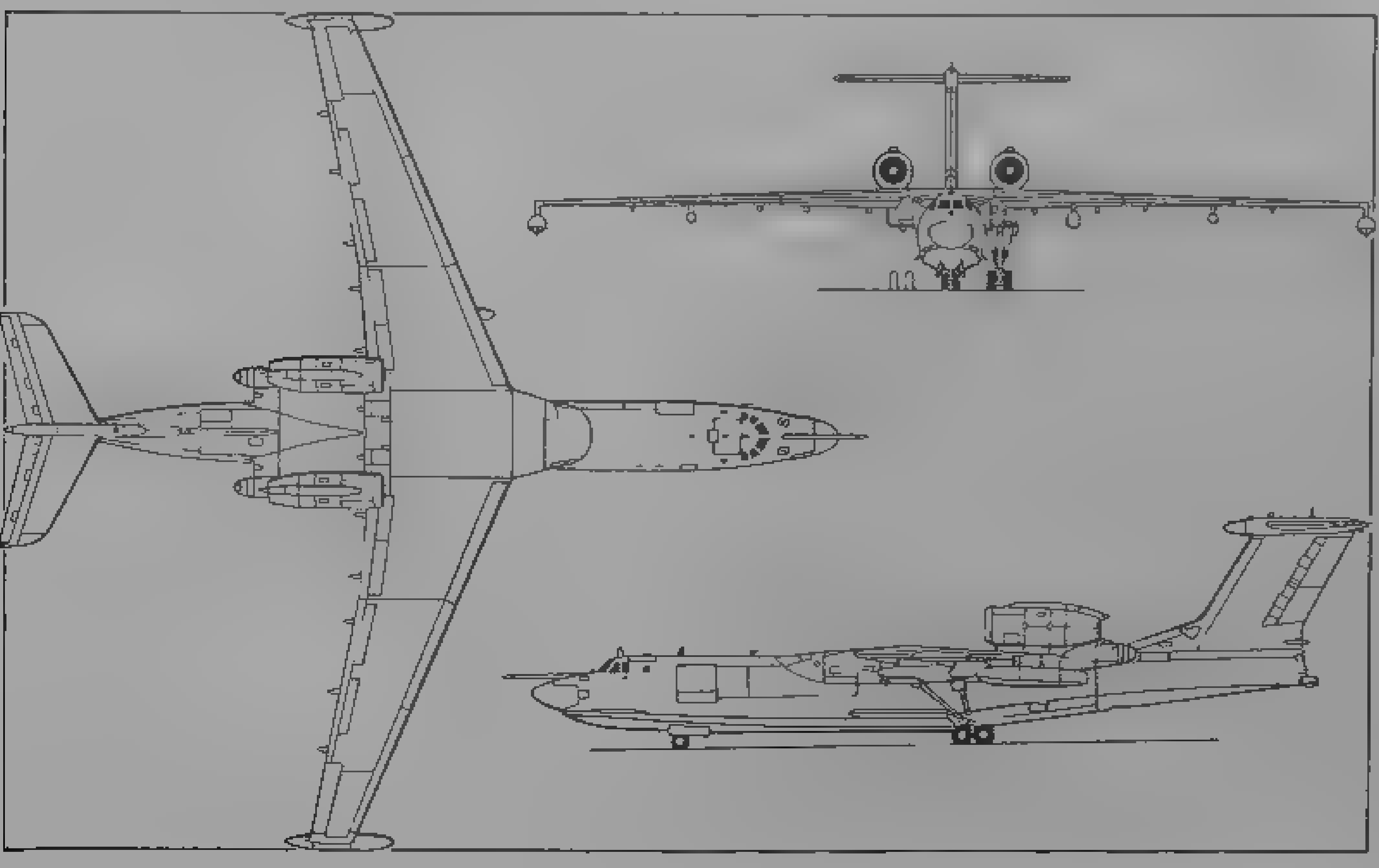


Beriev Be-42 twin-turbofan search and rescue amphibian *(Jane's/Mike Keep)*

1995

BERIEV Be-200

TYPE: Twin-turbofan multirole amphibian, primary mission firefighting

PROGRAMME: Details announced, and model displayed, at 1991 Paris Air Show; full-scale mockup constructed 1991, two prototypes being built by Irkutsk Aircraft Production Association in partnership with ILTA Trade Finance SA of Geneva, Switzerland. first flight of first experimental prototype scheduled November 1995, two more aircraft being built 1995, certification and first deliveries 1997

CURRENT VERSIONS: **Firefighting:** Tanks under cabin floor capacity 12 m³ (423 cu ft) water; tanks in cabin for 1 2 m³ (42.3 cu ft) liquid chemicals, two retractable water scoops forward of step, two aft. 30 fully equipped smoke jumpers can be carried on seats along sidewalls of cabin, 12 tonnes of water scooped from seas with waves up to 1 2 m (4 ft) Fully fuelled, Be-200 can drop total 320,000 kg (705,465 lb) of water in successive flights when airfield to reservoir distance is 108 n miles (200 km, 125 miles) and reservoir to fire zone distance is 5 4 n miles (10 km; 6.2 miles); or 140,000 kg (308 640 lb) when distances are respectively 108 n miles (200 km, 125 miles) and 27 n miles (50 km, 31 miles). Tanks quickly removable when aircraft carries freight Flight deck and cargo hold sealed against smoke ingress. ARIA-2000 avionics features include water source/drop zone track memory, automatic glide slope and digital flight deck/ground fire crew communications

Passenger: Two flight crew, two cabin attendants, and 64 tourist class passengers four-abreast in pairs, with centre aisle at seat pitch of 75 cm (29.5 in).

Cargo: Payload 8,000 kg (17,635 lb) in unobstructed cabin 17 0 m (55 ft 9 in) long, 2 6 m (8 ft 6 in) wide and 1 9 m (6 ft 3 in) high Estimated range 595 n miles (1,100 km, 685 miles) with 7 000 kg (15 430 lb) payload

Ambulance: Two flight crew, seven seated casualties/medical personnel, 30 stretchers in three tiers

Search and rescue: Sensors and searchlights for detecting survivors, and onboard medical equipment

CUSTOMERS: Reported 54 for Russian state forest service/firefighting agency; 50 for Sakhalin regional administration; five for Irkutsk regional administration

DESIGN FEATURES: Scaled-down version of A-40. Details generally similar; underwing stabilising floats moved inboard from tips, winglets added, twin-wheel main landing gear units, and no booster turbojets. Supercritical wing sections, thickness/chord ratio 16 per cent to 11.5 per cent

STRUCTURE: Hull made primarily of high-strength aluminium/lithium alloys, interior of composites, water tanks of ferric alloys of aluminium in firefighting version

FLYING CONTROLS: Area increasing single-slotted flaps

LANDING GEAR: Twin-wheel main units, tyre size 950 × 300 mm, pressure 9.8 to 10.3 bars (142 to 150 lb/sq in), nosewheel tyre size 620 × 180 mm, pressure 7.35 to 7.85 bars (106 to 114 lb/sq in). Ground turning radius 17.4 m (57 ft 1 in). Nosewheel steering angle ±45°

POWER PLANT: Two ZMKB Progress D-436T turbofans, each 73.6 kN (16,550 lb st). Much reduced fuel capacity compared with A-40. Total oil capacity 22 litres (5.8 US gallons, 4.85 Imp gallons)

ACCOMMODATION: Two flight crew, up to 68 tourist class passengers, or 10 to 32 first class and business class passengers at up to 102 cm (40 in) seat pitch, with provision for galley, toilet and baggage stowage. Two outward-opening doors each side, cargo door and emergency exits; forward and rear freight/baggage holds

SYSTEMS: All accommodation pressurised. Three hydraulic systems at 207 bars (3,000 lb/sq in); 150 litres (39.6 US gallons; 33 Imp gallons) of MGJ-5U fluid, flow rate 70 litres (18.5 US gallons, 15.4 Imp gallons)/min. Capacity of pneumatic system bottles 29 litres (1.02 cu ft). Electrical system, de-icing and APU as A-40

AVIONICS: *Radar:* MN-85 weather radar

Flight: INS standard

Instrumentation: AlliedSignal EFIS displays, with six LCDs

DIMENSIONS, EXTERNAL:

Wing span over winglets	32.70 m (107 ft 3½ in)
Wing chord: at root	5.58 m (18 ft 3½ in)
at tip	1.72 m (5 ft 7¾ in)
Length overall	32.05 m (105 ft 1¾ in)
Length of fuselage	29.18 m (95 ft 9 in)
Max diameter of fuselage	2.86 m (9 ft 4½ in)
Height overall	8.90 m (29 ft 2½ in)
Tailplane span	10.11 m (33 ft 2 in)
Wheel track	4.30 m (14 ft 1¼ in)
Wheelbase	11.14 m (36 ft 6½ in)
Width over stabilising floats	25.60 m (84 ft 0 in)
Passenger doors (each): Height	1.70 m (5 ft 7 in)
Width	0.90 m (2 ft 11½ in)
Cargo door: Height	1.80 m (5 ft 10¾ in)
Width	2.00 m (6 ft 6¾ in)
Emergency exits: Height	1.70 m (5 ft 7 in)
Width	0.90 m (2 ft 11½ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	17.00 m (55 ft 9 in)
Max width	2.60 m (8 ft 6¼ in)
Max height	1.90 m (6 ft 2¾ in)
Floor area	39.0 m² (420 sq ft)
Volume: forward baggage hold	8.8 m³ (310 cu ft)
rear baggage hold	4.5 m³ (159 cu ft)
main cabin and freight/baggage holds, total, cargo configuration	84 m³ (2,966 cu ft)

AREAS:

Wings, gross	117.44 m² (1,264.2 sq ft)
Ailerons (total)	3.56 m² (38.32 sq ft)
Flaps (total)	20.43 m² (219.91 sq ft)
Slats (total)	12.61 m² (135.74 sq ft)
Spoilers (total)	4.59 m² (49.41 sq ft)
Fin	12.60 m² (135.63 sq ft)
Rudder	4.60 m² (49.52 sq ft)
Tailplane	17.96 m² (193.33 sq ft)
Elevators (total)	6.96 m² (74.92 sq ft)

WEIGHTS AND LOADINGS:

Max fuel weight	12,260 kg (27,025 lb)
Max T-O and ramp weight	36,000 kg (79,365 lb)
Max airborne weight (after water scooping)	43,000 kg (94,800 lb)
Max landing weight, land or water	35,000 kg (77,160 lb)
Max wing loading	306.5 kg/m² (62.78 lb/sq ft)
Max power loading	244.5 kg/kN (2.40 lb/lb st)

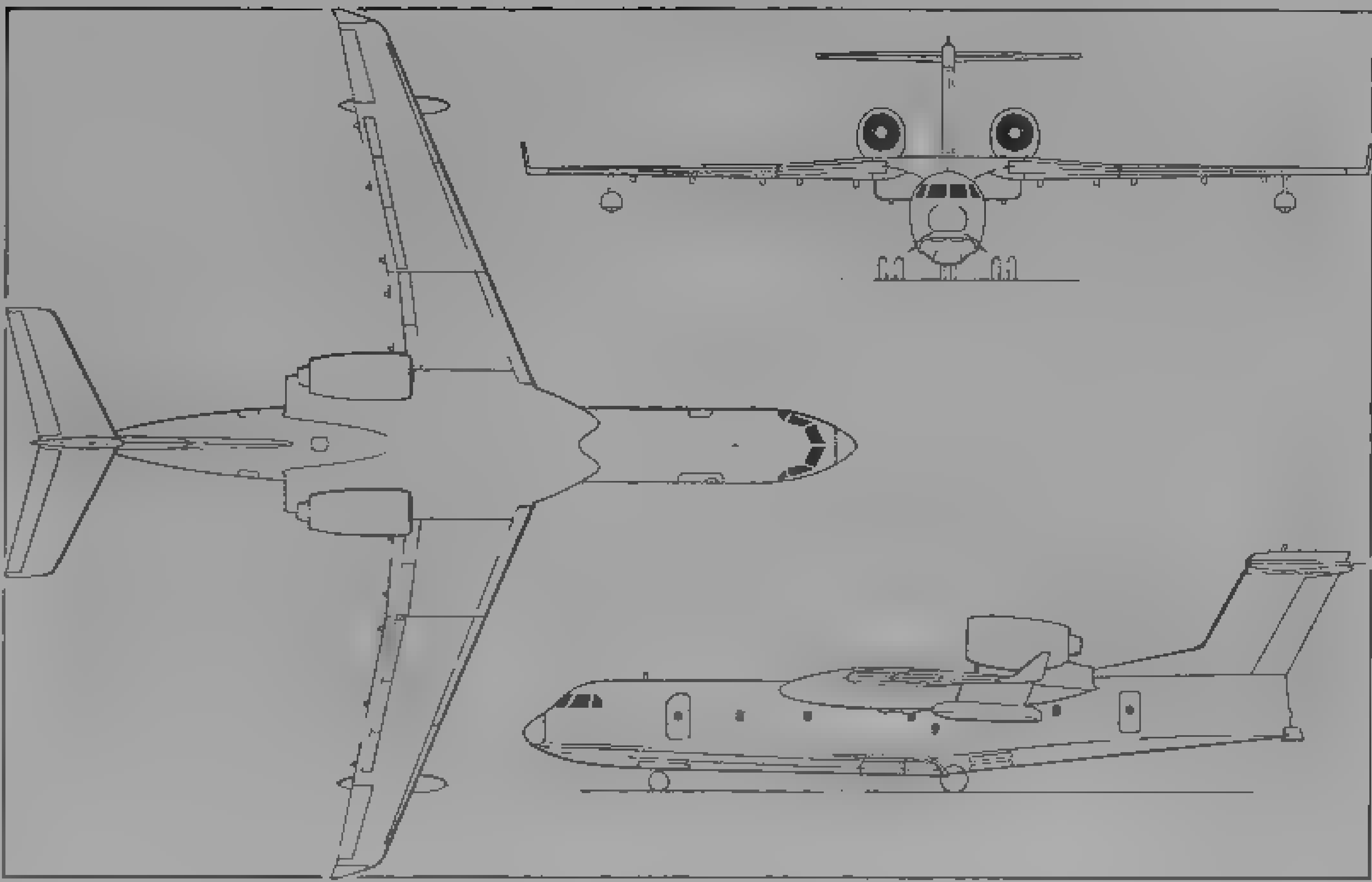
PERFORMANCE (estimated, at max T-O weight):

Max Mach number in level flight	0.69
Never-exceed speed (V_{NE})	329 kts (610 km/h, 379 mph) EAS
Max level speed at 7,000 m (22,965 ft)	388 kts (720 km/h, 447 mph)
Max cruising speed at 8,000 m (26,250 ft)	377 kts (700 km/h, 435 mph)
Stalling speed: flaps up	116 kts (215 km/h, 134 mph)
flaps down	84 kts (155 km/h, 97 mph)
Max rate of climb at S/L	840 m (2,755 ft)/min
Rate of climb at S/L, OEI	168 m (550 ft)/min
Service ceiling	11,000 m (36,090 ft)
Service ceiling, OEI	5,500 m (18,045 ft)
T-O to 15 m (50 ft): on land	600 m (1,970 ft)
on water	1,000 m (3,280 ft)
Landing from 15 m (50 ft): on land	1,050 m (3,445 ft)
on water	1,100 m (3,610 ft)
Water scooping distance to 15 m (50 ft)	1,450 m (4,760 ft)
Range: with 4,000 kg (8,818 lb) payload	1,133 n miles (2,100 km, 1,305 miles)
with max fuel	2,158 n miles (4,000 km; 2,485 miles)

OPERATIONAL NOISE LEVELS:

T-O	96 EPNdB
Climb	90 EPNdB
Landing	98 EPNdB

UPDATED



Beriev Be-200 civil utility amphibian (*Jane's/Mike Keep*) 1992

BERIEV Be-103

TYPE: Twin-engined light business amphibian

PROGRAMME: Design started 1992, model exhibited and initial data released at MosAeroshow '92, prototype construction began 1994; first flight scheduled for 1995

DESIGN FEATURES: Low-wing monoplane, with water-displacing wings of moderate sweep with large wingroot extensions, two-step boat hull, no stabilising floats; engine pylon-mounted on each side of rear fuselage, aft of wings; sweptback fin and rudder; tailplane mid-set on fin. Wing leading-edge sweep 22°; wing section NACA 2412M, dihedral 5° 3' on outer wings; incidence 1°; aspect ratio 6.46

FLYING CONTROLS: Manually operated, slab tailplane and ailerons by rods, rudder by cables, electric trim, spring feel in tailplane control, no flaps

STRUCTURE: All-metal semi-monocoque boat type fuselage; all-metal single-spar wings

LANDING GEAR: Pneumatically retractable tricycle type, single wheel on each unit, mainwheels retract inward into wing centre-section; nosewheel retracts forward, oleo-nitrogen shock absorbers, brakes on mainwheels. Mainwheel tyre size 400 × 150 mm, pressure 3 bars (43 lb/sq in); mainwheel tyres size 500 × 150 mm, pressure 3 bars (43 lb/sq in); disc brakes, self-centring nosewheel steerable ±35

POWER PLANT: Two 129 kW (173 hp) Bakanov M-17 piston engines, each driving an AV-103 three-blade variable-pitch tractor propeller, with optional reversible-pitch, fuel tank in each wing, total capacity 450 litres (119 US gallons, 99 Imp gallons)

ACCOMMODATION: Pilot and five passengers in pairs, upward-opening door on each side, hinged on centreline, baggage/freight compartment aft of cabin. Optional ambulance, all-cargo, patrol, ecological monitoring use

SYSTEMS: Interior heated and ventilated. Pneumatic system, bottle capacity 6 litres (365 cu in) of air, pressure 49 bars (711 lb/sq in). Electrical system 27 V DC and three-phase 36 V 400 Hz AC, supplied by 3 kW DC generators, rectifiers and 25 Ah battery

AVIONICS: *Comms:* VHF com radio, intercom and emergency locator beacon

Flight: Digital flight control and nav equipment; position, angle rate, linear acceleration and angle of attack sensors

Instrumentation: Conventional instrumentation

DIMENSIONS, EXTERNAL:

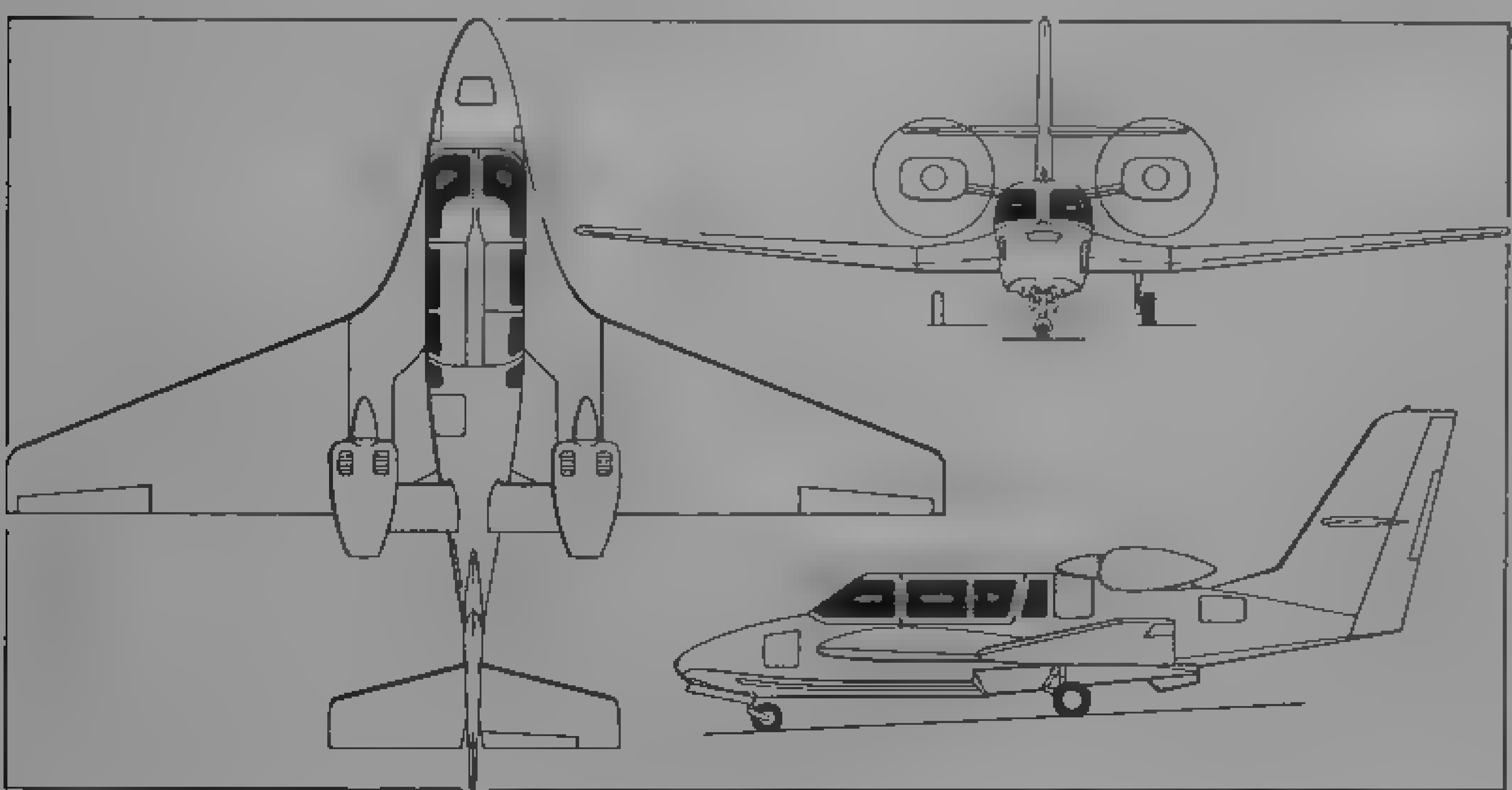
Wing span	12.72 m (41 ft 9 in)
Wing chord: at root	6.21 m (20 ft 4½ in)
at tip	0.83 m (2 ft 9 in)
Wing aspect ratio	6.45
Length overall	10.45 m (34 ft 3½ in)
Length of fuselage	9.96 m (32 ft 8 in)
Height overall	3.90 m (12 ft 9½ in)
Tailplane span	3.90 m (12 ft 9½ in)
Wheel track	2.91 m (9 ft 6½ in)
Wheelbase	4.15 m (13 ft 7¼ in)
Propeller diameter	1.60 m (5 ft 3 in)
Distance between propeller centres	3.00 m (9 ft 10¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length	3.00 m (9 ft 10¼ in)
Max width	1.34 m (4 ft 4¾ in)
Max height	1.26 m (4 ft 1½ in)
Floor area	3.00 m² (32.3 sq ft)
Volume	4.15 m³ (146.5 cu ft)

AREAS:

Wings, gross	25.10 m² (270.2 sq ft)
Ailerons, total	0.80 m² (8.65 sq ft)
Fin	2.86 m² (30.8 sq ft)



Beriev Be-103 twin-engined light multipurpose amphibian (*Jane's/Mike Keep*) 1994

Cutaway model of Beriev Be-103 *(Paul Jackson)*

1995

Flare pack on rear fuselage of A-50, and aerodynamic surface on side of landing gear fairing *(Mark Lambert)*

1993

Rudder	1.54 m² (16.6 sq ft)
Tailplane, total	3.68 m² (39.6 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	1,210 kg (2,668 lb)
Max payload, incl fuel	550 kg (1,212 lb)
Max fuel	320 kg (705 lb)
Max T-O and landing weight	1,760 kg (3,880 lb)
Max zero-fuel weight	1,665 kg (3,670 lb)
Max wing loading	70.12 kg/m² (14.36 lb/sq ft)
Max power loading	6.62 kg/kW (10.90 lb/hp)

PERFORMANCE (estimated at max T-O weight):

Never-exceed speed (VNE)	178 kts (330 km/h, 205 mph)
Max level speed at S/L	156 kts (290 km/h, 180 mph)
Max cruising speed at S/L	143 kts (265 km/h, 165 mph)
Stalling speed	54 kts (100 km/h, 62 mph)
Max rate of climb at S/L	390 m (1,280 ft)/min
Rate of climb at S/L, OEI	90 m (295 ft)/min
T-O run: on land	215 m (705 ft)
on water	390 m (1,280 ft)
T-O to 15 m (50 ft): on land	340 m (1,115 ft)
on water	500 m (1,640 ft)
Landing from 15 m (50 ft): on land	550 m (1,805 ft)
on water	590 m (1,935 ft)
Landing run: on land	190 m (625 ft)
on water	350 m (1,150 ft)
Range	
with max payload	270 n miles (500 km; 310 miles)
with max fuel	1,400 n miles (2,600 km, 1,615 miles)

UPDATED

BERIEV A-50

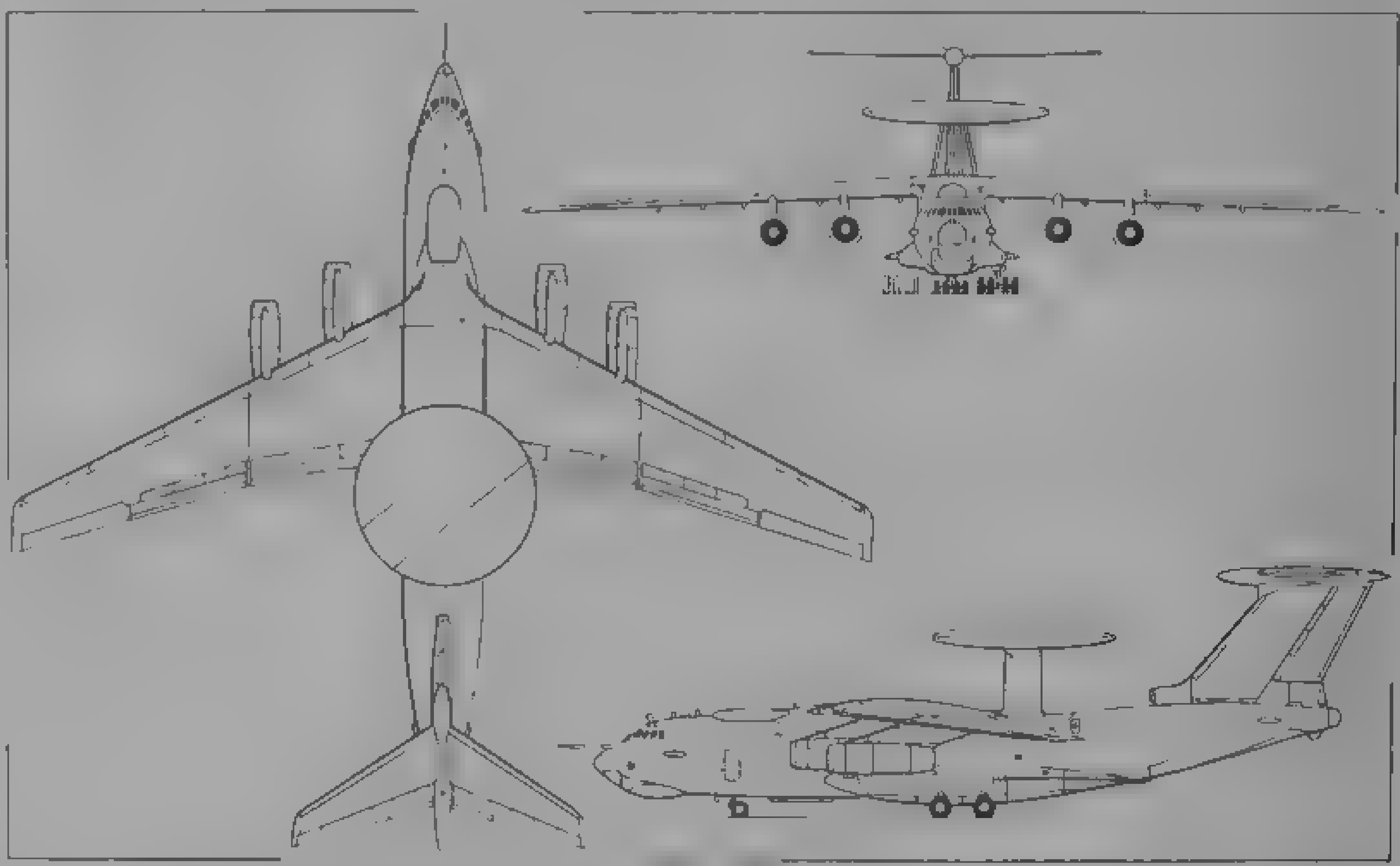
NATO reporting name: Mainstay

TYPE: Four-turbofan airborne early warning and control aircraft.

PROGRAMME: Development from Ilyushin Il-76 transport began in 1970s to replace Tu-126s of APVO; production began early 1980s, service entry 1984; at least five operated in civilian markings (RA-76452 to 76456), remainder being military, two operated round-the-clock over Black Sea during 1991 Gulf War, monitoring USAF flights from Turkey to Iraq and watching for possible stray US cruise missiles heading for CIS territory. Continued development by Beriev OKB.

CUSTOMERS: About 15 operational with MiG-29, MiG-31 and Su-27 counter-air fighters of Russian home defence and tactical air forces, alongside 10 obsolescent Tu-126s.

DESIGN FEATURES: Derivative of Il-76 (which see), with conventionally located rotating 'saucer' radome (diameter 9 m; 29 ft 6 in), lengthened fuselage forward of wings, flight refuelling noseprobe, satellite nav/com antenna above fuselage forward of wing, new IFF and comprehensive ECM, normal nose glazing around navigator's station replaced by non-transparent fairings, intake for avionics cooling at front of dorsal fin, no rear gun turret, small aerodynamic surface on each outer landing gear fairing, aft of wing trailing-edge.



Beriev A-50 AEW&C version of Ilyushin Il-76, known to NATO as 'Mainstay' *(Jane's/Dennis Punnett)*

1993

Nose of A-50 is much modified by comparison with that of Ilyushin Il-76 transport *(Linda Jackson)*

1993

FLYING CONTROLS: As for Il-76

STRUCTURE: As for Il-76, except as noted under Design Features

LANDING GEAR: As for Il-76

POWER PLANT: As for Il-76. In-flight refuelling difficult because of severe buffeting induced by rotating radome in tanker's slipstream

ACCOMMODATION: Normal crew of 15

AVIONICS: Considered capable of detecting and tracking aircraft and cruise missiles flying at low altitude over land and water, and of helping to direct fighter operations over combat areas as well as enhancing air surveillance and defence of CIS

Radar: Weather radar in nose, nav and ground-mapping radar under nose. AEW&C radar in rotating radome above fuselage.

Flight: Satellite nav/com and satellite datalink to ground stations

Instrumentation: Colour CRT displays for radar observers

Self-defence: RWR, flare pack on each side of rear fuselage; wingtip countermeasures pods under development

PERFORMANCE: Normally operates on figure-of-eight course at 10 000 m (33,000 ft), with 54 n miles (100 km, 62 miles) between centres of the two orbits

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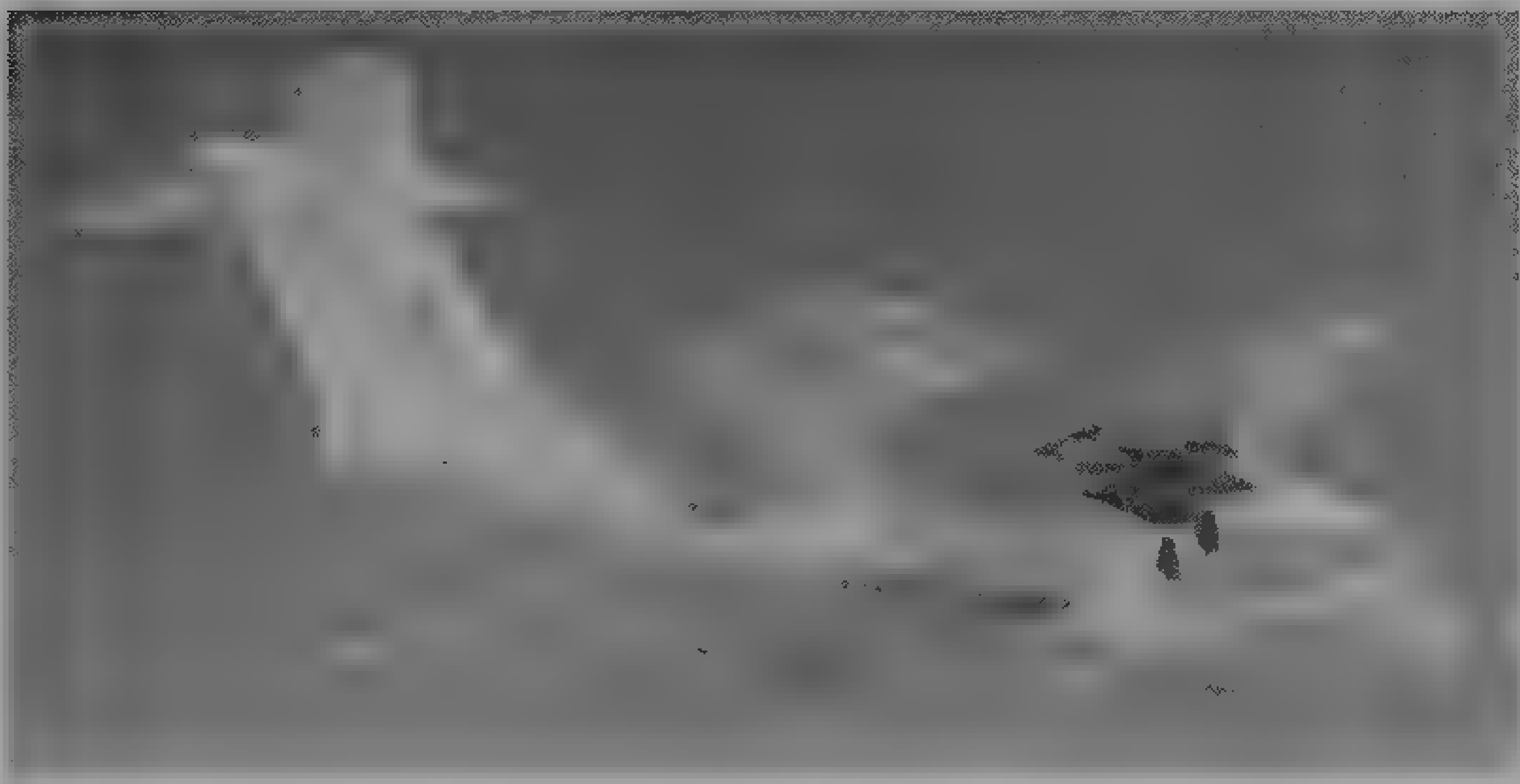


Beriev A-50 'Mainstay', the AEW&C version of the Ilyushin Il-76 *(Swedish Air Force, via FLYGvapenNYTT)*

1991

OTHER AIRCRAFT

Beriev Be-12 (NATO 'Mail') amphibians continue in service with Russian Naval Aviation, including **Be-14** SAR conversion. Several have been modified into forest firefighting configuration, others for cargo operation. The basic anti-submarine and maritime patrol version was last described fully in the 1991-92 *Jane's*. Details of the conversions can be found in *Jane's Aircraft Upgrades*

NEW ENTRY

ILYUSHIN

AVIATSIONNYI KOMPLEKS IMIENI S. V ILYUSHINA (Aviation Complex named after S. V. Ilyushin)

45g Leningradsky Prospekt, 125190 Moscow
Telephone: 7 (095) 943 83 25
Fax: 7 (095) 212 21 32, 212 02 75
Telex: 411956 Sokol

GENERAL DESIGNER: Genrikh V. Novozhilov

CHIEF DESIGNER: I. Ya. Katyrev

FOREIGN ECONOMIC RELATIONS DEPARTMENT:
V. A. Belyakov

Ilyushin OKB is named after Sergei Vladimirovich Ilyushin, who died 9 February 1977, aged 82. OKB was founded 1933, has been headed by Genrikh Novozhilov since 1970. About 60,000 aircraft of Ilyushin design have been built.

The GAZ 40 production plant at Voronezh was linked officially to the OKB in July 1994, as Ilyushin Aircraft Production Association

UPDATED

Ilyushin Il-20 (NATO 'Coot-A') electronic intelligence (elint) and reconnaissance aircraft *(Sergey Sergeyev, via Mark Wagner)*

1995

ILYUSHIN Il-20

NATO reporting name: Coot-A

TYPE: Military elint/reconnaissance variant of Il-18 four-turboprop airliner

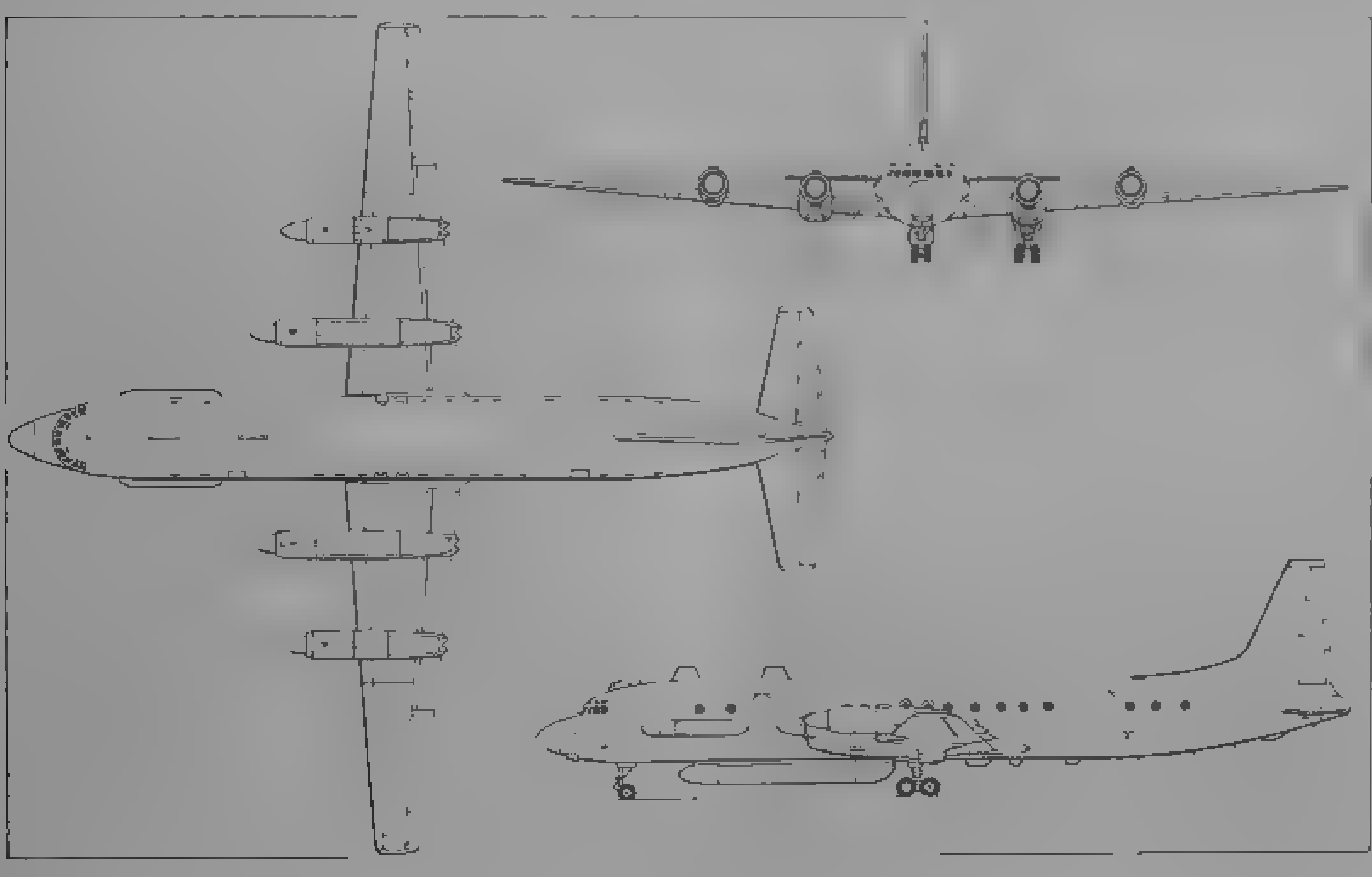
PROGRAMME: First observed 1978

CUSTOMERS: Russian air forces have 20 Il-20/22s, Naval Aviation has three Il-20s

DESIGN FEATURES: Il-18 airframe basically unchanged, underfuselage container, approximately 10.25 m (33 ft 7½ in) long and 1.15 m (3 ft 9 in) deep, assumed to house side-looking radar; container, approximately 4.4 m (14 ft 5 in) long and 0.88 m (2 ft 10½ in) deep, on each side of forward fuselage contains door over camera or other sensor; antennae and blisters include eight on undersurface of centre and rear fuselage, with two large plates projecting above forward fuselage

Detailed description of Il-18 airliner in 1979-80 and earlier editions of *Jane's; following abbreviated details of Il-18D indicate likely features retained by Il-20.*

POWER PLANT: Four 3,126 kW (4,190 ehp) ZMKB Progress/Ivchenko AI-20M turboprops, each with AV-681 four-blade reversible-pitch propeller. Ten flexible fuel tanks in inboard panel of each wing and integral tank in outboard panel; total capacity 23,700 litres (6,261 US gallons; 5,213 Imp gallons). Some Il-18 airliners have additional bag tanks in centre-section, giving total capacity of 30,000 litres (7,925 US gallons, 6,600 Imp gallons)



Ilyushin Il-20 (NATO 'Coot-A') elint/reconnaissance development of the Il-18 airliner *(Jane's/Dennis Punnett)*

1981

DIMENSIONS, EXTERNAL:
Wing span: 37.42 m (122 ft 9¼ in)
Wing chord: at root: 5.61 m (18 ft 5 in)
at tip: 1.87 m (6 ft 2 in)
Wing aspect ratio: 10.0
Length overall: 35.9 m (117 ft 9 in)
Height overall: 10.17 m (33 ft 4 in)
Tailplane span: 11.80 m (38 ft 8½ in)
Wheel track: 9.00 m (29 ft 6 in)
Wheelbase: 12.78 m (41 ft 10 in)
Propeller diameter: 4.50 m (14 ft 9 in)
Cabin doors (each): Height: 1.40 m (4 ft 7 in)
Width: 0.76 m (2 ft 6 in)
Height to sill: 2.90 m (9 ft 6 in)

DIMENSIONS, INTERNAL:
Flight deck: Volume: 9.36 m³ (330 cu ft)
Cabin, excl flight deck:
Length: approx 24.0 m (79 ft 0 in)
Max width: 3.23 m (10 ft 7 in)
Max height: 2.00 m (6 ft 6¾ in)
Volume: 238 m³ (8,405 cu ft)

AREAS:
Wings, gross: 140.0 m² (1,506.9 sq ft)

WEIGHTS AND LOADINGS (Il-18D airliner):
Max payload: 13,500 kg (29,750 lb)
Max T-O weight: 64,000 kg (141,100 lb)
Max wing loading: 457.1 kg/m² (93.6 lb/sq ft)
Max power loading: 5.12 kg/kW (8.42 lb/ehp)

PERFORMANCE (Il-18D airliner, at max T-O weight):
Max cruising speed: 364 kts (675 km/h, 419 mph)
Econ cruising speed: 337 kts (625 km/h, 388 mph)
Operating height: 8,000-10,000 m (26,250-32,800 ft)
T-O run: 1,300 m (4,265 ft)
Landing run: 850 m (2,790 ft)
Range, 1 h reserves:
with max fuel: 3,508 n miles (6,500 km, 4,040 miles)
with max payload: 1,997 n miles (3,700 km, 2,300 miles)

UPDATED

Ilyushin Il-22 (NATO 'Coot-B') airborne command post conversion of Il-18 airliner *(Mark Wagner/Flight International)*
1994

Ilyushin Il-24N derivative of Il-20 for fishery observation *(Mark Wagner/Flight International)*
1995

ILYUSHIN Il-22

NATO reporting name: Coot-B

Several Il-22 airborne command post adaptations of the Il-18 transport are operational with CIS air forces. It would be logical to expect variety of external fairings and antennae, differing from one aircraft to another, depending on its specific duties. Il-22 shown in an accompanying illustration was identified by bullet fairing at fin tip, long and shallow container under front fuselage and many small blade antennae above and below fuselage.

ILYUSHIN Il-24N

The Il-24N, shown in an accompanying illustration, is a civil derivative of the Il-20 for fishery observation. It retains the large underfuselage side-looking radar (SLAR) pod, but all elint equipment is deleted.

NEW ENTRY

ILYUSHIN Il-38

NATO reporting name: May

TYPE: Intermediate-range shore-based four-turboprop maritime patrol aircraft.

PROGRAMME: Development of Il-18 airliner, first flown 27 September 1961; 36 serve currently with Russian Naval Aviation; first export order, from India, for five in 1975.

CUSTOMERS: CIS Naval Aviation, Indian Navy (INAS 315 at Dabolim, Goa).

DESIGN FEATURES: Basic Il-18 airframe, with lengthened fuselage, and wings moved forward to cater for effect of role equipment and stores on CG position; few cabin windows, large undernose radome, MAD tail sting; wing dihedral 3° from roots; mean thickness/chord ratio 14 per cent.

FLYING CONTROLS: Flying controls cable actuated; mass and aerodynamically balanced ailerons with electric trim tabs; hydraulically assisted elevators and rudder, each with electric trim tab; additional rudder spring tab; hydraulically actuated double-slotted wing trailing-edge flaps.

STRUCTURE: All metal; three-spar wing centre-section, two spars in outer wings; circular section fail-safe semi-monocoque fuselage, with rip-stop doublers around window cutouts, door frames and more heavily loaded skin panels.

LANDING GEAR: Retractable tricycle type, strengthened by comparison with Il-18. Hydraulic actuation. Four-wheel bogie main units, with 930 × 305 mm tyres and hydraulic brakes. Steerable (±45°) twin-wheel nose unit, with 700 × 250 mm tyres. Hydraulic brakes. Pneumatic emergency braking.

POWER PLANT: Four ZMKB Progress/Ivchenko AI-20M turboprops, each 3,126 kW (4,190 ehp), with AV-68I four-blade reversible-pitch metal propellers. Multiple bag fuel tanks in centre-section and in inboard panel of each wing and integral tank in outboard panel, total capacity 30,000 litres (7,925 US gallons; 6,600 Imp gallons). Pressure fuelling through four international standard connections in inner nacelles. Provision for overwing fuelling. Oil capacity 58.5 litres (15.45 US gallons; 12.85 Imp gallons) per engine. Engines started electrically.

ACCOMMODATION: Pilot and co-pilot side by side on flight deck with dual controls, flight engineer to rear. Number of operational crew believed to be nine, but unconfirmed. Flight deck separated from main cabin by pressure bulkhead to reduce hazards following decompression of either. Main cabin has few windows and contains search equipment, electronic equipment and crew stations. Door on starboard side at rear of cabin (location of Il-18 service door).

SYSTEMS: Cabin maximum pressure differential 0.49 bar (7.1 lb/sq in). Eight engine-driven generators for 28 V DC and 115 V 400 Hz AC supply. Hydraulic system, pressure 207 bars (3,000 lb/sq in), for landing gear retraction, nosewheel steering, brakes, elevator and rudder actuators, flaps, weapon bay doors and radar antennae. Electrothermal de-icing for wings and tail unit.

AVIONICS: *Radar:* Navigation/weather radar in nose. Search radar (NATO 'Wet Eye') in undernose radome.

Flight: Automatic navigation equipment, radio compasses and radio altimeter probably similar to those of Il-18.

Mission: MAD tail sting.

ARMAMENT: Two weapons/stores bays forward and aft of wing carry-through structure on most aircraft, for attack weapons and sonobuoys.

DIMENSIONS, EXTERNAL:

As listed under Il-20 entry, except	
Length overall	39.60 m (129 ft 10 in)

WEIGHTS AND LOADINGS:

Weight empty	36,000 kg (79,367 lb)
Max T-O weight	63,500 kg (140,000 lb)
Max wing loading	453.6 kg/m² (92.9 lb/sq ft)
Max power loading	5.08 kg/kW (8.35 lb/ehp)

PERFORMANCE:

Max level speed at 6,400 m (21,000 ft)	390 kts (722 km/h, 448 mph)
Max cruising speed at 8,230 m (27,000 ft)	330 kts (611 km/h, 380 mph)
Patrol speed at 600 m (2,000 ft)	216 kts (400 km/h, 248 mph)
Min flying speed	103 kts (190 km/h, 118 mph)
T-O run	1,300 m (4,265 ft)
Landing run with propeller reversal	850 m (2,790 ft)
Range with max fuel	3,887 n miles (7,200 km, 4,473 miles)
Patrol endurance with max fuel	12 h

UPDATED

ILYUSHIN Il-62M/MK

NATO reporting name: Classic

No Il-62M four-turbofan airliners were delivered in 1993. Two were on the assembly line at Kazan (GAZ 22) in 1994; one was delivered that year; production has now terminated, approximately 285 of all variants built. Details and an illustration last appeared in the 1989-90 *Jane's*.

UPDATED

ILYUSHIN Il-76

NATO reporting name: Candid

Indian Air Force name: Gajaraj (King Elephant)

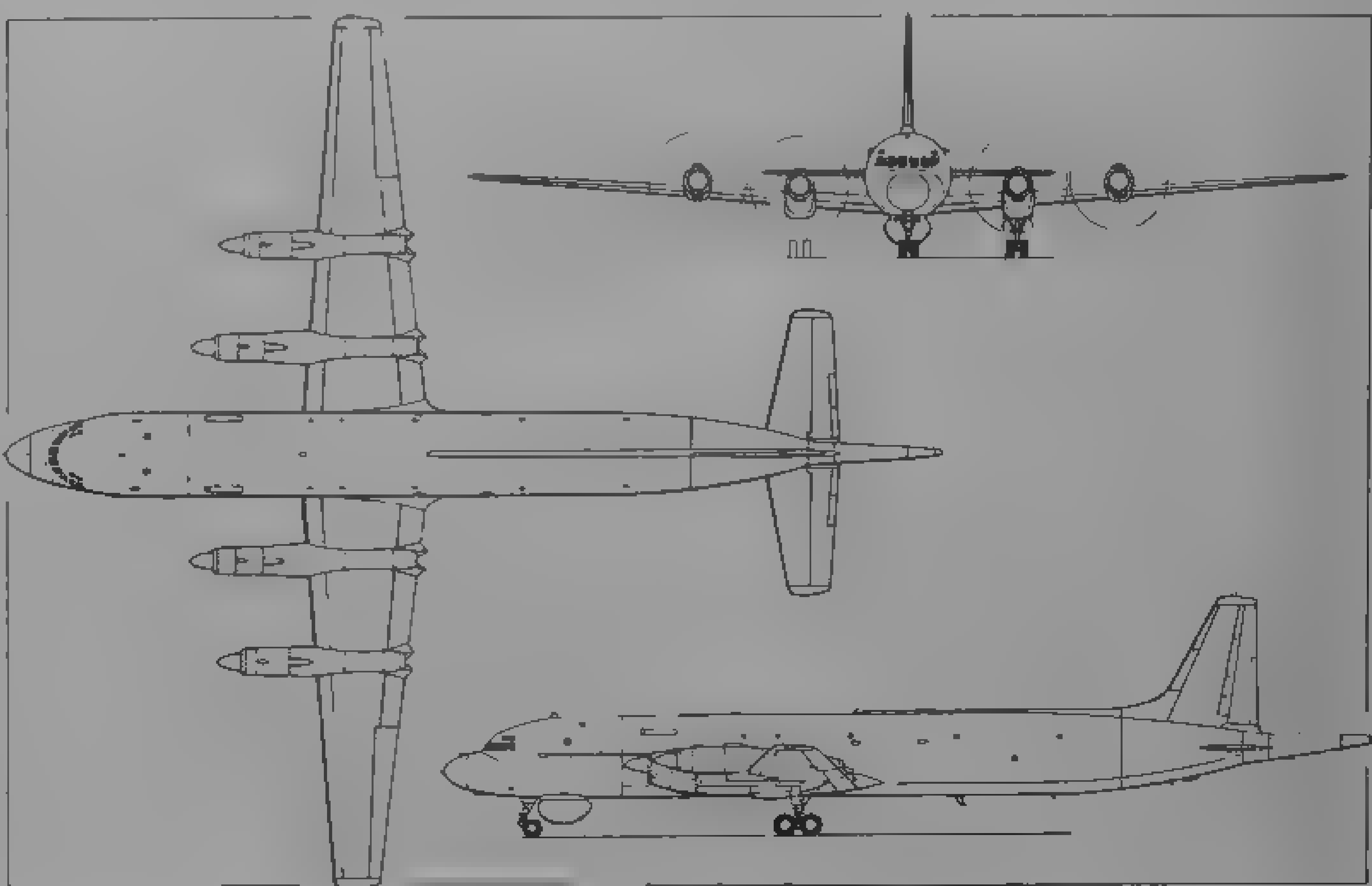
TYPE: Four-turbofan medium/long-range transport.

PROGRAMME: Design began late 1960s, led by G. V. Novozhilov, to replace turboprop An-12; prototype (SSSR-86712) flew 25 March 1971; three prototypes and three static test airframes built at Khodinka (GAZ 30); official 1974 film showed development squadron of Il-76s, with twin-gun rear turrets, as vehicles for airborne troops; series production began 1975, exceeded 800 by early 1994, seven delivered for civil use 1993; production continues at Chkalov Plant (GAZ 34), Tashkent, Uzbekistan.

CURRENT VERSIONS: **Il-76** ('Candid-A'): Initial basic military production version.

Il-76T ('Candid-A'): Civil conversion of Il-76, additional fuel in wing centre-section, above fuselage; heavier payload, no armament. *Description applies to this version.*

Il-76M ('Candid-B'): As Il-76T but military, up to 140 troops or 125 paratroops carried as alternative to freight, rear gun turret (not always fitted on export aircraft) containing two 23 mm twin-barrel GSh-23L guns, small ECM



Ilyushin Il-38 anti-submarine/maritime patrol derivative of the Il-18 airliner *(Jane's/Dennis Punnett)*
1975

Ilyushin Il-38 (four ZMKB Progress/Ivchenko AI-20M turboprops) *(Royal Air Force)*

1990

fairings (optional on export aircraft) between centre windows at front of navigator's compartment, on each side of front fuselage, and each side of rear fuselage, packs of ninety-six 50 mm IRCM flares on landing gear fairings and/or on sides of rear fuselage of aircraft operating into combat areas

Il-76K. Initial cosmonaut training version, enabling occupants to experience brief periods of weightlessness

Il-76TD ('Candid-A'). Unarmed, generally as Il-76T but with Aviadvigatel D-30KP-2 turbofans, maintaining full power to ISA +23°C against ISA +15°C for earlier models; maximum T-O weight and payload increased; 10,000 kg (22,046 lb) additional fuel increases maximum fuel range by 648 n miles (1,200 km, 745 miles); first identified when newly built SSSR 76467 passed through Shannon Airport, Ireland, November 1982, fully operational July 1983; one specially equipped with seats, soundproofing, buffet kitchen, toilet and working facilities to carry members of Antarctic expeditions between Maputo, Mozambique, and Molodozhnaya Station, Antarctica (proving flight February 1986 with 94 passengers, 4,000 kg, 30,865 lb of scientific equipment, cargo and baggage containers)

Il-76MD ('Candid-B'). Military version, generally as Il-76M but with improvements of Il-76TD

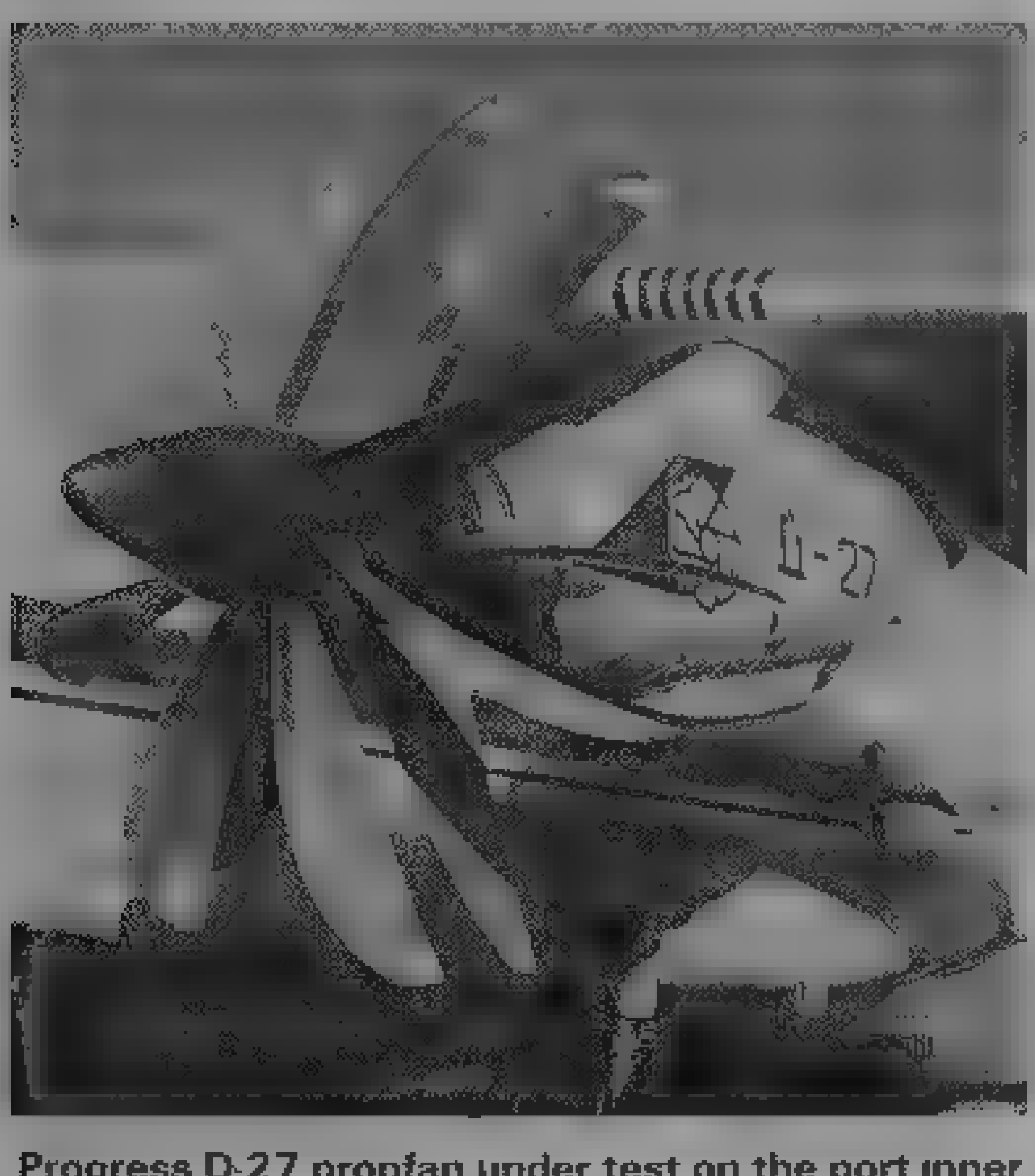
Il-76MDK: Adaptation of Il-76MD to enable cosmonauts to experience several tens of seconds of weightlessness during training

Under development is **new version** of Il-76TD **with CFM56 turbofans**, each rated at 138.8 kN (31,200 lb st), range increased 20 to 30 per cent, fuel burn decreased, noise reduced to comply with ICAO Ch 3 Appendix 16

Il-76MF: Stretched military version with four Aviadvigatel PS-90AN turbofans, each 156.9 kN (35,275 lb st). Cargo hold lengthened 6.6 m (21 ft 8 in) by two plugs, fore and aft of wings, maximum payload 52,000 kg (114,640 lb); range, with reserves, with 40,000 kg (88,185 lb) payload 2,805 n miles (5,200 km, 3,230 miles). First flight 1 August 1995. To be built in Tashkent. CFM56 engines to be optional

Il-76TF: Civil version of Il-76MF, available 1996

Il-76DMP: Firefighting conversion of Il-76 demonstrated first in 1990; up to 42,000 litres (11,095 US gallons, 9,240 Imp gallons) of water/fire retardant in two cylindrical tanks in hold, discharge, replenishment and draining systems; drop zone aiming devices; up to 384 meteorological cartridges in dispensers for weather modification, able to water-bomb an area of 550 × 100 m (1,805 × 330 ft), or to carry, and parachute when required, 40 firefighters, all airborne fire equipment (known as VAP-2, dischargeable aviation system, weight 5,000 kg, 11,025 lb) can be installed in standard Il-76, or removed, in 2 hours, tank replenishment time 10 to 12 minutes, discharge time 8 to 9 seconds, with option of successive discharge of tanks to cover 900 × 65 m (2,950 × 210 ft); airspeed during discharge 130 to 215 knots (240 to 400 km/h, 150 to 248 mph) at 80 m (260 ft)



Progress D-27 propfan under test on the port inner position of an Ilyushin Il-76LL *(Paul Jackson)*

1995

Il-76LL. Engine testbed conversion, carrying gas turbine of up to 245 kN (55,100 lb st), including turboprops, in place of normal port inner D-30KP; provisions for five test engineers, four Il-76LLs are available, on commercial contract basis, from Gromov Flight Research Institute; engines tested include NK 86, PS 90A and D-18T turbofans and D-236 and D-27 propfans, testing of NK 93 propfan scheduled to begin 1995

Il-76SK: Airborne control post for Tu-160SK/Burlak space launch system

Specialised variants and developments of Il-76 include transports modified to carry external loads, including Tu-160 tailplane, above fuselage, the AEW&C **A-50** known to NATO as 'Mainstay' (described separately under Beriev OKB entry); the **'Be-976'**, with rotating radome like A-50 and wingtip avionics pods but with nose glazing retained, used as radar picket at Zhukovsky to observe flight tests; the **Il-78** (NATO 'Midas') flight refuelling tanker (described separately); the AEW&C **Adnan 1** and single-point flight refuelling tanker modified for Iraq

CUSTOMERS: Russian Transport Aviation force (VTA) has 297 Il-76/76M/76MDs; air forces of Algeria (four MD), China (seven MD and, reportedly, 15 Ms ex-Uzbekistan)) and India (24, given name Gajaraj); commercial operators include Aeroflot and its successors (more than 180, including Il-76Ts and Ms, forming military reserve), China United Airlines (three MD), Cubana (two MD, Hungarian HeavyLift (two TD), Iraqi Airways (four T, six M and 20 MD, operated for military), Jamahiriya Libyan Arab Airlines (five M, five T and 12 TD), Air Koryo (North Korea, three MD), Inversija (Latvia) (three T and one TD) and Syrianair (two T, two M); Il-76Ms of airlines have no guns in turret. first of two Il-76MDs delivered for Cubana had no tail turret

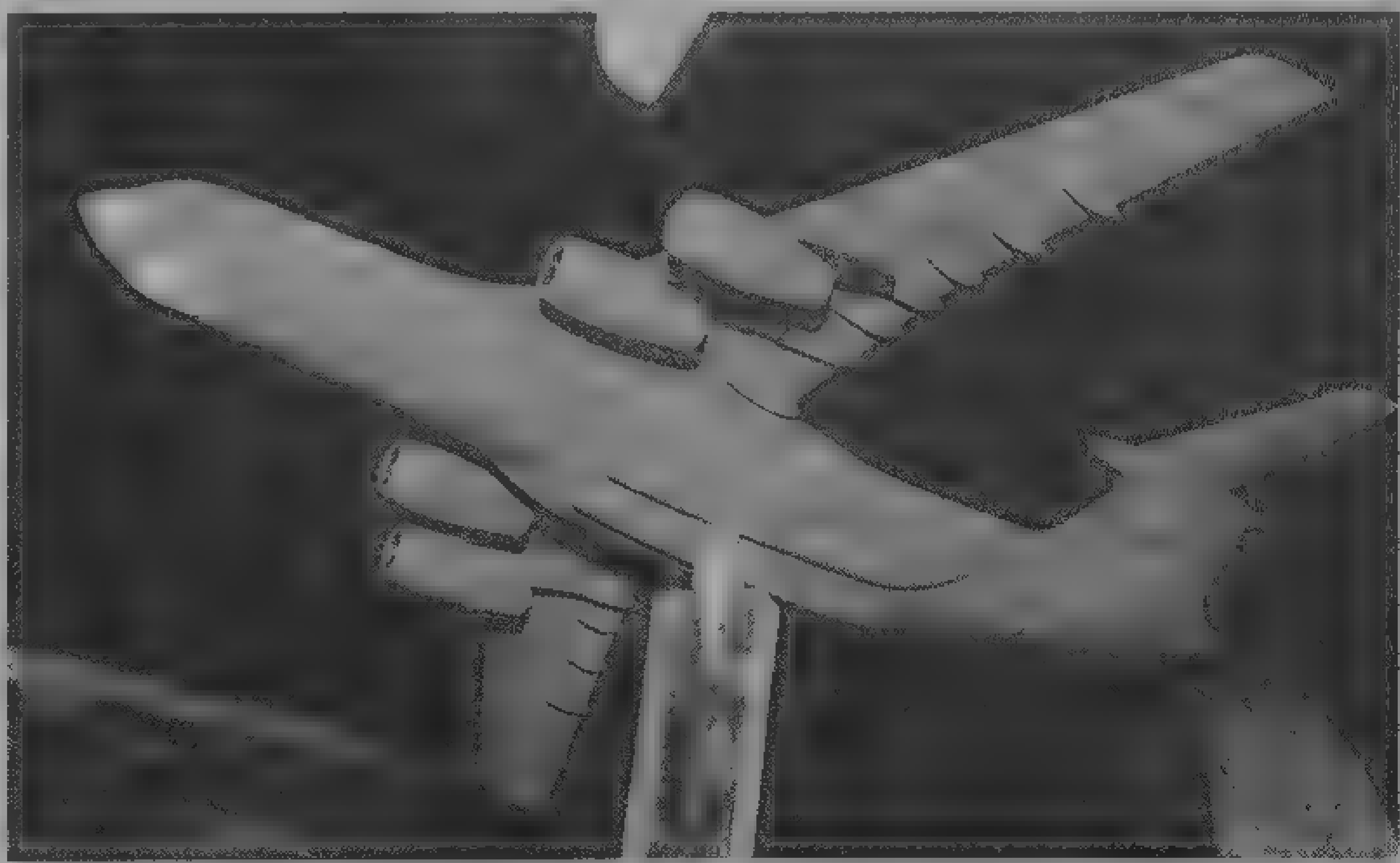
DESIGN FEATURES: Late 1960s requirement was to carry 40 tonnes of freight 2,700 n miles (5,000 km; 3,100 miles) in less than 6 hours, with ability to operate from short unprepared airstrips, in the most difficult weather conditions experienced in Siberia, the north of the Soviet Union and the Far East, while much simpler to service and able to fly much faster than An-12, wings mounted above fuselage to leave interior unobstructed, rear loading ramp/door, unique landing gear, with two large external fairings for each main gear. Wing anhedral constant outboard of centre-section, sweepback 25° at quarter-chord, thickness/chord ratio 13 per cent at root, 10 per cent at tip; all tail surfaces sweptback

FLYING CONTROLS: Hydraulically boosted, manual operation possible in emergency, mass balanced ailerons, with balance/trim tabs; two-section triple-slotted trailing-edge flaps over approximately 75 per cent of each semi-span, eight upper-surface spoilers forward of flaps on each wing, four on each inner and outer panel, leading-edge slats over almost entire span, two on each inner panel, three on each outer panel, variable incidence T tailplane, elevators and rudder aerodynamically balanced, each with tab

STRUCTURE: All-metal, five-piece wing of multispar fail-safe construction, centre-section integral with fuselage. Basically circular-section semi-monocoque fail-safe fuselage, underside of upswept rear fuselage made up of two outward-hinged clamshell doors, upward-hinged panel between doors, and downward-hinged ramp

'Water curtain' laid by Ilyushin Il-76DMP *(Paul Jackson)*

1995



Model of Il-76MF, with cargo hold lengthened by 6.6 m (21 ft 8 in) *(Piotr Butowski)*

1994

Ilyushin Il-76MD four-turbofan medium/long-range transport in Aeroflot insignia *(F. G. Rozendaal)*

1995

LANDING GEAR: Hydraulically retractable tricycle type. Steerable nose unit has two pairs of wheels, side by side, with central oleo. Main gear on each side has two units in tandem, each unit with four wheels on single axle. Low pressure tyres size 1,300 × 480 mm on mainwheels, 1,100 × 330 mm on nosewheels. Nosewheels retract forward. Main units retract inward into two large ventral fairings under fuselage, with additional large fairing on each side of lower fuselage over actuating gear. During retraction mainwheel axles rotate around leg, so that wheels stow with axles parallel to fuselage axis (that is wheels remain vertical but at 90° to direction of flight). All doors on wheel wells close when gear is down, to prevent fouling of legs by snow, ice, mud, and so on. Oleo-pneumatic shock absorbers. Tyre pressure can be varied in flight from 2.5 to 5 bars (36 to 73 lb/sq in) to suit different landing strip conditions. Hydraulic brakes on mainwheels.

POWER PLANT: Four Aviadvigatel D-30KP turbofans, each 117.7 kN (26,455 lb st), in individual underwing pods. Each pod on large forward-inclined pylon and fitted with clamshell thrust reverser. Integral fuel tanks between spars of inner and outer wing panels. Total fuel capacity 109,480 litres (28,922 US gallons, 24,083 Imp gallons).

ACCOMMODATION: Crew of seven, including two freight handlers. Side by side seating for pilot and co-pilot on flight deck. Station for navigator below flight deck in glazed nose. Forward-hinged main cabin door on each side of fuselage forward of wing. Crew emergency escape hatch forward of, and lower than, main door on port side, access via two-piece upward-folding door forming flight deck floor under port rear seat and via door at rear of navigator's compartment. Two windows on each side of hold serve as emergency exits. Hold has reinforced floor of titanium alloys, with folding roller conveyors, and is loaded via rear ramp. Entire accommodation pressurised, permitting carriage of 140 troops or 125 paratroops as alternative to freight. Advanced mechanical handling systems for containerised and other freight, which can include standard ISO containers, each 12 m (39 ft 4½ in) long, building machinery, heavy crawlers and mobile cranes. Typical loads include six containers measuring either 2.99 × 2.44 × 2.44 m (9 ft 9¾ in × 8 ft × 8 ft) or 2.99 × 2.44 × 1.90 m (9 ft 9¾ in × 8 ft × 6 ft 2¾ in) and with loaded weights of 5,670 kg (12,500 lb) or 5,000 kg (11,025 lb) respectively, or 12 containers measuring 1.46 × 2.44 × 1.90 m (4 ft 9½ in × 8 ft × 6 ft 2¾ in) and each weighing 2,500 kg (5,511 lb) loaded, or six pallets measuring 2.99 × 2.44 m (9 ft 9¾ in × 8 ft) and each weighing 5,670 kg (12,500 lb), or 12 pallets measuring 1.46 × 2.44 m (4 ft 9½ in × 8 ft) and each weighing 2,500 kg (5,511 lb). Folding seats along sidewalls in central portion of hold. Quick configuration changes made by use of modules, each able to accommodate 36 passengers in four-abreast seating, litter patients and medical attendants, or cargo. Three such modules can be carried, each approximately 6.10 m (20 ft) long, 2.44 m (8 ft) wide and 2.44 m (8 ft) high, loaded through rear doors by two overhead travelling cranes, and secured to cabin floor with cargo restraints. Two winches at front of hold, each with capacity of 3,000 kg (6,615 lb). Cranes embody total of four hoists, each with capacity of 2,500 kg (5,511 lb). Ramp can be used as additional hoist, with capacity of up to 30,000 kg (66,140 lb) to facilitate loading of large vehicles and those with caterpillar tracks. Pilot's and co-pilot's windscreens can each be fitted with two wipers, top and bottom.

SYSTEMS: Flight deck only, or entire interior, can be pressurised; maximum differential 0.50 bar (7.25 lb/sq in). Hydraulic system includes servo motors and motors to drive flaps, slats, landing gear and its doors, ramp, rear fuselage clamshell doors and load hoists. Flying control boosters supplied by electric pumps independent of central hydraulic supply. Electrical system includes engine-driven generators, auxiliary generators driven by APU, DC converters and batteries. It powers pumps for flying control system boosters, radio and avionics, and lighting systems.

AVIONICS: *Radar:* Weather radar in nose, nav and ground mapping radar in undernose radome.

Flight: Full equipment for all weather operation by day and night, including computer for automatic flight control and automatic landing approach.

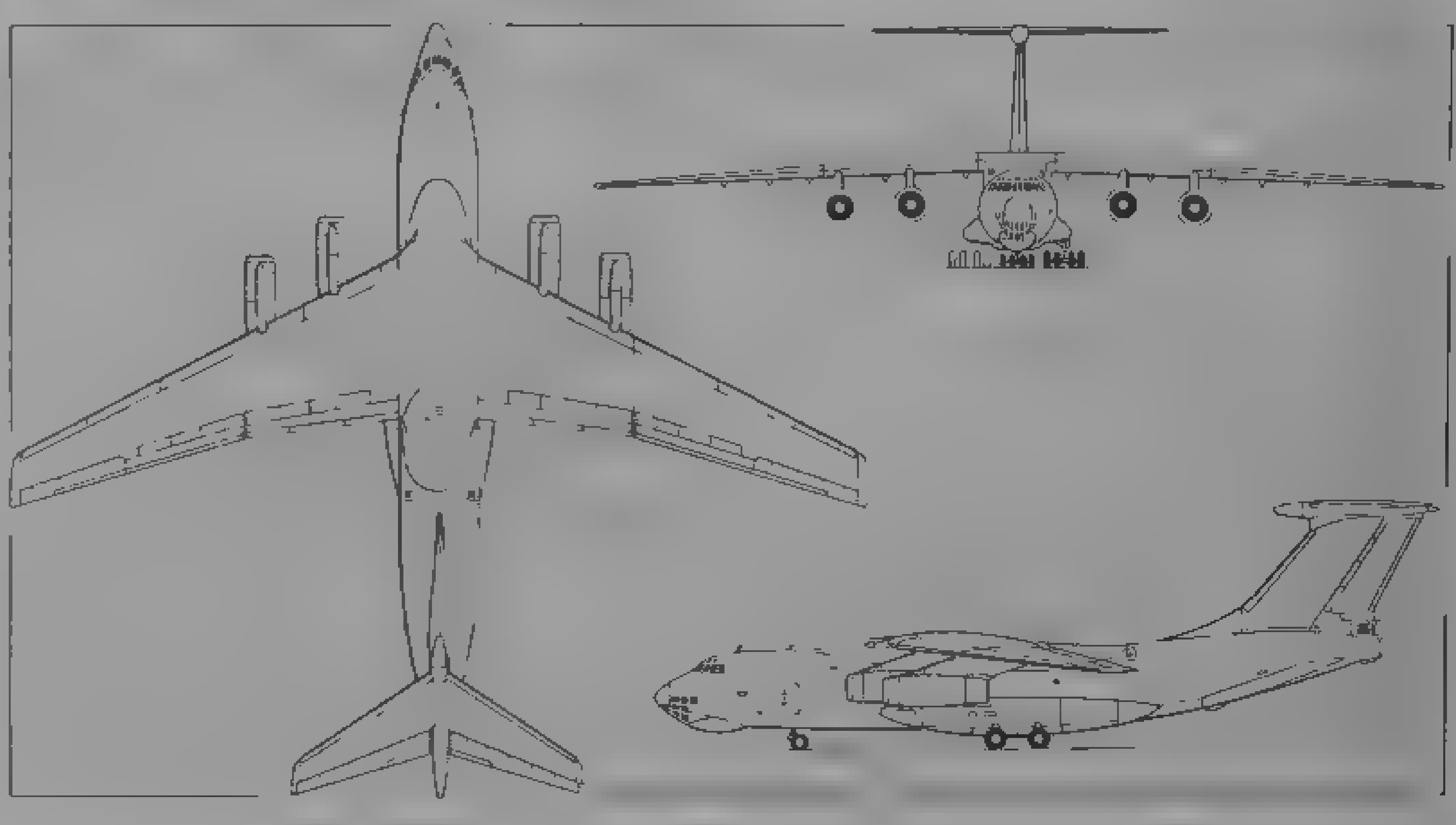
EQUIPMENT: APU in port side landing gear fairing for engine starting and to supply all aircraft systems on ground, making aircraft independent of ground facilities.

DIMENSIONS, EXTERNAL:

Wing span	50.50 m (165 ft 8 in)
Wing aspect ratio	8.5
Length overall	46.59 m (152 ft 10¼ in)
Fuselage: Max diameter	4.80 m (15 ft 9 in)
Height overall	14.76 m (48 ft 5 in)
Rear-loading aperture: Width	3.40 m (11 ft 1¾ in)
Height	3.45 m (11 ft 4 in)

Model of Ilyushin Il-76SK airborne control post *(Piotr Butowski)*

1995



Ilyushin Il-76MD four-turbofan military transport *(Jane's/Dennis Punnett)*

1990

DIMENSIONS, INTERNAL:
Cabin: Length: excl ramp 20.00 m (65 ft 7½ in)
incl ramp 24.50 m (80 ft 4½ in)
Width 3.40 m (11 ft 1¾ in)
Height 3.46 m (11 ft 4¼ in)
Volume 235.3 m³ (8,310 cu ft)
AREAS:
Wings, gross 300.0 m² (3,229.2 sq ft)
WEIGHTS AND LOADINGS:
Max payload: T 40,000 kg (88,185 lb)
TD 50,000 kg (110,230 lb)
TD from unprepared surface 33,400 kg (73,633 lb)
Max fuel: T 84,840 kg (187,037 lb)
Max T-O weight: T 170,000 kg (374,785 lb)
TD 190,000 kg (418,875 lb)
TD from unprepared surface 152,000 kg (335,100 lb)
Max landing weight: TD 151,500 kg (333,995 lb)
TD on unprepared surface 135,500 kg (298,720 lb)
Permissible axle load (vehicles):
T 7,500-11,000 kg (16,535-24,250 lb)
Permissible floor loading:
T 1,450-3,100 kg/m² (297-635 lb/sq ft)
Max wing loading: T 566.7 kg/m² (116.05 lb/sq ft)
TD 633.3 kg/m² (129.72 lb/sq ft)
Max power loading: T 361.1 kg/kN (3.54 lb/lb st)
TD 403.6 kg/kN (3.95 lb/lb st)
PERFORMANCE:
Max level speed: T, TD 459 kts (850 km/h; 528 mph)
Cruising speed:
T, TD 405-432 kts (750-800 km/h; 466-497 mph)
T-O speed: T 114 kts (210 km/h; 131 mph)
Approach and landing speed:
T 119-130 kts (220-240 km/h; 137-149 mph)
Normal cruising height:
T, TD 9,000-12,000 m (29,500-39,370 ft)
Absolute ceiling: T approx 15,500 m (50,850 ft)
T-O run: T 850 m (2,790 ft)
TD 1,700 m (5,580 ft)
Landing run: T 450 m (1,475 ft)
TD 900-1,000 m (2,950-3,280 ft)
Range with max payload:
TD 1,970 n miles (3,650 km; 2,265 miles)
Nominal range with 40,000 kg (88,185 lb) payload:
T 2,700 n miles (5,000 km; 3,100 miles)
Max range, with reserves:
T 3,617 n miles (6,700 km; 4,163 miles)
Range with 20,000 kg (44,090 lb) payload:
TD 3,940 n miles (7,300 km; 4,535 miles)

UPDATED

ILYUSHIN Il-76 COMMAND POST

TYPE: Airborne command post version of Il-76MD transport.

PROGRAMME: Two examples (SSSR-76450 and -76451) photographed at Zhukovsky Flight Research Centre 1992.

DESIGN FEATURES: Large canoe-shaped fairing above fuselage forward of wings; five small antennae above centre-section, other small antennae, and air intake scoops, under front fuselage and at rear of main landing gear fairings; long and shallow fairing forward of dorsal fin on each side at top of fuselage; large downward inclined flat plate antenna on each side under tailcone; long pod-mounted probe on pylon under each outer wing; nose glazing around navigator's compartment deleted and flight deck rear side windows covered; downward-facing exhaust near end of port landing gear fairing; partially retracted basket-drogue of what appears to be a VLF trailing wire aerial under rear fuselage.

VERIFIED

ILYUSHIN Il-78M

NATO reporting name: Midas

TYPE: Four-turbofan probe-and-drogue flight refuelling tanker.

PROGRAMME: Development began in late 1970s, to replace modified Myasishchev 3MS2 and 3MN2 (NATO 'Bison') used previously in this role; first operational Il-78 with single refuelling pod entered service 1987, supporting tactical combat aircraft; fully developed Il-78 is three-point tanker.

CURRENT VERSIONS: **Il-78**: Initial version with two cylindrical fuel storage tanks inside cargo hold, convertible into transport by removal of tanks; in addition to tanks in hold, fuel can be transferred from standard tanks in wing torsion box. Able also to refuel aircraft on ground, using conventional hoses. At least three converted to transports for Busol Airline of Ukraine by 1995.

Il-78M: Current standard: non-convertible, with third storage tank in hold, increasing available transfer fuel by 20,000 kg (44,090 lb); all three tanks fixed; lower structure weight; increased maximum T-O weight.

CUSTOMERS: Russian air forces have 20 with Long Range Aviation division at Engels airbase, Saratov region.

DESIGN FEATURES: Development of basic Il-76MD; three-point tanker, with UPAZ-1A refuelling system, utilising refuelling pods of same type under outer wings and on port side of rear fuselage; rear turret retained as flight refuelling observation station, without guns; rear-facing radar range finder built into bottom of upswept rear fuselage.

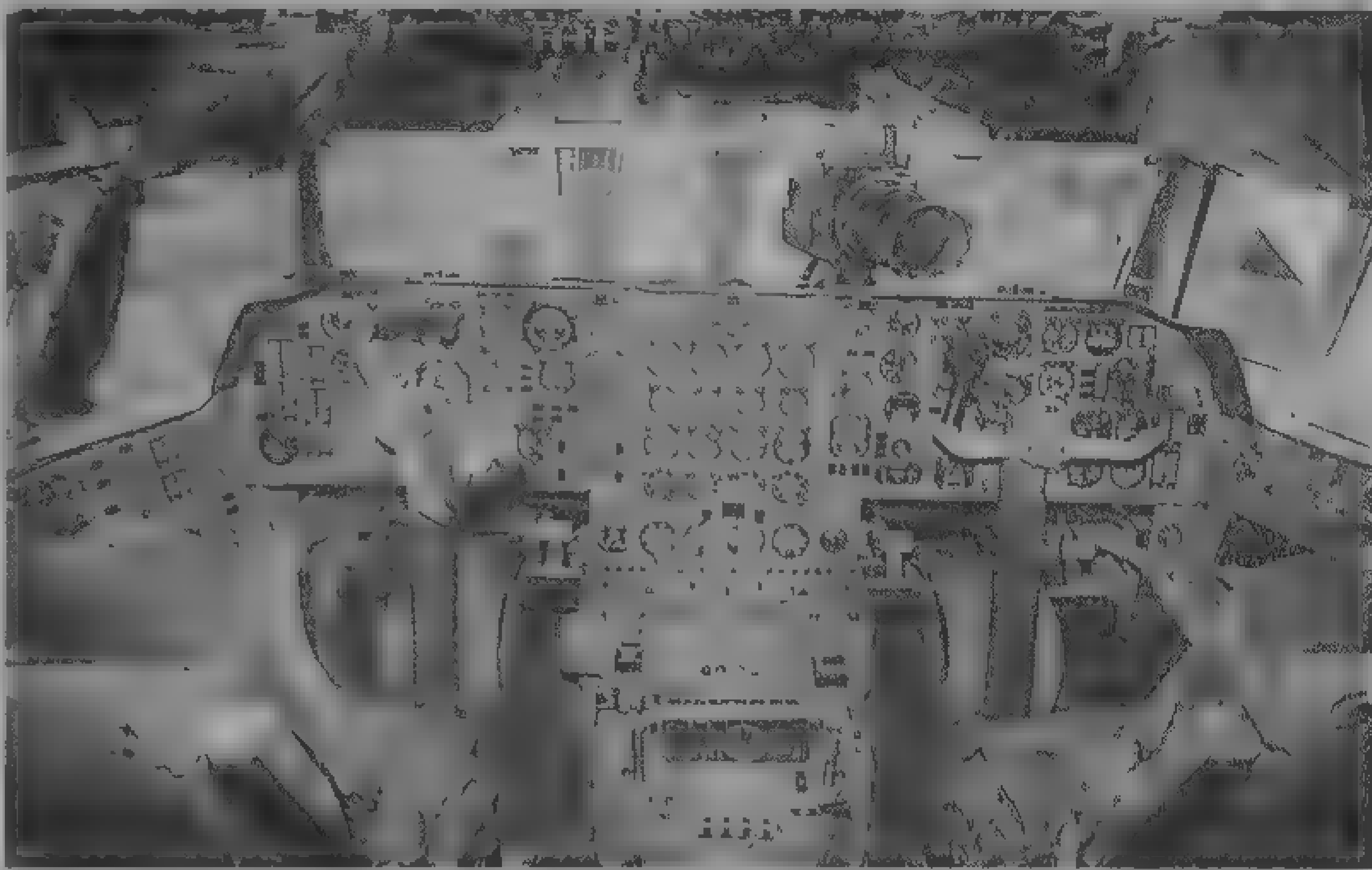
POWER PLANT: Four Aviadvigatel D-30KP-2 turbofans, each 117.7 kN (26,455 lb st).

ACCOMMODATION: Crew of seven.

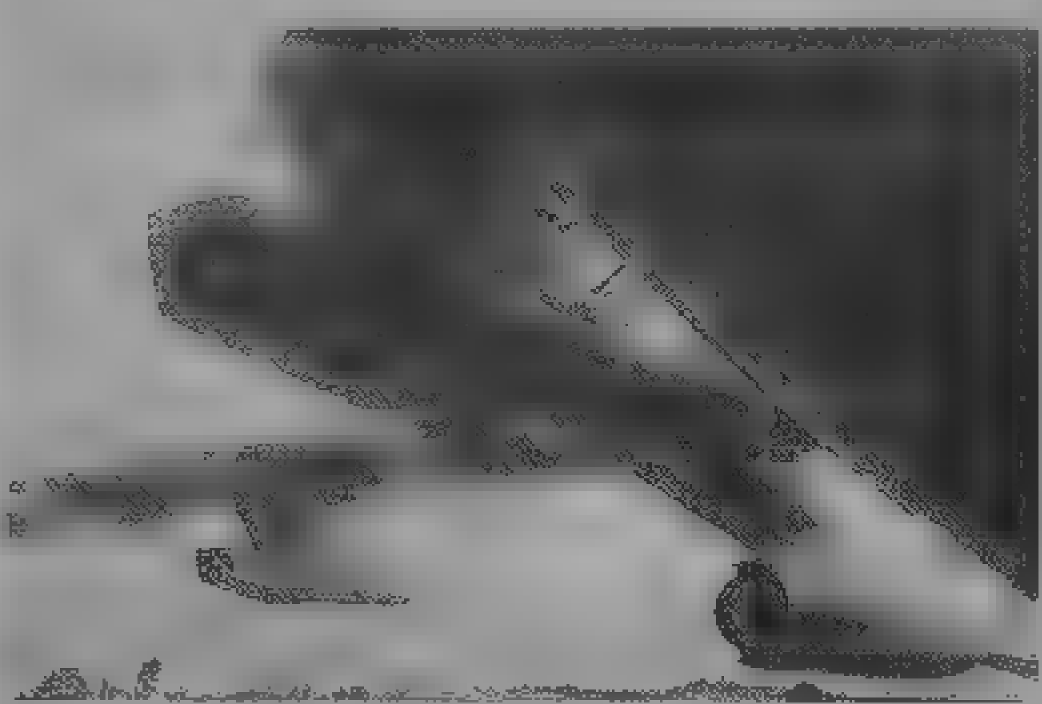
AVIONICS: *Mission*: Kupol navigation system and RSBN short-range nav system to permit all-weather day/night mutual detection and approach by receiver aircraft from distances up to 160 n miles (300 km; 185 miles). Systems control automatically the convergence and warn of too-close approach. Refuelling permitted only in direct visibility.

DIMENSIONS, EXTERNAL: Same as Il-76, except:
Distance of refuelling pods from c/l:
Underwing pods 16.40 m (53 ft 9¾ in)
Rear fuselage pod 3.00 m (9 ft 10⅛ in)
WEIGHTS AND LOADINGS:
Weight empty: 78 98,000 kg (216,050 lb)
Fuel load: Wing tanks: 78 90,000 kg (198,412 lb)
Fuselage tanks: 78 28,000 kg (61,728 lb)
Max T-O weight:
On concrete runway: 78 190,000 kg (418,875 lb)
78M 210,000 kg (462,965 lb)

'Flying Laboratory' based on Ilyushin Il-76MD *(Piotr Butowski)*
1995


Flight deck of Ilyushin Il-76MD *(Paul Jackson)*
1995

Ilyushin Il-78M flight refuelling tanker *(Paul Jackson)*
1995


Air-to-air refuelling pods on rear fuselage and under port wing of Il-78M *(Paul Jackson)*
1995

Il-78M with drogues streamed, in simulated operation with Tupolev Tu-95MS *(Peter J. Cooper)*

1994

On runway with bearing strength less than 6 kg/cm (85 lb/sq in): 78, 78M 157,000 kg (346,120 lb)
Max landing weight: 78 151,500 kg (333,995 lb)

PERFORMANCE:
Nominal cruising speed:
78 405 kts (750 km/h, 466 mph)
Refuelling speed:
78 232-318 kts (430-590 km/h; 267-366 mph)
Refuelling height: 78 2,000-9,000 m (6,560-29,525 ft)
Max T-O run: 78M 2,080 m (6,825 ft)
Refuelling radius:
with 60,000-65,000 kg (132,275-143,300 lb) transfer fuel: 78 540 n miles (1,000 km, 620 miles)
with 32,000-36,000 kg (70,545-79,365 lb) transfer fuel: 78 1,350 n miles (2,500 km; 1,553 miles)

VERIFIED

ILYUSHIN Il 86

NATO reporting name: Camber

TYPE: Four-turbofan medium-range wide-bodied passenger transport.

PROGRAMME: Construction of three prototypes (second for static testing only) started 1974; first flight 22 December 1976 from Ilyushin OKB headquarters at old Moscow Central Airport, Khodinka (GAZ 30), from 1,820 m (5,970 ft) runway, to official flight test centre, by prototype SSSR-86000; first production Il-86 (SSSR 86003) flew at Voronezh assembly plant (GAZ 40) 24 October 1977; first delivery (SSSR 86004) to Aeroflot 24 September 1979; scheduled services began 26 December 1980; first international service, Moscow-East Berlin, 3 July 1981; four delivered 1993, production terminated; total of 108 built, including four command posts, remainder all commercial. Programme to re-engine with CFM56 turbofans being discussed with five Russian airlines 1995, to increase range by 40 per cent.

CUSTOMERS: Aeroflot Russian International (23), Ajt Air International (2), Armenian Airlines (2), Belavia (1), China Airlines (5), Kazakhstan Airlines (7), Krasnoyarsk Airlines (5), Moscow Airways (1), Siberia Airlines (6), St Petersburg Avia (9), Transaero Airlines (1), Ural Airlines (4), Uzbekistan Airways (10), Vnukovo Airlines (20).

DESIGN FEATURES: Conventional low/mid swept wing, two-deck fuselage, intended to be entered via lower-deck doors, into stowage compartments for coats and hand baggage, and up stairways to passenger deck (deletion of lower deck airstairs and internal stairways optional), additional centreline bogie between main landing gear units; dihedral from roots on wings and tailplane, wing sweepback 35° at quarter-chord, all tail surfaces swept.

FLYING CONTROLS: Hydraulic actuation, without manual reversion for primary surfaces, aileron and two-section double-slotted flaps occupy entire trailing-edge of each wing, multisection upper-surface spoilers and airbrakes forward of each flap section, full span leading-edge slats; variable incidence tailplane; rudder and elevators each two-section.

STRUCTURE: All-metal, inner wings three-spar, outer panels two-spar; shallow fence above wing in line with each engine pylon, circular-section semi-monocoque fuselage, floors of both decks of honeycomb and carbonfibre reinforced plastics.

LANDING GEAR: Retractable four unit type. Forward-retracting steerable twin-wheel nose unit; three four wheel bogie main units. Two of latter retract inward into wingroot fairings, third is mounted centrally under fuselage, slightly forward of the others, and retracts forward. Mainwheel tyres size 1,300 × 480 mm, nosewheel tyres size 1,120 × 450 mm.

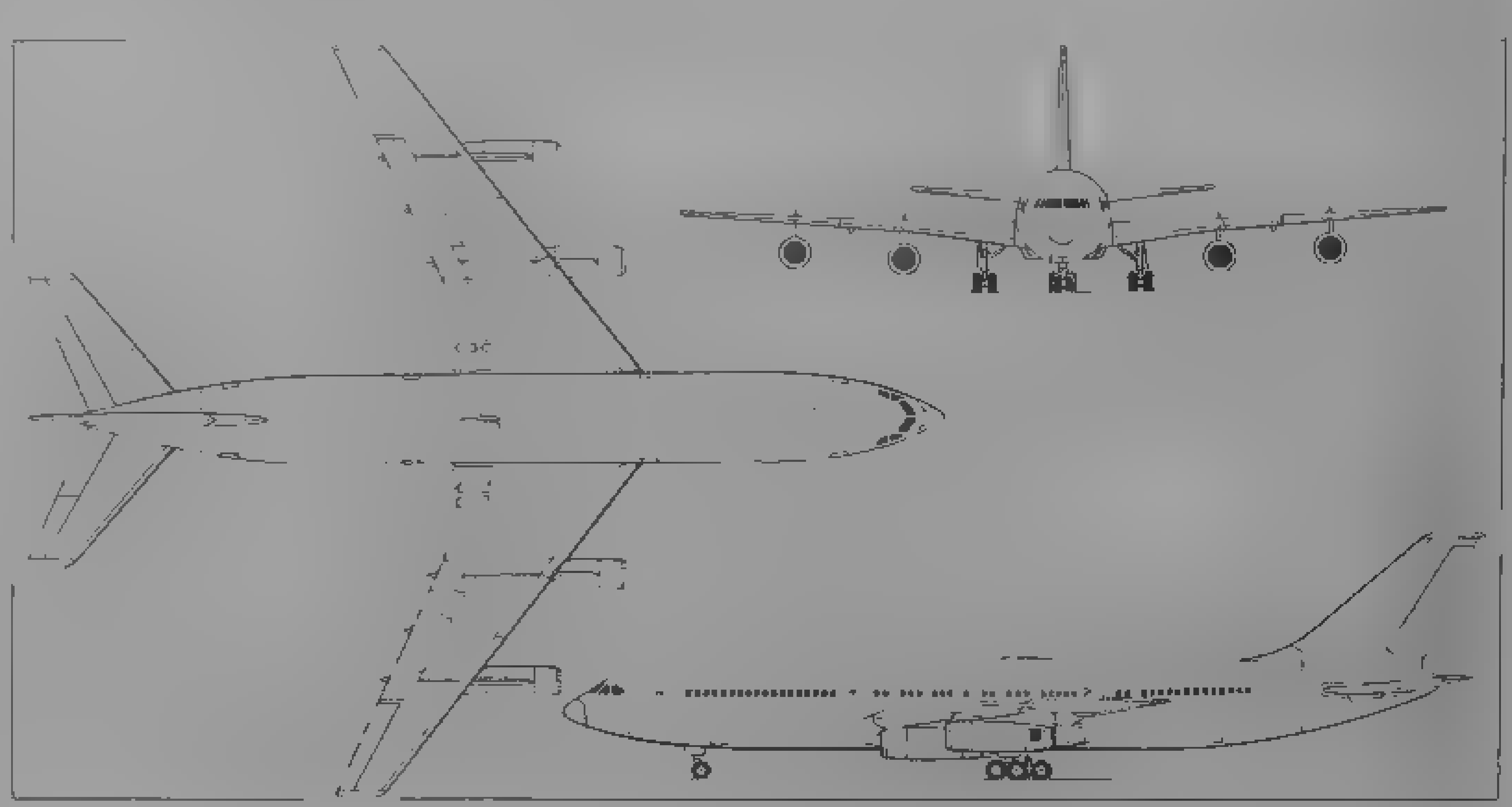
POWER PLANT: Four KKBM (Kuznetsov) NK 86 turbofans, each 127.5 kN (28,660 lb st), on pylons forward of wing leading-edges. Combined thrust reversers/noise attenuators. Integral fuel tanks in wings, capacity 114,000 litres (30,116 US gallons, 25,077 Imp gallons).

ACCOMMODATION: Two pilots and flight engineer, with provision for navigator. Flight engineer's seat normally faces to starboard, aft of co-pilot, but can pivot to central forward-facing position to enable engineer to operate throttles. Upper deck, on which all seats are located, divided into three separate cabins by wardrobes, a serving area connected by elevator to lower deck galley, and cabin staff accommodation, with eight toilets at front (two) and rear (six) of aircraft. Unusually large windows, indirect lighting in walls and in ceiling panels, and enclosed baggage lockers at top of sidewalls. Preponderance of metal and natural fibre materials rather than plastics throughout cabins to enhance safety in an emergency. Up to 350 passengers in basic nine-abreast seating throughout, with two aisles, each 55 cm (21.6 in) wide. Mixed class layout for 28 passengers six-abreast in front cabin, and 206 passengers eight-abreast in other two cabins. Three airstair doors (made in Kharkov) hinge down from port side of lower deck, one is forward of wing, others aft. Four further doors at upper deck level on each side, for emergency use (using dual inflatable escape slides) and for use at airports where utilisation of high-level boarding steps or bridges preferred. Coats and hand baggage stowed on lower deck before passengers climb one of three fixed stairways to main deck. (Optional deletion of lower deck airstair doors and stairways reduces operating weight empty by 3,000 kg; 6,610 lb and permits installation of 25 more seats on upper deck.) Cargo holds on lower deck accommodate heavy or registered baggage and freight in eight standard LD3 containers, or 16 LD3 containers if some carry-on baggage racks omitted. Access via upward-hinged doors forward of starboard wingroot leading-edge and at side of rear hold. Containers can be loaded and unloaded by self-propelled truck with built-in roller conveyor. Films can be shown in flight, and there is choice of 12 tape recorded audio programmes. A bar-buffet can be provided on lower deck in place of baggage and freight accommodation in forward vestibule.

SYSTEMS: Four self-contained hydraulic systems, each operated by one of engines, for actuation of flying control surfaces, tailplane variable incidence, spoilers, airbrakes, slats, flaps, landing gear, nosewheel steering, wheel brakes, anti-skid system, and upper level doors when passenger gangways used. All hot pipelines of air conditioning system, and all fuel supply lines, outside pressure cell. Primary 200/115 V 400 Hz AC electrical system powered by four 40 kVA engine-driven generators. Secondary 36 V three-phase AC and 27 V DC systems. Five accumulators and static transformer. Smoke detection sensors in baggage, freight and equipment stowage areas. Pulse generating de-icing system consuming 500 times less energy than conventional hot air or electrical system. APU in tailcone.

AVIONICS: *Flight*: Flight control and nav systems provide for automatic climb to selected height, control of rate of climb and automatic descent, and automatic landing in ICAO Cat. IIIa conditions. Preprogrammable Doppler nav system with readout display screen, on which microfilmed maps can be projected. Position of aircraft indicated by cursor, driven by computer. Nav system updated automatically by inputs from VOR or VOR/DME radio beacons. Collins TCAS II flight tested and available from early 1994.

DIMENSIONS, EXTERNAL:
Wing span 48.06 m (157 ft 8¼ in)
Length overall 59.54 m (195 ft 4 in)



Ilyushin Il-86 four-turbofan wide-bodied passenger transport *(Jane's/Dennis Punnett)*

1993

Ilyushin Il-86 wide-bodied transport (four KKBM NK-86 turbofans) *(Mark Wagner/Flight International)*

1995

Fuselage. Length 56.10 m (184 ft 0¼ in)
Max diameter 6.08 m (19 ft 11½ in)
Height overall 15.81 m (51 ft 10½ in)
Tailplane span 20.57 m (67 ft 6 in)
Wheel track (c/l of outer shock-struts)
11.15 m (36 ft 7 in)
Wheel base 21.34 m (70 ft 0 in)

DIMENSIONS, INTERNAL:
Main cabins. Height 2.61 m (8 ft 7 in)
Max width approx 5.70 m (18 ft 8½ in)

AREAS:
Wings, gross 320.0 m² (3,444 sq ft)

WEIGHTS AND LOADINGS:
Max payload 42,000 kg (92,600 lb)
Max fuel 88,350 kg (194,775 lb)
Max T-O weight (dependent on size and type of runway) 190,000-208,000 kg (418,875-458,560 lb)
Max landing weight 175,000 kg (385,800 lb)
Max wing loading 650.0 kg/m² (133.1 lb/sq ft)
Max power loading 407.9 kg/kN (4.0 lb/lb st)

PERFORMANCE (designed):
Normal cruising speed at 9,000-11,000 m (30,000-36,000 ft)
486-512 kts (900-950 km/h; 559-590 mph)
Approach speed
130-141 kts (240-260 km/h; 149-162 mph)
Field length for T-O and landing
2,300-2,600 m (7,550-8,530 ft)
* Range with 40,000 kg (88,185 lb) payload
1,944 n miles (3,600 km; 2,235 miles)
* with max fuel 2,480 n miles (4,600 km; 2,858 miles)

* *Reports suggest that these design ranges are not being achieved. The former East German airline Interflug quoted a max range of 1,350 n miles (2,500 km; 1,550 miles) in its sales literature*

UPDATED

ILYUSHIN Il-86 COMMAND POST

NATO reporting name: Maxdome

TYPE: Airborne command post version of Il-86 transport.

PROGRAMME: First observed at Zhukovsky Flight Research Centre 1992, four seen to be completed at that time (SSSR-86146 to 86149).

DESIGN FEATURES: Large boat-shaped fairing above fuselage forward of wings; large pod with ram air intake under each inner wing, long and shallow dished fairing forward of fin root, strake antenna under rear fuselage, small fin-like component on port side lower fuselage, carrying what appears to be drogue for VLF trailing wire aerial. SSSR 86146 and 86147 have large blade aerials above centre and rear fuselage and under forward fuselage.

UPDATED

ILYUSHIN (T-74) Il-96-300

TYPE: Four-turbofan wide-bodied passenger transport.

PROGRAMME: First of five T 74 (OKB designation) prototypes (SSSR-96000) flew at Khodinka 28 September 1988, second on 28 November 1989, further two airframes used for static and fatigue testing, all seven built at GAZ 30, Khodinka, areas of commonality with Il-86 permitted planned test programme to be reduced to 750 flights totalling 1,200 hours, route proving trials by SSSR-96005 conducted late 1991, production at GAZ 40, Voronezh, total nine (including prototypes) flying 1992; certification received 29 December 1992, two built 1993, four in 1994.

CUSTOMERS: Aeroflot Russian International Airlines had five by January 1995, operating Moscow-New York non-stop, it is expected to receive up to 10. Domodedovo Airlines has two.

DESIGN FEATURES: Superficial resemblance to Il-86, but new design, with different engines to overcome performance deficiencies of original Il-86; new structural materials and state-of-the-art technology intended to provide life of 60,000 hours and 12,000 landings; no lower-deck passenger entry, winglets standard, wing and tailplane dihedral from roots, supercritical wings, with 30° sweep at quarter-chord, sweepback at quarter-chord 37° 30′ on tailplane, 45° on fin. Current development aiming at range of 6,475 n miles (12,000 km; 7,450 miles) with 300 passengers.

FLYING CONTROLS: Triplex fly-by-wire, with manual reversion, each wing trailing-edge occupied by, from root, double slotted inboard flap, small inboard aileron, two-section single-slotted flaps, and outboard aileron used only as gust damper and to smooth out buffeting, seven-section full-span leading-edge slats on each wing, three airbrakes forward of each inboard trailing-edge flap, six spoilers forward of outer flaps, inboard pair supplement ailerons, others operate as airbrakes and supplementary ailerons; variable incidence tailplane; two-section rudder and elevators, without tabs.

STRUCTURE: Basically all-metal, including new high-purity aluminium alloy, with composites flaps, main-deck floors and underfloor holds of honeycomb and CFRP; inner wings three-spar, outer panels two-spar; each wing has seven machined skin panels, three top surface, four bottom, with integral stiffeners, circular-section semi-monocoque fuselage, leading- and trailing-edges of fin and tailplane of composites. Some components manufactured by PZL Mielec, Poland.

LANDING GEAR: Retractable four-unit type. Forward retracting steerable twin-wheel nose unit; three four-wheel bogie main units. Two of latter retract inward into wingroot/fuselage fairings, third is mounted centrally under fuselage, to rear of others, and retracts forward after the bogie has itself pivoted upward 20°. Oleo-pneumatic shock absorbers. Nosewheel tubeless tyres size 1,260 × 460 mm mainwheel tubeless tyres size 1,300 × 480 mm. Tyre pressure (all) 11.65 bars (169 lb/sq in).

POWER PLANT: Four Aviadvigatel PS-90A turbofans, each 156.9 kN (35,275 lb st), on pylons forward of wing leading-edges. Thrust reversal standard. Integral fuel tanks in wings and fuselage centre-section, total capacity 148,260 litres (39,166 US gallons; 32,613 Imp gallons).

ACCOMMODATION: Pilot, co-pilot and flight engineer; two seats for supplementary crew or observer. Ten or 12 cabin staff. Basic all-tourist configuration has two cabins for 66 and 234 passengers respectively, nine abreast at 87 cm (34.25 in) seat pitch, separated by buffet counter, video stowage and two lifts from galley on lower deck. Two aisles, each 55 cm (21.65 in) wide. Two toilets and wardrobe at front, six more toilets, a rack for cabin staff's belongings and seats for cabin staff at rear. Seats recline, and are provided with individual tables, ventilation, earphones and attendant call button. Indirect lighting is standard. 235-seat mixed class version has front cabin for 22 first class passengers, six-abreast in pairs, at 102 cm (40 in) seat pitch

Ilyushin Il-86 airborne command post (NATO 'Maxdome') *(Sebastian Zacharias)*

1993

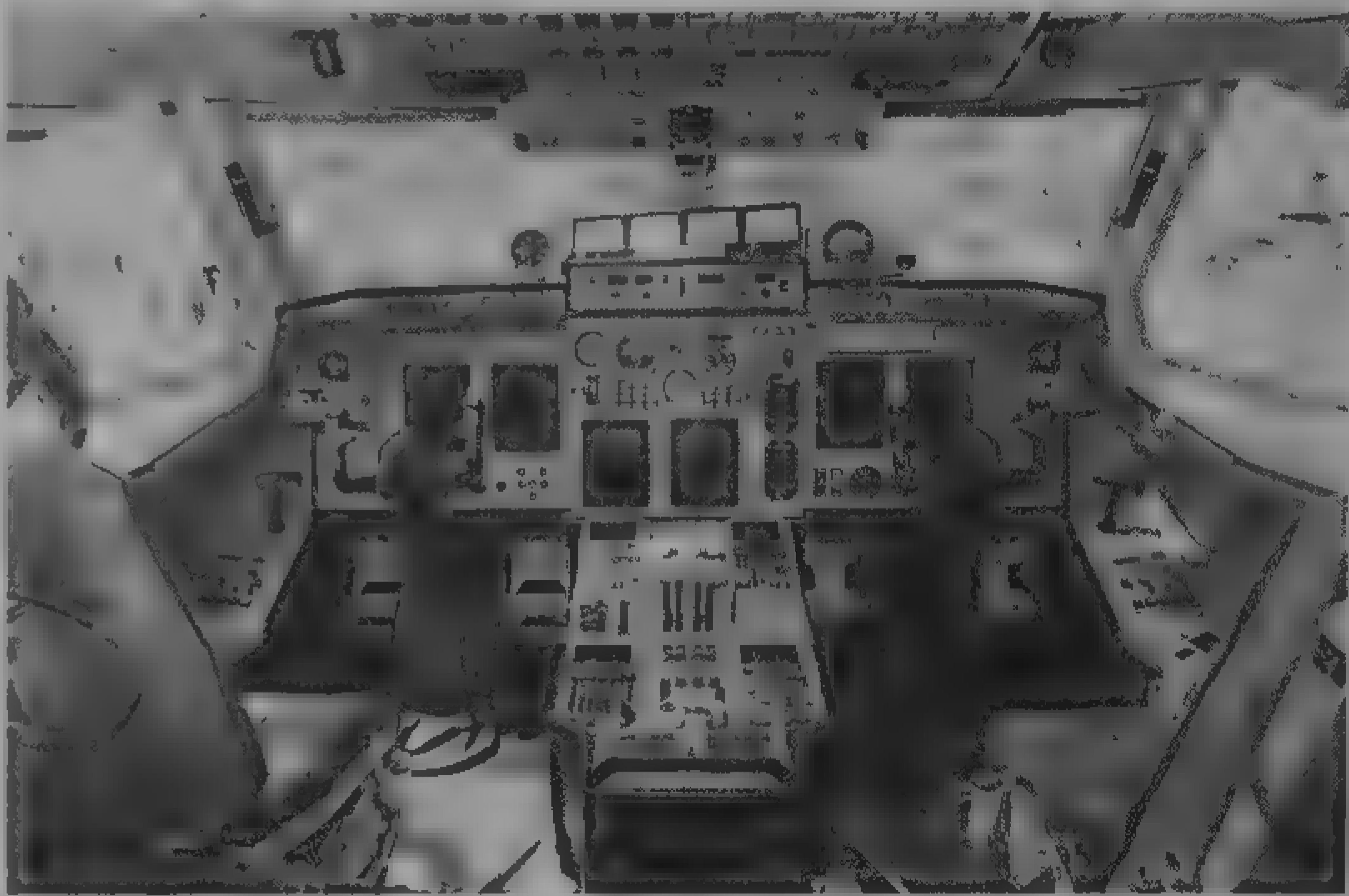
Ilyushin Il-96-300 four-turbofan wide-bodied passenger transport of Aeroflot Russian International Airlines *(Mark Wagner/Flight International)*
1995

and with aisles 75.5 cm (29.7 in) wide; [illegible] cabin with 40 business class seats [illegible] abreast at 90 cm (35.4 in) seat pitch and with aisles [illegible] 5 cm (22.25 in) wide; rear cabin for 173 tourist class passengers, basically nine-abreast at 87 cm (34.25 in) seat pitch, with aisle width of 55 cm (21.65 in). Unlike Il-86, passenger cabin is entered through three doors on port side of upper deck, at front and rear and forward of the wings. Opposite each door, on starboard side, is emergency exit door. Lower deck houses front cargo compartment for six ABK-1.5 (LD3) containers or igloo pallets, central compartment aft of wing for 10 ABK-1.5 containers or pallets, and tapering compartment for general cargo at rear. Three doors on starboard side provide separate access to each compartment. Galley and lifts are between front cargo compartment and wing, with separate door aft of front cargo compartment door.

SYSTEMS: Four independent hydraulic systems, using fireproof and explosion-proof fluid, at pressure of 207 bars (3,000 lb/sq in). APU in tailcone.

AVIONICS: *Flight*: Triplex flight control and flight management systems, together with a head-up display, permit fully automatic en route control and operations in ICAO Cat IIIa minima. Duplex engine and systems monitoring and failure warning systems feed in-flight information to both the flight engineer's station and monitors on the ground. Autothrottle is based on IAS, without angle of attack protection.

Instrumentation: On the flight deck conventional standby instruments are retained, but primary flight information is presented on dual twin-screen colour CRTs, fed by triplex INS, a satellite-based and Omega navigation system and other sensors. Another electronic system provides real-time automatic weight and CG situation data.



Flight deck of Ilyushin Il-96-300 four-turbofan wide-bodied airliner *(Photo Link)*
1993

DIMENSIONS, EXTERNAL:

Wing span: excl winglets	57.66 m (189 ft 2 in)
over winglets	60.11 m (197 ft 2½ in)
Wing aspect ratio	9.5
Length overall	55.35 m (181 ft 7¼ in)
Fuselage: Length	51.15 m (167 ft 9¾ in)
Max diameter	6.08 m (19 ft 11 in)
Height overall	17.57 m (57 ft 7¾ in)
Tailplane span	20.57 m (67 ft 6 in)
Wheel track	10.40 m (34 ft 1½ in)
Wheelbase	20.07 m (65 ft 10 in)
Passenger doors (three): Height	1.83 m (6 ft 0 in)
Width	1.07 m (3 ft 6 in)
Height to sill: Nos. 1 and 2	4.54 m (14 ft 10¾ in)
No. 3	4.80 m (15 ft 9 in)
Emergency exit doors (three):	
Height	1.825 m (5 ft 11¾ in)
Width	1.07 m (3 ft 6 in)
Cargo compartment doors (front and centre):	
Height	1.825 m (5 ft 11¾ in)
Width	1.78 m (5 ft 10 in)
Height to sill: front	2.34 m (7 ft 8¼ in)
centre	2.48 m (8 ft 1¾ in)
Cargo compartment door (rear):	
Height	1.38 m (4 ft 6¼ in)
Width	0.972 m (3 ft 2¼ in)
Height to sill	2.74 m (9 ft 0 in)
Galley door: Height	1.20 m (3 ft 11¼ in)
Width	0.80 m (2 ft 7½ in)

DIMENSIONS, INTERNAL:

Cabins, excl flight deck: Height	2.60 m (8 ft 6¼ in)
Max width	approx 5.70 m (18 ft 8½ in)
Volume	350 m³ (12,360 cu ft)
Cargo hold volume: front	37.10 m³ (1,310 cu ft)
centre	63.80 m³ (2,253 cu ft)
rear	15.00 m³ (530 cu ft)

AREAS:

Wings, gross	391.6 m² (4,215 sq ft)
Vertical tail surfaces (total)	61.0 m² (656.6 sq ft)
Horizontal tail surfaces (total)	96.5 m² (1,038.75 sq ft)

WEIGHTS AND LOADINGS:

Basic operating weight	117,000 kg (257,940 lb)
Max payload	40,000 kg (88,185 lb)
Max fuel	114,902 kg (253,311 lb)
Max T-O weight	216,000 kg (476,200 lb)
Max landing weight	175,000 kg (385,810 lb)
Max zero-fuel weight	157,000 kg (346,120 lb)
Max wing loading	551.6 kg/m² (113.0 lb/sq ft)
Max power loading	344.2 kg/kN (3.37 lb/lb st)

PERFORMANCE (estimated):

Normal cruising speed at 10,100-12,100 m (33,135-39,700 ft)
459-486 kts (850-900 km/h; 528-559 mph)

Approach speed	140 kts (260 km/h; 162 mph)
Balanced T-O runway length	2,600 m (8,530 ft)
Balanced landing runway length	1,980 m (6,500 ft)

Range, with UASA reserves: with max payload
4,050 n miles (7,500 km; 4,660 miles)
with 30,000 kg (66,140 lb) payload
4,860 n miles (9,000 km; 5,590 miles)
with 15,000 kg (33,070 lb) payload
5,940 n miles (11,000 km; 6,835 miles)

OPERATIONAL NOISE LEVELS: Il-96-300 is designed to conform with ICAO Chapter 3 Annex 16 noise requirements.

UPDATED

ILYUSHIN Il-96M and Il-96T

TYPE: Four-turbofan wide-bodied passenger or freight transport.

Prototype of increased-capacity Ilyushin Il-96M four-turbofan wide-bodied transport *(Paul Jackson)*
1995

PROGRAMME: Projected initially as Il-96-350, designation changed to Il-96M in 1990, when model exhibited at Moscow Aerospace '90; then at initial design stage, Pratt & Whitney supplying 10 PW2337 engines for two certification aircraft; conversion of Il-96-300 prototype (RA-96000) to **Il-96MO** prototype began early 1992, rolled out at Moscow City Airport 30 March 1993, first flight 6 April 1993; planned certification to FAR 25 and ICAO Annex 16 noise levels in 1995, deliveries to begin 1996. Production by GAZ 40, Voronezh.

CURRENT VERSIONS: **Il-96M**: Basic production version, as described and illustrated, scheduled to fly 1995, certification 1997.

Il-96MK: Projected development with ducted engines rated at 175 to 195 kN (38,000 to 43,000 lb st), with 17:1 or 18:1 bypass ratio.

Il-96T: Freighter; cargo door 3.60 m × 2.60 m (11 ft 9¾ in × 8 ft 6½ in) forward of wing on port side, to carry standard international containers and pallets, maximum payload 92,000 kg (202,820 lb). First flight scheduled late 1995, certification 1996.

CUSTOMERS: Aeroflot Russian International Airlines (10 Il-96T, 10 Il-96M), Uzbekistan Airways and Far East Aviation, orders and options totalled 42 in early 1995.

COSTS: Basic price $68 million.

DESIGN FEATURES: Basically as Il-96-300, lengthened fuselage of unchanged cross-section, permitting smaller tailfin, wings identical.

POWER PLANT: Four Pratt & Whitney PW2337 turbofans, each 164.6 kN (37,000 lb st), nacelles supplied by Rohr Industries, USA.

ACCOMMODATION: Two flight crew, three passenger arrangements proposed: (1) 18 first class passengers at 152.4 cm (60 in) seat pitch, with 0.77 m (2 ft 6¼ in) aisle, 44 business class at 91.5 cm (36 in) pitch, with 0.625 m (2 ft 0½ in) aisle, 250 tourist class at 86.4 cm (34 in) pitch, with 0.55 m (1 ft 9½ in) aisle; (2) 85 business class and 250 tourist class; (3) three tourist class cabins for 124, 162 and 89 passengers. Eight emergency exits. Underfloor hold for 32 standard LD3 containers.

AVIONICS: Rockwell Collins digital avionics. Designed for Cat. IIIb fully automatic landings.

Comms: Collins Srs 700 com/nav radios, Ball Airlink conformal antennae; SAT-900 satellite com.

Flight: Triple-redundant Smiths Industries flight management system to ARINC 700 specifications, three inertial platforms with laser gyros, GPWS, windshear detection radar, Litton LTN-2001 GPS and Glonass satellite nav receivers, Litton Flagship LTN-101 inertial reference centre.

Instrumentation: Six-CRT EFIS, EICAS.

DIMENSIONS, EXTERNAL:

Wing span: excl winglets	57.66 m (189 ft 2 in)
over winglets	60.11 m (197 ft 2½ in)
Length overall	63.94 m (209 ft 9 in)
Fuselage: Length	60.50 m (198 ft 6 in)
Max diameter	6.08 m (19 ft 11½ in)
Height overall	15.72 m (51 ft 7 in)
Wheel track	10.40 m (34 ft 1½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	49.13 m (161 ft 2¼ in)

WEIGHTS AND LOADINGS:

Operating weight empty	132,400 kg (291,887 lb)
Max payload	58,000 kg (127,866 lb)
Max T-O weight	270,000 kg (595,238 lb)
Max power loading	410.0 kg/kN (4.02 lb/lb st)

PERFORMANCE (estimated):

Max Mach No (MMO)	0.86
Normal cruising speed at 9,000-12,000 m (29,500-39,370 ft)	459-469 kts (850-870 km/h, 528-540 mph)
Balanced T-O runway length	3,350 m (11,000 ft)
Balanced landing runway length	2,250 m (7,385 ft)
Range (30,000 kg, 66,138 lb payload, international rules)	6,195 n miles (11,482 km, 7,136 miles)

UPDATED

ILYUSHIN Il-103

TYPE: Two/five-seat light aircraft for primary training, including basic aerobatics, and general aviation.

PROGRAMME: Exhibited in model form at Moscow Aerospace '90; programme go-ahead 1990; first flight (RA-10300) 17 May 1994, second prototype (RA-10303) flew 30 January 1995, third prototype has alternative 194 kW (260 hp) Textron Lycoming engine, production under way 1994 at Lukhovitsy plant, Moscow region; two preseries aircraft scheduled to fly late 1995, intended for ARMAK SNG (CIS) and FAR Pt 23 certification.

CURRENT VERSIONS: **Il-103**: Basic passenger/light freight transport.

Il-103 SPO: Equipped for private pilot and aerobatic training. Second prototype is to this standard.

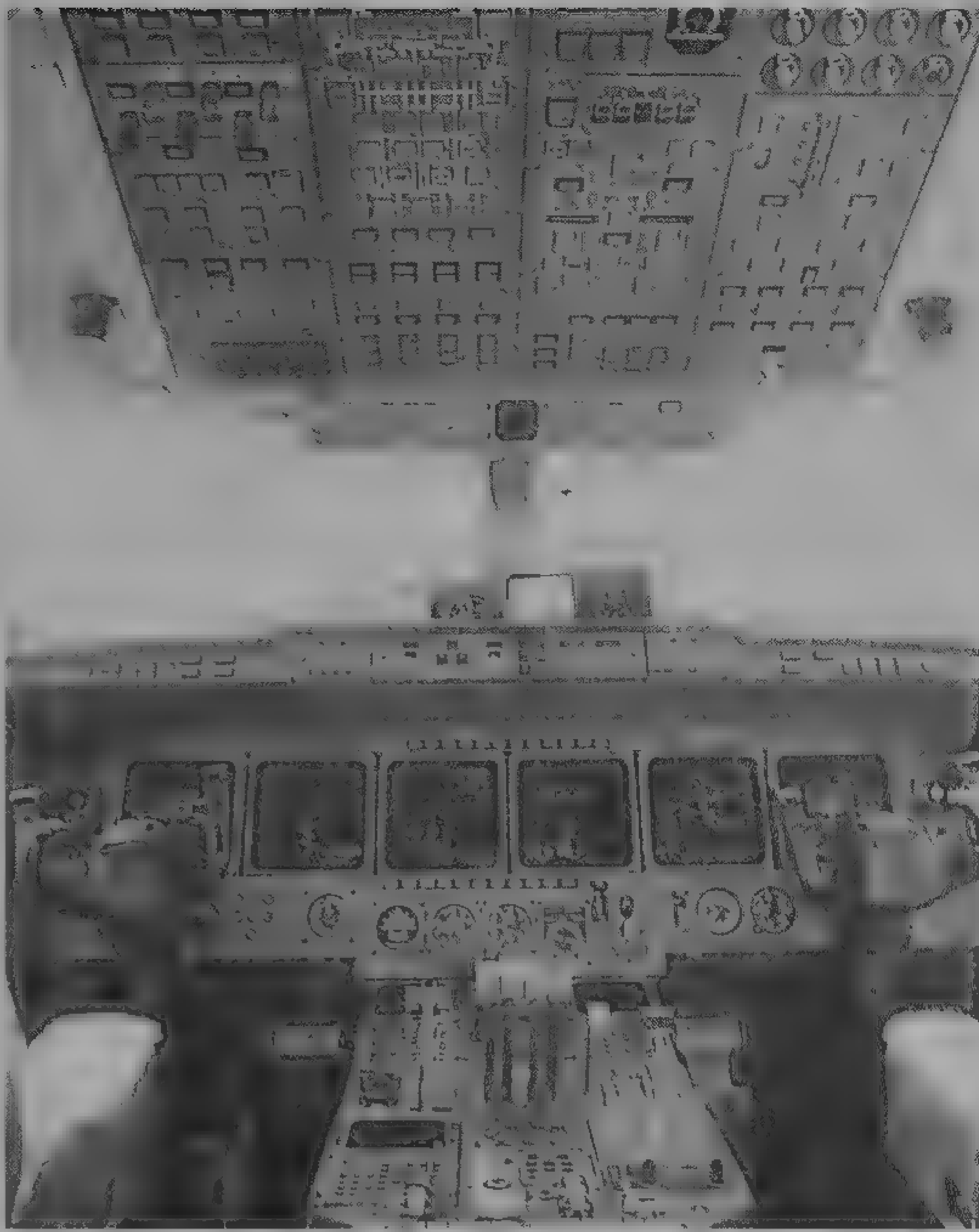
CUSTOMERS: Letters of intent for first 20 aircraft received Summer 1994.

DESIGN FEATURES: Conventional low-wing monoplane, with non-retractable landing gear, originally to meet DOSAAF requirement for 500 military/civil pilot trainers, wing sweep 0° at quarter-chord, slight dihedral from roots, twist 0°, thickness/chord ratio 16 per cent at root, 15 per cent at tip; swept vertical tail surfaces. Designed for daytime VFR flying, in non-icing conditions and ambient air temperature of −35 to +45°C.

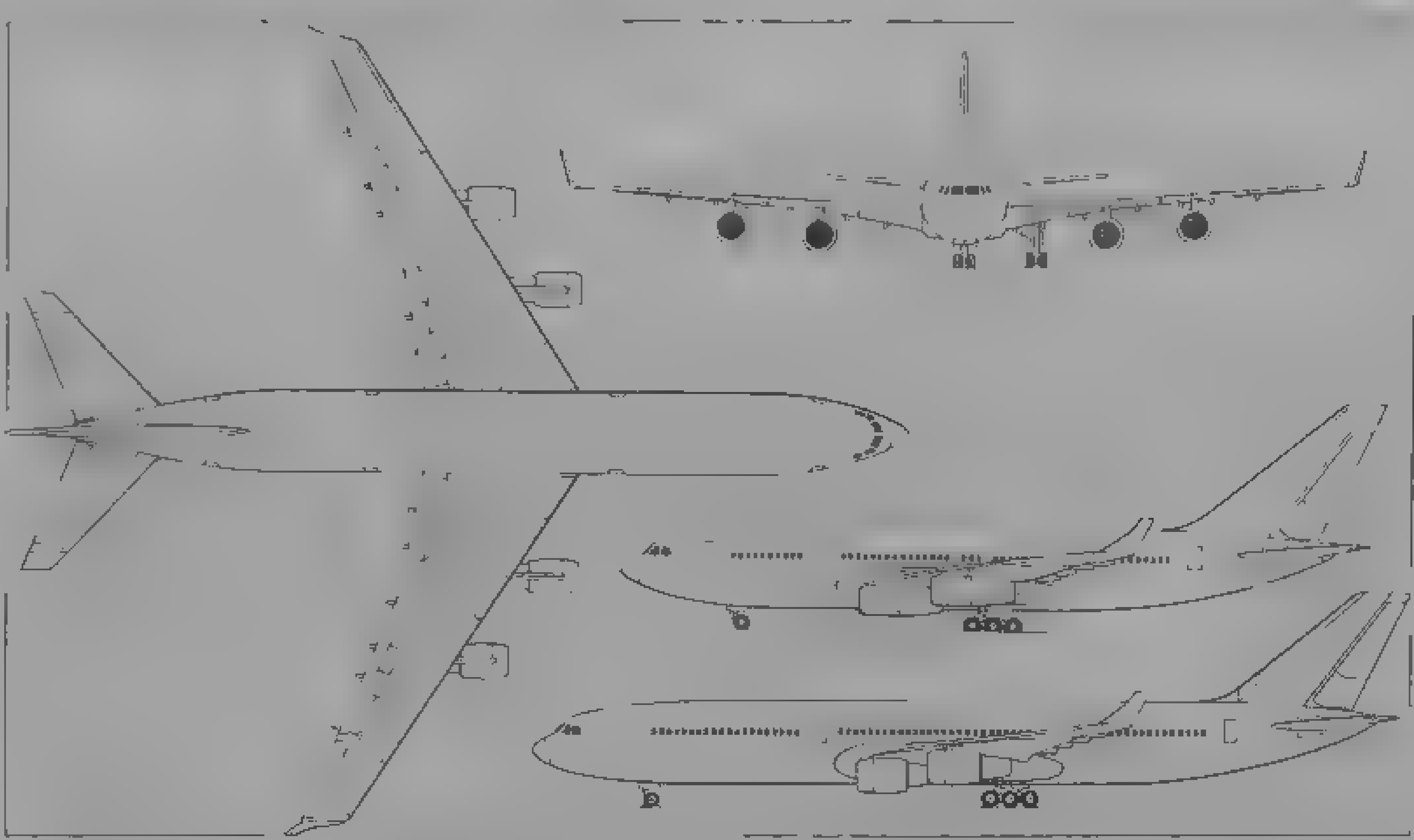
FLYING CONTROLS: Mechanically actuated via rigid pushrods except cable-actuated rudder, conventional ailerons, horn balanced elevators and rudder, single-slotted trailing-edge flaps, electrically actuated elevator trim tab.

STRUCTURE: All-metal, basically aluminium alloy except for titanium firewall frame and wingroot attachments, and bonded GFRP wingtips, elevator and rudder tips and elevator tab. Single-spar wings, with detachable leading edge, mounted at sides of fuselage. Semi-monocoque fuselage with inbuilt wing carry-through structure. Detachable fin and tailplane.

LANDING GEAR: Non-retractable tricycle type, with single wheel on each unit, cantilever spring nose and mainwheel legs, castoring nosewheel with shimmy damper, mainwheel tyres size 400 × 150-115 mm, nosewheel tyre size 310 × 135-99 mm. Multidisc hydraulic brakes on mainwheels.



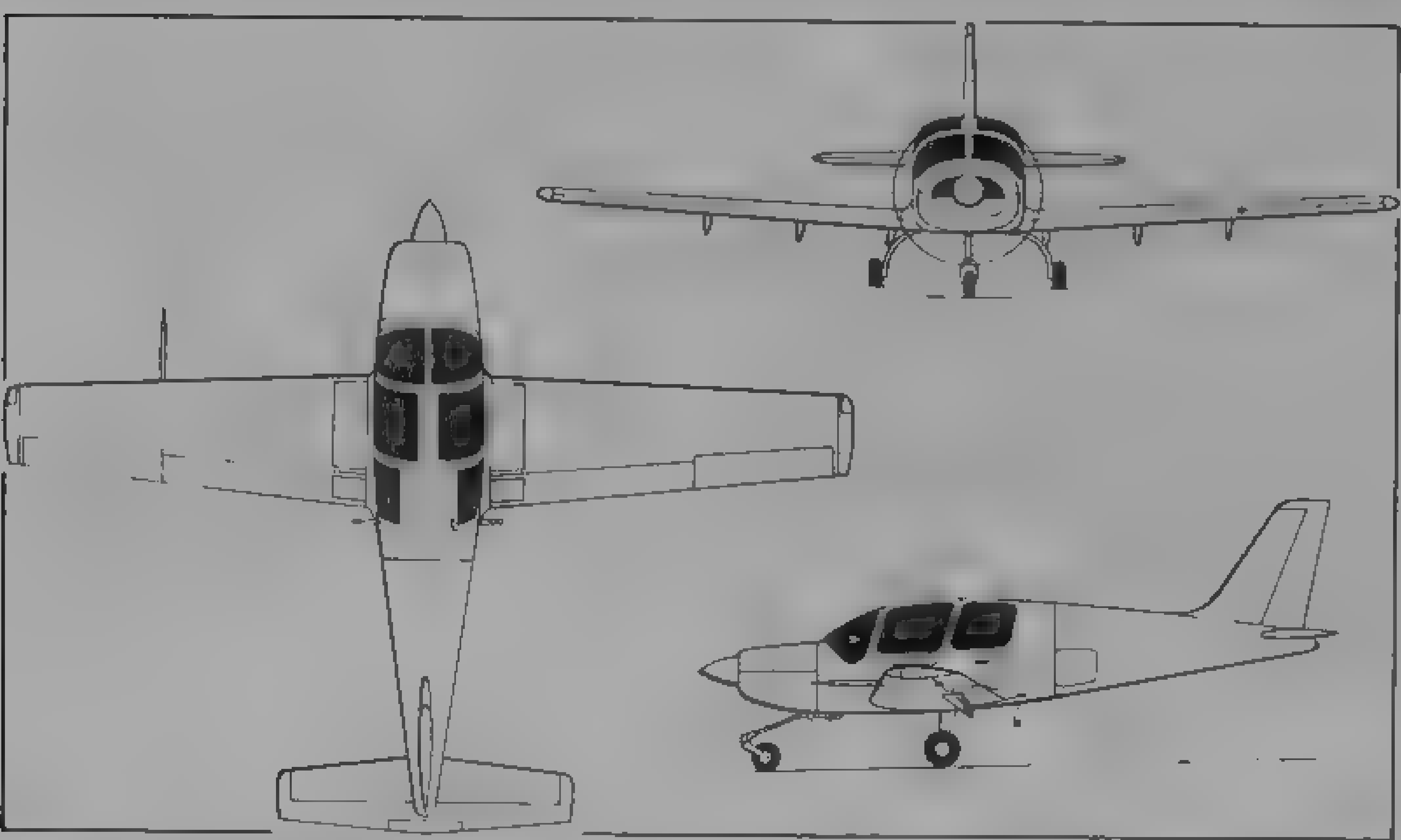
Flight deck of prototype Ilyushin Il-96M (*Mark Wagner/Flight International*) 1995



Ilyushin Il-96M powered by four P&W PW2337s, with additional side view (top) of the Il-96-300, powered by four Aviadvigatel PS-90As (*Jane's/Dennis Punnett*) 1993

Second prototype Ilyushin Il-103 *(Paul Jackson)*

1995



Ilyushin Il-103 two/five-seat multipurpose light aircraft *(Jane's/James Goulding)*

1995

Model of Ilyushin Il-106 four-turbofan heavy-lift transport *(Piotr Butowski)*

1994

POWER PLANT: One 157 kW (210 hp) Teledyne Continental IO-360-ES2B flat-six engine; Hartzell BHC-C2YF-1BF/F8459A-8R metal two-blade variable-pitch propeller. Fuel and oil systems suitable for inverted flight; two main fuel tanks in wingroots, total capacity 100 litres (26.4 US gallons, 22 Imp gallons); supply tank, capacity 3 litres (0.8 US gallons; 0.66 Imp gallons), in fuselage forward of wing front spar carry-through

ACCOMMODATION: Two forward-folding seats side by side at front of cabin; bench seat for two or three at rear; space for 220 kg (485 lb) freight with rear bench seat removed, two gull wing window/doors, hinged on centreline, at front of canopy. Unrestricted access to baggage hold

SYSTEMS: Cabin ventilated and heated and windscreen demisted electrically by fan heater. Electrical system 27 V DC, with 1,800 W generator and 25 Ah battery

AVIONICS: *Comms*: BRIZ VHF radio. Bendix/King integrated avionics under development for western market

Flight: BUR-4 flight data recorder

DIMENSIONS, EXTERNAL:

Wing span	10.56 m (34 ft 7¾ in)
Wing aspect ratio	7.58
Wing chord: at root	1.83 m (5 ft 11⅞ in)
at tip	0.96 m (3 ft 1¾ in)
Length overall	8.00 m (26 ft 3 in)
Height overall	3.14 m (10 ft 3½ in)
Tailplane span	3.90 m (12 ft 9½ in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase	2.05 m (6 ft 8½ in)
Propeller diameter	1.93 m (6 ft 4 in)
Baggage door: Width	0.70 m (2 ft 3½ in)
Height	0.34 m (1 ft 1¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.65 m (8 ft 8¼ in)
Max height	1.27 m (4 ft 2 in)
Max width	1.30 m (4 ft 3 in)

AREAS:

Wings, gross	14.71 m² (158.4 sq ft)
Ailerons (total)	1.137 m² (12.24 sq ft)
Flaps (total)	2.423 m² (26.08 sq ft)
Fin	0.84 m² (9.04 sq ft)
Rudder	0.56 m² (6.03 sq ft)
Tailplane	1.89 m² (20.30 sq ft)
Elevators (total)	1.16 m² (12.44 sq ft)

WEIGHTS AND LOADINGS (A: training, B: utility):

Weight empty: A	720 kg (1,587 lb)
B	765 kg (1,686 lb)
Payload: A	180 kg (397 lb)
B	395 kg (870 lb)
Max fuel: A, B	150 kg (330 lb)
Max T-O weight: A	965 kg (2,127 lb)
B	1,310 kg (2,888 lb)
Max wing loading: A	65.60 kg/m² (13.43 lb/sq ft)
B	89.05 kg/m² (18.23 lb/sq ft)
Max power loading: A	6.15 kg/kW (10.13 lb/hp)
B	8.34 kg/kW (13.75 lb/hp)

PERFORMANCE (estimated):

Max level speed at 3,000 m (9,840 ft)	
A	143 kts (265 km/h; 165 mph)
B	135 kts (250 km/h, 155 mph)
Cruising speed at 3,000 m (9,840 ft)	
A	127 kts (235 km/h, 146 mph)
B	121 kts (225 km/h, 140 mph)
Stalling speed: flaps up: A	53 kts (98 km/h, 6[illegible] mph)
B	60 kts (110 km/h, 69 mph)
flaps down: A	46 kts (85 km/h, 53 mph)
B	52 kts (95 km/h, 59 mph)
Max rate of climb at S/L: A	480 m (1,575 ft)/min
B	330 m (1,080 ft)/min
Radius of turn at 130 kts (240 km/h, 149 mph)	
A	85 m (280 ft)
Time of full turn at 130 kts (240 km/h, 149 mph)	
A	8 s
Rate of roll: A	84°/s
T-O run: B	340 m (1,115 ft)
T-O to 15 m (50 ft): B	520 m (1,706 ft)
Landing from 15 m (50 ft): B	480 m (1,575 ft)
Landing run: B	250 m (820 ft)
Max range with three passengers, with reserve	
B	577 n miles (1,070 km, 665 miles)
Max endurance: A	2 h
g limits: A	+6/−3
B	+4.4/−2.2

OPERATIONAL NOISE LEVELS: Designed to conform with GOST 23023-85 and ICAO Annex 16

UPDATED

ILYUSHIN Il-106

TYPE: Four-turbofan heavy-lift military transport

PROGRAMME: Announced late 1992, prototype planned to fly 1995

DESIGN FEATURES: High-mounted sweptback wings, with winglets, wide-body fuselage, with landing gear housed in pods on sides of lower fuselage, outside pressure cell; windows on each side of nose, below windscreen, as on Il-76, all-swept tail surfaces, with horizontal surfaces mounted on tailcone

POWER PLANT: Four Samara/Kuznetsov NK-92 turbofans, each 176.5 kN (39,680 lb st), in underwing pods

DIMENSIONS, EXTERNAL:	
Wing span	58.5 m (191 ft 11¼ in)
Length overall	57.6 m (188 ft 11¾ in)
Height overall	19.9 m (65 ft 3½ in)
DIMENSIONS, INTERNAL:	
Cabin: Length	34.0 m (111 ft 6½ in)
Width	6.0 m (19 ft 8¼ in)
Height	4.6 m (15 ft 1¼ in)
WEIGHTS AND LOADINGS:	
Nominal payload	80,000 kg (176,366 lb)
PERFORMANCE (estimated):	
Nominal cruising speed	442-458 kts (820-850 km/h; 509-528 mph)
Service ceiling	14,000 m (45,930 ft)

VERIFIED

ILYUSHIN Il-112

TYPE: Twin-turboprop short-range passenger transport

PROGRAMME: At initial design stage 1994, with Russian government considering funding, as alternative to Ukrainian Antonov An-38

DESIGN FEATURES: Conventional high-wing monoplane with T tail; no wing or tailplane sweep; sweptback fin and rudder, pressurised fuselage. Freight version with rear ramp and larger side doors being studied.

FLYING CONTROLS: Conventional ailerons, elevators and rudder; long-span trailing-edge flaps, two upper surface spoilers forward of flaps on each wing

LANDING GEAR: Retractable tricycle type, with single wheel on each unit; mainwheels retract into large fairings outside fuselage pressure cell

POWER PLANT: Two 1,839 kW (2,466 shp) Klimov TV7-117 turboprops

ACCOMMODATION: Flight crew of two, up to 32 passengers, three-abreast (two seats at rear), with single aisle, toilet at front, baggage compartment to rear of cabin, with inside access; airstair doors at front and rear of cabin on port side, with service doors opposite

DIMENSIONS, EXTERNAL:	
Wing span	21.00 m (68 ft 10¾ in)
Length overall	20.00 m (65 ft 7½ in)
Length of fuselage	18.20 m (59 ft 8½ in)
Height overall	8.50 m (27 ft 10½ in)
Tailplane span	6.66 m (21 ft 10½ in)
Wheel track	3.60 m (11 ft 9¾ in)
WEIGHTS AND LOADINGS (A, B, C, D as below):	
Weight empty: A, B	7,600 kg (16,755 lb)
C, D	8,200 kg (18,078 lb)
Max payload: A, B	3,000 kg (6,614 lb)
C, D	3,500 kg (7,716 lb)
Max T-O weight:	
A, 32 passengers	12,360 kg (27,250 lb)
B, 11 passengers	11,590 kg (25,550 lb)
C, 21 passengers	11,300 kg (24,910 lb)
D, 32 passengers	13,000 kg (28,660 lb)
PERFORMANCE (estimated):	
Max cruising speed: A, B	323 kts (600 km/h; 372 mph)
Econ cruising speed:	
A, B, C, D	270 kts (500 km/h; 310 mph)
Nominal cruising height:	
A, B	7,000-8,000 m (22,965-26,250 ft)
C, D	8,000 m (26,250 ft)
T-O run: A	380 m (1,250 ft)
B	320 m (1,050 ft)
C	300 m (985 ft)
D	410 m (1,345 ft)
T-O balanced field length: A	740 m (2,430 ft)
B	650 m (2,135 ft)
C	600 m (1,970 ft)
D	800 m (2,625 ft)
Landing run: A, D	350 m (1,150 ft)
B	330 m (1,085 ft)
C	300 m (985 ft)
Landing balanced field length: A, D	950 m (3,120 ft)
B	910 m (2,985 ft)
C	800 m (2,625 ft)
Range at max cruising speed, with reserves:	
A	809 n miles (1,500 km; 932 miles)
B	1,565 n miles (2,900 km; 1,802 miles)
Range at econ cruising speed, with reserves:	
A, D	1,025 n miles (1,900 km; 1,180 miles)
B	1,940 n miles (3,600 km; 2,235 miles)
C	540 n miles (1,000 km; 620 miles)

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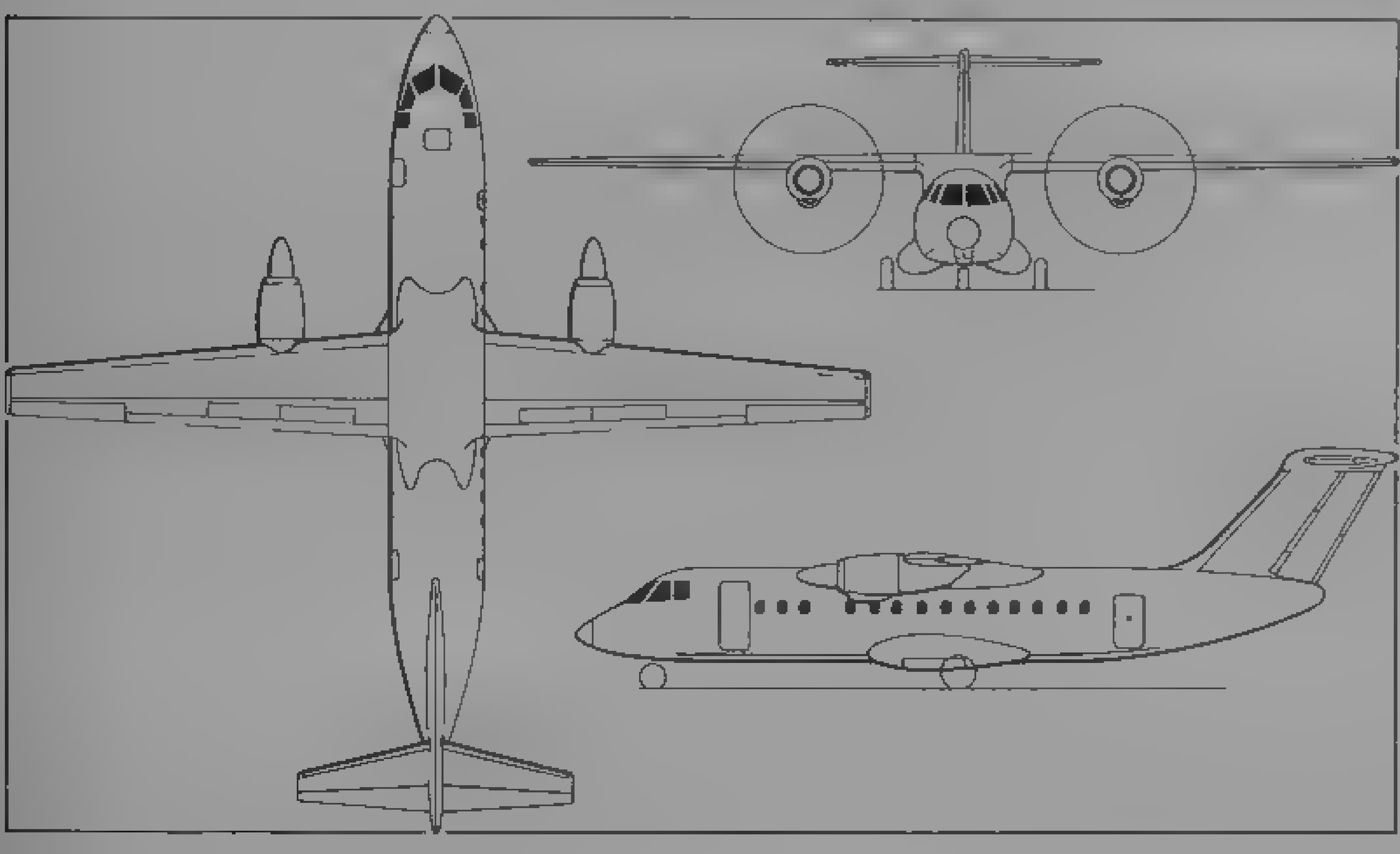
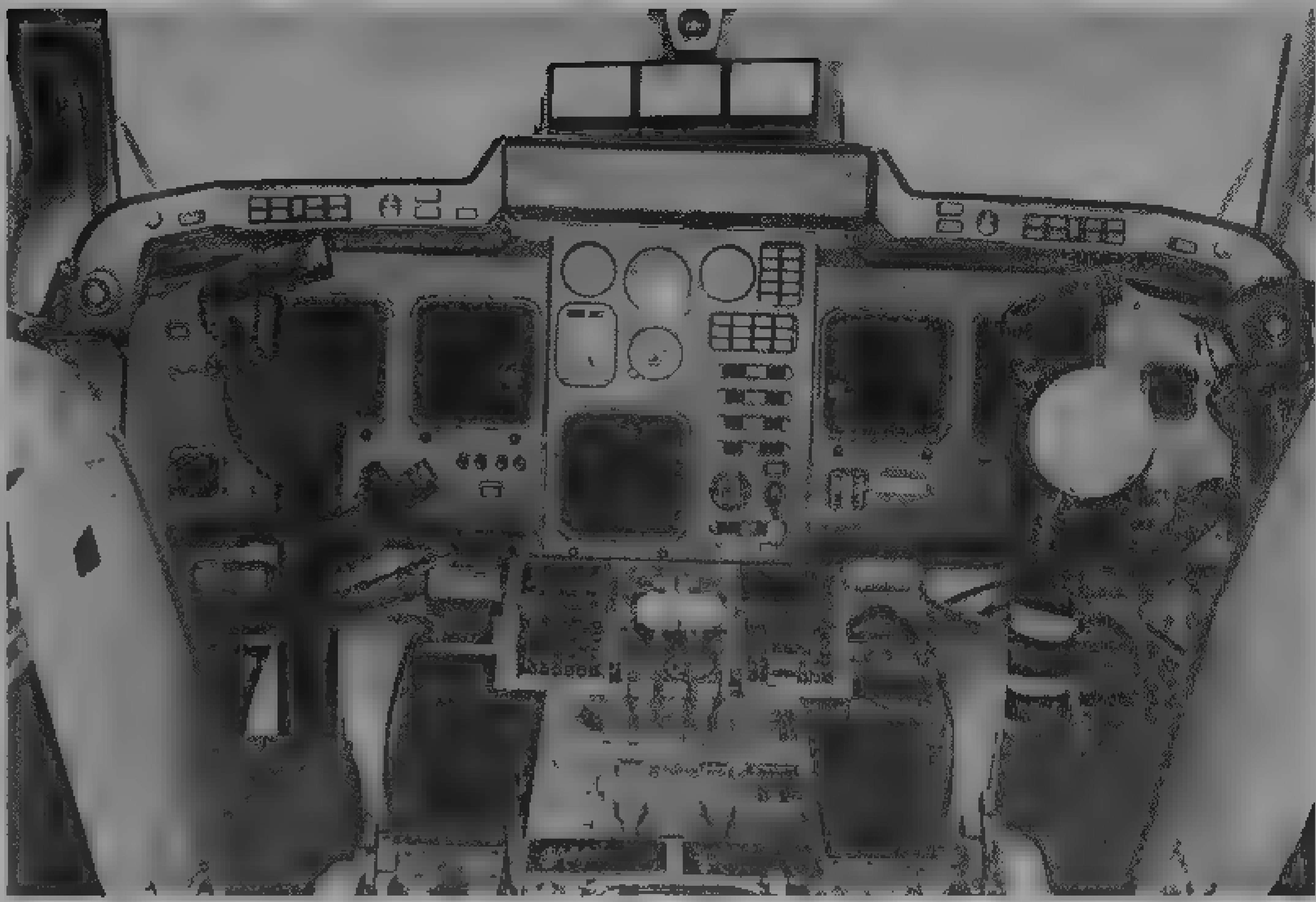


Ilyushin Il-112 twin-turboprop short-range passenger transport (*Jane's/Mike Keep*)

1994



Flight deck of Il-114 airliner (*Piotr Butowski*)

1995

ILYUSHIN Il-114

TYPE: Twin-turboprop short-range passenger and freight transport

PROGRAMME: Design finalised 1986, as replacement for aircraft in An-24 class; prototype (SSSR-54000) first flew at Zhukovsky flight test centre 29 March 1990; two more flying prototypes, two for static tests; in production at Tashkent; first production aircraft flew 7 August 1992; certification and delivery 1993. Eight flying, mid-1995

CURRENT VERSIONS: **Il-114**: *As described in detail.*

Il-114M: With TV7M-117 turboprops, increased maximum T-O weight and payload of 7,000 kg (15,430 lb).

CUSTOMERS: Aeroflot and its successors (original stated requirement 350), Arkhangelsk Airlines (2)

DESIGN FEATURES: Conventional low-wing monoplane; only fin and rudder swept; slight dihedral on wing centre-section, much increased on outer panels; operation from unpaved runways practical

FLYING CONTROLS: Manual actuation; each wing trailing-edge occupied entirely by aileron, with servo and trim tabs, and hydraulically actuated double-slotted trailing-edge flaps, inboard and outboard of engine nacelle; two airbrakes (inboard) and spoiler (outboard) forward of flaps; spoilers supplement ailerons differentially in event of engine failure during take-off; trim and servo tabs in rudder, trim tab in each elevator

STRUCTURE: Approximatley 10 per cent of airframe by weight made of composites; two-spar wings, removable leading-edge on outer panels; circular-section aluminium alloy semi-monocoque fuselage built as five subassemblies; metal tail unit (CFRP tailplane and fin boxes planned for later aircraft)

LANDING GEAR: Retractable tricycle type, with twin wheels on each unit. All retract forward hydraulically; emergency extension by gravity. Oleo-pneumatic shock-absorbers. Tyres size 620 × 80 mm on nosewheels, 880 × 305 mm on mainwheels. Nosewheels steerable ±55°. Disc brakes on mainwheels. All wheel doors remain closed except during retraction or extension of landing gear

POWER PLANT: Two 1,839 kW (2,466 shp) Klimov TV7-117 turboprops, each driving a low-noise six-blade SV-34 CFRP propeller. Integral fuel tanks in wings, capacity 8,360 litres (2,208 US gallons; 1,839 Imp gallons). APU in tailcone

ACCOMMODATION: Flight crew of two, plus stewardess. Emergency exit window each side of flight deck. Four-abreast seats for 64 passengers in main cabin, at 75 cm (29.5 in) seat pitch, with central aisle 45 cm (17.72 in) wide. Provision for rearrangement of interior for increased seating, removal of seats for cargo-carrying, and lengthening of fuselage for 70 to 75 passengers. Airstair door at front of cabin, further door at rear, both on port side, opening outward. Galley, cloakroom and toilet at rear, emergency escape slide by service door on starboard side. Type III emergency exit over each wing. Service doors at front and rear of cabin on starboard side. Baggage compartments forward of cabin on starboard side and to rear of cabin, plus overhead baggage racks. Optional carry-on baggage shelves in lobby by main door at front

SYSTEMS: Dual redundant pressurisation and air conditioning system using bleed air from both engines. Two independent hydraulic systems, pressure 207 bars (3,000 lb/sq in), for landing gear actuation, wheel brakes, nosewheel steering and flaps. Three-phase 115/220 V 400 Hz AC electrical system powered by 40 kW alternator on each engine. Secondary 24 V DC system. Wing and tail unit leading-edges de-iced electrically. Electrothermal anti-icing system for propeller blades and windscreen. Engine air intakes de-iced by hot air

AVIONICS: Digital avionics for automatic or manual control by day or night, including automatic approach and landing in limiting weather conditions (ICAO Cat I and II).

Instrumentation: Two colour CRTs for each pilot for flight and navigation information. Centrally mounted CRT for engine and systems data

DIMENSIONS, EXTERNAL:	
Wing span	30.00 m (98 ft 5¼ in)
Length overall	26.88 m (88 ft 2 in)
Diameter of fuselage	2.86 m (9 ft 4⅝ in)
Height overall	9.32 m (30 ft 7 in)
Tailplane span	11.10 m (36 ft 5 in)
Wheel track	8.40 m (27 ft 6¾ in)
Wheelbase	9.13 m (29 ft 11½ in)
Propeller diameter	3.60 m (11 ft 9¾ in)
Propeller ground clearance	0.50 m (1 ft 7¾ in)
Propeller fuselage clearance	0.97 m (3 ft 2¼ in)
Passenger doors (each): Height	1.70 m (5 ft 7 in)
Width	0.90 m (2 ft 11½ in)

Ilyushin Il-114 twin-turboprop airliner in insignia of Uzbekistan Airways *(Denis Hughes)*

1994

Service door (front): Height	1.30 m (4 ft 3¼ in)
Width	0.96 m (3 ft 1¾ in)
Service door (rear): Height	1.38 m (4 ft 6¼ in)
Width	0.61 m (2 ft 0 in)
Emergency exit (each): Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)
DIMENSIONS, INTERNAL:	
Length between pressure bulkheads	22.24 m (72 ft 11½ in)
Cabin: Max height	1.92 m (6 ft 3½ in)
WEIGHTS AND LOADINGS:	
Operating weight empty	15,000 kg (33,070 lb)
Max payload	6,500 kg (14,330 lb)
Max fuel	6,500 kg (14,330 lb)
Max T-O weight	22,700 kg (50,045 lb)
Max power loading	6.085 kg/kW (10.01 lb/shp)
PERFORMANCE:	
Nominal cruising speed	270 kts (500 km/h; 310 mph)
Approach speed	100 kts (185 km/h; 115 mph)
Optimum cruising height	7,200 m (23,625 ft)
T-O run, paved	1,550 m (5,085 ft)
Landing run, paved or unpaved	1,300 m (4,265 ft)
Range, with reserves:	
with 64 passengers	540 n miles (1,000 km; 621 miles)
with 1,500 kg (3,300 lb) payload	2,590 n miles (4,800 km; 2,980 miles)

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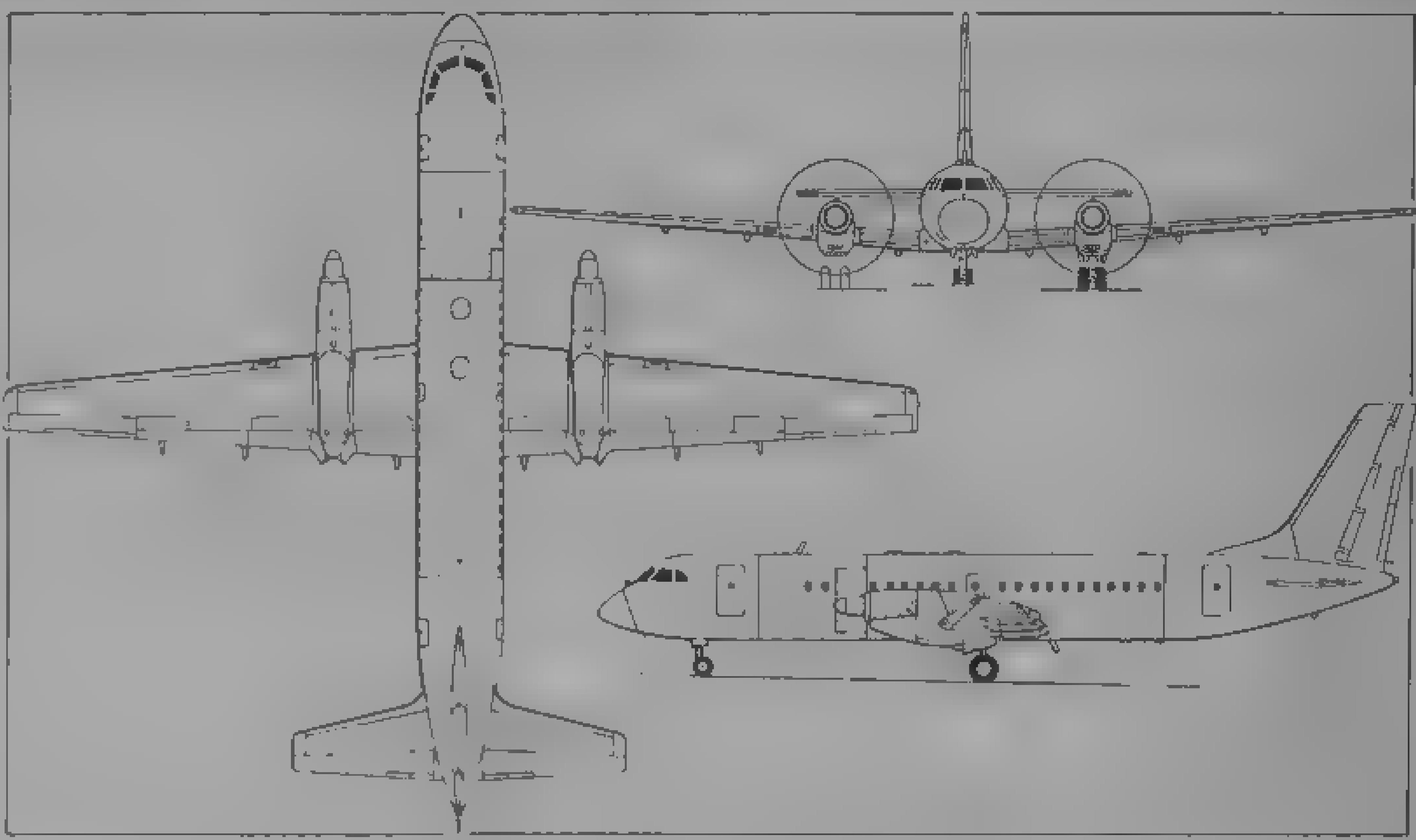

Ilyushin Il-114 short-range passenger and freight transport *(Jane's/Mike Keep)*

1993

INTERAVIA

JOINT-STOCK COMPANY INTERAVIA

18-b Otkritoye Road, 107370 Moscow
Telephone: 7 (095) 168 88 19
Fax: 7 (095) 292 65 11

UPDATED

INTERAVIA I-1L

TYPE: Two-seat light multipurpose aircraft.

PROGRAMME: Modification of SL-90 Leshii described under Aviotechnica entry in International section, produced since 1994 by Lukhovitsky Machine Building Plant, part of Moscow Aircraft Production Organisation (MAPO).

DESIGN FEATURES: As SL-90 Leshii. Intended for *ab initio* pilot training, passenger/cargo transport, search and rescue, aerial photography, ecological monitoring, agricultural work, patrol of forests, power lines, oil and gas pipelines, sport and touring.

POWER PLANT: One 104 kW (140 hp) Textron Lycoming O-320-E2A four-cylinder air-cooled piston engine; two-blade fixed-pitch propeller.

DIMENSIONS, EXTERNAL:	
Wing span	10.00 m (32 ft 9¾ in)
Length overall	6.70 m (22 ft 0 in)
WEIGHTS AND LOADINGS:	
Max payload	180 kg (397 lb)
Max T-O weight	820 kg (1,808 lb)
PERFORMANCE:	
Max level speed	97 kts (180 km/h; 112 mph)
Nominal cruising speed	75 kts (140 km/h; 87 mph)
T-O speed	46 kts (85 km/h; 53 mph)
Landing speed	51 kts (95 km/h; 59 mph)
Service ceiling	4,000 m (13,125 ft)
T-O run, unpaved runway	450 m (1,477 ft)
Landing run, unpaved runway	400 m (1,313 ft)
Range with max fuel	323 n miles (600 km; 372 miles)
g limits	+6/−3

NEW ENTRY

Interavia I-1L (Textron Lycoming O-320-E2A engine)

1995

INTERAVIA I-3

TYPE: Single/two-seat aerobatic aircraft.

PROGRAMME: Prototypes exhibited at MosAeroshow '93.

DESIGN FEATURES: Conventional low-wing monoplane, capable of unlimited aerobatics; tapered multispar wings of symmetrical section, without dihedral or anhedral; unswept tail surfaces with pointed rudder tip; clear view blister canopy over one or two seats. Convertible from two-seater to single-seater in 1 hour by removal of front cabin bay with control panel, installation of top fuselage panel and changing of canopy.

FLYING CONTROLS: Three-axis with long-span ailerons that can be drooped for take-off and landing; horn balanced rudder and elevators; ground-adjustable tab on rudder. Two suspended balance tabs on each aileron.

STRUCTURE: All-metal, semi-monocoque fuselage; fluted skin on fin, tailplane and all control surfaces.

LANDING GEAR: Non-retractable tailwheel type; cantilever mainwheel legs. Mainwheel tyres size 400 × 150 mm, tailwheel tyre size 200 × 80 mm

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial engine; three-blade wooden controllable-pitch propeller

ACCOMMODATION: One or two seats in tandem

DIMENSIONS, EXTERNAL:

Wing span	8.10 m (26 ft 7 in)
Length overall	6.72 m (22 ft 0½ in)
Tailplane span	2.80 m (9 ft 2¼ in)
Propeller diameter	2.40 m (7 ft 10½ in)

AREAS:

Wings, gross	11.54 m² (124.2 sq ft)

WEIGHTS AND LOADINGS (two seats):

Weight empty	760 kg (1,675 lb)
Max T-O weight	1,063 kg (2,343 lb)

PERFORMANCE (two seats, except where indicated):

Never-exceed speed (V_{NE})	242 kts (450 km/h; 280 mph)
Max level speed	189 kts (350 km/h; 217 mph)
Max rate of climb at S/L	660 m (2,165 ft)/min
Service ceiling	5,000 m (16,400 ft)
T-O run: paved runway	200 m (656 ft)
unpaved runway	262 m (860 ft)
Landing run: paved runway	452 m (1,483 ft)
unpaved runway	477 m (1,565 ft)
Range with max fuel	377 n miles (700 km; 435 miles)
g limits: single seat	+12, -10
two seats	+10, -8

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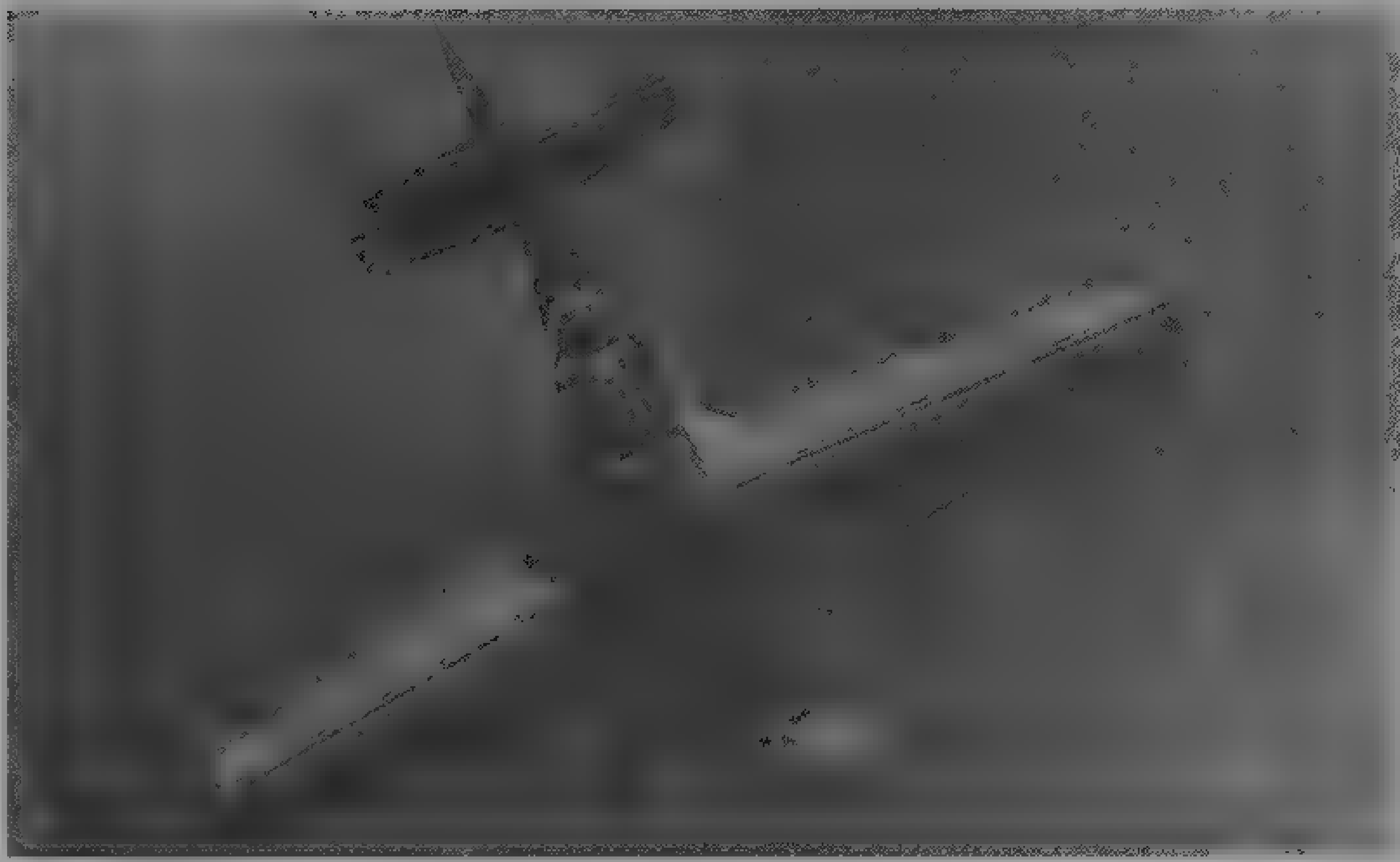


Interavia I-3 aerobatic aircraft in single-seat form

1995

KAMERTON-N

KAMERTON-N LTD

Tsiolkovskogo Street 2, Shchelkovo-3, 141100 Moscow Region

Telephone: 7 (095) 526 32 43

In association with V P Chkalov Air Force Science and Research Institute, Kamerton-N has designed and built the prototype Ratnik light multipurpose autogyro for military and civil use.

NEW ENTRY

KAMERTON-N RATNIK

TYPE: Experimental light two-seat autogyro.

PROGRAMME: Flight testing under way 1995.

DESIGN FEATURES: Short fuselage pod with extensively glazed cabin, engine at rear of pod, driving three-blade ducted pusher propeller; full-depth rudder in duct immediately aft of propeller; non-retractable tricycle landing gear, with single wheel on each unit; two-blade autorotating rotor, with optional drive for jump take-off.

POWER PLANT: One 50 kW (67 hp) Samson-760 or two 48 kW (64.5 hp) Rotax 582 piston engines.

ACCOMMODATION: Two seats side by side in enclosed cabin; provision for stretcher for ambulance duty, or for cargo-carrying.

ARMAMENT: Mounting for light gun or missile above landing gear each side of cabin on military version.

DIMENSIONS, EXTERNAL:

Rotor diameter	9.00 m (29 ft 6¼ in)
Overall length, excl rotor	4.95 m (16 ft 3 in)

WEIGHTS AND LOADINGS:

Normal payload	80 kg (176 lb)
Normal T-O weight	500 kg (1,102 lb)
Max T-O weight	600 kg (1,322 lb)

PERFORMANCE (estimated):

Max level speed	81 kts (150 km/h; 93 mph)
Max cruising speed	65 kts (120 km/h; 74 mph)
Econ cruising speed	43 kts (80 km/h; 50 mph)
Min flying speed	19 kts (35 km/h; 22 mph)
Service ceiling	4,000 m (13,125 ft)
Max range, 20 min reserve	135 n miles (250 km; 155 miles)
Max endurance	3 h

Kamerton-N two-seat light autogyro in military form

1995

NEW ENTRY

KAMOV

VERTOLETNYI NAUCHNO-TEKHNICHESKIY KOMPLEKS IMENI N. I. KAMOVA (VNTK) (Helicopter Scientific and Technology Complex named after N. I. Kamov)

March 8th Street, 140007 Lubertsy, Moscow Region

Telephone: 7 (095) 700 32 04, 171 37 43

Fax: 7 (095) 700 30 71

Telex: 206112 Kamov

GENERAL DESIGNER: Sergei Victorovich Mikheyev, PhD

DEPUTY GENERAL DESIGNER: Veniamin Kasjanikov

CHIEF DESIGNERS:
Juri Sokovikov
Vyacheslav Krygin
Evgeny Pak

Formed in 1947, this OKB continues work of Prof Dr Ing Nikolai Ilyich Kamov, a leading designer of rotating-wing aircraft from late 1920s, who died on 24 November 1973, aged 71; all Kamov helicopters in current service have coaxial contrarotating rotors. Ka-62, under development, has single main rotor.

VERIFIED

KAMOV Ka-25

NATO reporting name: Hormone

TYPE: Twin-turbine multipurpose military helicopter.

PROGRAMME: Prototype flew 1961; shown in Soviet Aviation Day flypast, Tushino Airport, Moscow, July 1961, carrying two dummy air-to-surface missiles (ASMs not fitted to production aircraft); about 460 built 1966-75, of which 88 remain operational with Russian Navy.

CURRENT VERSIONS: Four major variants in service:

Ka-25PL (protivolodochny) ('Hormone-A'): Ship-based anti-submarine helicopter, equipped with surveillance radar and dipping sonar; armed with one torpedo. *Detailed description applies to Ka-25PL.*

Ka-25Ts (tseleukazatel) ('Hormone-B'): Special electronics variant, providing over-the-horizon target acquisition for cruise missiles launched from ships on which it is based; larger undernose radome (NATO 'Big Bulge') than Ka-25PL, with spherical undersurface; cylindrical radome under rear cabin for missile mid-course guidance and helicopter-to-ship datalink; when radar operates, all landing gear wheels can retract upward to minimise interference to emissions; cylindrical fuel container each side of lower fuselage.

Ka-25BShZ: Equipped to tow minesweeping gear; externally similar to Ka-25PL, but without sonar.

Ka-25PS ('Hormone-C'): Search and rescue version, with special role equipment, including hoist.

CUSTOMERS: CIS Naval Aviation, India, Syria, Vietnam and former Yugoslavia.

DESIGN FEATURES: Folding three-blade coaxial rotors, requiring no tail rotor, and triple tailfins ensure compact stowed overall dimensions on board ship; engines above cabin and external mounting of operational equipment and auxiliary fuel leaves interior uncluttered.

FLYING CONTROLS, STRUCTURE, LANDING GEAR: See previous editions.

POWER PLANT: Two 662 kW (888 shp) Mars GTD-3F turboshafts, side by side above cabin forward of rotor driveshaft, on early aircraft. Later aircraft have 735 kW (986 shp) GTD-3M turboshafts. Independent fuel supply to each engine. Provision for external fuel tank each side of cabin. Single-point fuelling.

ACCOMMODATION: Pilot and co-pilot side by side on flight deck, with rearward-sliding door each side. Rearward-sliding door to rear of main landing gear on port side. Up to 12 folding seats for passengers optional.

AVIONICS: Equipment available for all versions includes autopilot, radio, nav system, radio compass, lighting for all-weather operation by day or night, and hoist above cabin door. IFF antennae (NATO 'Odd Rods') above nose and alongside central tailfin. Dipping sonar in compartment at rear of main cabin, immediately forward of tailboom, and search radar (NATO 'Short Horn') in flat bottom undernose radome (diameter 1.25 m, 4 ft 1 in) on Ka-25PL, which can have canister of sonobuoys mounted externally aft of starboard main landing gear. Most aircraft have cylindrical housing for ESM above tailboom, shallow blister fairing to rear of cylindrical housing and similar housing under rear of cabin for datalink.

ARMAMENT: Doors under fuselage of some aircraft enclose weapons bay for 450 mm (18 in) ASW torpedo.

DIMENSIONS, EXTERNAL:

Rotor diameter (each)	15.74 m (51 ft 7¾ in)
Length of fuselage	9.75 m (32 ft 0 in)
Height to top of rotor head	5.37 m (17 ft 7½ in)
Width over tailfins	3.76 m (12 ft 4 in)
Wheel track: front	1.41 m (4 ft 7½ in)
rear	3.52 m (11 ft 6½ in)
Cabin door: Height	1.10 m (3 ft 7¼ in)
Width	1.20 m (3 ft 11¼ in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	3.95 m (12 ft 11½ in)
Max width	1.50 m (4 ft 11 in)
Max height	1.25 m (4 ft 1¼ in)

AREAS:

Rotor disc (each)	194.6 m² (2,095 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	4,765 kg (10,505 lb)
Max T-O weight	7,200 kg (15,873 lb)

PERFORMANCE:

Max level speed	113 kts (209 km/h; 130 mph)
Normal cruising speed	104 kts (193 km/h; 120 mph)
Service ceiling	3,350 m (11,000 ft)
Range, with reserves:	
with standard fuel	217 n miles (400 km; 250 miles)
with external tanks	351 n miles (650 km; 405 miles)

VERIFIED

Kamov Ka-28 anti-submarine helicopter (NATO 'Helix-A') in Indian service *(SIRPA-Air)* *1995*

Kamov Ka-27PS search and rescue helicopter (NATO 'Helix-D') *(Piotr Butowski)* *1993*

KAMOV Ka-27 and Ka-28

NATO reporting names: Helix-A and D

TYPE: Twin-turbine multipurpose military helicopter.

PROGRAMME: Design started 1969 to overcome inability of Ka-25 to operate dipping sonar at night and in adverse weather; first flight of prototype 1973; first open reference in US Department of Defense's 1981 *Soviet Military Power* document, which stated that "Hormone variant" helicopters could be carried in telescoping hangar on 'Sovremenny' class of guided missile destroyers, for ASW missions; photographs of two on stern platform of *Udaloy*, first of new class of ASW guided missile destroyers, taken by Western pilots during Baltic exercises, September 1981; at least 16 observed on former 'Kiev' class carrier/cruiser *Novorossiysk* 1983, as stage in continuous replacement of Ka-25s with Ka-27s.

CURRENT VERSIONS: **Ka-27PL** ('Helix-A'): Basic ASW helicopter with three crew, operational since 1982, normally operated in pairs, one tracking hostile submarine, other dropping depth charges. Russian Naval Aviation has 88.

Ka-27PS ('Helix-D'): Search and rescue and plane guard helicopter, as Ka-27PL, but some operational equipment deleted, external fuel tank each side of cabin, as civil Ka-32, winch beside port cabin door.

Ka-28 ('Helix-A'): Export version of Ka-27PL, said by Yugoslavia to have 1,618 kW (2,170 shp) TV3-117BK turboshafts and 3,680 kg (8,113 lb) of fuel in 12 tanks.

Ka-29 ('Helix-B'): Described separately.

Ka-32 (civil 'Helix-C'): Described separately, general description (which see) applies also to Ka-27 and Ka-28.

CUSTOMERS: CIS Naval Aviation, India (at least 17 Ka-28 including three for training) and Yugoslavia (Ka-28).

DESIGN FEATURES: Basic configuration very like Ka-25, but longer and more capacious fuselage pod, no central tailfin and different undernose radome; similar overall dimensions with rotors folded enable Ka-27 to stow in shipboard hangars and use deck lifts built for Ka-25.

ACCOMMODATION: Crew of three: pilot, tactical co-ordinator, ASW systems operator.

AVIONICS: Basically as for Ka-32.

Comms: IFF (NATO 'Odd Rods').

Radar: Undernose 360° search radar; directional ESM radomes above rear of engine bay fairing and at tailcone tip.

Flight: Doppler box under tailboom.

Mission: Dipping sonar behind clamshell doors at rear of fuselage pod, sonobuoys stowed internally. MAD.

Self defence: RWR on nose and above tailplane, infrared jammer (NATO 'Hot Brick') at rear of engine bay fairing, station keeping light between ESM radome and jammer, chaff/flare dispensers; colour coded identification flares.

ARMAMENT: Ventral weapons bay for torpedoes, depth charges, other stores.

DIMENSIONS, EXTERNAL: As Ka-32

PERFORMANCE (Ka-28):

Max level speed at 10,700 kg (23,590 lb) AUW
145 kts (270 km/h; 168 mph)

Max cruising speed
124-129 kts (230-240 km/h; 143-149 mph)

Max rate of climb at S/L 750 m (2,460 ft)/min

Radius of action against submarine cruising at up to 40 kts (75 km/h; 47 mph) at depth of 500 m (1,640 ft)
108 n miles (200 km; 124 miles)

UPDATED

Kamov Ka-25PL ('Hormone-A') anti-submarine helicopter of Russian Naval Aviation *(Linda Jackson)* *1995*

KAMOV Ka-29 and Ka-31

NATO reporting name: Helix-B

TYPE: Twin-turbine assault transport and electronic warfare helicopter.

PROGRAMME: Entered service with Northern and Pacific Fleets 1985, photographed on board assault ship *Ivan Rogov* in Mediterranean 1987, thought to be Ka-27B and given NATO reporting name 'Helix-B', identified as Ka-29 combat transport at Frunze (Khodinka) air show, Moscow, August 1989. Ka-31 radar picket version completed initial shipboard trials on aircraft carrier *Admiral of the Fleet Kuznetsov* (then *Tbilisi*) 1990, both versions expected to equip this ship.

Flight deck of Kamov Ka-27PS search and rescue helicopter *(Piotr Butowski)*

1995

Kamov Ka-31 radar picket helicopter with antenna deployed and landing gear retracted

1994

Ka-29 (NATO 'Helix-B') combat transport helicopter *(Linda Jackson)*

1995

CURRENT VERSIONS: **Ka-29** ('Helix-B'): Development of Ka-27 for transport and close support of seaborne assault troops. *Detailed description generally as for Ka-32 except as under.*

Ka-31 (formerly Ka-29RLD: radiolokatsyonnogo dozora): Radar picket helicopter; first flown 1988, two examples seen on *Admiral of the Fleet Kuznetsov* early 1992, basic airframe of Ka-27, package of special avionics includes large NIIR rotating radar antenna (area 6.0 m² 64.5 sq ft) that stows flat against underfuselage and deploys downward, turning through 90° into vertical plane before starting to rotate, landing gear retracts upward to prevent interference. Maximum surveillance radius reported to be 54 to 81 n miles (100 to 150 km, 62 to 93 miles) for fighter-size targets, 135 n miles (250 km, 155 miles) for surface vessels, up to 20 targets tracked simultaneously. Two large panniers starboard side of cabin fore and aft of main landing gear on helicopter numbered 032 (forward panniers only on 031), starboard airstair-type cabin door, aft of flight deck, divided horizontally into upward- and downward-opening sections, with box fairing in place of window, hatch window deleted above starboard rear pannier, APU repositioned above rear of engine bay fairing, with slot type air intake at front of housing, displacing usual ESM and IR jamming pods; tailcone extended by conical, probably dielectric, fairing, no stores pylons or outriggers, unidentified structure at rear of fuselage. Crew of two. Endurance on station 2 hours 30 minutes at 3,500 m (11,500 ft).

CUSTOMERS: CIS Naval Aviation (more than 30 Ka-29s).

POWER PLANT: Two Klimov TV3-117V turboshafts, each 1,633 kW (2,190 shp). Engines started by APU.

ACCOMMODATION: Wider flight deck than Ka-27 for two crew, three flat-plate windscreen glazings instead of two-piece curved transparency, main cabin port-side door, aft of landing gear, divided horizontally into upward- and downward-opening sections, to facilitate rapid exit of up to 16 assault troops, four stretcher patients and six seated casualties in ambulance role, flight deck and engine bay heavily armoured.

AVIONICS: *Flight*: Doppler box under tailboom; IFF ('Slap Shot').

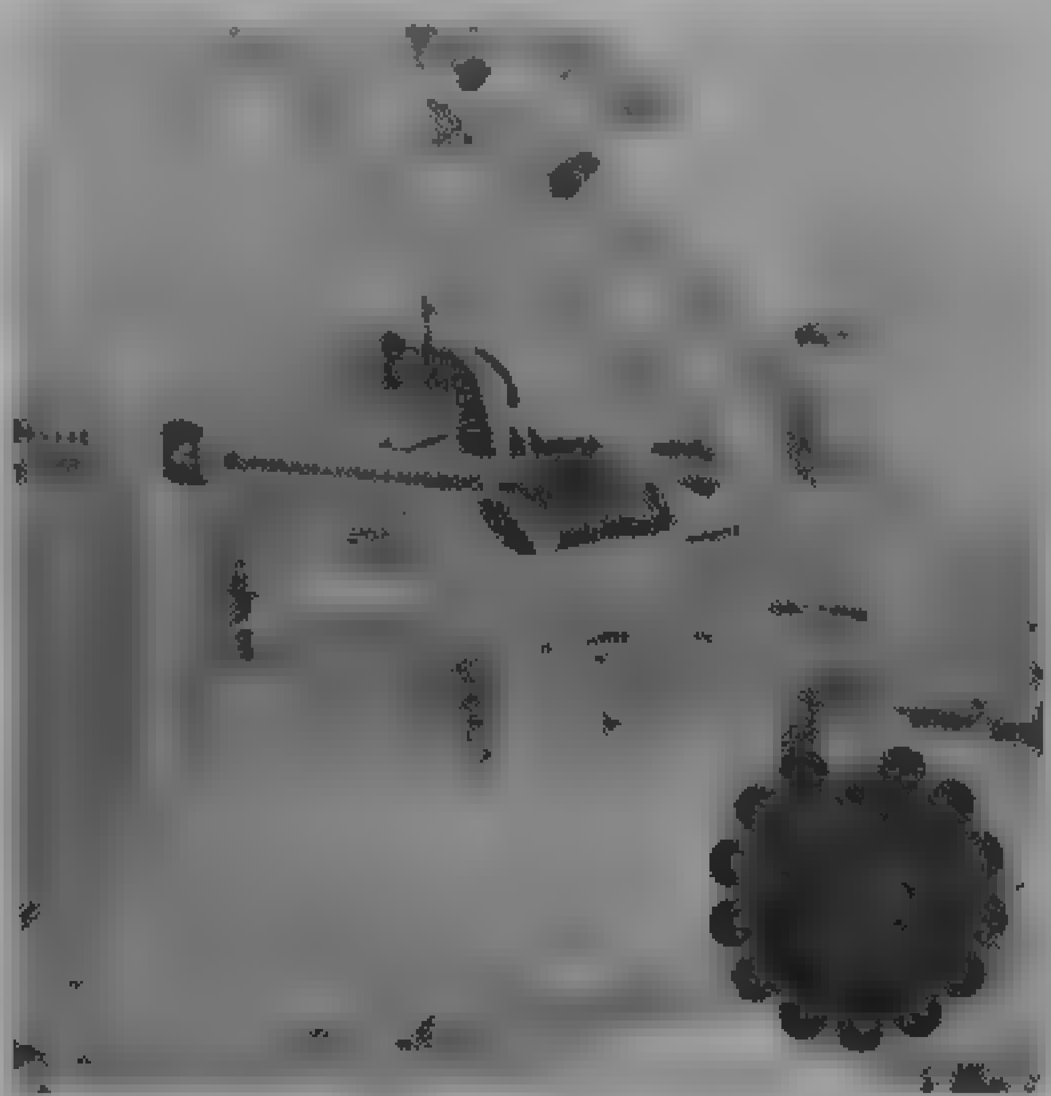
Mission: Undernose sensor pods appear similar to electro-optics and RF missile guidance pods of Mi-24V, ESM 'flower pot' above rear of engine bay fairing.

Self-defence: Infra-red jammer (NATO 'Hot Brick'); station keeping light between ESM and jammer, radar warning receivers.

ARMAMENT: Four-barrel Gatling type 7.62 mm machine gun with 1,800 rounds, flexibly mounted behind downward articulated door on starboard side of nose, four pylons on outriggers, for two four-round clusters of 9M114 Shturm (AT-6 'Spiral') air-to-surface missiles and two 57 or 80 mm rocket packs. Alternative loads include four rocket packs, two pods each containing a 23 mm gun and 250 rounds, or two ZB-500 incendiary tanks. Provision for 30 mm Type 2A42 gun above port outrigger, with ammunition feed from cabin.

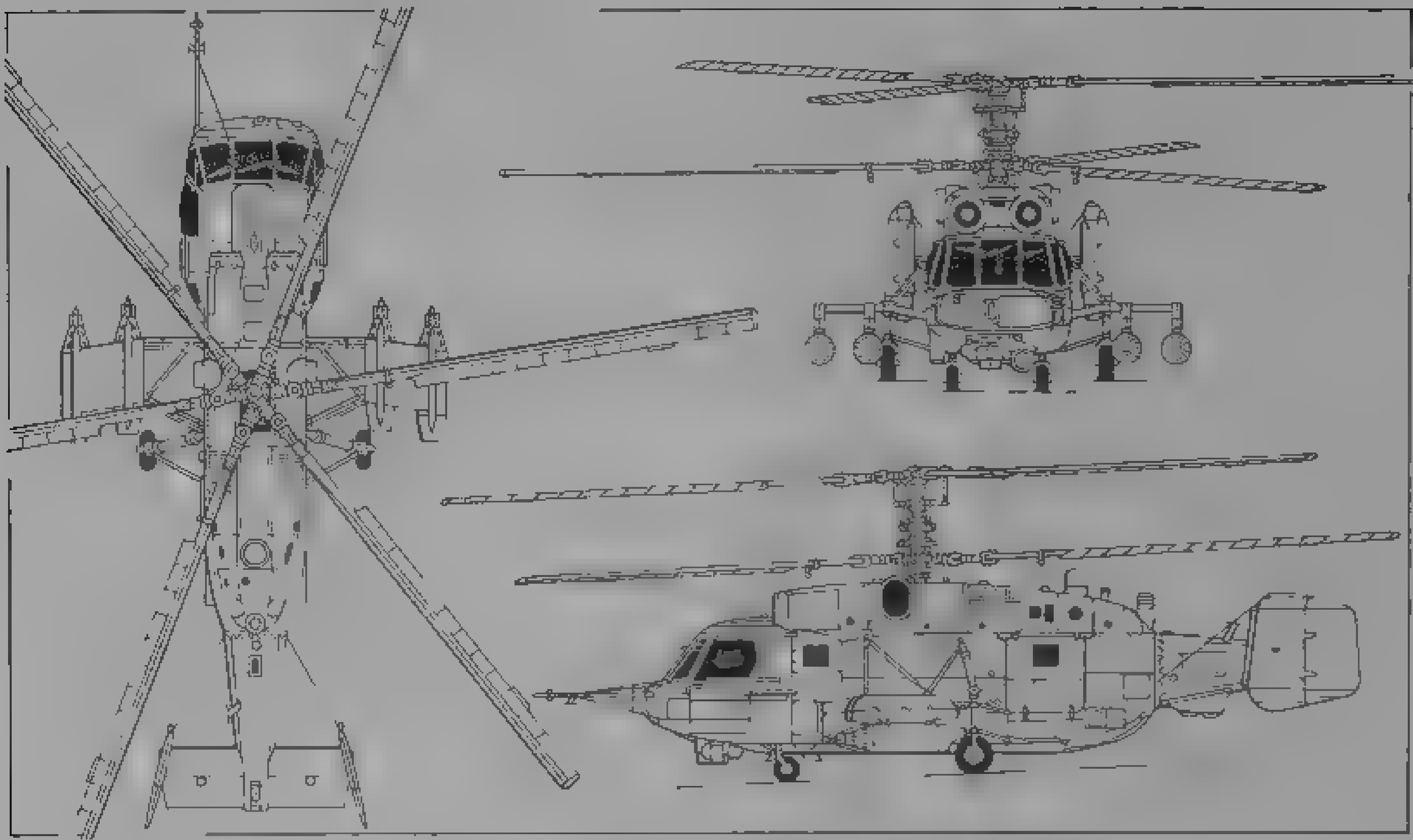
DIMENSIONS, EXTERNAL:

Rotor diameter (each)	15.90 m (52 ft 2 in)
Blade length, aerofoil section (each)	5.45 m (17 ft 10½ in)
Blade chord	0.48 m (1 ft 7 in)
Vertical separation of rotors	1.40 m (4 ft 7 in)
Length overall, excl noseprobe and rotors	11.30 m (37 ft 1 in)
Height overall	5.40 m (17 ft 8½ in)
Width: between centrelines of outboard pylons	5.65 m (18 ft 6½ in)
over tailfins and centred rudders	3.65 m (12 ft 0 in)
flight deck	2.20 m (7 ft 2 in)
Mainwheel track	3.50 m (11 ft 6 in)
Nosewheel track	1.40 m (4 ft 7 in)
Wheelbase	3.00 m (9 ft 10 in)



Type 2A42 gun on port outrigger of Ka-29

1992



Kamov Ka-29 combat transport helicopter *(Jane's/Mike Keep)*

1992

AREAS

Rotor disc (each)	98.5 m² (1,138 sq ft)

WEIGHTS AND LOADINGS

Weight empty	5,520 kg (12,170 lb)
Max load: internal	2,000 kg (4,409 lb)
external	4,000 kg (8,818 lb)
Normal T-O weight	11,000 kg (24,250 lb)
Max T-O weight	12,600 kg (27,775 lb)

PERFORMANCE

Max level speed at S/L	151 kts (280 km/h; 174 mph)
Nominal cruising speed	127 kts (235 km/h; 146 mph)
Max rate of climb at S/L	930 m (3,050 ft)/min
Service ceiling	4,300 m (14,100 ft)
Hovering ceiling OGE	3,700 m (12,140 ft)
Combat radius, with six to eight attack runs over target	54 n miles (100 km; 62 miles)
Range: max standard fuel	248 n miles (460 km; 285 miles)
ferry	400 n miles (740 km; 460 miles)

UPDATED

KAMOV Ka-32

NATO reporting name: Helix-C

TYPE: Twin-turbine civil utility helicopter.

PROGRAMME: Development of Ka-27/32 began 1969, first flight of common prototype 1973, first Ka-32 (SSSR-04173) exhibited Minsk Airport late 1981, during fourth CMEA scientific/technical conference on use of aircraft in national economy, carrying slung truck in flying display; prototype of utility version shown at Paris Air Show June 1985; in production at Kumertau Aircraft Production Enterprise.

CURRENT VERSIONS: **Ka-32T** ('Helix-C'): Utility transport, ambulance and flying crane, limited avionics; for carriage of internal or external freight, and passengers, along airways and over local routes, including support of offshore drilling rigs.

Ka-32S ('Helix-C'): Maritime version, more comprehensive avionics, including undernose radar, for IFR operation from icebreakers in adverse weather and over terrain devoid of landmarks, 300 kg (661 lb) electric load hoist standard; additional external fuel tanks available 1994, strapped on each side at top of cabin (see illustration); duties include ice patrol, guidance of ships through icefields, unloading and loading ships (up to 30 tonnes an hour, 360 tonnes a day), maritime search and rescue.

Ka-32K: Flying crane with retractable gondola for second pilot under cabin. Model shown 1990. Operational testing completed 1992.

Ka-32A: Assemblies and systems of basic Ka-32 modified in 1990-93 to meet all requirements of Russian NLGB-2 and US FAR 29/FAR 33 airworthiness standards in categories A and B. Russian type certificates obtained for Ka-32A and its TV3-117VMA engines in June 1993. Larger tyres. Optional pressure fuelling with reduced fuel capacity. Maximum accommodation for 13 passengers. Advanced avionics available, including Canadian Marconi dual CMA-900 flight management system, with EFIS, AFCS, CMA-2012 Doppler velocity sensor and CMA-3012 GPS sensor. Modification of helicopters to Ka-32A standard started by Kamov 1994.

Ka-32A1: Firefighting version of Ka-32A, available from 1994. Three delivered to Moscow fire service, with steerable water cannon and two types of rescue cage, able to lift up to 20 people from roofs of tall buildings.

CUSTOMERS: Aeroflot and its successors; operators in Bulgaria (32C), Yemen (32C/T).

DESIGN FEATURES: Conceived as completely autonomous 'compact truck', to stow in much the same space as Ka-25 with rotors folded, despite greater power and capability, and to operate independently of ground support equipment; special attention paid to ease of handling with single pilot; overall dimensions minimised by use of coaxial rotors, requiring no tail rotor, and twin fins on short tailboom; upper rotor turns clockwise, lower rotor anticlockwise; rotor mast tilted forward 3°; twin turbines and APU above cabin, leaving interior uncluttered; lower fuselage sealed for flotation.

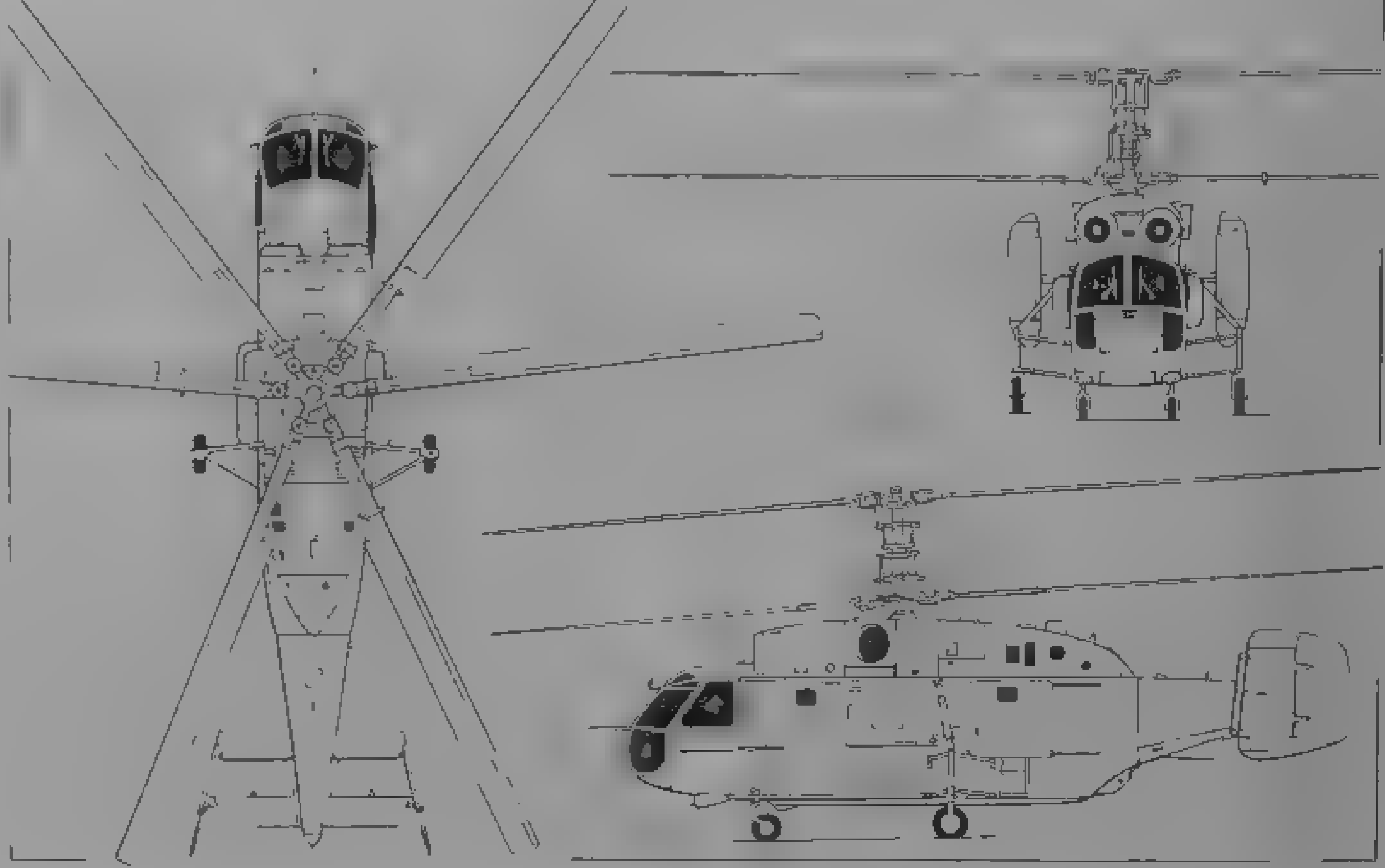
FLYING CONTROLS: Dual hydraulically powered flight control systems, without manual reversion; spring stick trim; yaw control by differential collective pitch applied through rudder pedals; mix in collective system maintains constant total rotor thrust during turns, to reduce pilot workload when landing on pitching deck, and to simplify transition to hover and landing; twin rudders intended mainly to improve control in autorotation, but also effective in coordinating turns; flight can be maintained on one engine at maximum T-O weight.

STRUCTURE: Titanium and composites used extensively, with particular emphasis on corrosion resistance; fully articulated three-blade coaxial contrarotating rotors have all-composites blades with carbonfibre and glassfibre main spars, pockets (13 per blade) of Kevlar type material, and filler similar to Nomex; blades have non-symmetrical aerofoil section, each has ground adjustable tab, each lower blade carries adjustable vibration damper, comprising two dependent weights, on root section, with further vibration dampers in fuselage; tip light on each upper blade; blades fold manually outboard of all control mechanisms, to folded width within track of main landing gear; rotor hub is 50 per cent titanium/50 per cent steel; rotor brake standard; all-metal fuselage; composites tailcone; fixed incidence tailplane, elevators, fins and rudders have aluminium alloy structure, composite skins; fins toe inward approximately 25°; fixed leading-edge slat on each fin prevents air flow over fin stalling in crosswinds or at high yaw angles.

LANDING GEAR: Four-wheel type. Oleo-pneumatic shock absorbers. Castoring nosewheels. Mainwheel tyres size 600 × 180 mm (Ka-32), 620 × 180 mm, pressure 10.8 bars (156 lb/sq in) (Ka-32A). Nosewheel tyres size 400 × 150 mm (Ka-32), 480 × 200 mm, pressure 5.9 bars (85 lb/sq in) (Ka-32A). Skis optional.

Kamov Ka-32K flying crane, with retractable pilot gondola extended under rear of cabin

1993



Kamov Ka-32T ('Helix-C') utility helicopter (two Klimov TV3-117V turboshafts) *(Jane's/Dennis Punnett)*

1985

POWER PLANT: Two 1,633 kW (2,190 shp) Klimov TV3-117V (Ka-32) or TV3-117VMA (Ka-32A) turboshafts, with automatic synchronisation system, side by side above cabin, forward of rotor driveshaft. Main gearbox brake standard. Oil cooler fan aft of gearbox. Cowlings hinge downward as maintenance platforms. Fuel in tanks under cabin floor and inside container each side of centre-fuselage, capacity of main tanks 2,180 litres (576 US gallons, 480 Imp gallons); maximum capacity with two underfloor auxiliary tanks 3,000 litres (792 US gallons; 660 Imp gallons). Single-point pressure refuelling behind small forward-hinged door on port side, where bottom of tailboom meets rear of cabin

ACCOMMODATION: Pilot and navigator side by side on air conditioned flight deck, in adjustable seats. Rearward-sliding jettisonable door with blister window each side. Seat behind navigator, on starboard side, for observer, loadmaster or rescue hoist operator. Alcohol windscreen anti-icing. Direct access to cabin from flight deck. Heated and ventilated main cabin of Ka-32 can accommodate freight or 16 passengers, on three folding seats at rear, six along port sidewall and seven along starboard sidewall (13 passengers in Ka-32A). Lifejackets under seats. Fittings to carry stretchers. No provisions for toilet or galley. Pyramid structure can be fitted on floor beneath rotor driveshaft to prevent swinging of external cargo sling loads. Rearward-sliding door aft of main landing gear on port side, with steps below. Emergency exit door opposite. Hatch to avionics compartment on port side of tailboom

SYSTEMS: Three hydraulic systems: main system supplies servos, mainwheel brakes and hydraulic winch when fitted; standby system supplies only servos after main system failure; auxiliary system supplies brakes after main system failure and adjusts height of helicopter fuselage above ground; it can also be connected to main system for checking all functions on ground. Electrical system includes two independently operating AC generators and two batteries, cut in automatically or manually via inverters after AC generating system failure. After failure of either generator, the other is switched automatically to supply both circuits. Two rectifiers supply DC power. Electrothermal de-icing of entire profiled portion of each blade switches on automatically when helicopter enters icing conditions. Hot air engine intake anti-icing. APU in rear of engine bay fairing on starboard side, for engine starting and to power all essential hydraulic and electrical services on ground, eliminating need for GPU

AVIONICS: *Flight:* Include electromechanical flight director controlled from autopilot panel, Doppler hover indicator, two HSI and air data computer. Fully coupled three-axis autopilot can provide automatic approach and hover at height of 25 m (82 ft) over landing area, on predetermined course, using Doppler. Radar altimeter. Doppler box under tailboom

EQUIPMENT: Doors at rear of fuel tank bay provide access to small compartment for auxiliary fuel, or liferafts which eject during descent in emergency, by command from flight deck. Container each side of fuselage, under external fuel containers, for emergency flotation bags, deployed by water contact. Optional rescue hoist, capacity 300 kg (661 lb), between top of door opening and landing gear. Optional external load sling, with automatic release and integral load weighing and stabilisation systems

Kamov Ka-32A ('Helix-C') modified for Russian and US civil certification *(Paul Jackson)* 1995

Kamov Ka-32S, showing external fuel tank at top of cabin *(Paul Jackson)* 1995

DIMENSIONS, EXTERNAL:

Rotor diameter (each)	15.90 m (52 ft 2 in)
Length overall: excl rotors	11.30 m (37 ft 1 in)
rotors folded	12.25 m (40 ft 2¼ in)
Width, rotors folded	4.00 m (13 ft 1½ in)
Height to top of rotor head	5.40 m (17 ft 8½ in)
Wheel track: mainwheels	3.50 m (11 ft 6 in)
nosewheels	1.40 m (4 ft 7 in)
Wheelbase	3.02 m (9 ft 11 in)
Cabin door: Height	approx 1.20 m (3 ft 11¼ in)
Width	approx 1.20 m (3 ft 11¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length	4.52 m (14 ft 10 in)
Max width	1.30 m (4 ft 3 in)
Max height	1.32 m (4 ft 4 in)

AREAS:

Rotor disc (each)	198.5 m² (2,138 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	6,500 kg (14,330 lb)
Max payload: internal	4,000 kg (8,818 lb)
external	5,000 kg (11,023 lb)
Normal T-O weight	11,000 kg (24,250 lb)
Max flight weight with slung load	12,600 kg (27,775 lb)

PERFORMANCE (Ka-32T at AUW of 11,000 kg; 24,250 lb. Ka-32A similar):

Max level speed	135 kts (250 km/h; 155 mph)
Max cruising speed	124 kts (230 km/h; 143 mph)
Service ceiling	5,000 m (16,400 ft)
Hovering ceiling OGE	3,500 m (11,480 ft)
Hovering ceiling OGE, OEI	1,705 m (5,600 ft)
Range with max fuel	432 n miles (800 km; 497 miles)
Endurance with max fuel	4 h 30 min

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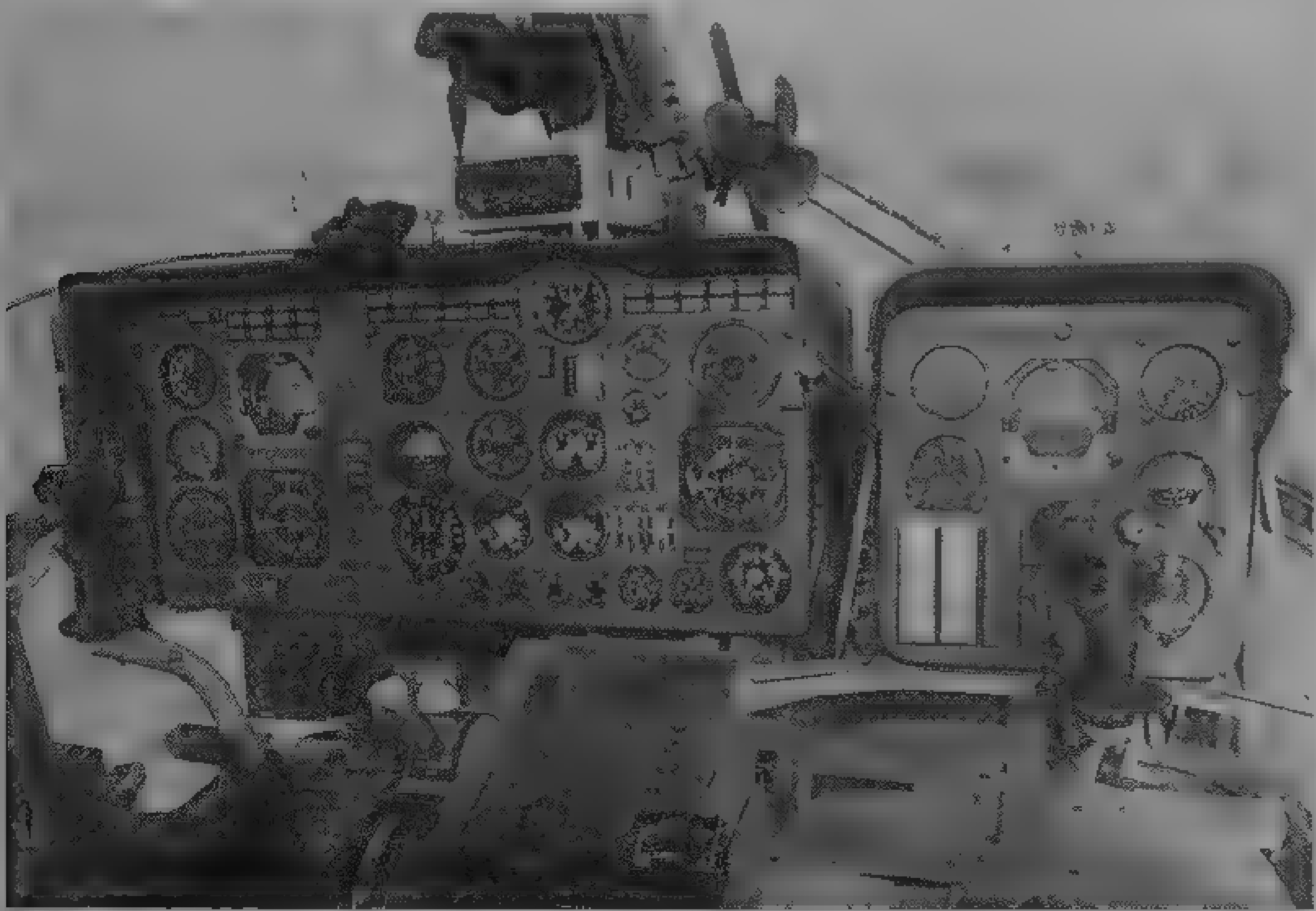


Flight deck of Kamov Ka-32 utility helicopter *(Paul Jackson)* 1995

KAMOV Ka-50

NATO reporting name: Hokum-A

TYPE: Twin-turbine close support helicopter.

PROGRAMME: Project design completed December 1977, as V-80 (Vertolyet-80, helicopter-80); first Ka-50 prototype (010) flew 27 July 1982; first Western report Summer 1984, first photograph published in US Department of Defense's *Soviet Military Power* document 1989, preseries production at Progress plant, Arsenyev, after competitive evaluation with Mi-28, first exhibited at 1992 Farnborough Air Show with Western name **Werewolf**

CURRENT VERSIONS: **Ka-50** ('Hokum-A', V-80Sh1): As described. Basic single-seat close support helicopter; in small-scale production. One seen with undernose sensor ball turret

Ka-52 ('Hokum B'; V-80Sh2): Side by side two-seat training and combat version, first flight scheduled 1996; described separately

CUSTOMERS: Twelve prototype and preseries Ka-50s (010-021, at least seven of which for flight trials) completed by 1995 for Russian Army Aviation. Reported requirement for 60 per cent Ka-50s, 40 per cent Ka-52s

DESIGN FEATURES: World's first single-seat close-support helicopter. Coaxial, contrarotating and widely separated semi-rigid three-blade rotors, with swept blade tip, attached to hub by steel plates; small fuselage cross-section, with nose sensors; flat-screen cockpit, heavily armour protected with rearview mirror above windscreen; small sweptback tailfin, with inset rudder and large tab; high set tailplane on rear fuselage, with endplate auxiliary fins; retractable landing gear; mid-set unswept wings, carrying ECM pods at tips, four underwing weapon pylons, engines above wingroots, with prominent exhaust heat suppressors, high agility for fast, low flying, close-range attack role, partially dismantled can be air-ferried in Il-76 freighter. Much of fuselage skin formed by large hinged door panels, providing access to interior equipment from ground level

STRUCTURE: Fuselage built around torsion box beam, of 1.0 m (3 ft 3½ in) square section. Wing centre-section passes

Kamov Ka-50 ('Hokum-A') close support helicopter *(Paul Jackson)*

1995

through beam. Cockpit mounted at front of beam, gearbox above and engines to sides. Composite materials constitute 35 per cent by weight of structure, including rotors. Approximately 350 kg (770 lb) of armour protects pilot and critical airframe parts, canopy and windscreen panels are heavy bulletproof glass.

LANDING GEAR: Hydraulically retractable tricycle type: twin-wheel steerable nose unit and single mainwheels all semi-exposed when up; all wheels retract rearward, low-pressure tyres.

POWER PLANT: Two 1,633 kW (2,190 shp) Klimov TV3-117VK turboshafts, with air intake dust filters. Fuel tanks, filled with reticulated foam, inside fuselage box beam. Provision for four 500 litre (132 US gallon; 110 Imp gallon) underwing auxiliary fuel tanks.

ACCOMMODATION: Double-wall steel armoured cockpit, able to protect pilot from hits by 20 and 23 mm gunfire over ranges as close as 100 m (330 ft). Specially designed Zvezda K-37 ejection system for safe ejection at any altitude; following explosive separation of rotor blades and cockpit roof, pilot is extracted from cockpit by large rocket; alternatively, he can jettison doors and stores before rolling out of cockpit sideways. Associated equipment includes automatic radio beacon, activated during ejection, inflatable liferaft and NAZ-7M survival kit.

SYSTEMS: All systems configured for operational deployment away from base for at least two weeks without need for maintenance ground equipment; refuelling, avionics and weapon servicing performed from ground level. APU for engine starting, and ground supply of hydraulic and electrical power, in top of centre-fuselage.

AVIONICS: Integrated by NPO Elektro Avtomatika, four Orbita computers to meet navigation, mission control and display demands.

Comms: VHF/UHF and HF com/nav; IFF ('Slap Shot').

Radar: Terrain-following radar in nose.

Flight: INS, autopilot, Doppler box under tailboom.

Instrumentation: Conventional instruments; MiG-29 type HUD; moving map display, small CRT beneath HUD with rubber hood, to display only FLIR and LLLTV imagery. Pilot has MiG-29 type helmet sight; when pilot has target centred on HUD, he pushes button to lock sighting and four-channel digital autopilot into one unit.

Mission: To reduce pilot workload and introduce a degree of low observability, target location and designation is assigned to other aircraft; equipment behind windows in nose includes laser marked target seeker and rangefinder; other equipment includes FLIR turret and LLLTV. Signal flare launchers in sides of rear fuselage.

Self defence: RWR in tailcone, at rear of each wingtip EW pod and under nose; total of 128 chaff/flare cartridges in wingtip pods.

ARMAMENT: Up to 80 S-8 80 mm air-to-surface rockets in four underwing B-8 packs, or up to 12 Vikhr-M (AT-12) tube-launched laser-guided air-to-surface missiles with range of 8 to 10 km (5 to 6.2 miles) capable of penetrating 900 mm of reactive armour; or mix of both. Single-barrel 30 mm 2A42 gun on starboard side of fuselage, with 280 rounds, can be depressed up to 30° and traversed 5 to 6° hydraulically and is kept on target in azimuth by tracker which turns helicopter on its axis; two ammunition boxes in centre-fuselage. Provision for alternative weapons, including 23 mm gun pods, R-60 (AA-8 'Aphid') or R-73 (AA-11 'Archer') air-to-air missiles, UB-32-57 rocket packs, FAB-500 bombs or dispenser weapons.

DIMENSIONS, EXTERNAL:

Rotor diameter (each)	14.5 m (47 ft 7 in)
Length overall, rotors turning	16.0 m (52 ft 6 in)
Height overall	4.93 m (16 ft 2 in)

AREAS:

Rotor disc (each)	165.13 m² (1,777.4 sq ft)

WEIGHTS AND LOADINGS:

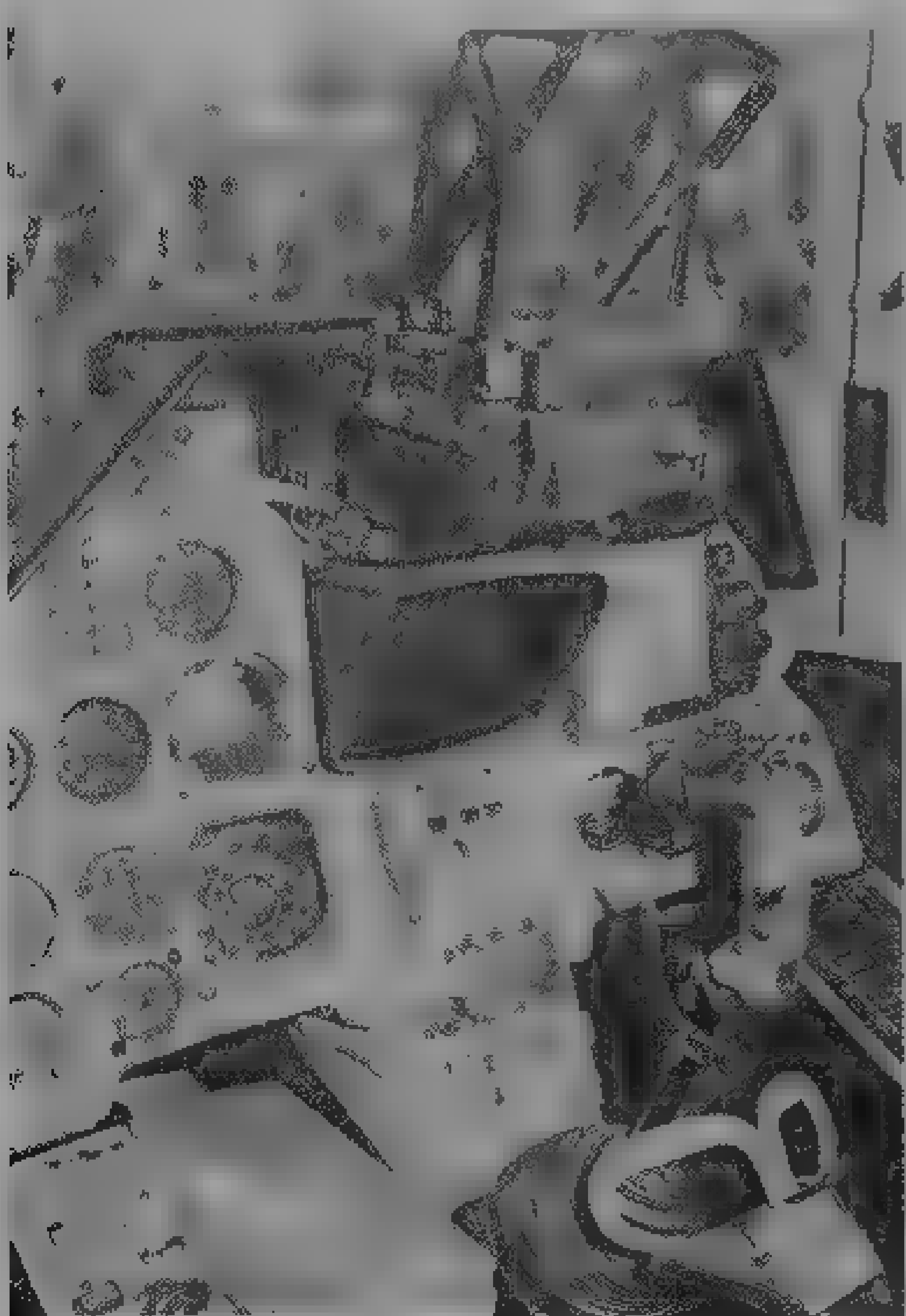
Max external stores	3,000 kg (6,610 lb)
Normal T-O weight	9,800 kg (21,605 lb)
Max T-O weight	10,800 kg (23,810 lb)

PERFORMANCE:

Max speed:	
in shallow dive	189 kts (350 km/h; 217 mph)
in level flight	167 kts (310 km/h; 193 mph)
Vertical rate of climb at 2,500 m (8,200 ft)	600 m (1,970 ft)/min
Hovering ceiling OGE	4,000 m (13,125 ft)

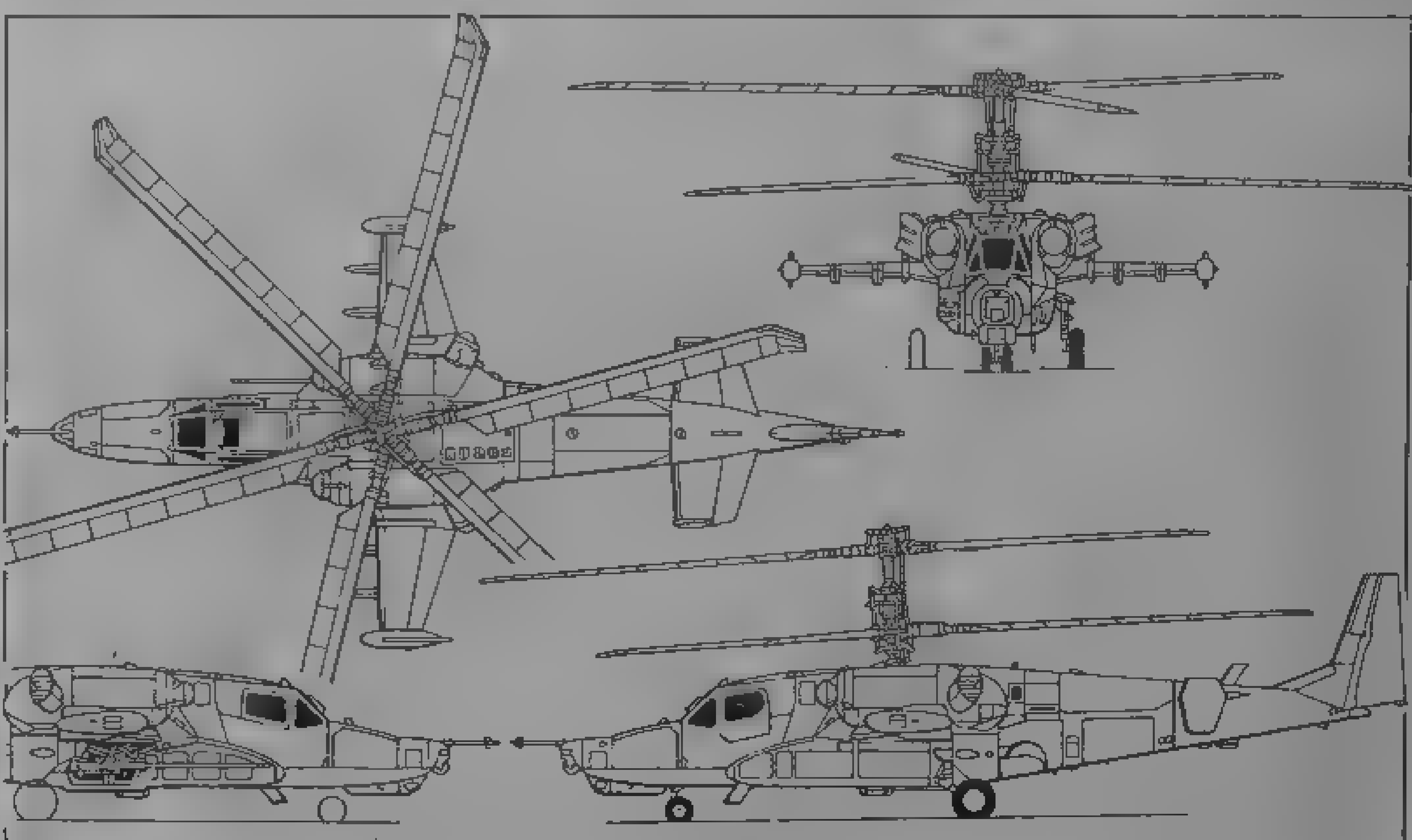
Kamov Ka-50 ('Hokum-A') close support helicopter in desert camouflage *(Piotr Butowski)*

1995



Cockpit of Kamov Ka-50 *(Brian M. Service)*

1993



Ka-50 ('Hokum-A') single-seat combat helicopter with scrap view of gun installation on starboard side *(Jane's/Mike Keep)*

1993

Combat radius (estimated) 135 n miles (250 km, 155 miles)
Endurance: standard fuel, 10 min reserve 1 h 40 min
with auxiliary tanks 4 h
g limit +3

UPDATED

KAMOV Ka-52

NATO reporting name: Hokum-B

TYPE: Two-seat all weather day/night combat and training helicopter

PROGRAMME: Revealed at 1995 Paris Air Show; first flight scheduled 1996

DESIGN FEATURES: See accompanying official illustration, 85 per cent similar to single-seat Ka-50, but front fuselage redesigned to accommodate two crew side by side, upward-hinged and bulged gull-wing type transparent canopy door over each seat

POWER PLANT: Klimov TV3-117 turboshafts uprated

ACCOMMODATION: Pilot and pupil or navigator/weapons operator have Zvezda ejection system, for simultaneous emergency escape, similar to that of Ka-50. Full dual controls standard

AVIONICS: Night vision systems in cockpit; Schkval electro-optical system for precision attacks on armour added beside FLIR imager in nose. All Ka-50 equipment retained. French avionics and nav/attack systems optional for export

ARMAMENT: As Ka-50. Igla V air-to-air missiles optional for export

PERFORMANCE (estimated):

Max level speed	162 kts (300 km/h, 186 mph)
Hovering ceiling OGE	3,600 m (11,810 ft)
Range with max fuel	248 n miles (460 km, 285 miles)

NEW ENTRY

KAMOV Ka-62

TYPE: Medium-sized twin-turbine multipurpose helicopter

PROGRAMME: Construction of prototype Ka-62 (then known as V-62) began early 1990; first flight scheduled Summer 1995, proposed development and marketing collaboration with Israel Aircraft Industries. Funded under Russian programme for development of civil aviation for year 2000

CURRENT VERSIONS: **Ka-62**: Basic model for domestic market *as described in detail*, production to begin at Ulan-Ude and certification 1996

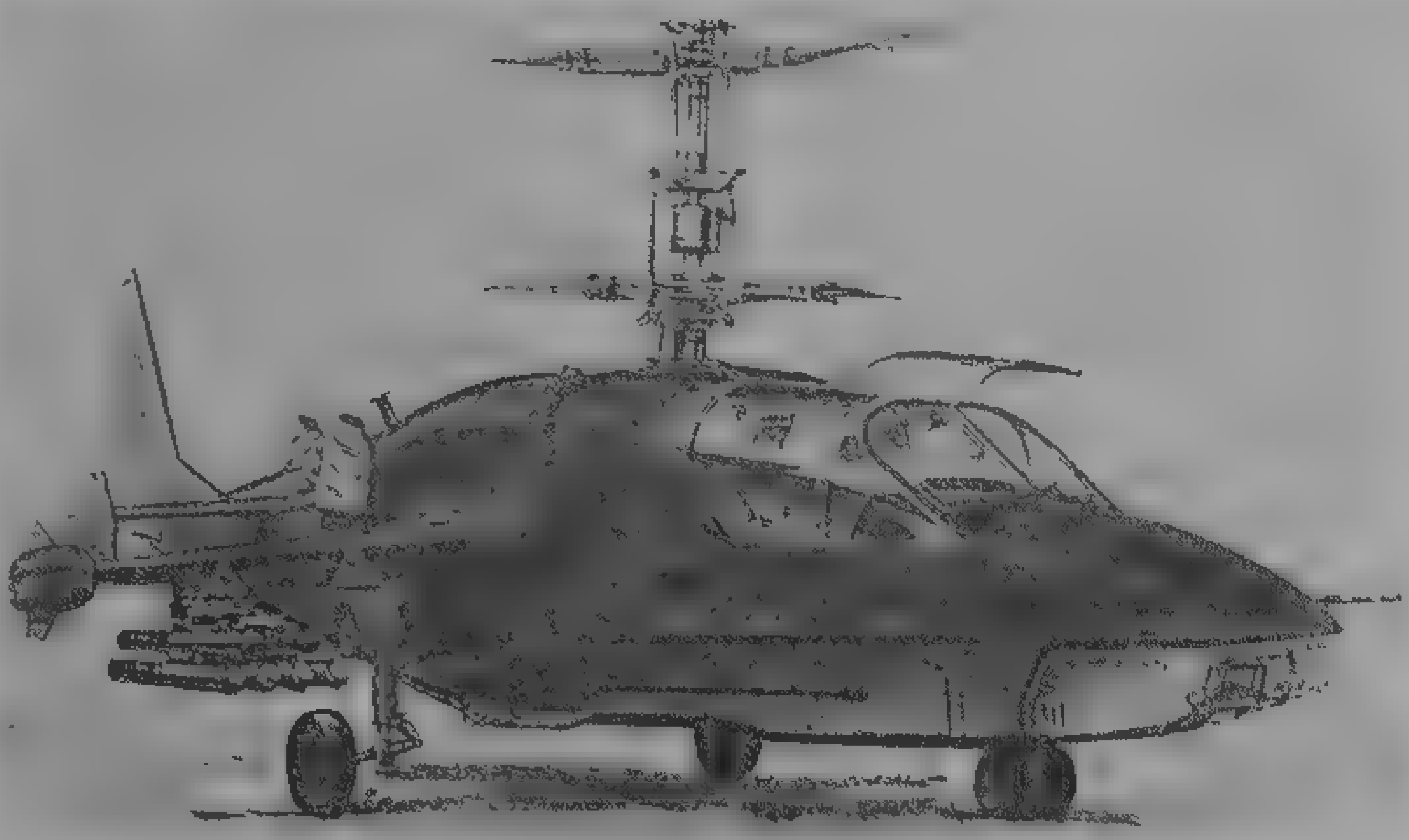
Ka-62M: Second and third prototypes, to be certificated to Western standards, for sale outside CIS, two 1,212 kW (1,625 shp) General Electric T700/CT7-2D turboshafts, five-blade main rotor; avionics to be developed jointly by Aviapribor and DASA, Germany

DESIGN FEATURES: Configuration resembles such Western types as Eurocopter Dauphin, with single main rotor and fan-in-fin similar to latter's Fenestron, retractable tailwheel landing gear

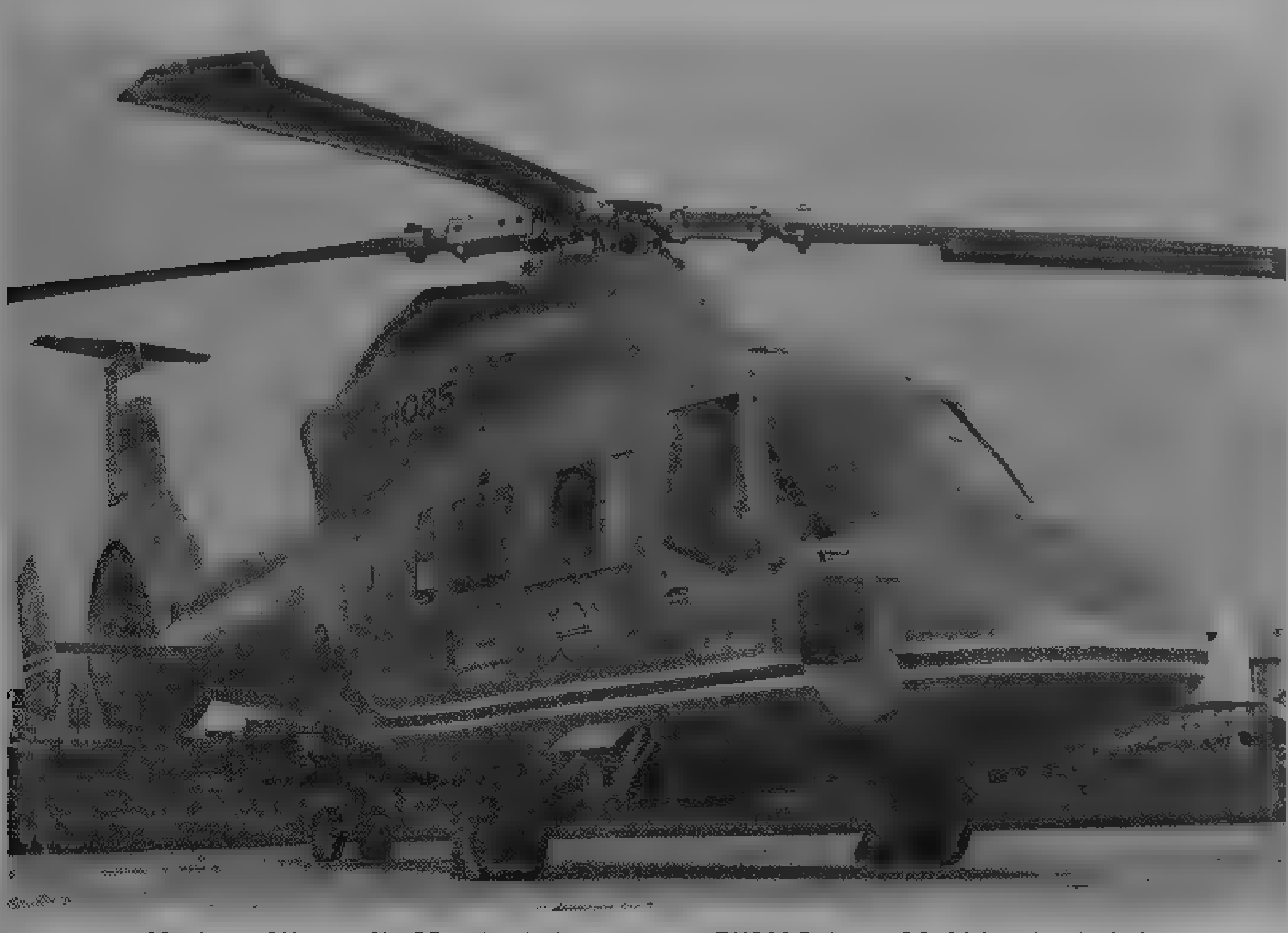
STRUCTURE: Between 50 and 55 per cent of structure made of composites, including four blades of main rotor; fuselage sides, doors, floor and roof, tailboom, fin, vertical stabilisers, and fan blades of carbon-reinforced Kevlar

LANDING GEAR: Retractable tailwheel type; single mainwheels retract inward and upward into bottom of fuselage; twin tailwheels retract into tailboom, shock-absorber in each unit. Optional inflatable pontoons for emergency use on water

2A42 gun installation on Kamov Ka-50 *(Paul Jackson)* 1995



Official Kamov drawing of Ka-52 two-seat all-weather combat and training helicopter 1995



Mockup of Kamov Ka-62 utility helicopter (two RKBM Rybinsk RD-600 turboshafts) 1994

POWER PLANT (basic Ka-62): Two RKBM Rybinsk RD-600 turboshafts, each 956 kW (1,282 shp); fuel tanks under floor, capacity 1,450 litres (383 US gallons, 319 Imp gallons). APU standard

ACCOMMODATION: Crew of one or two; optional bulkhead divider between flight deck and cabin, up to 16 passengers in four rows; forward-hinged door each side of flight deck, large forward-sliding door and small rearward hinged door each side of cabin, baggage hold to rear of cabin. VIP configuration to be available, with five to nine seats and refreshment bar

SYSTEMS: Interior heated and air conditioned

EQUIPMENT: Stretchers, hoist above port cabin door, cargo tie-downs, and other items as necessary for variety of roles including transport of slung freight, air ambulance/operating theatre, search and rescue, patrol of highways, forests, electric power lines, gas and oil pipelines, survey of ice areas, surveillance of territorial waters, economic areas and fisheries, mineral prospecting, and servicing of offshore gas and oil rigs

DIMENSIONS, EXTERNAL:

Main rotor diameter	13.50 m (44 ft 3½ in)
Length overall, rotors turning	15.60 m (51 ft 2¼ in)
Fuselage length	13.25 m (43 ft 5¾ in)
Height overall	4.20 m (13 ft 9⅜ in)
Width: over endplate fins	3.10 m (10 ft 2 in)
over mainwheels	2.50 m (8 ft 2½ in)
Wheelbase	4.725 m (15 ft 6 in)

AREAS:

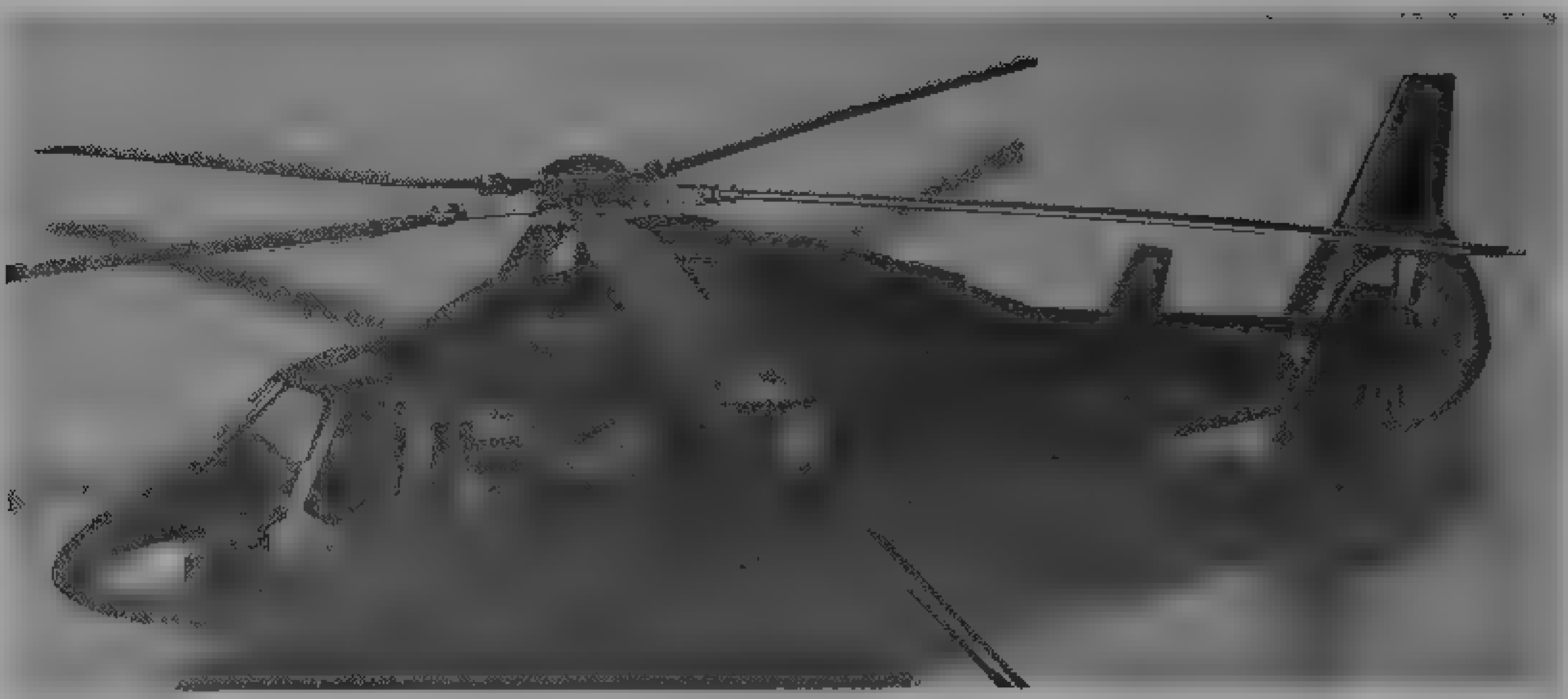
Main rotor disc	143.2 m² (1,541 sq ft)

WEIGHTS AND LOADINGS:

Max payload: internal: 62, 62M	2,000 kg (4,409 lb)
external: 62, 62M	2,500 kg (5,510 lb)
Max T-O weight:	
62, 62M, internal load	6,500 kg (14,330 lb)
62, 62M, external load	6,750 kg (14,880 lb)
Max disc loading: 62, 62M	47.13 kg/m² (9.66 lb/sq ft)

PERFORMANCE (estimated, at max T-O weight with internal load):

Max level speed:	
62, 62M	162 kts (300 km/h, 186 mph)
Cruising speed: 62, 62M	140 kts (260 km/h, 161 mph)
Max rate of climb at S/L: 62	624 m (2,047 ft)/min
62M	690 m (2,263 ft)/min
Rate of climb at S/L, OEI: 62, 62M	123 m (403 ft)/min
Service ceiling: 62, 62M	above 5,000 m (16,400 ft)
Hovering ceiling OGE: 62	2,100 m (6,890 ft)
62M	2,500 m (8,200 ft)
Range with max standard fuel at 500 m (1,640 ft), no reserves: 62	377 n miles (700 km, 435 miles)
62M	353 n miles (655 km, 407 miles)



Model of Ka-62M, with five-blade main rotor *(Piotr Butowski)*

1995

Range with auxiliary fuel at 500 m (1,640 ft), no reserves

62	628 n miles (1,165 km, 724 miles)
62M	553 n miles (1,025 km, 637 miles)

UPDATED

KAMOV Ka-126

NATO reporting name: Hoodlum-B

TYPE: General purpose light helicopter, turboshaft version of Ka-26.

PROGRAMME: Development began 1984, early mockup had two small turboshafts above cabin, single turboshaft adopted subsequently, ground test vehicle completed early 1986; first flight of prototype (SSSR-01963) later 1986; first flight of first of four Soviet built preproduction Ka-126s 19 October 1988.

DESIGN FEATURES: Compared with Ka-26 has turboshaft engine, significant increase in payload/endurance/range and greater year-round utilisation, updated equipment includes new low-volume spraygear.

Contrarotating coaxial three-blade rotors; hinge rotor head with 'rake' type blade attachment, to be succeeded eventually by hingeless head made of titanium and composites. Ka-26 blades of initial series to be succeeded by GFRP and CFRP blades with twin-contour spar, load-carrying rear section and electrothermal anti-icing; rotor brake standard; non-folding blades. Three-stage gearbox with planetary gear trains, of alloy steel and aluminium casting, flange mounted with four load-carrying bolts. Accessories include cooling fan, hydraulic pump and AC generator, engine input 6,000 rpm.

FLYING CONTROLS: Mechanical with irreversible hydraulic actuators. Automatic rotor constant-speed control, conventional four-channel control (longitudinal, lateral, cyclic and differential pitch). Two endplate fins and rudders, toed inward 15°, non-controllable horizontal stabiliser.

STRUCTURE: Airframe materials primarily aluminium alloys, steel alloys and composite sandwich panels of GFRP with honeycomb filler.

LANDING GEAR: Non-retractable four-wheel type. Main units, at rear, carried by stub-wings. All four units embody oleo-pneumatic shock-absorber. Forward wheels of castoring type, self centring, no brakes. Rear wheels have pneumatic brakes. Mainwheel tyres size 595 × 185 mm, pressure 2.45 bars (35.5 lb/sq in); forward wheel tyres size 300 × 125 mm, pressure 3.43 bars (50 lb/sq in). Skis optional. Provision for large inflatable pontoons, across front of aircraft forward of front wheels and under each mainwheel.

POWER PLANT: One 522 kW (700 shp) Mars (Omsk) TV-O-100 turboshaft, installed centrally in streamline fairing above cabin. Electronic-hydraulic automatic two-channel control system, with manual control in case of electronic governor failure. Front driveshaft with plate coupling to gearbox. Fuel in two forward and one aft tank, total capacity 800 litres (211.3 US gallons; 176 Imp gallons). Provision for two external tanks, on sides of fuselage, total capacity 320 litres (84.5 US gallons, 70.4 Imp gallons). Single-point main tank refuelling, on port side of aft tank.

ACCOMMODATION: Fully enclosed cabin, with rearward-sliding door each side, normal operation by single pilot, second seat and dual controls optional. Cabin ventilated, and warmed and demisted by air from combustion heater, which also heats passenger cabin when fitted. Air filter on nose of agricultural version. Space aft of cabin, between main landing gear legs and under transmission, can accommodate variety of interchangeable payloads. Cargo/passenger pod accommodates four or six persons on folding sidewall seats, with provision for seventh passenger beside pilot, two clamshell doors at rear of pod, emergency exit each side and hatch in floor. Ambulance pod accommodates two stretcher patients, two seated casualties and medical attendant. For agricultural work, chemical hopper (capacity 1,000 litres, 264 US gallons, 220 Imp gallons) and dust spreader or spraybars are fitted in this position, on aircraft's CG. Aircraft can also be operated with either an open platform for hauling freight or hook for slinging loads at end of a cable or in a cargo net.

SYSTEMS: Single hydraulic system, with manual override, for control actuators. Main electrical system 27 V 3 kW DC, with back up 40 Ah battery; secondary system 36/115 V AC with two static inverters; 115/200 V AC system with 16 kVA generator (6 kVA to power agricultural equipment and rotor anti-icing). Electrothermal rotor blade de-icing, hot air engine air intake anti-icing; alcohol windscreen anti-icing, electrically heated pitot. Pneumatic system for mainwheel brakes, tyre inflation, agricultural equipment control, pressure 39 to 49 bars (570 to 710 lb/sq in). Oxygen system optional.

AVIONICS: *Comms:* VHF and HF radio, intercom, ADF, emergency locator beacon.

Instrumentation: Radar altimeter, main and back-up artificial horizons.

DIMENSIONS, EXTERNAL:

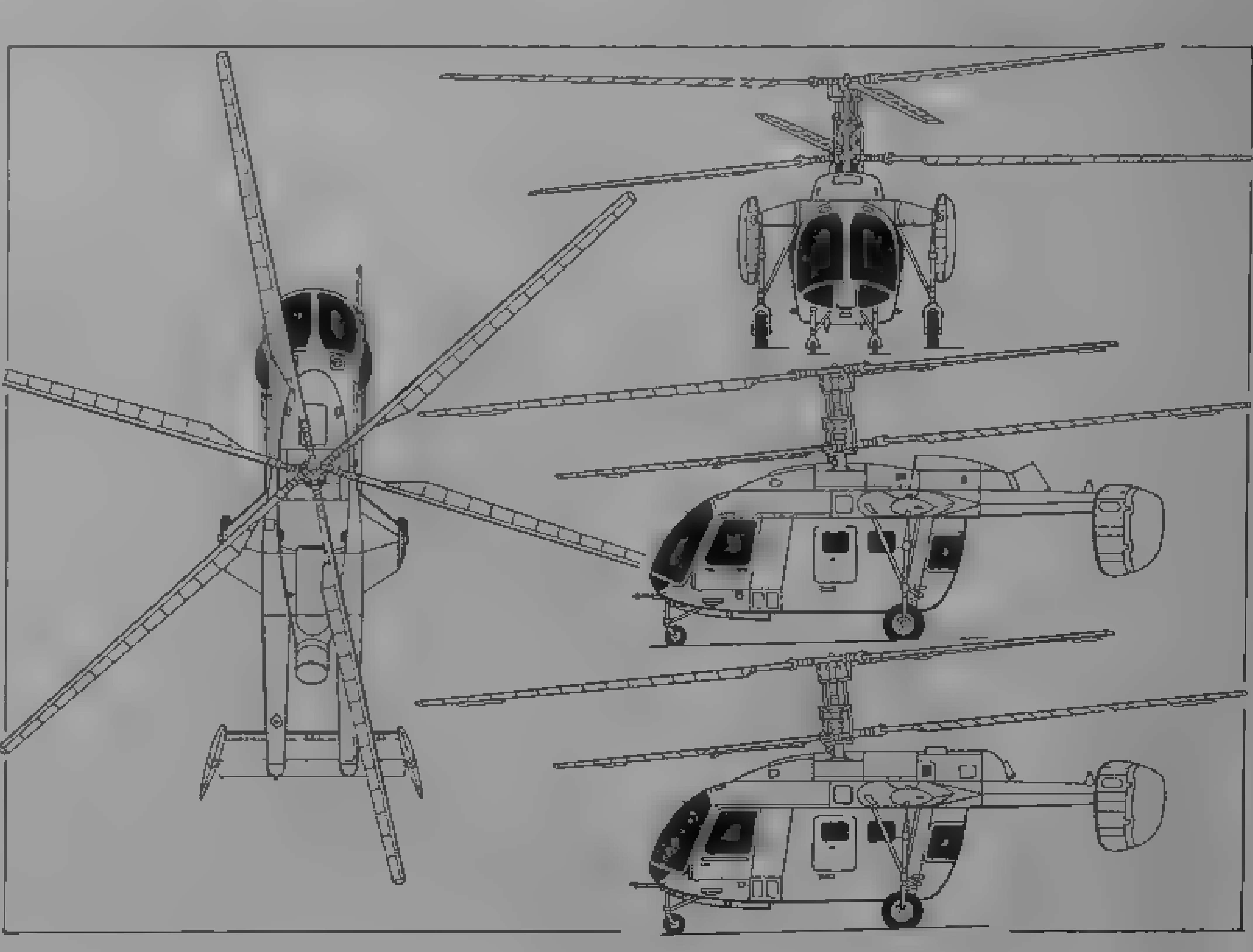
Rotor diameter (each)	13.00 m (42 ft 7¾ in)
Rotor blade chord	0.25 m (9.84 in)
Length overall, rotors turning	13.00 m (42 ft 7¾ in)
Length of fuselage	7.78 m (25 ft 6 in)
Width, excl rotors	3.22 m (10 ft 7 in)
Height to top of rotor head	4.16 m (13 ft 7½ in)
Wheel track: mainwheels	2.56 m (8 ft 4¾ in)
front wheels	0.90 m (2 ft 11½ in)
Wheelbase	3.48 m (11 ft 5 in)
Crew cabin doors (each): Height	1.06 m (3 ft 5¾ in)
Width	0.83 m (2 ft 8½ in)
Height to sill	0.60 m (1 ft 11¾ in)
Passenger pod doorway: Height	1.40 m (4 ft 7 in)
Width	1.40 m (4 ft 7 in)
Emergency exits (each): Height	0.86 m (2 ft 9¾ in)
Width	0.66 m (2 ft 2 in)
Floor hatch: Length	0.74 m (2 ft 5¼ in)
Width	0.54 m (1 ft 9¼ in)

DIMENSIONS, INTERNAL:

Passenger pod: Length	2.04 m (6 ft 8¼ in)
Max width, at floor	1.21 m (3 ft 11½ in)
Height	1.38 m (4 ft 6¼ in)
Volume	2.47 m³ (87.2 cu ft)

Kamov Ka-126 turbine-powered light helicopter carrying passenger pod *(Piotr Butowski)*

1993



Kamov Ka-126 turbine-powered development of Ka-26, with additional side elevation (bottom) of Ka-128 *(Jane's/Mike Keep)*

1993

WEIGHTS AND LOADINGS

Weight empty	1,915 kg (4,222 lb)
Max slung payload	1,000 kg (2,205 lb)
Max internal fuel	640 kg (1,411 lb)
Auxiliary fuel	256 kg (564 lb)
Max T-O weight	3,250 kg (7,165 lb)

PERFORMANCE

Never-exceed speed (VNE)	97 kts (180 km/h 112 mph)
Econ cruising speed at S/L	86 kts (160 km/h, 99 mph)
Max rate of climb at S/L	396 m (1,300 ft)/min
Vertical rate of climb at S/L	15 m (49 ft)/min
Service ceiling	3,850 m (12,630 ft)
Hovering ceiling IGE: ISA	970 m (3,180 ft)
ISA + 20°C	100 m (320 ft)
Hovering ceiling OGE: ISA	80 m (260 ft)
Range:	
with max payload	136 n miles (253 km, 157 miles)
with max internal fuel	384 n miles (713 km; 443 miles)
with auxiliary fuel, no reserves	547 n miles (1,015 km, 630 miles)
Max endurance, internal fuel, no reserves	5 h 36 min

UPDATED

Agricultural cropspraying version of Kamov Ka-126 general purpose light helicopter

1994

KAMOV Ka-128

TYPE: General purpose light helicopter: differs from Ka-126 only in power plant and addition of an intermediate gearbox.

PROGRAMME: Development began 1992. Apparently failed to achieve planned 1994 first flight.

POWER PLANT: One 531 kW (712 shp) Turbomeca Arriel 1D1 turboshaft, with similarly rated transmission.

WEIGHTS AND LOADINGS

Weight empty	1,820 kg (4,013 lb)
Max slung payload	1,000 kg (2,205 lb)
Max internal fuel	640 kg (1,411 lb)
Auxiliary fuel	256 kg (564 lb)
Max T-O weight	3,250 kg (7,165 lb)

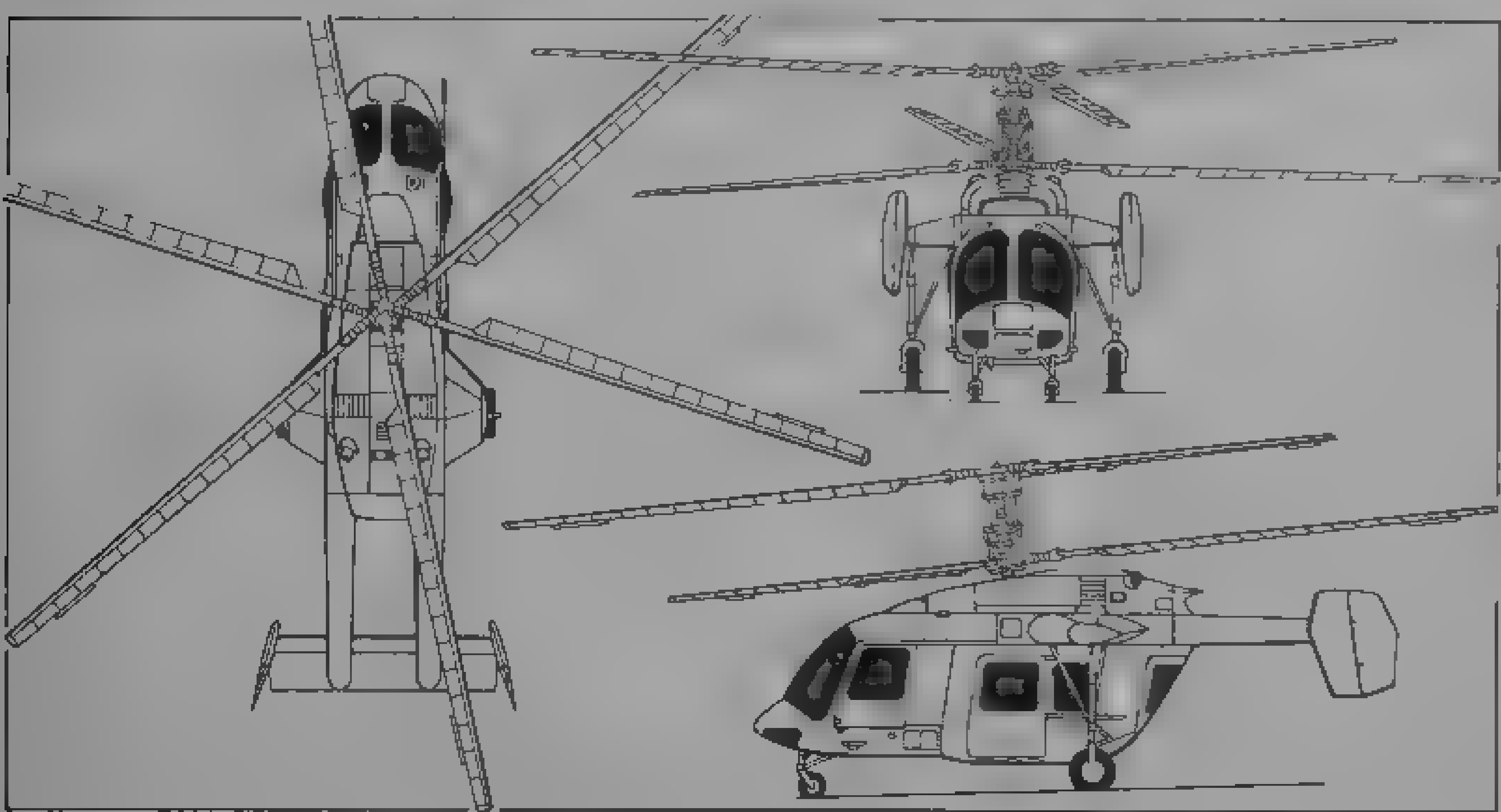
PERFORMANCE (estimated)

Never-exceed speed (VNE)	105 kts (195 km/h, 121 mph)
Econ cruising speed at S/L	86 kts (160 km/h, 99 mph)
Max rate of climb at S/L	468 m (1,535 ft)/min
Vertical rate of climb at S/L	90 m (295 ft)/min
Service ceiling	5,200 m (17,060 ft)
Hovering ceiling IGE: ISA	1,600 m (5,250 ft)
ISA + 20°C	850 m (2,785 ft)
Hovering ceiling OGE: ISA	750 m (2,460 ft)
Range:	
with max payload	198 n miles (367 km, 228 miles)
with max internal fuel	383 n miles (710 km, 441 miles)
with auxiliary fuel, no reserves	570 n miles (1,057 km, 656 miles)
Max endurance, internal fuel, no reserves	5 h 39 min

VERIFIED

Kamov Ka-226 twin-turbine utility and agricultural helicopter

1994



Kamov Ka-226, a refined development of the Ka-126 utility helicopter *(Jane's/Mike Keep)*

1994

KAMOV Ka-226

TYPE: Twin-turbine utility and agricultural helicopter.

PROGRAMME: Announced at 1990 Helicopter Association International convention, Dallas, USA. Apparently failed to achieve planned 1994 first flight. FAA certification to be sought; production will be in Russia.

DESIGN FEATURES: Refined development of Ka-26/126, changes to shape of nose, twin tailfins and rudders, and passenger pod; passenger cabin has much larger windows and remains interchangeable with variety of payload modules including agricultural systems with hopper capacity of 1,000 litres (264 US gallons; 220 Imp gallons); new rotor system, interchangeable with standard coaxial system, will become available later.

LANDING GEAR: Non-retractable four-wheel type. Main units at rear, carried by stub-wings. All units embody oleo-pneumatic shock absorber. Mainwheel tyres size 595 × 185 mm, pressure 2.5 bars + 0.5 (36.25 lb/sq in + 7.25); forward tyres size 300 × 125 mm, pressure 3.5 bars + 0.5 (50.75 lb/sq in + 7.25). Forward units of castoring type, without brakes. Rear wheels have pneumatic brakes.

POWER PLANT: Two 313 kW (420 shp) Allison 250-C20B turboshafts, side by side aft of rotor mast, in same position as single turboshaft of Ka-126, with individual driveshafts to rotor gearbox. Transmission rating 616 kW (840 shp). Standard fuel capacity 750 litres (198 US gallons, 165 Imp gallons), in tanks above and forward of payload module area. Provision for two external tanks, on sides of fuselage, total capacity 320 litres (84.5 US gallons, 70.4 Imp gallons).

ACCOMMODATION: Cabin module has two three-place rearward- and forward-facing bench seats; baggage compartment behind rear wall. Seventh passenger beside pilot on flight deck.

AVIONICS: Cockpit instrumentation and avionics to customer's choice, including Bendix/King equipment for IFR flight.

EQUIPMENT: Specially equipped payload modules available for variety of roles.

DIMENSIONS, EXTERNAL

Rotor diameter (each)	13.00 m (42 ft 7¾ in)
Length overall, excl rotors	8.10 m (26 ft 7 in)
Width over stub-wings	3.22 m (10 ft 6¾ in)
Height to top of rotor head	4.15 m (13 ft 7½ in)
Wheel track: nosewheels	0.90 m (2 ft 11½ in)
mainwheels	2.56 m (8 ft 4¾ in)
Wheelbase	3.48 m (11 ft 5 in)
Passenger pod: Length	2.04 m (6 ft 8¼ in)
Width	1.28 m (4 ft 2¼ in)
Depth	1.40 m (4 ft 7⅛ in)

AREAS

Rotor disc (each)	132.7 m² (1,430 sq ft)

WEIGHTS AND LOADINGS

Weight empty	1,952 kg (4,304 lb)
Max payload	1,300 kg (2,865 lb)
Max internal fuel	600 kg (1,322 lb)
Auxiliary fuel	256 kg (564 lb)
Normal T-O weight	3,100 kg (6,835 lb)
Max T-O weight	3,400 kg (7,500 lb)

PERFORMANCE (estimated):
Never exceed speed (VNE) 110 kts (205 km/h; 127 mph)
Econ cruising speed 100 kts (185 km/h; 115 mph)
Max rate of climb at S/L 540 m (1,770 ft)/min
Vertical rate of climb at S/L 168 m (550 ft)/min
Service ceiling 5,050 m (16,565 ft)
Hovering ceiling IGE, ISA 2,020 m (6,625 ft)
ISA + 20°C 1,200 m (3,935 ft)
Hovering ceiling OGE, ISA 1,280 m (4,200 ft)
ISA + 20°C 600 m (1,970 ft)
Range: with max payload 20 n miles (37 km, 23 miles)
with max internal fuel 325 n miles (602 km, 374 miles)
with auxiliary fuel, no reserves 470 n miles (873 km, 542 miles)
Max endurance, internal fuel, no reserves 4 h 38 min

VERIFIED

KAZAN (KVPO)

KAZAN HELICOPTER PRODUCTION ASSOCIATION

Tetsevskaya Street 13/30, 420085 Kazan, Tatarstan
Telephone: 7 (8432) 54 46 91
Fax: 7 (8432) 54 52 52
Telex: 224848 AGAT SU
GENERAL DIRECTOR: Vladimir A Samoilov

For many years, Kazan has marketed and built Mil helicopters including Mi-4, Mi-8, Mi-14 and Mi-17/172 series. At the 1995 Paris Air Show, it exhibited the Mi-17MD upgraded 40-passenger version of the Mi-17 and a mockup of the first product of its design office, the Ansat light multipurpose helicopter, designed in association with Mil.

NEW ENTRY

Kazan/Mil Mi-17MD 40-passenger upgraded version of Mi-17 *(Paul Jackson)*

1995

KAZAN/MIL Mi-17MD

TYPE: Twin-turbine multipurpose helicopter.
PROGRAMME: Prototype (RA-70937 converted from Mi-8MTV) displayed at 1995 Paris Air Show; in production.
DESIGN FEATURES: Generally similar to latest versions of Mi-17 (which see). Accommodation increased to 40 passengers; improved clamshell rear-loading doors and new hinged built-in ramp forming rear floor of fuselage pod, improved side doors, new avionics and cockpit displays, and extended-range fuel tanks.

NEW ENTRY

KAZAN/MIL ANSAT

TYPE: Twin-turbine light multipurpose helicopter.
PROGRAMME: Joint project of Kazan and Mil OKB; fuselage mockup exhibited at 1995 Paris Air Show, at initial design stage.
DESIGN FEATURES: See accompanying illustration. Conventional pod-and-boom fuselage; skid landing gear.
POWER PLANT: Two P&WC Klimov PK-206A turboshafts, each 470 kW (631 shp).
ACCOMMODATION: Two seats on flight deck, five or seven seats in cabin, or two stretcher patients and two attendants, or internal or externally slung freight.
DIMENSIONS, EXTERNAL:
Main rotor diameter 11.5 m (37 ft 9 in)
WEIGHTS AND LOADINGS:
Max freight: internal 1,000 kg (2,204 lb)
external 1,200 kg (2,645 lb)
Max T-O weight 3,300 kg (7,275 lb)
PERFORMANCE (estimated):
Max cruising speed 143 kts (265 km/h; 165 mph)
Service ceiling 5,000 m (16,400 ft)
Hovering ceiling OGE 3,000 m (9,840 ft)
Range with max fuel 313 n miles (580 km; 360 miles)
Endurance with max fuel 3 h 18 min

NEW ENTRY

Fuselage mockup of Kazan/Mil Ansat light helicopter *(Paul Jackson)*

1995

KHRUNICHEV

KHRUNICHEV STATE RESEARCH AND PRODUCTION SPACE CENTRE

Novozavodskaya Street 18, 121309 Moscow
Telephone: 7 (095) 145 83 43
Fax: 7 (095) 142 59 00
GENERAL DIRECTOR: Anatoly I Kiselyov
DEPUTY GENERAL DIRECTORS:
Alexander V Lebedev, Anatoly A Kalinin
Aviation Department
Telephone: 7 (095) 145 88 60
Fax: 7 (095) 145 94 77
CHIEF DESIGNER: Evgeny P Grunin
DEPUTY CHIEF DESIGNER: Arnold I Andrianov
AVIATION DEPARTMENT MANAGER: Sergei M Zhiganov
RESEARCH AND DEVELOPMENT DIVISION MANAGER:
Yuri I Polavsky
DESIGN DIVISION MANAGER: Mikhail M. Vasyuk

The Aviation Department of this State Research Centre was formed in August 1994 to develop and manufacture general purpose aircraft. It comprises a design bureau, experimental facilities and operational and maintenance services. The main task of the Aviation Department is to develop to the series production stage aircraft designed on the basis of foreign and domestic components, and then to market them worldwide.

NEW ENTRY

KHRUNICHEV T-201 STERH

TYPE: Turboprop-powered general utility aircraft.
PROGRAMME: Under development by Khrunichev as re-engined version of Aeroprogress/ROKS-Aero T-101 Grach.
DESIGN FEATURES: As described for Aeroprogress/ROKS-Aero T-201 Aist (which see), except as follows.
POWER PLANT: One 917 kW (1,230 shp) P&WC PT6A-65AR turboprop.
WEIGHTS AND LOADINGS:
Max fuel 1,400 kg (3,086 lb)
Max zero-fuel weight 5,200 kg (11,464 lb)
PERFORMANCE (estimated):
T-O run 350 m (1,150 ft)
T-O to 15 m (50 ft) 565 m (1,854 ft)
Landing from 15 m (50 ft) 500 m (1,641 ft)
Range, 45 min reserve, at 3,000 m (9,850 ft):
with max payload 259 n miles (480 km, 298 miles)
with max fuel 890 n miles (1,650 km, 1,025 miles)

NEW ENTRY

KHRUNICHEV T-411 WOLVERINE

TYPE: Four/five seat multipurpose light aircraft with STOL capability.
PROGRAMME: Programme started in 1994, production began simultaneously; available also from Washington Aeroprogress Inc (see US section).
DESIGN FEATURES: Configuration generally similar to Aeroprogress/ROKS-Aero T-411 Aist-2 (which see), slightly stretched airframe and more roomy cabin; different landing gear and power plant.
FLYING CONTROLS: As for Aist-2.
STRUCTURE: Primary structure of aluminium alloy and alloy steel, part covered with Dacron synthetic fabric. Two-spar wings, metal skin on leading-edge and over fuel tanks at root, Dacron covered between spars. Welded tube truss fuselage, covered with metal sheet and Dacron. Metal tail surfaces, Dacron covered.
LANDING GEAR: Non-retractable tailwheel type, single wheel on each unit, with fairings on mainwheels. Arched cantilever tubular spring main legs. Self-centring steerable tailwheel. Mainwheel tyres size 6.00-6. Brakes on mainwheels.
POWER PLANT: One 261 kW (350 hp) Teledyne Continental TSIO-550-B flat-six engine; Hartzell three-blade variable-pitch propeller. Two main and two auxiliary fuel tanks in wingroots.
ACCOMMODATION: Pilot and three or four passengers, on side by side front seats and rear bench seat, starboard front seat and rear bench removable, or bench seat foldable, for carrying equivalent freight; convertible into ambulance for one stretcher patient, one seated casualty and medical attendant in addition to pilot. Dual controls standard. Baggage compartment aft of rear seats, with large upward opening door on port side, used also for loading freight or

stretcher. Forward-hinged jettisonable door each side of cabin. Ventilation and heating standard.

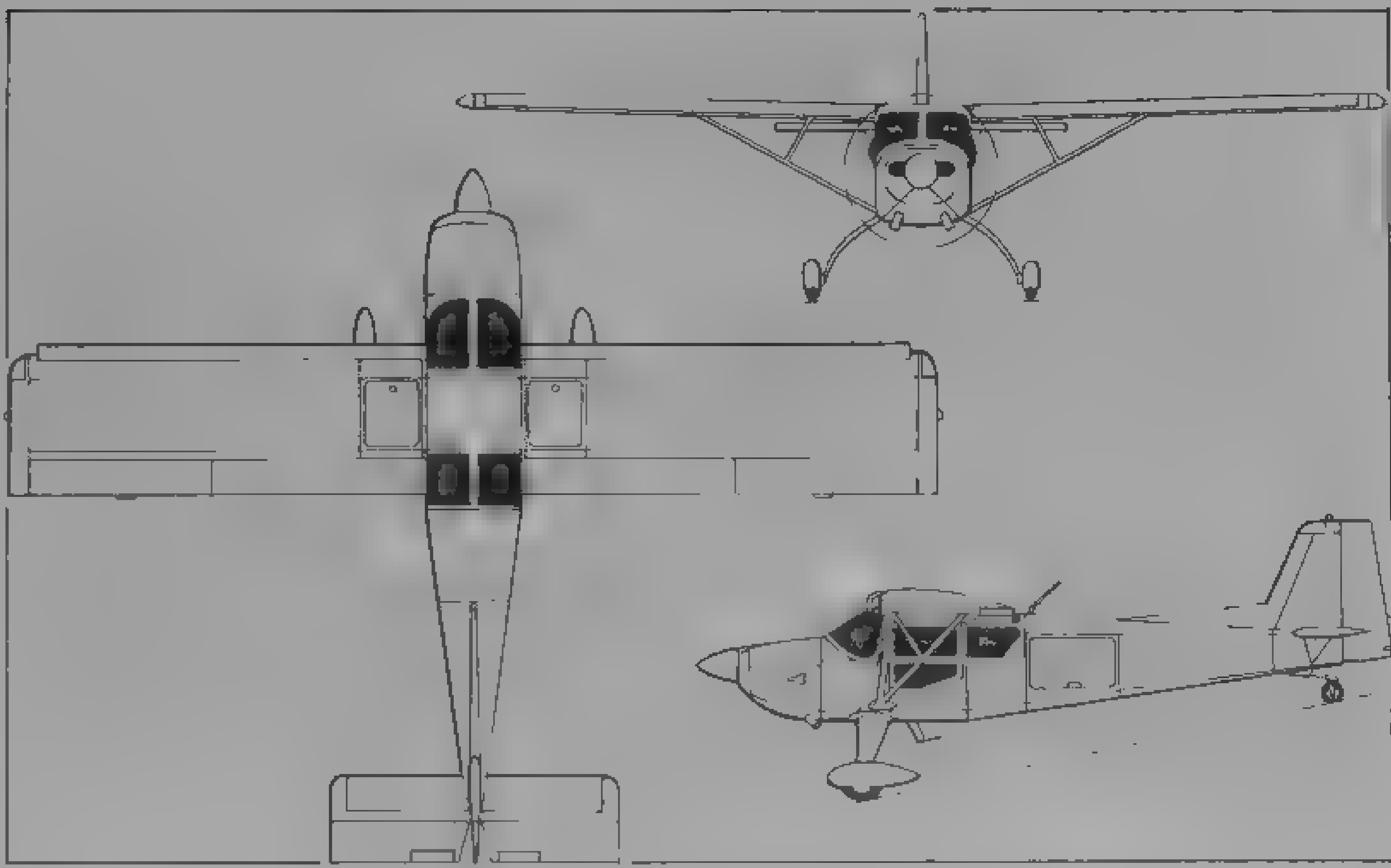
SYSTEMS: Generator on engine supplies 24 V DC electrical power; 25 Ah battery.

AVIONICS: *Comms*: Bendix/King nav/com for VFR flight, including radio survival beacon.

Flight: Marker beacon receiver.

DIMENSIONS, EXTERNAL:	
Wing span	12.73 m (41 ft 9¼ in)
Length overall	9.40 m (30 ft 10 in)
Height overall	2.80 m (9 ft 2¼ in)
Wheel track	3.13 m (10 ft 3¼ in)
Wheelbase	6.50 m (21 ft 4 in)
Propeller diameter	2.03 m (6 ft 8 in)
Baggage door: Max height	0.65 m (2 ft 1½ in)
Width	1.22 m (4 ft 0 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	2.94 m (9 ft 7¾ in)
Max width	1.27 m (4 ft 2 in)
Max height	1.30 m (4 ft 3 in)
AREAS:	
Wings, gross	24.3 m² (261.6 sq ft)
WEIGHTS AND LOADINGS:	
Max payload	360 kg (794 lb)
Normal fuel	150 kg (330 lb)
Max fuel	300 kg (661 lb)
Max T-O weight	1,550 kg (3,417 lb)
Max wing loading	63.8 kg/m² (13.1 lb/sq ft)
Max power loading	5.94 kg/kW (9.76 lb/hp)
PERFORMANCE (estimated):	
Max cruising speed	108 kts (200 km/h; 124 mph)
Stalling speed	43 kts (80 km/h; 50 mph)
Max rate of climb at S/L	288 m (945 ft)/min
Service ceiling	3,000 m (9,840 ft)
T-O to 15 m (50 ft)	225 m (738 ft)
Landing from 15 m (50 ft)	350 m (1,149 ft)
Range:	
with normal fuel	324 n miles (600 km; 372 miles)
with max fuel	593 n miles (1,100 km; 683 miles)

NEW ENTRY



Khrunichev T-411 Wolverine four/five-seat light aircraft *(Jane's/James Goulding)*

1995

KHRUNICHEV T-417 PEGASUS

TYPE: Single-engined light freight transport.

PROGRAMME: Design started 1994.

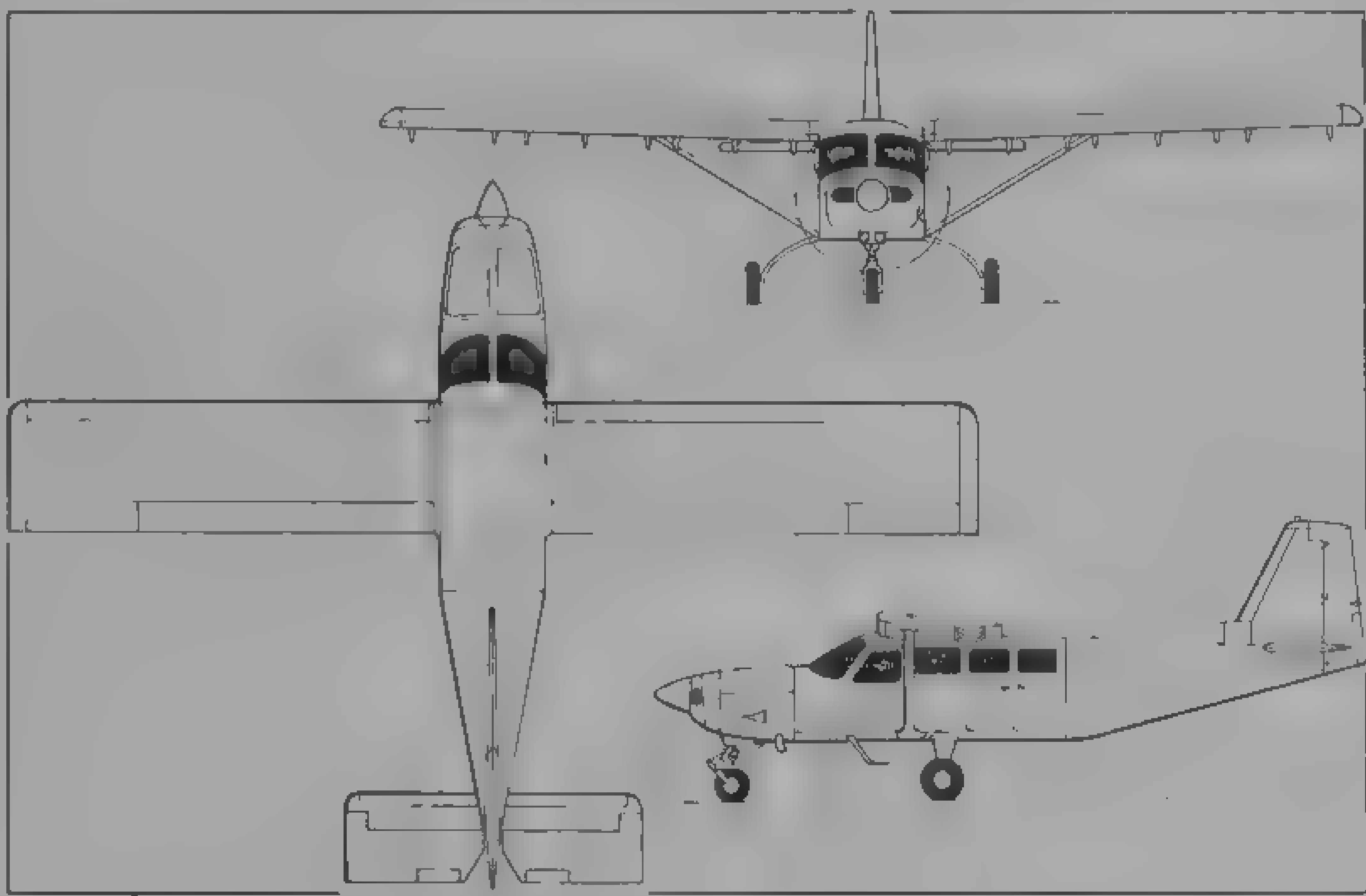
DESIGN FEATURES: Conventional strut-braced high-wing monoplane, with non-retractable tricycle landing gear (see three-view).

LANDING GEAR: Mainwheel tyres size 550 × 200 mm, nosewheel tyre size 450 × 150 mm.

POWER PLANT: One 261 kW (350 hp) Teledyne Continental TSIO-550 flat-six engine.

ACCOMMODATION: Side by side seats for two persons on flight deck, with jettisonable forward-hinged door each side. Dual controls standard. Normally flown by pilot only as freighter, but provision for pilot and up to six passengers. Large double freight door on port side of cabin, vertically split to open forward and rearward for unrestricted access.

AVIONICS: Bendix/King equipment standard.

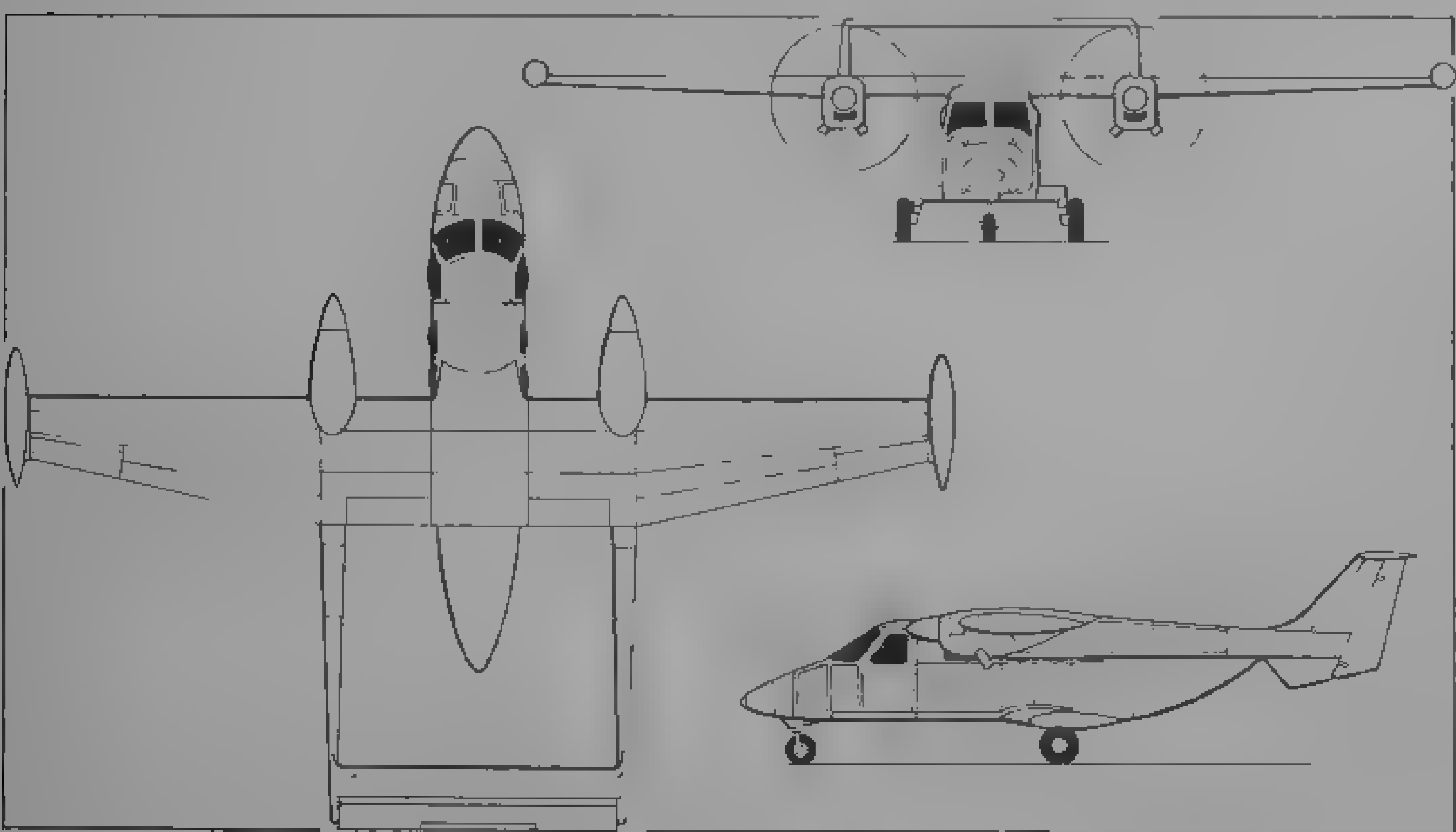


Khrunichev T-417 Pegasus light freight transport *(Jane's/James Goulding)*

1995

DIMENSIONS, INTERNAL:	
Cabin, incl flight deck: Length	3.60 m (11 ft 9¾ in)
Width	1.30 m (4 ft 3 in)
Height	1.25 m (4 ft 1 in)
WEIGHTS AND LOADINGS:	
Max fuel	300 kg (661 lb)
Max payload	600 kg (1,323 lb)
Max T-O weight	1,980 kg (4,365 lb)
Max power loading	7.59 kg/kW (12.47 lb/hp)
PERFORMANCE (estimated):	
Max level speed	165 kts (305 km/h; 190 mph)
T-O to 15 m (50 ft)	340 m (1,115 ft)
Landing from 15 m (50 ft)	490 m (1,608 ft)
Range:	
with max payload	458 n miles (850 km; 528 miles)
with max fuel	1,074 n miles (1,990 km; 1,236 miles)

NEW ENTRY



Khrunichev T-420A Strizh-A twin-engined passenger/freighter *(Jane's/James Goulding)*

1995

KHRUNICHEV T-420A STRIZH (SWIFT)

TYPE: Twin-engined passenger/freight transport.

PROGRAMME: Design started August 1994, first flight 1996.

CURRENT VERSIONS: **T-420A Strizh-A**: *Detailed description applies to this version.*

T-420: With two 265 kW (355 hp) VOKBM M-14P piston engines.

T-420C: With two 261 kW (350 hp) Teledyne Continental TSIO-550-B piston engines.

Light freighter: Alternative version, revealed June 1995, has 'beaver tail' rear door, conventional wingtips, two 157 kW (210 hp) Teledyne Continental TSIO-360 piston engines and wider track, cantilever self-sprung landing gear with spats. Maximum payload 500 kg (1,102 lb), maximum T-O weight 1,990 kg (4,387 lb).

COSTS: Estimated $470,000.

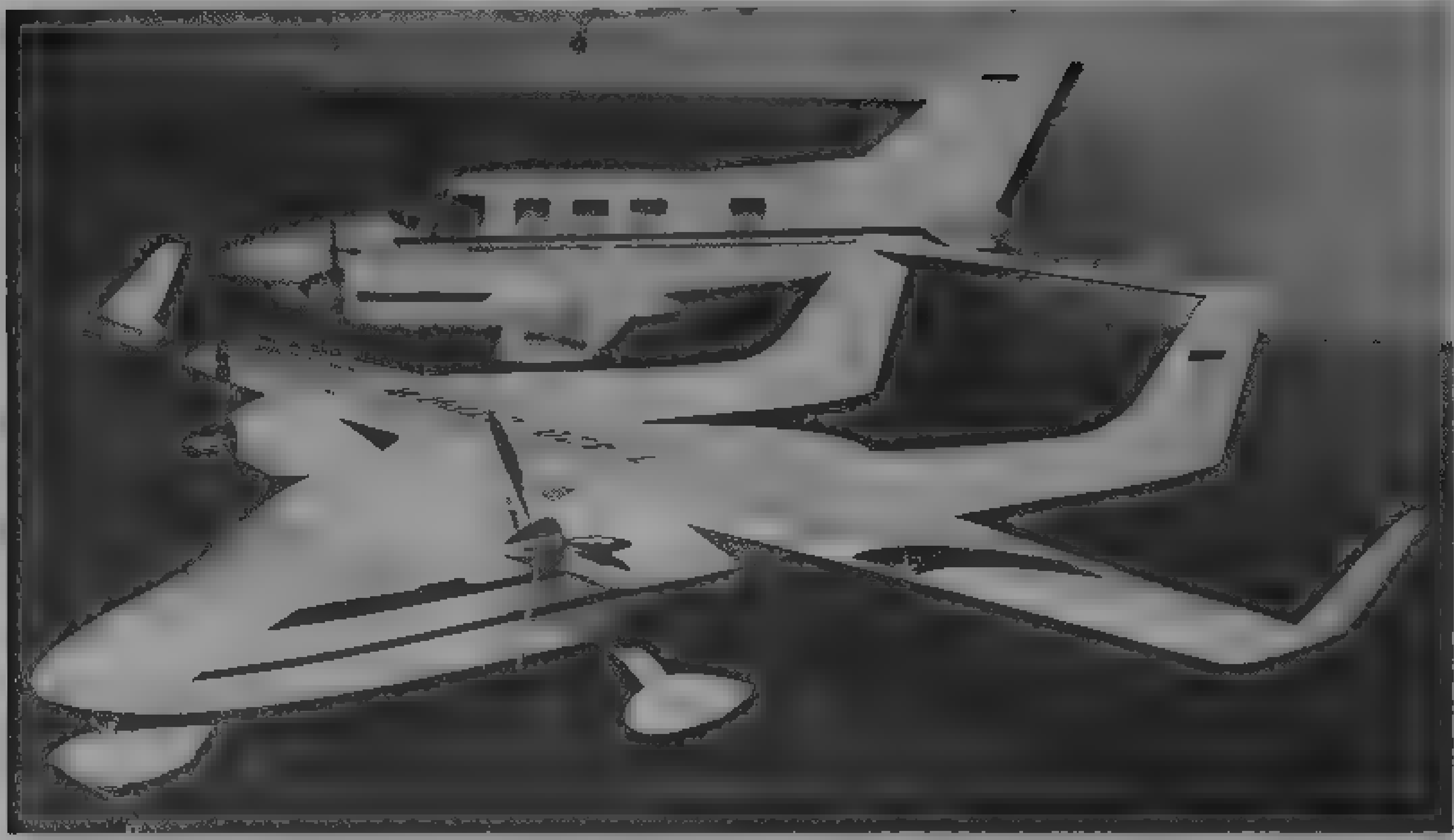
DESIGN FEATURES: High-wing monoplane with twin tail booms, providing easy access to upward hinged door forming rear of fuselage pod. Wingtip fuel tanks form aerodynamic fences, but alternative version has winglets. High-mounted tailplane is above turbulent air flow from propellers.

FLYING CONTROLS: Conventional three-axis, elevator trim tab.

STRUCTURE: All-metal construction, semi-monocoque fuselage pod, two-spar wings with duralumin skin.

LANDING GEAR: Non-retractable tricycle type, single wheel on each unit, oleo-pneumatic shock-absorbers. Mainwheel tyre size 6.50-10, pressure 4.8 bars (70 lb/sq in); nosewheel tyre size 6.00-6, pressure 2.45 bars (35.5 lb/sq in). Skis and floats optional.

POWER PLANT: Two 313 kW (420 shp) Allison 250-B17C turboprops, each driving Hartzell three-blade constant-speed propeller. Integral fuel tanks in wings, total capacity 950 litres (251 US gallons, 209 Imp gallons); wingtip tanks, total capacity 175 litres (46.2 US gallons, 38.5 Imp



Model of T-420 variant with winglets and wider track, spatted landing gear *(Paul Jackson)*

1995

gallons). Cross-feed allows refuelling via point above either main tank. Total oil capacity 22.8 litres (6 US gallons, 5 Imp gallons).

ACCOMMODATION: One or two pilots on flight deck, with door each side, eight passengers in pairs, or equivalent freight, in main cabin standard, six passengers in business version with galley and toilet. Hand baggage hold at rear of cabin, main baggage compartment forward of flight deck. Passenger and freight access via upward-hinged rear door. Heating and ventilation standard.

SYSTEMS: Hydraulic mainwheel brakes. Two 28 V 150 A starter-generators and two voltage regulators in main electrical system, 24 V 29 Ah battery for engine starting and emergency use. Electric anti-icing of propeller blades, pitot tubes and windscreen, pneumatic de-icing of wing and tail unit leading-edges.

AVIONICS: *Comms:* Com/nav radio and transponder.
Radar: Weather radar in nose.
Flight: ADF, ILS and radio altimeter for IFR operation.

DIMENSIONS, EXTERNAL:

Wing span: without tiptanks	13.04 m (42 ft 9½ in)
with tiptanks	13.72 m (45 ft 0¼ in)
Wing chord: at root	1.80 m (5 ft 10¾ in)
at tip	0.87 m (2 ft 10¼ in)
Length overall	9.95 m (32 ft 7¾ in)
Length of fuselage pod	7.64 m (25 ft 0¾ in)
Width of fuselage	1.35 m (4 ft 5¼ in)
Height overall	3.99 m (13 ft 1 in)
Tailplane span	4.20 m (13 ft 9½ in)
Wheel track	2.60 m (8 ft 6½ in)
Wheelbase	3.95 m (12 ft 11½ in)
Propeller diameter	2.03 m (6 ft 8 in)
Propeller ground clearance	0.90 m (2 ft 11½ in)
Distance between propeller centres	4.20 m (13 ft 9½ in)
Rear-loading door: Height	1.20 m (3 ft 11¼ in)
Width	1.10 m (3 ft 7¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length, incl flight deck	4.46 m (14 ft 7½ in)
Max width and height	1.25 m (4 ft 1¼ in)

AREAS:

Wings, gross	20.78 m² (223.7 sq ft)
Fins (total)	3.40 m² (36.60 sq ft)
Rudders (total)	1.48 m² (15.93 sq ft)
Tailplane	2.23 m² (24.00 sq ft)
Elevator	1.55 m² (16.68 sq ft)

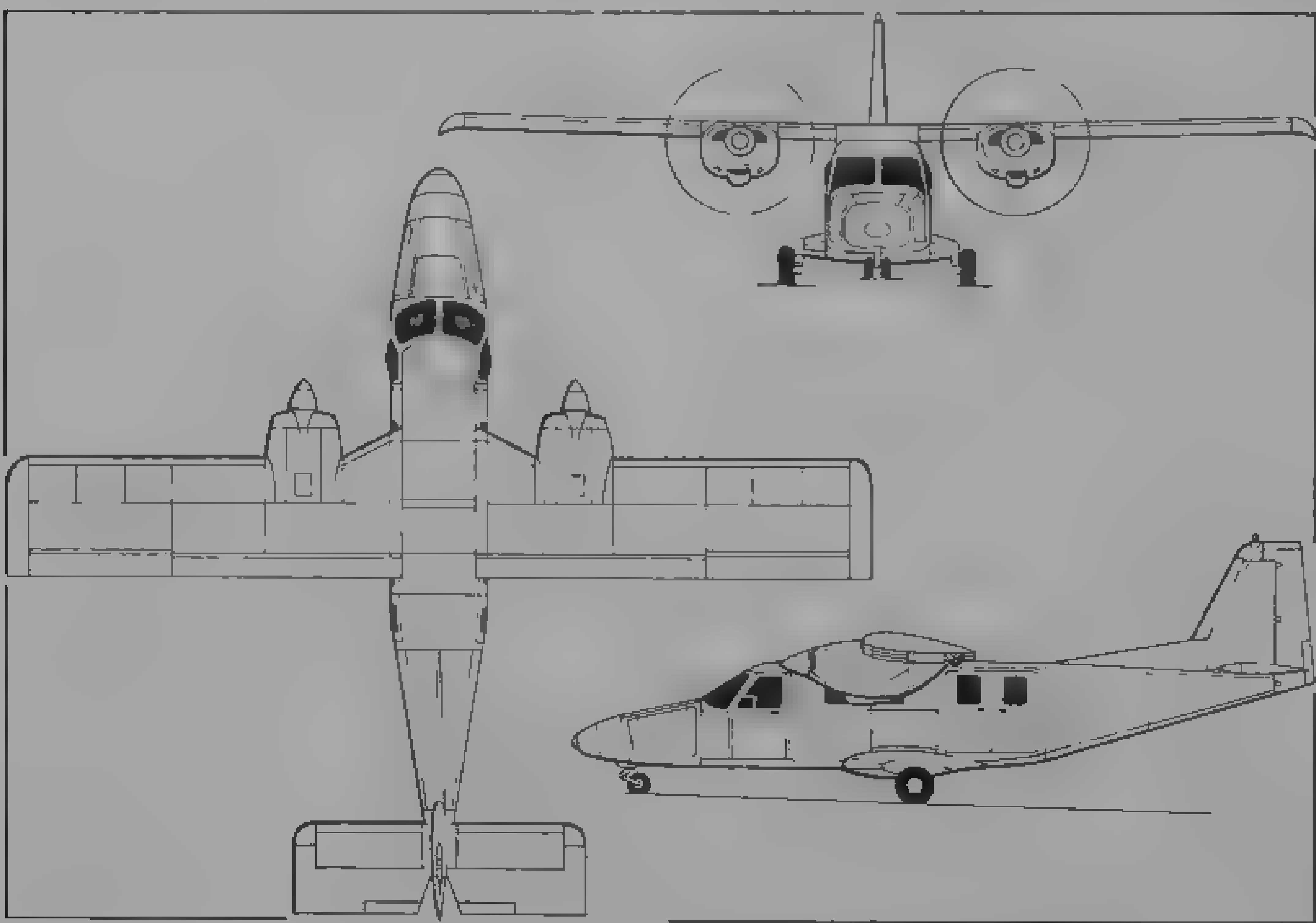
WEIGHTS AND LOADINGS:

Weight empty, equipped	2,000 kg (4,409 lb)
Max payload	1,500 kg (3,306 lb)
Max fuel: internal	700 kg (1,543 lb)
tiptanks	130 kg (287 lb)
Max T-O weight	3,100 kg (6,835 lb)
Max landing weight	3,050 kg (6,724 lb)
Max zero-fuel weight	2,800 kg (6,172 lb)
Max wing loading	149.2 kg/m² (30.6 lb/sq ft)
Max power loading	4.95 kg/kW (8.13 lb/shp)

PERFORMANCE (estimated):

Never-exceed speed (V_{NE})	202 kts (375 km/h; 233 mph)
Max level speed and max cruising speed	194 kts (360 km/h; 223 mph)
Econ cruising speed	165 kts (305 km/h; 190 mph)
Stalling speed, flaps down, engines on	59 kts (108 km/h; 68 mph)
Max rate of climb at S/L	468 m (1,535 ft)/min
Service ceiling	6,000 m (19,685 ft)
T-O run	360 m (1,182 ft)
T-O to 15 m (50 ft)	575 m (1,887 ft)
Landing from 15 m (50 ft)	475 m (1,559 ft)
Landing run	270 m (886 ft)
Range, 45 min reserve: with max payload	302 n miles (560 km; 348 miles)
with max fuel	863 n miles (1,600 km; 994 miles)

NEW ENTRY



Khrunichev T-422 Yastreb passenger/freight transport *(Jane's/James Goulding)*

1995

KHRUNICHEV T-422 YASTREB (HAWK)

TYPE: Twin-engined light passenger/freight transport.

PROGRAMME: Design started August 1994.

CURRENT VERSIONS: **T-422**: *Detailed description applies to this version.*

T-422M: With two 265 kW (355 hp) VOKBM M-14P piston engines.

T-422A: With two 313 kW (420 shp) Allison 250-B17 turboprops.

COSTS: Estimated $470,000.

DESIGN FEATURES: Conventional cantilever high-wing monoplane (see three-view).

FLYING CONTROLS: Manually operated three-axis.

STRUCTURE: Conventional light alloy construction, single spar wings, semi-monocoque fuselage; two-spar fin and tailplane.

LANDING GEAR: Non-retractable tricycle type, with single wheel on each unit. Oleo-pneumatic shock-absorbers. Mainwheel tyre size 6.50-10, pressure 4.8 bars (70 lb/sq in); nosewheel tyre size 6.00-6, pressure 2.45 bars (35.5 lb/sq in). Skis and floats optional.

POWER PLANT: Two 261 kW (350 hp) Teledyne Continental TSIO-550-B piston engines, each driving Hartzell three-blade constant-speed propeller. Integral fuel tanks in wings, total capacity 950 litres (251 US gallons, 209 Imp gallons). Crossfeed allows fuelling via point above either tank. Total oil capacity 24.6 litres (6.5 US gallons, 5.4 Imp gallons).

ACCOMMODATION: One or two pilots on flight deck, with door each side. Standard configuration has eight passenger seats in main cabin, with three rows of two seats and two single seats to rear. Business variant has three rows of two seats, with optional galley and toilet. Hand baggage hold at rear of cabin, main baggage compartment forward of flight deck. Two-piece sideways-opening passenger/cargo door at rear of cabin on port side, emergency exit opposite. Heating and ventilation standard.

SYSTEMS: Hydraulic mainwheel brakes. Two 28 V 150 A starter-generators and two voltage regulators in main electrical system, 24 V 29 Ah battery for engine starting and emergency use. Electric anti-icing of propeller blades, pitot tubes and windscreen, pneumatic de-icing of wing and tail unit leading-edges.

AVIONICS: *Comms:* Com/nav radio and transponder.
Radar: Weather radar in nose.
Flight: ADF, ILS and radio altimeter for IFR operation.

DIMENSIONS, EXTERNAL:

Wing span	11.85 m (38 ft 10½ in)
Wing chord (constant)	1.96 m (6 ft 5¼ in)
Length overall	10.10 m (33 ft 1¾ in)
Width of fuselage	1.35 m (4 ft 5¼ in)
Height overall	4.00 m (13 ft 1½ in)
Wheel track	2.48 m (8 ft 1¾ in)
Wheelbase	3.78 m (12 ft 5 in)
Propeller diameter	2.03 m (6 ft 8 in)
Propeller ground clearance	0.84 m (2 ft 9 in)
Distance between propeller centres	3.78 m (12 ft 5 in)
Passenger/freight door: Height	1.10 m (3 ft 7¼ in)
Width	1.30 m (4 ft 3¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length, incl flight deck	4.70 m (15 ft 5 in)
Max width	1.25 m (4 ft 1¼ in)
Max height	1.30 m (4 ft 3¼ in)

AREAS:

Wings, gross	21.84 m² (235.1 sq ft)
Fin, incl dorsal fin	1.53 m² (16.47 sq ft)
Rudder	0.86 m² (9.26 sq ft)
Tailplane	2.40 m² (25.83 sq ft)
Elevators (total)	2.40 m² (25.83 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	2,000 kg (4,410 lb)
Max fuel	700 kg (1,543 lb)
Max T-O weight	3,000 kg (6,615 lb)
Max landing weight	2,950 kg (6,503 lb)
Max zero-fuel weight	2,800 kg (6,170 lb)
Max wing loading	137.4 kg/m² (28.1 lb/sq ft)
Max power loading	5.75 kg/kW (9.44 lb/hp)

PERFORMANCE (estimated):

Never-exceed speed (V_{NE})	205 kts (380 km/h; 236 mph)
Max level speed and max cruising speed	194 kts (360 km/h; 223 mph)
Econ cruising speed	151 kts (280 km/h; 174 mph)
Min stalling speed, flaps down, engine on	62 kts (115 km/h; 72 mph)
Max rate of climb at S/L	390 m (1,279 ft)/min
Service ceiling	3,000 m (9,840 ft)
T-O run	320 m (1,050 ft)
T-O to 15 m (50 ft)	450 m (1,477 ft)
Landing from 15 m (50 ft)	475 m (1,560 ft)
Landing run	295 m (970 ft)
Range, with 45 min reserve: with max payload	593 n miles (1,100 km; 683 miles)
with max fuel	1,241 n miles (2,300 km; 1,429 miles)

NEW ENTRY

KHRUNICHEV T-430 SPRINTER

TYPE: Twin-engined light business aircraft.

PROGRAMME: Intended production of Aeroprogress/ROKS Aero T-602 Orel (which see for detailed description).

NEW ENTRY

KHRUNICHEV T-2402 DINOSAUR

TYPE: Twin-turboprop medium/long-range cargo/passenger STOL transport

PROGRAMME: Design started 1995

COSTS: Estimated cost of production aircraft $8,500,000

DESIGN FEATURES: High-mounted tandem-wing configuration, high-lift devices on each wing ensure STOL performance, with exceptional CG range. Twin tailbooms provide easy access to rear loading ramp/door on fuselage pod. See three-view for detailed information

POWER PLANT: Two 2,237 kW (3,000 shp) Klimov TV7-117 turboprops, each driving SV-34 six-blade CFRP propeller

ACCOMMODATION: Three crew on flight deck, with provision for fourth person, payload handler and up to 56 passengers, equivalent freight or combined passenger/freight payload in cabin

DIMENSIONS, EXTERNAL (provisional):

Wing span (rear wing)	27.2 m (89 ft 3 in)
Length overall	22.7 m (74 ft 6 in)
Height overall	6.0 m (19 ft 9 in)

WEIGHTS AND LOADINGS (provisional):

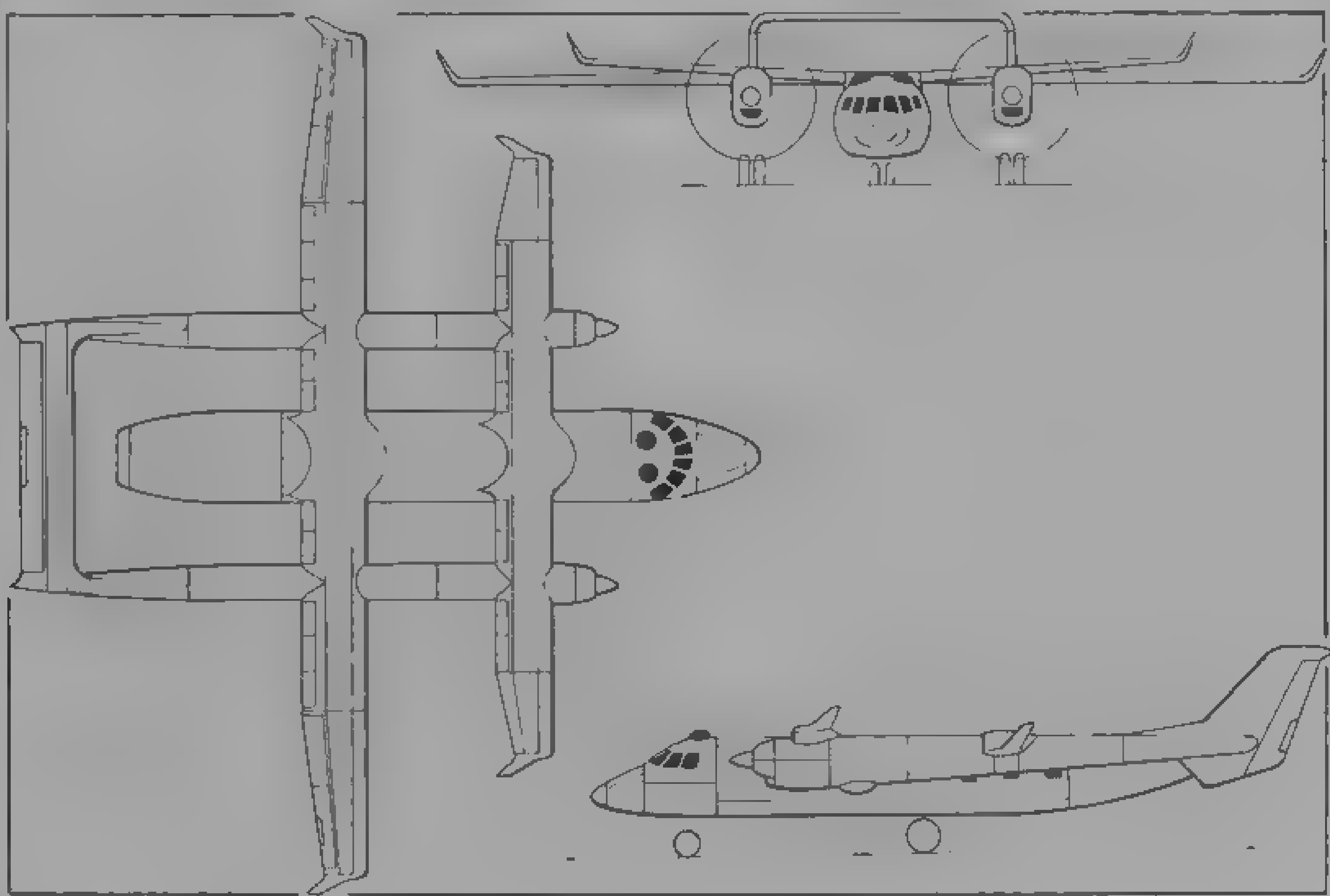
Max payload	6,000 kg (13,225 lb)
Max fuel	5,500 kg (12,125 lb)
Max T-O weight	24,500 kg (54,000 lb)

PERFORMANCE (estimated):

Max level speed	292 kts (540 km/h; 336 mph)
Nominal cruising speed	270 kts (500 km/h; 311 mph)
T-O to 15 m (50 ft)	800 m (2,625 ft)
Landing from 15 m (50 ft)	600 m (1,969 ft)
Range:	
with max payload	863 n miles (1,600 km; 994 miles)
with max fuel	2,429 n miles (4,500 km; 2,796 miles)

NEW ENTRY

Model of Khrunichev T-430 Sprinter (two VOKBM M-14 engines) *(Paul Jackson)* 1995



Khrunichev T-2402 Dinosaur cargo/passenger STOL transport *(Jane's/James Goulding)* 1995

KNAAPO

KOMSOMOLSK-ON-AMUR AIRCRAFT PRODUCTION ASSOCIATION

3 Sovetskaya Street, 681018 Komsomolsk-on-Amur, Khabarovskiy District

Telephone: 7 (09352) 6 32 00 or 6 32 30

Fax: 7 (09352) 2 98 51 TSENTR

Telex: 141149 BURAN SU

A major production centre for Sukhoi aircraft at the present time, KNAAPO manufactures combat aircraft of the Su-27 series, including the naval Su-33, and will also be responsible for the new S-80 STOL transport. Formerly known as GAZ 416, it shared with Novosibirsk production of the Su-24 combat aircraft.

NEW ENTRY

KUMERTAU

KUMERTAU AIRCRAFT PRODUCTION ENTERPRISE

15A Novozarinskaya, 453350 Kumertau, Bashkortostan

Telephone: 7 (34761) 2 23 00

Fax: 7 (34761) 2 39 13

GENERAL DIRECTOR: Boris S. Malyshev

EXPORT DEPARTMENT: R. M. Rafikov

Current activities at Kumertau include manufacture of the Kamov Ka-27/28/29/32 helicopter series.

NEW ENTRY

MAPO-MiG

MOSCOW AIRCRAFT SCIENTIFIC-PRODUCTION ORGANISATION 'MiG' (MAPO-MiG)

7 1st Botkinsky Drive, 125040 Moscow

Telephone: 7 (095) 252 81 41

Fax: 7 (095) 250 88 19

GENERAL DIRECTOR: Vladimir V. Kouzmin

GENERAL DESIGNER: Rostislav A. Belyakov

FIRST DEPUTY GENERAL DIRECTOR/CHIEF ENGINEER: Victor M. Pouzanov

FIRST DEPUTY GENERAL DIRECTOR, COMMERCIAL DIRECTOR: Alexander N. Bezroukov

In May 1995 the Russian government approved the amalgamation of the Mikoyan OKB and Moscow Aircraft Production Organisation (MAPO).

MAPO had its origin in a company founded in 1893, has produced 25,000 aircraft of more than 40 types, including Nieuport (1913), Farman (1916-21), P-1 reconnaissance aircraft (1923), I-1 fighter (1924), U-2/Po-2 trainer and utility aircraft (1927), P-5 reconnaissance aircraft (1927), I-5, I-16 and I-153 Chaika fighters (1930s), Il-2 Shturmovik (8,652 built 1941-45), Il-12 passenger transport (646 built 1946-49), Il-28 bomber (2,490 built 1950-56), Il-14 transport (687 built, exported to nine countries, 1956-58), Il-18 turboprop transport (560 built, exported to 13 countries, 1957-69), Su-9 interceptor (1958-62), front fuselage and engine control unit of Buran space shuttle (1979-86), MiG-21 (more than 3,000 built, exported to 28 countries, 1962-74), MiG-23 (more than 4,000 built, exported to 16 countries, 1968-85), MiG-29 (more than 1,200 built from 1983 to date, for 21 operators). Other current products include MiG-AT advanced trainer, Aeroprogress/ROKS-Aero T-101 Gratch, MAI (Aviatika) 890 and Ilyushin Il-103 light aircraft. Service activities include complete maintenance support and pilot training.

NEW ENTRY

In 1971 Artem I. Mikoyan, the original head of MiG OKB, was succeeded as General Designer by Academician Rostislav A. Belyakov. He supervised completion of production of the MiG-23 and 25, designed under A. I. Mikoyan, while later aircraft such as MiG 27 and 29 (both in many versions) and MiG-31 were developed and put into service.

In addition to new combat aircraft, MiG OKB is developing training and light transport aircraft, and others with air cushion landing gear. It is also manufacturing horizontal tail surfaces for Dassault Falcon 900 business jets and participating in development of the Chengdu FC-1 fighter (see Addenda).

VERIFIED

MiG-25PU ('Foxbat-C') of the Indian Air Force *(Peter Steinemann)*

1993

MIKOYAN MiG-25

NATO reporting name: Foxbat

TYPE: Single-seat interceptor, reconnaissance aircraft and two-seat conversion trainer.

PROGRAMME: Design started 1959 as Ye 155P supersonic high-altitude interceptor to counter all potential threats, from low flying cruise missiles to A-11 (SR-71A reconnaissance aircraft) under US development; programme launched officially February 1962; Ye-155R reconnaissance version designed and built 1961-62, Ye-155R-1 first to fly 6 March 1964; Ye-155P-1 interceptor prototype flew 9 September 1964, early history in previous editions of *Jane's*; production, as MiG-25/25R series, completed mid-1980s.

CURRENT VERSIONS (general): Produced in five main families, as below:

Type 02: MiG-25R, RB, RBV and RBT plus RBK (02K), RBS (02S), RBF (02F) and BM (02M).
Type 22: MiG-25RU
Type 39: MiG-25PU
Type 84: MiG-25P, PD and PDS
Type 99. Ye-155M (experimental)

CURRENT VERSIONS (specific): **MiG-25RB** ('Foxbat-B'): Single-seat high altitude reconnaissance-bomber, derived from Ye-155R-1 prototype; production began as MiG-25R for reconnaissance only, in 1969, bombing capability added and redesignated RB in 1970; no guns or air-to-air missiles, R-15BD-300 turbojets, any one of three interchangeable photographic/elint modules, with five camera windows and flush dielectric panels, carried aft of small dielectric nosecap, instead of interceptor's Smerch radar; slightly reduced wing span; wing leading-edge sweep constant 41° from root to tip, first aircraft produced in former USSR with INS updated by Doppler; specially developed automatic bombing system makes possible all-weather day/night precision attacks at supersonic speed from heights above 20 000 m (65,600 ft) against targets with known geographic co-ordinates, carrying four 500 kg bombs under wings, two under fuselage, SRS-4B elint equipment; fuel tank in each fin, providing additional 700 litres (185 US gallons, 154 Imp gallons) capacity, provision for 5,300 litre (1,400 US gallon; 1,165 Imp gallon) underbelly tank, able to fly long distances at cruising speed of Mach 2.35, maximum speed of Mach 2.83 with full bomb load.

MiG-25RBV and RBT ('Foxbat-B'): As MiG-25RB, with different equipment, including SRS-9 elint on RBV (V for Virazh SLAR). Produced 1978-82.

MiG-25PU ('Foxbat-C'): Training version of original MiG-25P interceptor, redesigned nose section containing separate cockpit with individual canopy for instructor forward of standard cockpit and at lower level, no armament, weapon release simulation standard, some systems modified and updated, permitting simulation of failures, no radar in nose, first roll-out 1968, maximum speed limited to Mach 2.65.

MiG-25RU ('Foxbat-C'): Training version of MiG-25R, identical to MiG-25PU except for absence of combat simulation system, no reconnaissance sensors; first roll-out 1972.

MiG-25RBK ('Foxbat-D'): Produced simultaneously with RB series in 1971-80, reconnaissance modules contain different elint (K of designation for Kub SLAR) and other avionics and no cameras, modified cockpit, electrical and air conditioning systems; bombing capability retained.

MiG-25RBS ('Foxbat-D'): As MiG-25RBK but with different sensors, in production 1971-77; all RBSs upgraded to **MiG-25RBSh** during servicing from 1981.

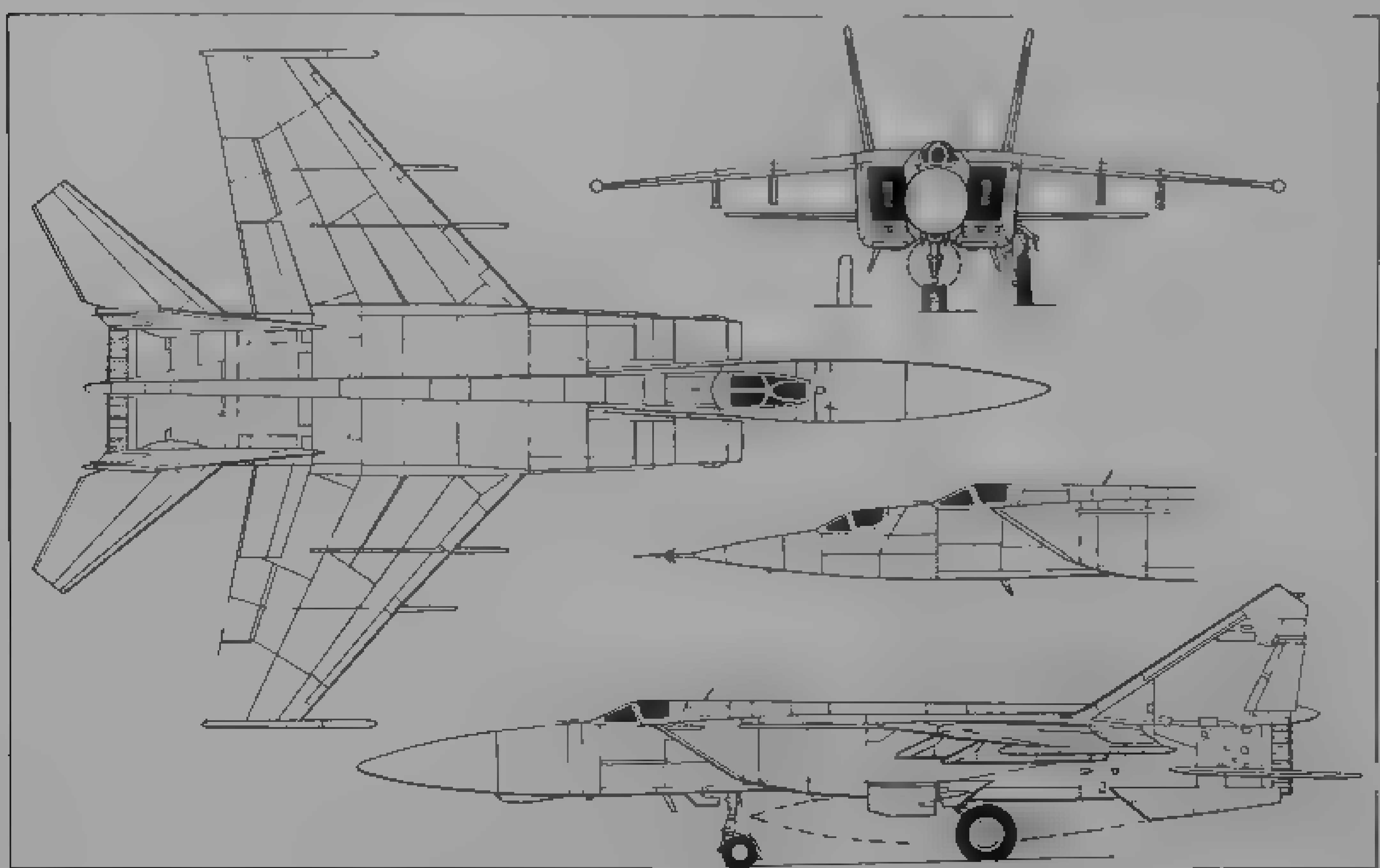
MiG-25RBF: Updated MiG-25RB, conversions from 1981. Generally to MiG-25RBK standard, but panoramic cameras retained and different active/passive countermeasures.

MiG-25PD ('Foxbat-E'): Development of original MiG-25P interceptor, produced 1978-82; uprated R-15BD-300 turbojets with life of 1,000 hours instead of former 150 hours; Saphir-25 radar and IRST, giving look-down/shoot-down capability comparable with MiG-23M; two R-40 (K-40; NATO AA-6 'Acrid') and four R-60 (K-60, NATO AA-8 'Aphid') missiles, provision for same underbelly tank as on MiG-25R series.

MiG-25PDS ('Foxbat-E'): All operational MiG-25Ps upgraded to PDS from 1979. As MiG-25PD; front fuselage lengthened by 250 mm (10 in) to accommodate flight refuelling equipment on some aircraft. *Detailed description applies to MiG 25PDS, except where indicated.*

MiG-25BM ('Foxbat-F'): Defence suppression aircraft derived from MiG-25RB, development started 1972, produced 1982-85, ECM in place of reconnaissance module in lengthened nose, with dielectric panel each side; small blister each side at rear of radome, dielectric panel at front of each outboard weapon pylon, underbelly auxiliary fuel tank as MiG-25R series, four Kh-58 (NATO AS-11 'Kilter') anti-radiation missiles underwing to attack surface-to-air missile radars over standoff ranges. Weights and performance almost identical to RB.

CUSTOMERS: Russia retains 85 for reconnaissance and ECM, Algeria ('Foxbat-A/B'); India ('Foxbat-B/C'); Iraq ('Foxbat A'); Libya ('Foxbat-A/B/D/E'), Syria ('Foxbat A/B').



Mikoyan MiG 25PDS single-seat fighter (NATO 'Foxbat E'), with scrap view of front fuselage of two-seat MiG-25PU ('Foxbat-C') *(Jane's/Dennis Punnett)*

1993

DESIGN FEATURES: With MiG 31 derivative, is fastest combat aircraft yet identified in squadron service, original role demanded high-speed high-altitude capability and weapon system for attack over considerable range; high swept wings with anti-flutter body (maximum diameter 30 cm, 11.8 in) at each tip, slim front fuselage, with ogival nosecone, blended into rectangular air intake trunks with wedge intakes, inner wall of intakes curved at top and not parallel with outer wall, hinged panel forms lower intake lip, which, with internal door, enables area to be varied electronically, spill door in top of each trunk, fuselage undersurface dished between engines, all-swept tail surfaces, twin 11° outward canted fins and twin outward canted ventral fins, all with large flush antennae, wing anhedral 5° from roots, leading-edge sweepback 42° 30′ inboard, 41° outboard of each outer missile pylon, sweepback at quarter-chord 32°; sweepback on tailplane leading-edge 50°, fins 60°. Two shallow upper surface fences on each wing, in line with weapon pylons.

FLYING CONTROLS: Two-section aileron at centre of each wing trailing-edge; plain flap on inboard 37 per cent, all-moving horizontal tail surfaces able to operate differentially at high speeds. inset rudders, no tabs, airbrakes above and below jetpipes at rear of fuselage.

STRUCTURE: Airframe 80 per cent welded tempered steel, 8 per cent titanium in areas subject to extreme heating, such as wing and tail unit leading-edges, 11 per cent D19 heat-resistant aluminium alloy, by weight, two main wing spars forming torsion box, auxiliary front spar and two auxiliary rear spars; 14 primary fuselage frames, many intermediate frames and stringers.

LANDING GEAR: Retractable tricycle type. Single wheel, with tyre size 1,300 × 360 mm, pressure 11.75 + 0.5 bars (170 + 7 lb/sq in), on each forward-retracting main unit, wheel stows vertically between air intake duct and outer skin of each trunk. Twin-wheel forward-retracting nose unit, tyre size 700 × 200 mm, pressure 9.8 + 0.5 bars (142 + 7 lb/sq in). Probe for brake-chute on port ventral fin. Twin circular (60 m²; 645 sq ft) or cruciform (50 m²; 538 sq ft) brake-chutes in fairing above and between jet nozzles.

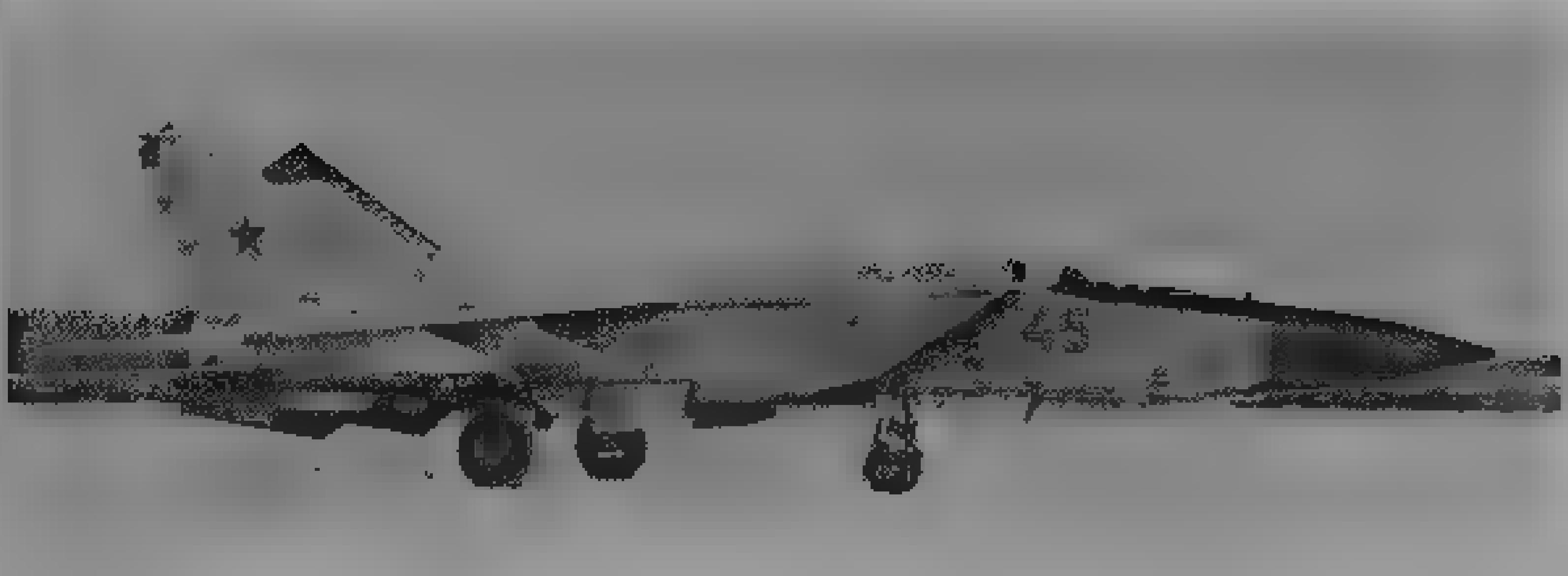
POWER PLANT: Two Soyuz/Tumansky R-15BD-300 turbojets, each rated at 86.30 kN (19,400 lb st) dry, 109.75 kN (24 675 lb st) with afterburning, in compartment of silver-coated steel. Fuel in two welded structural tanks occupying 70 per cent of volume of fuselage, between cockpit and engine bay, in saddle tanks around intake ducts, and in integral tank in each wing, filling almost entire volume inboard of outer fence, total capacity 17,660 litres (4,665 US gallons, 3,885 Imp gallons); single-point fuelling, provision for 5,300 litre (1,400 US gallon; 1,165 Imp gallon) underbelly tank.

ACCOMMODATION: Pilot only, on KM-1 zero-height/70 to 675 knots (130 to 1,250 km/h; 80 to 775 mph) ejection seat. Canopy hinged to open sideways, to starboard.

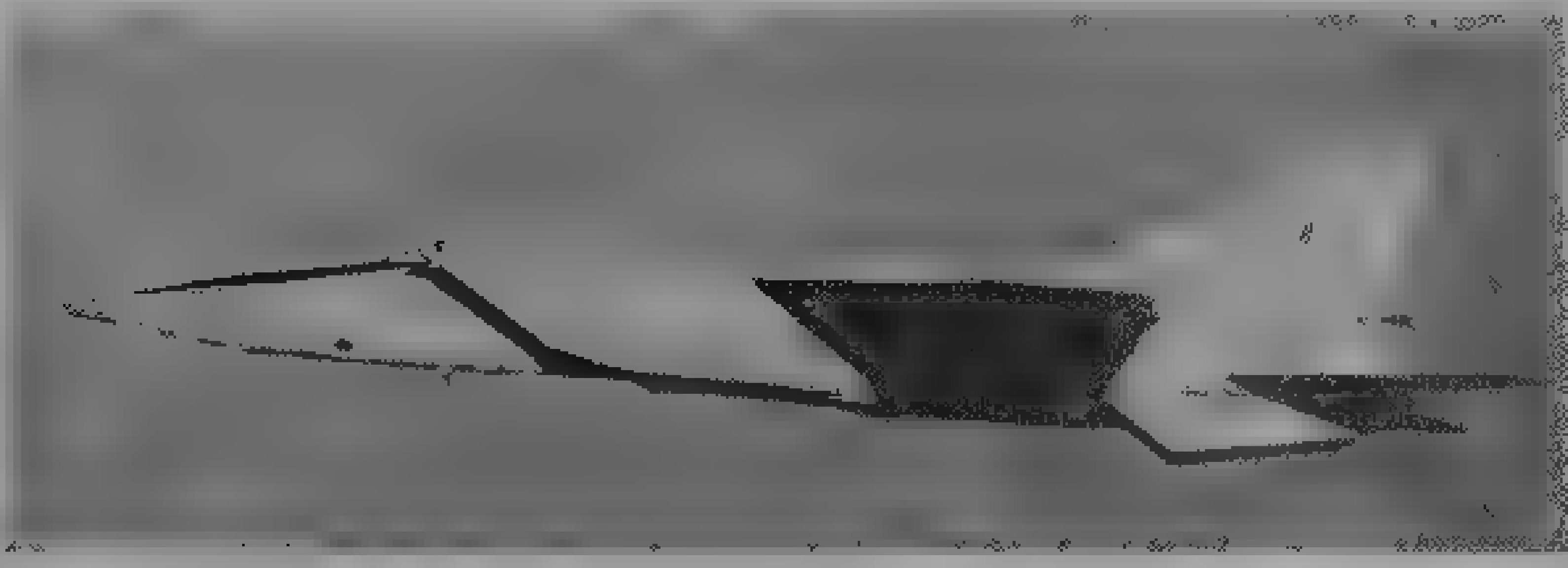
SYSTEMS: Autonomous main and booster hydraulic systems, main system supplies one chamber of twin-chamber flight control power units, landing gear, air inlet system, airbrakes, nosewheel steering and main and emergency wheel brakes; booster system supplies second chamber of each flight control power unit and emergency wheel brakes. Systems include two tanks, four engine-driven pumps and gas/oil accumulator. Main system utilises same flow restrictors and cut-offs triggered by falling pressure as booster system. Tanks are automatically pressurised by nitrogen to ensure adequate system pressure in event of pump failure. Electrical system of MiG-25PD/PDS includes constant-speed generators at nominal 27 V and variable three-phase generator for 200/115 V 400 Hz stabilised frequency driven by each engine, two batteries and rotary transformers give variable and constant frequency in emergency. MiG-25RB has variable-frequency electric supply from two combined variable-speed generators giving 115 and 36 V with 400 Hz stabilised frequency. Electronic fuel control system.

AVIONICS: *Comms:* RSB 70/RPS HF, R 832M VHF-UHF transceiver; R-831 UHF; SRO-2M/SRZO-2 ('Odd Rods') IFF; SOD 57M ATC/SIF with antennae in starboard fin tip, SOD-63 transponder.

Radar: Saphir-25 (RP-25, 'Fox Fire') fire-control radar in nose, search range 54 n miles (100 km, 62 miles), tracking range 40 n miles (75 km; 46 miles), forward of



Lengthened nose distinguishes the MiG-25PDS *1991*



MiG-25R ('Foxbat-B') of the Indian Air Force *(Peter Steinemann)* *1993*

avionics compartment housing navigation radar; K 10T radar scope

Flight: SAU-155 automatic flight control system. SP-50 ('Swift Rod') ILS, MRP-56P marker beacon receiver; RSBN-6S short-range nav, RV-UM or RV-4 radio altimeter; ARK 10 radio compass

Mission: Infra-red search/track sensor pod under front fuselage.

Self-defence: Sirena-3 360° radar warning system with receivers in centre of each wingtip anti-flutter body and starboard fin tip, ECCM, decoys and jammers

EQUIPMENT: Retractable landing light under front of each intake trunk. Back-up optical weapon sight.

ARMAMENT: No gun. Air-to-air missiles on four underwing attachments, originally one radar guided R-40R (K-40R, NATO AA-6 'Acrid') and one infra-red R-40T (K-40T; NATO AA-6 'Acrid') under each wing, alternatively, one R-40 and two R-60s under each wing and, later, one R-23 (K-23, NATO AA-7 'Apex') and two R-73A (NATO AA-11 'Archer') or R-60T (NATO AA-8 'Aphid') under each wing

DIMENSIONS, EXTERNAL:
Wing span: MiG-25P 14.015 m (45 ft 11¾ in)
MiG-25RB 13.42 m (44 ft 0¼ in)
Wing aspect ratio: MiG-25P 3.4
Length overall: MiG-25R 21.55 m (70 ft 8½ in)
Length of fuselage, excl probe
MiG-25P 19.75 m (64 ft 9½ in)
Height overall: MiG-25P 6.10 m (20 ft 0¼ in)
MiG-25R 6.50 m (21 ft 4 in)
Tailplane span: MiG-25R 8.74 m (28 ft 8 in)
Wheel track 3.85 m (12 ft 7½ in)
Wheelbase 5.14 m (16 ft 10½ in)

AREAS:
Wings, gross: MiG-25P 61.40 m² (660.9 sq ft)
Ailerons (total): MiG-25R 2.72 m² (29.28 sq ft)
Trailing-edge flaps (total):
MiG-25R 4.30 m² (46.29 sq ft)
Vertical tail surfaces (total) 16.00 m² (172.2 sq ft)
Rudders (total): MiG-25R 2.12 m² (22.82 sq ft)
Horizontal tail surfaces (total) 9.81 m² (105.6 sq ft)

WEIGHTS AND LOADINGS:
Max internal fuel: P 14,570 kg (32,120 lb)
R series 15,245 kg (33,609 lb)
Max fuel with underbelly tank: P 18,940 kg (41,755 lb)
Take-off weight:
P, clean, max internal fuel 34,920 kg (76,985 lb)
P, four R-40 missiles, max internal fuel
36,720 kg (80,950 lb)
R series, normal 37,000 kg (81,570 lb)
R series, max 41,200 kg (90,830 lb)
Max landing weight: R series 24,000 kg (52,910 lb)
Max wing loading: P 598 kg/m² (122.5 lb/sq ft)
R series 671 kg/m² (137.4 lb/sq ft)
Max power loading: P 166.9 kg/kN (1.64 lb/lb st)
R series 187.3 kg/kN (1.84 lb/lb st)

PERFORMANCE:
Max permitted Mach number at height: P, R series 2.83
Max level speed: at 13,000 m (42,650 ft)
P, R series 1,620 kts (3,000 km/h; 1,865 mph)
at S/L, P, R series
Mach 0.98 (647 kts; 1,200 km/h; 745 mph)
T-O speed: P 195 kts (360 km/h; 224 mph)
Landing speed: P 157 kts (290 km/h; 180 mph)
R series 140-151 kts (260-280 km/h; 161-174 mph)
Time to 20,000 m (65,600 ft) at Mach 2.35: P 8.9 min
Time to 19,000 m (62,335 ft): R series, clean 6.6 min
R series, with 2,000 kg (4,410 lb) of bombs 8.2 min
Service ceiling: P 20,700 m (67,900 ft)
R series, clean 21,000 m (68,900 ft)
T-O run: P 1,250 m (4,100 ft)
Landing run, with brake-chute: P 800 m (2,625 ft)
Range with max internal fuel:
P, supersonic 675 n miles (1,250 km; 776 miles)
P, subsonic 933 n miles (1,730 km; 1,075 miles)
R series, supersonic
882 n miles (1,635 km; 1,015 miles)
R series, subsonic
1,006 n miles (1,865 km; 1,158 miles)
Range with 5,300 l external tank: R series, supersonic
1,150 n miles (2,130 km; 1,323 miles)
R series, subsonic
1,295 n miles (2,400 km; 1,491 miles)
Endurance: P 2 h 5 min
g limit: P, supersonic +4.5

UPDATED

MIKOYAN MiG-29

NATO reporting name: Fulcrum
Indian Air Force name: Baaz (Eagle)

TYPE: All-weather single-seat counter-air fighter, with attack capability, and two-seat combat trainer

PROGRAMME: Technical assignment (operational requirement) for LFI (legkiy frontovoy istrebitel: light frontline fighter) issued 1972, to replace MiG-21, MiG-23, Su-15 and Su-17, initial order placed simultaneously; detail design began 1974, first of 11 prototypes and eight preseries aircraft built for factory and State testing (Factory index 9.01) flew 6 October 1977, photographed by US satellite, Ramenskoye flight test centre, November 1977 and given interim Western designation 'Ram-L'; second prototype flew June 1978, second and fourth prototypes lost through engine failures; after major design changes (see previous editions of *Jane's*) production began 1982, deliveries to Frontal Aviation 1983, operational early 1985, first detailed Western study possible after visit of demonstration team to Finland July 1986, production of basic MiG-29 combat aircraft by Moscow Aircraft Production Organisation (MAPO), and of MiG-29UB combat trainers at Nizhny Novgorod, for CIS air forces completed, but manufacture of MiG-29SE for export continues

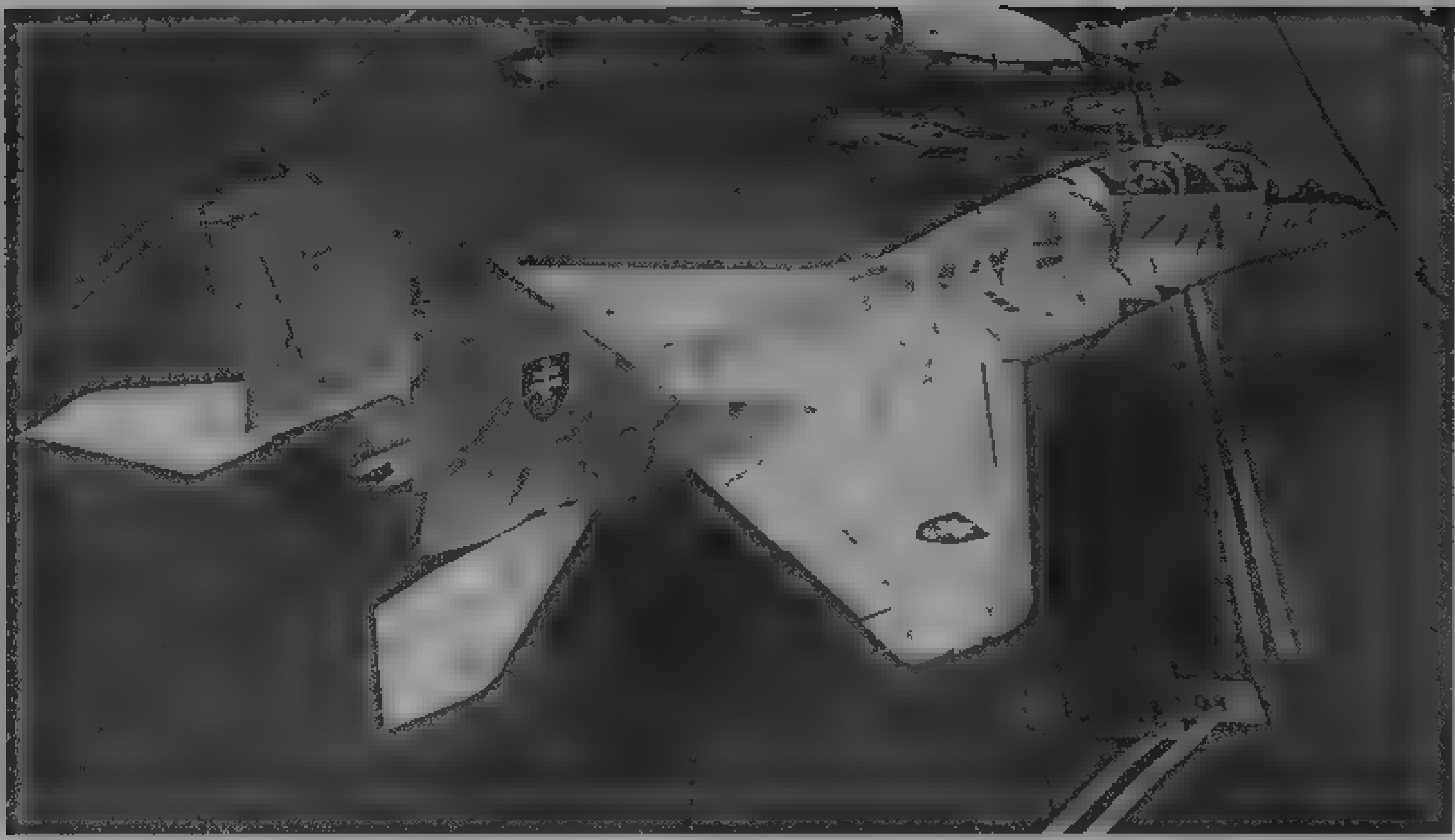
CURRENT VERSIONS: **MiG-29** (Factory index 9.12 'Fulcrum-A'). Land-based single-seat counter-air tactical fighter. First 100 aircraft with anti-spin ventral fins that were optionally removable after further spin tests. Control surface deflection range increased and rudder chord extended for improved control at extreme angles of attack. To meet air force requirements, dorsal fins extended forward to house chaff/flare dispensers, so extending keel area without impairing flight stability. Aircraft for export known as 9.12B.

MiG-29UB (Factory index 9.5, 'Fulcrum-B'): Combat trainer; second K-36DM ejector seat forward of normal cockpit under continuous canopy, with periscope for rear occupant, no radar, gun, IRST sensor, laser rangefinder and underwing stores pylons retained. Length 17.42 m (57 ft 2 in). First flown 29 April 1981, production began 1982.

MiG-29 (Factory index 9.13, 'Fulcrum-C'): First flown 23 December 1980, generally as 'Fulcrum-A', but introduced deeply curved top to fuselage aft of cockpit to house

Fully armed second prototype of MiG-29K with wings folded *(Piotr Butowski)* *1994*

Three-view drawing of MiG-29S 'Fulcrum-C' fighter. Additional side views at top show late-model 'Fulcrum-A' and two-seat 'Fulcrum-B' *(Jane's/Mike Keep)* *1992*



MiG-29UB ('Fulcrum-B') two-seat combat trainer of Slovak Air Force in special 'tiger' colour scheme *(Paul Jackson)*

1995

More deeply curved spine identifies the MiG 29 type 9 13 'Fulcrum-C' *(F G. Rozendaal)*

1995

additional avionics, including active jammers; two 1,150 litre (304 US gallon, 253 Imp gallon) underwing fuel tanks, a 1,450 litre (383 US gallon; 319 Imp gallon) underbelly fuel tank and weapons load increase to 3,000 kg (6,615 lb). Ammunition shellcase disposal was modified to avoid centreline tank, auxiliary antennas added to wingtips, and weapon control system improved. No 'Fulcrum-C' exports. *Detailed description refers to this version*

MiG-29S (Factory index 9 13S, 'Fulcrum-C'): Multistage upgrade of type 9 13; internal fuel capacity increased by 75 litres (20 US gallons, 17 Imp gallons); maximum total fuel capacity 8,240 litres (2,177 US gallons; 1,813 Imp gallons), for maximum range of 1,565 n miles (2,900 km, 1 800 miles) Optional non-retractable, detachable, flight refuelling probe on starboard side. Five-section leading-edge flaps, increased rudder deflection AOA operating range increased to 28°; N019M Topaz radar detection range 54 n miles (100 km; 62 miles) against fighter-size targets, able to track 10 targets and engage two simultaneously. Able to carry R-27R1, R-27RE1, R-27T1, R-27TE1 and R-73E AAMs, R 77 (AA 12 'Adder') AAMs after radar upgrade, or up to 4,000 kg (8,820 lb) of bombs, S-24B rockets, B-8M1 packs of S-8 rockets, ZAB-500 napalm tanks or BKF cluster bombs First flown 1984. Approximately two squadrons only Maximum T-O weight 19,700 kg (43 430 lb) Provision for anti-submarine, ARM and TV and laser guided missiles added 1995 with further AoA increase to 30

MiG-29SE ('Fulcrum-C'). Export version of MiG-29S. Phazotron NIIR N019ME Topaz radar, six R 77 AAMs, maximum T-O weight 20,000 kg (44,090 lb), service ceiling 18,000 m (59,055 ft)

MiG-29SD ('Fulcrum-A'). Export upgrade of basic MiG 29 (9 12), with most SE improvements. Locally designated **MiG-29N** for Malaysia has Western IFF, cockpit placards in English, voice warning system, instruments and displays calibrated in feet, knots, feet/minute and nautical miles, AN/ARN 139 Tacan, GPS and ILS Malaysian aircraft delivered with, or reworked, to latest standards, with 3,000 kg (6,615 lb) weapon load, two-target engagement, active radar homing missile compatibility, and so on

MiG-29M/MiG-33 (Factory index 9 15): Advanced tactical fighter for control of upper airspace, ground attack and naval high-altitude precision weapons control; greatly redesigned airframe, two 86.3 kN (19,400 lb st) Klimov RD-33K turbofans; quadruplex analog fly-by-wire controls and 'glass' cockpit with two monochrome (green) multifunction CRTs (not push-button, but HOTAS), modifications to extend aft centre of gravity limit for relaxed stability. First of six prototypes flown 25 April 1986 with RD-33 engines, first flight with RD-33K engines late 1989, first exhibited at Machulishche airfield, February 1992, enlarged engine air intakes with movable lower lip to increase mass flow on take-off Original FOD doors in air intakes replaced by lighter retractable grids, permitting deletion of overwing louvres and internal ducting in lightweight aluminium lithium alloy centre-section, providing increased fuel tankage, total internal fuel capacity 6,000 to 6,250 litres (1,585 to 1,651 US gallons, 1,320 to 1,375 Imp gallons). New wing section, with sharp leading-edge Increased-span ailerons; bulged wingtips with fore and aft RWRs; more rounded wingtip trailing-edge; sharp-edge slightly raised LERX, increased-chord horizontal tail surfaces, with dogtooth leading-edge. Welded aluminium-lithium front fuselage, welded steel behind, nose lengthened by approximately 20 cm (7½ in), 40 mm (1½ in) higher and longer canopy; pilot's seat raised, wider and longer dorsal spine, having new Gardeniya active jammer and terminating in 'beaver tail' structure, containing twin 13 m² (140 sq ft) brake-chutes, that extends beyond jet nozzles; single larger honeycomb composite over-fuselage airbrake

Phazotron NIIR N010 Zhuk terrain-following and ground mapping radar with 680 mm (26.77 in) dish antenna in larger diameter radome, able to track 10 targets and engage four simultaneously; new OLS-M longer-range IRST; added TV and laser designator/marked target seeker Chaff/flare dispensers relocated in dorsal spine. New IFF and Gardeniya active jammer Claimed more comfortable to fly, with increased permissible angle of attack, better manoeuvrability, improved cruise efficiency, eight underwing hardpoints for 4,500 kg (9,920 lb) stores, including four laser-guided Kh-25ML (AS-10 'Karen') or Kh-29L (AS-14 'Kedge'), anti-radiation Kh-25MP (AS-12 'Kegler') and Kh-31P (AS-17 'Krypton') or TV guided Kh 29T (AS-14 'Kedge') air-to-surface missiles, eight R 77 (AA-12) AMRAAM class air-to-air missiles, R-73A (AA-11 'Archer') air-to-air missiles or KAB-500KR 500 kg TV guided bombs. Rounds for gun reduced to 100. Performance as for MiG-29S, except range on internal fuel 1,079 n miles (2,000 km; 1,242 miles), with three external tanks 1,726 n miles (3,200 km; 1,988 miles) Redesignated MiG-33 (which see), 1995

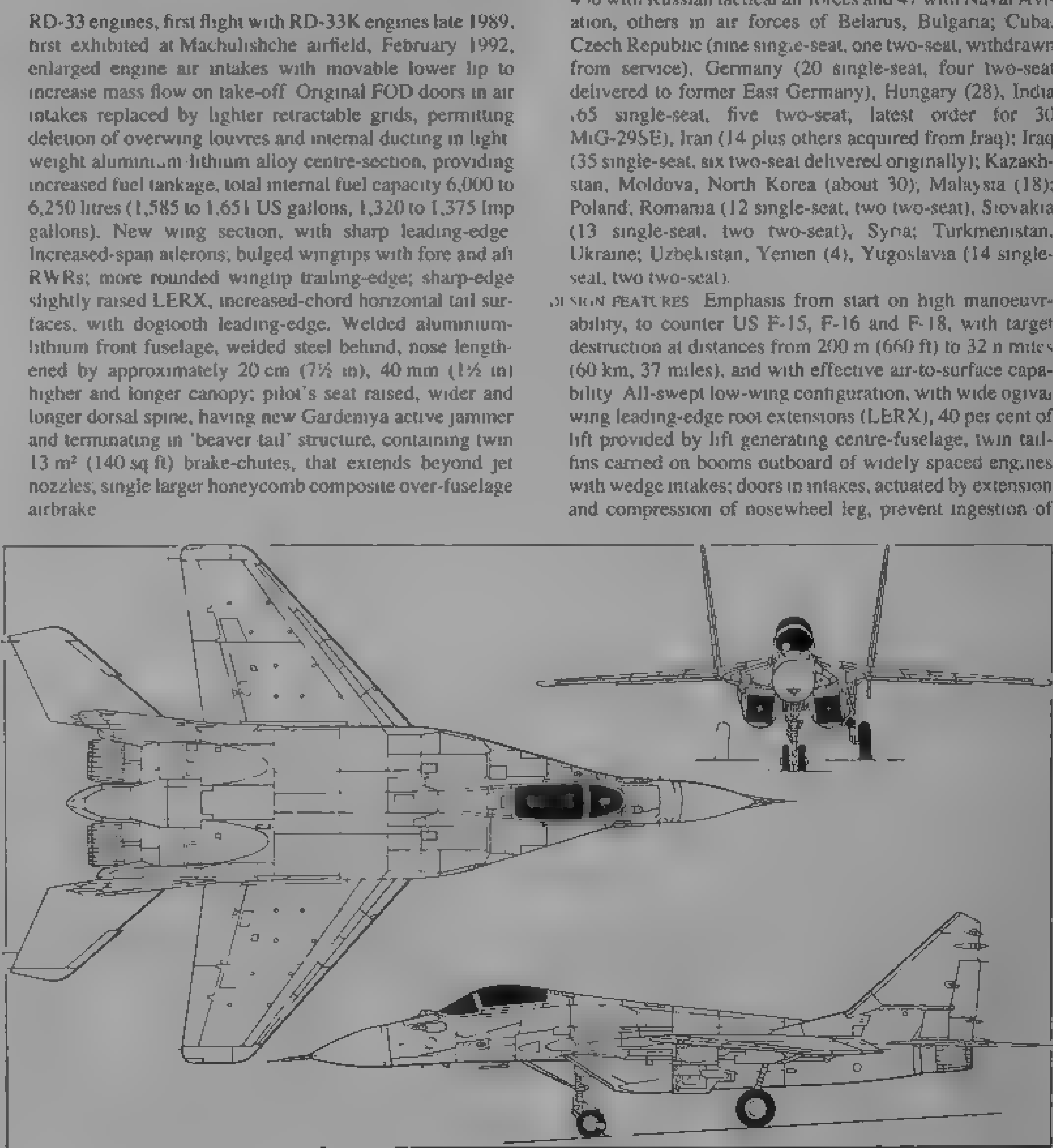
MiG-29ME Export version of MiG-29M, airframe and power plant of 29M, N019M radar and weapons of MiG 29 Redesignated **MiG-33** (which see), 1994

MiG-29K (Factory index 9 31; K for korabelnyy; ship-based)· Maritime version, used for ski-jump take-off and deck landing trials on carrier *Admiral of the Fleet Kuznetsov* (formerly *Tbilisi*), beginning 1 November 1989, two new-build prototypes, using MiG-29M structure; wing of increased area, new centre-section without overwing louvres (see MiG-29M); upward-folding outer wing panels, RD-33K turbofans. First flown 23 June 1988 (16188). Exhibited at Machulishche airfield, Minsk February 1992 with typical anti-ship armament of four Kh 31P/A (AS-17 'Krypton') air-to-surface missiles and four R-73A (AA-11 'Archer') air-to-air missiles. Production MiG-29K was intended to use same basic airframe, power plant, avionics and equipment as MiG-29M, with added wing folding, strengthened landing gear, arrester hook, retractable flight refuelling probe, and other naval requirements. Further development officially ended when not selected for deployment on *Admiral of the Fleet Kuznetsov*. (More details in 1993 94 *Jane's*)

MiG-29KVP· Refined for STOL operations; fitted with arrester hook and tested at land base as demonstrators for MiG-29K. Approximately five converted from early 'Fulcrum-A' airframes

CUSTOMERS More than 1,200 built by MAPO by April 1995, 430 with Russian tactical air forces and 47 with Naval Aviation, others in air forces of Belarus, Bulgaria; Cuba, Czech Republic (nine single-seat, one two-seat, withdrawn from service), Germany (20 single-seat, four two-seat delivered to former East Germany), Hungary (28), India (65 single-seat, five two-seat; latest order for 30 MiG-29SE), Iran (14 plus others acquired from Iraq); Iraq (35 single-seat, six two-seat delivered originally); Kazakhstan, Moldova, North Korea (about 30), Malaysia (18); Poland, Romania (12 single-seat, two two-seat), Slovakia (13 single-seat, two two-seat), Syria; Turkmenistan, Ukraine; Uzbekistan, Yemen (4), Yugoslavia (14 single-seat, two two-seat).

DESIGN FEATURES Emphasis from start on high manoeuvrability, to counter US F-15, F-16 and F-18, with target destruction at distances from 200 m (660 ft) to 32 n miles (60 km, 37 miles), and with effective air-to-surface capability All-swept low-wing configuration, with wide ogival wing leading-edge root extensions (LERX), 40 per cent of lift provided by lift generating centre-fuselage, twin tailfins carried on booms outboard of widely spaced engines with wedge intakes; doors in intakes, actuated by extension and compression of nosewheel leg, prevent ingestion of



Mikoyan MiG-29M advanced counter-air fighter *(Jane's/Mike Keep)*

1995

Cockpit of MiG-29SE ('Fulcrum-C') development aircraft 36581 *(Paul Jackson)* *1995*

'Glass' cockpit of sixth prototype MiG-29M (05556) *(Paul Jackson)* *1995*

foreign objects during take-off and landing, gap between roof of each intake and skin of wingroot extension for boundary layer bleed.

Fire control and mission computers link radar with laser rangefinder and infra-red search/track sensor, in conjunction with helmet-mounted target designator; radar able to track 10 targets simultaneously; targets can be approached and engaged without emission of detectable radar or radio signals, sustained turn rate much improved over earlier Soviet fighters; thrust/weight ratio better than one; allowable angles of attack at least 70 per cent higher than previous fighters, difficult to get into stable flat spin, reluctant to enter normal spin, recovers as soon as controls released wing leading-edge sweepback 73° 30′ on LERX, 42° on outer panels, anhedral approximately 2°; aspect ratio 3.5 tailfins canted outward 6°; leading-edge sweep 47° 50′ on fins, 50° on horizontal surfaces. Design flying life 2,500 hours

FLYING CONTROLS: Mechanical controls, hydraulically powered, with autopilot and rate dampers. AOA limiter set at 26° (30° permitted in symmetrical manoeuvres without banking), computer-controlled four-section leading-edge manoeuvring flaps over full span of each wing, except tip, and plain trailing-edge flaps, inset ailerons, each with manually adjustable trim tab, inset rudders and all-moving (+15°/−35° collectively and differentially) horizontal tail surfaces, without tabs, interconnect allows rudders to augment roll rate, mechanical yaw stability augmentation system; hydraulically actuated forward-hinged airbrakes above and below rear fuselage between jetpipes

STRUCTURE: Approximately 7 per cent of airframe, by weight, of composites; remainder metal, including aluminium-lithium alloy for wing carry-through structure housing fuel tanks, three-spar wings, trailing-edge wing flaps, ailerons and vertical tail surfaces of carbonfibre honeycomb, approximately 65 per cent of horizontal tail surfaces aluminium alloy, remainder carbonfibre; semi-monocoque all metal fuselage, sharply tapered and downswept aft of flat-sided cockpit area, with ogival dielectric nosecone; small vortex generator each side of nose helps to overcome early tendency to aileron reversal at angles of attack above 25° tail surfaces carried on slim booms alongside engine nacelles

LANDING GEAR: Retractable tricycle type, made by Hydromash, with single wheel on each main unit and twin nose wheels. Mainwheels retract forward into wingroots turning through 90° to lie flat above leg, nosewheels, on trailing-link oleo, retract rearward between engine air intakes. Hydraulic retraction and extension, with mechanical emergency release. Nosewheels steerable ±8° for taxying, T-O and landings, ±30° for slow speed manoeuvring in confined areas (selector in cockpit). Mainwheel tyres size 840 × 290 mm, nosewheel tyres size 570 × 140 mm Pneumatic steel brakes. Mudguard to rear of nosewheels Container for 17 m² (183 sq ft) cruciform brake-chute in centre of boat-tail between engine nozzles

POWER PLANT: Two Klimov/Sarkisov RD-33 turbofans, each 49.4 kN (11,110 lb st) dry and 54.9 to 81.4 kN (12,345 to 18,300 lb st) with afterburning. Engine ducts canted at approximately 9°, with wedge intakes, sweptback at approximately 35°, under wingroot leading-edge extensions. Multisegment ramp system, including top-hinged forward door (containing a very large number of small holes) inside each intake that closes the duct while aircraft is taking off or landing, to prevent ingestion of foreign objects, ice or snow. Air is then fed to each engine through five louvres in top of each wingroot leading-edge extension and perforations in duct closure door. Doors are opened by extension of nose gear oleo when T-O speed reaches 108 knots (200 km/h, 124 mph) and closed by oleo compression at touchdown. Louvres also have air inlet control function, sometimes asymmetrical with three lattice spill doors aft of each. Basic 'Fulcrum-A' has integral fuel tank in inboard portion of each wing, capacity 350 litres (92.5 US gallons, 77 Imp gallons); four tanks in fuselage, respectively 705 litres (186 US gallons, 155 Imp gallons), 875 litres (231 US gallons, 192.5 Imp gallons), 1,800 litres (476 US gallons, 396 Imp gallons) and 285 litres (75 US gallons, 62.5 Imp gallons), total fuel capacity 4,365 litres (1,153 US gallons, 960 Imp gallons). Attachment for 1,500 litre (396 US gallon, 330 Imp gallon) non-conformal external fuel tank under fuselage, between ducts. Some aircraft piped to carry 1,150 litre (304 US gallon, 253 Imp gallon) external tank under each wing. Single-point pressure refuelling through receptacle in port wheel well. Overwing receptacles for manual fuelling. Airscoop for GTDE-117 turboshaft APU, rated at 73 kW (98 eshp), for engine starting, above rear fuselage on port side, exhaust passes through underbelly fuel tank when fitted

ACCOMMODATION: Pilot only, on 10° inclined K-36DM zero/zero ejection seat, under hydraulically actuated rearward hinged transparent blister canopy in high-set cockpit. Sharply inclined one-piece curved windscreen. Three internal mirrors provide rearward view

SYSTEMS: Hydraulic system pressure 207 bars (3,000 lb/sq in), with 80 litres (21 US gallons; 17.5 Imp gallons) fluid

AVIONICS: Integrated by NPO Elektro Avtomatika

Comms: R 862 com radio; SRO-2 ('Odd Rods') IFF transponder and SRZ-15 interrogator. Optional V/UHF radios.

Radar: RLS RP-29 (N019 Sapfir-29) coherent pulse Doppler look-down/shoot-down engagement radar (NATO 'Slot Back'; able to track 10 targets simultaneously; search range 54 n miles, 100 km, 62 miles, tracking range 38 n miles; 70 km, 43 miles), target tracking limits 60° up, 38° down, 67° each side, collimated with laser rangefinder

Flight: ARK-19 DF. Optional INS, Tacan, VOR/ILS and/or GPS equipment

Instrumentation: HUD; infra-red search/track sensor (fighter detection range 8 n miles, 15 km, 9.25 miles) forward of windscreen (protected by removable fairing on

Afterburner take-off by sixth MiG-29M prototype 05556 *(Paul Jackson)* *1995*

non-operational flights), and helmet-mounted target designation system for off-axis aiming of air-to-air missiles.

Self-defence: Sirena-3 360° radar warning system, with sensors on wingroot extensions, wingtips and port fin. Two SO-69 ECM antennae under conformal dielectric fairings in leading-edge of each wingroot extension. BVP 30-26M flare dispenser, with thirty 26 mm cartridges, in each fin root extension.

ARMAMENT: Six close-range R-60T or R-60MK (NATO AA-8 'Aphid') infra-red air-to-air missiles, or four R-60TMK and two medium-range radar guided R-27R1 (AA-10A 'Alamo-A'), on three pylons under each wing; alternative air combat weapons include R-73A or R-73E (AA-11 'Archer') close-range infra-red missiles. Able to carry eight FAB-250 or four FAB-500 bombs, KMGU-2 submunitions dispensers, 3B-500 napalm tanks, B-8M1 (20 × 80 mm) rocket packs and 130 mm and 240 mm rockets in attack role. One 30 mm GSh-301 gun in port wingroot leading-edge extension, with 150 rounds.

DIMENSIONS, EXTERNAL:

Wing span	11.36 m (37 ft 3¼ in)
Wing chord, at c/l	5.60 m (18 ft 4½ in)
at tip	1.27 m (4 ft 2 in)
Wing aspect ratio	3.5
Length overall: incl noseprobe	17.32 m (56 ft 10 in)
excl noseprobe	16.28 m (53 ft 5 in)
Length of fuselage, excl noseprobe	14.875 m (48 ft 9¾ in)
Height overall	4.73 m (15 ft 6¼ in)
Tailplane span	7.78 m (25 ft 6¼ in)
Wheel track	3.09 m (10 ft 1¾ in)
Wheelbase	3.645 m (11 ft 11½ in)

AREAS:

Wings, gross	38.0 m² (409.0 sq ft)

WEIGHTS AND LOADINGS (A, MiG-29; B, MiG-29S):

Operating weight empty: A	10,900 kg (24,030 lb)
Max weapon load: A	3,000 kg (6,615 lb)
Max fuel load: A	4,640 kg (10,230 lb)
B	6,670 kg (14,705 lb)
Normal T-O weight (interceptor):	
A	15,240 kg (33,600 lb)
B	15,300 kg (33,730 lb)
Max T-O weight: A	18,500 kg (40,785 lb)
B	19,700 kg (43,430 lb)
Max wing loading	486.8 kg/m² (99.7 lb/sq ft)
Max power loading	113.6 kg/kN (1.11 lb/lb st)

PERFORMANCE:

Max level speed: at height: A, B	Mach 2.3 (1,320 kts; 2,445 km/h; 1,520 mph)
at S/L: A, B	Mach 1.225 (810 kts; 1,500 km/h; 932 mph)
T-O speed: A	119 kts (220 km/h; 137 mph)
B	140-151 kts (260-280 km/h; 162-174 mph)
Acceleration: A, B at 1,000 m (3,280 ft):	
325-595 kts (600-1,100 km/h; 373-683 mph)	13.5 s
595-700 kts (1,100-1,300 km/h; 683-805 mph)	8.7 s
Approach speed: A	140 kts (260 km/h; 162 mph)
Landing speed: A	127 kts (235 km/h; 146 mph)
B	135-140 kts (250-260 km/h; 155-162 mph)
Max rate of climb at S/L: A, B	19,800 m (65,000 ft)/min
Service ceiling: A	17,000 m (55,775 ft)
B	18,000 m (59,050 ft)
T-O run: A, B with afterburning	250 m (820 ft)
B without afterburning	600-700 m (1,970-2,300 ft)
Landing run, with brake-chute:	
A, B	600-700 m (1,970-2,300 ft)
Radius of turn at 3.8g:	
A at 432 kts (800 km/h; 497 mph)	350 m (1,150 ft)
A at over 216 kts (400 km/h; 249 mph)	225 m (740 ft)
Range: A with max internal fuel	810 n miles (1,500 km; 932 miles)
A with underbelly auxiliary tank	1,133 n miles (2,100 km; 1,305 miles)
B with three external tanks	1,565 n miles (2,900 km; 1,800 miles)
g limits: above Mach 0.85: A	+7
below Mach 0.85: A, B	+9

UPDATED

MIKOYAN MiG-31

NATO reporting name: Foxhound

TYPE: Two-seat twin-engined strategic interceptor.

PROGRAMME: First flown, as Ye-155MP (originally Type 83 MiG-25MP), 16 September 1975; production started 1979; first regiments operational 1982, replacing MiG-23s and Su-15s; production continues at Sokol production plant, Nizhny Novgorod.

CURRENT VERSIONS: **MiG-31** (Type 01; 'Foxhound-A'): Two-seat, all-weather, all-altitude interceptor, able to be guided automatically, and to engage targets, under ground control.

Detailed description applies to this version.

MiG-31M (Type 05; 'Foxhound-B'): Improved interceptor, under development since 1984, first shown publicly February 1992; upgraded engines, with modified nozzles, one-piece rounded windscreen, small side windows only for rear cockpit; wider and deeper dorsal spine, containing additional fuel, more rounded wingtips, with flush dielectric areas at front and rear; taller fins with larger, curved root extensions; modified and extended wingroot leading-edge extensions, smaller wing upper-surface fences, all systems upgraded, digital flight controls, multifunction CRT cockpit displays; new Phazotron phased-array radar, with 1.40 m (55 in) diameter antenna, in 3° 30′ downward-inclined nose; semi-retractable flight refuelling probe transferred to starboard side of nose; non-retractable IRST pod, no gun; number of fuselage weapon stations increased to six, by addition of two centreline pylons, with R-37 AAMs instead of R-33s, four new-type underwing pylons for R-77 (AA-12) AMRAAM class active radar-guided missiles. Prototype lost on 9 August 1991, seven more prototypes, at least one (057) with cylindrical wingtip ECM/ECCM jammer pods carrying upper and lower winglets. Maximum T-O weight 52,000 kg (114,640 lb).

MiG-31B (Type 12): Some basic MiG-31s converted and others built under this designation. Possible hybrid of MiG-31/31M, compatible with R-37 AAMs and with interchangeable wingtips, but retaining original radar. Avionics upgrade includes A-723 long-range navigation system, compatible with Loran/Omega and Chaika ground stations.

Two **MiG-31A** (Type 07) dedicated anti-satellite models were produced, with ballast instead of radar in nose, a flat fuselage undersurface without recesses, and underwing ASAT missiles.

CUSTOMERS: CIS air forces including 300 with Russian air defence forces, 30 with tactical units; others reportedly to China.

DESIGN FEATURES: Initiated to counter threat of USAF B-52 bombers carrying ALCMs. Basic MiG-25 configuration retained, but very different aircraft, strengthened to permit supersonic flight at low altitude; more powerful engines than MiG-25; major requirement increased range, not speed, advanced digital avionics; Zaslon radar was first electronically scanned phased-array type to enter service, enabling MiG-31 to track 10 targets and engage four simultaneously, including targets below and behind its own location; fuselage weapon mountings added, crew increased to two. Wing anhedral 4° from roots; sweepback approximately 40° on leading-edge, 32° at quarter-chord, with small sharply swept wingroot extensions, all-swept tail surfaces, with twin outward canted fins and dihedral horizontal surfaces.

FLYING CONTROLS: Large-span ailerons and flaps, wing leading-edge slats in four sections on each wing, all-moving horizontal tail surfaces, inset rudders.

STRUCTURE: Airframe 50 per cent arc-welded nickel steel, 16 per cent titanium, 33 per cent light alloy, 1 per cent composites, including radome; three-spar wings, no wingtip fairings or mountings; small forward-hinged airbrake under front of each intake trunk, undersurface of centre-fuselage not dished between engine ducts like MiG-25, much enlarged air intakes, jet nozzles extended rearward, shallow fairing extends forward from base of each fin leading-edge; fence above each wing in line with stores pylon.

Development MiG-31M 21496 with original refuelling probe and windscreen *(Paul Jackson)* *1995*

LANDING GEAR: Retractable tricycle type, offset tandem twin wheels on each main unit, retracting forward into air intake trunk, facilitate operation from unprepared ground and gravel, rearward retracting twin nosewheel unit with mudguard.

POWER PLANT: Two Aviadvigatel D-30F6 turbofans, each 93.1 kN (20,930 lb st) dry, 151.9 kN (34,170 lb st) with afterburning, internal fuel capacity approximately 20,250 litres (5,350 US gallons; 4,455 Imp gallons), provision for two underwing tanks, each 2,500 litres (660 US gallons; 550 Imp gallons), semi-retractable flight refuelling probe on port side of front fuselage.

ACCOMMODATION: Pilot and weapon systems operator in tandem under individual rearward hinged canopies; rear canopy has only limited side glazing and blends into shallow dorsal spine fairing which extends to forward edge of jet nozzles.

AVIONICS: *Radar:* NIIP N007 S-800 Zaslon electronically scanned phased-array fire control radar (NATO 'Flash Dance') in nose; search range of 108 n miles (200 km; 124 miles) in clutter-free forward sector, 65 n miles (120 km; 75 miles) in look-down mode; ranges in rear sector 48 n miles (90 km; 56 miles) and 37 n miles (70 km; 43 miles), respectively; capable of tracking 10 targets and attacking four simultaneously.

Flight: Marshrut long-range and Tropik medium-range nav systems.

Mission: In four-aircraft group interception mission, only lead MiG-31 is linked to AK RLDN automatic guidance network on ground; other three MiG-31s have APD-518 digital datalink to lead aircraft, permitting line-abreast radar sweep of zone 430 to 485 n miles (800 to 900 km; 495 to 560 miles) wide by 140° sector scanning angles. Semi-retractable infra-red search/track sensor under cockpit, tactical situation display.

Self-defence: Radar warning receivers.

EQUIPMENT: Active infra-red and electronic countermeasures.

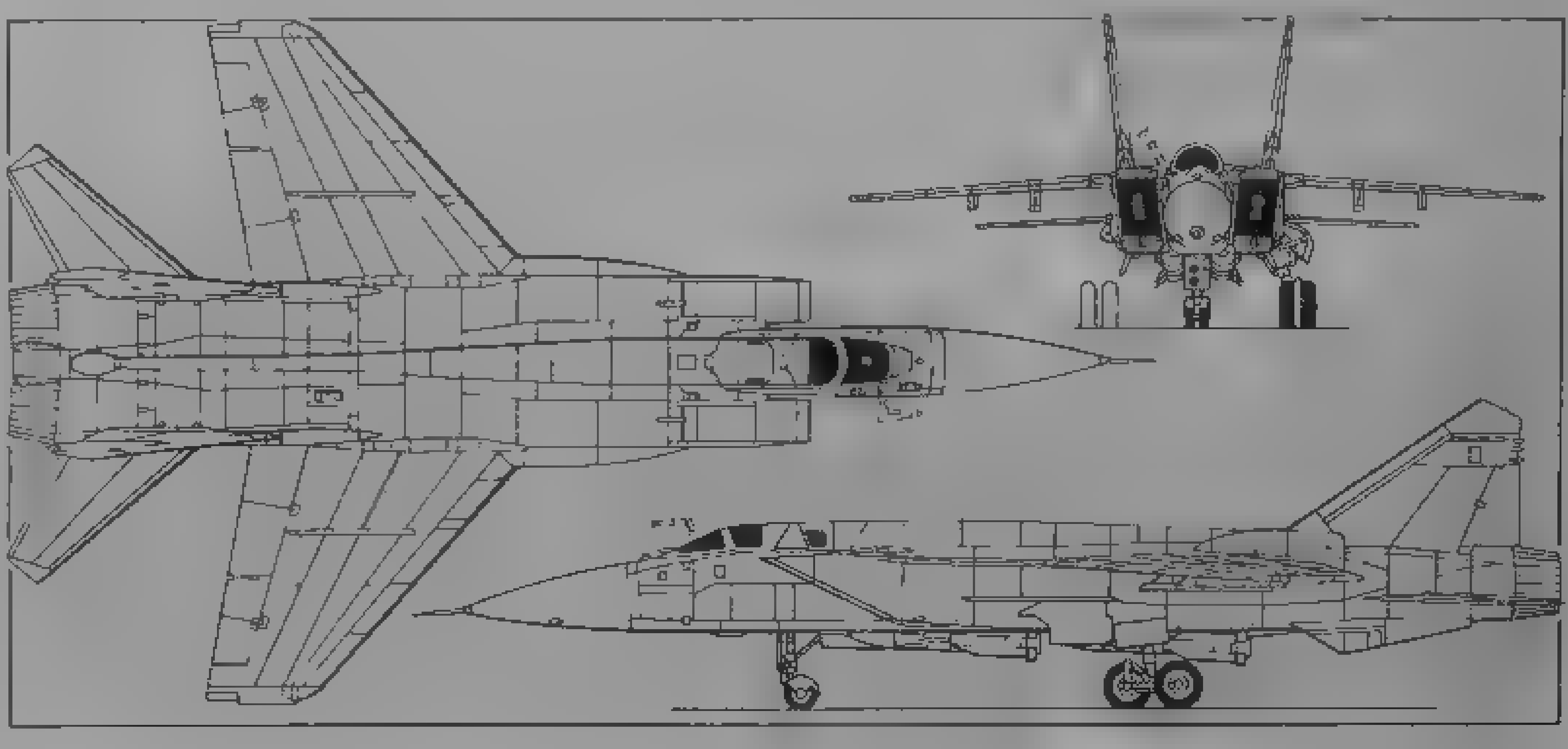
ARMAMENT: Four R-33 (NATO AA-9 'Amos') semi-active radar homing long-range air-to-air missiles in pairs on AKU ejector pylons under fuselage, plus two R-40T (AA-6 'Acrid') medium-range infra-red missiles on inner underwing pylons, four infra-red R-60 (K-60, AA-8 'Aphid') air-to-air missiles on outer underwing pylons, in pairs. Front pair of R-33s is semi-recessed in fuselage. GSh-6-23 six-barrel Gatling-type 23 mm gun inside fairing on starboard side of lower fuselage, adjacent main landing gear, with 260 rounds.

DIMENSIONS, EXTERNAL:

Wing span	13.464 m (44 ft 2 in)
Wing aspect ratio	2.94
Length overall	22.688 m (74 ft 5¼ in)
Height overall	6.15 m (20 ft 2¼ in)

AREAS:

Wings, gross	61.6 m² (663.0 sq ft)



MiG-31M ('Foxhound-B') all-weather interceptor *(Jane's/Mike Keep)* *1995*

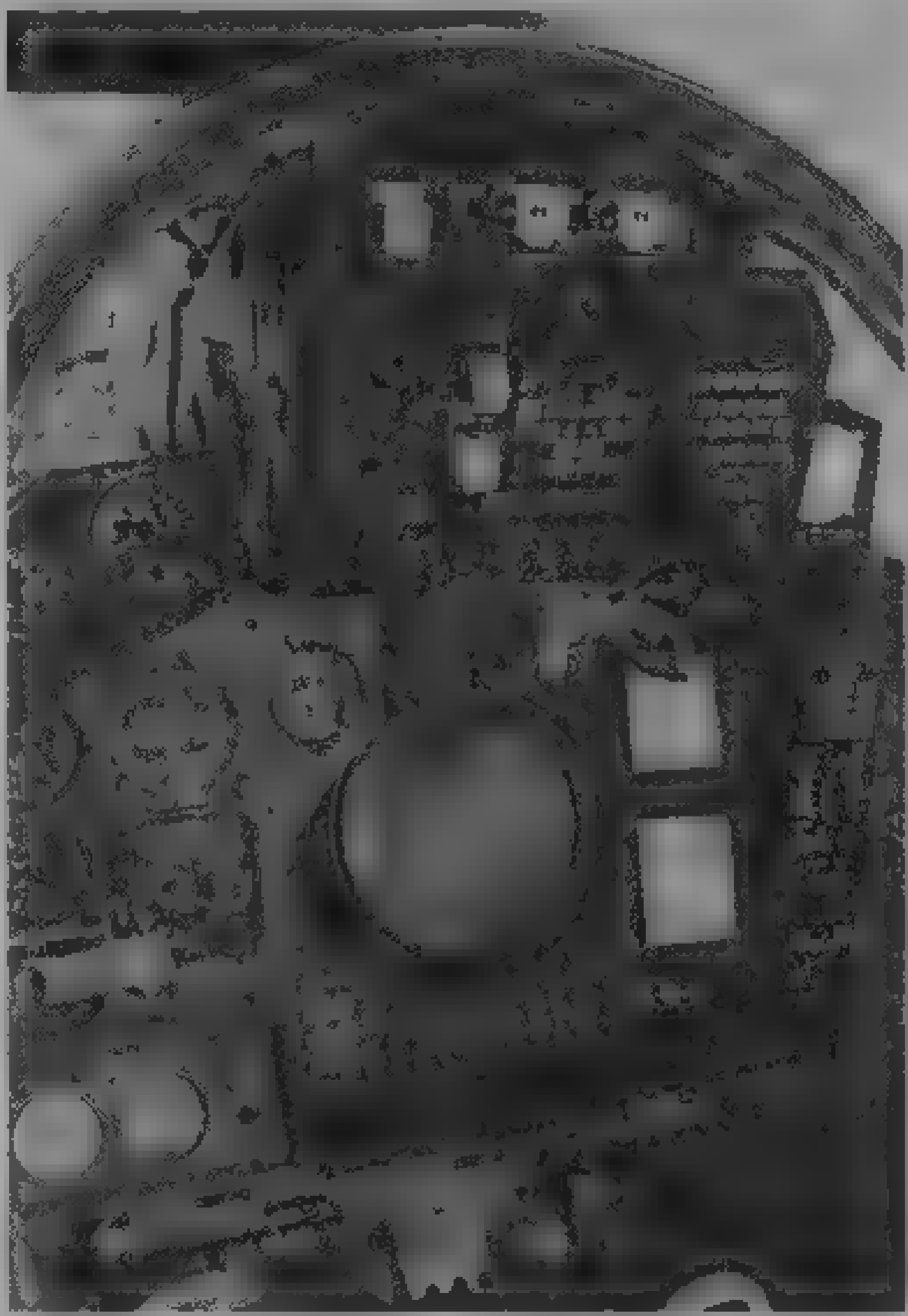
MiG-31B ('Foxhound-A') all-weather interceptor *(Piotr Butowski)*

1993

WEIGHTS AND LOADINGS
- Weight empty: 21,820 kg (48,105 lb)
- Internal fuel: 16,350 kg (36,045 lb)
- Max T-O weight:
  - with max internal fuel: 41,000 kg (90,390 lb)
  - with max internal fuel and two underwing tanks: 46,200 kg (101,850 lb)
- Max wing loading: 750.0 kg/m² (153.6 lb/sq ft)
- Max power loading: 152.0 kg/kN (1.49 lb/lb st)

PERFORMANCE
- Max permitted Mach number at height: Mach 2.83
- Max level speed at 17,500 m (57,400 ft): 1,620 kts (3,000 km/h; 1,865 mph)
  - at S/L: 810 kts (1,500 km/h; 932 mph)
- Max cruising speed at height: Mach 2.35
- Econ cruising speed: Mach 0.85
- Landing speed: 151 kts (280 km/h; 174 mph)
- Time to 10,000 m (32,800 ft): 7 min 54 s
- Service ceiling: 20,600 m (67,600 ft)
- T-O run at max T-O weight: 1,200 m (3,940 ft)
- Landing run: 800 m (2,625 ft)
- Radius of action with max internal fuel and four R-33 missiles: at Mach 2.35: 388 n miles (720 km; 447 miles)
  - at Mach 0.85: 647 n miles (1,200 km; 745 miles)
  - at Mach 0.85 with two underwing tanks: 755 n miles (1,400 km; 870 miles)
  - at Mach 0.85 with two underwing tanks and one flight refuelling: 1,185 n miles (2,200 km; 1,365 miles)
- Ferry range, max internal and external fuel, no missiles: 1,780 n miles (3,300 km; 2,050 miles)
- Max endurance with underwing tanks:
  - unrefuelled: 3 h 36 min
  - refuelled in flight: 6-7 h
- g limit: supersonic: +5

UPDATED



Rear cockpit of MiG-31 ('Foxhound-A') *(Piotr Butowski)*

1994

Front cockpit of MiG-31 ('Foxhound-A') *(Piotr Butowski)*

1994

MIKOYAN MiG-33

TYPE: Redesignated MiG-29M/ME (which see), brief data follow.

WEIGHTS AND LOADINGS
- Max weapons load: 5,500 kg (12,125 lb)
- Normal T-O weight: 16,800 kg (37,037 lb)

PERFORMANCE
- Max level speed at height: above Mach 2.2
- Max rate of climb at S/L: 19,800 m (64,960 ft)/min
- Max stabilised turn rate at 3,000 m (9,840 ft): 23°/s
- Combat radius:
  - with six air-to-air missiles and three external tanks: 755 n miles (1,400 km; 870 miles)
  - with 3,000 kg (6,615 lb) of bombs and three external tanks: 647 n miles (1,200 km; 745 miles)
- Max range:
  - internal fuel: 1,079 n miles (2,000 km; 1,242 miles)
  - with three external tanks: 1,726 n miles (3,200 km; 1,988 miles)

NEW ENTRY

MIKOYAN 1-42

TYPE: Single-seat multirole combat aircraft (mnogofunktsionalnyy-istrebityel MFI).

PROGRAMME: Intended as next generation fighter; two prototypes reported to be completed in advance of engine availability 1994; first flight possible with Lyulka engines as in Su-27/35 series; high-speed taxi trials began late 1994, but first flight still awaited (mid-1995), reportedly because of funding shortage.

DESIGN FEATURES: Accompanying illustration suggests possible main features of configuration. Twin-fin delta with large canards and possible thrust-vectoring engine nozzles with aim of improving on agility of Su-27. A degree of 'stealth' can be assumed, through use of RAM (radar absorbent materials) rather than RAS (radar absorbent structure). Emphasis on true multirole capability from start, with possible internal stowage for some air-to-air missiles and heavy reliance on countermeasures. Wing span similar to that of Su-27; unconfirmed reports of weight in 35,000 kg (77,160 lb) class.

POWER PLANT: Two Saturn/Lyulka AL-41F afterburning turbofans.

AVIONICS: *Radar:* New Phazotron-developed phased-array fire control radar.

UPDATED

MIKOYAN MiG-AT

TYPE: Two-seat advanced jet trainer and light attack aircraft.

PROGRAMME: Selected as one of two finalists in Russian competition to replace Aero L-29 and L-39 Albatros; under October 1992 agreement, two prototypes are powered by Larzac engines supplied by SNECMA of France; production aircraft will have Larzacs licence-built by Chernyshov of Moscow; prototype rolled out 18 May 1995, production of first series of 15 under way at MAPO Dementyev plant. Russian requirement for 200 to 250 trainers in this category, whether or not MiG-AT wins competition, will be offered for export.

CURRENT VERSIONS: **MiG-ATF:** Prototype, equipped with French avionics.

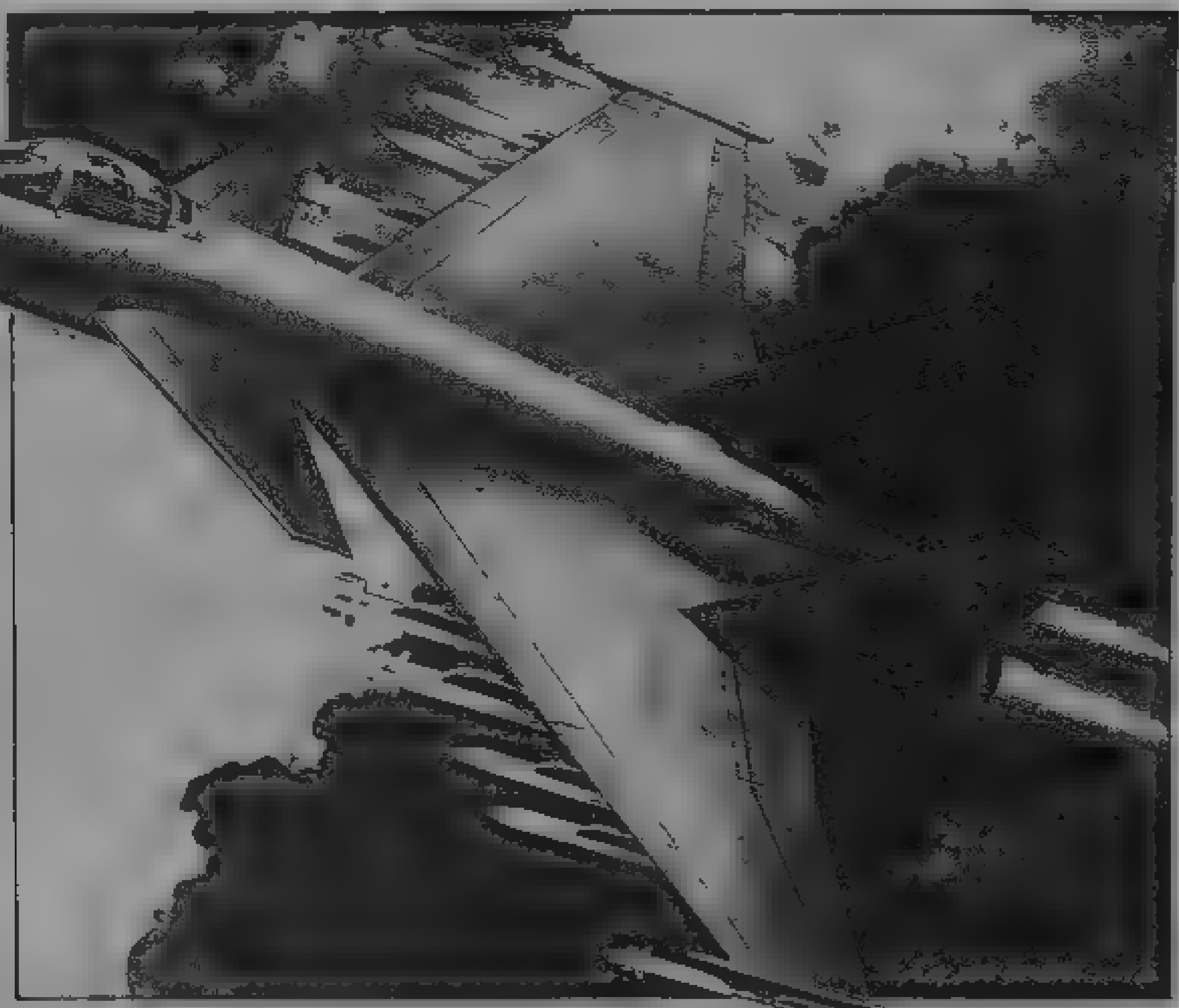
MiG-ATR: Second prototype, Russian avionics.

MiG-ATB (Boyevoy, combat): Light attack version, intended to compete in international market with BAe Hawk 200.

DESIGN FEATURES: Conventional low-wing monoplane, wing-root leading-edges sweptforward, with engine air intakes overwing; sweptback vertical tail surfaces, unswept tailplane, tailcone comprises two front-hinged door type

Representative MiG-33 (fifth prototype MiG-29M 05555) with AAM and ASM armament *(Peter J. Cooper)*

1995



Artist's impression of Mikoyan 1.42 multirole combat aircraft *(Jane's/Keith Fretwell)* 1994

MiG-ATF two-seat advanced jet trainer on display at Paris before first flight *(Paul Jackson)* 1995

airbrakes. Designed for manoeuvrability comparable with front-line combat aircraft, and service life of 15,000 flying hours or 30 years, with not fewer than 30,000 landings; maximum angle of attack of 25°, and sustained 5.4 *g* turn in 4 km (2.5 m le) radius at Mach 0.7. Onboard simulation of manoeuvring target, meteorological conditions and system failures via HUD, as well as all operational modes of the most modern combat aircraft.

FLYING CONTROLS: Fly-by-wire system.

STRUCTURE: Three-panel wings of aluminium alloy honeycomb; CFRP ailerons and flaps; 40 per cent of fuselage skin CFRP and GFRP; fin integral with rear fuselage. Production aircraft expected to have composites wings made in South Korea.

LANDING GEAR: Retractable tricycle type; single wheel on each unit; wide-track main units retract inward, nosewheel forward; mainwheel tyre size 660 × 200 mm, pressure 8.8 ± 0.5 bars (128 ± 7 lb/sq in); nosewheel tyre size 500 × 150 mm, pressure 4.9 ± 0.5 bars (71 ± 7 lb/sq in); high efficiency brakes; operation practicable from unpaved surfaces of bearing ratio 6 kg/cm² (85.3 lb/sq in).

POWER PLANT: Two Turbomeca-SNECMA Larzac 04-R20 turbofans; each 14.12 kN (3,175 lb st), mounted above wingroots. One fuselage fuel tank, capacity 850 kg (1,874 lb), and one in wing, capacity 200 kg (441 lb). Tanks pressurised with engine bleed air to ensure high-altitude supply.

ACCOMMODATION: Two crew in tandem, on zero/zero ejection seats, rear seat raised by 400 mm (15.75 in) to improve occupant's forward view; one-piece birdproof canopy.

AVIONICS: Integrated by Russian GosNIIAS avionics research institute and Sextant Avionique, France. Multifunctional central computer, with all data integrated through MIL-STD-1553B databus.

Flight: Automatic control system, air data system, INS, Tacan, ILS, IFF.

Instrumentation: Two multifunctional CRT displays with buttons, HUD with input from colour video and TV camera. HSI/ADI.

Self-defence: Radar warning receivers.

ARMAMENT (optional): Seven hardpoints for up to 2,000 kg (4,410 lb) of guided and unguided missiles, guns and bombs.

DIMENSIONS, EXTERNAL:	
Wing span	10.16 m (33 ft 4 in)
Wing aspect ratio	5.66
Length overall	12.01 m (39 ft 4¾ in)
Height overall	4.62 m (15 ft 2 in)
Wheel track	3.80 m (12 ft 5½ in)
Wheelbase	4.48 m (14 ft 8½ in)
AREAS:	
Wings, gross	17.67 m² (190.2 sq ft)
WEIGHTS AND LOADINGS:	
Normal T-O weight	4,610 kg (10,163 lb)
Max T-O weight	7,000 kg (15,430 lb)
Max wing loading	260-396 kg/m² (53.25-81.1 lb/sq ft)
Max power loading	193.3 kg/kN (1.90 lb/lb st)
PERFORMANCE (estimated):	
Max level speed	460 kts (850 km/h; 528 mph)
T-O speed	97 kts (180 km/h; 112 mph)
Landing speed	92 kts (170 km/h; 106 mph)
Service ceiling	15,500 m (50,850 ft)
Ferry range	1,620 n miles (3,000 km; 1,865 miles)
g limits	+8.0/−3.0

UPDATED

MIKOYAN MiG-110

TYPE: Projected twin-turboprop multipurpose transport.

PROGRAMME: Announced during 1993, shown in model form at MosAeroshow '93; development received government approval January 1994.

CURRENT VERSIONS: Cabin can be equipped for passenger, combined cargo/passenger or cargo operations.

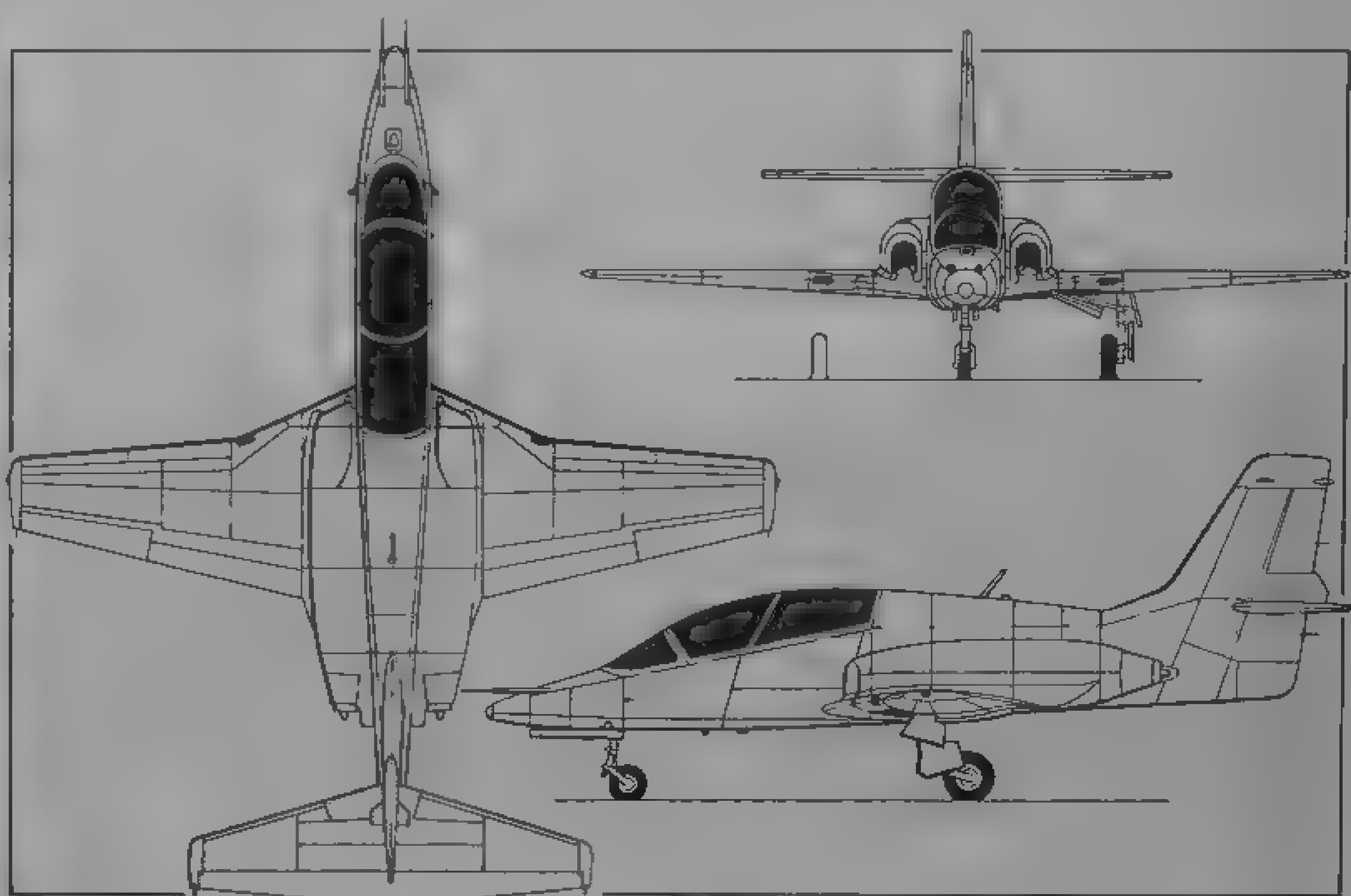
DESIGN FEATURES: High-wing monoplane; anhedral centre-section between twin booms carrying engines at front and twin fins at rear; horizontal tail surfaces between fin tips; retractable tricycle landing gear, suitable for use on paved or unpaved surfaces; twin wheels on each unit; mainwheels retract into booms to rear of engines; fuselage pod slung from centre-section, with upward-hinged rear fuselage section and loading ramp. Intended service life 25,000 hours.

FLYING CONTROLS: Conventional ailerons, elevator and twin rudders.

POWER PLANT: Two 1,838 kW (2,465 shp) Klimov TV7-117SV turboprops, six-blade propellers.

ACCOMMODATION: Seats for 35 passengers; or provisions for 15 passengers and 3,500 kg (7,715 lb) of freight, or

Front cockpit of MiG-ATF (French avionics) *(Paul Jackson)* 1995



Provisional three-view of Mikoyan MiG-AT advanced trainer *(Jane's/Mike Keep)* 1995

5,000 kg (11,025 lb) freight. Cargo hold can be refrigerated. To be available with equipment for ambulance, patrol, firefighting, rescue and agricultural duties

DIMENSIONS, EXTERNAL:

Wing span	22.12 m (72 ft 7 in)
Length overall	18.295 m (60 ft 0¼ in)
Height overall	5.385 m (17 ft 8 in)

DIMENSIONS, INTERNAL:

Cargo cabin: Length	7.40 m (24 ft 3¼ in)
Max width	2.20 m (7 ft 2½ in)
Max height	2.20 m (7 ft 2½ in)

WEIGHTS AND LOADINGS:

Max T-O weight	15,300 kg (33,730 lb)

PERFORMANCE (estimated):

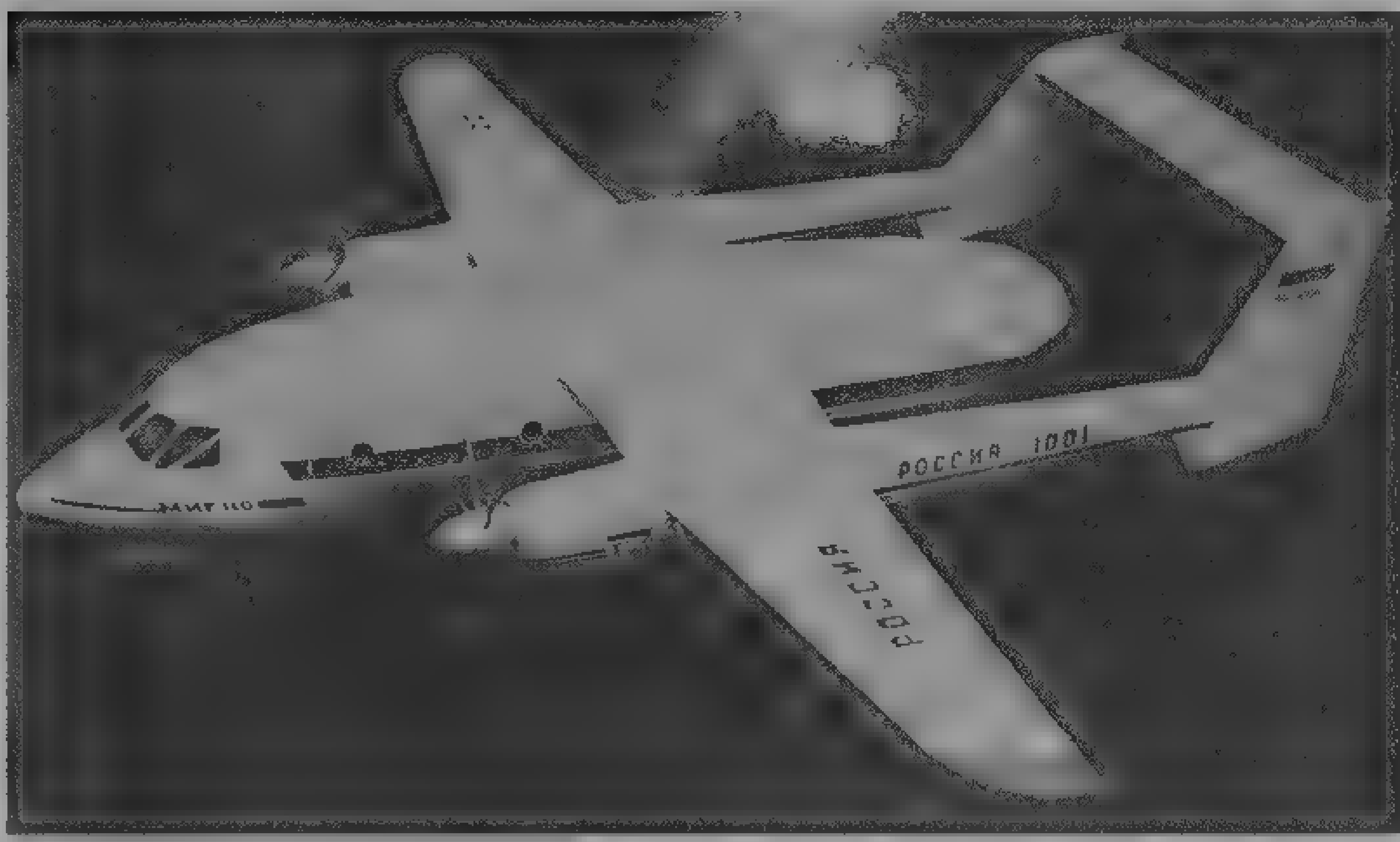
Nominal cruising speed at 11,000 m (36,000 ft)	270 kts (500 km/h, 310 mph)
T-O run	600 m (1,970 ft)
Range, 30 min reserve: with max payload	836 n miles (1,550 km, 963 miles)
with max fuel	2,185 n miles (4,050 km, 2,515 miles)

UPDATED

OTHER AIRCRAFT

MiG-23 and **MiG-27** series retired from Russian combat service, full descriptions in 1994-95 *Jane's*; now in *Jane's Aircraft Upgrades*

NEW ENTRY



Model of MiG-110 twin-turboprop cargo/passenger transport *(Paul Jackson)*

1995

MIL

MOSKOVSKY VERTOLYOTNY ZAVOD (MVZ) IMIENI M. L. MILYA (Moscow Helicopter Plant named after M. L. Mil)

2 Sokolnichyesky Val, 107113 Moscow
Telephone: 7 (095) 264 90 83
Fax: 7 (095) 264 55 71
Telex: 412144 MIL SU

CHIEF DIRECTOR, GENERAL DESIGNER: Mark V. Vineberg

OKB founded 1947 by Mikhail Leontyevich Mil, who was involved with Soviet gyroplane and helicopter development from 1929 until his death on 31 January 1970, aged 60. His original Mi-1, first flown September 1948 and introduced into service 1951, was first series production helicopter built in former USSR. More than 25,000 helicopters of Mil design built, representing 95 per cent of all helicopters in CIS.

Mil design and production facilities to be integrated into group comprising Mil Moscow, Kazan and Rostov plants, a helicopter operating company, financial and insurance interests. Associates will include Ulan-Ude production centre, Arsenyev and Viatka factories.

VERIFIED

MIL Mi-6 and Mi-22

NATO reporting name: Hook

TYPE: Twin-turbine heavy transport helicopter.

PROGRAMME: Joint military/civil requirement issued 1954, prototype flew 5 June 1957 as, by far, world's largest helicopter of that time; five built for development testing, initial preseries of 30, more than 860 built for civil/military use, ending 1981, developments included Mi-10 and Mi-10K flying cranes, Mi-6 dynamic components used in duplicated form on V-12 (Mi-12) of 1967, which remains largest helicopter yet flown.

CURRENT VERSIONS: **Mi-6** ('Hook A'): Basic transport. *Description applies to this version.* Full description last appeared in 1983-84 *Jane's*.

Mi-6VKP (vozduzhnyi komandnii punkt: airborne command post) ('Hook B'): Command support helicopter, flat bottom U-shape antenna under tailboom; X configuration blade antennae forward of horizontal stabilisers, large heat exchanger on starboard side of cabin, small cylindrical container aft of starboard rear cabin door.

Mi-6AYa/Mi-22 ('Hook C'): Developed command support version with sweptback plate antenna above forward part of tailboom instead of 'Hook-B's' U-shape antenna, small antennae under fuselage, pole antenna on starboard main landing gear of some aircraft.

CUSTOMERS: CIS ground forces, primarily to haul guns, armour, vehicles, supplies, freight and troops in combat areas, but also in command support roles, air forces of Algeria, Iraq, Peru and Vietnam, Peruvian Army Aviation. More than 60 exported by Aviaexport.

DESIGN FEATURES: Two small shoulder wings offload rotor by providing some 20 per cent of total lift in cruising flight. Removed when aircraft is operated as flying crane.

POWER PLANT: Two 4,045 kW (5,425 shp) Aviadvigatel/Soloviev D-25V (TV-2BM) turboshafts, mounted side by side above cabin, forward of main rotor shaft. Eleven internal fuel tanks, capacity 6,315 kg (13,922 lb); two external tanks, on each side of cabin, capacity 3,490 kg (7,695 lb); provision for two ferry tanks inside cabin, capacity 3,490 kg (7,695 lb).

ACCOMMODATION: Crew of five: two pilots, navigator, flight engineer and radio operator. Four jettisonable doors and overhead hatch on flight deck. Electrothermal anti-icing system for glazing of flight deck and navigator's compartment. Equipped normally for cargo operation, with easily removable tip-up seats along sidewalls; when these seats are supplemented by additional seats in centre of cabin, 65 to 90 passengers can be carried, with cargo or baggage in aisles. Normal military seating for 70 combat equipped troops. As ambulance, 41 stretcher cases and two medical attendants on tip-up seats can be carried, one attendant's station, provided with intercom to flight deck; provision for portable oxygen installations for patients. Cabin floor stressed for loadings of 2,000 kg/m² (410 lb/sq ft), provision for cargo tiedown rings. Rear clamshell doors and ramps operated hydraulically. Standard equipment includes electric winch of 800 kg (1,765 lb) capacity and pulley block system. Central hatch in cabin floor for cargo sling for bulky loads. Three jettisonable doors, fore and aft of main landing gear on port side and aft of landing gear on starboard side.

AVIONICS: *Comms:* VHF and HF communications radio, intercom.

Flight: Radio altimeter, radio compass, three-channel autopilot, marker beacon receiver, directional gyro.

ARMAMENT: Some military Mi-6s have a 12.7 mm machine gun in nose.

DIMENSIONS, EXTERNAL:

Main rotor diameter	35.00 m (114 ft 10 in)
Tail rotor diameter	6.30 m (20 ft 8 in)
Length overall, rotors turning	41.74 m (136 ft 11½ in)
fuselage, excl nose gun and tail rotor	33.18 m (108 ft 10½ in)
Height overall	9.86 m (32 ft 4 in)
Wing span	15.30 m (50 ft 2½ in)
Wheel track	7.50 m (24 ft 7¼ in)
Wheelbase	9.09 m (29 ft 9¾ in)
Rear-loading doors: Height	2.70 m (8 ft 10¼ in)
Width	2.65 m (8 ft 8¼ in)
Passenger doors: Height: front door	1.70 m (5 ft 7 in)
rear doors	1.61 m (5 ft 3½ in)
Width	0.80 m (2 ft 7½ in)
Sill height: front door	1.40 m (4 ft 7¼ in)
rear doors	1.30 m (4 ft 3¼ in)
Central hatch in floor	1.44 m (4 ft 9 in) × 1.93 m (6 ft 4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	12.00 m (39 ft 4½ in)
Max width	2.65 m (8 ft 8¼ in)
Max height: at front	2.01 m (6 ft 7 in)
at rear	2.50 m (8 ft 2½ in)
Cabin volume	80 m³ (2,825 cu ft)

AREAS:

Main rotor disc	962.1 m² (10,356 sq ft)
Tail rotor disc	31.17 m² (335.5 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	27,240 kg (60,055 lb)
Max internal payload	12,000 kg (26,450 lb)
Max slung cargo	8,000 kg (17,637 lb)
Fuel load: internal	6,315 kg (13,922 lb)
with external tanks	9,805 kg (21,617 lb)
Max T-O weight with slung cargo at altitudes below 1,000 m (3,280 ft)	38,400 kg (84,657 lb)
Normal T-O weight	40,500 kg (89,285 lb)
Max T-O weight for VTO	42,500 kg (93,700 lb)
Max disc loading	44.17 kg/m² (9.05 lb/sq ft)

PERFORMANCE (at max T-O weight for VTO):

Max level speed	162 kts (300 km/h, 186 mph)
Max cruising speed	135 kts (250 km/h, 155 mph)
Service ceiling	4,500 m (14,750 ft)
Range with 8,000 kg (17,637 lb) payload	334 n miles (620 km, 385 miles)
Range with external tanks and 4,500 kg (9,920 lb) payload	540 n miles (1,000 km, 621 miles)
Max ferry range (tanks in cabin)	781 n miles (1,450 km, 900 miles)

VERIFIED

Mi-6VKP ('Hook-B') command support helicopter *(Mark Wagner/Flight International)*

1995

MIL Mi-8 (V-8)

NATO reporting name: Hip

TYPE: Twin-turbine multipurpose helicopter.

PROGRAMME: Development began May 1960, to replace piston-engined Mi-4; first prototype, with single AI-24V turboshaft and four-blade main rotor, flew June 1961, given NATO reporting name 'Hip-A'; second prototype ('Hip-B'), with two production standard TV2-117 engines and five-blade main rotor, flew August 1962; more than 10,000 Mi-8s, Mi-17s and Mi-171s (which see) marketed and delivered from Kazan (Mi-8, Mi-17) and Ulan-Ude (Mi-171) plants (see separate entries for addresses) for civil and military use, including 2,800 exported; many Mi-8s converted to Mi-17 standard.

CURRENT VERSIONS: **Mi-8** ('Hip-C'): Civil passenger helicopter, standard seating for 28 to 32 persons in main cabin with large square windows. *Detailed description applies to this version, except where indicated.*

Mil Mi-8MTV on humanitarian service in Cambodia with the UN *(Jean-Louis Gaynecoetche)*

1995

Mi-8T ('Hip-C'): Civil utility version; normal payload internal or external freight, but 24 tip-up passenger seats along cabin sidewalls optional, square cabin windows

Mi-8TG: Modified TV2-117TG engines permit operation on liquefied petroleum gas (LPG) and kerosene. LPG contained in large tanks, on each side of cabin, under low pressure. Engines switch to kerosene for take-off and landing. Reduced harmful exhaust emissions in flight offer anti pollution benefits. Modification to operate on LPG requires no special equipment and can be effected on in-service Mi-8s at normal maintenance centre. Weights unchanged. Large external tanks, each side of cabin, reduce payload by 100 to 150 kg (220 to 330 lb) over comparable ranges, with little effect on performance. First flight on LPG made 1987

Mi 8 Salon ('Hip-C'). De luxe version of standard Mi-8, normally 11 passengers, on eight-place inward-facing couch on port side, two chairs and swivelling seat on starboard side, with table, square windows, air-to-ground radiotelephone and removable ventilation fans; compartment for attendant, with buffet and crew wardrobe, forward of cabin, toilet (port) and passenger wardrobe (starboard) to each side of cabin rear entrance, alternative nine-passenger configuration; maximum T-O weight 10,400 kg (22,928 lb); range 205 n miles (380 km, 236 miles) with 30 minutes fuel reserve

Military versions, with smaller circular cabin windows, are

Mi-8T ('Hip-C'): Standard assault transport of CIS army support forces; twin-rack for stores each side, to carry 64 × 57 mm S-5 rockets in four UV-16-57 packs, or other weapons; more than 1,500 in service with CIS armies; some uprated to Mi-17 ('Hip-H') standard as **Mi-8MT** and **Mi-8MTV** (visotnii high-altitude, engines further uprated for 'hot and high' operation), identified by port-side tail rotor; twin or triple stores racks, but normal armament only 40 × 80 mm S-8 rockets in two B8V 8-20A packs

Mi-8PS ('Hip-C'): Military VIP transport, basically as civil Mi-8 Salon

Mi-8VZPU (vozdushnyi zapasnoi punkt upravlenya airborne reserve command post) ('Hip-D'): As 'Hip-C' but rectangular-section canisters on outer stores racks; two large dorsal antennae above forward part of tailboom; no armament

Mi-8TBK ('Hip-E'): Development of 'Hip-C'; KV-4 flexibly mounted 12.7 mm machine gun, with 700 rounds, in nose; triple stores rack each side, to carry total 192 S-5 rockets in six UV-32-57 packs, plus four 9M17P Falanga M (AT-2 'Swatter') anti-tank missiles (semi-automatic command to line of sight) on rails above racks, about 250 in CIS ground forces, some uprated to Mi-17 standard as **Mi-8MTV**, with port-side tail rotor

Mi-8TV ('Hip-F'): Export 'Hip-E', missiles changed to six 9M14 Malyutka (NATO AT-3 'Saggers', manual command to line of sight)

'Hip-G'. See separate entry on Mi-9

'Hip-H': See separate entry on Mi-17

Mi-8SMV ('Hip-J'): ECM version, additional small boxes each side of fuselage, fore and aft of main landing gear legs

Mi-8PPA ('Hip-K'): Active communications jammer, rectangular container and array of six cruciform dipole antennae each side of cabin; no Doppler box under tail boom, heat exchangers under front fuselage; some uprated to Mi-17 standard, with port-side tail rotor. See also Mi-17 'Hip-K derivative'

CUSTOMERS. CIS ground forces (estimated 2,400 Mi-8/17s), CIS air forces, at least 40 other air forces, civil operators worldwide

DESIGN FEATURES: Conventional pod and boom configuration, five-blade main rotor, inclined forward 4° 30′ from vertical interchangeable blades of basic NACA 230 section, solidity 0.0777, spar failure warning system, drag and flapping hinges a few inches apart, blades carried on machined spider; pendulum vibration damper; three-blade starboard tail rotor, transmission comprises VR-8 two-stage planetary main reduction gearbox giving main rotor shaft/engine rpm ratio of 0.016:1, intermediate and tail rotor gearboxes, main rotor brake, and drives off main gearbox for tail rotor, fan, AC generator, hydraulic pumps and tachometer generators, tail rotor pylon forms small vertical stabiliser; horizontal stabiliser near end of tailboom, clamshell rear-loading freight doors

FLYING CONTROLS: Mechanical system, with irreversible hydraulic boosters; main rotor collective pitch control linked to throttles.

STRUCTURE: All-metal, main rotor blades each have extruded light alloy spar carrying root fitting, 21 honeycomb-filled trailing edge pockets and blade tip; balance tab on each blade, each tail rotor blade made of spar and honeycomb filled trailing-edge; semi-monocoque fuselage

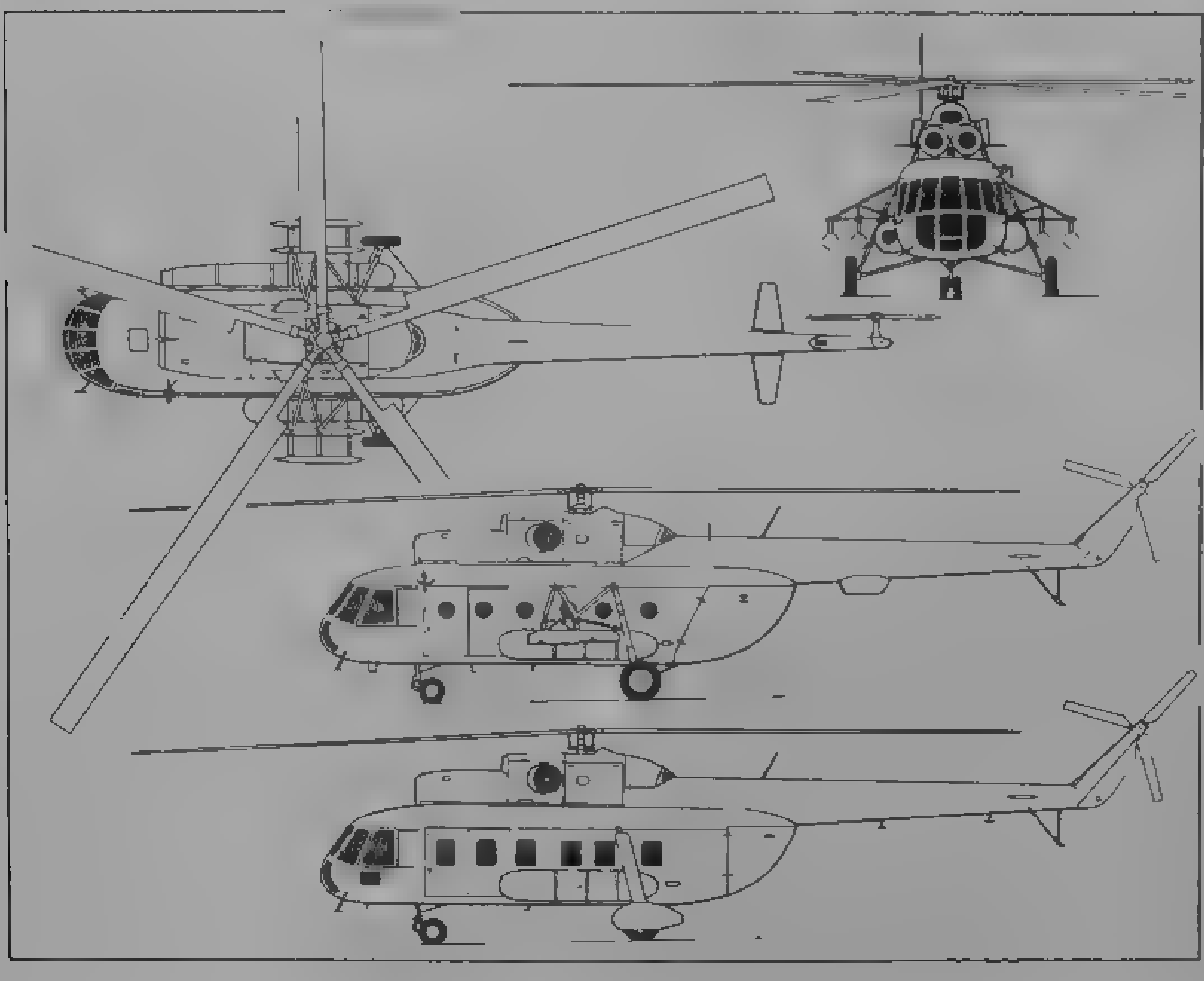
LANDING GEAR: Non-retractable tricycle type, steerable twin-wheel nose unit, locked in flight, single wheel on each main unit, oleo-pneumatic (gas) shock-absorbers. Mainwheel tyres 865 × 280 mm, nosewheel tyres 595 × 185 mm. Pneumatic brakes on mainwheels; pneumatic system can also recharge tyres in the field, using air stored in main landing gear struts. Optional mainwheel fairings.

POWER PLANT: Two 1,250 kW (1,677 shp) Klimov TV2-117A turboshafts (1,434 kW, 1,923 shp TV3-117MTs in Mi-8MT). Main rotor speed governed automatically, with manual override. Single flexible internal fuel tank, capacity 445 litres (117.5 US gallons, 98 Imp gallons), two external tanks, each side of cabin, capacity 745 litres (197 US gallons, 164 Imp gallons) in port tank, 680 litres (179.5 US gallons, 149.5 Imp gallons) in starboard tank, total standard fuel capacity 1,870 litres (494 US gallons; 411.5 Imp gallons). Provision for one or two ferry tanks in cabin raising maximum total capacity to 3,700 litres (977 US gallons; 814 Imp gallons). Fairing over starboard external tank houses optional cabin air conditioning equipment at front. Engine cowling side panels form maintenance platforms when open, with access via hatch on flight deck. Total oil capacity 60 kg (132 lb).

ACCOMMODATION: Two pilots side by side on flight deck, with provision for flight engineer's station. Military versions can be fitted with external flight deck armour. Windscreen de-icing standard. Basic passenger version furnished with 24 to 26 four-abreast track-mounted tip-up seats at pitch of 72 to 75 cm (28 to 29.5 in), with centre aisle 32 cm


Mil Mi-8MT, the uprated version of 'Hip-C' *(Piotr Butowski)*

1994


'Hip-C' military version of Mil Mi-8 twin-turbine helicopter, with additional side view (bottom) of commercial version *(Jane's/Dennis Punnett)*

1975

(12.5 in) wide removable bar, wardrobe and baggage compartment. Seats and bulkheads of basic version quickly removable for cargo carrying. Mi-8T and standard military versions have cargo tiedown rings in floor, winch of 150 kg (330 lb) capacity and pulley block system to facilitate loading of heavy freight, an external cargo sling system (capacity 3,000 kg, 6,614 lb), and 24 tip-up seats along sidewalls of cabin. All versions can be converted for air ambulance duties, with accommodation for 12 stretchers and tip-up seat for medical attendant. Large windows on each side of flight deck slide rearward. Sliding, jettisonable main passenger door at front of cabin on port side; electrically operated rescue hoist (capacity 150 kg, 330 lb) can be installed at this doorway. Rear of cabin made up of clamshell freight-loading doors, which are smaller on commercial versions, with downward-hinged passenger airstair door centrally at rear. Hook-on ramps used for vehicle loading.

SYSTEMS: Standard heating system can be replaced by full air conditioning system; heating of main cabin cut out when carrying refrigerated cargoes. Two independent hydraulic systems, each with own pump; operating pressure 44 to 64 bars (640 to 925 lb/sq in). DC electrical supply from two 27 V 18 kW starter/generators and six 28 Ah storage batteries, AC supply for automatically controlled electrothermal de-icing system and some radio equipment supplied by 208/115/36/7.5 V 400 Hz generator, with 36 V three-phase standby system. Engine air intake de-icing standard. Provision for oxygen system for crew and, in ambulance version, for patients. Freon fire extinguishing system in power plant bays and service fuel tank compartments, actuated automatically or manually. Two portable fire extinguishers in cabin.

AVIONICS: *Comms:* R-842 HF transceiver, frequency range 2 to 8 MHz and range up to 540 n miles (1,000 km, 620 miles), R-860 VHF transceiver on 118 to 135.9 MHz effective up to 54 n miles (100 km, 62 miles), intercom, radiotelephone.

Flight: Four-axis autopilot to give yaw, roll and pitch stabilisation under any flight conditions, stabilisation of altitude in level flight or hover, and stabilisation of preset flying speed. Doppler radar box under tailboom.

Instrumentation: For all-weather flying by day and night: two gyro horizons, two airspeed indicators, two main rotor speed indicators, turn indicator, two altimeters, two rate of climb indicators, magnetic compass, astrocompass for Polar flying, ARK-9 automatic radio compass, RV-3 radio altimeter with 'dangerous height' warning.

Self-defence (optional): Infra-red jammer ('Hot Brick') above forward end of tailboom, three ASO-2V flare dispensers above rear cabin window on each side.

ARMAMENT: See individual model descriptions of military versions.

DIMENSIONS, EXTERNAL:

Main rotor diameter	21.29 m (69 ft 10¼ in)
Tail rotor diameter	3.91 m (12 ft 9¾ in)
Distance between rotor centres	12.65 m (41 ft 6 in)
Length, overall, rotors turning	25.24 m (82 ft 9¾ in)
fuselage, excl tail rotor	18.17 m (59 ft 7⅜ in)
Width of fuselage	2.50 m (8 ft 2½ in)
Height overall	5.65 m (18 ft 6½ in)
Height to top of rotor head	4.38 m (14 ft 4½ in)
Wheel track	4.80 m (15 ft 9 in)
Wheelbase	4.26 m (13 ft 11¾ in)
Fwd passenger door: Height	1.41 m (4 ft 7½ in)
Width	0.82 m (2 ft 8¼ in)
Rear passenger door: Height	1.70 m (5 ft 7 in)
Width	0.84 m (2 ft 9 in)
Rear cargo door: Height	1.82 m (5 ft 11¾ in)
Width	2.34 m (7 ft 8¼ in)

DIMENSIONS, INTERNAL:

Passenger cabin: Length	6.36 m (20 ft 10½ in)
Width	2.34 m (7 ft 8¼ in)
Height	1.80 m (5 ft 10¾ in)
Cargo hold (freighter)	
Length at floor	5.34 m (17 ft 6¼ in)
Width	2.34 m (7 ft 8¼ in)
Height	1.80 m (5 ft 10¾ in)
Volume	23 m³ (812 cu ft)

Mil Mi-8T 'civil' utility helicopter in German Navy communications colour scheme *(Paul Jackson)* 1995

Mil Mi-8MTV-GA upgraded version of 'Hip C' *(Paul Jackson)* 1995

AREAS:

Main rotor disc	356 m² (3,832 sq ft)
Tail rotor disc	12.01 m² (129.2 sq ft)

WEIGHTS AND LOADINGS:

Weight empty:	
civil passenger version	6,799 kg (14,990 lb)
civil cargo version	6,624 kg (14,603 lb)
military versions (typical)	7,260 kg (16,007 lb)
Max payload, internal	4,000 kg (8,820 lb)
external	3,000 kg (6,614 lb)
Fuel: standard tanks	1,450 kg (3,197 lb)
with two auxiliary tanks	2,870 kg (6,327 lb)
Normal T-O weight	11,100 kg (24,470 lb)
T-O weight, with 28 passengers, each with 15 kg (33 lb) of baggage	11,570 kg (25,508 lb)
with 2,500 kg (5,510 lb) of slung cargo	11,428 kg (25,195 lb)
Max T-O weight for VTO	12,000 kg (26,455 lb)
Max disc loading	33.7 kg/m² (6.90 lb/sq ft)

PERFORMANCE (civil Mi-8T):

Max level speed at 1,000 m (3,280 ft):	
normal AUW	140 kts (260 km/h, 161 mph)
Max level speed at S/L:	
normal AUW	135 kts (250 km/h, 155 mph)
max AUW	124 kts (230 km/h, 142 mph)
with 2,500 kg (5,510 lb) of slung cargo	97 kts (180 km/h, 112 mph)
Max cruising speed:	
normal AUW	121 kts (225 km/h, 140 mph)
max AUW	97 kts (180 km/h, 112 mph)
Service ceiling: normal AUW	4,500 m (14,765 ft)
max AUW	4,000 m (13,125 ft)
Hovering ceiling at normal AUW:	
IGE	1,800 m (5,905 ft)
OGE	850 m (2,785 ft)
Ranges: cargo version at 1,000 m (3,280 ft), with standard fuel, 5% reserves	248-259 n miles (460-480 km, 286-298 miles)
with 24 passengers at 1,000 m (3,280 ft), with 20 min fuel reserves	229 n miles (425 km, 264 miles)
cargo version, with auxiliary fuel, 5% reserves	518 n miles (960 km, 596 miles)

UPDATED

Model of Mil Mi-8TG with large external tanks for LPG fuel *(Mark Lambert)* 1994

MIL Mi-9

NATO reporting name: Hip-G

Designation Mi-9 applies to airborne command post variant of Mi-8, 'hockey stick' antennae projecting from rear of cabin and from undersurface of tailboom, aft of Doppler radar box, rearward inclined short whip antenna above forward end of tailboom, strakes on fuselage undersurface. Crew of three to six.

VERIFIED

MIL Mi-14

NATO reporting name: Haze

TYPE: Twin-turbine shore-based amphibious helicopter.

PROGRAMME: Development of Mi-8; first flew September 1969, under designation V-14 and with Mi-8 power plant; changed to Mi-17 engines for production, which continues.

CURRENT VERSIONS: **Mi-14PL** ('Haze-A'): Basic ASW version; four crew; large undernose radome, OKA-2 retractable sonar in starboard rear of planing bottom, forward of two probable sonobuoy or signal flare chutes, APM-60 towed magnetic anomaly detection (MAD) bird stowed against rear of fuselage pod (moved to lower position on some aircraft); weapons include torpedoes, bombs and depth charges in enclosed bay in bottom of hull. VAS-5M-3 liferaft (in all versions).

Mi-14PW: Polish designation of Mi-14PL.

Mi-14BT ('Haze-B'): Mine countermeasures version, fuselage strake, for hydraulic tubing, and air conditioning pod on starboard side of cabin, no MAD; container for searchlight, to observe MCM gear during deployment and retrieval, under tailboom forward of Doppler box.

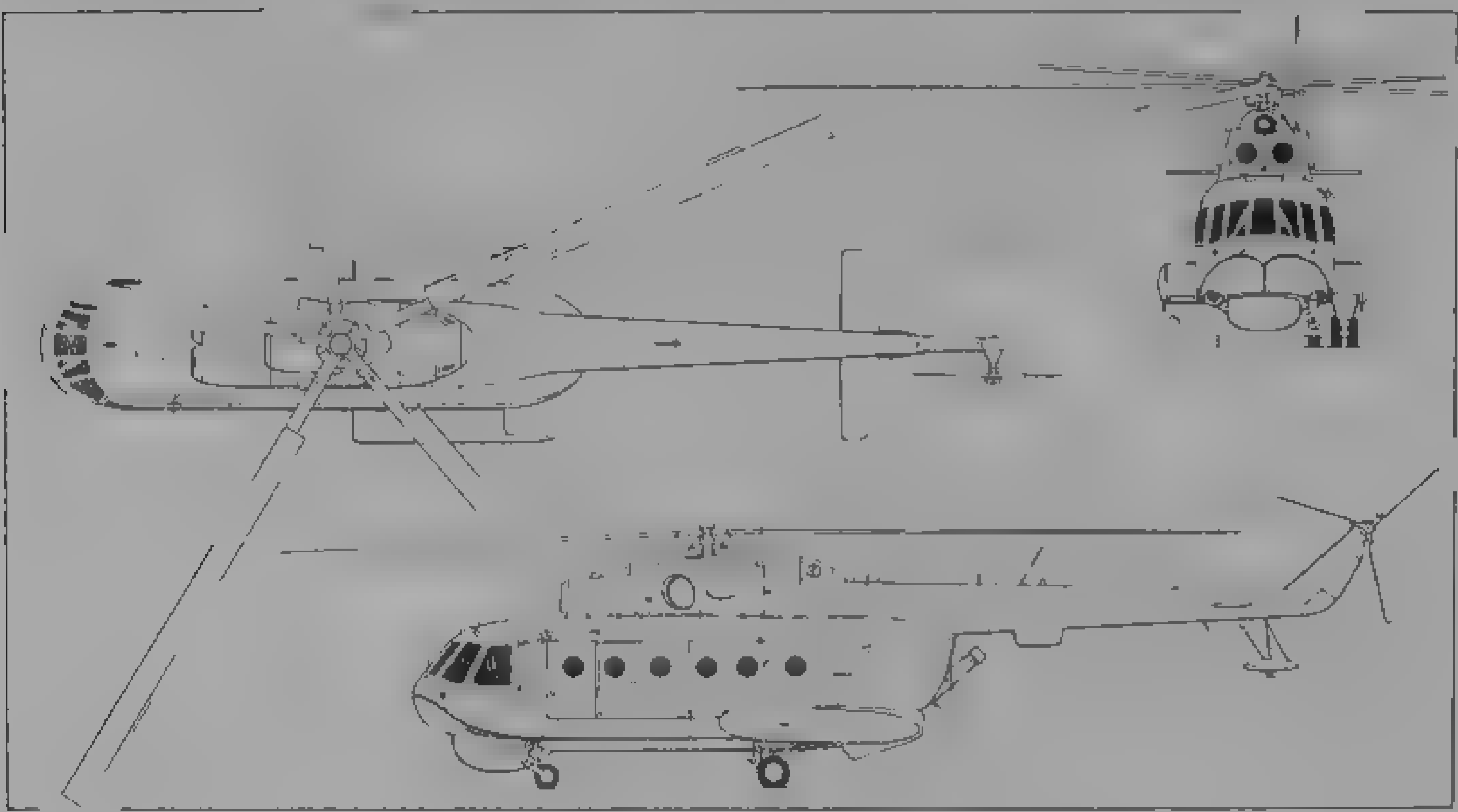
Mi-14PS ('Haze-C'): Search and rescue version, carrying ten 20-place liferafts, room for 10 survivors in cabin including two on stretchers, provision for towing many more survivors in liferafts, fuselage strake and air conditioning pod as Mi-14BT; double-width sliding door at front of cabin on port side, with retractable rescue hoist able to lift up to three persons in basket; searchlight each side of nose and under tailboom; three crew.

Details of a firefighting conversion of the Mi-14, known as the Terminator II, can be found under the Isolair entry in the US section of *Jane's Aircraft Upgrades*.

CUSTOMERS: At least 230 delivered. Russian Naval Aviation has 63, Bulgaria (10), Cuba (14), the former East Germany (eight, including Mi-14BT now withdrawn), North Korea, Libya (12), Poland (12 Mi-14PW, five Mi-14PS), Romania (six), Syria (12), Yugoslavia.

DESIGN FEATURES: Developed from Mi-8; power plant and dynamic components as Mi-17; new features include boat hull, sponson carrying inflatable flotation bag each side at rear and small float under tailboom; fully retractable

Mil Mi-14PL ('Haze-A') with MAD bird mounted in low position *(Piotr Butowski)*
1991



Mil Mi-14PL ASW helicopter (NATO 'Haze-A') *(Jane's/Dennis Punnett)*
1990

landing gear with two forward-retracting single-wheel nose units and two rearward-retracting twin-wheel main units.

AVIONICS (Mi-14PL): *Comms*: R-842-M HF transceiver, R-860 VHF transceiver, SBU-7 intercom.

Radar: Type 12-M undernose radar.

Instrumentation: RW3 radio altimeter, ARK-9 and ARK-U2 ADFs, DISS-15 Doppler, Chrom Nikel IFF, AP34-B autopilot/autohover system and SAU-14 autocontrol system.

DIMENSIONS, EXTERNAL:

Main rotor diameter	21.29 m (69 ft 10¼ in)
Main rotor blade chord	0.52 m (1 ft 8½ in)
Tail rotor diameter	3.91 m (12 ft 9¾ in)
Length overall, rotors turning	25.30 m (83 ft 0 in)
fuselage: Mi-14PL	18.38 m (60 ft 3½ in)
Mi-14PS	18.78 m (61 ft 7½ in)
Height overall	6.93 m (22 ft 9 in)
Wheelbase	4.13 m (13 ft 6½ in)

AREAS:

Main rotor disc	356 m² (3,832 sq ft)
Tail rotor disc	12.01 m² (129.2 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: Mi-14PL	11,750 kg (25,900 lb)
Max T-O weight	14,000 kg (30,865 lb)
Max disc loading	39.3 kg/m² (8.05 lb/sq ft)

PERFORMANCE:

Max level speed	124 kts (230 km/h; 143 mph)
Max cruising speed	116 kts (215 km/h; 133 mph)
Normal cruising speed	110 kts (205 km/h; 127 mph)
Service ceiling	3,500 m (11,500 ft)
Range with max fuel	612 n miles (1,135 km; 705 miles)
Endurance with max fuel	5 h 56 min

UPDATED

MIL Mi-17, Mi-171 and Mi-172

NATO reporting names: Hip-H and K derivative

TYPE: Twin-turbine multipurpose helicopter.

PROGRAMME: First displayed at 1981 Paris Air Show, successor to Mi-8 for civil use and export; exports began (to Cuba) 1983. Mi-17M/V and Mi-172 production continues at Kazan and Mi-171 at Ulan-Ude plants, from where they are marketed (see these entries for addresses).

CURRENT VERSIONS: **Mi-17** ('Hip-H'): Mid-life update of Mi-8 with more powerful turboshafts, giving overall performance improvement, particularly hover ceiling; in CIS military service, as Mi-8MT and Mi-8MTV. *Detailed description applies to basic Mi-17, except where indicated.*

Mi-17P ('Hip-K derivative'): ECM communications jammer; two observed in Hungarian service in 1990; antenna array much more advanced than that of Mi-8 ('Hip-K'), large 32-element array, resembling vertically segmented panel, aft of main landing gear each side, four-element array to rear on tailboom each side, large radome each side of cabin below jet nozzle, triangular container in place of rear cabin window each side; six heat exchangers under front fuselage.

Mi-171 ('Hip-H'): First displayed 1989 Paris Air Show; more powerful TV3-117VM turboshafts, each 1,545 kW (2,070 shp); improved rates of climb and hover ceilings; other weights and performance generally unchanged.

Mi-17 1VA: Version produced for Ministry of Health of former USSR as flying hospital equipped to highest practicable standards for relatively small helicopter; interior, with equipment developed in Hungary, had provision for three stretchers, operating table, extensive surgical and medical equipment, accommodation for doctor/surgeon and three nursing attendants.

Mi-17M/17V ('Hip-H'): Current production versions from Kazan Helicopter Production Association; TV3-117VM engines as Mi-171; optional nose radar, flotation gear and firefighting equipment.

Mi-17MD: Described under Kazan heading in this section.

Mi-172: As Mi-17M/17V, also from Kazan, but with equipment changes and planned for certification to FAR Pt 29 standards; TV3-117VM Srs 2 engines, giving maximum cruising speed of 118 knots (218 km/h; 135 mph) and service ceiling of 6,000 m (19,685 ft); air conditioning and heating systems, main and tail rotor blade de-icing, canopy demisting and heating of engine air intakes standard; options include flotation gear, Doppler, weather radar, DME, GPS, VOR, ILS, transponder and VIP interiors for seven, nine and 11 passengers. Standard seating for up to 26 passengers. First exhibited at 1994 Singapore Air Show. Seven ordered by Mesco, India, Spring 1995.

A **further military variant**, presumably with electronic warfare role, first seen in Czech Air Force service at Dobrany-Line air base, near Plzen, 1991; each of two examples had a tandem pair of large cylindrical containers mounted each side of cabin; assumed that containers made of dielectric material and contain receivers to locate and analyse hostile electronic emissions; each of two operator's stations in main cabin has large screens, computer-type keyboards and oscilloscope; several blade antennae project from tailboom.

An upgraded version of the Mi-172, known as the **MK 30**, is being developed by Daewoo Heavy Industries of South Korea (see *Jane's Aircraft Upgrades*).

CUSTOMERS: Many operational side by side with Mi-8s in CIS armed forces, Angola, Cuba (16), Czech Republic, Hungary, India, North Korea, Nicaragua, Papua New Guinea, Peru, Poland, Slovakia. More than 810 exported by Aviaexport. Up to 60 operated on international projects by SkyLink Aviation and Transportation Services, Canada.

DESIGN FEATURES: Distinguished from basic Mi-8 by port-side tail rotor; shorter engine nacelles, with air intakes extending forward only to mid-point of door on port side at front of cabin; small orifice each side forward of jetpipe; correct rotor speed maintained automatically by system that also synchronises output of the two engines. For operation in 'hot and high' conditions, Kazan commercial versions can be supplied with TV3-117MT engines and tail rotor with wider-chord blades.

POWER PLANT (basic Mi-17): Two 1,434 kW (1,923 shp) Klimov TV3-117MT turboshafts; should one engine stop, output of the other increased automatically to contingency rating of 1,637 kW (2,195 shp), enabling flight to continue. APU for pneumatic engine starting; deflectors on engine air intakes prevent ingestion of sand, dust and foreign objects.

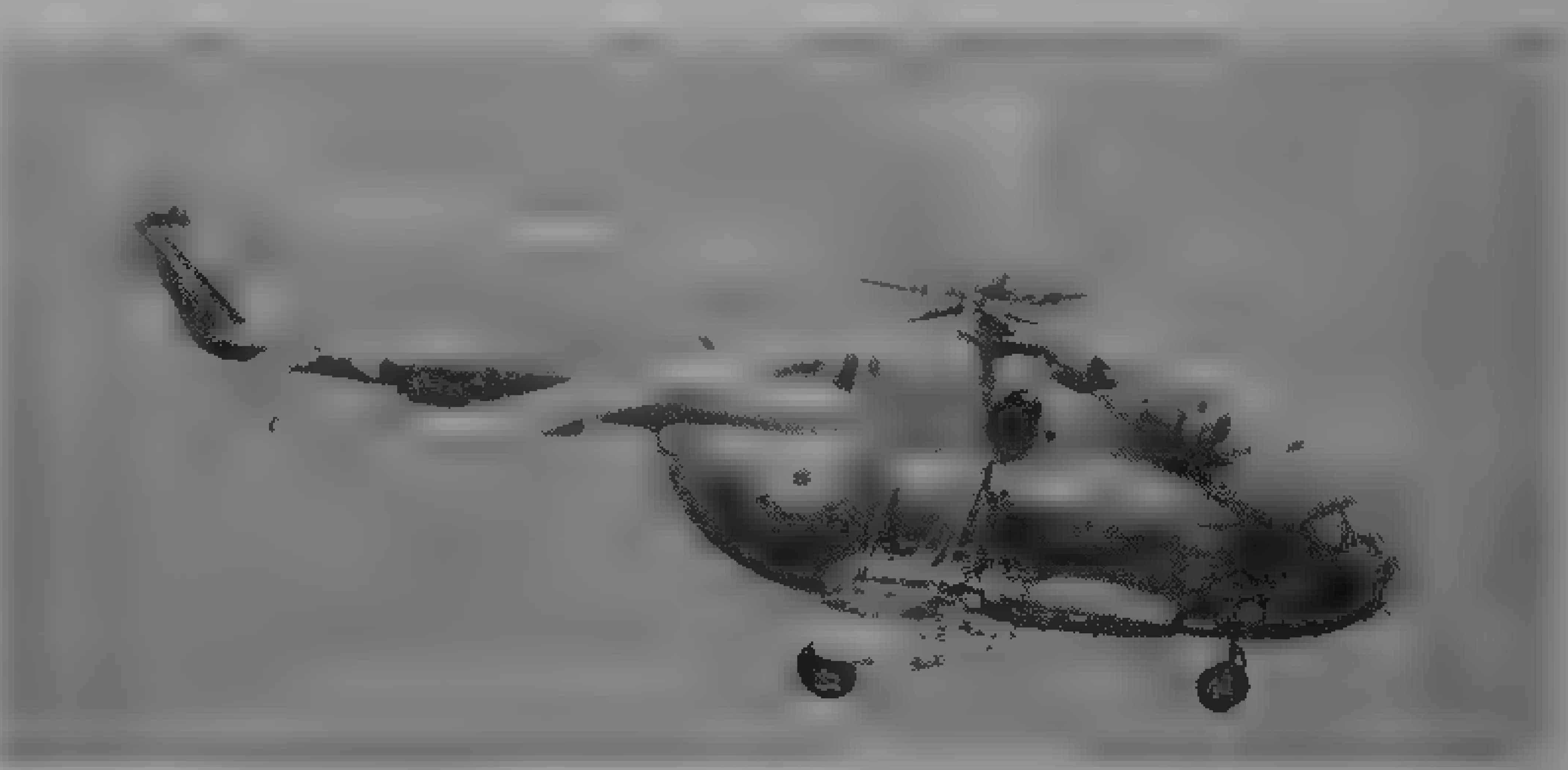
ACCOMMODATION: Configuration and payloads generally as Mi-8, but civilian Mi-17 promoted as essentially a cargo carrying helicopter, with secondary passenger transport role.

SYSTEMS (Mi-17V/171): AC electrical supply from two 40 kW three-phase 115/220 V 400 Hz GT40/P-48 V generators.

AVIONICS (Mi-17V/171): *Comms*: Baklan-20 and Yadro-1G1 com radio.

Radar: Type 8A 813 weather radar.

Flight: Type A-723 long-range nav



Mil Mi-17 ('Hip-H') in Indian Air Force service *(Peter Steinemann)*
1993

Instrumentation: ARK-15M radio compass, ARK-UD radio compass, DISS-32-90 Doppler; AGK-77 and AGR-74V automatic horizons, BKK-18 attitude monitor, ZPU-24 course selector; A 037 radio altimeter.
Self defence (optional): ASO-2 chaff/flare dispenser under tailboom and IR jammer (NATO 'Hot Brick') at forward end of tailboom.

EQUIPMENT: AI 9V APU for engine starting, options as for Mi-8, plus, on military versions, external cockpit armour.

ARMAMENT: Options as for Mi-8, plus 23 mm GSh-23 gun packs.

DIMENSIONS, EXTERNAL: As for Mi 8, except
Distance between rotor centres 12.661 m (41 ft 6½ in)
Length overall, rotors turning 25.352 m (83 ft 2 in)
fuselage, excl tail rotor 18.424 m (60 ft 5⅜ in)
Height to top of main rotor head 4.755 m (15 ft 7¼ in)
Wheel track 4.510 m (14 ft 9½ in)
Wheelbase 4.281 m (14 ft 0½ in)

DIMENSIONS, INTERNAL: As for Mi-8

AREAS: As for Mi 8

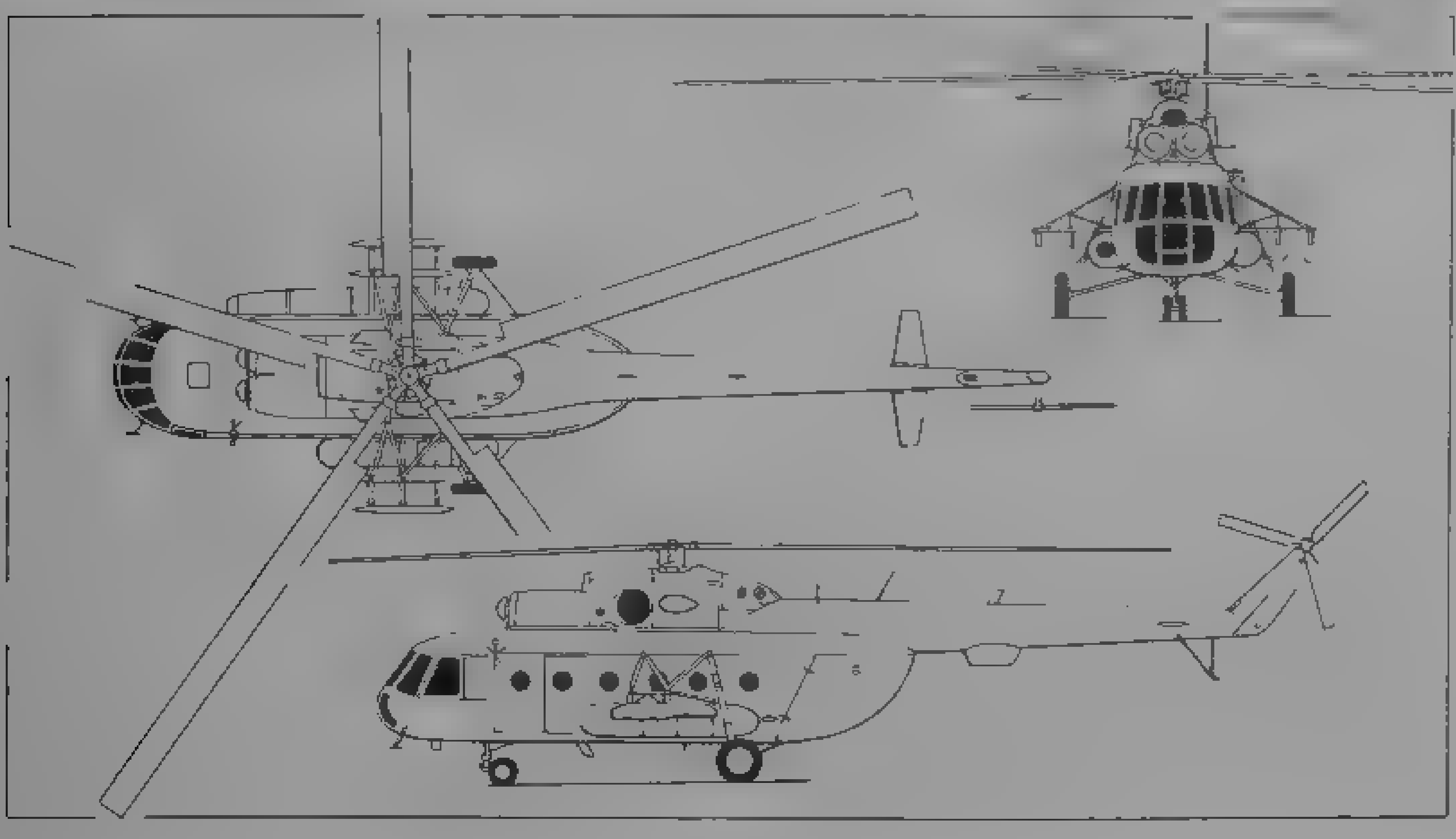
WEIGHTS AND LOADINGS:
Weight empty, equipped: Mi-17 7,100 kg (15,653 lb)
Mi-17V/171 7,055 kg (15,555 lb)
Internal fuel: Mi 17V/171 2,027 kg (4,469 lb)
Internal fuel plus one aux tank
Mi 17V/171 2,737 kg (6,034 lb)
Internal fuel plus two aux tanks
Mi-17V/171 3,447 kg (7,600 lb)
Max payload
internal: Mi-17, Mi-17V/171/172 4,000 kg (8,820 lb)
external, on sling
Mi-17, Mi-17V/171/172 3,000 kg (6,614 lb)
Normal T-O weight
Mi-17, Mi-17V/171 11,100 kg (24,470 lb)
Max T-O weight
Mi-17, Mi-17V/171/172 13,000 kg (28,660 lb)
Max disc loading
Mi-17, Mi-17V/171/172 36.5 kg/m² (7.48 lb/sq ft)

PERFORMANCE:
Max level speed
Mi-17, max AUW 135 kts (250 km/h, 155 mph)
Mi-17V/171, normal AUW
135 kts (250 km/h, 155 mph)
Mi-17V/171, max AUW 124 kts (230 km/h, 143 mph)
Max cruising speed
Mi-17, max AUW 129 kts (240 km/h, 149 mph)
Mi 17V/171, normal AUW
124 kts (230 km/h, 143 mph)
Mi-17V/171, max AUW
113 kts (210 km/h, 130 mph)
Service ceiling: Mi-17, normal AUW 5,000 m (16,400 ft)
Mi-17, max AUW 3,600 m (11,800 ft)
Mi-17V/171, normal AUW 5,700 m (18,700 ft)
Mi-17V/171, max AUW 4,500 m (14,760 ft)
Hovering ceiling OGE
Mi-17, max AUW 1,760 m (5,775 ft)
Mi-17V/171, normal AUW 3,980 m (13,055 ft)
Mi 17V/171, max AUW 1,700 m (5,575 ft)
Range with max standard fuel, 5% reserves
Mi-17, normal AUW 267 n miles (495 km, 307 miles)
Mi-17, max AUW 251 n miles (465 km, 289 miles)
Range at 500 m (1,640 ft), max AUW, 30 min reserves
Mi-17V/171, internal fuel
307 n miles (570 km, 354 miles)
Mi-17V/171, internal fuel plus one aux tank
440 n miles (815 km, 506 miles)
Mi-17V/171, internal fuel plus two aux tanks
575 n miles (1,065 km, 661 miles)

UPDATED

Demonstration of abseiling by Mil Mi-17M production version of Mi-17 series from Kazan *(Paul Jackson)* *1995*


Czech Air Force Mil Mi-17 ('Hip-H') *(Paul Jackson)* *1995*


Mi-17 military general purpose helicopter, with external stores carriers *(Jane's/Dennis Punnett)* *1984*

MIL Mi-22

See Mi-6 entry earlier in this section

VERIFIED

MIL Mi-24

NATO reporting name: Hind

TYPE: Twin-turbine gunship helicopter, with transport capability.

PROGRAMME: Development began second half of 1960s, as first fire support helicopter in former USSR, with accommodation for eight armed troops; 12 prototypes built, first flight 19 September 1969; first reported in West 1972; photographs became available 1974, when two units of approximately squadron strength based in East Germany; reconfiguration of front fuselage changed primary role to gunship, new version first observed 1977; used operationally in Chad, Nicaragua, Ceylon (Sri Lanka), Angola, Afghanistan, Chechnya and Iran/Iraq war, when at least one Iranian F-4 Phantom II destroyed by AT-6 (NATO 'Spiral') anti-tank missile from Mi-24; low-rate production continued, for export, until 1994.

CURRENT VERSIONS: **Mi-24A** ('Hind-A, B and C'): Early versions with pilot and co-pilot/gunner in tandem under large-area continuous glazing, large flight deck, about 250 built, including **Mi-24U** unarmed dual-control trainers (first flight 1972); last described in 1989-90 *Jane's*.

Mi-24D (Type 24-6, 'Hind D'): Interim gunship version, design began 1971, entered production at Arsenyev and Rostov plants 1973, about 350 built 1973-77. Basically as late model 'Hind A' with TV3-117 engines and port-side tail rotor, but entire front fuselage redesigned above floor forward of engine air intakes; heavily armoured separate cockpits for weapon operator and pilot in tandem, flight mechanic optional, in main cabin; transport capability retained; USUP 24 gun system, with rangefinding, undernose JakB-12.7 four-barrel 12.7 mm machine gun in turret, slaved to adjacent KPS-53A electro-optical sighting pod, for air-to-air and air-to-surface use; Falanga P (Phalanx) anti-tank missile system, nosewheel leg extended to increase ground clearance of sensor pods, nosewheels semi-exposed when retracted. **Mi-24DU** dual-control training version has no gun turret. (See also Mi-25.)
Detailed description applies to Mi-24D, except where indicated.

Mi-24V (Types 20-1 and 24-2, 'Hind E'): As Mi-24D, but modified wingtip launchers and four underwing pylons; weapons include up to eight 9M114 (NATO AT-6 'Spiral') radio guided tube-launched anti-tank missiles in pairs in Shturm V (Attack) missile system, ASP-17V enlarged undernose automatic missile guidance pod on port side, with fixed searchlight to rear; R-60 (K-60, NATO AA-8 'Aphid') air-to-air missiles optional on underwing pylons; pilot's HUD replaces former reflector gunsight. Deliveries to Soviet Air Force began 29 March 1976; about 1,000 built at Arsenyev and Rostov 1976-86. (See also Mi-35.)

Mi-24VP: Variant of Mi-24V with twin-barrel 23 mm GSh-23 gun, with 450 rds, in place of four-barrel 12.7 mm gun in nose, photographed 1992; small production series built at Rostov.

Mi-24P (Type 24-3; 'Hind-F'): Development started 1974, about 620 built 1981-90; first shown in service in

Mil Mi-24P ('Hind-F') helicopter gunship, with twin-barrel 30 mm gun, of the 'Berkut' (Golden Eagles) formation team *(Piotr Butowski)*

1995

982 photographs, P of designation refers to pushka = cannon, as Mi-24V, but nose gun turret replaced by GSh-30-2 twin-barrel 30 mm gun (with 750 rounds) in semi cylindrical pack on starboard side of nose, bottom of nose smoothly faired above and forward of sensors

Mi-24R (Type 46-2, 'Hind-G1') Identified at Chernobyl after April 1986 accident at nuclear power station, no undernose electro-optical and RF missile guidance pods, instead of wingtip weapon mounts, has 'clutching hand' mechanisms on lengthened pylons, to obtain six soil samples per sortie, for NBC (nuclear/biological/chemical) warfare analysis; air samples sucked in via pipe on port side, aft of doors, datalink to pass findings to ground, lozenge shape housing with exhaust pipe of air filtering system under port side of cabin, bubble window on starboard side of main cabin small rearward-firing marker flare pack on tailskid, crew of four wear NBC suits, deployed six per helicopter regiment throughout CIS ground forces Designation (also appearing as Mi-24RCh) indicates Razvedchik reconnaissance/chemical About 150 built 1983-89

Mi-24K (korrektirovchik corrector) ('Hind-G2'): As Mi-24R, but with large camera in cabin, f8/1,300 mm lens on starboard side, six per helicopter regiment for reconnaissance and artillery fire correction; gun and B-8V-20 rocket pods retained No target designator pod under nose upward hinging cover for IR sensor About 150 built 1983 to 1989

Mi-24BMT: Modified 1973 for minesweeping

Mi-24 Ecological Survey Version: Modification by Polyot industria, research organisation, to assess oil pollution on water and seasonal changes of water level First seen 1991 with large flat sensor 'tongue' projecting from nose in place of gun turret, large rectangular sensor pod on outer starboard underwing pylon, unidentified modification replaces rear cabin window on starboard side

Mi-25: Export Mi-24D, including those for Afghanistan Cuba and India

Mi-35: Export Mi-24V Unarmed, dual control trainer version also produced for India

Mi-35P: Export Mi-24P

Mi-35M: Upgraded Mi-24/35 designed to meet the latest air mobility requirements of the Russian Army Features include Mi-28 main and tail rotors and transmission more powerful engines, new avionics, twin 23 mm nose guns in turret, and 9K114-9 Attacka laser beam-riding developments of the tube launched AT-6 'Spiral' anti-tank missile Empty weight reduced to 8,050 kg (17,747 lb). normal T-O weight 10,900 kg (24,030 lb); hovering ceiling OGE 3,000 m (9,840 ft), service ceiling 5,750 m (18,860 ft)

CUSTOMERS: More than 2,500 produced at Arsenyev and Rostov, about 1,250 in CIS army service, most with helicopter attack regiments of Mi-8/17s and Mi-24s; air forces of Afghanistan, Algeria, Angola, Bulgaria, Croatia, Cuba, Czech Republic, the former East Germany, Hungary, India, Iraq, North Korea Libya, Mozambique, Nicaragua, Peru, Poland, Vietnam, Yemen

DESIGN FEATURES: Typical helicopter gunship configuration, with stepped tandem seating for two crew and heavy weapon load on stub-wings; fuselage unusually wide for role, due to requirement for carrying eight troops, dynamic components and power plant originally as Mi-8, but soon upgraded to Mi-17-type power plant and port side tail rotor Main rotor blade section NACA 230, thickness/chord ratio 11 to 12 per cent, tail rotor blade section NACA 230M, stub-wing anhedral 12°, incidence 19°, wings contribute approximately 25 per cent of lift in cruising flight fin offset 3°

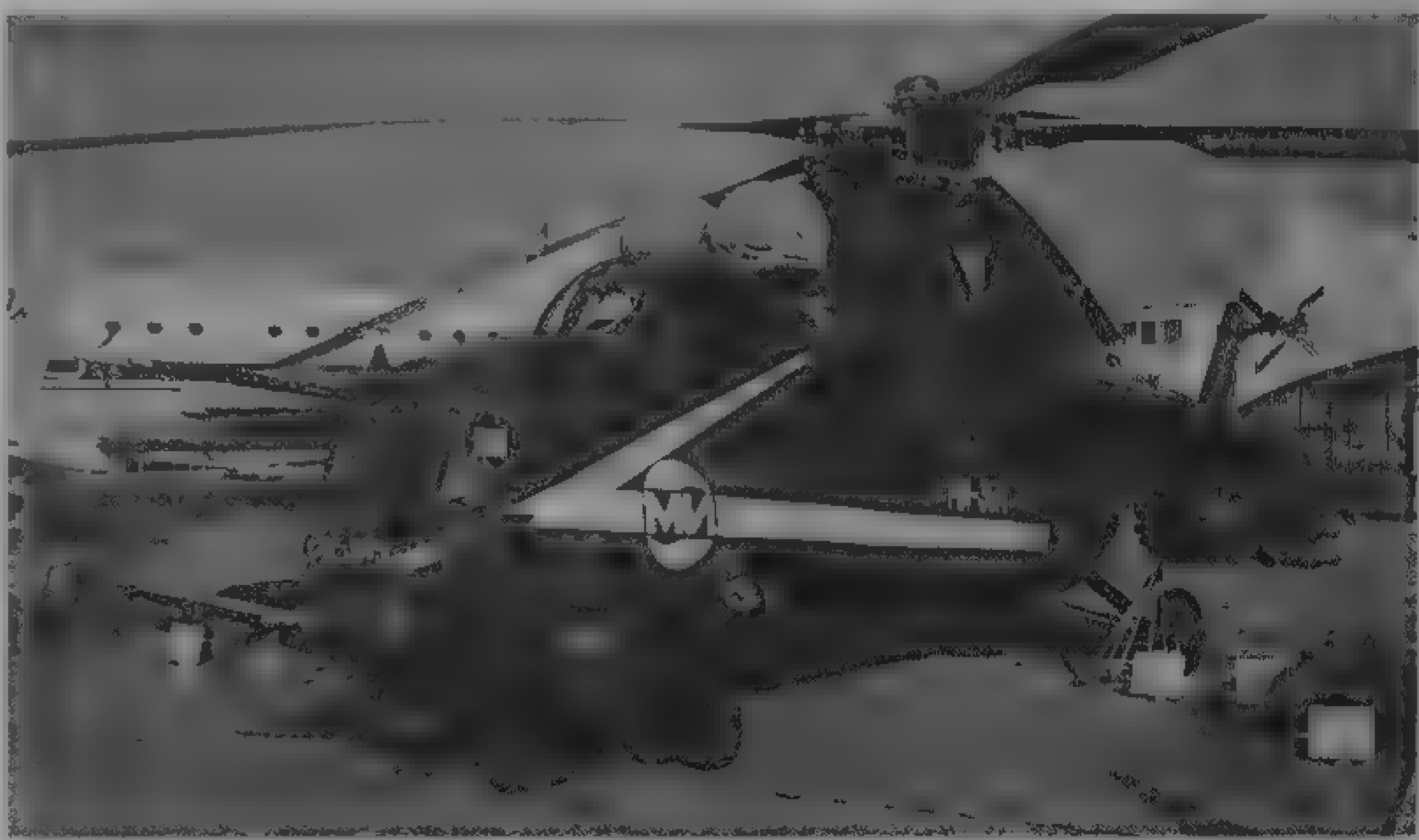
STRUCTURE: Five-blade constant-chord main rotor, forged and machined steel head, with conventional flapping, drag and pitch change articulation, each blade has aluminium alloy spar, skin and honeycomb core; spars nitrogen pressurised for crack detection, hydraulic lead/lag dampers, balance tab on each blade, aluminium alloy three-blade tail rotor, main rotor brake, all-metal semi-monocoque fuselage pod and boom; 5 mm hardened steel integral side armour on front fuselage; all-metal shoulder wings with no movable surfaces, swept fin/tail rotor mounting; variable incidence horizontal stabiliser

LANDING GEAR: Tricycle type, rearward-retracting steerable twin-wheel nose unit, single-wheel main units with oleo-pneumatic shock-absorbers and low-pressure tyres, size 720 × 320 mm on mainwheels 480 × 200 mm on nosewheels Main units retract rearward and inward into aft end of fuselage pod, turning through 90° to stow almost vertically, discwise to longitudinal axis of fuselage, under prominent blister fairings Tubular tripod skid assembly, with shock-strut, protects tail rotor in tail-down take-off or landing

POWER PLANT: Two Klimov TV3-117 turboshafts, each with maximum rating of 1,633 kW (2,190 shp), side by side above cabin, with output shafts driving rearward to main rotor shaft through combining gearbox There is 5 mm hardened steel armour protection for engines Main fuel tank in fuselage to rear of cabin, with bag tanks behind main gearbox Internal fuel capacity 1,500 kg (3,307 lb), can be supplemented by 1,000 kg (2,205 lb) auxiliary tank in cabin (Mi-24D), provision for carrying (instead of auxiliary tank) up to four external tanks, each 500 litres (132 US gallons; 110 Imp gallons), on two inner pylons under each wing Optional deflectors and separators for foreign objects and dust in air intakes, and infra-red suppression exhaust mixer boxes over exhaust ducts

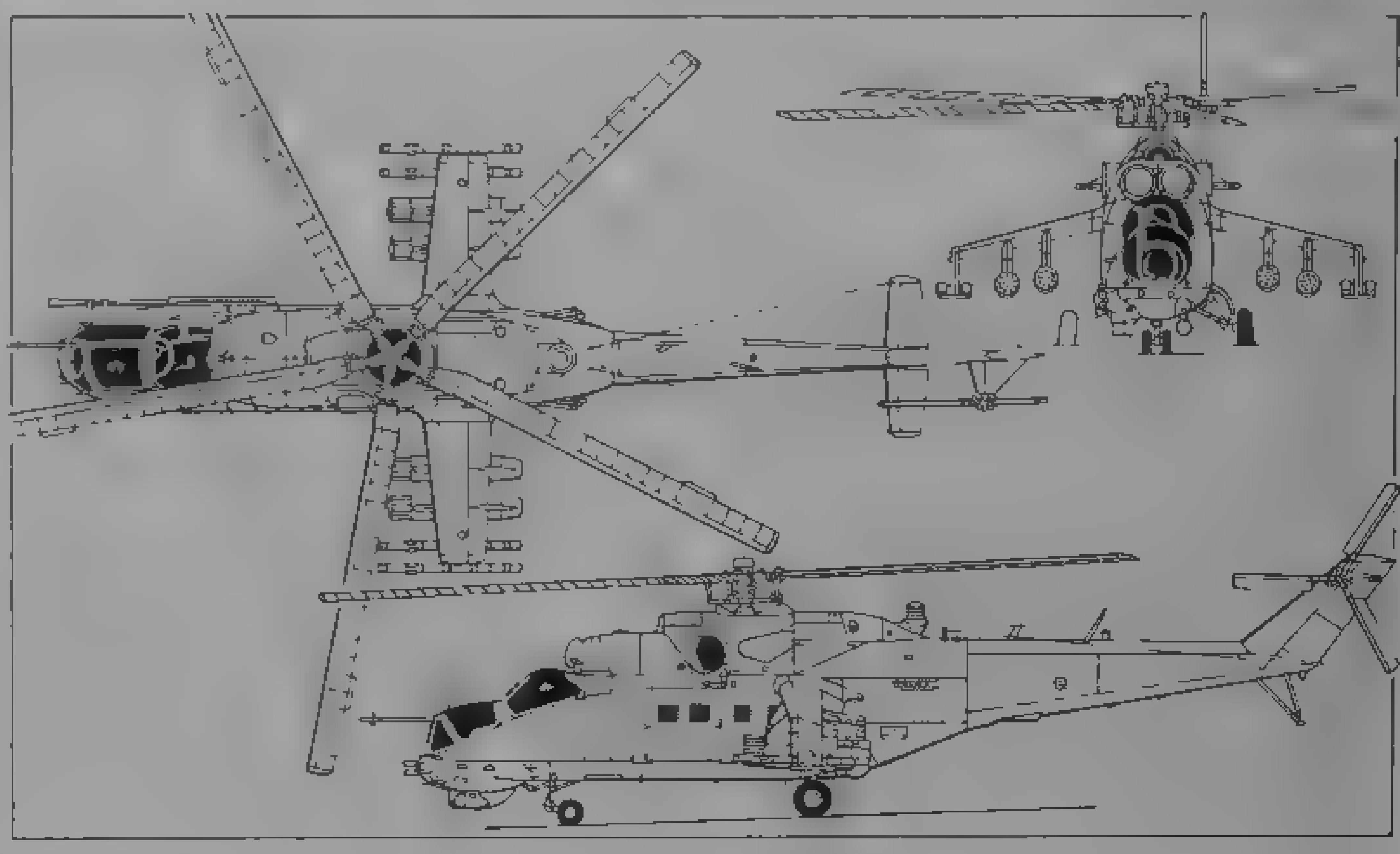
ACCOMMODATION: Pilot (at rear) and weapon operator on armoured seats in tandem cockpits under individual canopies, dual flying controls with retractable pedals in front cockpit if required, flight mechanic on jump-seat in cabin, with narrow passage between flight deck and cabin Front canopy hinged to open sideways to starboard, footstep under starboard side of fuselage for access to pilot's rearward-hinged door, rear seat raised to give pilot unobstructed forward view; anti-fragment shield between cockpits Main cabin can accommodate eight persons on folding seats, or four stretchers, at front of cabin on each side is a door, divided horizontally into two sections hinged to open upward and downward respectively, with integral step on lower portion Optically flat bulletproof glass windscreen, with wiper, for each crew member.

SYSTEMS: Cockpits and cabin heated and ventilated Dual electrical system, with three generators, giving 36, 115 and 208 V AC at 400 Hz, and 27 V DC Retractable landing/taxying light under nose, navigation lights, anti-collision light above tailboom Stability augmentation system



Mil Mi-35M demonstrator fitted with 23 mm cannon turret and FLIR ball on port side of forward fuselage *(Paul Jackson)*

1995



Mil Mi-24P gunship, known to NATO as 'Hind-F' *(Jane's/Mike Keep)*

1990

Mil Mi-35M rotor head *(Paul Jackson)*
1995

Mil Mi-24K 'Hind-G2', showing camera port in side of cabin *(F. G. Rozendaal)*
1995

Electrothermal de-icing system for main and tail rotor blades. AI-9 V APU mounted transversely inside fairing aft of rotor head

AVIONICS: *Comms:* Include VHF and UHF radio

Flight: Autopilot, ARK 15M radio compass, ARK-U2 radio compass, RV-5 radio altimeter

Instrumentation: Blind-flying instrumentation, and ADF navigation system with Doppler-fed mechanical map display. Air data sensor boom forward of top starboard corner of bulletproof windscreen at extreme nose

Mission: Undernose pods for electro-optics (starboard) and Raduga-F semi-automatic missile guidance (port). Many small antennae and blisters, including SRO-2 Khrom (NATO 'Odd Rods') IFF transponder

Self-defence: Sirena-3M radar warning antennae on each side of front fuselage and on trailing-edge of tail rotor pylon. Infra-red jammer (L-166V-11E Ispanka microwave pulse lamp; 'Hot Brick') in 'flower pot' container above forward end of tailboom. ASO-2V flare dispensers under tailboom forward of tailskid assembly initially; later triple racks (total of 192 flares) on sides of centre-fuselage.

EQUIPMENT: Gun camera on port wingtip. Colour-coded identification flare system

ARMAMENT: One remotely controlled YakB 12.7 four-barrel Gatling type 12.7 mm machine gun, with 1,470 rounds, in VSPU-24 undernose turret with field of fire 60° to each side, 20° up, 60° down, gun slaved to KPS-53AV undernose sighting system with reflector sight in front cockpit, four 9M17P Skorpion (NATO AT-2 'Swatter') anti-tank missiles on 2P32M twin rails under endplate pylons at wingtips; four underwing pylons for UB-32 rocket pods (each 32 S-5 type 57 mm rockets), B-8V-20 pods each containing twenty 80 mm S-8 rockets, 130 mm S-13 and 250 mm S-24 rockets, UPK-23-250 pods each containing a GSh-23L twin-barrel 23 mm gun, GUV pods each containing either one four-barrel 12.7 mm YakB-12.7 machine gun with 750 rds and two four barrel 7.62 mm 9-A-622 machine guns with total 1,100 rds or an AGS-17 Plamia 30 mm grenade launcher, up to 1,500 kg (3,300 lb) of conventional bombs, mine dispensers, night flares or other stores. R-60 (AA-8 'Aphid'), R-73 (AA-11 'Archer') and Igla air-to-air missiles fitted experimentally. Helicopter can be landed to install reload weapons carried in cabin. PKV reflector gunsight for pilot. Provisions for firing AKMS guns from cabin windows

GSh-30-2 cannon and weapon sighting sensor of Mil Mi-24P *(Paul Jackson)*
1995

Front (weapon operator's) cockpit of Mil Mi-35 gunship helicopter *(Mark Wagner/Flight International)*
1994

DIMENSIONS, EXTERNAL (Mi-24P):

Main rotor diameter	17.30 m (56 ft 9¼ in)
Main rotor blade chord	0.58 m (1 ft 10¾ in)
Tail rotor diameter	3.91 m (12 ft 10 in)
Wing span	6.54 m (21 ft 5½ in)
Width of fuselage	1.70 m (5 ft 7 in)
Length overall	
excl rotors and gun	7.51 m (57 ft 5¼ in)
rotors turning	21.35 m (70 ft 0 in)
Height: to top of rotor head	3.97 m (13 ft 0¼ in)
overall, rotors turning	6.50 m (21 ft 4 in)
Span of horizontal stabiliser	3.27 m (10 ft 9 in)
Wheel track	3.03 m (9 ft 11¼ in)
Wheelbase	4.39 m (14 ft 5 in)

DIMENSIONS, INTERNAL:

Main cabin: Length	2.825 m (9 ft 3¼ in)
Width	1.46 m (4 ft 9½ in)
Height	1.20 m (3 ft 11¼ in)

AREAS:

Main rotor disc	235.06 m² (2,530.2 sq ft)
Tail rotor disc	11.99 m² (129.1 sq ft)

WEIGHTS AND LOADINGS (Mi-24P):

Weight empty	8,200 kg (18,078 lb)
Max external stores	2,400 kg (5,290 lb)
Normal T-O weight	11,200 kg (24,690 lb)
Max T-O weight	12,000 kg (26,455 lb)
Max disc loading	51.1 kg/m² (10.5 lb/sq ft)

PERFORMANCE (Mi-24P):

Max level speed	180 kts (335 km/h, 208 mph)
Cruising speed	145 kts (270 km/h, 168 mph)
Econ cruising speed	117 kts (217 km/h, 135 mph)
Max rate of climb at S/L	750 m (2,460 ft)/min
Service ceiling	4,500 m (14,750 ft)
Hovering ceiling OGE	1,500 m (4,920 ft)
Combat radius	
with max military load	86 n miles (160 km, 99 miles)
with two external fuel tanks	121 n miles (224 km, 139 miles)
with four external fuel tanks	155 n miles (288 km, 179 miles)
Range: standard internal fuel	270 n miles (500 km, 310 miles)
with auxiliary tanks	540 n miles (1,000 km, 620 miles)
Max endurance	4 h

UPDATED

MIL Mi-25

NATO reporting name: Hind-D

Some export variants of Mi-24D, including those for Angola, India and Peru, are designated Mi-25; change presumably signifies different equipment standards

VERIFIED

MIL Mi-26

NATO reporting name: Halo

TYPE: Twin-turbine multipurpose heavy-lift helicopter

PROGRAMME: Development started early 1970s; aim was payload capability 1½ to 2 times greater than that of any previous production helicopter; first prototype flew 14 December 1977, one of several prototype or preproduction Mi-26s (SSSR-06141) displayed at 1981 Paris Air Show; in field evaluation, probably with military development squadron, began early 1982, fully operational 1983; export deliveries started (to India), June 1986, more than 300 built; production continues, with **manufacture and marketing by Rostov Helicopter Manufacturing Association (Rostvertol), 5 Novatorov Street, 344038 Rostov-on-Don, Russia**. FAA certification scheduled 1995

CURRENT VERSIONS: **Mi-26**: Basic military transport

Mi-26A: With PNK-90 integrated flight/nav systems for

Mil Mi-26 heavy lift helicopter (two ZMKB Progress D-136 turboshafts) *(Mark Wagner/Flight International)*

1995

automatic approach and descent to critical decision point and other tasks

Mi-26T Basic civil transport, generally as military Mi-26. Variants include **Firefighting Mi-26**, able to dispense 7,500 litres (1,980 US gallons, 1,650 Imp gallons) fire retardant from one or two vents. **Geological Survey Mi-26** towing seismic gear, with tractive force of 10,000 kg (22,045 lb) or more, at 97 to 108 knots (180 to 200 km/h, 112 to 124 mph) at 55 to 100 m (180 to 330 ft) for up to 3 hours

Mi-26MS. Medical evacuation version, with life support section for four casualties and two medics, surgical section for one casualty and three medics, pre-operating section for two casualties and two medics, ambulance section for five stretcher patients, three seated casualties and two attendants, laboratory, and amenities section with toilet, washing facilities, food storage and recreation unit

Mi-26P: Transport for 63 passengers, basically four abreast in airline type seating, with centre aisle, toilet, galley and cloakroom aft of flight deck

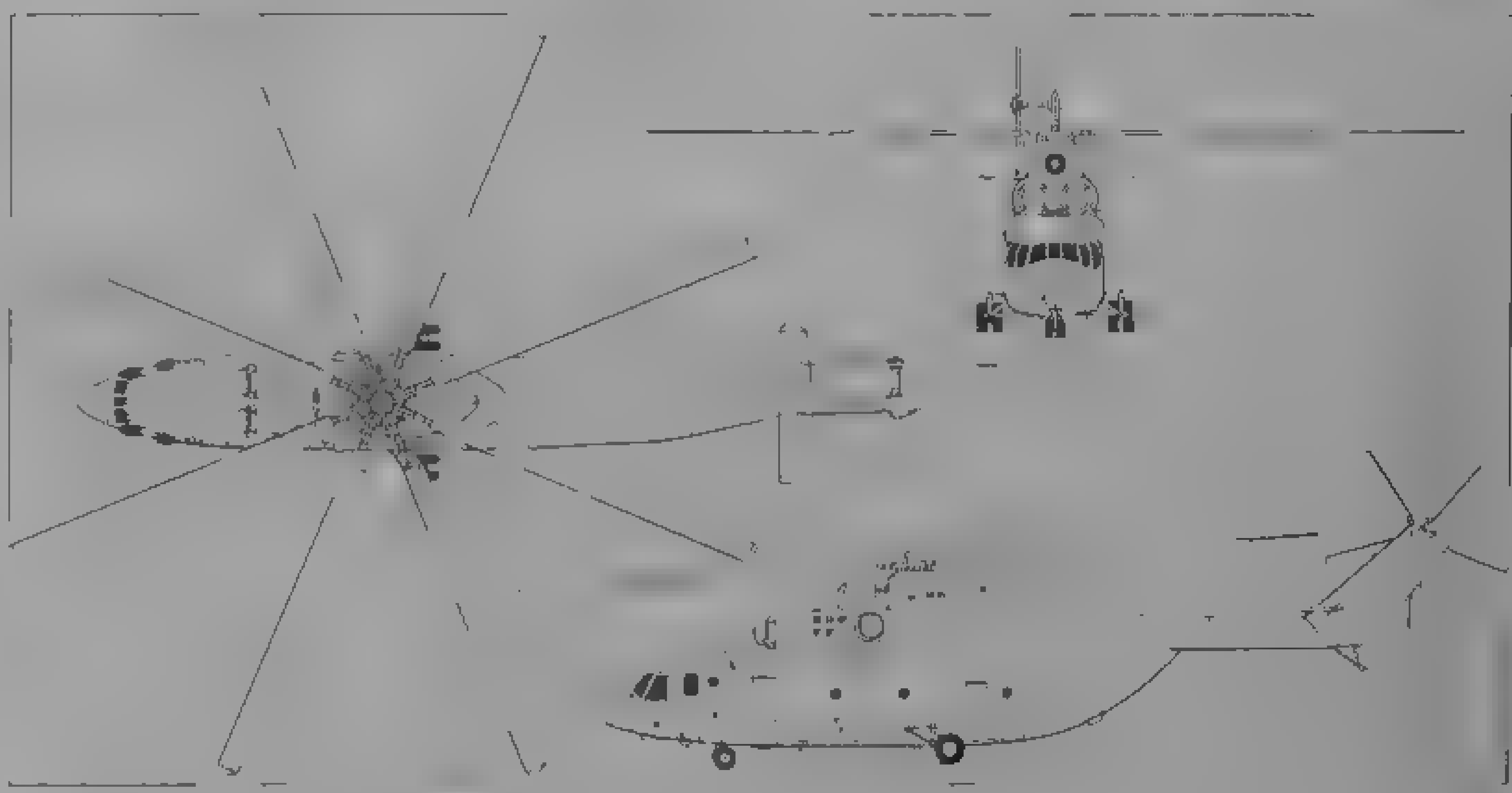
Mi-26TM Flying crane, with gondola for pilot/sling supervisor under fuselage aft of nosewheels or under rear loading ramp, rear gondola can accommodate pilot and trainee

Mi-26TZ. Tanker with 14 040 litres (3,710 US gallons, 3,088 Imp gallons) additional fuel and 1,040 litres (275 US gallons, 228 Imp gallons) lubricants, dispensed through four hoses for aircraft, 10 hoses for ground vehicles.

Mi-26M Upgrade under development in 1994; all-GFRP main rotor blades of new aerodynamic configuration, new ZMKB Progress D-127 turboshafts (each approximately 10,440 kW, 14,000 shp), and modified integrated flight/nav system with EFIS. Transmission rating unchanged, but full payload capability maintained under 'hot and high' conditions, OEI safety improved, hovering and service ceilings increased, and greater maximum payload (25,000 kg, 55,115 lb) for crane operations

The 1990 edition of US Department of Defense's *Soviet Military Power* stated "New variants of 'Halo' are likely in the early 1990s to begin to replace 'Hooks' specialised for command support" *Detailed description applies to basic Mi-26, except where indicated*

CUSTOMERS CIS armed forces (more than 60), India (10) More than 12 operated by SkyLink Aviation and Transportation Services, Canada



Mil Mi-26, first helicopter to operate successfully with an eight-blade main rotor *(Jane's/Dennis Punnett)*

1981

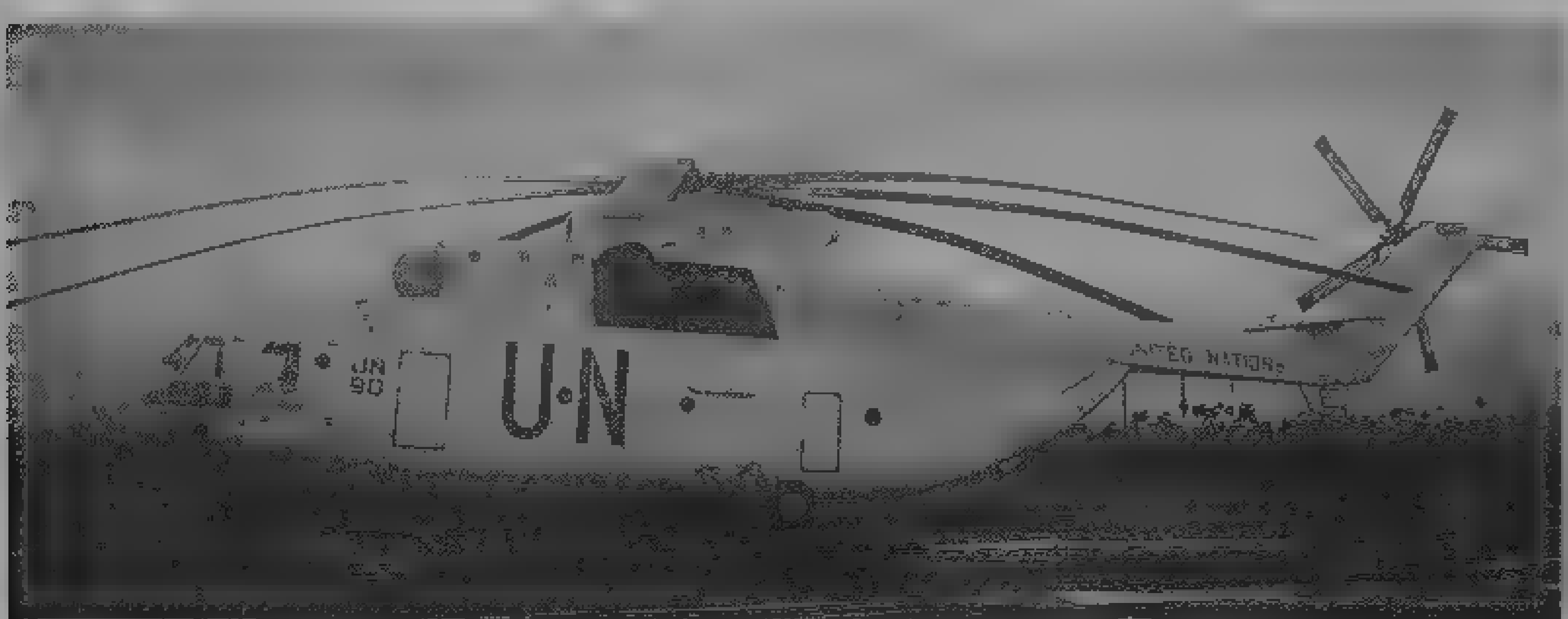
DESIGN FEATURES: Largest production helicopter, empty weight comparable to that of Mi-6 and, as specified, is approximately 50 per cent of maximum T-O weight, weight saved by in house design of main gearbox providing multiple torque paths, GFRP tail rotor blades, titanium main and tail rotor heads, main rotor blades of mixed metal and GFRP, use of aluminium-lithium alloys in airframe; conventional pod and boom configuration, but first successful use of eight-blade main rotor, of smaller diameter than Mi-6 rotor, payload and cargo hold size similar to those of Lockheed C 130 Hercules; auxiliary wings not required, rear-loading ramp/doors, main rotor rpm 132

FLYING CONTROLS. Hydraulically powered cyclic and collective pitch controls actuated by small parallel jacks, with redundant autopilot and stability augmentation system inputs. Fly-by-wire system flight tested 1994

STRUCTURE: Eight blade constant chord main rotor; flapping and drag hinges, droop stops and hydraulic drag dampers, no elastomeric bearings or hinges, each blade has one-piece tubular steel spar and 26 GFRP aerofoil shape full-chord pockets, honeycomb filled, with ribs and stiffeners and non-removable titanium leading-edge abrasion strip, blades have moderate twist, taper in thickness toward tip, and are attached to small forged titanium head of unconventional design, each has ground adjustable trailing-edge tab, five-blade constant-chord tail rotor, starboard side, has GFRP blades, forged titanium head, conventional transmission, with tail rotor shaft inside cabin roof; all-metal riveted semi monocoque fuselage with clamshell rear doors, flattened tailboom undersurface, engine bay of titanium for fire protection, all metal tail surfaces, swept vertical stabiliser/tail rotor support profiled to produce sideways lift, ground adjustable variable incidence horizontal stabiliser

LANDING GEAR Non-retractable tricycle type, twin wheels on each unit; steerable nosewheels; mainwheel tyres size 1,120 × 450 mm. Retractable tailskid at end of tailboom to permit unrestricted approach to rear cargo doors. Length of main legs adjusted hydraulically to facilitate loading through rear doors and to permit landing on varying surfaces. Device on main gear indicates take-off weight to flight engineer at lift-off, on panel on shelf to rear of his seat

POWER PLANT: Two 7,460 kW (10 000 shp) ZMKB Progress D-136 free-turbine turboshafts, side by side above cabin, forward of main rotor driveshaft. Air intakes fitted with particle separators to prevent foreign object ingestion, and have both electrical and bleed air anti icing systems. Above and behind is central oil cooler intake. VR-26 fan-cooled main transmission, rated at 14,710 kW (19,725 shp), with air intake above rear of engine cowlings. System for synchronising output of engines and maintaining constant rotor rpm; if one engine fails, output of other is increased to maximum power automatically. Independent fuel system for each engine; fuel in eight underfloor rubber tanks, feeding into two header tanks above engines, which permit gravity feed for a period in emergencies, maximum



Mil Mi-26T on charter to the UN in Cambodia *(Jean-Louis Gaynecoetche)*

1995

Two-man gondola under rear ramp of Mi-26TM crane helicopter *(Mark Lambert)*

1993

Mil Mi-26TM crane helicopter with gondola for pilot/sling supervisor under front fuselage *(Paul Jackson)*

1995

Cockpit of Mil Mi-26 *(Mark Wagner/Flight International)*

1994

standard internal fuel capacity 12,000 litres (3,170 US gallons, 2,640 Imp gallons), provision for four auxiliary tanks. Two large panels on each side of main rotor mast fairing, aft of engine exhaust outlet, hinge downward as work platforms.

ACCOMMODATION: Crew of four on flight deck: pilot (on port side) and co-pilot side by side, tip-up seat between pilots, and seats for flight engineer (port) and navigator (starboard) to rear. Four-seat passenger compartment aft of flight deck. Loads in hold include two airborne infantry combat vehicles and a standard 20,000 kg (44,090 lb) ISO container; about 20 tip-up seats along each sidewall of hold; maximum military seating for 80 combat equipped troops, alternative provisions for 60 litter patients and four/five attendants. Heated windscreen, with wipers, four large blistered side windows on flight deck, forward pair swing open slightly outward and rearward. Downward-hinged doors, with integral airstairs, at front of hold on port side, and each side of hold aft of main landing gear units. Hold loaded via downward-hinged lower door, with integral folding ramp, and two clamshell upper doors forming rear wall of hold when closed; doors opened and closed hydraulically, with back-up hand pump for emergency use. Two electric hoists on overhead rails, each with capacity of 2,500 kg (5,511 lb), enable loads to be transported along cabin; winch for hauling loads, capacity 500 kg (1,100 lb); roller conveyor in floor and load lashing points throughout hold. Flight deck and hold fully air conditioned.

SYSTEMS: Two hydraulic systems, operating pressure 207 bars (3,000 lb/sq in). Electrical system 28 V DC. APU under flight deck, with intake louvres (forming fuselage skin when closed) and exhaust on starboard side, for engine starting and to supply hydraulic, electrical and air conditioning systems on ground. Electrically heated leading-edge of main and tail rotor blades for anti-icing. Only flight deck pressurised.

AVIONICS: All items necessary for day and night operations in all weathers are standard.

Radar: Weather radar in hinged (to starboard) nosecone.

Flight: Integrated flight/nav system and automatic flight control system, Doppler, map display, HSI, and automatic hover system.

Self-defence: Military versions can have infra-red jammers and suppressors, infra-red decoy dispensers and colour-coded identification flare system.

EQUIPMENT: Hatch for load sling in bottom of fuselage, in line with main rotor shaft, sling cable attached to internal winching gear. Closed circuit TV cameras to observe slung payloads.

ARMAMENT: None.

DIMENSIONS, EXTERNAL:

Main rotor diameter	32.00 m (105 ft 0 in)
Tail rotor diameter	7.61 m (24 ft 11½ in)
Length: overall, rotors turning	40.025 m (131 ft 3¾ in)
fuselage, excl tail rotor	33.73 m (110 ft 8 in)
Height to top of rotor head	8.145 m (26 ft 8¾ in)
Width over mainwheels	8.15 m (26 ft 9 in)
Wheel track	7.17 m (23 ft 6¼ in)
Wheelbase	8.95 m (29 ft 4½ in)

DIMENSIONS, INTERNAL:

Freight hold:	
Length: ramp trailed	15.00 m (49 ft 2½ in)
excl ramp	12.00 m (39 ft 4½ in)
Width	3.20 m (10 ft 6 in)
Height	2.95-3.17 m (9 ft 8 in-10 ft 4¾ in)
Volume	121 m³ (4,273 cu ft)

AREAS:

Main rotor disc	804.25 m² (8,657 sq ft)
Tail rotor disc	45.48 m² (489.6 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	28,200 kg (62,170 lb)
Max payload, internal or external	20,000 kg (44,090 lb)
Normal T-O weight	49,600 kg (109,350 lb)
Max T-O weight	56,000 kg (123,450 lb)
Max disc loading	69.6 kg/m² (14.26 lb/sq ft)
Max transmission power loading	3.81 kg/kW (6.26 lb/shp)

PERFORMANCE (A, Mi-26, B, Mi-26M):

Max level speed: A	159 kts (295 km/h; 183 mph)
Normal cruising speed: A	137 kts (255 km/h; 158 mph)
Service ceiling: A	4,600 m (15,100 ft)
B	5,900 m (19,350 ft)
Hovering ceiling IGE:	
A, ISA, with 5,100 kg (11,240 lb) payload	1,000 m (3,280 ft)
B, ISA + 15°C, with 12,300 kg (27,115 lb) payload	1,000 m (3,280 ft)
Hovering ceiling OGE, ISA: A	1,800 m (5,900 ft)
B	2,800 m (9,185 ft)
Range: A at 2,500 m (8,200 ft) ISA + 15°C, with 7,700 kg (16,975 lb) payload	270 n miles (500 km; 310 miles)
B at 2,500 m (8,200 ft) ISA + 15°C, with 13,700 kg (30,200 lb) payload	270 n miles (500 km; 310 miles)
A, S/L ISA, with max internal fuel at max T-O weight, 5% reserves	432 n miles (800 km; 497 miles)
A, S/L ISA, with four aux tanks	1,036 n miles (1,920 km; 1,190 miles)

UPDATED

MIL Mi-28

NATO reporting name: Havoc

TYPE: Two-seat twin-turbine combat helicopter.

PROGRAMME: Design started 1980; first of four prototypes flew 10 November 1982; fourth prototype demonstrated at Asian Aerospace '94; small-scale preseries production by Rostvertol, Rostov.

CURRENT VERSIONS: **Mi-28**: Basic version, *as described in detail*. Few only to be built, for service evaluation.

Mi-28N: Added night/all weather operating capability. Russian Army funding announced January 1994, first flight scheduled mid-1995, possible service entry 1997. Multiwindow chin fairing in place of nose sensor turret; armament to include 9M114 Shturm (AT-6 'Spiral') ASMs and Igla (SA-16 'Gimlet') AAMs, with 360° scan mast-mounted millimetre wave radar, a FLIR ball instead of two fixed IR sensors of basic version, and low-light-level TV. Weights and performance generally unchanged.

Versions for naval amphibious assault support and air-to-air missions projected.

DESIGN FEATURES: Conventional gunship configuration, with two crew in stepped cockpits, original three-blade tail rotor superseded by 'scissors' type comprising two independent two-blade rotors set as narrow X (35°/145°) on same shaft, known in USA as (delta 3) type, resulting flapping freedom relieves flight loads, agility enhanced by doubling hinge offset of main rotor blades compared with Mi-24, survivability emphasised, crew compartments protected by titanium and ceramic armour and armoured glass transparencies, vital structural elements shielded by less vital, single hit will not knock out both engines, vital units and parts are redundant and widely separated, multiple self-sealing fuel tanks in centre-fuselage enclosed in composites second skin, outside metal fuselage skin, no explosion, fire or fuel leakage results if tanks hit by bullet or shell fragment; energy absorbing seats and landing gear protect crew in crash landing at descent rate of 12 m (40 ft)/s, crew doors are rearward-hinged, to open quickly and remain open in emergency; parachutes are mandatory for CIS military helicopter aircrew, if Mi-28 crew had to parachute, emergency system would jettison doors, blast away stub-wings, and inflate bladder beneath each door sill: as crew jumped, they would bounce off bladders and clear main landing gear, no provision for rotor separation, port-side door, aft of wing, provides access to avionics compartment large enough to permit combat rescue of two or three persons on ground, although it lacks windows, heating and ventilation, handcrank, inserted into end of each stub-wing, enables stores of up to 500 kg (1,100 lb) to be winched on to pylons without hoists or ground equipment; current 30 mm gun is identical with that of CIS army ground vehicles and uses same ammunition, jamming averted by attaching twin ammunition boxes to sides of gun mounting, so that they turn, elevate and depress with gun; main rotor shaft has 5° forward tilt, providing tail rotor clearance; transmission capable of running without oil for 20 to 30 minutes; main rotor rpm 242, with main rotor blades and wings removed, helicopter is air transportable in An-22 or Il-76 freighter.

FLYING CONTROLS: Hydraulically powered mechanical type, horizontal stabiliser linked to collective; controls for pilot only.

STRUCTURE: Five-blade main rotor, blades have very cambered high-lift section and sweptback tip leading-edge, full-span upswept tab on trailing-edge of each blade, structure comprises numerically controlled, spirally wound glassfibre D-spar, blade pockets of Kevlar-like material with Nomex-like honeycomb core, and titanium erosion strip on leading-edge; each blade has single elastomeric root bearing, mechanical droop stop and hydraulic drag damper; four-blade GFRP tail rotor with elastomeric


Fourth prototype of Mil Mi-28 ('Havoc') combat helicopter (*Paul Jackson*)

1995

bearings for flapping rotor brake lever on starboard side of cockpit strong and simple machined titanium main rotor head with elastomeric bearings, requiring no lubrication, power output shafts from engines drive main gearbox from each side, tail rotor gearbox, at base of tail pylon, driven by aluminium alloy shaft inside composite duct on top of tail boom; sweptback mid-mounted wings have light alloy primary box structure, leading- and trailing-edges of composites, no wing movable surfaces, provision for countermeasures pod on each wingtip, housing chaff/flare dispensers and sensors, probably RWR, light alloy semi-monocoque fuselage, with titanium armour around cockpits and vulnerable areas, composites access door aft of wing on port side; swept fin has light alloy primary box structure, composites leading- and trailing-edges; cooling air intake at base of fin leading-edge, exhaust at top of trailing-edge; two-position composites horizontal stabiliser

LANDING GEAR. Non-retractable tailwheel type, with single wheel on each unit, mainwheel tyres size 720 × 320 mm, pressure 5.4 bars (78 lb/sq in), castoring tailwheel with tyre size 480 × 200 mm

POWER PLANT: Two Klimov TV3 117VM turboshafts, each 1,545 kW (2,070 shp), in pod above each wingroot, three jetpipes inside downward deflected composites nozzle fairing on each side of third prototype shown in Paris 1989 upward deflecting type also tested. Ivchenko AI 9V APU in rear of main pylon structure supplies compressed air for engine starting and to drive small turbine for preflight ground checks. Deflectors for dust and foreign objects forward of air intakes, which are de-iced by engine bleed air Provision for four external fuel tanks on underwing pylons.

ACCOMMODATION. Navigator/gunner in front cockpit, pilot behind, on elevated seat, transverse armoured bulkhead between; flat non-glint tinted transparencies of armoured glass, navigator/gunner's door on port side, pilot's door on starboard side

SYSTEMS: Cockpits air conditioned and pressurised by engine bleed air Duplicated hydraulic systems, pressure 152 bars (2,200 lb/sq in). 208 V AC electrical system supplied by two generators on accessory section of main gearbox, ensuring continued supply during autorotation. Low air speed system standard, giving speed and drift via main rotor blade-tip pitot tubes at −50 to +70 km/h (−27 to +38 knots; -31 to +43 mph) in forward flight, and ±70 km/h (±38 knots, ±43 mph) in sideways flight. Main and tail rotor blades electrically de-iced.

AVIONICS: *Comms:* UHF/VHF nav/com; small IFF fairing each side of nose and tail

Instrumentation: Conventional IFR instrumentation. with autostabilisation, autohover, and hover/heading hold lock in attack mode, pilot has HUD and centrally mounted CRT for basic TV, aircraft designed for use with night vision goggles.

Mission: Radio for missile guidance in nose radome; radar warning receivers. Daylight optical weapons sight and laser ranger/designator in double-glazed nose turret above gun, with which it rotates through ±110°; wiper on outer glass protects inner optically flat panel. Cylindrical container each side of this turret for FLIR and low light level TV night vision systems on prototype shown in Paris, 1989 (systems not fitted Containers deleted on fourth prototype)

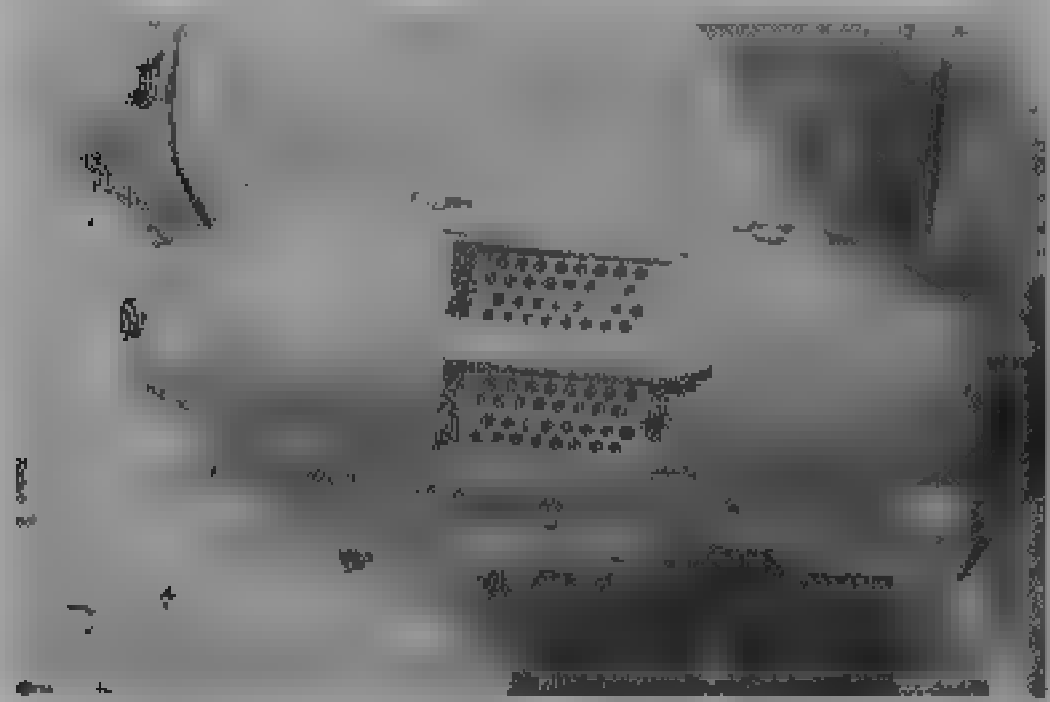
Self-defence: Two fixed IR sensors on initial basic production Mi-28; IR suppressors, radar and laser warning receivers standard, optional countermeasures pod on each wingtip, housing chaff/flare dispensers and sensors.

EQUIPMENT: Two slots, one above the other on port side of tail-boom, for colour-coded identification flares. Three pairs of rectangular formation-keeping lights in top of tailboom further pair in top of main rotor pylon fairing

ARMAMENT: One NPPU-28 30 mm turret-mounted gun (with 250 rounds) at nose, able to rotate ±110°, elevate 13° and depress 40°; maximum rate of fire 900 rds/min air-to-air and air-to-ground. (New specially designed gun under development.) Two pylons under each stub-wing, each with capacity of 480 kg (1,058 lb), typically for total of sixteen 9M114 Shturm C (AT-6 'Spiral') radio-guided tube-launched anti-tank missiles and two UB-20 pods of twenty 80 mm C-8 or 130 mm C-13 rockets. Gun fired and guided weapons launched normally only from front cockpit, unguided rockets fired from both cockpits. (When fixed, gun can be fired also from rear cockpit.)

DIMENSIONS, EXTERNAL

Main rotor diameter	17.20 m (56 ft 5 in)
Main rotor blade chord	0.67 m (2 ft 2⅜ in)
Tail rotor diameter	3.84 m (12 ft 7¼ in)
Tail rotor blade chord	0.24 m (9½ in)
Length overall, excl rotors	17.01 m (55 ft 9¾ in)
Fuselage max width	1.85 m (6 ft 1 in)
Width over stub-wings	4.88 m (16 ft 0¼ in)


Wingtip countermeasures pod on Mi-28
(*Nick Cook/Jane's Defence Weekly*)

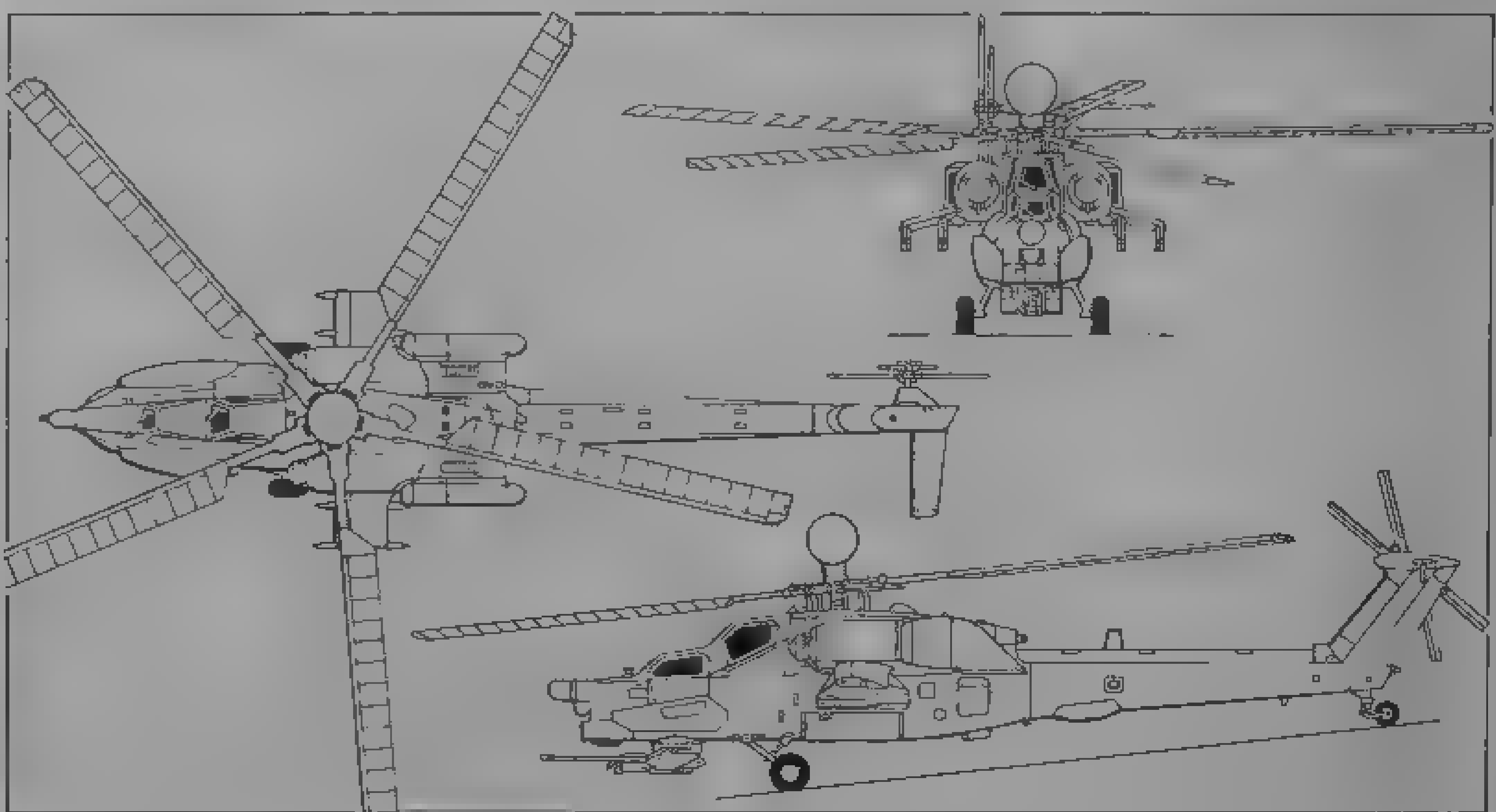
1992


Model of Mi-28N night/all-weather attack helicopter (*Paul Jackson*)

1995


Rear (pilot's) cockpit of Mi-28 (*Paul Jackson*)

1995


Mil Mi-28N combat helicopter (two Klimov TV3-117VM turboshafts) (*Jane's/James Goulding*)

1995

Close-up of Mi-28 armament *(Piotr Butowski)*

1995

Height to top of rotor head 3.82 m (12 ft 6½ in)
Height overall 4.70 m (15 ft 5 in)
Wheel track 2.29 m (7 ft 6¼ in)
Wheelbase 11.00 m (36 ft 1 in)

AREAS:
Main rotor disc 232.3 m² (2,501 sq ft)
Tail rotor disc 11.58 m² (124.7 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 8,095 kg (17,846 lb)
Internal fuel: standard 1,337 kg (2,947 lb)
with added tanks 1,782 kg (3,928 lb)
Normal T-O weight 10,400 kg (22,928 lb)
Max T-O weight 11,660 kg (25,705 lb)
Max disc loading 50.19 kg/m² (10.28 lb/sq ft)

PERFORMANCE:
Max level speed 162 kts (300 km/h, 186 mph)
Max cruising speed 145 kts (270 km/h, 167 mph)
Max rate of climb at S/L 816 m (2,677 ft)/min
Service ceiling 5,800 m (19,025 ft)
Hovering ceiling OGE 3,600 m (11,810 ft)
Radius of action, standard fuel, 10 min loiter at target, 5% reserves 108 n miles (200 km; 124 miles)
Range, max standard fuel 248 n miles (460 km; 285 miles)
Ferry range, 5% reserves 593 n miles (1,100 km; 683 miles)
Endurance with max fuel 2 h
g limits +3/–0.5

UPDATED

MIL Mi-34

NATO reporting name: Hermit

TYPE: Lightweight two/four-seat multipurpose helicopter.

PROGRAMME: First flight 1986; two prototypes and structure test airframe completed by mid-1987, when exhibited for first time at Paris Air Show; first helicopter built in former USSR to perform normal loop and roll; series production began at Progress Plant, Arsenyev, 1993; marketed by Mil Light Helicopters, planned completion of 30 in 1994-95.

CURRENT VERSIONS: Basic **Mi-34** as described, may be available with 261 kW (350 hp) Textron Lycoming TIO-540-J engine as alternative to M-14V; projected **Mi-34A** would have 335 kW (450 shp) Allison 250-C20R turboshaft.

CUSTOMERS: First three for Mayor's office, Moscow, others for police and ambulance duties.

DESIGN FEATURES: Intended primarily for training and international competition flying, Mil claims Mi-34 is aerobatic; conventional pod and boom configuration, piston engine of same basic type as that in widely used Yakovlev fixed-wing training aircraft and Kamov Ka-26 helicopters; suitable also for light utility, mail delivery, observation and liaison duties, and border patrol.

FLYING CONTROLS: Mechanical, with no hydraulic boost.

STRUCTURE: Semi-articulated four-blade main rotor with flapping and cyclic pitch hinges, but natural flexing in lead/lag plane; blades of GFRP with CFRP reinforcement, attached by flexible steel straps to head like that of McDonnell Douglas MD 500; two-blade tail rotor of similar composites construction, on starboard side; riveted light alloy fuselage, sweptback tailfin with small unswept T tailplane.

LANDING GEAR: Conventional non-retractable skids on arched support tubes; small tailskid to protect tail rotor.

POWER PLANT: One 243 kW (325 hp) VOKBM M-14V-26 nine-cylinder radial air-cooled engine mounted sideways in centre-fuselage. Fuel system for inverted flight.

ACCOMMODATION: Normally one or two pilots, side by side, in enclosed cabin, with optional dual controls. Rear of cabin contains low bench seat, available for two passengers and offering flat floor for cargo carrying. Forward-hinged door on each side of flight deck and on each side of rear cabin.

AVIONICS: *Comms:* VHF radio.
Flight: ADF and radio altimeter.
Instrumentation: Magnetically slaved compass system incorporating radio magnetic indicator.

EQUIPMENT: Gyro horizon.

DIMENSIONS, EXTERNAL:
Main rotor diameter 10.00 m (32 ft 9¾ in)
Main rotor blade chord 0.22 m (8⅔ in)
Tail rotor diameter 1.48 m (4 ft 10¼ in)
Tail rotor blade chord 0.16 m (6¼ in)
Length of fuselage 8.75 m (28 ft 8½ in)
Width of fuselage 1.40 m (4 ft 7¼ in)
Skid track 2.24 m (7 ft 4¼ in)

AREAS:
Main rotor disc 78.5 m² (845 sq ft)
Tail rotor disc 1.72 m² (18.52 sq ft)

WEIGHTS AND LOADINGS:
Fuel weight 128 kg (282 lb)
T-O weight, training and aerobatic missions
Aerobatic 1,100 kg (2,425 lb)
Normal 1,280 kg (2,822 lb)
Max 1,350 kg (2,976 lb)
Max disc loading 17.2 kg/m² (3.52 lb/sq ft)

PERFORMANCE (at normal T-O weight, except where indicated):
Max level speed 118 kts (220 km/h; 136 mph)
Max cruising speed 97 kts (180 km/h; 112 mph)
Normal cruising speed 86 kts (160 km/h; 99 mph)
Service ceiling 4,500 m (14,765 ft)
Hovering ceiling 1,500 m (4,920 ft)
Range at T-O weight of 1,350 kg (2,976 lb)
with 165 kg (363 lb) payload 97 n miles (180 km; 112 miles)
with 145 kg (320 lb) payload 194 n miles (360 km; 224 miles)

UPDATED

MIL Mi-34 VAZ

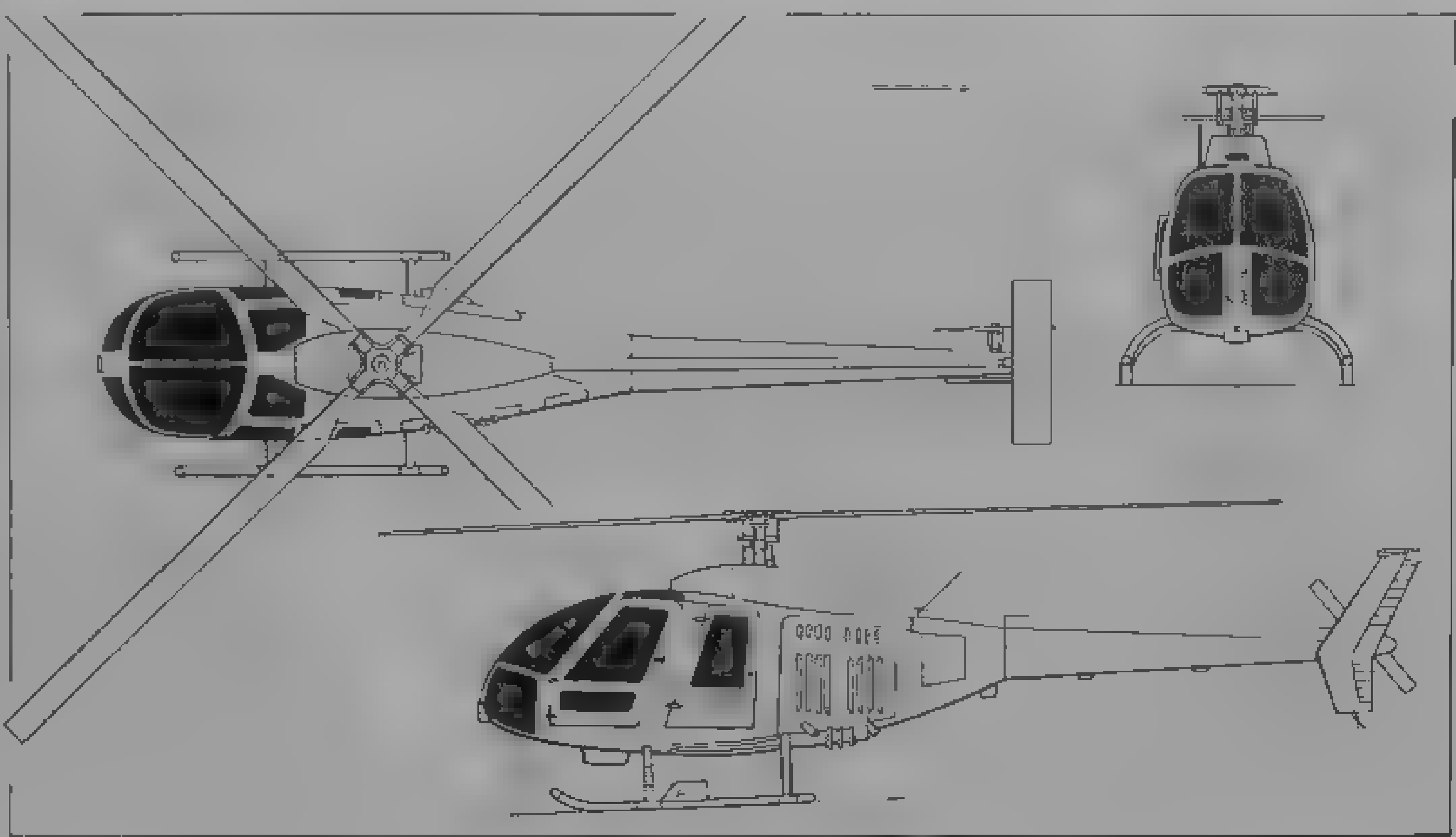
TYPE: Lightweight two/four-seat twin-engined helicopter.

PROGRAMME: Now in development; powered by two rotary engines, produced by VAZ motorcar works in Togliatti, prototype exhibited at MosAeroshow '92, IOC expected 1996.

DESIGN FEATURES: Basically as Mi-34 but completely new rotor head based on carbonfibre star plate, anchoring pitch cases that are integral with main blade section (sleeve over starplate arm), droop stops under blade root, no drag dampers, starplate clamped between upper and lower metal forgings attached to main shaft, pitch-change fittings also metal

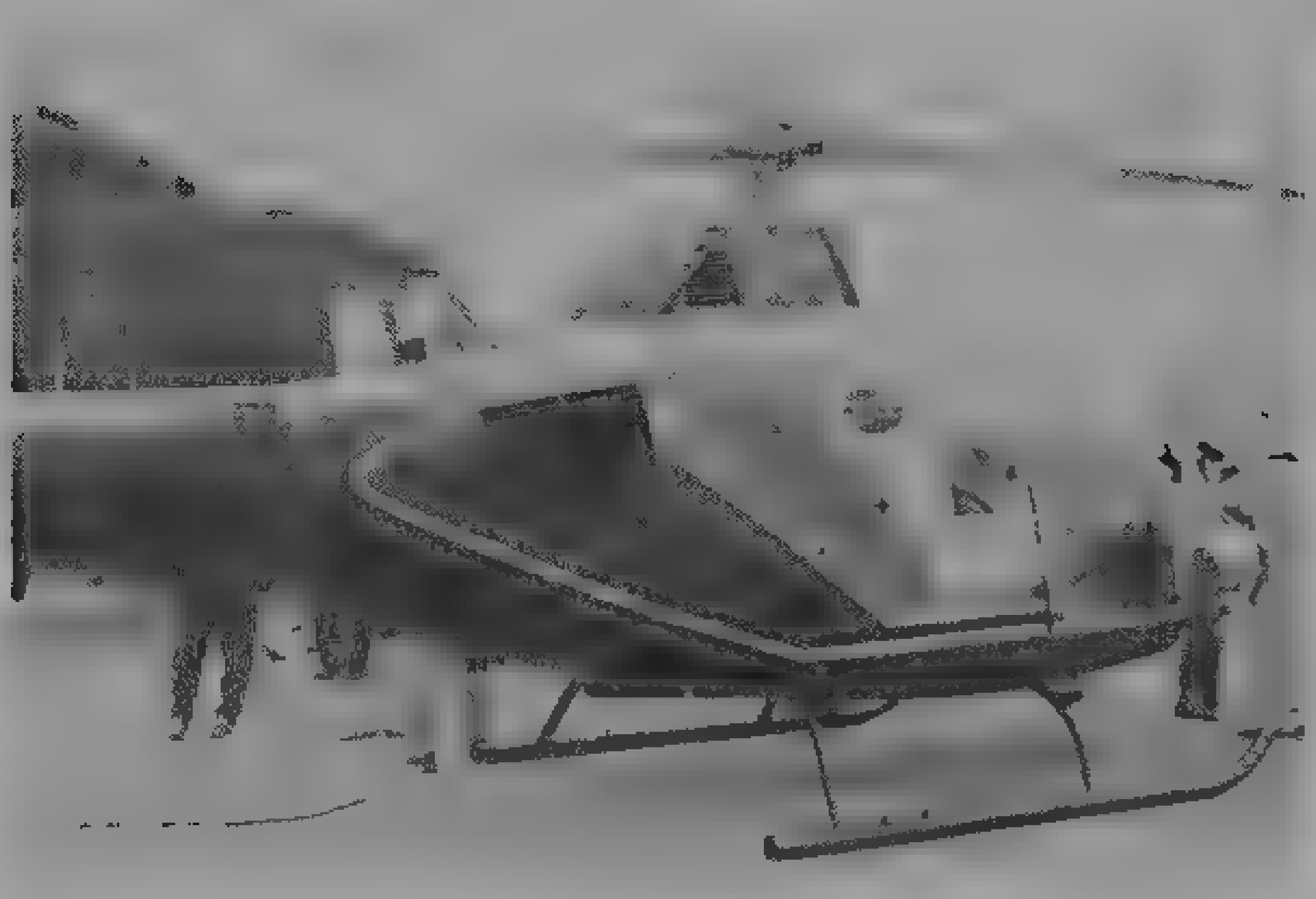
Mil Mi-34 light multipurpose helicopter (M-14V-26 engine) *(Paul Jackson)*

1995

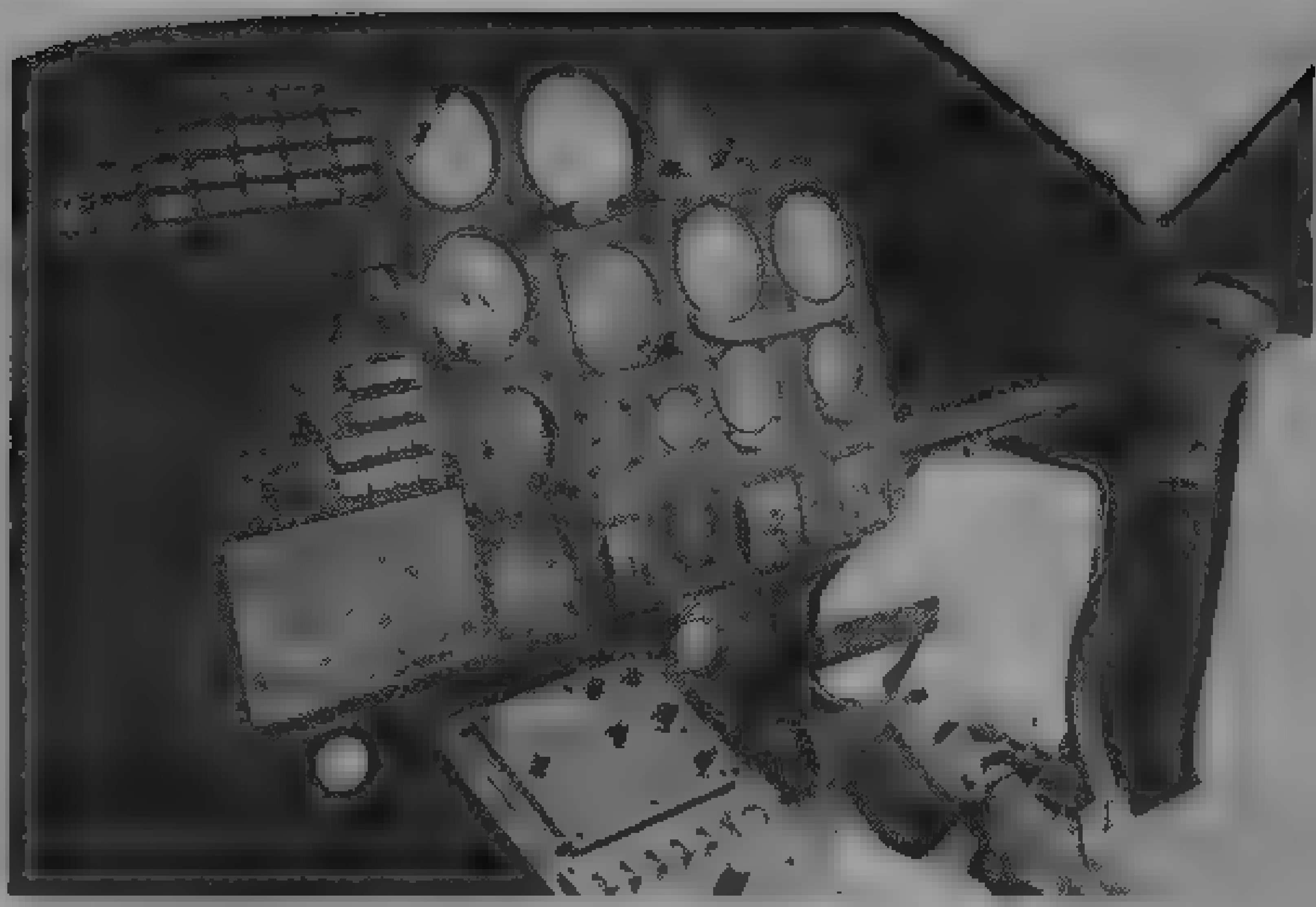


Mil Mi-34 two/four-seat training and competition helicopter *(Jane's/Dennis Punnett)*

1993



Prototype of twin-engined Mil Mi-34 VAZ light helicopter *(Mark Lambert)* 1993



Cockpit of prototype Mil Mi-34 VAZ *(Mark Lambert)* 1993

forgings. Resultant large apparent hinge offset gives high control response. Main rotor tip speed 205 m (672 ft)/s

POWER PLANT: Two VAZ-430 twin-chamber rotary engines, each 169 kW (227 hp) for T-O, 198.5 kW (266 hp) contingency. Internal fuel capacity 245 litres (64.7 US gallons; 54 Imp gallons), auxiliary fuel capacity 245 litres (64.7 US gallons; 54 Imp gallons). Engines burn Mogas and have power/weight ratio of 0.5 kg (1.1 lb)/hp

ACCOMMODATION: As Mi-34, plus optional stretcher for EMS duties and optional cargo sling

SYSTEMS: Cabin heated, de-icing system for main rotor blades and cabin windows

AVIONICS: *Flight:* Navigation equipment for flying in adverse weather optional

DIMENSIONS, EXTERNAL:
Main rotor diameter 11.40 m (37 ft 5 in)
Tail rotor diameter 1.50 m (4 ft 11 in)
Length of fuselage 9.50 m (31 ft 2 in)
Width of fuselage 1.45 m (4 ft 9 in)

DIMENSIONS, INTERNAL:
Cabin: Length 2.40 m (7 ft 10½ in)
Width 1.60 m (5 ft 3 in)
Height 1.30 m (4 ft 3¼ in)

WEIGHTS AND LOADINGS:
Max payload 550 kg (1,212 lb)
Max T-O weight 1,960 kg (4,320 lb)

PERFORMANCE (estimated):
Max level speed 118 kts (220 km/h; 136 mph)
Nominal cruising speed 97 kts (180 km/h; 112 mph)
Service ceiling 5,000 m (16,400 ft)
Hovering ceiling OGE: ISA 1,500 m (4,920 ft)
ISA + 15°C 800 m (2,625 ft)
Range: with max payload, 30 min reserves
43 n miles (80 km; 50 miles)
with max standard fuel, 340 kg (750 lb) payload, 30 min reserves 323 n miles (600 km; 372 miles)
Endurance with max standard fuel, 320 kg (705 lb) payload 5 h to 5 h 30 min

UPDATED

MIL Mi-35

Mi-35 is export version of Mi-24V, **Mi-35P** is export version of Mi-24P; Mi-35M is proposed upgrade (see Mi-24 entry)

UPDATED

MIL Mi-38

TYPE: Twin-turbine multirole medium-range helicopter

PROGRAMME: Model shown at 1989 Paris Air Show, when aircraft at mockup stage; first of initial batch of 10 scheduled to fly 1997, production planned in Kazan, certification to FAR Pt 29 standards and first deliveries 1999. Under December 1992 agreement, Eurocopter will integrate cockpit, avionics and passenger systems, and will adapt Mi-38 for international market. Euromil joint stock company established September 1994 to advance collaboration, now to include Kazan production plant and Klimov engine manufacturer, each with 25 per cent interest. Modifications in evidence by 1993 included fixed landing gear with wider track and reduced base

COSTS: Civil export price about $30 million

DESIGN FEATURES: Conventional pod and boom configuration, power plant above cabin, six-blade main rotor with considerable non-linear twist and swept tips, two independent two-blade tail rotors, set as narrow X on same shaft; port side door at front of cabin, clamshell rear-loading doors and ramp, hatch in cabin floor, under main rotor driveshaft, for tactical/emergency cargo airdrop and for cargo sling attachment; optional windows for survey cameras in place of hatch, sweptback fin/tail rotor mounting, small horizontal stabiliser. Mi-38 planned as Mi-8/17 series replacement, designed to FAR Pt 29 standards, for day/night operation over temperature range −60 to +50°C; Western engines optional

FLYING CONTROLS: Fly-by-wire, with manual back-up

STRUCTURE: Composites main and tail rotors, low-profile titanium main rotor head, with elastomeric bearings, main rotor has hydraulic drag dampers; single lubrication point, at driveshaft. fuselage mainly composites

LANDING GEAR: Fixed tricycle type; single wheel on each main unit, twin nosewheels, low pressure tyres, optional pontoons for emergency use in overwater missions

POWER PLANT: Two Klimov TVA-3000 turboshafts, each rated at 1,838 kW (2,465 shp) for T-O, single-engine rating 2,610 kW (3,500 shp) and transmission rated for same power. Power plant above cabin, to rear of main reduction gear; air intakes and filters in sides of cowling. Bag fuel tanks beneath floor of main cabin, provision for external auxiliary fuel tanks. Liquid petroleum gas fuel planned as alternative to aviation kerosene

ACCOMMODATION: Crew of two on flight deck, separated from main cabin by compartment for majority of avionics, single-pilot operation possible for cargo missions. Lightweight seats for 30 passengers as alternative to unobstructed hold for 5,000 kg (11,020 lb) freight. Ambulance and air survey versions planned. Provision for hoist over port-side door, remotely controlled hydraulically actuated rear cargo ramp, powered hoist on overhead rails in cabin, and roller conveyor system in cabin floor and ramp

SYSTEMS: Air conditioning by compressor bleed air, or APU on ground, maintains temperature of not more than 25°C on flight deck in outside temperature of 40°C, and not less than 15°C on flight deck and in main cabin in outside temperature of −50°C. Three independent hydraulic systems, any one able to maintain control of helicopter in emergency. Electrical system has three independent AC generators, two batteries, and transformer/rectifiers for DC supply, electric rotor blade de-icing. Independent fuel system for each engine, with automatic cross-feed, forward part of cowling houses VD-100 APU, hydraulic, air conditioning, electrical and other system components

AVIONICS: *Radar:* Weather/nav radar (range 54 n miles; 100 km; 62 miles)

Flight: Preset flight control system allows full autopilot autohover and automatic landing. Avionics controlled by large central computer, linked also to automatic nav system with Doppler, ILS, satellite nav system, main radar, autostabilisation system and automatic radio compass.

Instrumentation: Six colour CRTs for use in flight and by servicing personnel on ground. Equipment monitoring, failure warning and damage control system. Closed-circuit TV for monitoring cargo loading and slung loads. Options include low-cost electromechanical instrumentation based on that of Mi-8, sensors for weighing and CG positioning of cargo in cabin, and for checking weight of slung loads

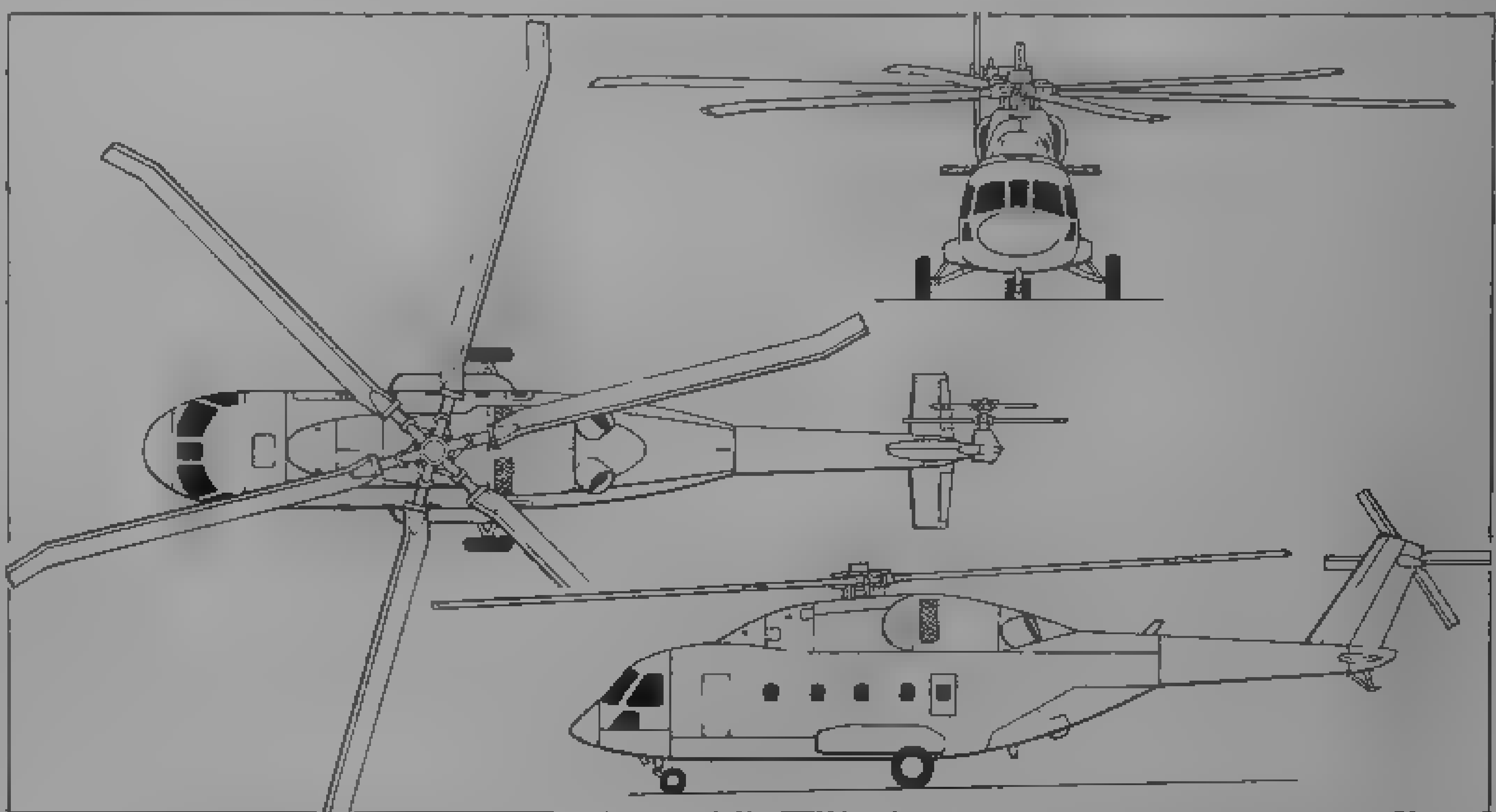
DIMENSIONS, EXTERNAL:
Main rotor diameter 21.10 m (69 ft 2¾ in)
Tail rotor diameter 3.84 m (12 ft 7¼ in)
Length overall, excl rotors 19.95 m (65 ft 5½ in)
Height to top of rotor head 5.20 m (17 ft 0¾ in)
Stabiliser span 4.20 m (13 ft 9⅓ in)
Wheel track 4.50 m (14 ft 9¼ in)
Wheelbase 5.17 m (16 ft 11½ in)
Forward freight door: Width 1.50 m (4 ft 11 in)
Height 1.70 m (5 ft 7 in)
Floor hatch: Length 1.15 m (3 ft 9¼ in)
Width 0.75 m (2 ft 5½ in)

DIMENSIONS, INTERNAL:
Main cabin: Length to ramp 6.80 m (22 ft 3½ in)
Length, incl fwd part of tailboom
10.70 m (35 ft 1¼ in)
Max width 2.36 m (7 ft 9 in)
Width at floor 2.20 m (7 ft 2½ in)
Height: centre 1.80 m (5 ft 10¾ in)
rear 1.85 m (6 ft 1 in)

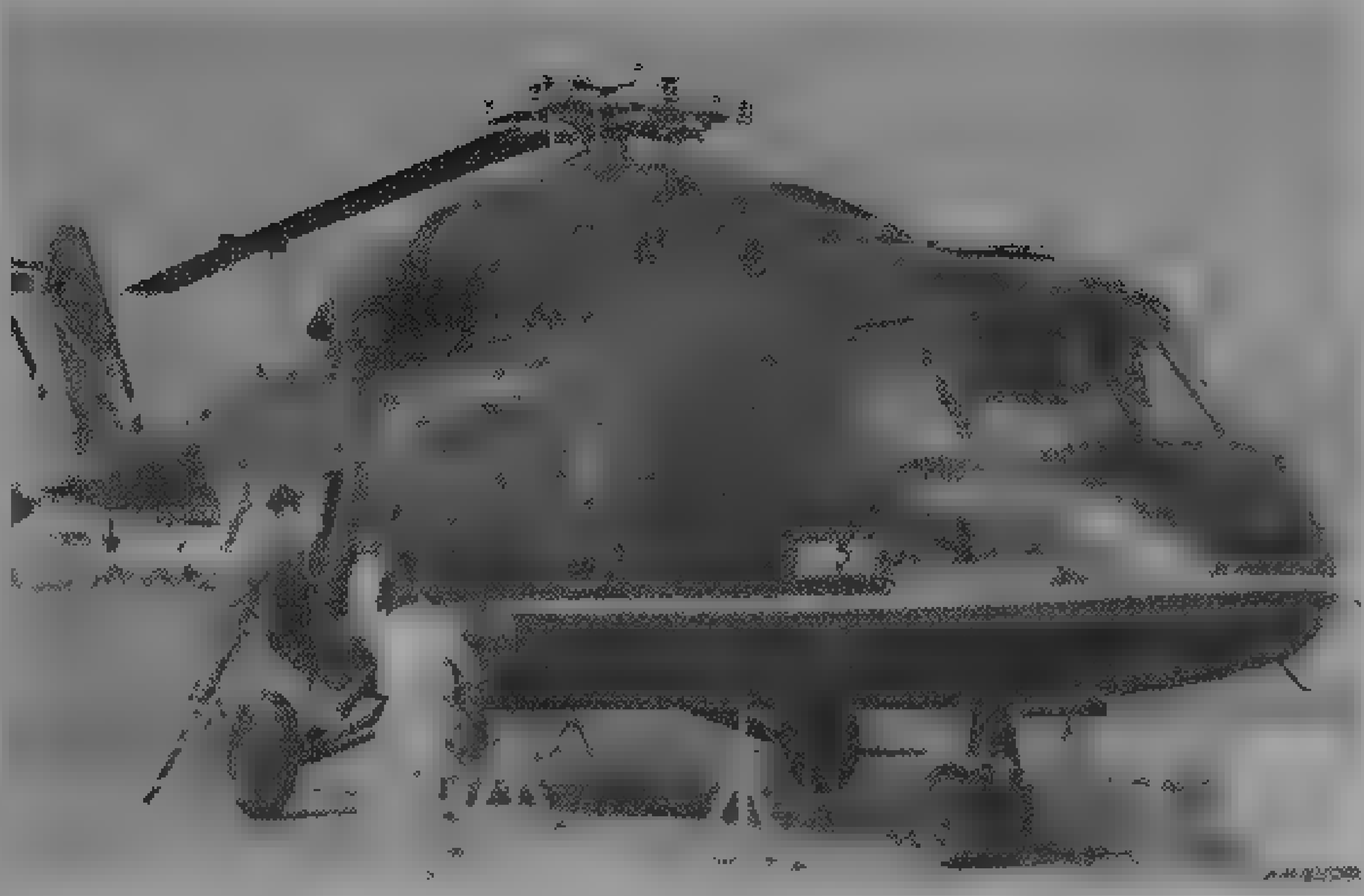
AREAS:
Main rotor disc 349.67 m² (3,763.8 sq ft)
Tail rotor disc 11.58 m² (124.7 sq ft)

WEIGHTS AND LOADINGS (provisional):
Max payload: internal 5,000 kg (11,020 lb)
external 6,000 kg (13,225 lb)
Normal T-O weight 14,200 kg (31,305 lb)
Max T-O weight 15,600 kg (34,392 lb)
Max disc loading 44.61 kg/m² (9.14 lb/sq ft)
Max transmission power loading
5.97 kg/kW (9.82 lb/shp)

PERFORMANCE (estimated, at max T-O weight):
Max level speed 148 kts (275 km/h; 171 mph)
Cruising speed 135 kts (250 km/h; 155 mph)
Service ceiling 6,500 m (21,325 ft)
Hovering ceiling OGE 2,500 m (8,200 ft)

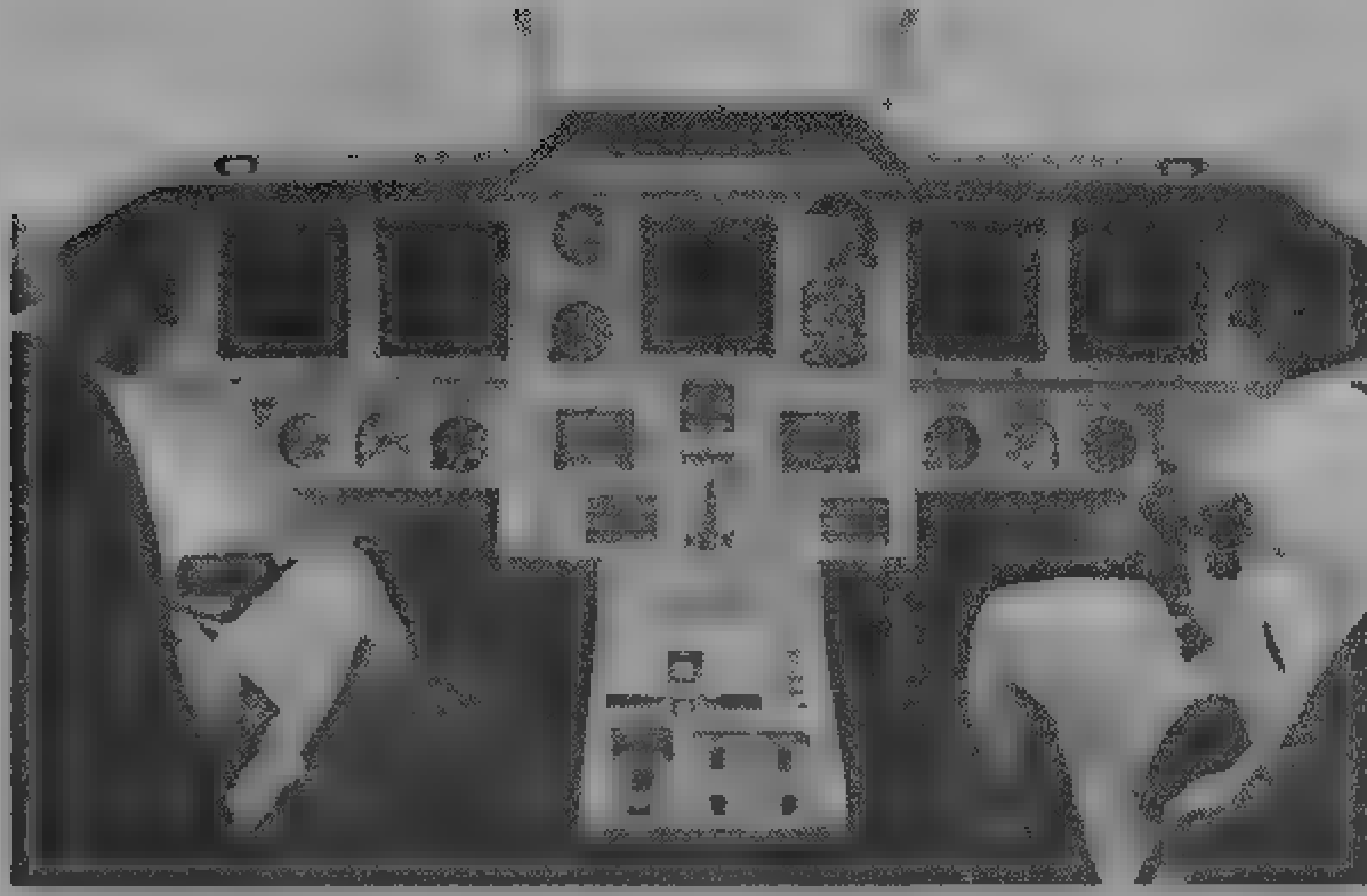


Mil Mi-38 medium-range helicopter to replace the Mi-8/17 *(Jane's/Mike Keep)* 1995



Full-scale mockup of Mil Mi-38 *(Mark Lambert)*

1993



Mockup cockpit of Mil Mi-38 *(R. J. Malachowski)*

1993

Range, 30 min reserves
- with 5,000 kg (11,020 lb) payload 175 n miles (325 km, 202 miles)
- with 4,500 kg (9,920 lb) payload (30 passengers and baggage) 286 n miles (530 km; 329 miles)
- with 3,500 kg (7,715 lb) payload and standard fuel 430 n miles (800 km, 497 miles)
- with 1,800 kg (3,965 lb) payload and auxiliary fuel 700 n miles (1,300 km, 808 miles)

UPDATED

MIL Mi-40

TYPE: Twin-turboshaft infantry combat helicopter

PROGRAMME: Project announced Summer 1992; redesigned model shown at MosAeroshow '93, at preliminary design stage in early 1994, with initial government funding

DESIGN FEATURES: Development of Mi-24 concept, to deliver seven troops to battlefield in armoured cabin behind flight deck and to provide fire support. Dynamic and avionics systems based on those of Mi-28, for other details see illustration

LANDING GEAR: Retractable nosewheel type, twin-wheel nose unit, single wheel on main units

POWER PLANT: As for Mi-28N

ACCOMMODATION: Pilot and navigator/weapon systems operator side by side, up to seven combat-equipped troops in main cabin, horizontally divided door in upward-opening/downward-opening sections on each side. Compartment at rear of cabin for gunner, with large side and rear windows, and door on starboard side

AVIONICS: *Mission*: Optics in mast-mounted pod, probably similar to those of Mi-28N

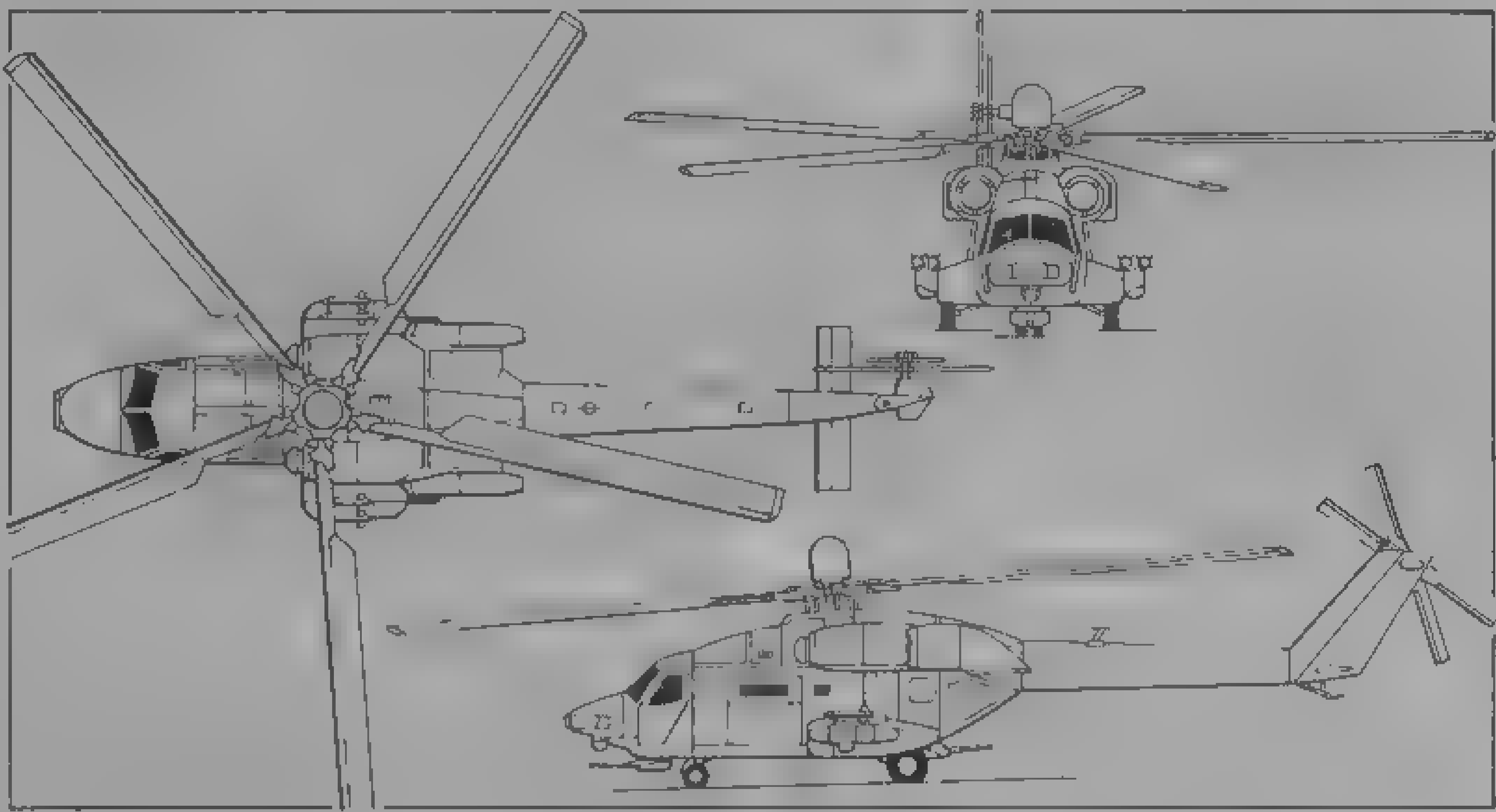
ARMAMENT: Undernose turret for 23 mm multibarrel gun, basic mission specifies up to eight air-to-surface or air-to-air missiles, gun and seven troops, provision for flexibly mounted 12.7 mm gun at rear of cabin pod.

DIMENSIONS, EXTERNAL:

Main rotor diameter	17.20 m (56 ft 5 in)
Tail rotor diameter	3.84 m (12 ft 7¼ in)
Length overall	16.00 m (52 ft 6 in)
Height overall	4.60 m (15 ft 11 in)
Wheel track	3.00 m (9 ft 10¼ in)
Wheelbase	4.15 m (13 ft 7½ in)

WEIGHTS AND LOADINGS:

Weight empty	7,675 kg (16,920 lb)
Max payload	1,800 kg (3,968 lb)
Max internal fuel	1,170 kg (2,580 lb)
Max T-O weight	11,900 kg (26,235 lb)



Mil Mi-40 twin-turboshaft infantry combat helicopter *(Jane's/Mike Keep)*

1994

PERFORMANCE (estimated):

Max level speed	167 kts (310 km/h; 192 mph)
Nominal cruising speed	140 kts (260 km/h, 161 mph)
Service ceiling	5,550 m (18,200 ft)
Hovering ceiling OGE	3,300 m (10,825 ft)
Max range, 5% reserves	215 n miles (400 km; 248 miles)

VERIFIED

MIL Mi-46T

TYPE: Twin-turboshaft passenger/freight transport helicopter

PROGRAMME: Project announced Summer 1992, not yet flown, planned IOC 2000

DESIGN FEATURES: Replacement for Mi-6, with T-O weight just over half that of Mi-26. General configuration similar to Mi-26: seven-blade main rotor; five-blade tail rotor; non-retractable tricycle landing gear with twin wheels on each unit; few windows in hold; rear-loading ramp and doors, engines above hold, forward of main rotor driveshaft

POWER PLANT: Two new-type Aviadvigatel turboshafts, each 5,590 kW (7,495 shp)

ACCOMMODATION: Equipped normally to carry freight

DIMENSIONS, EXTERNAL:

Main rotor diameter	27.6 m (90 ft 6¾ in)
Length overall, excl rotors	26.3 m (86 ft 3½ in)
Wheel track	5.00 m (16 ft 5 in)

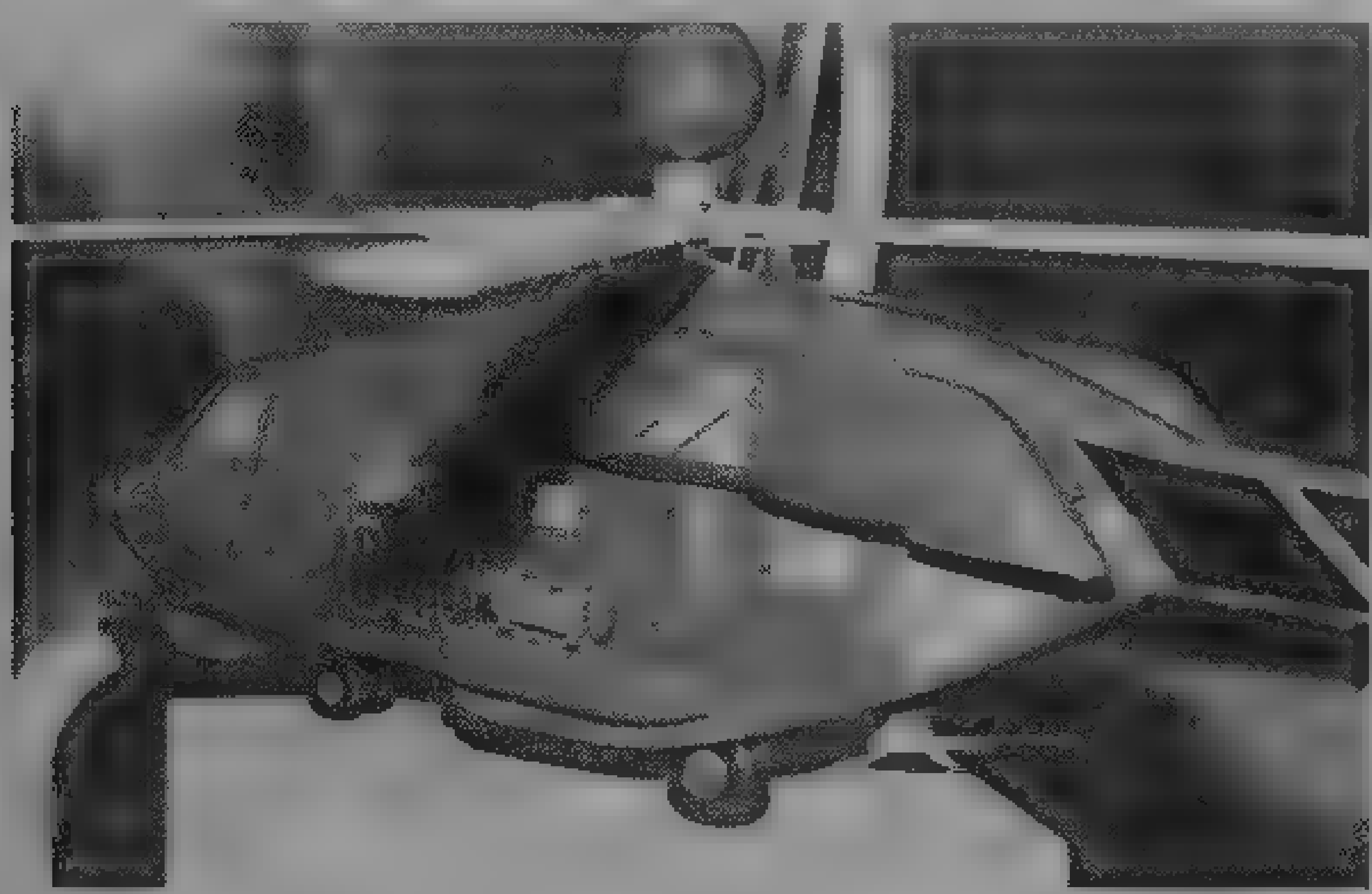
WEIGHTS AND LOADINGS:

Weight empty	16,200 kg (35,715 lb)
Max payload	12,000 kg (26,455 lb)
Max T-O weight	30,000 kg (66,137 lb)

PERFORMANCE (estimated):

Nominal cruising speed	145 kts (270 km/h, 168 mph)
Hovering ceiling OGE	2,300 m (7,550 ft)
Normal range with 10,000 kg (22,045 lb) payload	215 n miles (400 km; 248 miles)

UPDATED

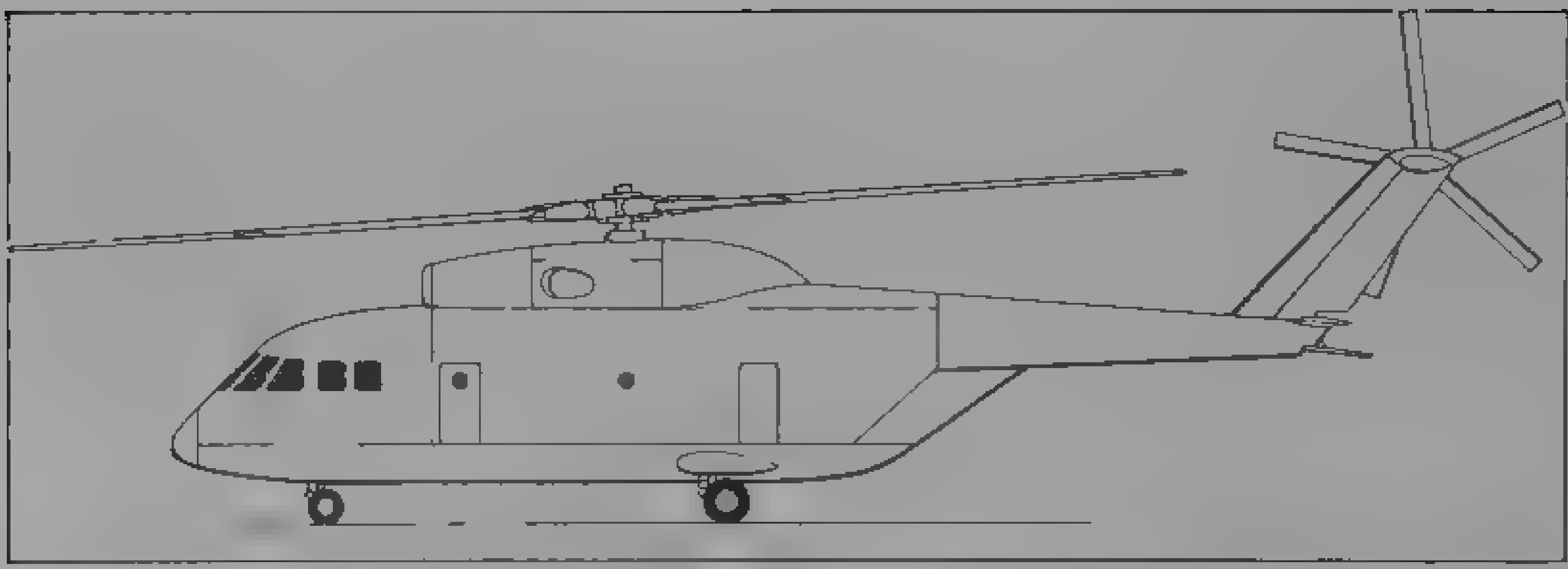


Model of Mil Mi-40 in current, much redesigned, form *(Piotr Butowski)*

1994

Artist's impression of Mil Mi-46K flying crane counterpart of Mi-46T *(Jane's/Mike Keep)*

1993



Provisional drawing of Mil Mi-46T twin-turboshaft passenger/freight transport helicopter *(Jane's/Mike Keep)*

1993

Model of Mil Mi-52 three-seat light helicopter *(Brian M. Service)*

1994

MIL Mi-46K

TYPE: Twin-turboshaft flying crane helicopter

PROGRAMME: Project revealed Summer 1992, no subsequent [illegible]

DESIGN FEATURES: Replacement for Mi-10K, of typical large flying crane configuration, utilising fuselage nose, flight deck, power plant and dynamic components of Mi-46T, flat bottomed, shallow centre and rear fuselage, with short stub-wings and long tripod-braced mainwheel units, glazed gondola for second pilot, facing rearward behind front fuselage pod, to control helicopter during loading and unloading. Sling cable directly under main rotor driveshaft for payload.

POWER PLANT: Two unspecified 5,965 kW (8,000 shp) turboshafts

WEIGHTS AND LOADINGS:

Weight empty	19,700 kg (43,430 lb)
Max T-O weight	36,500 kg (80,467 lb)

PERFORMANCE (estimated):

Hovering ceiling at max T-O weight	2,300 m (7,545 ft)
Range with 11,000 kg (24,250 lb) payload at max T-O weight, 30 min reserves	215 n miles (400 km, 248 miles)

UPDATED

MIL Mi-52

TYPE: Three-seat light helicopter

PROGRAMME: Announced, and model displayed, at 1993 Paris Air Show, first flight scheduled 1994 but delayed, production at small plant in Moscow, adjoining OKB, from 1996-97

DESIGN FEATURES: Smallest helicopter yet developed by Mil, configuration shown in accompanying photograph of model. Four-blade main rotor, two-blade tail rotor

LANDING GEAR: Non-retractable tricycle type; single wheel on each unit; cantilever spring legs, fairing over each wheel

POWER PLANT: One rotary (Wankel type) engine, probably related to VAZ-430 in Mi-34 VAZ

ACCOMMODATION: Enclosed cabin for pilot, in front, and two passengers on rear bench seat, two doors on each side

DIMENSIONS, EXTERNAL:

Main rotor diameter	10.00 m (32 ft 9¾ in)
Length overall, excl rotors	8.71 m (28 ft 7 in)
Wheel track	2.00 m (6 ft 6¾ in)

WEIGHTS AND LOADINGS:

Max payload	250 kg (551 lb)
Max T-O weight	1,150 kg (2,535 lb)

PERFORMANCE (estimated):

Nominal cruising speed	86-91 kts (160-170 km/h, 100-105 mph)
Hovering ceiling OGE	1,600 m (5,250 ft)
Range with standard fuel	215 n miles (400 km, 248 miles)

UPDATED

MIL Mi-54

TYPE: Twin-turbine commercial utility helicopter

PROGRAMME: Project announced Summer 1992, at preliminary design stage by 1993, to replace Mi-2 and Mi-8, model displayed at MosAeroshow '92, single-engined version for Asian market also being studied, IOC planned 1998.

DESIGN FEATURES: Configuration shown in accompanying illustrations; four-blade composites main and tail rotors, high excess power will permit operation as Cat. A helicopter from sites of limited size, intended for passenger/cargo, oil rig support, ambulance and executive duties

LANDING GEAR: Non-retractable tricycle type; single wheel on each main unit, carried on short sponsons, twin nosewheels, tailskid

POWER PLANT: Two Saturn/Lyulka AL-32 turboshafts, each 574 kW (770 shp), mounted side by side above cabin

ACCOMMODATION: Normal seating for 10 to 12 passengers

DIMENSIONS, EXTERNAL:

Main rotor diameter	13.50 m (44 ft 3½ in)
Tail rotor diameter	2.60 m (8 ft 6½ in)
Length overall, excl rotors	13.20 m (43 ft 3¾ in)
Height to top of rotor head	3.55 m (11 ft 7¾ in)
Wheel track	3.00 m (9 ft 10¼ in)
Wheelbase	3.90 m (12 ft 9½ in)

WEIGHTS AND LOADINGS:

Payload	1,000-1,300 kg (2,205-2,865 lb)
Max T-O weight	4,000 kg (8,820 lb)

PERFORMANCE (estimated):

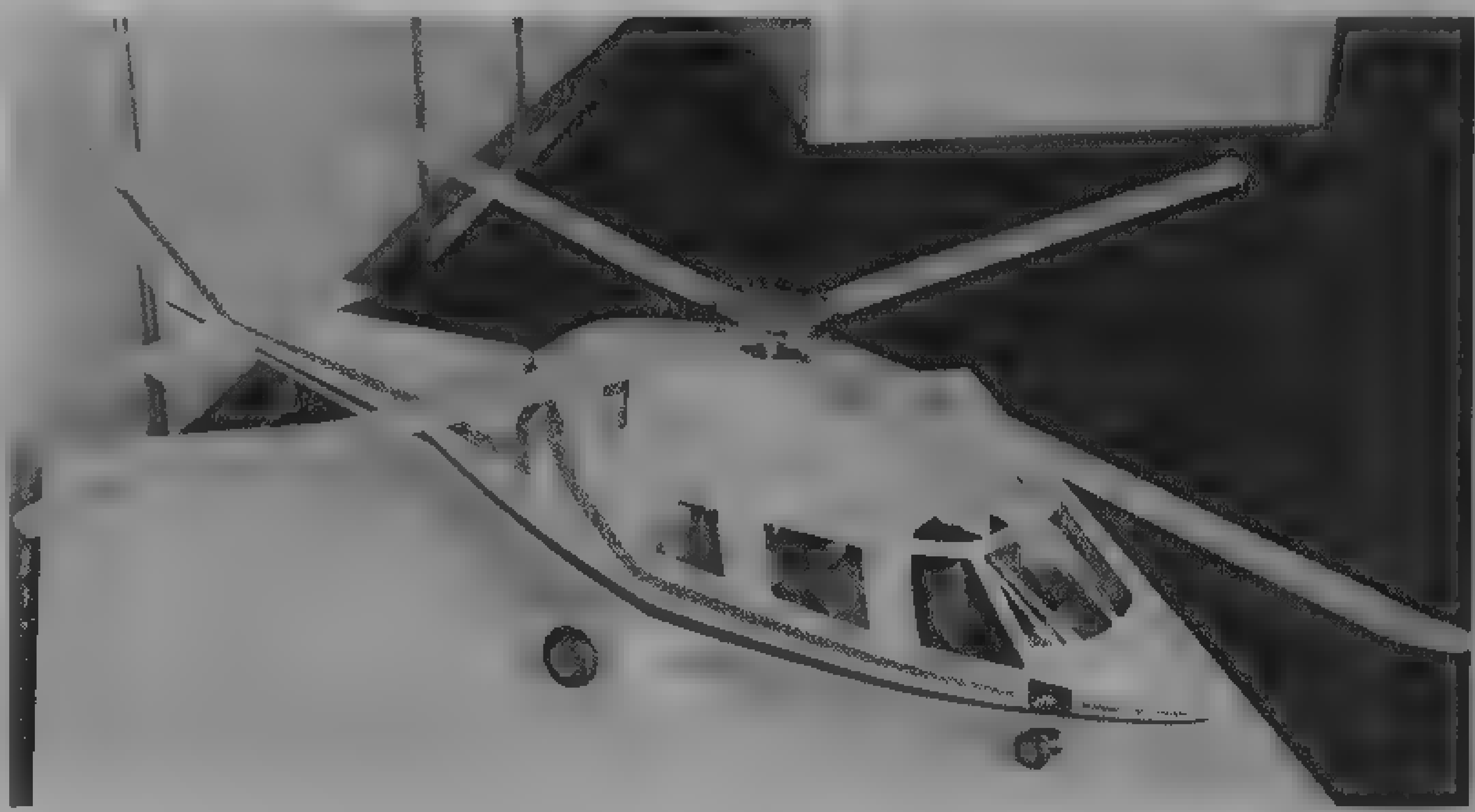
Max level speed	151 kts (280 km/h, 174 mph)
Nominal cruising speed	140 kts (260 km/h, 161 mph)
Hovering ceiling OGE	2,000 m (6,560 ft)
Range, 30 min reserves: with max internal fuel	431 n miles (800 km, 497 miles)
with 1,200 kg (2,645 lb) payload	242 n miles (450 km, 280 miles)

VERIFIED

MIL Mi-58

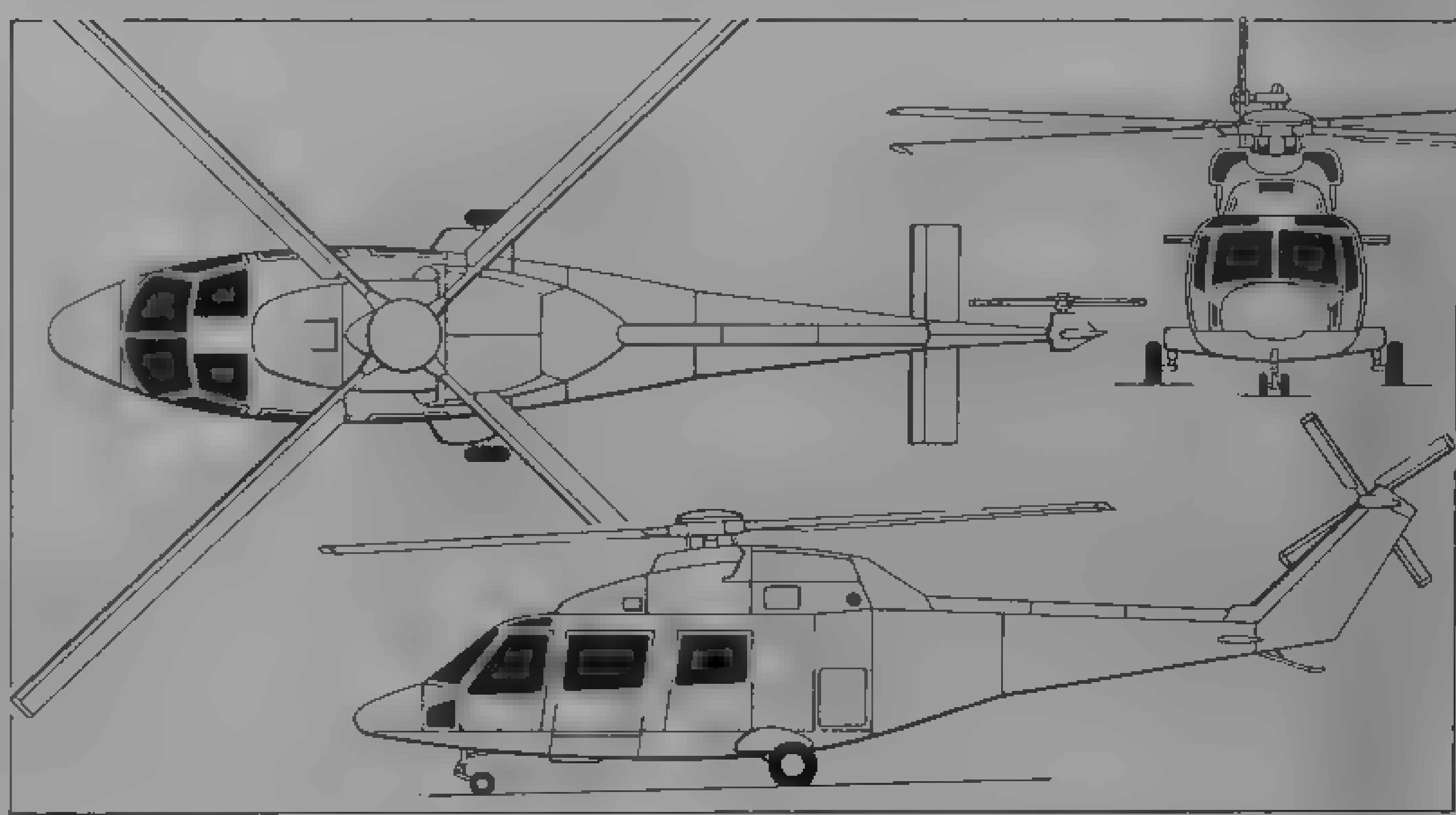
TYPE: Twin-turbine passenger-carrying helicopter

PROGRAMME: Announced 1995 Paris Air Show, planned certification to Russian and FAR Pt 29 requirements, deliveries possible 1998



Model of Mil Mi-54 displayed at MosAeroshow '92 *(Mark Lambert)*

1993



Mil Mi-54 twin-turbine commercial utility helicopter *(Jane's/Mike Keep)*

1993

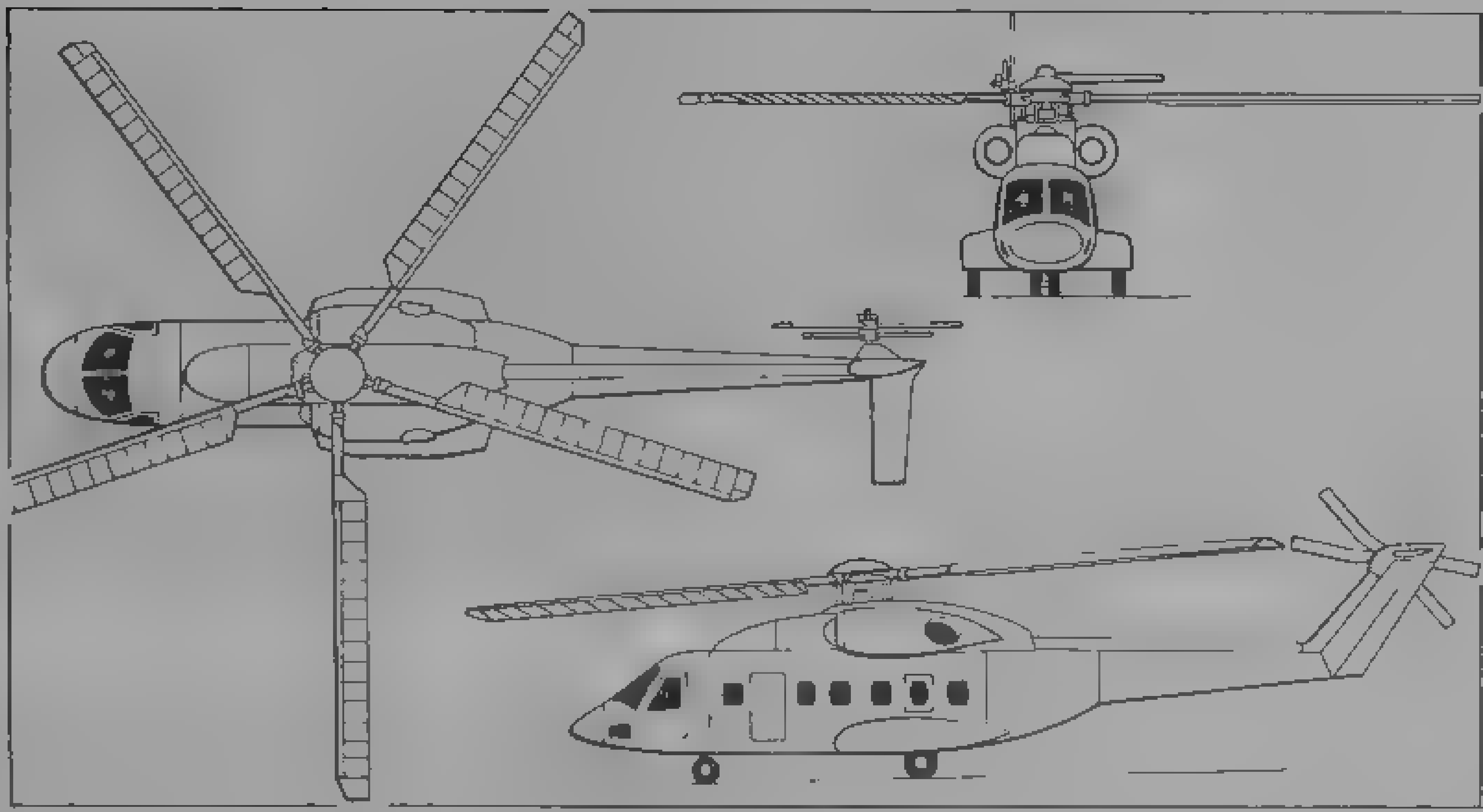
DESIGN FEATURES: Conventional pod and boom configuration; five-blade main rotor, two independent 'scissors' type tail rotors and dynamic system similar to those of Mi-28.

LANDING GEAR: Non-retractable tricycle type; single wheel on each main unit carried on long sponson on each side of fuselage; twin nosewheels.

POWER PLANT: Two Klimov TV3-117VMA-SB3 turboshafts, each with contingency rating of 2,088 kW (2,762 shp).

ACCOMMODATION: Basic version for 20 passengers, with four rearward-facing seats at front of cabin, 12 seats three abreast with aisle, and four seats at rear. Door on each side of flight deck, main cabin door at front on port side, emergency exit each side over sponson. VIP version projected. No other data yet available.

NEW ENTRY



Provisional three-view of Mil Mi-58 20-passenger helicopter *(Jane's/James Goulding)* *1995*

MOLNIYA

MOLNIYA SCIENTIFIC AND INDUSTRIAL ENTERPRISE

Novoposelkovaya 4, 123459 Moscow
Telephone: 7 (095) 493 33 35, 493 50 93
Fax: 7 (095) 492 93 71
GENERAL DIRECTOR: Alexander Bashilov
GENERAL DESIGNER: Gleb Lozino-Lozinsky

To compensate for reduced funding for Buran space shuttle orbiter programme, in which it was much involved, Molniya has projected a series of civil aircraft. First to fly was six-seat Molniya-1. Others, at various design stages, include Molniya-100, a 15-seat twin-engined airliner; Molniya-300 twin-engined business jet; Molniya-400 twin-engined cargo jet, and six-engined Heracles freighter, which would be world's heaviest aeroplane. Molniya suggests that manufacture of the -300, -400 and Heracles could begin in five to eight years given adequate funding.

UPDATED

MOLNIYA-1

TYPE: Single-engined six-seat light aircraft.

PROGRAMME: Announced at MosAeroshow '92. Prototype (01200.) flew 18 December 1992; initial production series of 20 has been built, certification under way 1995.

DESIGN FEATURES: Low-wing configuration, with three lifting surfaces in tandem, foreplanes mid-mounted on nose, wings at rear of fuselage pod, carrying twin tailbooms with tailplane bridging tips of sweptback vertical tail surfaces; non-retractable tricycle landing gear, with single wheel and low-pressure tyre on each unit, fairing over each wheel, skis optional, engine mounted at rear of fuselage pod. Folding wings optional to permit driving on roads and transportation in container hangar. 'Tandem triplane' configuration prevents spin at high angles of attack. Operation practicable from unpaved 500 m (1,640 ft) fields with bearing strength of 4.5 kg/cm² (64 lb/sq in). Designed to permit flying by pilot of average ability after 8 to 16 hours' instruction.

POWER PLANT: One 265 kW (355 hp) VOKBM M-14PM-1 air-cooled radial piston engine, driving three-blade pusher propeller; or Teledyne Continental TSIOL-550-B horizontally opposed engine. Initially unsupercharged but supercharged later. Allison 250-B17F turboprop also being considered.

ACCOMMODATION: Six persons in pairs, seats quickly removable for freight carrying. Alternative configurations include business version with forward-facing seat beside pilot, two armchairs, table, safe, com equipment and small buffet, ambulance for stretcher patient, two attendants and medical equipment, training version with dual controls. Air conditioning optional.

AVIONICS: *Comms:* Radio standard.
Flight: Navaids standard. Autopilot and satellite nav optional.
Instrumentation: Digital instruments optional.
Mission: Fax optional.

DIMENSIONS, EXTERNAL:

Wing span	8.50 m (27 ft 10¾ in)
Length overall	7.86 m (25 ft 9½ in)
Height overall	2.30 m (7 ft 6½ in)
Width, wings removed or folded	3.60 m (11 ft 9¾ in)
Wheel track	3.02 m (9 ft 11 in)
Wheelbase	3.34 m (10 ft 11½ in)

WEIGHTS AND LOADINGS:

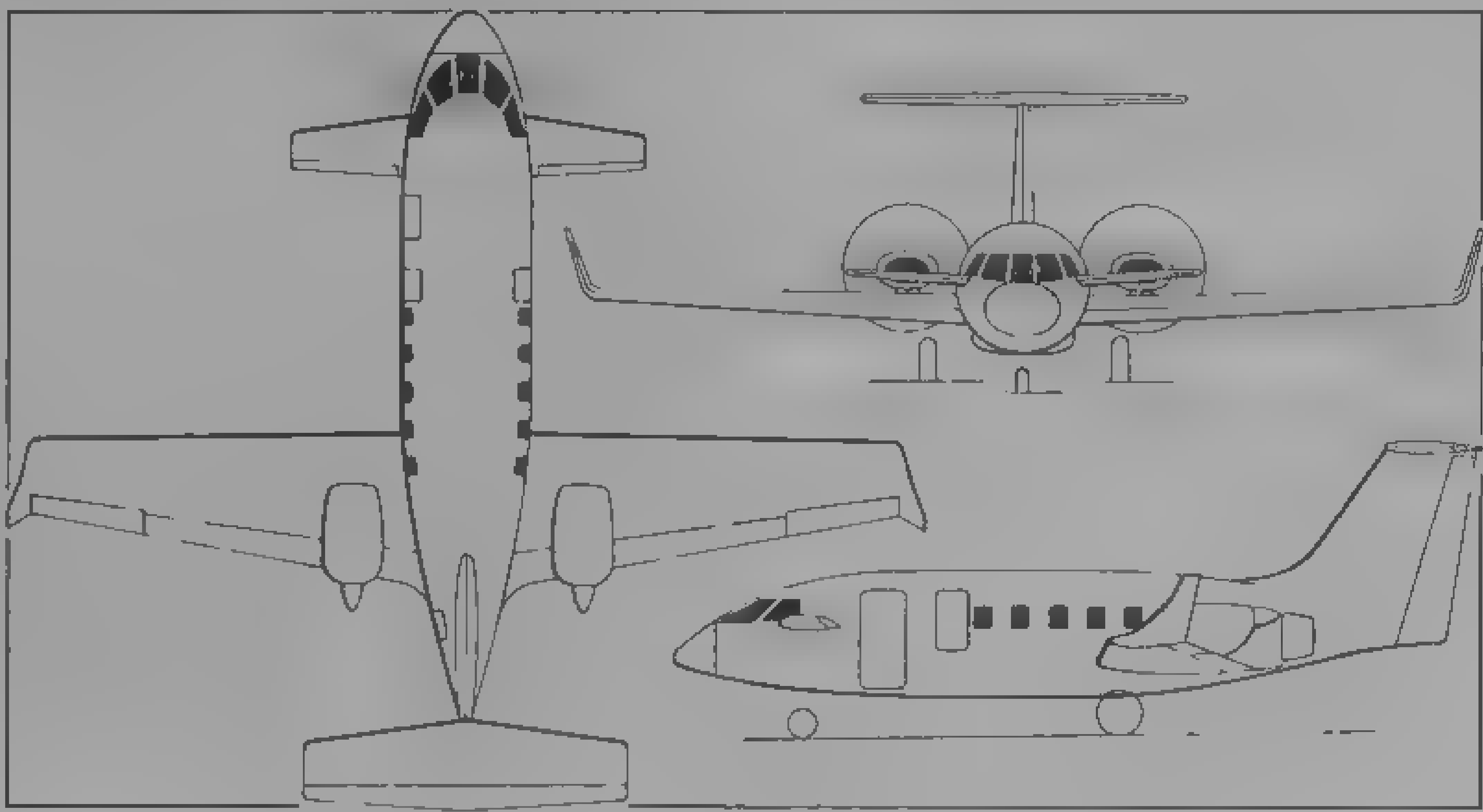
Max payload	505 kg (1,115 lb)
Max fuel	220 kg (485 lb)
Max T-O weight	1,740 kg (3,835 lb)

PERFORMANCE (estimated, with supercharged M-14PM or Continental engine):

Max level speed	216 kts (400 km/h, 248 mph)
Nominal cruising speed	135-172 kts (250-320 km/h, 155-198 mph)
Landing speed	68 kts (125 km/h, 78 mph)
T-O run	350 m (1,150 ft)
* Range: with max payload at 145 kts (270 km/h, 168 mph)	270 n miles (500 km, 310 miles)
with max fuel	648 n miles (1,200 km, 745 miles)

* *Ranges with unsupercharged engine at 195-247 kts (225-285 km/h, 140-177 mph) at 1,500 m (4,920 ft) are close to those listed*

UPDATED



Molniya-100 twin-engined multipurpose light transport *(Jane's/Mike Keep)* *1994*

MOLNIYA-100

TYPE: Twin-engined multipurpose light transport.

PROGRAMME: Design study completed.

DESIGN FEATURES: Unconventional 'tandem triplane' with three unswept lifting surfaces: foreplanes mid-set on nose, main wings mid mounted at rear of fuselage, with winglets, T tailplane at tip of sweptback vertical tail surfaces; circular section wide-body fuselage, engines mounted on upper surface of main wings, driving three-blade pusher propellers.

LANDING GEAR: Retractable tricycle type; single wheel on each unit, nosewheel retracts forward.

POWER PLANT: Two 324 kW (435 hp) Teledyne Continental GTSIO-520-K flat-six engines, version with Allison 250 turboprops being studied.

ACCOMMODATION: Two crew side by side; basic version has 15 seats in cabin three-abreast, with twin seats on starboard side of aisle. Crew wardrobe, compartment for hand baggage and passenger wardrobe, and toilet at front of cabin; door at front of cabin on port side, emergency exit each side forward of front row of seats, baggage compartment in tailcone with door on port side. Business version for up to eight passengers in two-section cabin with table, safe, divan and sideboard. Ambulance configuration for four litter patients, two medical personnel and medical equipment. All seating and furnishings quickly removable for freight transport, cargo moored by nets to floor fittings.

Molniya-1 (VOKBM M-14PM-1 engine) at Samara *1995*

AVIONICS: *Comms:* Nav/com radio for VFR and IFR operations.
Flight: GPS optional.
Instrumentation: Conventional flight instruments.

DIMENSIONS, EXTERNAL:

Wing span	14.30 m (46 ft 11 in)
Length overall	12.48 m (40 ft 11½ in)
Height overall	4.50 m (14 ft 9¼ in)
Cargo door: Max height	1.35 m (4 ft 5 in)
Width	1.20 m (3 ft 11¼ in)

WEIGHTS AND LOADINGS:

Max payload	1,500 kg (3,307 lb)
Max fuel	950 kg (2,095 lb)
Max T-O weight	4,300 kg (9,480 lb)

PERFORMANCE (estimated):

Max level speed	216 kts (400 km/h, 248 mph)
Nominal cruising speed at 3,000 m (9,840 ft)	175-205 kts (325-380 km/h, 202-236 mph)
Landing speed	70 kts (130 km/h, 81 mph)
T-O run	430 m (1,410 ft)
Landing run	350 m (1,150 ft)
Range: with max payload	323 n miles (600 km, 372 miles)
with max fuel	1,080 n miles (2,000 km, 1,242 miles)

UPDATED

MOLNIYA 300

TYPE: Twin turbofan business aircraft.

PROGRAMME: Design study completed, production could begin in six years after allocation of adequate funding.

DESIGN FEATURES: 'Tandem triplane' with three lifting surfaces, all surfaces swept back, T tailplane, engines pod mounted on rear fuselage.

LANDING GEAR: Retractable tricycle type; single wheel on each unit.

POWER PLANT: Two turbofans, each 12.0 kN (2,690 lb st).

ACCOMMODATION: Two crew side by side; six passengers in executive configuration, 15 in economy class (three-abreast).

AVIONICS: State-of-the-art avionics for IFR and ICAO Cat II operations.

DIMENSIONS, EXTERNAL:

Wing span	13.44 m (44 ft 1¼ in)
Length overall	13.20 m (43 ft 3¾ in)
Height overall	4.40 m (14 ft 5¼ in)

WEIGHTS AND LOADINGS:

Max payload	1,350 kg (2,976 lb)
Max fuel	2,100 kg (4,630 lb)
Max T-O weight	6,800 kg (14,991 lb)

PERFORMANCE (estimated):

Max level speed	502 kts (930 km/h, 578 mph)
Nominal cruising speed at 3,000 m (9,840 ft)	432 kts (800 km/h, 497 mph)
T-O run	630 m (2,067 ft)
Landing run	460 m (1,510 ft)
Range: with 15 passengers	1,565 n miles (2,900 km, 1,801 miles)
with max fuel	2,753 n miles (5,100 km, 3,169 miles)

NEW ENTRY

MOLNIYA-400

TYPE: Twin-turbofan freight transport.

PROGRAMME: Feasibility study completed; preliminary design under way 1995, production could begin six years after allocation of adequate funding. Combined passenger/cargo version being considered.

DESIGN FEATURES: 'Tandem triplane' with three lifting surfaces, all surfaces swept back; foreplanes with winglets low-mounted on nose; wings with winglets shoulder-mounted on fuselage; tailplane mid-mounted on fin; engines pylon-mounted underwing.

LANDING GEAR: Retractable tricycle type; twin nosewheels; each main unit comprises three pairs of wheels in tandem.

POWER PLANT: Two Aviadvigatel PS-90A turbofans, each 156.9 kN (35,275 lb st).

ACCOMMODATION: Unrestricted cargo hold, with rear-loading ramp/door.

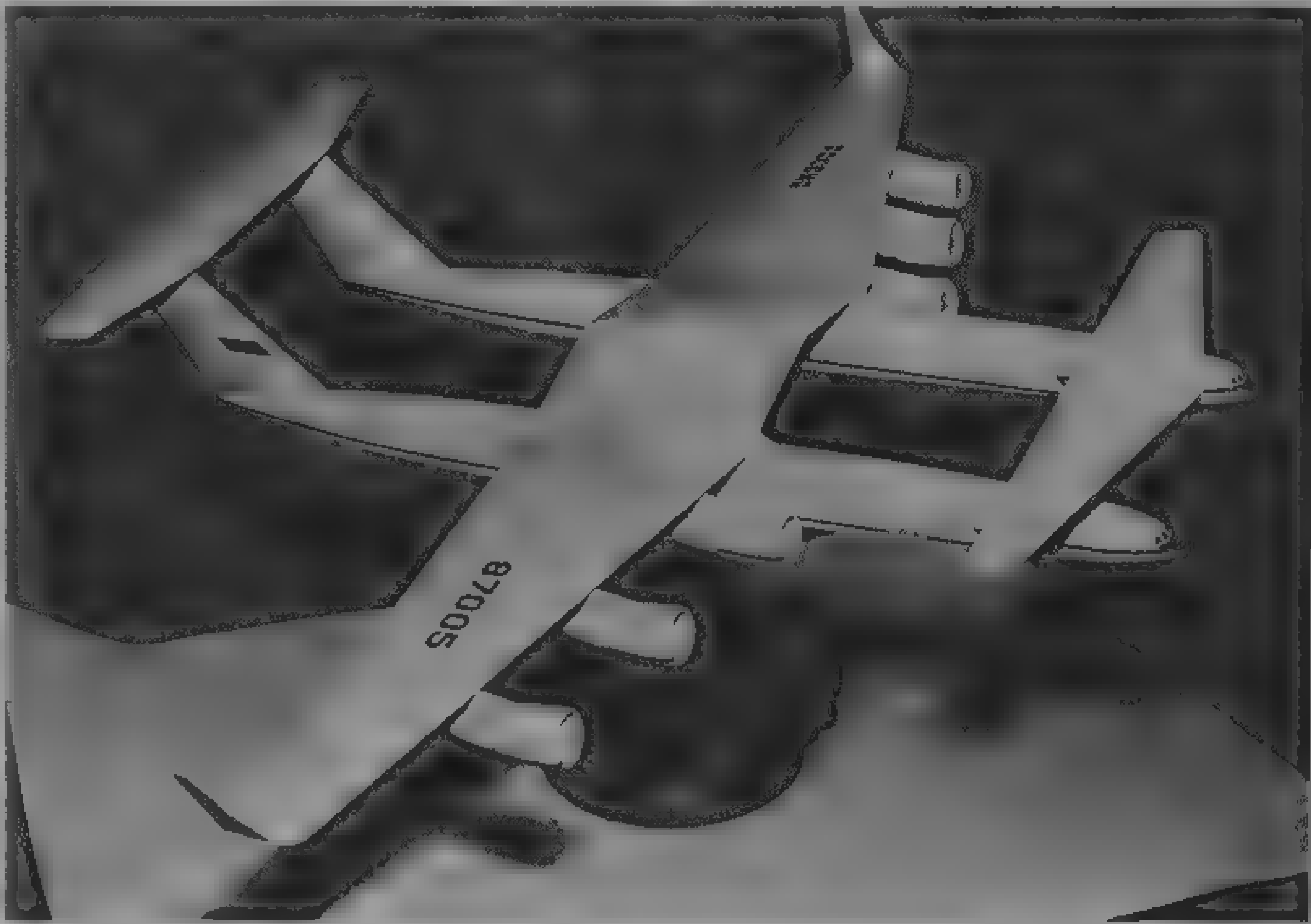
AVIONICS: State-of-the-art avionics for IFR and ICAO Cat II operations.

DIMENSIONS, EXTERNAL:

Wing span	42.7 m (140 ft 0 in)
Length overall	41.5 m (136 ft 3 in)
Height overall	15.56 m (51 ft 0¾ in)

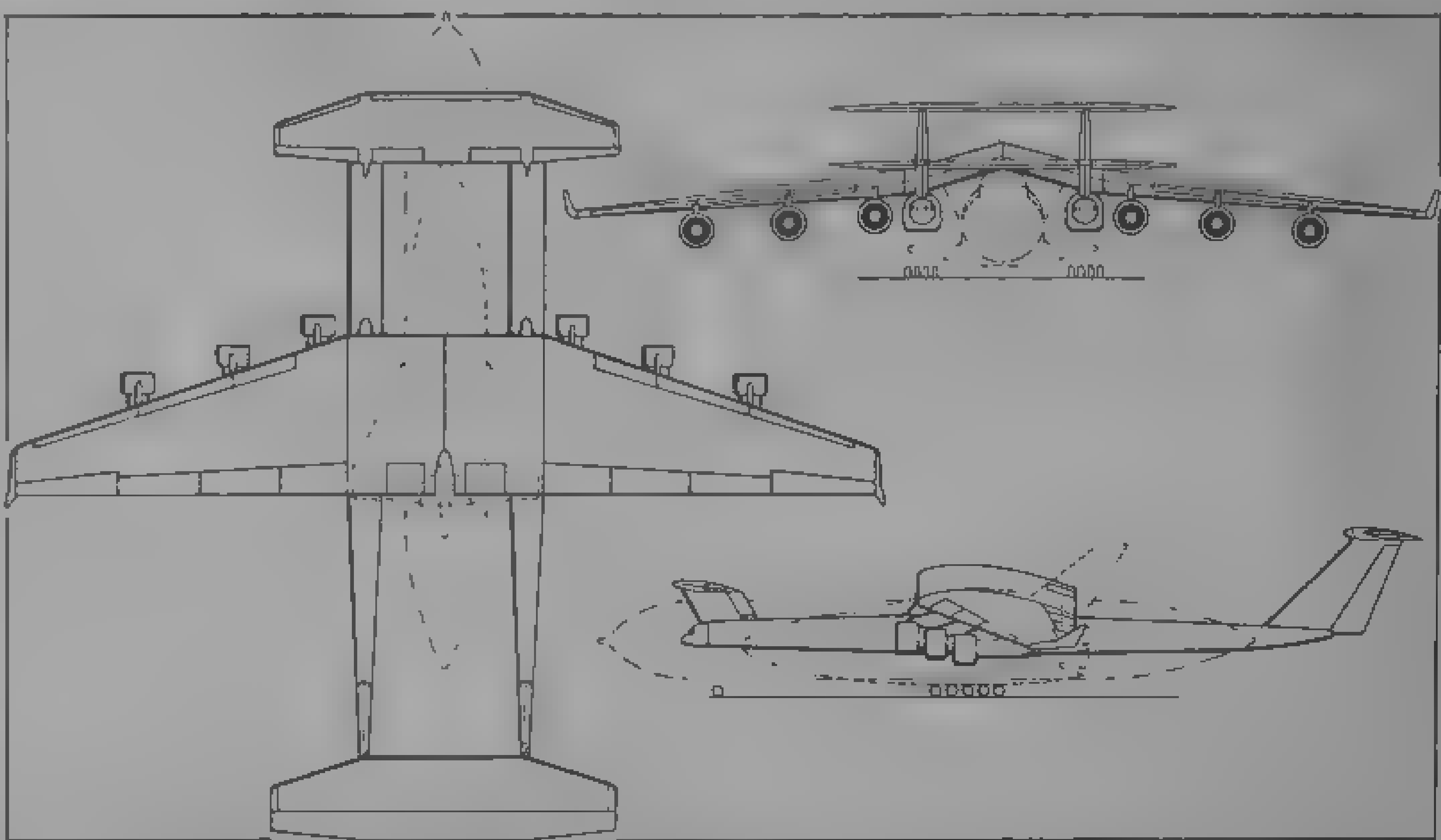
Model of Molniya-100 (*Paul Jackson*)

1995



Model of Molniya-1000 Heracles super-heavy airlifter

1995

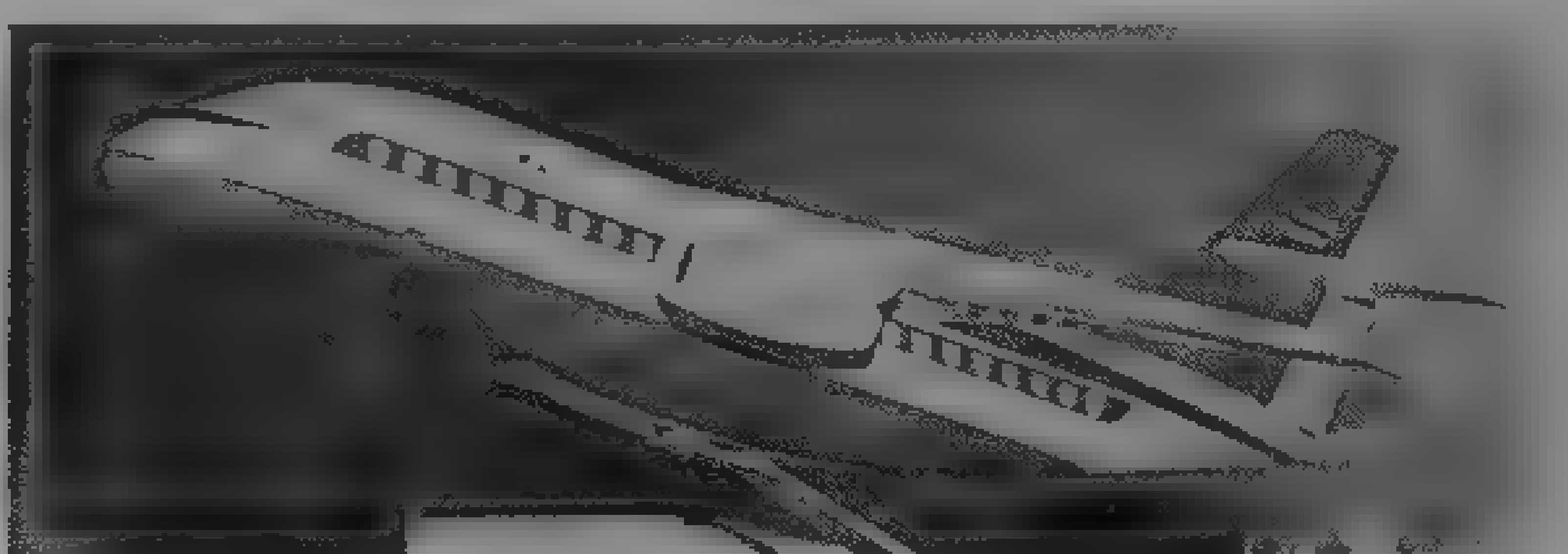


Molniya-1000 Heracles; dotted lines indicate alternative aerospacecraft and canister payloads (*Jane's/Mike Keep*)

1994

1995 model of Molniya-300 business aircraft (*Paul Jackson*)

1995



Model of Molniya-400 twin-turbofan freighter (*Paul Jackson*)

1995

WEIGHTS AND LOADINGS:
Max payload: Normal 30,000 kg (66,135 lb)
Overload 50,000 kg (110,230 lb)
Max fuel 48,500 kg (106,920 lb)
Max T-O weight: Normal 109,800 kg (242,065 lb)
Overload (load factor limit 2.25) 121,100 kg (266,975 lb)

PERFORMANCE (estimated):
Max level speed 502 kts (930 km/h; 578 mph)
Nominal cruising speed 410-432 kts (760-800 km/h; 472-497 mph)
T-O run: Normal T-O weight 1,230 m (4,035 ft)
Balanced runway length: Overload 2,600 m (8,530 ft)
Range with max payload: Normal T-O weight 2,699 n miles (5,000 km; 3,106 miles)
Overload 1,619 n miles (3,000 km; 1,864 miles)
Range with max fuel:
Normal 6,047 n miles (11,200 km; 6,959 miles)

NEW ENTRY

MOLNIYA-1000 HERACLES

TYPE: Six turbojet super-heavy airlifter.

PROGRAMME: Designed to follow VM-T Atlant and An-225 Mriya; feasibility studies under way 1994, production could begin eight years after allocation of funding.

DESIGN FEATURES: 'Tandem triplane' with three lifting surfaces; twin slender fuselages, each with small cabin in nose; foreplane on pylons above cabins, high wings with inverted-V centre-section, tailplane bridges tips of twin swept fins. Payload suspended from centre-section.

LANDING GEAR: Retractable quadricycle type; twin-wheel nose unit under each cabin; 20-wheel main gear, comprising five rows of four wheels, under each mid-fuselage.

POWER PLANT: Six Samara bypass turbojets, pod-mounted on underwing pylons; alternative General Electric CF6-90VH or Pratt & Whitney PW4084 turbofans.

DIMENSIONS, EXTERNAL:
Wing span 90.40 m (295 ft 3½ in)
Length overall 73.40 m (240 ft 9¾ in)
Height overall 17.50 m (57 ft 5 in)

WEIGHTS AND LOADINGS:
Max payload 450,000 kg (992,065 lb)
Max fuel 358,000 kg (789,250 lb)
Max T-O weight 900,000 kg (1,984,125 lb)

PERFORMANCE (estimated):
Nominal cruising speed 454 kts (840 km/h; 522 mph)
T-O run 2,370 m (7,775 ft)
Range: with max payload 1,242-1,674 n miles (2,300-3,100 km; 1,429-1,925 miles)
with max fuel and 240,000 kg (529,100 lb) payload 4,212-5,562 n miles (7,800-10,300 km; 4,845-6,400 miles)

UPDATED

MYASISHCHEV

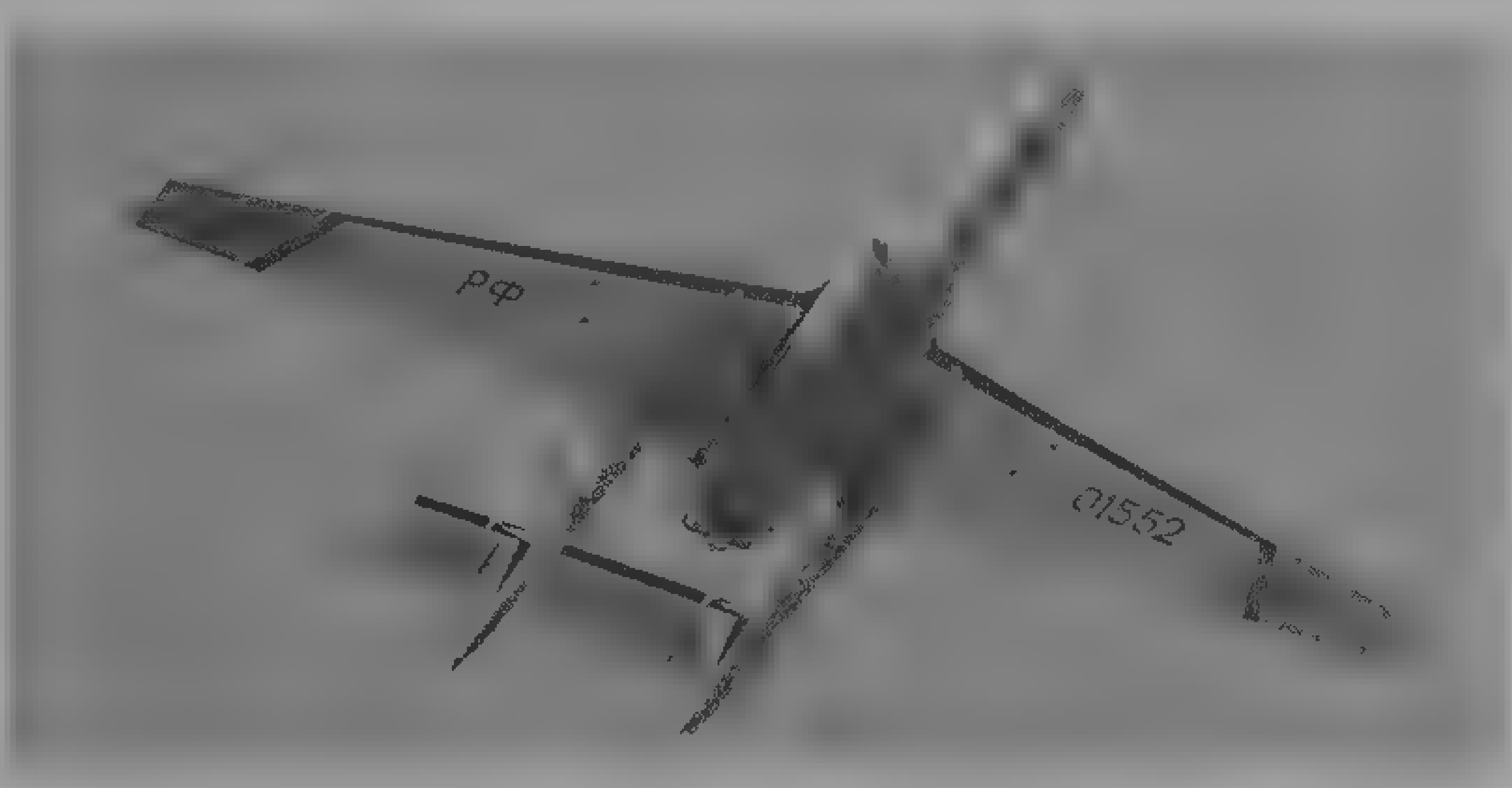
MYASISHCHEV DESIGN BUREAU

140160 Zhukovsky, Moscow Region
Telephone: 7 (095) 272 60 41
Fax: 7 (095) 556 55 83

GENERAL DESIGNER: Valery K. Novikov

CHIEF DESIGNERS:
Alexander Brook
Leonid Sokolov

The Myasishchev OKB was founded in 1951, under the leadership of Prof Vladimir Mikhailovich Myasishchev, who died on 14 October 1978. In the 1950s it developed and built the M-4 and 3M (NATO 'Bison') subsonic strategic bombers and M-50 ('Bounder') supersonic strategic missile carrier. In the 1970s and 1980s the bureau was engaged in development of multi-purpose subsonic high-altitude aircraft, and in modifying two 3M bombers into VM-T Atlant aircraft to transport sections of the Energia rocket launch vehicle and airframe of the Buran space shuttle orbiter. In 1981 the design bureau was named after Prof Myasishchev.



Prototype Myasishchev M-55 ('Mystic-B') high-altitude research aircraft *(David Stephens)*
1995

MYASISHCHEV VM-T ATLANT

TYPE: Special purpose heavy-lift transport.

PROGRAMME: Development began 1977, two Atlants built, first flight 29 April 1981; more than 200 missions flown to transport outsize cargoes from manufacturing plants to Baikonur cosmodrome.

DESIGN FEATURES: Conversion of Myasishchev 3M (NATO 'Bison-C') heavy bomber to transport sections of Energia rocket launch vehicle and airframe of Buran space shuttle orbiter on overfuselage mounts. Fuselage and wing structure considerably strengthened, new tail unit with toed-in rectangular fins and rudders at tips of dihedral tailplane; control system and equipment updated.

POWER PLANT: Four RKBM/Kolesov VD-7MD turbojets, each 105.4 kN (23,700 lb st).

ACCOMMODATION: Unique capability of transporting above fuselage cargoes of four types, with maximum weight 50,000 kg (110,230 lb) and maximum diameter 8.00 m (26 ft 3 in).

DIMENSIONS, EXTERNAL:
Wing span 53.16 m (174 ft 5 in)
Length overall 51.20 m (167 ft 11¾ in)
Height overall 10.60 m (34 ft 9½ in)
Wheel track (wingtip units) 52.34 m (171 ft 8¾ in)

AREAS:
Wings, gross 351.78 m² (3,786.7 sq ft)

WEIGHTS AND LOADINGS:
Max T-O weight 138,000 kg (304,233 lb)
Max wing loading 392.3 kg/m² (80.34 lb/sq ft)
Max power loading 327.32 kg/kN (3.21 lb/lb st)

PERFORMANCE:
Max cruising speed at 6,000-8,000 m (19,700-26,250 ft) 270-323 kts (500-600 km/h; 310-372 mph)
Balanced runway length 3,500 m (11,500 ft)
Range with max payload 810 n miles (1,500 km; 932 miles)

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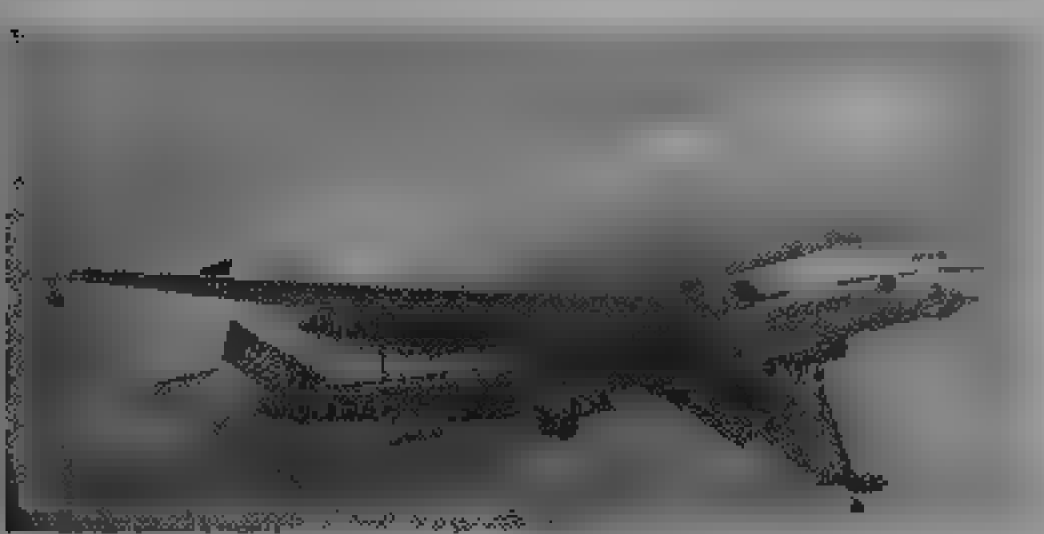


Outsize loads transported by VM-T Atlant include sections of Energia launch rocket
1994

MYASISHCHEV M-17 and M-55

NATO reporting name: Mystic

TYPE: Single-seat high-altitude reconnaissance and research aircraft.

PROGRAMME: Development began mid-1970s, intended originally as high-altitude aircraft, with dorsal gun turret, to shoot down unmanned stratospheric balloons flown by USA over USSR for surveillance/sigint/elint purposes, with satellite data relay; this role lapsed when US use of balloons ended.

M-17 Chaika (Seagull) prototype (SSSR-17100) crashed on first flight, December 1978, second airframe for static tests, second prototype (SSSR-17103) flown 26 May 1982, differed substantially in exterior appearance; observed at Ramenskoye flight test centre 1982, given provisional US designation 'Ram-M'; later designated 'Mystic-A'; total three flying prototypes, plus two M-17RM (Razvedchik Modifitsirovannyi: modified reconnaissance) (M-55, 'Mystic-B') prototypes and two preproduction 'Bs', completed by early 1992, M-17RM intended for target location as counterpart of USAF's PLSS-equipped U-2R but later publicised as civilian research aircraft. Production continues.

CURRENT VERSIONS: **M-17** ('Mystic-A'): Three aircraft, each with single RKBM Rybinsk RD-36-51V turbojet, rated at 117.7 kN (26,459 lb st) in non-afterburning form (68.6 kN, 15,430 lb st quoted to FAA after record flights). Two class C1i altitude records of 21,830 m (71,620 ft), set 28 March 1990, unbeaten in 1995. Third flying prototype (SSSR 17401) reallocated to scientific research following trials for M-55 version, named Stratosfera (Stratosphere) December 1989 at start of programme. SSSR 17103 in outdoor display of historic aircraft, Monino since 1989.

M-55/R-17M Geophysica ('Mystic-B'): First flown 16 August 1988 (SSSR 01552, later RF-01552). Basically as M-17, but with two Aviadvigatel D-30-V12 engines (V10s in first two aircraft), each 93.2 kN (20,952 lb st), side by side at rear of fuselage pod; lengthened and more capacious nose, raised cockpit, small underfuselage radome forward of nosewheels. Able to loiter for 4 hours 12 minutes at 20,000 m (65,600 ft) with 1,500 kg (3,305 lb) of sensors, or 5 hours at 17,000 m (55,775 ft); following completion of military trials, 01552 adopted Aeroflot insignia and said to be for environmental research, named Geophysica (Geophysics). Smaller wing span than 'Mystic-A'. Civilian payloads may include SLAR, A-84 optical camera, 'Argos' optical scanner, IR linescan and 'Radius' scanning radiometer. Fifteen international class C1j records set September/October 1993, including height of 21,360 m (70,078 ft) with 2,000 kg payload, unbeaten in 1995. Second M-55 prototype (SSSR-23570) scrapped by 1993, third and fourth are RF-55203 and 55204; Western debut by 55204 in November 1993, within scope of joint Russian/Italian scientific programme of Arctic and Antarctic atmospheric research.

Approximately 12 being built at Smolensk for Russian Air Force, including one or two **M-55U** tandem-seat trainers and, possibly, examples of Geophysica-2.

M-55 Geophysica-2. Described separately.

DESIGN FEATURES: High-aspect ratio high-wing configuration, with central fuselage pod and twin tailbooms with bridging T tailplane, side air ducts for engine(s), mounted at rear of fuselage pod, 2° 30' constant wing anhedral from roots, long and shallow ventral strake under port tailboom, assumed to have similar powered sailplane performance to US Lockheed U-2 series, large compartment in lower fuselage for cameras and other sensors.

FLYING CONTROLS: Aileron, with tab, and three-section deceleration flaps over most of each wing trailing-edge; elevators and twin rudders, with tabs.

LANDING GEAR: Retractable tricycle type, twin wheels on each unit, all units retract rearward, mainwheels into tailbooms. Mainwheel tyre size 660 × 200 mm; nosewheel 520 × 125 mm.

POWER PLANT: See Current Versions. Fuel capacity 10,000 litres (2,640 US gallons, 2,200 Imp gallons) in M-17 and M-55.

ACCOMMODATION: Single seat under rearward-hinged canopy. Severin/Zvezda K-36L ejection seat in both versions.

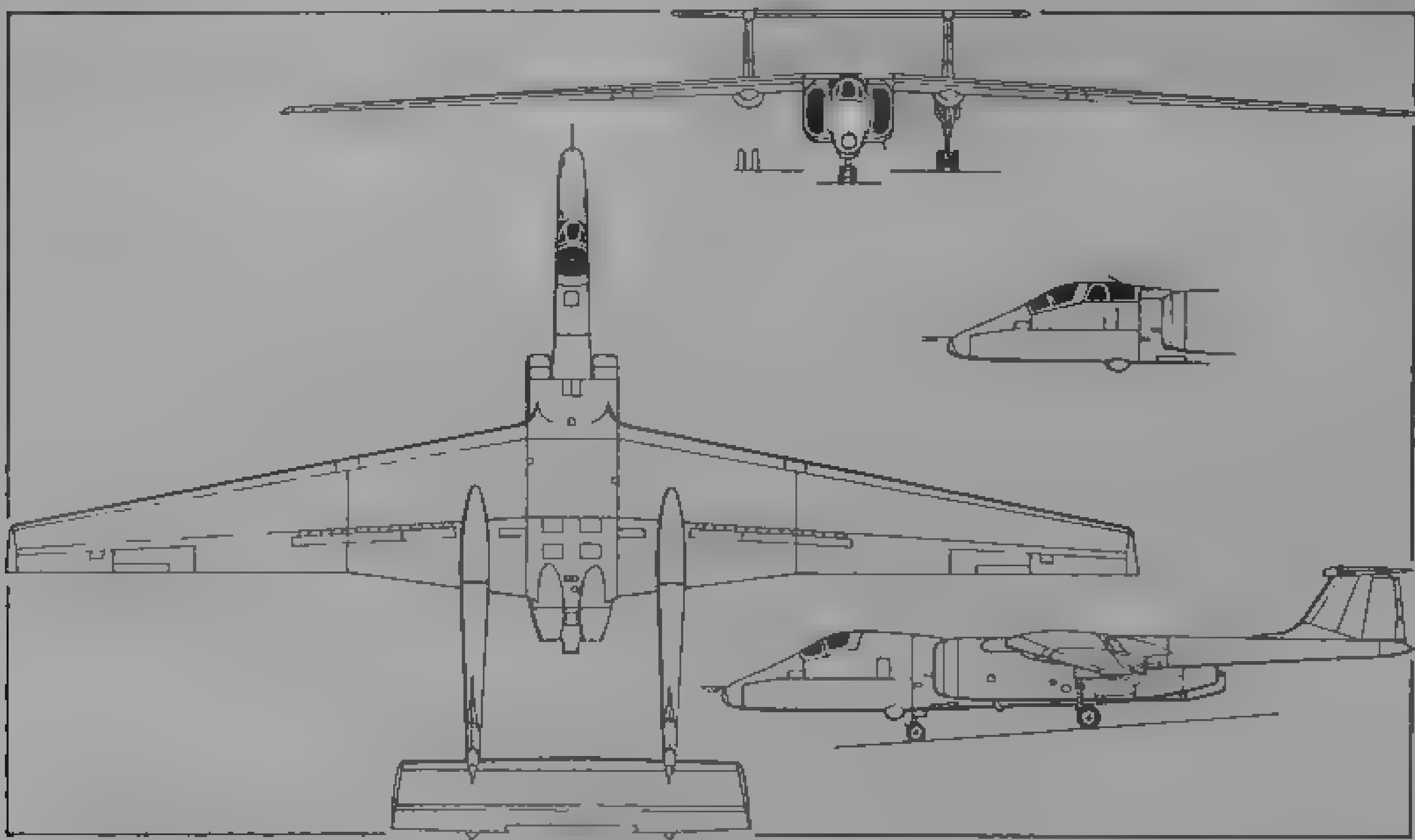
AVIONICS ('Mystic-A'): *Comms:* R-863 and R-864 radios, 'Parol' IFF.
Flight: 'Korall' short-range nav/ILS.
Mission: PrNK-17 detection and aiming system (including two electro-optical location-finders and rangefinder).

DIMENSIONS, EXTERNAL (A: 'Mystic-A', B: 'Mystic-B'):
Wing span: A 40.32 m (132 ft 3¾ in)
B 37.464 m (122 ft 11 in)
Length overall: A 22.27 m (70 ft 0¾ in)
B excl probes 22.867 m (75 ft 0¼ in)
Height overall: A 4.87 m (15 ft 11¾ in)
B 4.83 m (15 ft 10¼ in)
Tailplane span: A 12.12 m (39 ft 9¼ in)
B 11.96 m (39 ft 3 in)
Wheel track: A 6.65 m (21 ft 10 in)
B 6.60 m (21 ft 8 in)
Wheelbase: A 5.62 m (18 ft 5 in)
B 5.735 m (18 ft 9¾ in)

AREAS:
Wings, gross: A 137.7 m² (1,482.2 sq ft)
B 131.6 m² (1,416.5 sq ft)

The twin-turbofan Myasishchev M-55/M-17RM at Farnborough Air Show, 1994 *(Paul Jackson)*

1995



Myasishchev M-55/M-17RM ('Mystic-B') reconnaissance and environmental research aircraft with scrap view of M-55U trainer *(Jane's/Mike Keep)*

1995

Ailerons (total): A	7.58 m² (81.59 sq ft)
B	7.56 m² (81.38 sq ft)
Horizontal tail surfaces (total):	
A	27.45 m² (295.48 sq ft)
B	27.62 m² (297.30 sq ft)
Fins (total): A	11.30 m² (121.64 sq ft)
B	10.01 m² (107.75 sq ft)
Rudders (total): A	4.60 m² (49.52 sq ft)
B	4.56 m² (49.09 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: B	14,000 kg (30,865 lb)
Payload: B	1,500 kg (3,307 lb)
Max fuel weight: B	8,300 kg (18,298 lb)
Max T-O weight: A, normal	18,400 kg (40,565 lb)
A, record flights	19,950 kg (44,000 lb)
B	23,800 kg (52,470 lb)
Power loading: A, normal	156.3 kg/kN (1.53 lb/lb st)
B	127.7 kg/kN (1.25 lb/lb st)

PERFORMANCE:

Max level speed: A, B at 5,000 m (16,400 ft)
179 kts (332 km/h; 206 mph)
A at 20,000 m (65,600 ft)
401 kts (743 km/h; 461 mph)
B at 20,000 m (65,600 ft)
377-405 kts (700-750 km/h; 435-466 mph)
T-O speed at normal AUW:
A, B 95 kts (175 km/h; 109 mph)
Landing speed: A at 16,300 kg (35,935 lb) weight
102 kts (188 km/h; 117 mph)
B at 23,400 kg (51,587 lb) weight
102 kts (188 km/h; 117 mph)

Service ceiling: A	21,550 m (70,705 ft)
B	20,000 m (65,600 ft)
T-O run: A	340 m (1,116 ft)
B	900 m (2,953 ft)
Landing from 15 m (50 ft): B	1,750 m (5,745 ft)
Landing run: A	875 m (2,871 ft)
B	780 m (2,559 ft)

Range:
A (5% reserves) 710 n miles (1,315 km; 817 miles)
B 2,680 n miles (4,965 km; 3,085 miles)
Max endurance at 17,000 m (55,775 ft): A 2 h 14 min
B, without payload 6 h 30 min

UPDATED

MYASISHCHEV M-55 GEOPHYSICA-2

TYPE: Two-seat high-altitude research aircraft.

PROGRAMME: Under development; available for service in 1997.

DESIGN FEATURES: Development of M-55 Geophysica with second crew member as researcher and observer. Fuselage extended 1.50 m (4 ft 11 in) by insertion of plug behind cockpit, extending wheelbase and increasing space for experimental equipment from 9.0 m³ (318 cu ft) (including tailbooms) to 11.3 m³ (399 cu ft); provision for underwing pods, each with 1.5 m³ (53 cu ft) available for measuring equipment. Winglets on increased-span wings; increased fuel volume and maximum T-O weight, endurance extended by 25 per cent.

DIMENSIONS, EXTERNAL:

Wing span	40.00 m (131 ft 2¾ in)
Length overall, excl probes	23.77 m (78 ft 0 in)

WEIGHTS AND LOADINGS:

Max fuel weight	10,100 kg (22,266 lb)
Payload	3,000 kg (6,614 lb)
Max T-O weight	27,000 kg (59,525 lb)

PERFORMANCE:

Max endurance at 19,000-20,000 m (62,325-65,620 ft)
6 h 30 min

NEW ENTRY

MYASISHCHEV M-101 GZHEL

TYPE: Multipurpose eight-seat turboprop light aircraft.

PROGRAMME: First shown in model form at Moscow Aeroshow '90 exhibition; developed full-scale mockup exhibited at MosAeroshow '92 with piston engine and at MosAeroshow '93 with turboprop, latter version in production at Sokol plant, Nizhny Novgorod; prototype (RA-15001) first flew 31 March 1995.

DESIGN FEATURES: Conventional all-metal low-wing monoplane; sweptback vertical tail surfaces. Designed in accordance with Russian AR 23 and US FAR 23 airworthiness requirements.

LANDING GEAR: Retractable tricycle type; single wheel on each unit, nosewheel retracts rearward, mainwheels inward into wingroots and fuselage; levered suspension legs; designed to use unpaved runways.

POWER PLANT: One 580 kW (778 shp) Motorlet M 601F turboprop, driving AV-510 five-blade propeller. Version with P&WC PT6A turboprop envisaged.

ACCOMMODATION: One or two pilots and six or seven passengers, in pairs in pressurised cabin; door to flight deck on port side; large double door for passengers and freight loading aft of wing on port side, emergency exit on starboard side above wing; provision for rapid change to cargo/passenger, freight or ambulance configuration.

DIMENSIONS, EXTERNAL:

Wing span	13.00 m (42 ft 8 in)
Length overall	9.90 m (32 ft 5¾ in)
Height overall	3.72 m (12 ft 2½ in)
Tailplane span	4.32 m (14 ft 2 in)
Propeller diameter	2.30 m (7 ft 6½ in)

WEIGHTS AND LOADINGS:

Max payload	630 kg (1,390 lb)
Max T-O weight	3,000 kg (6,615 lb)

PERFORMANCE (estimated):

Max cruising speed	270 kts (500 km/h; 310 mph)
Min flying speed	61 kts (113 km/h; 71 mph)
Service ceiling	7,600 m (24,935 ft)
Unpaved runway required	500-600 m (1,640-1,970 ft)

Range with max fuel
1,620 n miles (3,000 km; 1,865 miles)

UPDATED

MYASISHCHEV M-112

TYPE: Twin-turboprop light multimission transport.

PROGRAMME: Designed to FAR (JAR) Pt 25 requirements; first shown in model form at ILA-94, Berlin; two prototypes being manufactured at Smolensk, certification initially by Russian Aviaregister, followed by FAA and CAA.

DESIGN FEATURES: Conventional unswept high-wing monoplane for operation from short and unprepared airfields, with complete independence from ground equipment. Wings built in three sections, with advanced wing section for optimum lift/drag ratio; unswept horizontal tail surfaces, swept vertical surfaces with long dorsal fin, widebody fuselage with sharply upswept rear section containing loading ramp for freight and vehicles, mainwheels retract into fuselage-side pods, engines underwing.

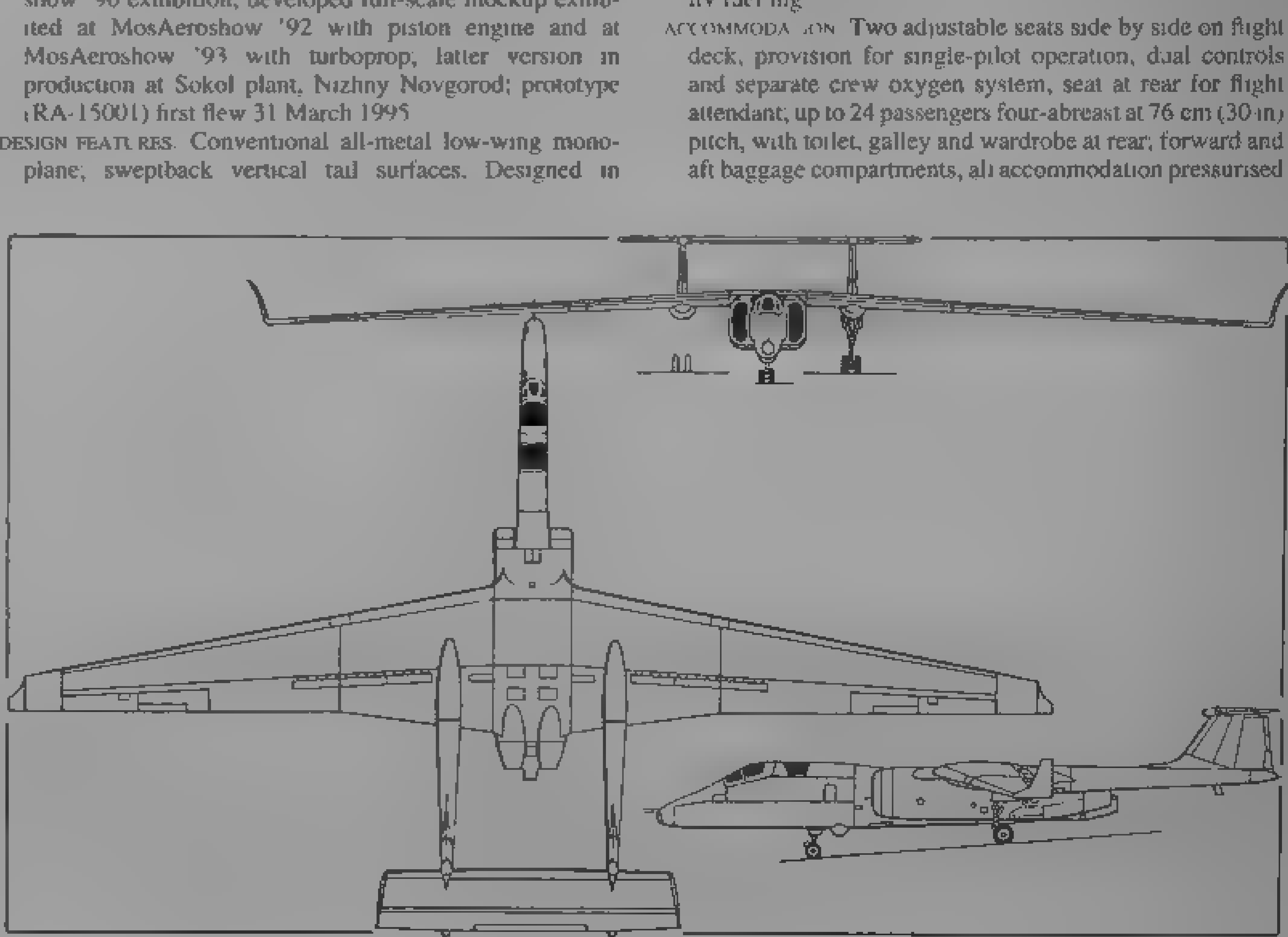
FLYING CONTROLS: Conventional three-axis ailerons, elevators and rudder, all manually operated, two hydraulically operated single-slotted Fowler flaps per wing, ailerons droop with flaps. Electric trim for all flight control surfaces.

STRUCTURE: Fail-safe primary structure designed for more than 30,000 one-hour flights without major repair.

LANDING GEAR: Hydraulically retractable tricycle type. Steerable twin nosewheels; single mainwheels retract into fuselage pods, hydraulic brakes.

POWER PLANT: Two 1,235 kW (1,657 shp) Pratt & Whitney Canada PT6A turboprops; five- or six-blade metal constant-speed fully feathering reversible-pitch propellers of advanced design to minimise noise levels. Six integral wing fuel tanks, total capacity 2,500 litres (660 US gallons, 550 Imp gallons); optional external tanks; pressure or gravity fuelling.

ACCOMMODATION: Two adjustable seats side by side on flight deck, provision for single-pilot operation, dual controls and separate crew oxygen system, seat at rear for flight attendant; up to 24 passengers four-abreast at 76 cm (30 in) pitch, with toilet, galley and wardrobe at rear; forward and aft baggage compartments, all accommodation pressurised

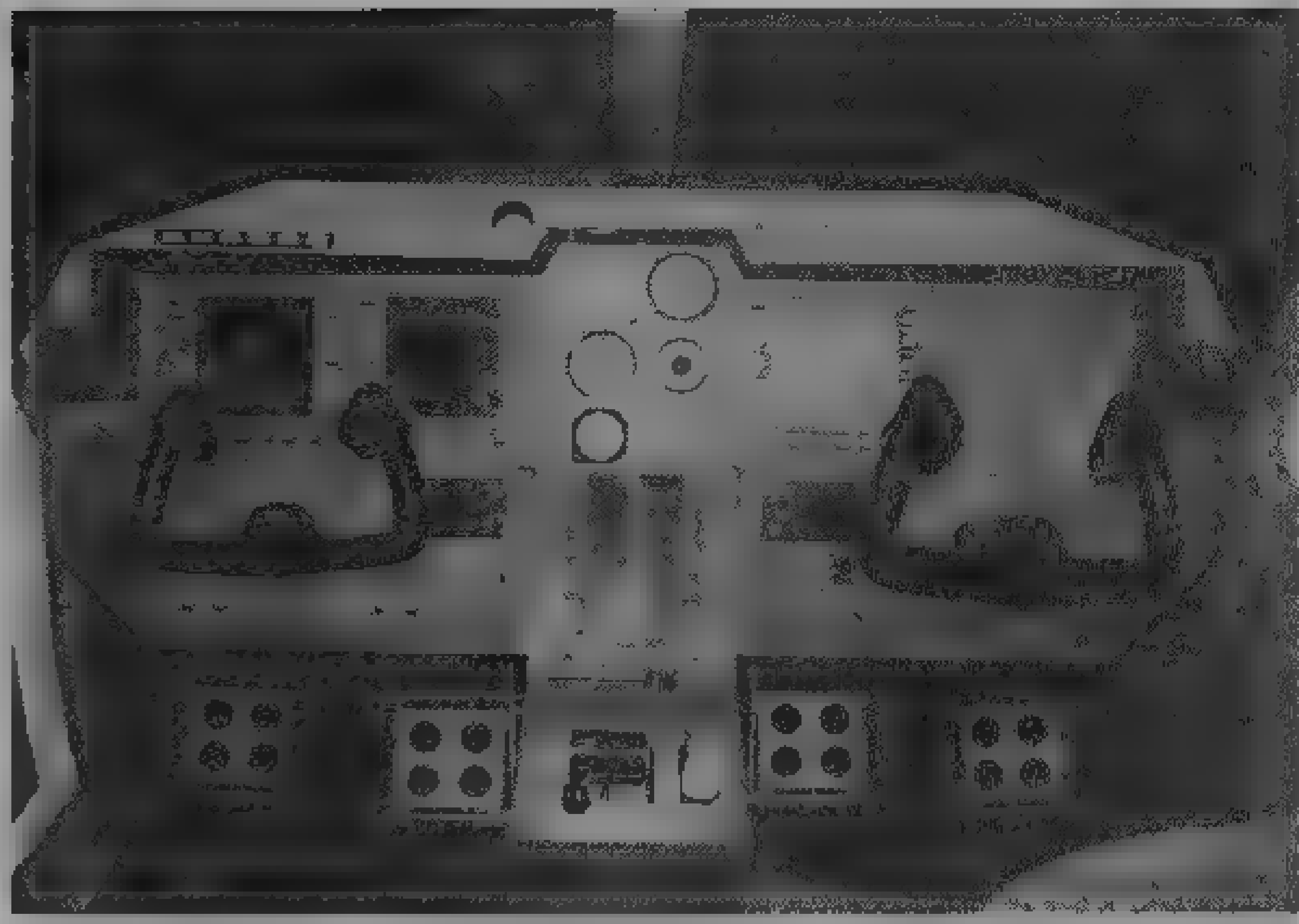


Myasishchev M-55 Geophysica-2 two-seat research aircraft *(Jane's/Paul Jackson)*

1995

Cockpit of Myasishchev M-55 Geophysica *(Piotr Butowski)*

1995



Mockup cockpit of M-101 Gzhel *(Piotr Butowski)*

1995

and air conditioned. Full provision for ambulance use, freight or vehicle transport. Doors with airstairs at front and rear of cabin; five additional emergency exits.

SYSTEMS: Air conditioning and pressurisation system, maximum pressure differential 0.40 bar (5.8 lb/sq in), ram air for airborne cooling, electric fan for cooling on ground, heating by engine bleed air, optional cooling turbine. Hydraulic system for landing gear actuation, brakes, wing flaps and nosewheel steering, supplied by engine-driven pump, with standby hand pump and accumulator. Two 30 V 400 A engine-driven starter/generators for 115 V 400 Hz and 26 V 400 Hz AC electrical systems, 28 V DC system, four 25 Ah batteries, optional APU. Engine bleed air de-icing of wing, tailplane and fin leading-edges and engine air intakes, electric de-icing of windscreen and propellers, electrically heated pitot; windscreen demisted by hot air.

AVIONICS: Full IFR capability.

Comms: Two VHF, 118 to 136 MHz, 760 channels, two transponders; optional voice recorder, passenger address system and flight ground crew intercom.

Radar: Weather radar in nose.

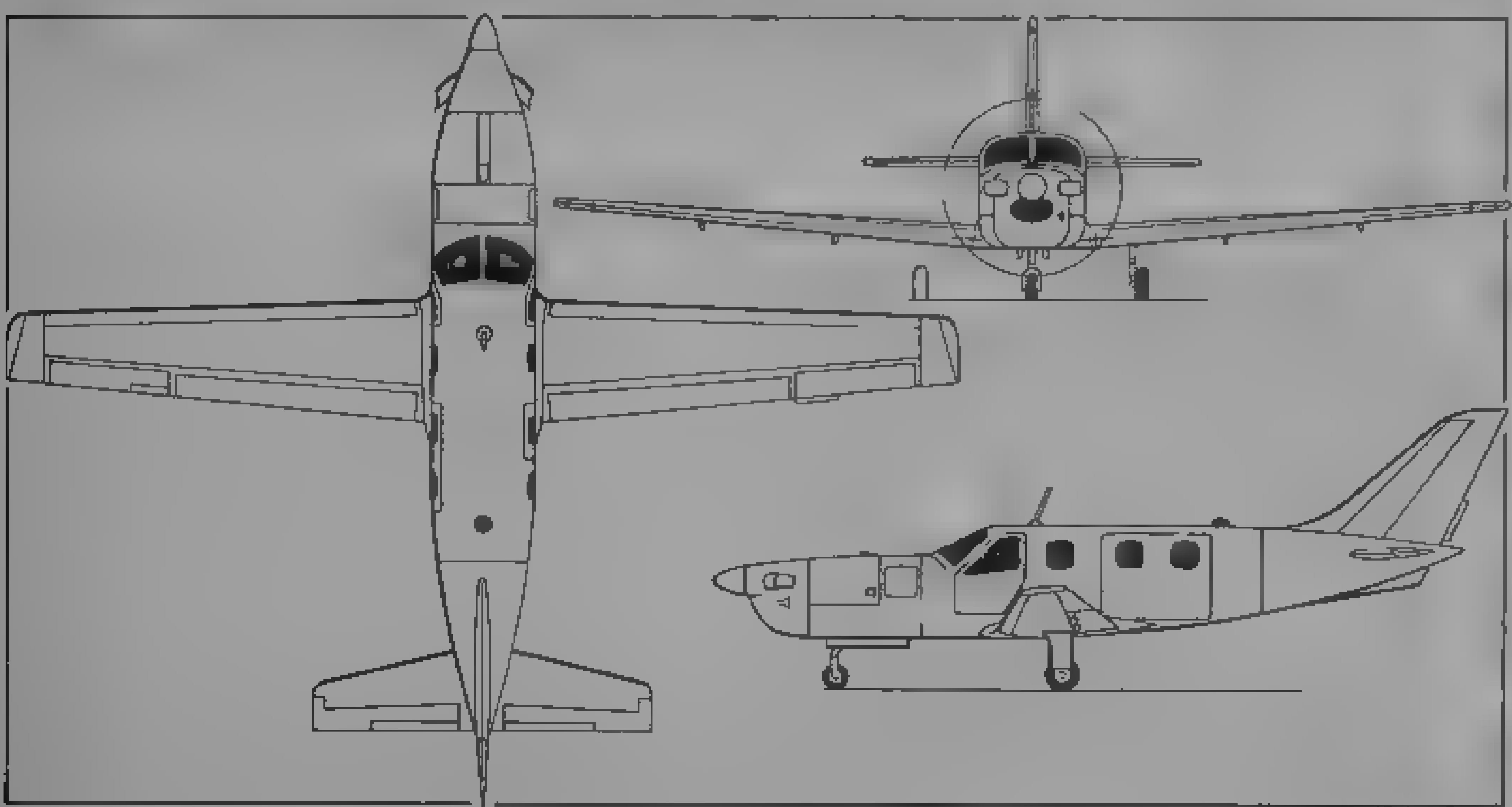
Flight: Two VOR, DME and ADF with RMI indicator; optional HF com and area nav system. Flight director system, HSI with directional/vertical gyros, three-axis autopilot.

DIMENSIONS, EXTERNAL:	
Wing span	19.20 m (63 ft 0 in)
Length overall	18.2[illegible] m (59 ft [illegible] in)
Height overall	7.20 m (23 ft 7½ in)
Rear-loading ramp: Width	2.00 m (6 ft 6¾ in)
Cabin height at sill	2.00 m (6 ft 6¾ in)
DIMENSIONS, INTERNAL:	
Cabin: Width at floor	2.25 m (7 ft 4½ in)
Aisle width	0.51 m (1 ft 8 in)
Baggage compartments	
Volume (total)	more than 4.0 m³ (141 cu ft)
WEIGHTS AND LOADINGS:	
Operational weight empty	4,800 kg (10,582 lb)
Max payload	2,400 kg (5,290 lb)
Max fuel	2,000 kg (4,410 lb)
Max T-O weight	9,200 kg (20,282 lb)
PERFORMANCE (estimated):	
Max level speed	243 kts (450 km/h, 280 mph)
T-O run	875 m (2,870 ft)
Landing run	620 m (2,035 ft)

UPDATED

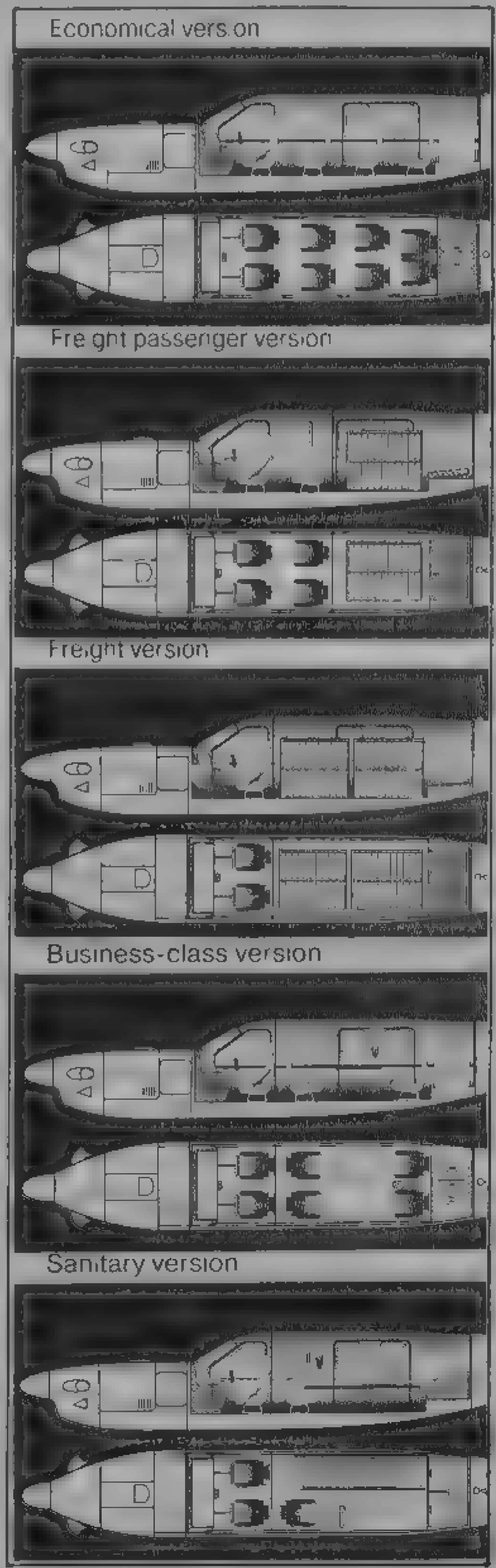
Prototype Myasishchev M-101 Gzhel turboprop-powered light aircraft

1995



Myasishchev M-101 Gzhel eight-seat light aircraft *(Jane's/Mike Keep)*

1994



Alternative interior configurations for M-101 Gzhel

1995

MYASISHCHEV M-200

TYPE: Two-seat military and civil advanced jet trainer.

PROGRAMME: One of designs by five OKBs to meet Russian official UTS requirement to replace Aero L-29 and L-39 Albatros; details announced and model shown at Mosaeroshow '93. R&D terminated. Details in 1994-95 *Jane's*.

UPDATED

MYASISHCHEV MGS-6

TYPE: Projected six-engined super heavy airlifter.

PROGRAMME: Myasishchev counterpart to Molniya-1000, similar timescale.

DESIGN FEATURES: Smaller of two projects in M-90 Samson programme. Catamaran configuration; twin slender fuselages suspended from wings on large truss structures that extend rearwards as twin supports for tail unit, unswept wings with two large fences in line with outer engines; twin fins and rudders. To operate from unprepared airfields without special loading facilities.

LANDING GEAR: 15 four-wheel bogies under fuselages and load platform.

POWER PLANT: Six KKBM NK-63 ducted propfans; each 294.2 kN (66,138 lb st), pylon-mounted above wing leading-edge.

ACCOMMODATION: Four-person flight deck in nose of starboard fuselage, forward of small passenger compartment. Payload suspended from centre section; typically, bank of standardised containers on trailer platform forming part of aircraft structure, or cylindrical tank 5 m (16 ft 5 in) in diameter and 35 m (115 ft) long for fuel or other contents.

DIMENSIONS, EXTERNAL:

Wing span	96.00 m (315 ft 0 in)
Length overall	64.05 m (210 ft 1¾ in)
Height overall	19.60 m (64 ft 3¾ in)

AREAS:

Wings, gross	1,010 m² (10,872 sq ft)

WEIGHTS AND LOADINGS:

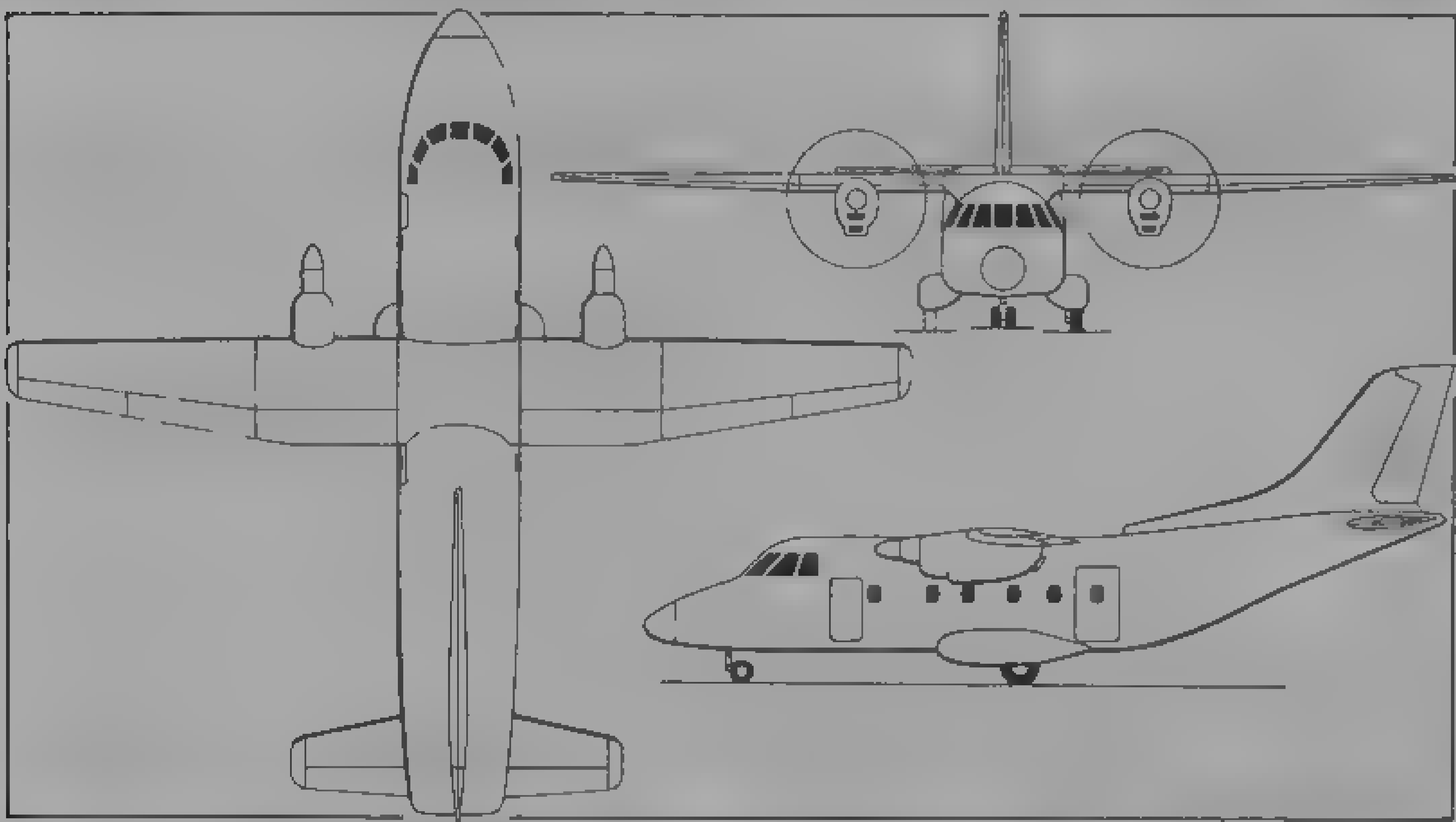
Max payload	250,000 kg (551,150 lb)
Max T-O weight	650,000 kg (1,432,975 lb)

PERFORMANCE (estimated):

Nominal cruising speed	356 kts (660 km/h; 410 mph)
T-O run	2,500 m (8,200 ft)
Range with max payload	2,592 n miles (4,800 km; 2,980 miles)

UPDATED

Model of Myasishchev M-112 twin-turboprop light multimission transport *(Paul Jackson)* *1995*



Myasishchev M-112 (two P&WC PT6A turboprops) *(Jane's/Mike Keep)* *1994*

MYASISHCHEV MGS-8

TYPE: Projected eight-engined super heavy airlifter.

PROGRAMME: As MGS-6.

DESIGN FEATURES: Generally as MGS-6; tail support structure more tapered, endplate fins and rudders, large winglets.

POWER PLANT: Eight KKBM NK-63 ducted propfans, each 294.2 kN (66,138 lb st), pylon-mounted on wing leading-edge; alternative high bypass ratio turbofans being studied.

DIMENSIONS, EXTERNAL: As MGS-6

WEIGHTS AND LOADINGS:

Max payload	400,000 kg (881,825 lb)
Max T-O weight	850,000 kg (1,873,900 lb)

PERFORMANCE (estimated):

Nominal cruising speed	356 kts (660 km/h; 410 mph)
T-O run	3,000 m (9,850 ft)
Range with max payload	2,430 n miles (4,500 km; 2,796 miles)

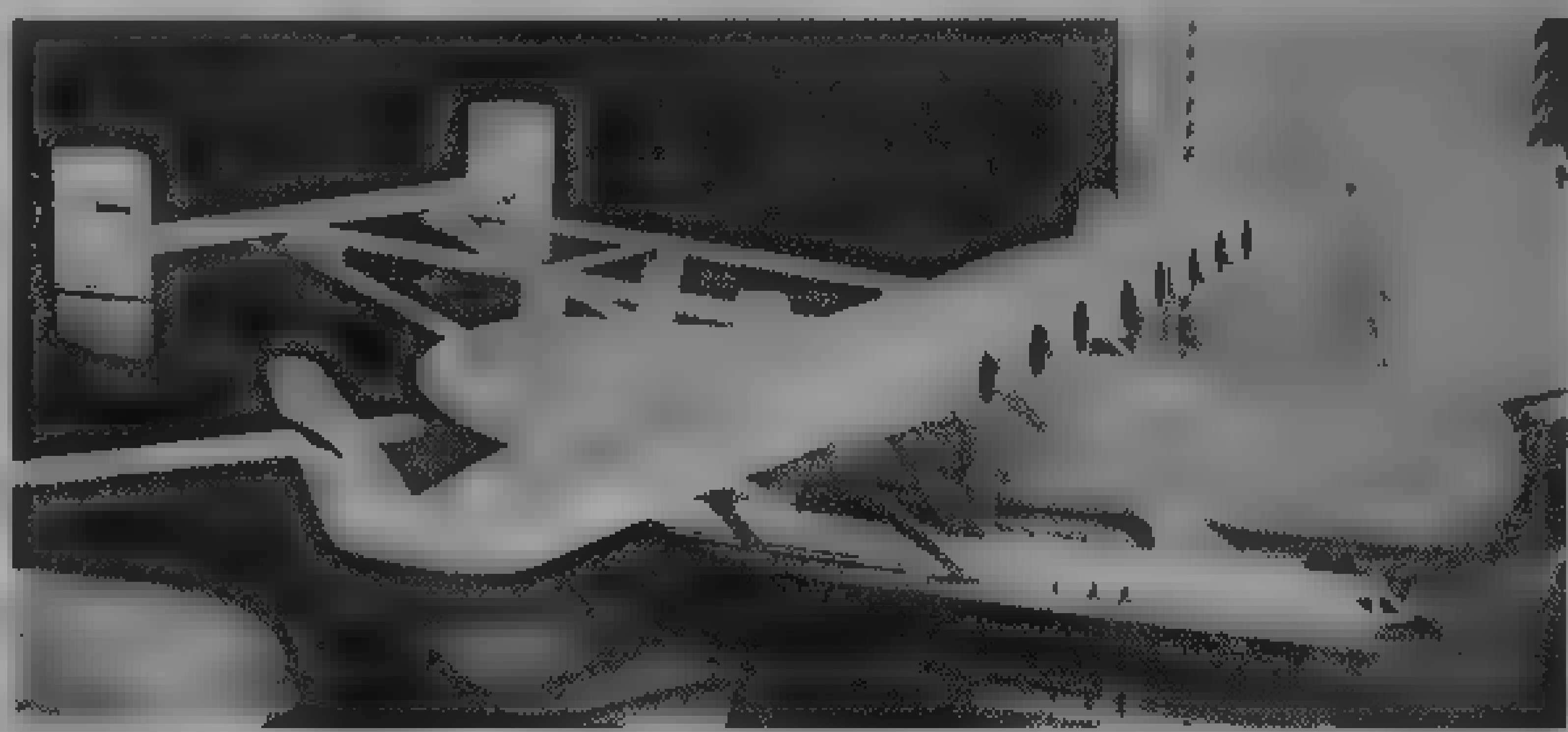
UPDATED

OTHER AIRCRAFT

Refer to International section for **Myasishchev/NAL M-102 Duet/Saras**. The **Myasishchev/Aviaspetstrans Yamal** is described under Aviaspetstrans entry in this section.

NEW ENTRY

MGS-6 version of M-90 Samson catamaran concept by Myasishchev *(Piotr Butowski)* *1994*



Eight-engined MGS-8 version of Myasishchev's M-90 catamaran *(Piotr Butowski)* *1994*

NAPA

NOVOSIBIRSK AIRCRAFT PRODUCTION ASSOCIATION

15 Polzunova Street, 630051 Novosibirsk
Telephone: 7 (3832) 79 85 01
Fax: 7 (3832) 77 37 03 or 77 10 35
Telex: 133211 NAPO SU

GENERAL DIRECTOR: N. I. Bobritsky

Founded in 1936, NAPA has been responsible (as GAZ 153) for manufacture of the Sukhoi Su-24 multirole combat aircraft, in parallel with the Komsomolsk-on-Amur plant. Its current products include the Antonov An-38 and Sukhoi Su-34.

NEW ENTRY

NIAT

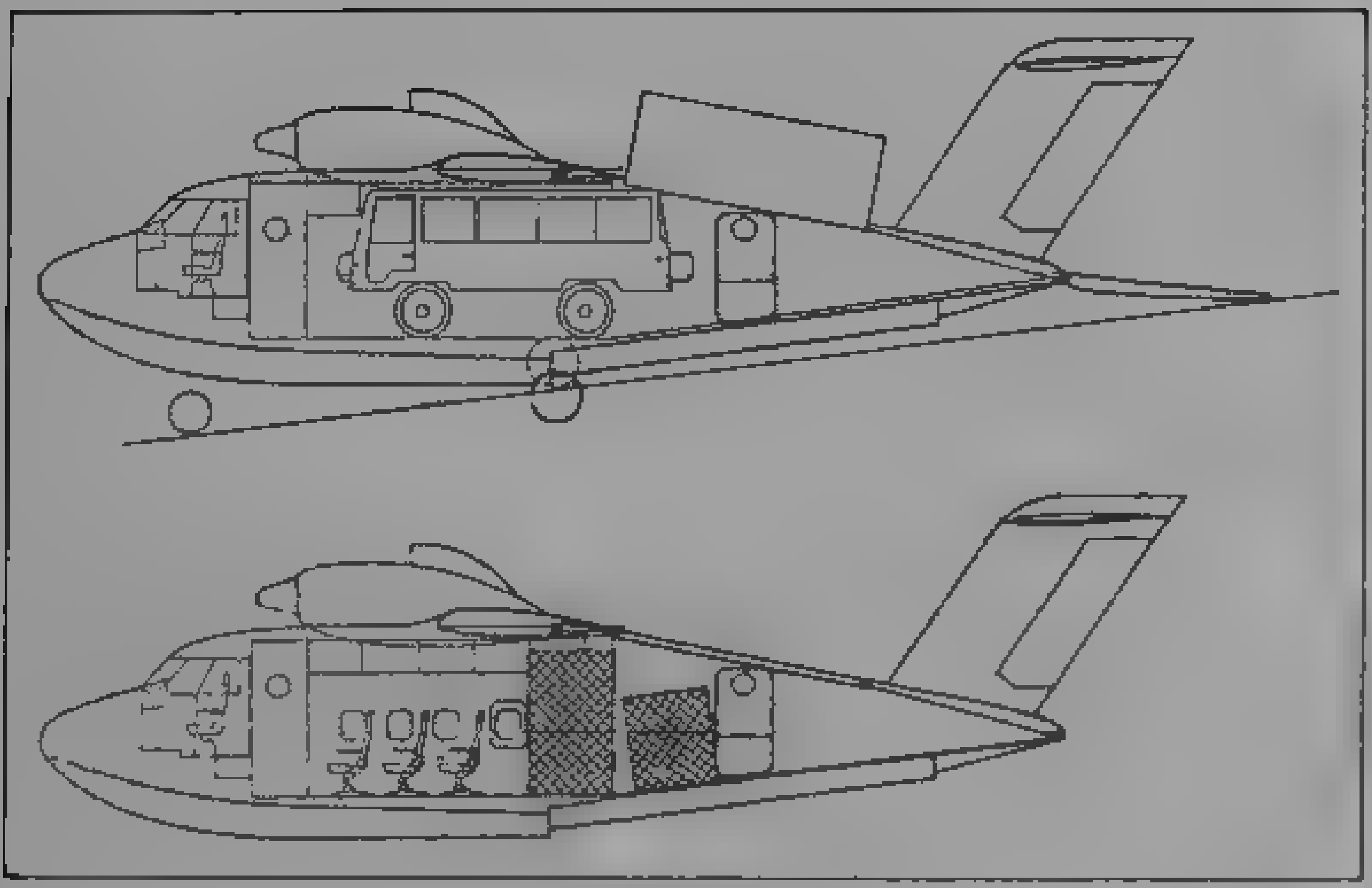
JOINT-STOCK COMPANY NATIONAL INSTITUTE OF AVIATION TECHNOLOGIES

24 Petrovka Street, 103051 Moscow
Telephone: 7 (095) 200 76 01
Fax: 7 (095) 292 65 11
Telex: 411700 PTB SV FOR NIAT

DIRECTOR OF FOREIGN ECONOMIC RELATIONS: Victor P. Pushkov

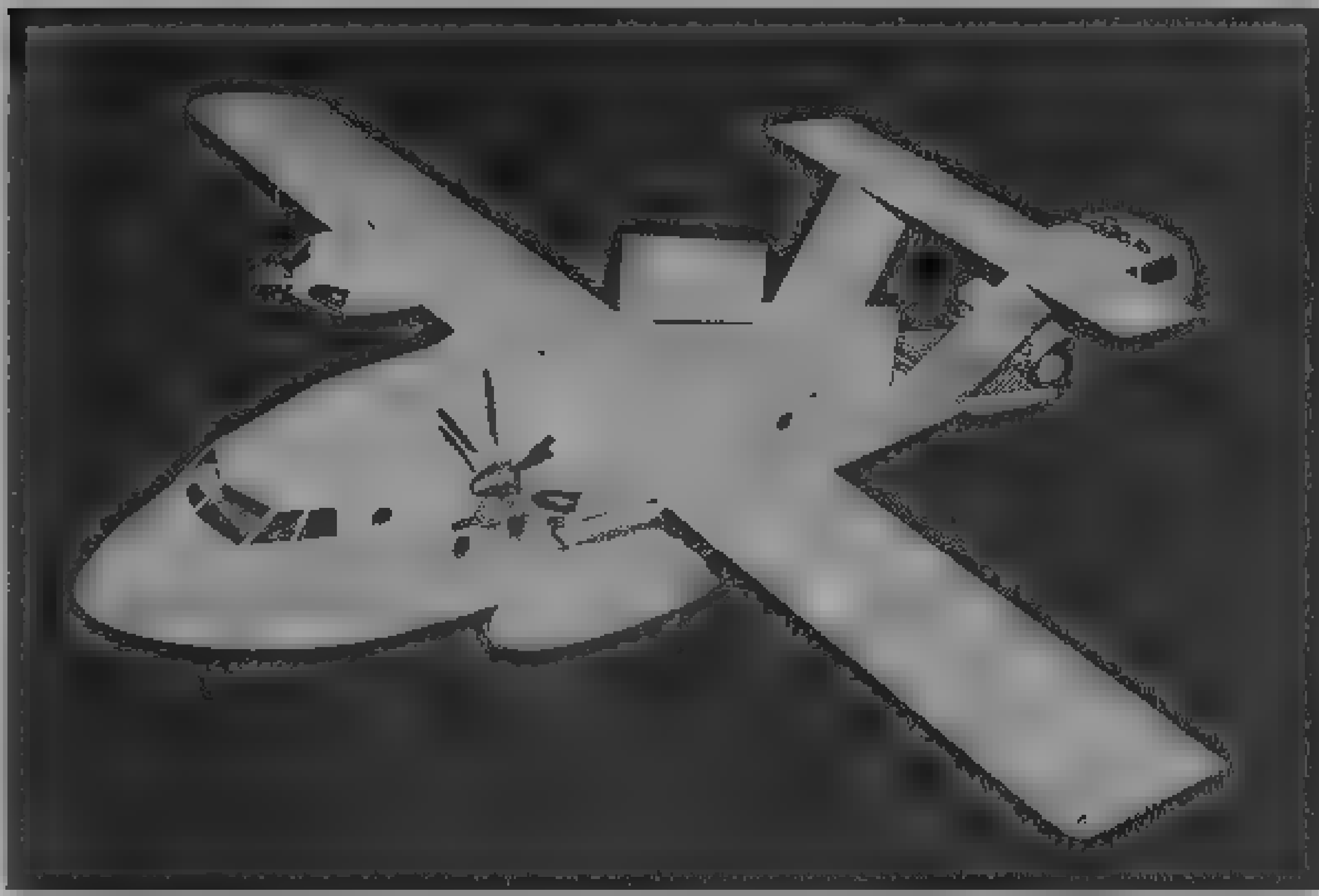
Under the Programme for Development of Russian General Purpose Aviation, NIAT scientific centre has projected a small amphibious transport aircraft suitable for operation in remote areas of Siberia and South-East Asia. TsAGI GOSNITS is involved in the proposal, which is intended to use hi-tec structural materials such as aluminium-lithium, titanium alloys and composites available at Russian aviation plants under the Konversiya policy.

NEW ENTRY



Alternative roles for NIAT Freighty include transporting vehicles (top) and combination of passengers and cargo

1995



Model of NIAT Freighty loading a four-wheel drive vehicle *(Paul Jackson)*

1995

NIAT 2.5 ST FREIGHTY

TYPE: Twin-turboprop light amphibious cargo/passenger transport

PROGRAMME: Initial design and market studies completed beginning June 1995, series production and certification planned for 1997

CUSTOMERS: Estimated domestic market for 350 aircraft, primarily for fuel and power engineering companies, government and local authorities and shipping companies, estimated export market for 300 aircraft. Planned production of seven aircraft in 1997, 30 in 1998 and 60 in 1999

COSTS: Investment of approximately $2.5 million sought for 1995-96; basic aircraft cost estimated at $1 to 3 million

DESIGN FEATURES: Cantilever high-wing monoplane; constant-chord wings without sweep, rectangular-section twin-step flying-boat hull, twin outward-canted and swept back tailfins with tailplane mounted near tips, stabilising float carried on long-chord fairing each side of hull

FLYING CONTROLS: Conventional three-axis, aileron and two-section flaps over full span of each wing, twin rudders and elevators

LANDING GEAR: Retractable tricycle type; twin wheels on each unit; main wheels retract into floats

POWER PLANT: Two 1,029 kW (1,380 shp) Omsk Mars TVD-20 turboprops; other engines optional

ACCOMMODATION: Unobstructed cabin space for such vehicles as minibuses, loaded via rear ramp and side-hinged doors forming top of rear fuselage aft of wings when closed, door on each side of flight deck, horizontally split two-piece main cabin door at rear on port side. Seats at front of cabin in combi version, emergency exit window each side under wing

DIMENSIONS, EXTERNAL:

Wing span	20.00 m (65 ft 7½ in)
Length overall	16.15 m (53 ft 0 in)
Height overall	5.41 m (17 ft 9 in)
Tailplane span	8.00 m (26 ft 3 in)

WEIGHTS AND LOADINGS: Not available

PERFORMANCE (estimated):

Nominal speed in level flight
188-215 kts (350-400 km/h; 217-248 mph)

T-O run: on land	530 m (1,740 ft)
on water	655 m (2,150 ft)
Landing run: on land	620 m (2,035 ft)
on water	700 m (2,297 ft)

Max range: with 2,500 kg (5,511 lb) cargo
323 n miles (600 km; 372 miles)
with 1,000 kg (2,205 lb) cargo
809 n miles (1,500 km; 932 miles)

NEW ENTRY

OREL

INDUSTRIAL COMMERCIAL COMPANY "OREL"

6 Skhodnenskaya Street, 123363 Moscow
Telephone: 7 (095) 496 33 28 and 497 94 22
Fax: 7 (095) 496 33 28 and 497 72 00

Orel's current activities include manufacture of the Molniya-1 general purpose light aircraft.

NEW ENTRY

PHOENIX-AVIATECHNICA

JOINT STOCK COMPANY 'PHOENIX-AVIATECHNICA'

No further progress has been reported with the LKhS-4 twin-engined utility aircraft last described in the 1994-95 *Jane's*.

UPDATED

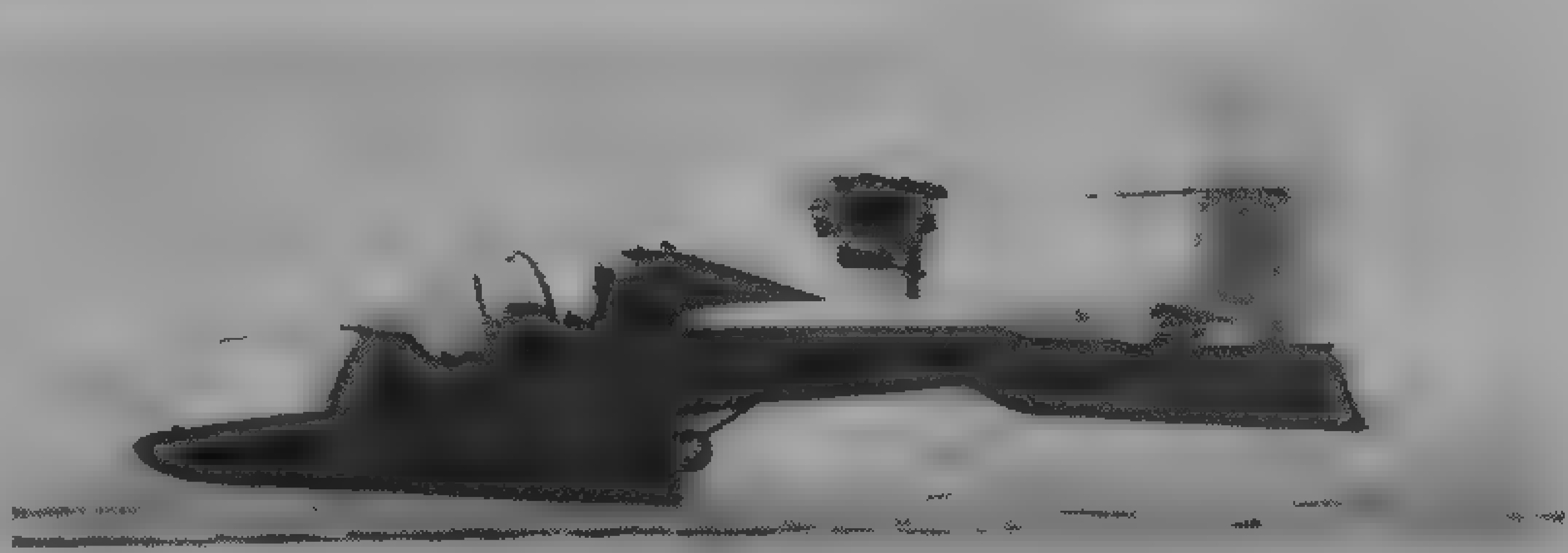
PONY

JOINT STOCK COMPANY PONY

17/17-20 Kolokolnikov Street, 103045 Moscow
Telephone: 7 (095) 925 62 76
Fax: 7 (095) 928 61 02

This joint-stock company holds all rights in the Pony light two-seat amphibian designed by Reda MDT Ltd and built by MAPO. Under development is a four-seat version known as the **Prize**, with enclosed cabin, and two ducted Teledyne Continental IOL-240 or Textron Lycoming O-235 engines shoulder-mounted aft of the cockpit, with the wings attached outboard of the ducts.

NEW ENTRY



Prototype Reda Pony two-seat light amphibian

1995

REDA PONY

TYPE: Light two-seat amphibian

PROGRAMME: Prototype first flew December 1994; certification planned for Autumn 1996, under JAR VLA requirements

DESIGN FEATURES: Cantilever mid-wing monoplane of constant chord, without dihedral or sweep; pod and boom fuselage; engine with ducted pusher propeller (no duct fitted initially) mounted above rear of pod, wire-braced tailplane mid-mounted on fin, main floats mounted on sides of pod, with third float under tailboom. Able to operate in Sea State 1

FLYING CONTROLS: Conventional three-axis, with ailerons, elevators and rudder; two-section flaps between aileron and fuselage on each wing

STRUCTURE: All-metal airframe, composite floats

LANDING GEAR: Retractable tailwheel type; single wheel on each unit. Three JSC Apatek floats, forward pair projecting forward of fuselage pod

POWER PLANT: One 59 kW (79 hp) Rotax 912A engine

ACCOMMODATION: Two seats side by side in enclosed (initially open) cabin

DIMENSIONS, EXTERNAL:

Wing span	11.00 m (36 ft 1 in)
Length overall	8.40 m (27 ft 6½ in)
Height overall	2.84 m (9 ft 4 in)
Tailplane span	5.00 m (16 ft 5 in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase	5.84 m (19 ft 2 in)

DIMENSIONS, INTERNAL:

Cabin: Length	1.10 m (3 ft 7¼ in)
Max width	1.15 m (3 ft 9¼ in)

AREAS
- Wings, gross 16 5 m² (177 6 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty 545 kg (1,201 lb)
- Max T-O weight 750 kg (1,653 lb)

PERFORMANCE
- Max level speed 81 kts (150 km/h, 93 mph)
- Max cruising speed (75% power) 73 kts (135 km/h, 84 mph)
- T-O and landing speed 38 kts (70 km/h, 44 mph)
- Max rate of climb at S/L 78-144 m (256-472 ft)/min
- T-O run: on land 120 m (394 ft)
  - on water 300 m (985 ft)
- T-O to 15 m (50 ft): on land 300 m (985 ft)
  - on water 480 m (1,575 ft)
- Landing from 15 m (50 ft): on land 400 m (1,313 ft)
  - on water 440 m (1,445 ft)
- Landing run: on land 80 m (263 ft)
  - on water 120 m (394 ft)
- Normal range 270 n miles (500 km; 310 miles)
- Range with max fuel 367 n miles (680 km, 422 miles)
- Normal endurance 3 h 30 min

NEW ENTRY

ROMASHKA

ROMASHKA AGROTECHNICAL COMPANY

Kosmonavtov Street 60, 394055 Voronezh

VERIFIED

ROMASHKA BSKhS

TYPE: Single-seat agricultural aircraft

PROGRAMME: First shown in form of full-scale mockup at MosAeroshow '93 Development and production plans not disclosed.

DESIGN FEATURES: Conventional strut-braced low-wing monoplane; unswept constant-chord wings and tailplane; sweptback fin; tailwheel type non-retractable landing gear with cantilever mainwheel legs, high-set enclosed cockpit, for optimum forward view over sloping nose; hopper between engine and windscreen; spraybars aft of wing trailing-edge

FLYING CONTROLS: Ailerons, elevators, rudders and flaps (occupying wing trailing-edge between fuselage and aileron each side) all have ribbed skin; ground adjustable tab on rudder and each elevator

LANDING GEAR: Low-pressure mainwheel tyres, size 700 × 250 mm, tailwheel tyre size 300 × 125 mm

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial engine, three-blade fixed-pitch propeller

DIMENSIONS, EXTERNAL:
- Wing span 12 56 m (41 ft 2½ in)
- Length overall 8 62 m (28 ft 3½ in)
- Height overall 3 00 m (9 ft 10¼ in)
- Wheel track 2 60 m (8 ft 6½ in)
- Wheelbase 6.44 m (21 ft 1½ in)

DIMENSIONS, INTERNAL:
- Hopper volume 1 18 m³ (41 6 cu ft)

AREAS:
- Wings, gross 22 50 m² (242.2 sq ft)

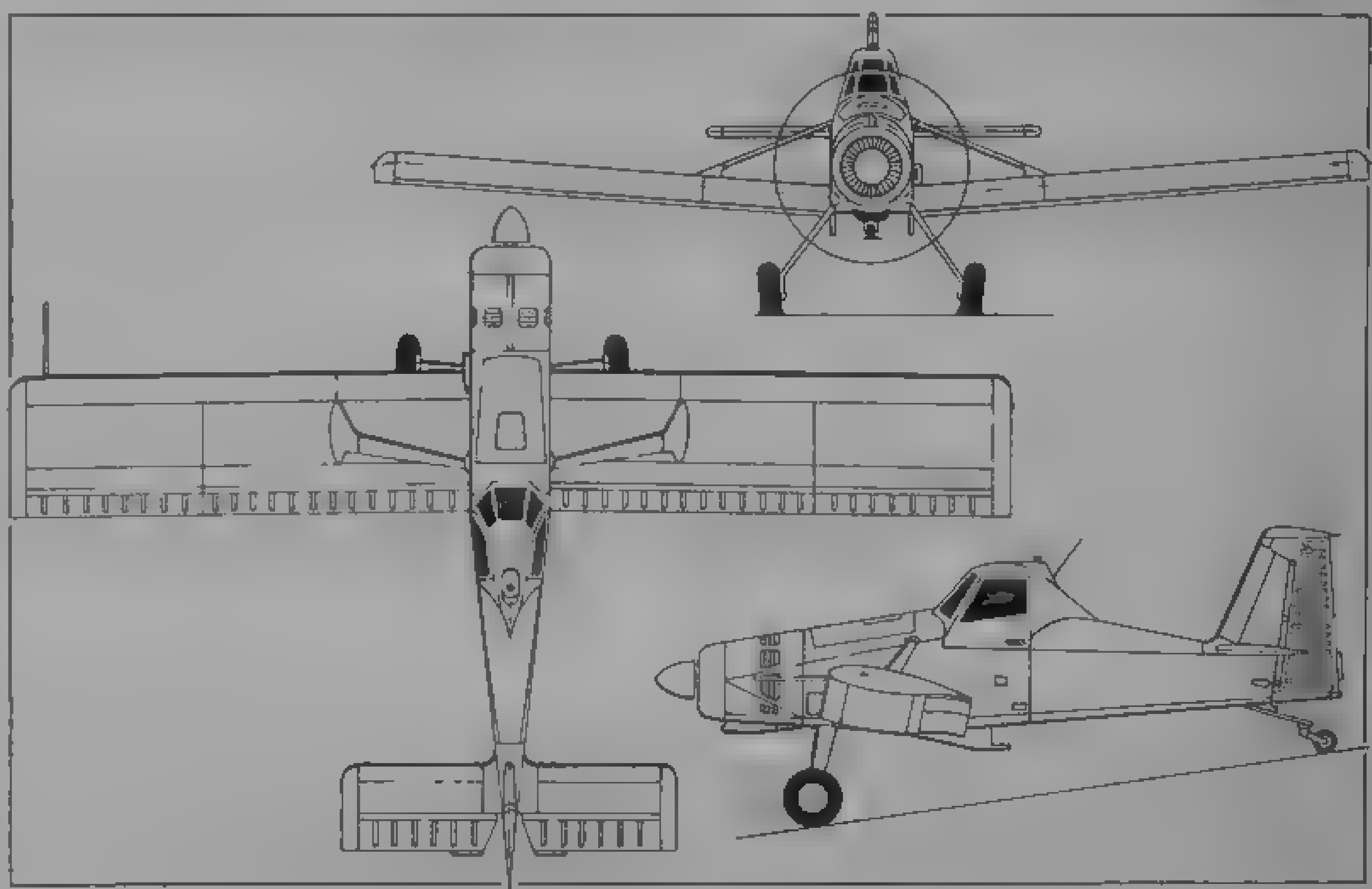
WEIGHTS AND LOADINGS:
- Weight empty 1,096 kg (2,416 lb)
- Max T-O weight 2,190 kg (4,828 lb)
- Max wing loading 97 3 kg/m² (19 93 lb/sq ft)

PERFORMANCE (estimated at max T-O weight):
- Max level speed 129 kts (240 km/h, 149 mph)
- Nominal cruising speed 92 kts (170 km/h; 105 mph)
- Min flying speed 51 kts (94 km/h, 59 mph)
- T-O speed 58 kts (107 km/h, 67 mph)
- Landing speed 42 kts (77 km/h, 48 mph)
- Max rate of climb at S/L 270 m (885 ft)/min
- Service ceiling 4,050 m (13,285 ft)
- T-O run 166 m (545 ft)
- Landing run 144 m (475 ft)
- Range with max fuel 275 n miles (510 km, 317 miles)

UPDATED

Mockup of Romashka BSKhS single-seat agricultural aircraft *(Piotr Butowski)*

1994



Romashka BSKhS (VOKBM M-14P nine-cylinder radial engine) *(Jane's/Mike Keep)*

1994

SUKHOI

SUKHOI DESIGN BUREAU AVIATION SCIENTIFIC-INDUSTRIAL COMPLEX

23A Polikarpov Street, 125284 Moscow
Telephone: 7 (095) 945 65 25
Fax: 7 (095) 200 42 43
Telex: 414716 SUHOI SU

GENERAL DESIGNER AND CEO: Mikhail Petrovich Seemonov

FIRST DEPUTY GENERAL DESIGNER: Mikhail A Pogosian

DIRECTOR MANUFACTURER: Vladimir N Avramenko

DEPUTY GENERAL DESIGNERS:
- Alexander F Barkovsky
- Nikolai F Nikitin
- Aleksei I Knishev
- Boris V Rakitin (Sport Aviation Projects)
- Vladimir M Korchagin (Avionics)
- Alexander I Blinov (Strength Problems)

OKB named for Pavel Osipovich Sukhoi, who headed it from 1939 until his death in September 1975. It remains one of two primary Russian centres for development of fighter and attack aircraft, and is widening its activities to include civilian aircraft, under konversiya programme.

Sukhoi also active in design and construction of large ground effect vehicles, including 100/150-passenger A.90.150 Ekranoplan described in *Jane's High Speed Marine Craft 1995-96*

UPDATED

Note: Several current programmes were redesignated early in 1995, type numbers will therefore differ from previous editions of *Jane's*

SUKHOI Su-17, Su-20 and Su-22

NATO reporting names: Fitter-C, -D, -E, -F, -G, -H, -J and -K

TYPE: Single-seat variable geometry ground attack fighter, reconnaissance aircraft and two-seat combat trainer

PROGRAMME: Prototype S-22I or Su-7IG (Izmenyaemaya Geometriya, variable geometry) was minimal conversion of fixed-wing Su-7 (NATO 'Fitter-A'): only 4.2 m (13 ft 9 in) of each wing pivoted, outboard of large fence and deepened inboard glove panel; first flew 2 August 1966, shown at Aviation Day display July 1967, given NATO reporting name 'Fitter B', two squadrons of **Su-17** 'improved Fitter-Bs' in Soviet air forces 1972, AL-21F-3 engine then replaced AL-7 in major Soviet air force production versions, beginning with 'Fitter-C' Production ended 1990

CURRENT VERSIONS: **Su-17M** (S-32M, 'Fitter-C'): Single-seat attack aircraft, AL-21F 3 engine, gun in each wingroot, ranging radar, RWR, eight stores pylons, additional wing fence on each glove panel, curved dorsal fin, operational with CIS air forces and Naval Aviation since 1971 in small numbers

Su-17R: Reconnaissance version of Su 17M

Su-17M-2/M-2D (S 32M2, 'Fitter D'): Generally as Su-17M, but forward fuselage lengthened by 0 38 m (15 in) and drooped 3° to improve pilot's view while keeping intake face vertical; added undernose Doppler navigation radar pod, Klen laser rangefinder in intake centrebody

Su-17UM-3 ('Fitter-G'): Two-seat trainer version of Su-17M-3 with combat capability, drooped forward fuselage like Su 17M 2, deepened dorsal spine fairing for additional fuel tankage, taller vertical tail surfaces, removable ventral fin, starboard wingroot gun only, laser rangefinder in intake centrebody

Su-17M-3 (S-52, 'Fitter-H') Improved single-seater; same deepened spine and tail modifications as Su 17UM 3; Doppler navigation radar internally in deepened undersurface of nose, gun in each wingroot; launcher for R 60 (AA-8 'Aphid') air-to-air missile between each pair of underwing pylons, 'Fitter-H/Ks' equipped for tactical reconnaissance carry, typically, centreline sensor pod, active ECM pod under port wing glove, two underwing fuel tanks

Su-17M-4 (S 54, 'Fitter K'): Single seat version, cooling air intake at front of dorsal fin; otherwise as Su-17M-3 externally Development began 1978, prototype flew June 1980; production started 1980; first production aircraft flew 1981; deliveries began 1982. *Detailed description applies to this version, except where indicated otherwise*

Su-20 (S-32MK, 'Fitter-C'): Export version of Su-17M

Su-20R Reconnaissance version of Su-20

Sukhoi Su-17M-3 ('Fitter-H') with ventral reconnaissance pod

1995

All Su-17s and Su-20s have AL 21F 3 engine, some Su-22 export aircraft have Tumansky R-29BS-300 (112 8 kN, 25,350 lb st with afterburning) in more bulged rear fuselage, with rearranged small external air intakes on rear fuselage and shorter plain metal shroud terminating fuselage, as follows

Su-22U ('Fitter-E'): Tandem two-seat trainer developed from Su-17M-2, with Tumansky engine; no Doppler pod, deepened dorsal spine fairing for additional fuel tankage, port wingroot gun deleted

Su-22 ('Fitter-F') Export Su-17M-2; modified undernose electronics pod, R-29 engine, gun in each wingroot, weapons include R-3 (AA-2 'Atoll') air-to-air missiles, aircraft supplied to Peru had Sirena-2 limited coverage radar warning system and virtually no navigation aids, some basic US-supplied avionics retrofitted

Su-22UM-3K ('Fitter-G'): Export Su-17UM-3, AL-21F-3 or R-29B engine

Su-22M-3 ('Fitter-J'): As Su-17M-3 but R 29 engine, internal fuel tankage 6,270 litres (1,656 US gallons, 1,379 Imp gallons); more angular dorsal fin, AA-2 ('Atoll') air-to-air missiles

Su-22M-4 ('Fitter-K'): As Su-17M 4, AL-21F-3A engine; 78 0 kN (17 535 lb st) dry, 111 5 kN (25,065 lb st) with afterburning

CUSTOMERS: CIS air forces, including 120 for ground attack and 50 for reconnaissance with Russian tactical air forces, 35 with Naval Aviation, 130 in Ukraine; air forces of Afghanistan (Su-20/22M-4), Algeria (Su-20), Angola (Su-20/22), Czech Republic (Su-22M-4), Egypt (Su-20), former East Germany (Su-22M-4), Hungary (Su-22), Iraq (Su-20), North Korea (Su-20/22), Libya (Su-22), Peru (Su-22), Poland (Su-22M-4), Slovakia (Su-22M-4), Syria (Su-20/22), Vietnam (Su-20/22), Yemen (Su-22)

DESIGN FEATURES Modest amount of variable geometry added to original fixed-wing Su-7 permitted doubled external load from strips little more than half as long, and 30 per cent greater combat radius, progressive refinements led to very effective final versions. Conventional mid-wing all-swept monoplane, except for variable geometry outer wings with manually selected positions of 30°, 45°, 63°; wide-span fixed centre-section glove panels, basically circular fuselage with 3° drooped nose and deep dorsal spine, ram intake with fixed shock cone centrebody; pitot on port side of nose, transducer to provide pitch and yaw data for fire control computer starboard, anti flutter bodies near tailplane tips. Wing anhedral 3°, incidence 1°, no twist. Fin sweepback 55°.

FLYING CONTROLS: Slotted ailerons operable at all times, slotted trailing-edge flap on each variable geometry wing panel operable only when wings spread, area-increasing flap on each centre-section glove panel, full-span leading-edge slats on variable geometry wing panels, top and bottom door-type airbrakes each side of rear fuselage, forward of tailplane all moving horizontal tail surfaces, conventional rudder, no tabs.

STRUCTURE. All-metal, semi monocoque fuselage, large main wing fence on each side, at junction of fixed and movable panels, square-cut at front, with attachment for external store; shorter fence above glove panel each side

LANDING GEAR Retractable tricycle type, with single wheel on each unit; nosewheel retracts forward, mainwheels retract inward into centre section KT 117 mainwheel tyres, size 880 × 230 mm, pressure 14 2 bars (206 lb/sq in); K2106 nosewheel tyre, size 660 × 200 mm, pressure 9 1 bars (132 lb/sq in) Nosewheel steerable ±27° Container for single cruciform brake-chute between base of rudder and tailpipe

POWER PLANT: One Saturn/Lyulka AL-21F 3 turbojet, 76.5 kN (17,200 lb st) dry and 110.3 kN (24,800 lb st) with afterburning. Fuel capacity 4,590 litres (1,212 US gallons, 1 010 Imp gallons), with some tankage in dorsal spine fairing, provision for two 800 litre (211 US gallon, 176 Imp gallon) PTB-800 drop tanks and two 1,150 litre (304 US gallon; 253 Imp gallon) drop tanks on outboard wing pylons and under fuselage; when underfuselage tanks carried, only the two inboard wing pylons may be used for ordnance, to total 1,000 kg (2,204 lb). Oil capacity 15 kg (33 lb). Two solid propellant rocket units attached optionally to rear fuselage to shorten T O run

ACCOMMODATION Pilot only, on K-36 ejection seat, under rearward-hinged transparent canopy; rearview mirror above canopy

SYSTEMS. Two independent hydraulic systems, each 207 bars (3,000 lb/sq in). Pneumatic system pressure 150 bars (2,175 lb/sq in). Gaseous oxygen system

AVIONICS. *Comms:* R-862 com radio, SOD-57M ATC/SIF, with transponder housing beneath brake-chute container, SRO-2M ('Odd Rods') IFF with SO-69 transponder

Flight: CVM 20-22 mission computer; PrNK 54 nav system with RSDN Loran and A-312 Tacan, DISS-7 Doppler; IKV-8 inertial platform.

Instrumentation: ASP-5ND fire control system, ARK-22 radio compass

Mission Klen-45 laser rangefinder in intake centrebody, ASP-17BC gunsight

Self defence SPO 15LE Sirena 3 radar warning system providing 360° coverage, with antennae in slim cylindrical housing above brake-chute container and in each centre-section leading-edge, between fences

EQUIPMENT Front and rear pairs of ASO-2 chaff/flare dispensers to each side of dorsal spine fairing. KDS decoy dispensers in forward section of spine fairing.

ARMAMENT Two 30 mm NR-30 guns, each with 80 rounds, in wingroot leading-edges, nine weapon pylons (one on centreline, two tandem pairs under fuselage, one under each centre section leading-edge, one under each main wing fence) for 4,000 kg (8,820 lb) of bombs, including nuclear weapons, rocket pods, S-25 tube-launched rockets with 325 mm head, 23 mm SPPU 22 gun pods, two R 3 or R 13M (AA 2 'Atoll'), R 60 (AA 8 'Aphid') or R-73A (AA-11 'Archer') air-to-air missiles, Kh-25ML (AS-10 'Karen'), Kh-27 (AS-12 'Kegler'), Kh-29 (AS 14 'Kedge') or Kh-58 (AS-11 'Kilter') air-to-surface missiles, or a reconnaissance pod. When four SPPU 22 gun pods are fitted, with downward attack capability, the two underfuselage pods can be mounted to fire rearward

DIMENSIONS, EXTERNAL

Wing span fully spread	13 68 m (44 ft 10¼ in)
fully swept	10 025 m (32 ft 10¾ in)
Wing chord at root	5 855 m (19 ft 2½ in)
at tip	1 301 m (4 ft 3¼ in)
Wing aspect ratio: fully spread	4 88
fully swept	2.69
Length overall, incl probes	19 026 m (62 ft 5 in)
Fuselage length	15 87 m (52 ft 1 in)
Diameter of fuselage (max)	1 55 m (5 ft 1 in)
Height overall	5.129 m (16 ft 10 in)
Tailplane span	4 645 m (15 ft 3 in)
Wheel track	3 83 m (12 ft 6¾ in)
Wheelbase	5 25 m (17 ft 2¾ in)

AREAS

Wings, gross, fully spread	38 49 m² (414 3 sq ft)
fully swept	34 85 m² (375 1 sq ft)
Ailerons (total)	1 81 m² (19 48 sq ft)
Trailing-edge flaps (total)	3 91 m² (42 07 sq ft)
Fin	4 61 m² (49 63 sq ft)
Rudder	0.924 m² (9.95 sq ft)
Tailplane	5 58 m² (60 06 sq ft)

WEIGHTS AND LOADINGS (Su 22M 4)

Weight empty, equipped	10,767 kg (23,737 lb)
Max internal fuel	3,770 kg (8,310 lb)
Max external stores	4,000 kg (8,820 lb)
Max T-O weight	19,400 kg (42,770 lb)
Max landing weight	13,000 kg (28,660 lb)
Max wing loading swept	556 7 kg/m² (114 0 lb/sq ft)
Max power loading	174 0 kg/kN (1 71 lb/lb st)

Sukhoi Su 22M 4 ('Fitter K') of Czech Air force *(Paul Jackson)*

1995

Su 17M 3 ('Fitter-H'), single-seat version of the variable geometry 'Fitter' series *(Jane's/Dennis Punnett)*

1993

PERFORMANCE (Su-22M-4):

Max level speed: at height	Mach 1.74 (1,000 kts; 1,850 km/h; 1,150 mph)
at S/L, clean	Mach 1.10 (729 kts; 1,350 km/h; 838 mph)
at S/L, with external stores	Mach 1.02 (675 kts; 1,250 km/h; 777 mph)
T-O speed at max T-O weight	194 kts (360 km/h; 224 mph)
Landing speed	154 kts (285 km/h; 177 mph)
Stalling speed	162 kts (300 km/h; 187 mph)
Max rate of climb at S/L	13,800 m (45,275 ft)/min
Service ceiling	15,200 m (49,865 ft)
T-O run: clean	1,500 m (4,922 ft)
Landing run, with parachute brake	1,100 m (3,609 ft)
Range with max internal and external fuel:	
at high altitude	1,375 n miles (2,550 km; 1,585 miles)
at low altitude	756 n miles (1,400 km; 870 miles)

UPDATED

SUKHOI Su-24

NATO reporting name: Fencer

TYPE: Two-seat variable geometry 'battlefield bomber', reconnaissance and EW aircraft.

PROGRAMME: Design started 1965 under Yevgeniy S Felsner, Pavel Sukhoi's successor, to replace Il-28 and Yak-28 attack aircraft; T-6-1 prototype, first flown 2 July 1967 and now at Monino, had fixed delta wings with downswept tips, and two pairs of RD-36-35 lift-jets mounted at inclined angle in rear fuselage, to exhaust slightly rearward for improved take-off performance; T-6-2IG variable geometry prototype, without lift jets, chosen for production; first flight 17 January 1970; by 1981, delivery rate 60-70 a year; more than 900 delivered from Komsomolsk plant; production of Su-24M/MR/MP continues.

CURRENT VERSIONS: **Su-24** ('Fencer-A'): First flown (seventh prototype) December 1971. Had rectangular rear fuselage box enclosing jet nozzles; few early aircraft only; deployed with trials unit 1974.

Su-24 ('Fencer-B'): First operational version, 1976. Deeply dished bottom skin to rear fuselage box between jet nozzles; larger brake-chute housing at base of rudder.

Su-24 ('Fencer-C'): Introduced 1981; important avionics changes, multiple nose fitting instead of former simple probe, triangular fairing for RWR on side of each engine air intake, forward of fixed wingroot, and each side of fin near tip; chord of fin leading-edge extended forward except at tip, giving kinked profile.

Su-24M ('Fencer-D'): Major attack version. T-6-8M prototype first flew 24 July 1977; entered production 1978; service 1983; believed to have terrain-following radar instead of earlier terrain-avoidance system; added flight refuelling capability, with centrally mounted retractable probe forward of windscreen, nose approximately 0.75 m (2 ft 6 in) longer to accommodate new avionics bay for PNS-24M nav/attack system, including Kaira-24 laser/TV weapon guidance system, large overwing fences integral with extended wingroot glove pylons on all but late production aircraft for domestic use: fences sometimes squared off at front to house chaff/flare dispensers; undernose antennae deleted; laser ranger/designator housing aft of nosewheel bay, single long noseprobe; export version is **Su-24MK**.

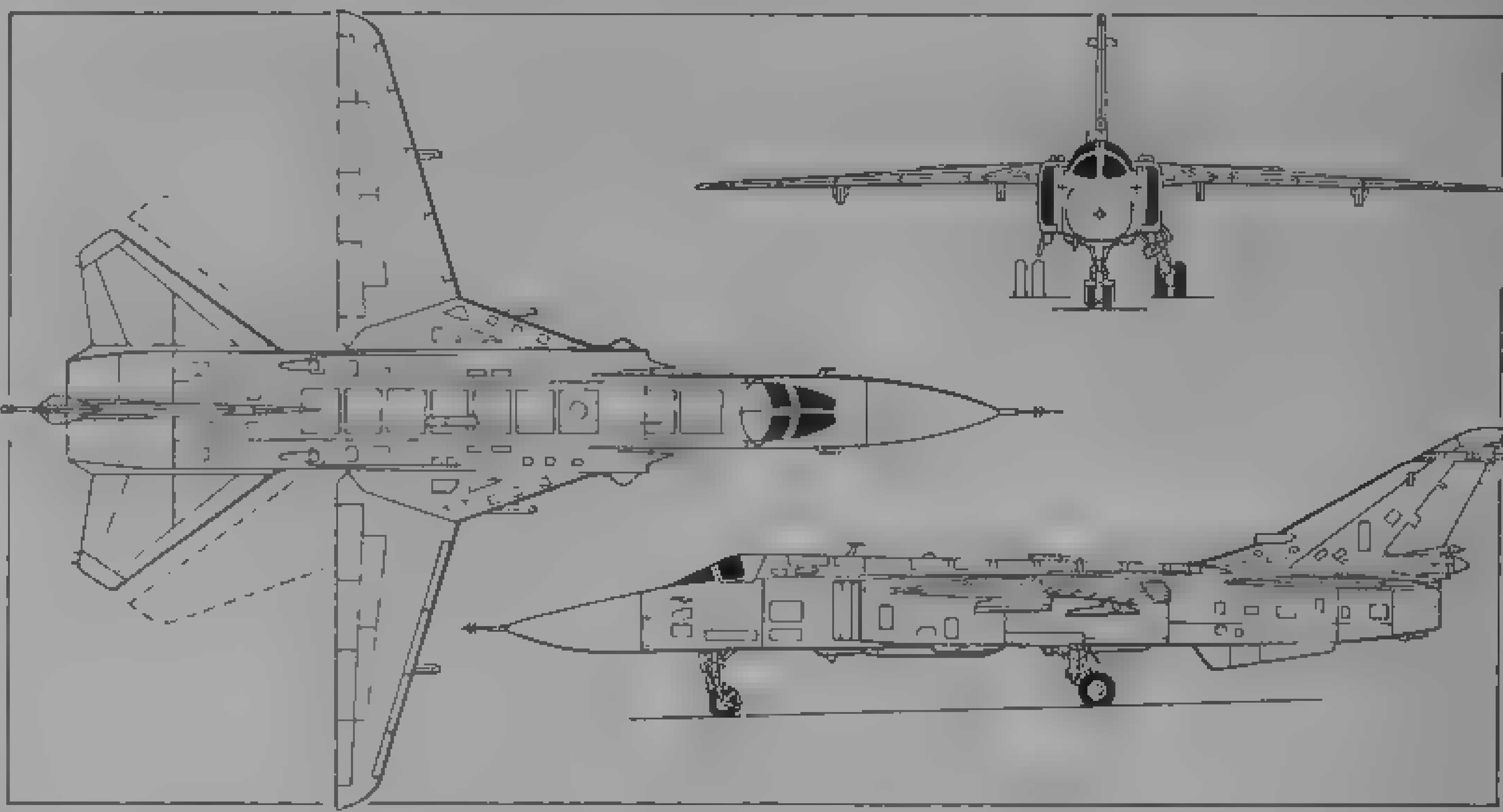
Su-24MR ('Fencer-E'): Reconnaissance version of Su-24M used by tactical and naval air forces; BKR-1 internal equipment includes Shtik side-looking airborne multimission radar in nose, Zima IR reconnaissance system under centre-fuselage, Aist-M TV reconnaissance system, AFA AP-402M panoramic camera in nose and AFA A-100 oblique camera behind crew cabin. A Shpil-2M laser pod can be carried on centreline, with a Tangazh elint pod or Efir-1M radiation detector pod on starboard underwing swivelling pylon and two R-60 air-to-air missiles under port wing. Data can be transmitted to ground by datalink. No overwing fences; shorter nose radome, with flush dielectric side panels on nose, domed centre fuselage air intake for heat exchanger; provision for two 3,000 litre (792 US gallon; 660 Imp gallon) underwing auxiliary fuel tanks, flight refuelling capability retained, but weapons control system and attack capability deleted. First of two prototypes (T6MR-26 and -34) flew September 1980; deliveries to Baltic fleet, replacing Tu-16s, began Summer 1985. Maximum speed at 200 m (660 ft) limited to 648 knots (1,200 km/h; 746 mph) when carrying full external equipment.

Su-24MP ('Fencer-F'): Electronic warfare/jamming/sigint version to replace Yak-28PP 'Brewer-E'. First of T6MP-25 and -35 prototypes flew December 1979; dielectric nose panels differ from those of Su-24MR, added blade antenna under nose; no underside electro-optics; 'hockey stick' communications jamming antenna at bottom of fuselage under nose section of each engine air intake, centreline EW pod. Starboard cockpit display panels replaced by EW console. Armament GSh-6-23M gun and four R-60 (AA-8 'Aphid') air-to-air missiles. Production reportedly limited to 12 aircraft.

CUSTOMERS: Russian air forces have 480 for ground attack and 90 for reconnaissance and ECM. Naval Aviation has 107 for attack and 20 for reconnaissance/electronic warfare; others with air forces of Azerbaijan (16 Su-24MR); Ukraine (250), Algeria (10), Iraq (most of 24 now in Iran), Iran (12 plus ex-Iraqi aircraft), Libya (15), Syria (42). 'Fencer-A/B/C' built at GAZ 153 Novosibirsk, Su-24M versions initially at GAZ 153 (approximately 380), then GAZ 416 Komsomolsk-on-Amur (over 290).

Sukhoi Su-24MR ('Fencer-E') of Russian Air Force *(Swedish Air Force)*

1995



Sukhoi Su-24M ('Fencer-D') variable geometry attack aircraft *(Jane's/Mike Keep)*

1990

DESIGN FEATURES: Variable geometry shoulder wing, wing section SR14S-5.376 on fixed panels, SR14S-9.226 to SR16M-10 on outer panels; 4° 30′ anhedral from roots, incidence 0° at root, −4° at tip; triangular fixed glove box, four-position (16°, 35°, 45°, 69°) pivoted outer panels, each with pivoting stores pylon, slab-sided rectangular section fuselage; integral engine air intake trunks, each with splitter plate and outer lip inclined slightly downward, chord of lower part of tailfin extended forward, giving kinked leading-edge; leading-edge sweepback 59° 30′ on fin, 30° on inset rudder, 50° on horizontal tail surfaces, basic operational task, as designated 'frontal bomber', to deliver wide range of air-to-surface missiles for defence suppression, with some hard target kill potential, specially developed long range navigation system and electro-optical weapons systems make possible penetration of hostile airspace at night or in adverse weather with great precision, to deliver ordnance within 55 m (180 ft) of target.

FLYING CONTROLS: Full-span leading-edge slats, drooping aileron and two-section double-slotted trailing-edge flaps on each outer wing panel, differential spoilers forward of flaps for roll control at low speeds and use as lift dumpers on landing, airbrake under each side of centre-fuselage; inset rudder; all-moving horizontal tail surfaces operate collectively for pitch control, differentially for roll control, assisted by wing spoilers except when wings fully swept. Artificial feel system. Automatic flight control system.

STRUCTURE: All-metal, semi-monocoque fuselage, two slightly splayed ventral fins.

LANDING GEAR: Hydraulically retractable tricycle type, with twin wheels on each unit; main units retract forward and inward into air intake duct fairings; steerable nose unit retracts rearward. Oleo-pneumatic shock-absorbers. Trailing-link main units, KT-172 mainwheel tyres size 950 × 300 mm, pressure 12.15 bars (176 lb/sq in); KN-21 nosewheel tyres size 600 × 200 mm, pressure 9.1 bars (132 lb/sq in); KT-69/430 brakes on mainwheels, with IA-58 anti-skid units, mudguard on nosewheels, two cruciform brake-chutes, each 25 m² (269 sq ft).

POWER PLANT: Two Saturn/Lyulka AL-21F-3A turbojets, each 75.0 kN (16,865 lb st) dry and 109.8 kN (24,690 lb st) with afterburning, fixed engine air intakes. Four internal fuel tanks, capacity 11,700 litres (3,090 US gallons; 2,574 Imp gallons), can be supplemented by two 2,000 litre (528 US gallon, 440 Imp gallon) external tanks under fuselage and two 3,000 litre (792 US gallon; 660 Imp gallon) tanks under wing gloves. Pressure and gravity fuelling. Probe-and-drogue flight refuelling capability, including operation as buddy tanker using UPAZ-A underbelly pod. Oil capacity 24 litres (6.35 US gallons; 5.25 Imp gallons).

ACCOMMODATION: Crew of two (pilot and weapon systems officer) side by side on K-36DM ejection seats; cockpit width 1.65 m (5 ft 5 in), jettisonable canopy, hinged to open upward and rearward in two panels, split on centreline.

SYSTEMS: Cockpit air conditioned, with automatic pressure and temperature control. Three independent hydraulic systems. Main and emergency pneumatic systems, each with 18 litre bottle, pressure 152 bars (2,200 lb/sq in). Two electrical generators for 200/115 V AC supply and two for 28.5 V DC supply. Gaseous oxygen system. Hot-air de-icing system.

AVIONICS: *Radar:* Two superimposed radar scanners in nose, for nav/attack and terrain clearance and ranging to airborne target.

Mission: Laser ranger/designator under front fuselage.

Self-defence: SPO-15 radar warning receivers on sides of engine air intakes and tailfin; LO-82 Mak UL missile warning receivers above centre-fuselage and below front fuselage, Geran-F active jamming system. Aircraft supplied to Iran have 54 chaff/flares in wing fence dispensers, in addition to standard 24 on sides of rear fuselage.

ARMAMENT (Su-24M): Nine pylons under fuselage, each wingroot glove and outer wings for guided and unguided air-to-surface weapons, including TN-1000 and TN-1200 nuclear weapons, up to four TV or laser-guided bombs, missiles such as Kh-23 (NATO AS-7 'Kerry'), Kh-25ML (AS-10 'Karen'), Kh-58 (AS-11 'Kilter'), Kh-25MP (AS-12 'Kegler'), Kh-59 (AS-13 'Kingbolt'), Kh-29 (AS-14 'Kedge') and Kh-31A/P (AS-17 'Krypton'), rockets of 57 mm to 330 mm calibre, bombs (typically 38 × 100 kg FAB-100), 23 mm gun pods or external fuel tanks; two R-60 (AA-8 'Aphid') air-to-air missiles can be carried for self defence. No internal weapons bay. One GSh-6-23M six-barrel 23 mm Gatling type gun inside fairing on starboard side of fuselage undersurface, fairing for recording camera on other side.

DIMENSIONS, EXTERNAL:

Wing span: 16° sweep	17.64 m (57 ft 10½ in)
69° sweep	10.365 m (34 ft 0 in)
Wing aspect ratio: 16° sweep	5.63
69° sweep	2.10
Length overall, incl probe:	
Su-24	22.67 m (74 ft 4½ in)
Su-24M	24.595 m (80 ft 8⅜ in)
Height overall: Su-24	5.92 m (19 ft 5 in)
Su-24M	6.19 m (20 ft 3¾ in)

Sukhoi Su-24MP ('Fencer-F') electronic warfare/jamming/sigint aircraft *(F. G. Rozendaal)* 1995

Tailplane span	8 39 m (27 ft 6½ in)
Wheel track	3 31 m (10 ft 10½ in)
Wheelbase	8 51 m (27 ft 11 in)
AREAS	
Wings, gross 16° sweep	55 17 m² (593 8 sq ft)
69° sweep	51 02 m² (549 2 sq ft)
Leading-edge flaps (total)	3 035 m² (32.68 sq ft)
Trailing edge flaps (total)	10.21 m² (109 90 sq ft)
Spoilers (total)	2 06 m² (22.17 sq ft)
Fin	9 47 m² (101.94 sq ft)
Rudder	1 37 m² (14.75 sq ft)
Horizontal tail surfaces (total)	13.705 m² (147 55 sq ft)
WEIGHTS AND LOADINGS (Su-24M)	
Weight empty, equipped	22,300 kg (49,163 lb)
Max internal fuel	9,764 kg (21,526 lb)
Max external stores	8,100 kg (17,857 lb)
Normal T-O weight	35,970 kg (79,300 lb)
Max T-O weight	39,570 kg (87,235 lb)
Max landing weight	24,500 kg (54,012 lb)
Max wing loading	775.6 kg/m² (158.8 lb/sq ft)
Max power loading	180.2 kg/kN (1.77 lb/lb st)
PERFORMANCE (Su-24MK)	
Max level speed, clean at height	Mach 1 35
at S/L	Mach 1 08 (712 kts, 1,320 km/h, 820 mph)
Stalling speed, flaps and wheels down	151 kts (280 km/h, 174 mph)
Max rate of climb at S/L	9,000 m (29,525 ft)/min
Service ceiling	17,500 m (57,400 ft)
T-O run	1,300 m (4,265 ft)
T-O to 15 m (50 ft)	1,500 m (4,920 ft)
Landing from 15 m (50 ft)	1 600 m (5,250 ft)
Landing run	950 m (3,120 ft)
Combat radius:	
lo-lo-lo	over 174 n miles (322 km, 200 miles)
lo-lo-hi with 2,500 kg (5,500 lb) of weapons	515 n miles (950 km, 590 miles)
hi-lo-hi, with 3,000 kg (6,615 lb) of weapons and two external tanks	565 n miles (1,050 km, 650 miles)
g limit	+6.5

UPDATED

Cockpit of Sukhoi Su-24MR ('Fencer-E') *(Brian M. Service)* 1997

SUKHOI Su-25 and Su-28

NATO reporting name: Frogfoot

TYPE: Single-seat close support aircraft and two-seat trainer

PROGRAMME: Development began 1968, prototype, known as T 8-1, flew 22 February 1975, with two 25.5 kN (5 732 lb st) non-afterburning versions of Tumansky RD-9 turbojet and underbelly twin-barrel AO-17A 30 mm gun in fairing in eventual developed form, second prototype, T-8-2, had more powerful non afterburning versions of R 13, designated R 95Sh, wingtip avionics/speed brake pods, under wing weapon pylons, and internal gun, observed by satellite at Ramenskoye flight test centre 1977, given provisional US designation 'Ram-J'; entered production 1978 with R-95 turbojets, trials unit, followed by squadron of 12, sent to Afghanistan for co-ordinated low-level close support of Soviet ground forces in mountain terrain, with Mi 24 helicopter gunships, fully operational 1984, attack versions built initially at Tbilisi, Georgia, production at Tbilisi ended 1989 (approximately 330 built), production now at Ulan-Ude; all production for CIS completed 1991 92: see separate entry on Su 25T

CURRENT VERSIONS: **Su-25** ('Frogfoot A'). Single-seat close support aircraft. Export version **Su-25K** (kommercheskiy; commercial) *Detailed description applies basically to late production Su-25K.*

Su-25UB ('Frogfoot B'). Tandem two-seat operational conversion and weapons trainer; first photographs Spring 1989, rear seat raised considerably, giving humpback appearance, separate hinged portion of continuous framed canopy over each cockpit, taller tailfin, increasing overall height to 5 20 m (17 ft 0¾ in); new IFF blade antenna forward of windscreen instead of SRO-2 (NATO 'Odd Rods'); weapons pylons and gun retained Export version **Su-25UBK**.

Su-25UT ('Frogfoot-B'): As Su-25UB, but without weapons, prototype first flew 6 August 1985, demonstrated 1989 Paris Air Show as **Su-28**, overall length 15 36 m (50 ft 4¾ in), few only

Su-25UTG (G for gak; hook) ('Frogfoot-B'): As Su 25UT, with added arrester hook under tail, used initially for deck landing training on dummy flight deck marked on runway at Saki naval airfield, Ukraine, on 1 November 1989 was third aircraft to land for trials on carrier *Admiral of the Fleet Kuznetsov*, after Su-27K and MiG 29K, 10 built in 1989 90, five in Ukrainian use at Saki; one lost, four at Severomorsk, Kola Peninsula, for service individually on *Kuznetsov*

Su-25UBP: Ten standard Su-25UBs were to be converted to Su 25UBP (Palubnyi shipborne) for service on *Admiral of the Fleet Kuznetsov* to supplement Su-25UTGs Reportedly cancelled

Su-25T: See separate entry

Su-25BM (BM for buksir misheney, target towing aircraft) As Su-25 attack aircraft, with added underwing pylons for rocket-propelled targets released for missile training by fighter pilots

CUSTOMERS: Russian tactical air forces have 192, Naval Aviation has 55, exports to Afghanistan, Angola (10), Bulgaria (24), Czech Republic (30), Hungary (38), Iraq (45) and Slovakia (eight).

DESIGN FEATURES: Shoulder mounted wings; approximately 20° sweepback; anhedral from roots; extended chord leading-edge dogtooth on outer 50 per cent each wing, wingtip pods each split at rear to form airbrakes that project above and below pod when extended, retractable landing light in base of each pod, outboard of small glareshield and aft of dielectric nosecap for ECM, semi-monocoque fuselage, with 24 mm (0 94 in) welded titanium armoured cockpit, pitot on port side of nose, transducer to provide data for fire control computer on starboard side, conventional tail unit; variable incidence tailplane, with slight dihedral

Emphasis on survivability led to features accounting for 7 5 per cent of normal T-O weight, including armoured cockpit, pushrods instead of cables to actuate flying control surfaces (duplicated for elevators), damage-resistant main load-bearing members, widely separated engines in stainless steel bays fuel tanks filled with reticulated foam for protection against explosion

Maintenance system packaged into four pods for carriage on underwing pylons, covers onboard systems checks, environmental protection, ground electrical power supply for engine starting and other needs, and pressure refuelling from all likely sources of supply in front line areas, engines can operate on any fuel likely to be found in combat area, including MT petrol and diesel oil.

FLYING CONTROLS: Hydraulically actuated ailerons, with manual back-up, multiple tabs in each aileron, double slotted two-section wing trailing-edge flaps; full span leading-edge slats, two segments per wing, manually operated elevators and two-section inset rudder, upper rudder section operated through sensor vanes and transducers on nose probe and automatic electromechanical yaw damping system, tabs in lower rudder segment and each elevator

STRUCTURE: All-metal; three spar wings, semi monocoque slab-sided fuselage

LANDING GEAR: Hydraulically retractable tricycle type, mainwheels retract to lie horizontally in bottom of engine air intake trunks. Single wheel with low-pressure tyre on each

levered suspension unit, with oleo-pneumatic shock absorber; mudguard on forward-retracting steerable nosewheel, which is offset to port. Mainwheel tyres size 840 × 360 mm, pressure 9.3 bars (135 lb/sq in); nosewheel tyre size 660 × 200 mm, pressure 7.35 bars (106 lb/sq in). Brakes on mainwheels. Twin cruciform brake-chutes housed in tailcone.

POWER PLANT: Two Soyuz/Tumansky R-195 turbojets in long nacelles at wingroots, each 44.18 kN (9,921 lb st); 5 mm thick armour firewall between engines, current upgraded R-195 turbojets have pipe-like fitment at end of tailcone, from which air is expelled to lower exhaust temperature and so reduce infra-red signature; non-waisted undersurface to rear cowlings, which have additional small air-scoops (as three-view). Fuel tanks in fuselage between cockpit and wing front spar, and between rear spar and fin leading-edge, and in wing centre-section, provision for four PTB-1500 external fuel tanks on underwing pylons.

ACCOMMODATION: Single K-36L zero/zero ejection seat under sideways-hinged (to starboard) canopy, with small rear-view mirror on top; flat bulletproof windscreen. Folding ladder for access to cockpit built into port side of fuselage.

SYSTEMS: 28 V DC electrical system, supplied by two engine-driven generators.

AVIONICS: *Comms*: SRO-1P (NATO 'Odd Rods') or (later) SRO-2 IFF transponder, with antennae forward of windscreen and under tail.

Mission: Laser rangefinder and target designator under flat sloping window in nose, strike camera in top of nosecone.

Self-defence: Sirena-3 radar warning system antenna above fuselage tailcone; ASO-2V chaff/flare dispensers (total of 256 flares) can be carried above root of tailplane and above rear of engine ducts.

ARMAMENT: One twin-barrel AO-17A 30 mm gun with rate of fire of 3,000 rds/min in bottom of front fuselage on port side, with 250 rounds (sufficient for a one second burst during each of five attacks). Eight large pylons under wings for 4,400 kg (9,700 lb) of air-to-ground weapons, including UB-32A rocket pods (each 32 × 57 mm S-5), B-8M1 rocket pods (each 20 × 80 mm S-8), 240 mm S-24 and 330 mm S-25 guided rockets, Kh-23 (NATO AS-7 'Kerry'), Kh-25 (AS-10 'Karen') and Kh-29 (AS-14 'Kedge') air-to-surface missiles, laser-guided rocket-boosted 350 kg, 490 kg and 670 kg bombs, 500 kg incendiary, anti-personnel and other cluster bombs, and SPPU-22 pods each containing a 23 mm GSh-23 gun with twin barrels that can pivot downward for attacking ground targets, and 260 rounds. Two small outboard pylons for R-3S (K-13T; NATO AA-2D 'Atoll') or R-60 (AA-8 'Aphid') air-to-air self-defence missiles.


Sukhoi Su-25 ('Frogfoot-A') close support aircraft of Czech Air Force (*Paul Jackson*) *1995*

DIMENSIONS, EXTERNAL (Su-25K):

Wing span	14.36 m (47 ft 1½ in)
Wing aspect ratio	6.12
Length overall	15.53 m (50 ft 11½ in)
Height overall	4.80 m (15 ft 9 in)

AREAS:

Wings, gross	33.7 m² (362.75 sq ft)

WEIGHTS AND LOADINGS:

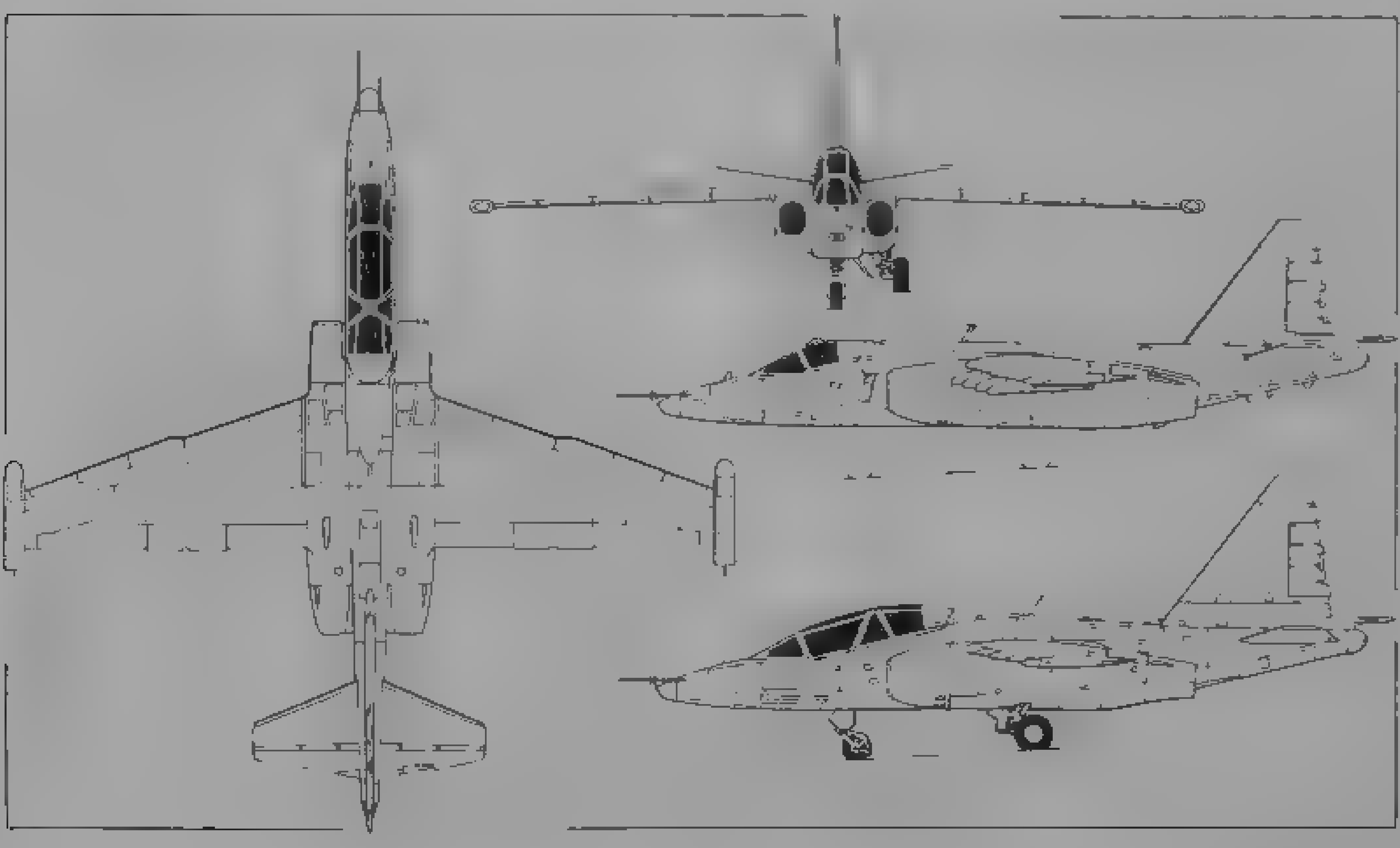
Weight empty	9,500 kg (20,950 lb)
Max T-O weight	14,600-17,600 kg (32,187-38,800 lb)
Max landing weight	13,300 kg (29,320 lb)
Max wing loading	522.2 kg/m² (107.0 lb/sq ft)
Max power loading	199.2 kg/kW (1.96 lb/lb st)

PERFORMANCE:

Max level speed at S/L	Mach 0.8 (526 kts; 975 km/h, 606 mph)
Max attack speed, airbrakes open	372 kts (690 km/h, 428 mph)
Landing speed (typical)	108 kts (200 km/h, 124 mph)
Service ceiling: clean	7,000 m (22,965 ft)
with max weapons	5,000 m (16,400 ft)
T-O run: typical	600 m (1,970 ft)
with max weapon load from unpaved surface	under 1,200 m (3,935 ft)
Landing run: normal	600 m (1,970 ft)
with brake-chutes	400 m (1,312 ft)
Range with 4,400 kg (9,700 lb) weapon load and two external tanks: at S/L	405 n miles (750 km; 466 miles)
at height	675 n miles (1,250 km; 776 miles)
g limits, with 1,500 kg (3,306 lb) of weapons	+6.5
with 4,400 kg (9,700 lb) of weapons	+5.2

UPDATED


Sukhoi Su-25UB ('Frogfoot-B') operational conversion and weapons trainer (*F. G. Rozendaal*) *1995*


Sukhoi Su-28 (Su-25UT), with added side elevation (centre) of Su-25K (*Jane's/Dennis Punnett*) *1990*

SUKHOI Su-25T

TYPE: Single-seat anti-tank aircraft.

PROGRAMME: Three **Su-25T** development aircraft (Sukhoi T-8M) were converted Su-25UB airframes, with humped rear cockpit faired over and internal space used to house new avionics and extra tonne of fuel; conversions began 1976, first flight 17 August 1984, construction of initial batch of 10 preseries aircraft for air force acceptance testing began 1979; first one flew 1989, redesignated **Su-25TM** after equipment changes, first exhibited at Dubai '91 Air Show as export **Su-25TK**, deliveries began 1991, with initial operational capability 1993, total of 20 delivered by 1 January 1994, former designation Su-39 now reallocated.

DESIGN FEATURES: Basically as Su-25 (which see), but embodies lessons learned during war in Afghanistan, particularly survival in intense anti-aircraft defence environment. New nav system makes possible flights to and from combat areas under largely automatic control; equipment in widened nose includes TV activated some 5 n miles (10 km, 6 miles) from target, subsequent target tracking, weapon selection and release automatic; wingtip countermeasures pods introduced, gun transferred to underbelly position, on starboard side of farther-offset nosewheel. Wing leading-edge sweepback 19° 54′, aspect ratio 6.0, dihedral 2° 30′, incidence 0° 43′.

FLYING CONTROLS: Basically as Su-25. Trim only on rudder; artificial feel in lateral and longitudinal channels. SAU-8 automatic control system.

LANDING GEAR: KT-163D mainwheels, with tyre size 840 × 360 mm, pressure 9.3 bars (135 lb/sq in). KH-27A nosewheel, with tyre size 680 × 260 mm, pressure 7.35 bars (106 lb/sq in), metal and ceramic disc brakes, with anti-skid units. Two PTK-25 cruciform brake-chutes, each 13.0 m² (140 sq ft).

POWER PLANT: As Su-25. Ten internal fuel tanks, total capacity 4,890 litres (1,292 US gallons; 1,076 Imp gallons). Provision for four 800 litre (211 US gallon; 176 Imp gallon) or two 1,150 litre (304 US gallon; 253 Imp gallon) underwing tanks. Single-point pressure fuelling in starboard engine air intake duct, optional gravity fuelling.

ACCOMMODATION: As Su-25.

SYSTEMS: Pressurised cockpit, maximum differential 0.25 bar (3.55 lb/sq in). Hydraulic system using AMG-10 fluid, flow rate 76 litres (20 US gallons; 17.7 Imp gallons)/min, pressure 207 bars (3,000 lb/sq in). AC and DC electrical systems. Gaseous oxygen system.

AVIONICS: *Radar*: Kinzhal (dagger) radar.

Flight: Nav system has two digital computers and inertial platform.

Instrumentation: HUD, Voskhod nav/attack system and Schkval electro-optical system for precision attacks on armour.

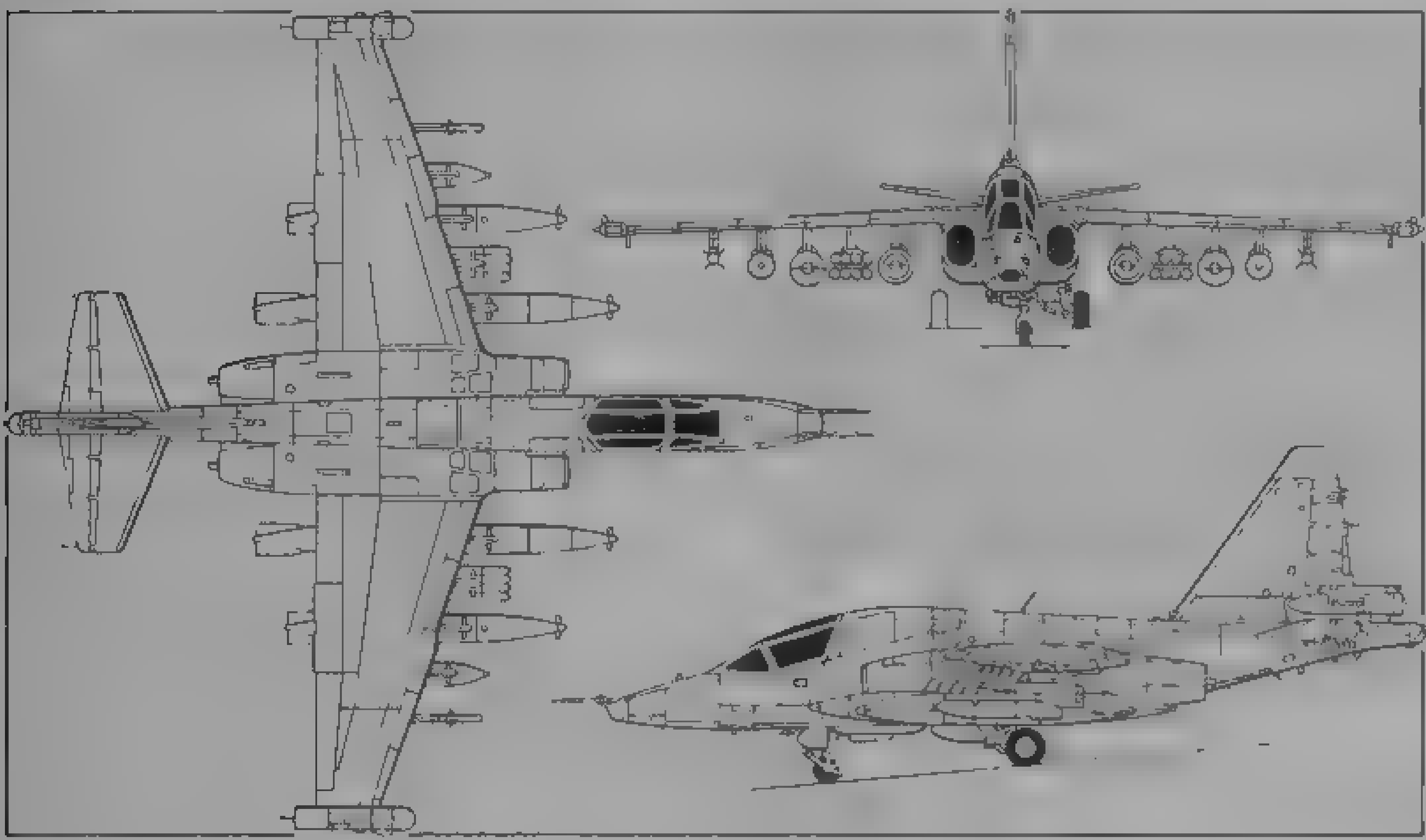
Mission: Larger window in nose for TV, laser rangefinder and target designator of improved capability, all using same stabilised mirror, 23× magnification lens and cockpit CRT, Khod (motion) centreline IR pack.

Self-defence: Radar warning/emitter location system, chaff/flare dispensers in top of fuselage tailcone and in large cylindrical housing at base of rudder that also contains IR jammer optimised against Stinger and Redeye missile frequencies.

ARMAMENT: One NNPU-8M twin-barrel 30 mm gun with 200 rounds, 10 external stores attachments; two eight-round underwing clusters of Vikhr (AT-9) tube-launched primary attack missiles able to penetrate 900 mm of reactive armour; other weapons include laser-guided Kh-25ML (AS-10 'Karen') and Kh-29L (AS-14 'Kedge'),

Sukhoi Su-25T adaptation of Su-25 ('Frogfoot') *(Paul Jackson)*

1995



Sukhoi Su-25T single-seat anti-tank aircraft *(Jane's/Mike Keep)*

1992

rocket/ramjet Kh-31A/P (AS-17 'Krypton') and anti-radiation Kh-58 (AS-11 'Kilter') air-to-surface missiles, KAB-500 laser-guided bombs, S-25L laser-guided rockets and R-60 (AA-8 'Aphid') air-to-air missiles.

DIMENSIONS, EXTERNAL:

Wing span	14.52 m (47 ft 7¾ in)
Wing chord: at root	3.00 m (9 ft 10¼ in)
at tip	1.025 m (3 ft 4¼ in)
Length overall	15.35 m (50 ft 4½ in)
Height overall	5.20 m (17 ft 0¾ in)
Tailplane span	4.58 m (15 ft 0½ in)
Wheel track	2.505 m (8 ft 2¾ in)

AREAS:

Wings, gross	30.10 m² (324.00 sq ft)
Ailerons (total)	1.51 m² (16.25 sq ft)
Trailing-edge flaps (total)	4.44 m² (47.79 sq ft)
Leading-edge slats (total)	3.16 m² (34.02 sq ft)
Fin	5.28 m² (56.84 sq ft)
Rudder	0.75 m² (8.07 sq ft)
Tailplane	5.61 m² (60.39 sq ft)
Elevators (total)	1.88 m² (20.24 sq ft)

WEIGHTS AND LOADINGS:

Max combat load	4,360 kg (9,612 lb)
Max fuel: internal	3,840 kg (8,465 lb)
external	3,070 kg (6,768 lb)
Max T-O weight	19,500 kg (42,990 lb)
Max landing weight	13,200 kg (29,100 lb)
Max wing loading	648.0 kg/m² (132.7 lb/sq ft)
Max power loading	220.7 kg/kN (2.17 lb/lb st)

PERFORMANCE:

Never-exceed speed (VNE)	Mach 0.82
Max level speed at S/L	Mach 0.77 (512 kts; 950 km/h; 590 mph)
Max cruising speed at 200 m (650 ft)	378 kts (700 km/h; 435 mph)
Econ cruising speed	350 kts (650 km/h; 404 mph)
Max rate of climb at S/L	3,480 m (11,415 ft)/min
Rate of climb at S/L, OEI	1,020 m (3,345 ft)/min
Service ceiling	10,000 m (32,800 ft)
Service ceiling, OEI	9,000 m (29,525 ft)
T-O run: normal	600 m (1,970 ft)
unpaved runway	700 m (2,300 ft)
Landing run	700 m (2,300 ft)
Combat radius with 2,000 kg (4,410 lb) weapon load: at S/L	215 n miles (400 km; 248 miles)
at height	378 n miles (700 km; 435 miles)
Ferry range	1,350 n miles (2,500 km; 1,550 miles)
g limits	+6.5

UPDATED

SUKHOI Su-26M

TYPE: Single-seat aerobatic competition aircraft.

PROGRAMME: Su-26 prototype first flew June 1984, took part in World Aerobatic Championships, Hungary, August 1984 (details in 1985-86 *Jane's*); modified Su-26Ms identified by sharp-cornered (rather than rounded) rudder and reduced fuselage side glazing, gained both men's and women's team prizes 1986 Championships, UK; further refined **Su-26M** shown 1989 Paris Air Show; pilots of former USSR had won 61 gold medals in competitions when **Su-26MX** (X for export) appeared at Farnborough Air Show 1990; in production.

CUSTOMERS: Marketed worldwide; approximately 70 built by early 1995, exported principally to USA, but also UK, Switzerland and elsewhere.

DESIGN FEATURES: Typical aerobatic competition aircraft, mid-wing of specially developed symmetrical section, variable along span, slightly concave in region of ailerons to increase their effectiveness, leading-edge somewhat sharper than usual to improve responsiveness to control surface movement; thickness/chord ratio 18 per cent at root, 12 per cent at tip; no dihedral, incidence or sweep at quarter-chord.

FLYING CONTROLS: Mechanical actuation: ailerons and elevators by pushrods, rudder by cables; each aileron has ground adjustable tab on trailing-edge and two suspended triangular balance tabs; no flaps; horn balanced rudder and elevators, each with ground adjustable tab.

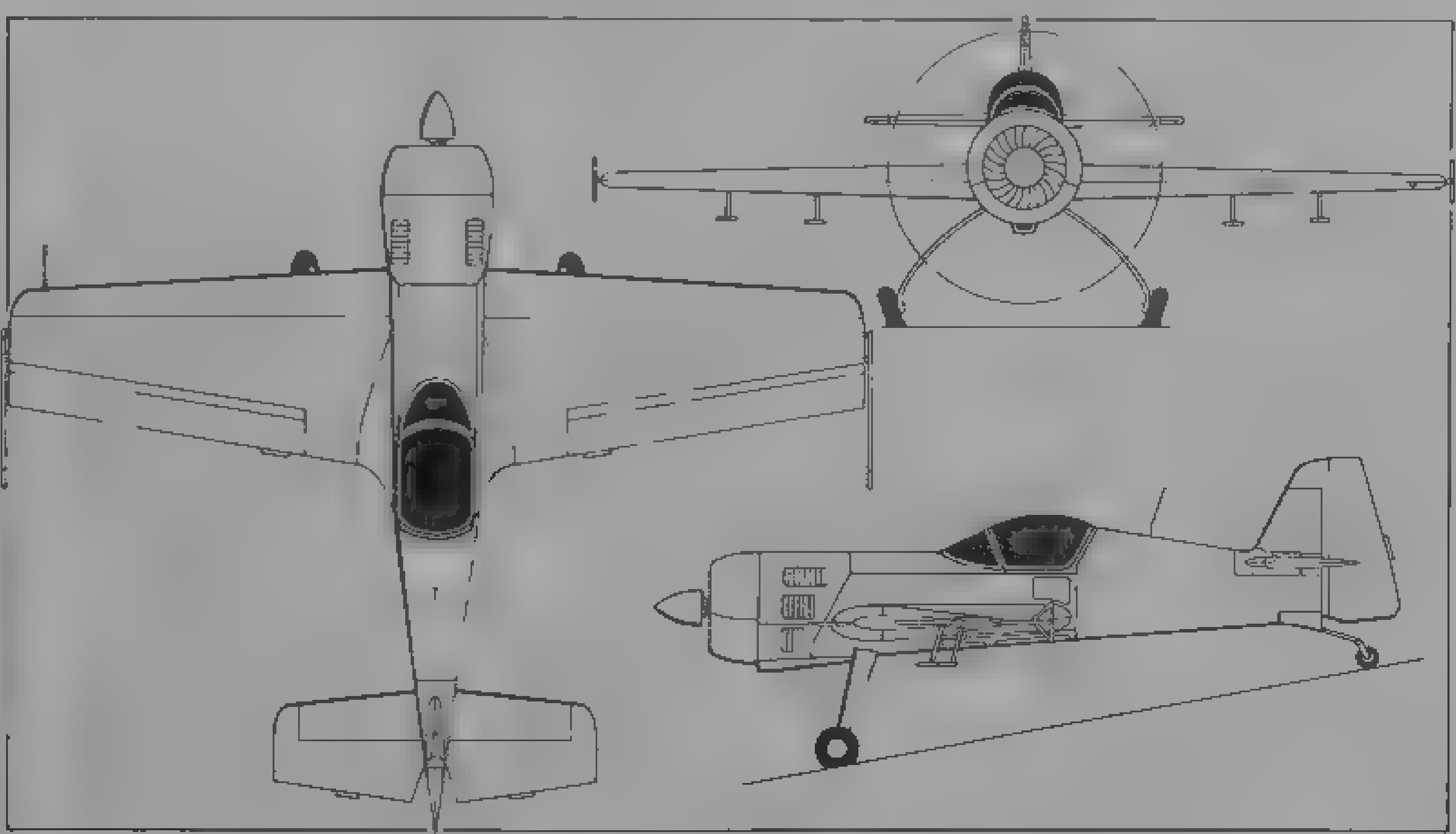
STRUCTURE: Composites comprise more than 50 per cent of airframe weight; one-piece wing, covered with honeycomb composite panels; foam filled front box spar with CFRP booms and wound glassfibre webs; channel section rear spar of CFRP; titanium truss ribs; plain ailerons have CFRP box spar, GFRP skin and foam filling; fuselage has basic welded truss structure of VNS-2 high strength stainless steel tubing, lower nose section of truss removable for wing detachment, quickly removable honeycomb composite skin panels, light alloy engine cowlings; integral fin and tailplane construction same as wings; rudder and elevator construction same as ailerons.

LANDING GEAR: Non-retractable tailwheel type, arched cantilever mainwheel legs of titanium alloy; mainwheels size 400 × 150 mm, with hydraulic disc brakes; steerable tail wheel, on titanium spring, connected to rudder.

POWER PLANT: One 294 kW (394 hp) VOKBM M-14PF nine-cylinder radial engine, three-blade Gerd Muhlbauer variable-pitch metal propeller; optional V-530TA-D35

Cockpit of Sukhoi Su-25T *(Piotr Butowski)*

1994



Sukhoi Su-26M single-seat aerobatic aircraft *(Jane's/Mike Keep)*

1994

Sukhoi Su-26M aerobatic competition aircraft *(Paul Jackson)*

1995

two-blade variable-pitch propeller Steel tube engine mounting. Fuel tank in fuselage forward of front spar, capacity 63 litres (16 6 US gallons, 13 8 Imp gallons); tank in each wing leading-edge, total 200 litres (53 US gallons, 44 Imp gallons), for ferry flights, oil capacity 22.6 litres (6 US gallons, 5 Imp gallons), fuel and oil systems adapted for inverted flight, pneumatic engine starting system

ACCOMMODATION One-piece pilot's seat of GFRP, inclined at 45° and designed for use with PLP 60 backpack parachute, rearward-hinged jettisonable canopy; safety harness anchored to fuselage structure

SYSTEMS Electrical system 24/28 V, with 3 kW generator, batteries and external supply socket

AVIONICS: *Comms* Briz VHF radio

DIMENSIONS, EXTERNAL

Wing span	7 80 m (25 ft 7 in)
Wing chord, at root	1 95 m (6 ft 4¾ in)
at tip	1.10 m (3 ft 7¼ in)
Wing aspect ratio	5 6
Length overall	6.845 m (22 ft 5½ in)
Height overall	2 78 m (9 ft 1½ in)
Tailplane span	2 95 m (9 ft 8¼ in)
Wheel track	2.20 m (7 ft 2½ in)
Wheelbase	5 05 m (16 ft 6¾ in)
Propeller diameter	2.40 m (7 ft 10½ in)

AREAS

Wings, gross	11 80 m² (127 0 sq ft)
Ailerons (total)	1 18 m² (12 70 sq ft)
Fin	0 34 m² (3 66 sq ft)
Rudder	0 89 m² (9 58 sq ft)
Tailplane	1 10 m² (11 84 sq ft)
Elevators (total)	1 53 m² (16.47 sq ft)

WEIGHTS AND LOADINGS

Weight empty	705 kg (1,554 lb)
Max T-O weight	1,000 kg (2,205 lb)
Max wing loading	84 75 kg/m² (17 36 lb/sq ft)
Max power loading	3 73 kg/kW (6 13 lb/hp)

PERFORMANCE

Never-exceed speed (VNE)	243 kts (450 km/h, 280 mph)
Max level speed at S/L	167 kts (310 km/h, 192 mph)
Normal cruising speed	140 kts (260 km/h, 161 mph)
T O speed	65 kts (120 km/h; 75 mph)
Landing speed	62 kts (115 km/h; 72 mph)
Stalling speed	60 kts (110 km/h, 69 mph)
Max rate of climb at S/L	1 080 m (3 540 ft)/min
Service ceiling	4,000 m (13,125 ft)
Rate of roll	more than 360°/s
T-O run	160 m (525 ft)
Landing run	250 m (820 ft)
Ferry range at 1,000 m (3,280 ft)	432 n miles (800 km, 497 miles)
g limits	+12/−10 (operating) +23 (ultimate)

UPDATED

SUKHOI Su-27

NATO reporting name Flanker

TYPE: Single-seat all-weather air superiority fighter and single/two-seat ground attack aircraft, two-seat combat trainer

PROGRAMME: Development began 1969 under leadership of Pavel Sukhoi, construction of T 10-1 prototype (first of 15 **Su-27** 'Flanker-As'), under Mikhail Simonov's supervision, began 1974 and it was flown 20 May 1977 by Vladimir Ilyushin. Prototypes had curved wingtips rearward-retracting nosewheel, tailfins mounted centrally above engine housings, development was not easy, two pilots lost their lives before major airframe redesign resulted in T-10S production configuration, production began 1979 with first flight of production aircraft 1981 and entry into service 1985, current production, for export only, centred in plant at Komsomolsk-on-Amur, Khabarovsk Territory, ground attack role observed in 1991

CURRENT VERSIONS: **Su-27P** ('Flanker-B'): Single-seat land based production version for air defence force, square wingtips, carrying air-to-air missile launchers; tailfins outboard of engine housings; extended tailcone, forward-retracting nosewheel, first flown 20 April 1981. Standard radar tracks 10 targets simultaneously, engages only one *Detailed description applies to this version, except where indicated*

Su-27S ('Flanker B'): As Su-27P but delivered to tactical air forces for dual role air combat/ground attack operation, distinguished by Sorbtsya active ECM jammer pods, each approximately 4 0 m (13 ft 1½ in) long, on wingtips Armament, totalling up to 4,000 kg (8,818 lb), includes 250 and 500 kg bombs, packs of 80, 130 and 250 mm rockets, KMGU cluster bombs, or podded 30 mm gun with downward-deflecting barrel for air-to-ground and air-to-air use. Export version is **Su-27SK**, with upgraded radar

Su-27PD: Basic Su-27P, specially prepared for demonstration flying by Anatoli Kvotchur. Added in-flight refuelling probe on port side of windscreen. At least one aircraft (27598)

Su-27UB ('Flanker-C'): Tandem two-seat trainer version of 'Flanker-B' with full combat capability (Sukhoi designation T-10U); instructor in raised rear seat, taller fin, overall height 6 357 m (20 ft 10¼ in). Built at Irkutsk (more than 50 aircraft)

Su-27LL-PS: Su-27UB (T-10-16, '08') modified for thrust-vectoring development, first with large two- and three-dimensional box nozzle on port tailpipe and later with similar nozzles on both tailpipes. Trials at Zhukovsky test centre, under direction of TsIAM and Saturn/Lyulka OKB

Su-27K (K for korabelnyy, ship based): Two prototypes for Su-33 (which see)

Su-27KU (**Su-27IB**: Istrebitel Bombardirovschik fighter-bomber): Side by side two-seat Su-27 variant, first flown ('42') 13 April 1990; first seen in *Tass* photograph showing this aircraft approaching (but not necessarily landing on) the carrier *Admiral of the Fleet Kuznetsov*; described as **Su-27KU** deck landing trainer, but no wing folding or deck arrester hook, foreplanes and twin nosewheels like Su-27K, completely new and wider front fuselage, with wing extensions taken forward as chines to tip of nose: shallow nose, without radar, reminiscent of US Lockheed SR-71 and source of Russian unofficial name 'Platypus', deep fairing behind wide curved canopy, no IRST. Nosewheel leg moved forward to retract rearward, four nosewheel doors replace usual single door; no ventral fins, K 36 ejection seats staggered and splayed to separate pilots after ejection; 30 mm gun retained. Under designation **Su-27IB**, '42' exhibited to CIS leaders at Machulishche airfield, Minsk, February 1992, with simulated attack armament on 10 external stores pylons (under each intake duct, on each wingtip, three under each wing); Kh-31A/P (AS 17 'Krypton') air-to-surface missiles under ducts, R 73A (AA 11 'Archer') air to-air missiles on wingtips; a 500 kg laser guided bomb inboard, TV/laser-guided Kh 29 (AS 14 'Kedge') on central pylon and R 77 (AA 12 'Adder') air to-air missile outboard under each wing, retractable flight refuelling probe. Further development as **Su-32FN/Su-34** (which see)

Su-27PU: Two prototypes only, described in 1993 94 *Jane's* In production as Su 30 (which see)

P-42: Specially prepared Su-27, set 31 official world records, including climb to 12,000 m (39,370 ft) in 55,542 seconds, and to 22,250 m (73,000 ft) with 1,000 kg (2,205 lb) payload, some records are in FAI category for STOL aircraft

Su-30: See separate entry.

Su-33: See separate entry

Su-35: See separate entry

CUSTOMERS: More than 200 delivered to Russian home defence interceptor force and 150 to fighter components of tactical air forces, China received 26 (24 single-seat, two two-seat) in 1991-92, 24 more (22 single-seat, two two-seat) ordered 1995, licence manufacture being negotiated, Vietnam has first batch of about six; Syria has requested 14

DESIGN FEATURES: Developed to replace Yak 28P, Su 15 and Tu 28P/128 interceptors in APVO, for dual role ground attack/air combat and to escort Su 24 deep penetration strike missions; basic requirement was effective engagement of F-15 and F-16 and other future aircraft and cruise missiles; exceptional range on internal fuel made flight refuelling unnecessary until Su-24s received probes, external fuel tanks still not considered necessary, all swept integrated mid-wing configuration, with long curved wing leading-edge root extensions, lift-generating fuselage, twin tailfins and widely spaced engines with wedge intakes; rear-hinged doors in intakes hinge up to prevent ingestion of foreign objects during take-off and landing, integrated fire control system with pilot's helmet-mounted target designator; exceptional high-Alpha performance, basic wing leading-edge sweepback 42°, no dihedral or incidence

FLYING CONTROLS: Four-channel analog fly-by-wire, no mechanical back-up; artificial feel, inherently unstable, no ailerons; full-span leading-edge flaps and plain half-span inboard flaperons controlled manually for take-off and landing, computer-controlled in flight, differential/collective tailerons operate in conjunction with flaperons and rudders for pitch and roll control, flight control system limits *g* loading to +9 and normally limits angle of attack to 30 to 35°; angle of attack limiter can be overruled manually for certain flight manoeuvres, large door-type airbrake in top of centre-fuselage

STRUCTURE: All metal, with extensive use of aluminium-lithium alloys and many titanium components but no composites; comparatively conventional three-spar wings basically circular section semi-monocoque fuselage, sloping down sharply aft of canopy; cockpit high-set behind drooped nose, large ogival dielectric nosecone, long rectangular blast panel forward of gun on starboard side, above wingroot extension, two-spar fins and horizontal tail surfaces, uncanted vertical surfaces on narrow decks outboard of engine housings, fin extensions beneath decks form parallel, widely separated ventral fins.

LANDING GEAR: Hydraulically retractable tricycle type, made by Hydromash, with single wheel on each unit; main wheels retract forward into wingroots; steerable

Sukhoi Su-27PD single-seat air defence fighter modified for aerobatic displays *(Paul Jackson)*

1995

nosewheel, with mudguard, also retracts forward, mainwheel tyres 1300 × 350 mm; pressure 12.25 to 15.7 bars (178 to 227 lb/sq in), nosewheel tyre 680 × 260 mm, pressure 9.3 bars (135 lb/sq in); hydraulic brakes with two-signal anti-skid system, brake-chute housed in fuselage tailcone

POWER PLANT: Two Saturn/Lyulka AL-31F turbofans, each 122.6 kN (27,557 lb st) with afterburning. Large auxiliary air intake louvres in bottom of each three-ramp engine duct near primary wedge intake, two rows of small vertical louvres in each sidewall of wedge, and others in top face; fine grille screen hinges up from bottom of each duct to shield engine from foreign object ingestion during take-off and landing. Pressure or gravity fuelling

ACCOMMODATION: Pilot only, on Zvezda K-36MD zero/zero ejection seat, under large rearward-opening transparent blister canopy, with low sill

SYSTEMS: Automatically regulated cockpit air conditioning. Two independent hydraulic systems, pressure 275 bars (4,000 lb/sq in), for nosewheel steering, landing gear and wing flaps. Pneumatic system pressure 210 bars (3,045 lb/sq in) for back-up landing gear extension. DC and AC electrical supply. Gaseous oxygen for four flight hours

AVIONICS: Systems integrated by NPO Elektro Avtomatika.

Radar: Phazotron N001 Zhuk ('Slot Back') track-while-scan coherent pulse Doppler look-down/shoot-down radar (antenna diameter approximately 1.0 m; 3 ft 4 in) with search range of up to 54 n miles (100 km, 62 miles) against MiG-21 size target (ability to track 10 targets and engage two simultaneously in current Su-27SK).

Instrumentation: Integrated fire control system enables radar, IRST and laser rangefinder to be slaved to pilot's helmet-mounted target designator and displayed on wide-angle HUD, autopilot able to restore aircraft to right side-up level flight from any attitude when 'panic button' depressed

Mission: Infra-red search/track (IRST) sensor, range 27 n miles (50 km, 31 miles), and laser rangefinder, range 4.3 n miles (8 km, 5 miles), functioning through common optics in transparent housing forward of windscreen. Provision for reconnaissance pod on centreline pylon

Self-defence: Sirena-3 360° radar warning receivers outboard of each bottom air intake lip and at tail. Three banks of chaff/flare dispensers in bottom of long tailcone extension

ARMAMENT: One 30 mm GSh-301 gun in starboard wingroot extension, with 150 rounds. Up to 10 air-to-air missiles in air combat role, on tandem pylons under fuselage between engine ducts, beneath each duct, under each centre-wing and outer-wing, and at each wingtip. Typically, two short-burn semi-active radar homing R-27R (NATO AA-10A 'Alamo-A') in tandem under fuselage, two short-burn infra-red homing R-27T (AA-10B 'Alamo-B') missiles on centre-wing pylons, and long burn semi-active radar homing R-27ER (AA-10C 'Alamo-C') or infra-red R-27ET (AA-10D 'Alamo-D') beneath each engine duct. The four outer pylons carry either R-73A (AA-11 'Archer') or R-60 (AA-8 'Aphid') close-range infra-red missiles. R-33 (AA-9 'Amos') missiles optional in place of AA-10s

DIMENSIONS, EXTERNAL (Su-27P):
Wing span 14.70 m (48 ft 2¾ in)
Length overall, excl nose probe 21.935 m (71 ft 11½ in)
Height overall 5.932 m (19 ft 5½ in)
Fuselage: Max width 1.50 m (4 ft 11 in)
Tailplane span 9.90 m (32 ft 6 in)
Distance between fin tips 4.30 m (14 ft 1¼ in)
Wheel track 4.36 m (14 ft 3¾ in)
Wheelbase 5.88 m (19 ft 3½ in)

AREAS:
Wings, gross 62.0 m² (667.4 sq ft)
Vertical tail surfaces (total) 15.4 m² (165.75 sq ft)
Horizontal tail surfaces (total) 12.3 m² (132.4 sq ft)

WEIGHTS AND LOADINGS (B: Su-27P, C: Su-27UB):
Max T-O weight:
B 23,000-33,000 kg (50,705-72,750 lb)
C 22,500 kg (49,600 lb)
Max wing loading: B 491.9 kg/m² (100.75 lb/sq ft)
C 362.9 kg/m² (74.32 lb/sq ft)
Max power loading: B 124.4 kg/kN (1.22 lb/lb st)
C 91.8 kg/kN (0.90 lb/lb st)

PERFORMANCE:
Max level speed at height: B, C
Mach 2.35 (1,350 kts, 2,500 km/h, 1,550 mph)

Sukhoi Su-27S ('Flanker-B') in ground attack configuration *(AviaData)*

1992

Sukhoi Su-27UB ('Flanker-C') two-seat operational trainer *(Paul Jackson)*

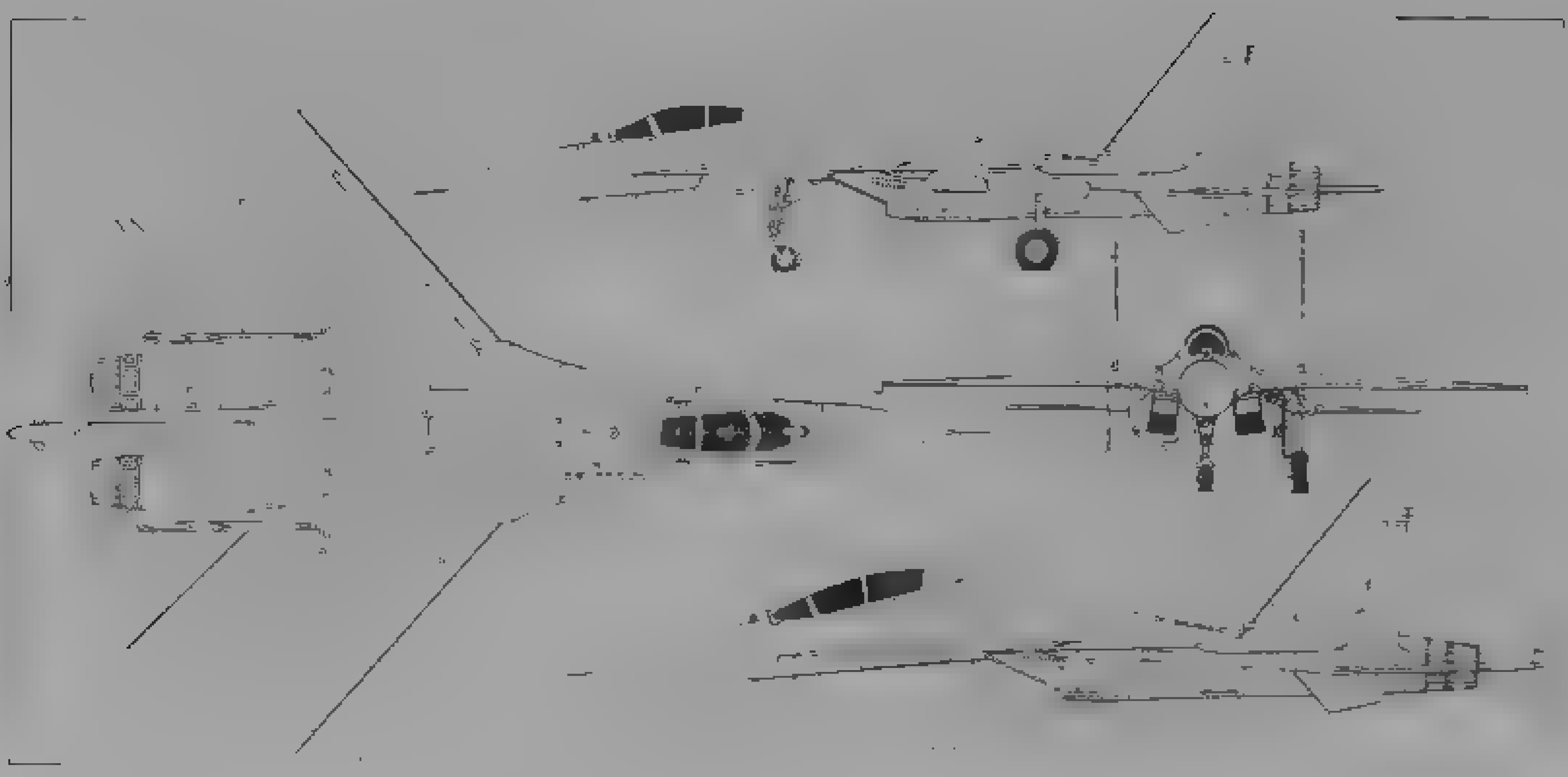
1995

Sukhoi Su-27P ('Flanker-B') in special aerobatic colours *(Paul Jackson)*

1995

Cockpit of Sukhoi Su-27P ('Flanker-B') *(Paul Jackson)*

1995



Sukhoi Su-27P, with added side elevation (bottom) of two-seat Su-27UB *(Jane's/Dennis Punnett)*

1990

at S/L, B, C	Mach 1.1 (725 kts, 1,345 km/h, 835 mph)
Stalling speed	108 kts (200 km/h, 125 mph)
Rate of roll	approx 270°/s
Service ceiling: B, C	18,000 m (59,055 ft)
T-O run: B	450 m (1,475 ft)
C	550 m (1,805 ft)
Landing run: B	620 m (2,035 ft)
C	650 m (2,135 ft)
Combat radius: B	810 n miles (1,500 km, 930 miles)
Range with max fuel:	
B	1,985 n miles (3,680 km, 2,285 miles)
C	1,620 n miles (3,000 km, 1,865 miles)
g limit (operational): B, C	+9

UPDATED

SUKHOI Su-29

TYPE: Tandem two-seat training/single-seat aerobatic aircraft.

PROGRAMME: Announced at Moscow Aerospace '90 Air Show; design started 1990; construction of first of three prototypes and two static test airframes began 1991; prototype first flew 1991; first production aircraft May 1992; entered service July 1992.

CURRENT VERSIONS: **Su-29**: Basic two-seat training/aerobatic aircraft, as described.

Su-29KS: Development vehicle for Zvezda KS-38 lightweight ejection system. Exhibited at 1994 Farnborough Air Show.

Su-29M: Production version with KS-38 ejection seats.

CUSTOMERS: Over 35 basic Su-29s built and sold by late 1994; most exported to USA (eight in 1992, 10 in 1993; seven in 1994); others to Australia, South Africa and UK.

DESIGN FEATURES: Basically two-seat development of Su-26M; wing span and overall length increased; improved aerodynamics and reduced stability margin for enhanced manoeuvrability. Wing leading-edge sweepback 3° 28'; symmetrical section, thickness/chord ratio 16 per cent at root, 12 per cent at tip; aspect ratio 5.51; dihedral 0°; incidence 0°. Service life 1,250 hours.

FLYING CONTROLS: Mechanically actuated ailerons, elevators and rudder; elevators and rudder horn balanced; elevator trim; two suspended triangular balance tabs under each aileron. No flaps.

STRUCTURE: Generally as Su-26M, but proportion of composites increased by 60 per cent, limiting increase in empty weight.

LANDING GEAR: As Su-26M. Composites fairings optional for mainwheels.

POWER PLANT: Generally as Su-26M, but MTV-3 8-S-L250-21 three-blade propeller. Capacity of each wing fuel tank 106.5 litres (28.15 US gallons; 23.4 Imp gallons); total fuel capacity 276 litres (72.9 US gallons; 60.6 Imp gallons); gravity fuelling. Oil capacity 20 litres (5.3 US gallons; 4.4 Imp gallons).

ACCOMMODATION: Pilot only for aerobatic competition, two persons in tandem for training. Canopy opens normally sideways to starboard, upward and rearward in emergency to jettison. Dual controls standard. Space for 5 kg (11 lb) baggage in rear fuselage.

SYSTEMS: As Su-26M.

AVIONICS: As Su-26M, plus optional Bekker and Bendix/King nav and Garmin GPS.

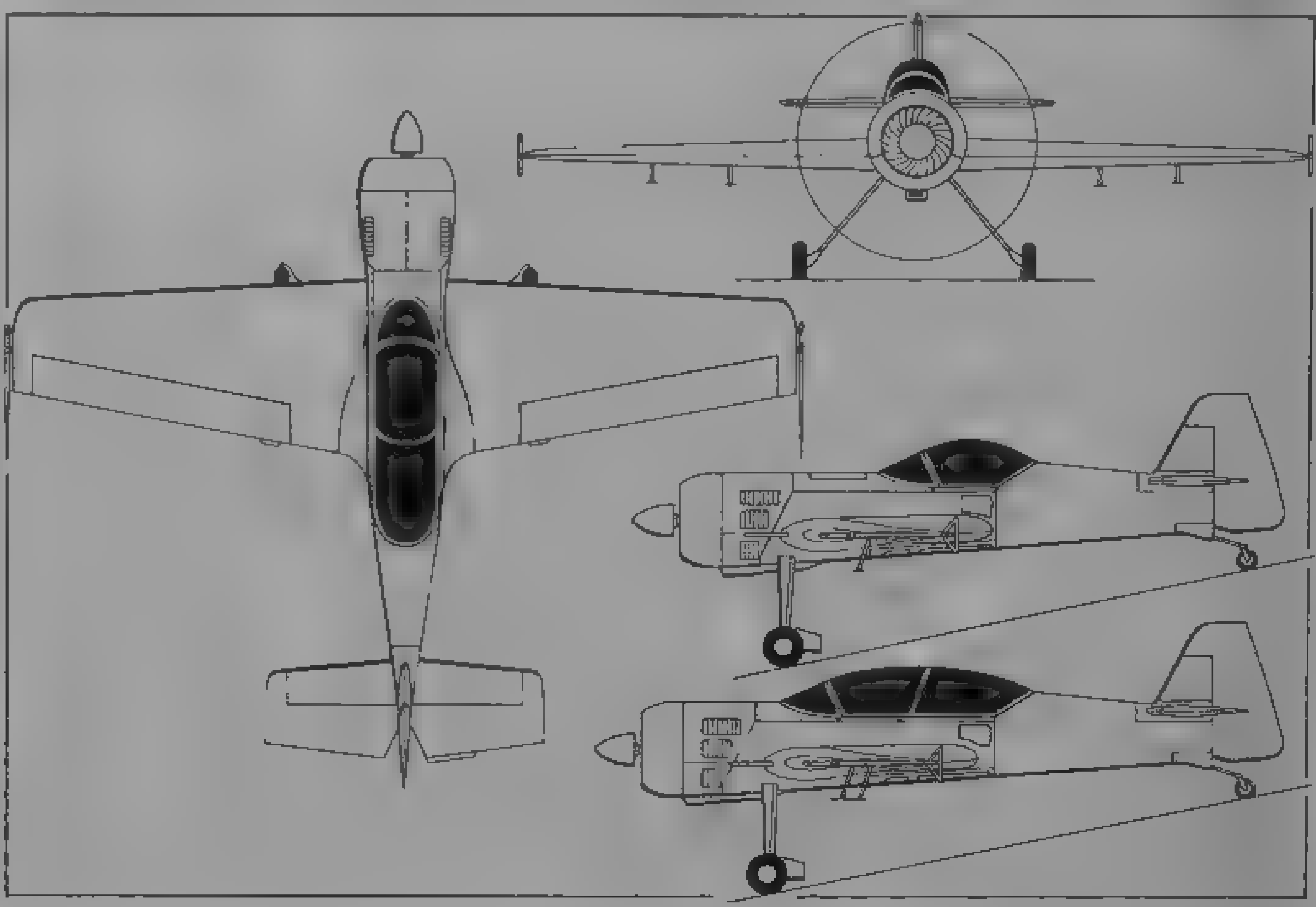
DIMENSIONS, EXTERNAL:	
Wing span	8.20 m (26 ft 10¾ in)
Wing chord: at root	1.985 m (6 ft 6¼ in)
at tip	1.04 m (3 ft 4¾ in)
Length overall	7.285 m (23 ft 10¾ in)
Height overall	2.885 m (9 ft 5¾ in)
Tailplane span	2.90 m (9 ft 6¼ in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase	5.08 m (16 ft 8 in)
Propeller diameter	2.50 m (8 ft 2½ in)
Propeller ground clearance	0.425 m (1 ft 4¾ in)
DIMENSIONS, INTERNAL:	
Cockpit: Length	2.60 m (8 ft 6¼ in)
Max width	0.82 m (2 ft 8¼ in)
Max height	1.05 m (3 ft 5¼ in)
Volume	4.42 m³ (156 cu ft)
AREAS:	
Wings, gross	12.203 m² (131.35 sq ft)
Ailerons (total)	2.32 m² (24.97 sq ft)
Fin	0.28 m² (3.01 sq ft)
Rudder	0.90 m² (9.69 sq ft)
Tailplane	0.98 m² (10.55 sq ft)
Elevators (total)	1.56 m² (16.79 sq ft)
WEIGHTS AND LOADINGS (two persons):	
Weight empty	735 kg (1,620 lb)
Max fuel	207 kg (456 lb)
Max T-O weight: pilot only	860 kg (1,896 lb)
two persons	1,204 kg (2,655 lb)
Max wing loading	98.7 kg/m² (20.2 lb/sq ft)
Max power loading	4.54 kg/kW (7.48 lb/hp)
PERFORMANCE:	
Never-exceed speed (V_{NE})	242 kts (450 km/h, 279 mph)
Max level speed	175 kts (325 km/h, 202 mph)
Stalling speed	62 kts (115 km/h, 72 mph)

Sukhoi Su-29KS RA-01485 with Zvezda KS-38 extraction system *(Paul Jackson)*

1995

Extraction of dummy pilot from Su-29KS *(Paul Jackson)*

1995



Sukhoi Su-29 training and aerobatic aircraft with additional side view (centre) of Su-31T *(Jane's/Mike Keep)*

1994

Max rate of climb at S/L	960 m (3,150 ft)/min
Service ceiling	4,000 m (13,125 ft)
* T-O run	120 m (394 ft)
* Landing run	380 m (1,247 ft)
Range with max fuel	647 n miles (1,200 km, 745 miles)
g limits	+12/−10

* *at 914 kg (2,015 lb) AUW*

UPDATED

SUKHOI Su-30

TYPE: Two-seat long-range combat trainer.

PROGRAMME: Design started 1986; construction of two prototypes began at Irkutsk in 1987 as Su-27PU, first flown 1988; prototype flew 7,252 n miles (13,440 km; 8,351 miles) in 15 hours 42 minutes non-stop during round trips Moscow-Novaya Zemlia-Moscow and Moscow-Komsomolsk-Moscow; first two production Su-30s, without military equipment, sold to aerobatic team at Zhukovsky flight test centre; in preseries production, small number built.

CURRENT VERSIONS: **Su-30** (Sukhoi T-10PU): Basic long-range fighter for PVO; designed for mission of 10 hours or more, including group missions with four Su-27s; only Su-30 would operate radar, enabling it to assign targets to Su-27s by radio datalink; can carry bombs and rockets but not guided air-to-surface weapons. Su-27UB training capability retained.

Su-30MK (Sukhoi T-10PMK): Multirole version, described separately.

DESIGN FEATURES: Development of Su-27/27UB, with latter's tandem seating and new avionics, but without Su-35's advanced radar, foreplanes, advanced control system and new power plant. Designed for effective engagement of fighters at long distances from base, and to destroy bombers and intercept cruise missiles. Integral configuration similar to Su-27UB, with unstable aerodynamic characteristics. Automatic control system standard.

FLYING CONTROLS: As Su-27.

STRUCTURE: As Su-27.

LANDING GEAR: As Su-27.

POWER PLANT: As Su-27, but flight refuelling probe and buddy refuelling capability standard.

ACCOMMODATION: Two crew in tandem in identical cockpits on K-36 zero/zero ejection seats, with rear seat raised.

SYSTEMS: As Su-27, except gaseous oxygen for 10 hours flight.

AVIONICS: *Radar*: Phazotron Topaz coherent pulse Doppler look-down/shoot-down radar, detection range 43 n miles (80 km; 50 miles), tracking range 30 n miles (55 km; 34 miles); able to track 10 targets and engage two simultaneously.

Flight: New navigation system based on Loran and Omega.

Mission: Provision for fitting foreign-made airborne and weapon systems at customer's request.

ARMAMENT: One 30 mm GSh-301 gun, with 150 rounds; up to six R-27R1E and R-27T1E (AA-10 'Alamo') radar homing and IR long-range air-to-air missiles, and six R-73E (AA-11 'Archer') IR close-range air-to-air missiles; unguided bombs or rockets as Su-27.

DIMENSIONS, EXTERNAL: As Su-27

WEIGHTS AND LOADINGS:	
Normal T-O weight	24,000 kg (52,910 lb)
Max T-O weight	33,000 kg (72,750 lb)
PERFORMANCE:	
Max level speed at height	Mach 2
T-O run	550 m (1,805 ft)
Landing run	670 m (2,200 ft)
Combat range, with max internal fuel	1,619 n miles (3,000 km, 1,865 miles)
with one flight refuelling	2,805 n miles (5,200 km, 3,230 miles)

UPDATED

SUKHOI Su-30MK

TYPE: Two-seat multirole fighter.

PROGRAMME: Design started 1991, demonstration and development work by Su-27UB 1040806 '321' and 04003 '56'; conversion of first prototype began 1993, 1010101 '603' (ex-Su-27UB prototype) demonstrated at Berlin and Farnborough 1994.

CURRENT VERSIONS: Basic **two-seat version** as described; **single-seat version** reportedly ordered for Russian Air Force 1993.

CUSTOMERS: Indian Air Force initial requirement for 20 reported Summer 1995.

DESIGN FEATURES: Improvement on combat capabilities of Su-30 by compatibility with high-precision guided air-to-surface weapons with standoff launch range up to 65 n miles (120 km, 75 miles), in addition to Su-30's ability to engage two airborne targets simultaneously.

In other details, identical with Su-30 except as follows.

AVIONICS: In addition to standard Su-30 systems, Su-30MK has more accurate navigation system, a TV command guidance system, a guidance system for anti-radiation missiles, a display system in rear cockpit for air-to-surface missile guidance, and ability to carry one or two pods, typically for laser designation or ARM guidance in association with Pastel RWR and APK-9 datalink. Western avionics, guidance pods and weapons can be fitted optionally.

Sukhoi Su-30MK multirole combat aircraft *(Paul Jackson)*

1995

ARMAMENT: One 30 mm GSh-301 gun, with 150 rounds; 12 external stations for more than 8,000 kg (17,635 lb) of stores, including bombs up to 1,500 kg each; unguided rockets of various calibres; up to six medium-range air-to-air missiles with active or semi-active radar homing, up to two IR homing medium-range and six IR homing close-range air-to-air missiles, and a variety of air-to-surface weapons such as four ARMs, six guided bombs or short-range missiles with TV homing, six laser homing short-range missiles, or two long-range missiles with TV command guidance; these include Kh-31 (AS-17 'Krypton'), Kh-59 (AS-13 'Kingbolt') and Kh-59M (AS-18 'Kazoo').

DIMENSIONS, EXTERNAL: As Su-27 except:

Height overall	6.357 m (20 ft 10¼ in)
WEIGHTS AND LOADINGS:	
Normal T-O weight	25,000 kg (55,115 lb)
Max T-O weight	34,000 kg (74,955 lb)
PERFORMANCE:	
Max level speed at height	Mach 2.0
T-O run	550 m (1,805 ft)
Landing run	670 m (2,200 ft)
Combat range: internal fuel	1,620 n miles (3,000 km, 1,865 miles)
with one in-flight refuelling	2,805 n miles (5,200 km; 3,230 miles)

UPDATED

SUKHOI Su-31

TYPE: Single-seat aerobatic competition and training aircraft.

PROGRAMME: Design started 1991, prototype construction began 1992, flew June 1992 as Su-29T, demonstrated at 1992 Farnborough Air Show, followed by two more prototypes and two static test airframes; first production aircraft by Sukhoi Advanced Technologies (RA-01405) flown 1994.

CURRENT VERSIONS: **Su-31T**: Basic version, non-retractable landing gear; *described in detail*.

Su-31M: As Su-31T but with Zvezda KS-38 ejection system.

Su-31X: Export version of Su-31T.

Su-31U: As Su-31T but retractable landing gear.

DESIGN FEATURES: Basically single-seat version of Su-29 with uprated engine, new landing gear; 35° inclination of seat enables pilot to employ repeatedly a g load of +12/−10, giving advantages in controlling aircraft within limited flying area and to perform very complicated manoeuvres; improved field of view; two baggage compartments.

STRUCTURE: More than 70 per cent composites by weight; centre-fuselage is welded truss of high-strength stainless steel tube, with detachable skin panels of honeycomb filled composite sandwich; rear fuselage is semi-monocoque of composites with honeycomb filler; one-piece two-spar wing is of carbonfibre and organic composites, covered with honeycomb sandwich skin; tail unit is all-composites.

POWER PLANT: One 294 kW (395 hp) VOKBM M-14PF nine-cylinder radial engine, MTV-9 three-blade propeller. Basic fuel capacity 78 litres (20.6 US gallons, 17.2 Imp gallons), in fuselage tank, provision for 210 litre (55.5 US gallon, 46.2 Imp gallon) centreline drop tank for ferrying, or two tanks in wings, total capacity 200 litres (53 US gallons, 44 Imp gallons).

DIMENSIONS, EXTERNAL (Su-31T):	
Wing span	7.80 m (25 ft 7 in)
Wing chord: at root	1.99 m (6 ft 6¼ in)
at tip	1.04 m (3 ft 4¾ in)
Length overall	6.90 m (22 ft 7¾ in)
Height overall	2.76 m (9 ft 0¾ in)
Tailplane span	2.90 m (9 ft 6¼ in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase	4.90 m (16 ft 1 in)
Propeller diameter	2.50 m (8 ft 2½ in)
Propeller ground clearance	0.425 m (1 ft 4¾ in)
AREAS (Su-31T): As Su-29 except:	
Wings, gross	11.8 m² (127.0 sq ft)
WEIGHTS AND LOADINGS (Su-31T):	
Weight empty, equipped	650 kg (1,433 lb)
Max fuel: internal	53 kg (117 lb)
external	209 kg (461 lb)
Normal T-O weight	780 kg (1,720 lb)

Sukhoi Su-31M single-seat aerobatic competition aircraft *(Paul Jackson)*

1995

Max T-O weight	968 kg (2,134 lb)
Max wing loading	82.0 kg/m² (16.8 lb/sq ft)
Max power loading	3.29 kg/kW (5.40 lb/hp)

PERFORMANCE (Su-31T):

Max never-exceed speed (VNE)	243 kts (450 km/h; 280 mph)
Max level speed	178 kts (330 km/h; 205 mph)
Stalling speed	61 kts (113 km/h; 71 mph)
T-O speed	60 kts (110 km/h; 69 mph)
Landing speed	62 kts (115 km/h; 72 mph)
Max rate of climb at S/L	1,440 m (4,725 ft)/min
Service ceiling	4,000 m (13,125 ft)
Rate of roll	400°/s
T-O run	110 m (360 ft)
Landing run	300 m (985 ft)
Range, internal fuel	156 n miles (290 km; 180 miles)
Max ferry range	400-645 n miles (740-1,200 km; 460-745 miles)
g limits	+12/−10

UPDATED

Sukhoi Su-32FN exhibited at Paris (*Paul Jackson*)

1995

SUKHOI Su-32FN/Su-34

TYPE: Long-range theatre bomber

PROGRAMME: Production development of Su-27KU/Su-27IB ('42', which see), to replace MiG-27, Su-17 and some Su-24s from 1996. First preseries example ('43'), described as Su-34, built at Novosibirsk, flew 18 December 1993; at Zhukovsky flight test centre early 1994. Aircraft '45' exhibited as Su-32FN at 1995 Paris Air Show. Fourth and fifth aircraft (excluding two static test airframes '41' and '44') under assembly May 1995; 12 scheduled for delivery by 1998; electronic warfare version reportedly under development.

CURRENT VERSIONS: **Su-34**: Designation of preseries aircraft '43', as described in detail.

Su-32FN: Designation of aircraft '45', first flight 28 December 1994; displayed 1995 Paris Air Show. Described as two-seat specialised strike aircraft for day/night all-weather attack on surface vessel, submarine and ground targets, at all altitudes and speeds, with terrain following capability and high level of automatic operation. Major weapons include Kh-31 (AS-17 'Krypton') anti-ship missiles.

DESIGN FEATURES: Airframe basically as Su-27, completely new and wider front fuselage containing two seats side by side; wing extensions taken forward as chines to blend with dielectric nose housing nav/attack and terrain following/avoidance radar; deep fairing behind wide humped canopy, small foreplanes, louvres on engine air intake ducts reconfigured, new landing gear; broader-chord and thicker tailfins, containing fuel, no ventral fins, and a longer, larger diameter tailcone. This has been raised and now extends as a spine above the rear fuselage to blend into the rear of the cockpit fairing. It houses at its tip a rearward-facing radar to detect aircraft approaching from the rear.

LANDING GEAR: Retractable tricycle type, strengthened twin nosewheel unit, tyre size 680 × 260 mm, farther forward than on Su-27 and retracting rearward; main units have smaller tandem wheels with tyres size 950 × 400 mm. Brake-chute repositioned in spine to rear of spine/fairing juncture.

POWER PLANT: Two Saturn/Lyulka AL-35F (AL-31FM) turbofans, each 137.3 kN (30,865 lb st) with afterburning. Additional fuel in tailfins. Retractable flight refuelling probe beneath port windscreen.

ACCOMMODATION: Two crew side by side on K-36 zero/zero ejection seats. Access to cockpit via built-in ladder to door in nosewheel bay; area protected with 17 mm (0⅔ in) thick titanium; toilet and galley inside deep fuselage section aft of cockpit.

AVIONICS: *Radar:* Multifunction radar with high-resolution, rearward-facing radar in tailcone.

Instrumentation: Multifunction displays.

Mission: No IRST sensor. Sorbtsya active ECM jamming pods under test on Su-27IB prototype 1995.

Self-defence: Internal ECM.

ARMAMENT: One 30 mm GSh-301 gun, as Su-27. High-precision self-homing and guided air-to-surface missiles and KAB-500 laser-guided bombs with ranges of 0 to 135 n miles (250 km; 155 miles), R-73 (AA-11 'Archer') and R-77 (AA-12 'Adder') air-to-air missiles.

DIMENSIONS, EXTERNAL: Not available

WEIGHTS AND LOADINGS: Not available, except:

Max T-O weight	44,360 kg (97,800 lb)

PERFORMANCE:

Max level speed: at 11,000 m (36,000 ft)	Mach 1.8
at S/L	Mach 1.15 (755 kts; 1,400 km/h; 870 mph)
Range with max internal fuel	2,160 n miles (4,000 km; 2,485 miles)

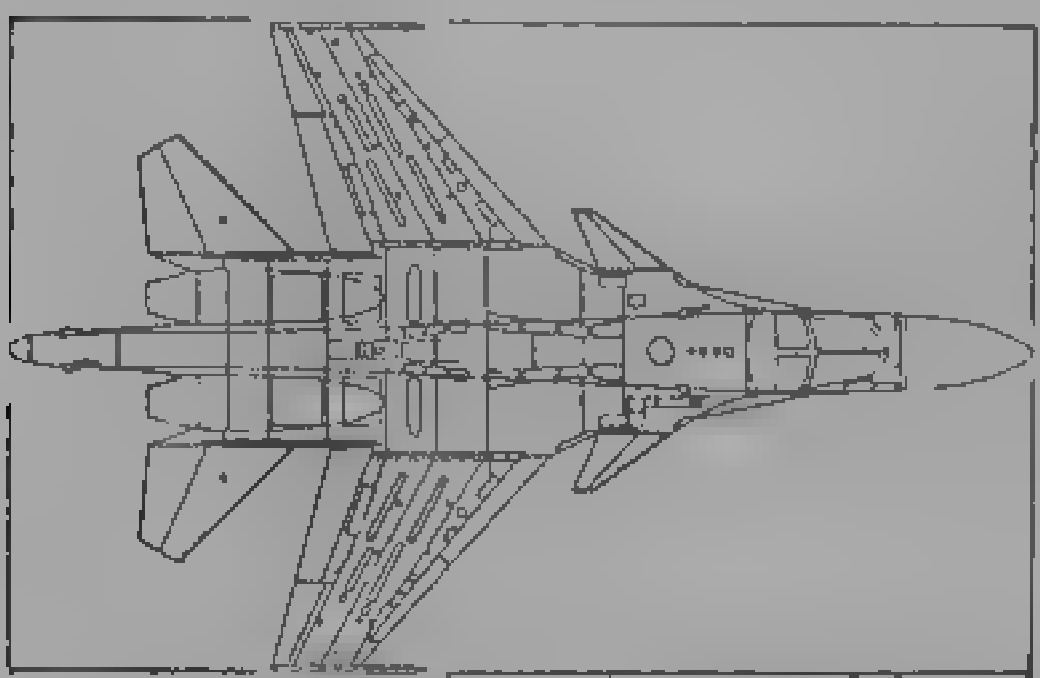
UPDATED

SUKHOI Su-33

NATO reporting name: Flanker-D

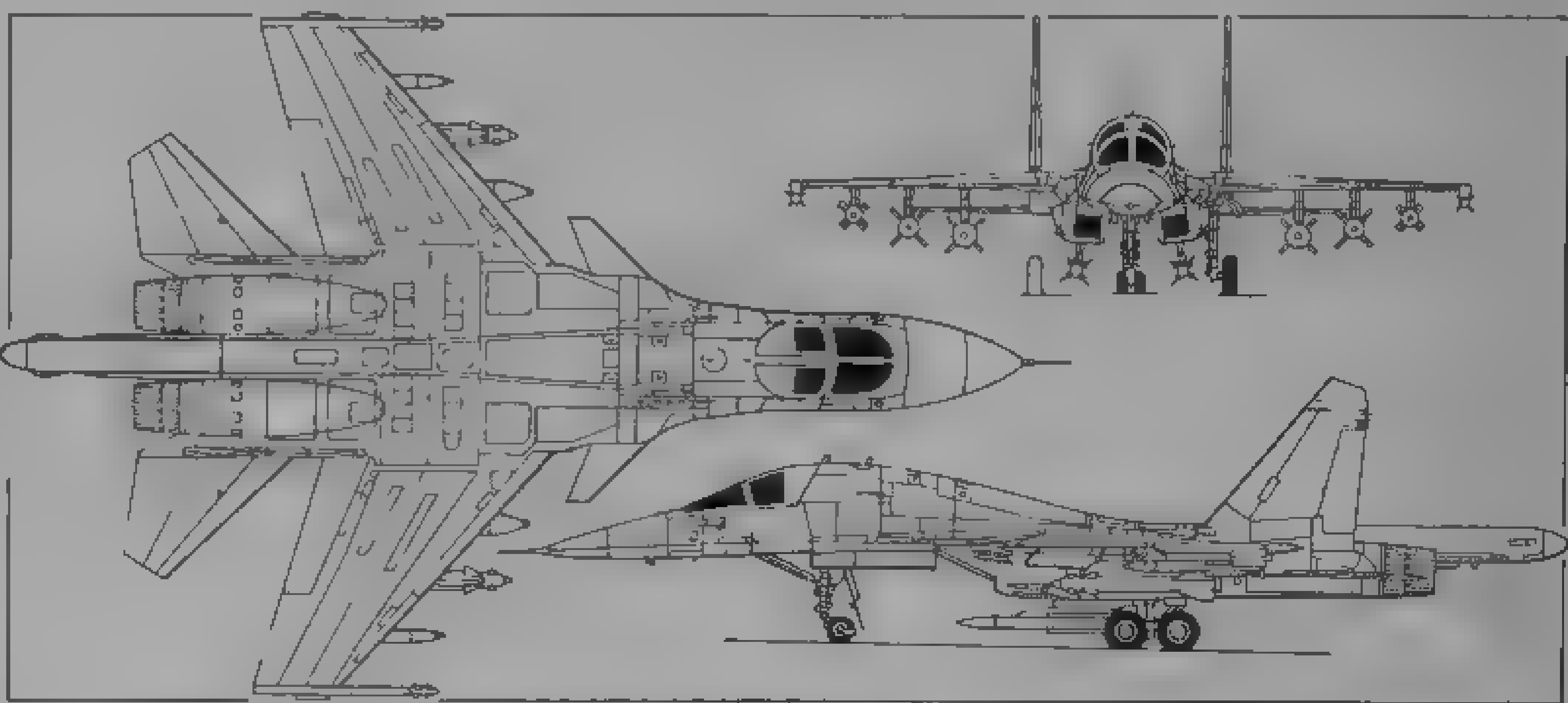
TYPE: Single-seat ship-based air defence fighter.

PROGRAMME: Development began 1976; based on production Su-27, but embodying folding wings, other features for shipboard operation, and movable foreplanes. Navalised Su-27 (T-10-25), with arrester hook, flew 1984; first **Su-27K** (K for korabelnyy: ship-based) prototype (T-10K-1 '29') flew 17 August 1987; second (T-10K-2) made first conventional (non-V/STOL) landing by Soviet aircraft on ship, the *Admiral of the Fleet Kuznetsov* (then *Tbilisi*), 1 November 1989; production at Komsomolsk-on-Amur began 1990; first production **Su-33** (T-10K-3) flew 1990; deliveries began 1991, initial operational capability 1992; 20 delivered and shore-based on Kola



Plan view of Sukhoi Su-32FN showing revised nose contours

1995



Three-view drawing of Sukhoi Su-34 twin-turbofan theatre bomber (*Jane's/Mike Keep*)

1994

Sukhoi Su-34 at Zhukovsky flight test centre (*Yefim Gordon via Mark Wagner*)

1994

Preseries Sukhoi Su-33 ship-based air defence fighter during deck trials

1994

Peninsula mid-1994, five months of intensive flying from *Kuznetsov*, in Barents Sea, in second half 1994

DESIGN FEATURES: Airframe generally similar to Su-27, but with folding wings and tailplane, added foreplanes, arrester hook and other features for carrierborne operations, strengthened landing gear with twin nosewheels, long tailcone of land-based versions shortened to prevent tailscrapes during take-off and landing on ship, IRST with wider angle of view

FLYING CONTROLS: Basically as Su-27, but with sweptback (52°) foreplanes that operate at all speeds and only collectively, not differentially (7° up/70° down). Fly-by-wire, automatic control system and central control column. Broader-chord slotted Fowler-type flaps

STRUCTURE: Generally as Su-27, but hydraulically folding outer wings (through 135°) and upward folding horizontal tail surfaces. Riveted and welded structure of aluminium and titanium alloys and steel

LANDING GEAR: Generally as Su-27, but mainwheel tyres size 1030 × 350 mm, twin nosewheel tyres size 620 × 180; nosewheels steerable through ±60°. Arrester hook under tailcone

POWER PLANT: As Su-27, but with retractable flight refuelling probe beneath windscreen on port side; provision for centreline buddy refuelling pack

ACCOMMODATION: As Su-27

SYSTEMS: As Su-27

AVIONICS: *Flight*: Nav systems specialised for use over sea

ARMAMENT: Basically as Su-27, plus ability to carry Kh-31 (AS-17 'Krypton') air-to-surface missiles underwing. Exhibited with inert 4,500 kg (9,920 lb) Kh-41 (3M80 Moskit 'mosquito') anti-ship missile on centreline, but this considered as impracticable operational load

DIMENSIONS, EXTERNAL:

Wing span	14.70 m (48 ft 2¾ in)
Length overall, incl nose probe	21.185 m (69 ft 6 in)
Width, wings folded	7.40 m (24 ft 3½ in)
Height overall	5.90 m (19 ft 4¼ in)
Tailplane span	9.90 m (32 ft 6 in)
Wheel track	4.40 m (14 ft 5¼ in)
Wheelbase	5.89 m (19 ft 4 in)

AREAS:

Wings, gross	67.80 m² (729.82 sq ft)
Foreplanes (total)	3.00 m² (32.29 sq ft)
Ailerons (total)	2.40 m² (25.83 sq ft)
Trailing-edge flaps (total)	6.60 m² (71.04 sq ft)
Leading-edge flaps (total)	5.40 m² (58.13 sq ft)
Fins (total)	11.60 m² (124.87 sq ft)
Rudders (total)	3.50 m² (37.67 sq ft)
Horizontal tail surfaces (total)	12.30 m² (132.40 sq ft)

WEIGHTS AND LOADINGS: Not available

PERFORMANCE:

Never-exceed speed (VNE) at 11,000 m (36,000 ft)
Mach 2.165 (1,240 kts, 2,300 km/h, 1,430 mph)

Min flying speed	130 kts (240 km/h, 150 mph)
T-O run on carrier with 14° ramp	120 m (395 ft)

Range with max internal fuel
1,620 n miles (3,000 km, 1,865 miles)

g limit	+8

UPDATED

SUKHOI Su-35

TYPE: Single-seat all-weather counter-air fighter and ground attack aircraft

PROGRAMME: Experimental version of Su-27 with foreplanes (T-10-24) flew May 1985, first of six prototypes (successively T-10S-70, Su-27M, Su-35) flew 28 June 1988; another was exhibited at 1992 Farnborough Air Show, in final stages of flight testing early 1993. 11 prototype and preseries aircraft ('701' to '711') built by September 1994, of which '711' modified for thrust-vectoring experiments (photograph in Addenda); in production at Komsomolsk-on-Amur

CUSTOMERS: Scheduled entry into Russian Air Force service mid-1990s, for effective operation until 2015-2020

DESIGN FEATURES: Advanced development of Su-27; airframe, power plant, avionics and armament all upgraded; quadruplex digital fly-by-wire controls under development, claimed to be first series-built fighter with static instability and tandem 'triplane' layout, with foreplanes; double-slotted flaperons, taller, square-tip twin tailfins with integral fuel tanks; reprofiled front fuselage for larger-diameter radar antenna; enlarged tailcone for rearward-facing radar; twin-wheel nose landing gear; three-dimensional thrust vectoring nozzles under development for use on production aircraft

STRUCTURE: Higher proportion of carbonfibre and aluminium-lithium alloy in fuselage; composites used for components such as leading-edge flaps, nosewheel door and radomes

POWER PLANT: Two Saturn/Lyulka AL-35F (AL-31MF) turbofans; each 137.3 kN (30,865 lb st) with afterburning. Retractable flight refuelling probe on port side of nose

ACCOMMODATION: Pilot only, on Zvezda K-36MD zero/zero ejection seat

AVIONICS: *Radar*: Phazotron N011 Zhuk 27 multimode low-altitude terrain-following/avoidance radar, search range 54 n miles (100 km, 62 miles) in forward sector, 30 n miles (55 km, 34 miles) rearward, able to track 10 targets and engage four simultaneously. Phazotron Zhuk PH phased array radar under development for later use, search range 89 to 132 n miles (165 to 245 km, 102 to 152 miles) in forward sector, 32 n miles (60 km, 37 miles) rearward, with simultaneous tracking of 24 air targets and ripple fire engagement of six. N014 rearward facing radar, range approximately 2 n miles (4 km, 2.5 miles), may enable firing of rearward-facing IR homing air-to-air missiles.

Flight: Fully automatic flight modes and armament control against ground, maritime and air targets, including automatic low-altitude flight and automatic target designation.

Instrumentation: EFIS, with three colour CRTs. HUD.

Mission: New-type IRST moved to starboard, all combat flight phases computerised. Shown at Farnborough with GEC Ferranti TIALD (thermal imaging airborne laser designator) night/adverse visibility pod fitted for possible future use.

Self defence: Enhanced ECM, including wingtip jammer pods, RWR

ARMAMENT: One 30 mm GSh-30 gun in starboard wingroot extension, with 150 rounds. Mountings for up to 14 stores, including R-27 (AA-10 'Alamo-A/B/C/D'), R-40 (AA-6 'Acrid'), R-60 (AA-8 'Aphid'), R-73A (AA-11 'Archer') and R-77 (AA-12 'Adder') air-to-air missiles, Kh-25ML (AS-10 'Karen'), Kh-25MP (AS-12 'Kegler'), Kh-29T (AS-14 'Kedge'), Kh-31 (AS-17 'Krypton') and Kh-59 (AS-18) air-to-surface missiles, KAB-500 bombs and rocket packs. Maximum weapon load 8,000 kg (17,635 lb)

DIMENSIONS, EXTERNAL:

Wing span, over ECM pods	15.00 m (49 ft 2½ in)
Length overall	22.20 m (72 ft 10 in)
Height overall	6.36 m (20 ft 10½ in)

PERFORMANCE:

Max level speed: at height
Mach 2.35 (1,350 kts, 2,500 km/h, 1,555 mph)
at S/L Mach 1.14 (755 kts, 1,400 km/h, 870 mph)

Service ceiling	18,000 m (59,055 ft)
Balanced runway length	1,200 m (3,940 ft)

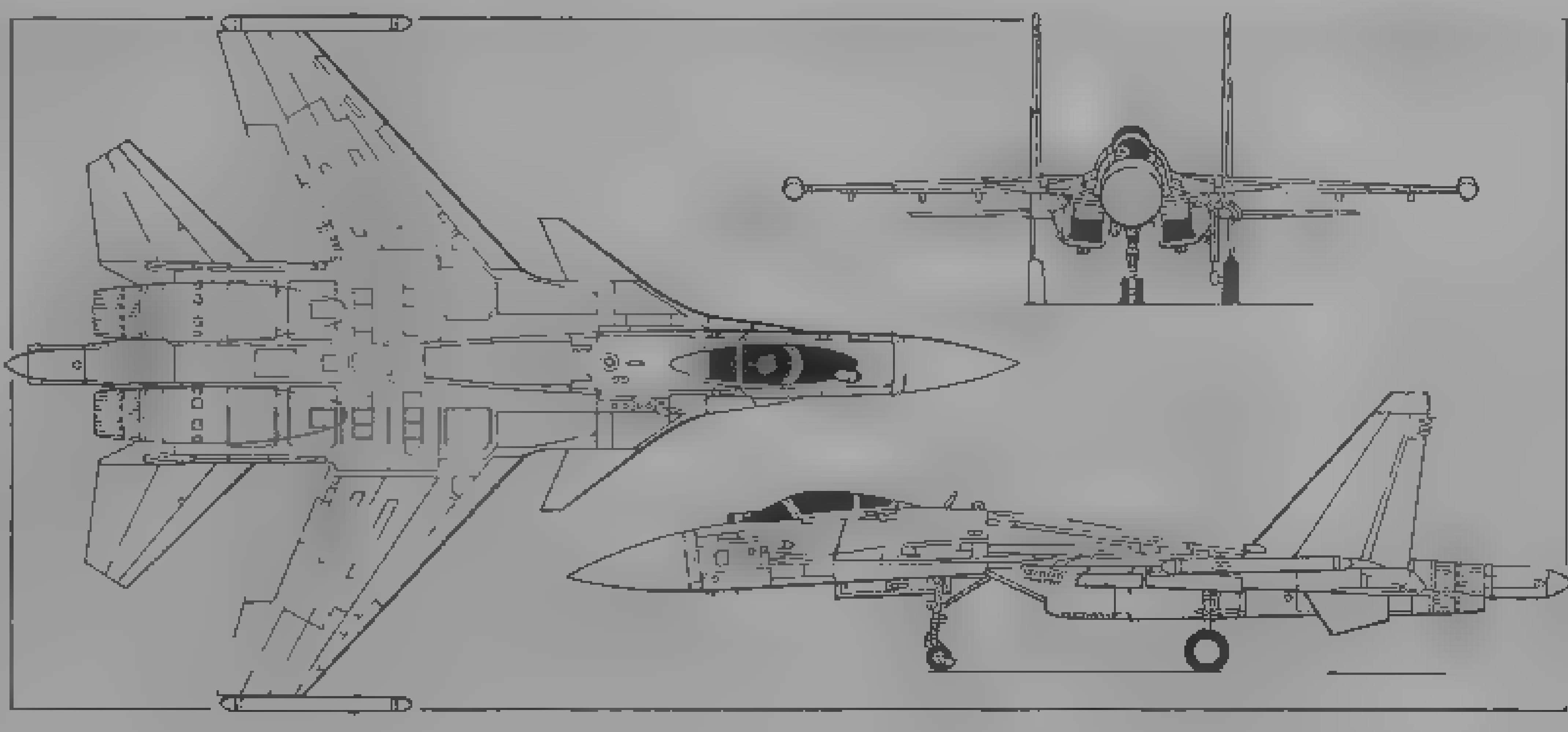
Range: with max internal fuel
more than 2,160 n miles (4,000 km, 2,485 miles)
with flight refuelling
more than 3,510 n miles (6,500 km, 4,040 miles)

g limit	+10

UPDATED

Sukhoi Su-35 advanced development of the Su-27 series (*Paul Jackson*)

1995



Sukhoi Su-35 single-seat counter-air and ground attack fighter (*Jane's/Mike Keep*)

1993

SUKHOI Su-38

TYPE: Single/two-seat agricultural aircraft.

PROGRAMME: Design started August 1993, construction of prototype began January 1994, scheduled for Russian and Western certification.

COST: $100,000.

DESIGN FEATURES: Conventional low-wing monoplane, with non-retractable landing gear, based on airframe and power plant of Su-29 two-seat aerobatic aircraft. Wing span extended and winglets added; tailplane enlarged, cockpit revised; and landing gear strengthened for rough field operation. Constant chord wings without sweep, except for root fairings, P 31Y wing section, thickness/chord ratio 16 per cent, aspect ratio 5.71, dihedral 3°, incidence 2°. Airframe life 10,000 hours.

FLYING CONTROLS: Mechanically actuated ailerons, horn balanced elevators, and rudder; trim tab in starboard elevator trailing-edge flaps.

LANDING GEAR: Non-retractable tailwheel type, as Su-29 but strengthened, mainwheel tyre diameter 500 mm, tailwheel 250 mm.

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder radial engine; MTV 9 three-blade variable-pitch propeller. Fuel tank in each wing; total capacity 200 litres (53 US gallons, 44 Imp gallons). Oil capacity 20 litres (5.3 US gallons, 4.4 Imp gallons).

ACCOMMODATION: Normally pilot only, on raised rear seat, but provision for passenger.

SYSTEMS: Cockpit air conditioning and air filter. Hydraulic system pressure 24.5 bars (355 lb/sq in). Pneumatic system pressure 49 –5 bars (710 –71 lb/sq in). Electrical system 28.5 V, with 28 Ah battery.

AVIONICS: *Comms:* Briz VHF radio.
Flight: Loran, Tacan and GPS optional.

EQUIPMENT: Underwing spraybars, chemicals in either ventral pod or fuselage hopper, replacing passenger seat. Alternative equipment for firefighting, aerial photography and patrol duties.

DIMENSIONS, EXTERNAL:

Wing span	11.344 m (37 ft 2¾ in)
Wing chord: at root	2.056 m (6 ft 9 in)
at tip	1.75 m (5 ft 9 in)
Length overall	7.235 m (23 ft 9 in)
Height overall	2.97 m (9 ft 9 in)
Tailplane span	4.20 m (13 ft 9½ in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase	5.08 m (16 ft 8 in)
Propeller diameter	2.50 m (8 ft 2½ in)
Propeller ground clearance	0.50 m (1 ft 7½ in)

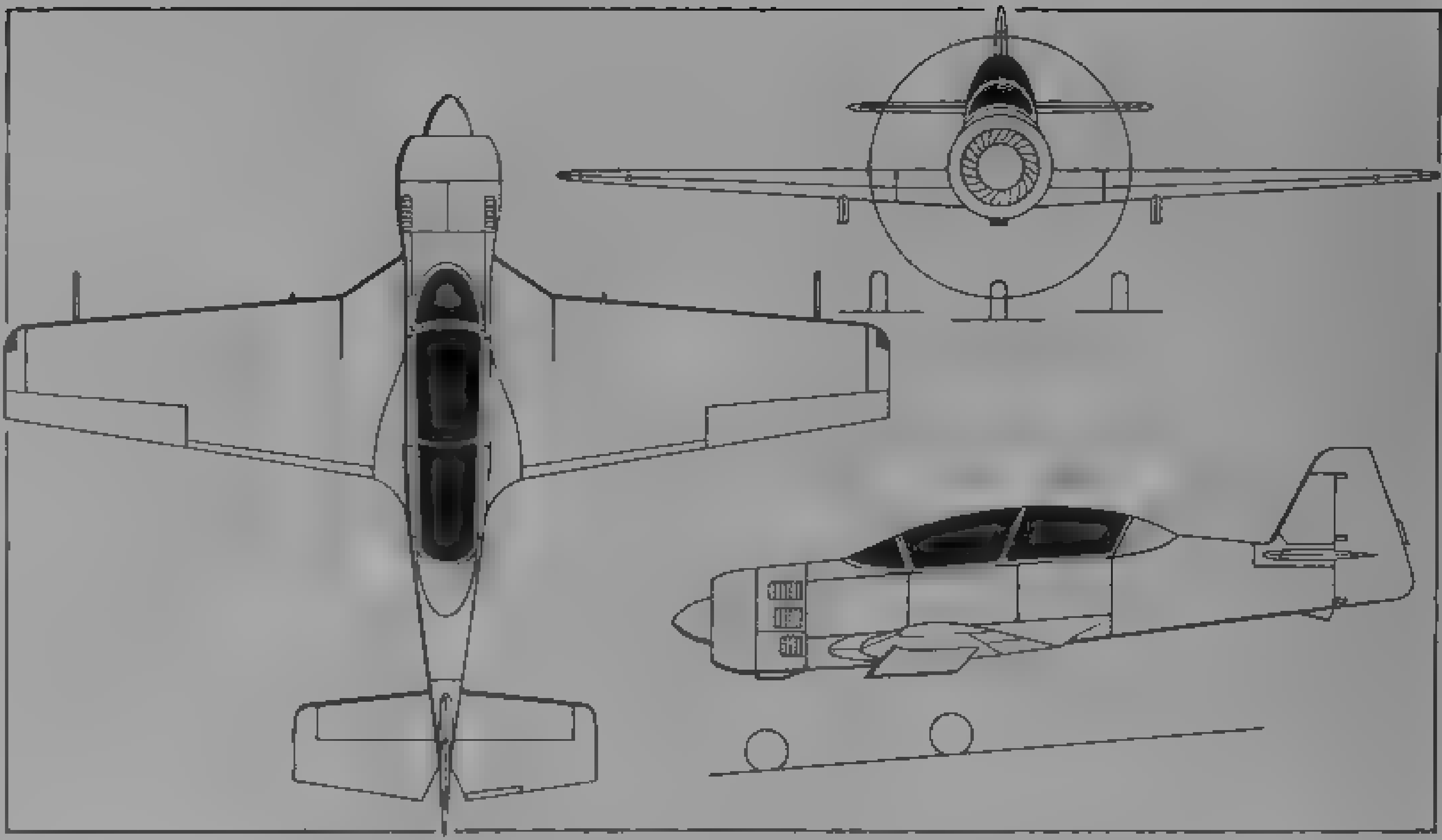
WEIGHTS AND LOADINGS:

Weight empty, equipped	1,000 kg (2,205 lb)
Max payload	700 kg (1,543 lb)
Max fuel	150 kg (330 lb)
Normal T-O and landing weight	1,650 kg (3,637 lb)
Max T-O weight	1,800 kg (3,968 lb)
Max power loading	6.79 kg/kW (11.18 lb/hp)

PERFORMANCE (estimated):

Never-exceed speed (VNE)	175 kts (325 km/h, 202 mph)
Max level speed at S/L	162 kts (300 km/h, 186 mph)
Max cruising speed at S/L	119 kts (220 km/h; 137 mph)
T-O speed	76 kts (140 km/h, 87 mph)
Landing speed	81 kts (150 km/h, 94 mph)
Max rate of climb at S/L	360 m (1,180 ft)/min
Service ceiling	3,600 m (11,800 ft)
T-O run	120 m (395 ft)
T-O to 15 m (50 ft)	300 m (985 ft)
Landing from 15 m (50 ft)	500 m (1,640 ft)
Landing run	280 m (920 ft)
Service range	431 n miles (800 km; 497 miles)

UPDATED

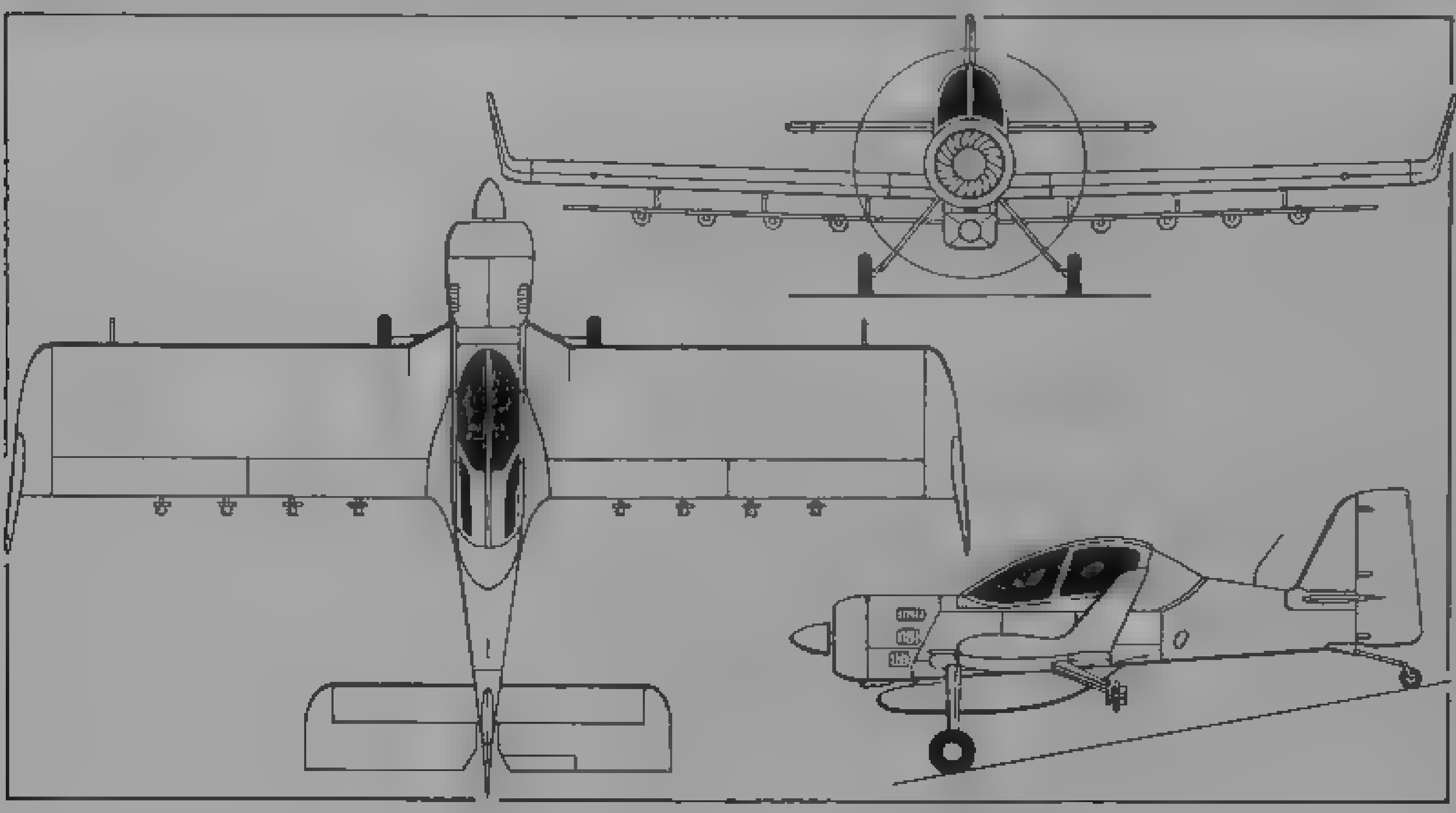


Sukhoi Su-39 civil and military primary trainer *(Jane's/Mike Keep)*

1994

Mockup of Sukhoi Su-38 (VOKBM M-14P engine)

1995



Sukhoi Su-38 agricultural aircraft, based on Su-29 *(Jane's/Mike Keep)*

1994

SUKHOI Su-39

TYPE: Tandem two-seat primary trainer and general purpose aircraft.

PROGRAMME: Design started July 1992, under former designation Su-32, construction of prototype began 1994; first flight of prototype scheduled second half 1996. P&WC/Klimov PK6A 25 turboprop under negotiation as replacement for M-14F piston engine in at least proportion of production aircraft.

CUSTOMERS: Orders for 1,500 for Russian Air Force flying schools and DOSAAF, Air Force version has more complex equipment.

COSTS: Standard aircraft $500,000.

DESIGN FEATURES: Based on Su-26 and Su-29 aerobatic aircraft, with objectives of short take-off and landing and high manoeuvrability, plus optional carriage of guided and unguided weapons and suitability for counter-insurgency, patrol and coastal protection missions. Wing leading-edge sweepback 5° 30', wing section NACA 23012, aspect ratio 5.9, dihedral 1° 30', incidence 0°. Service life 10,000 hours.

FLYING CONTROLS: Mechanically actuated ailerons, elevators and rudder; elevators and rudder horn balanced, pneumatically operated wing trailing-edge slotted area-increasing flaps and ventral airbrake. Provision for autopilot.

STRUCTURE: Two-spar wings; single-spar fin and tailplane. Fuselage longerons and wing spars of CFRP, wing, fuselage and tail unit skin panels of Kevlar type composites and GFRP.

LANDING GEAR: Pneumatically retractable tricycle type, single wheel on each unit, main units retract inward, nosewheel rearward, oleo-pneumatic shock-absorbers, Rubin mainwheels type KT-214, nosewheel type K-214, all three tyres size 400 × 150-140, pressure 3 to 3.5 bars (43.5 to 50.75 lb/sq in), hydraulic brakes on mainwheels.

POWER PLANT: One 294 kW (395 hp) VOKBM M-14PF nine-cylinder radial engine; three-blade MTV-9 propeller. Alternative PK6A-25 turboprop. Fuel tank in each wing, capacity 150 litres (39.6 US gallons, 33 Imp gallons), header tank in fuselage, capacity 20 litres (5.3 US gallons, 4.4 Imp gallons); total internal fuel capacity 320 litres (84.5 US gallons; 70.4 Imp gallons), provision for two 100 litre (26.4 US gallon, 22 Imp gallon) underwing tanks, gravity fuelling, oil capacity 20 litres (5.3 US gallons, 4.4 Imp gallons).

ACCOMMODATION: Two seats in tandem; rear (instructor's) seat raised. Zvezda SKS-94 ejection system (54 to 215 knots; 100 to 400 km/h, 62 to 248 mph/10 m, 33 ft), crew ejected through canopy on diverging trajectories in emergency, without seats; canopy hinged to starboard. Baggage space behind cockpits, capacity 0.2 m³ (7.0 cu ft).

SYSTEMS: Cockpit air conditioning and pressurisation standard. Brake hydraulic system pressure 24.5 bars (355 lb/sq in). Pneumatic system pressure 50.6 bars (735 lb/sq in). One 3.5 kW generator for 27 V DC electrical system. Propeller anti-iced and windscreen demisted by hot air.

AVIONICS: *Comms:* KX 165 VHF com/nav, KT 46A transponder, KR-87 ADF, GO3 area nav and KLN-90.
Radar: Provision for external radar pod.
Flight: Optional automatic approach and satellite nav.
Self-defence: RWR and IR warning system in military versions.

ARMAMENT: Provision for integral gun, bombs, air-to-air and anti-tank missiles in combat versions.

DIMENSIONS, EXTERNAL:

Wing span	8.50 m (27 ft 10¾ in)
Wing chord, at root	1.88 m (6 ft 2 in)
at tip	0.885 m (2 ft 10¾ in)
Length overall	7.285 m (23 ft 10¾ in)
Height overall	2.60 m (8 ft 6⅜ in)
Tailplane span	2.90 m (9 ft 6¼ in)
Wheel track	2.00 m (6 ft 6¾ in)
Wheelbase	1.78 m (5 ft 10 in)
Propeller diameter	2.50 m (8 ft 2½ in)
Propeller ground clearance	0.24 m (9½ in)

Model of Sukhoi Su-39 shown at MosAeroshow '93 *(Piotr Butowski)*

1994

DIMENSIONS, INTERNAL:
Cockpit: Length 2.70 m (8 ft 10¼ in)
Max width 0.60 m (1 ft 11½ in)
Max height 1.10 m (3 ft 7¼ in)
Floor area 2.50 m² (26.9 sq ft)

AREAS:
Wings, gross 12.20 m² (131.32 sq ft)
Ailerons (total) 2.24 m² (24.11 sq ft)
Trailing-edge flaps (total) 3.30 m² (35.52 sq ft)
Fin 0.30 m² (3.23 sq ft)
Rudder 0.90 m² (9.69 sq ft)
Tailplane 0.98 m² (10.55 sq ft)
Elevators (total) 1.56 m² (16.79 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 850 kg (1,874 lb)
Max fuel: internal 260 kg (573 lb)
external 200 kg (441 lb)
Normal T-O weight 1,300 kg (2,866 lb)
Max T-O and landing weight 1,500 kg (3,307 lb)
Max wing loading 122.95 kg/m² (25.18 lb/sq ft)
Max power loading 5.66 kg/kW (9.31 lb/hp)

PERFORMANCE (estimated, at 1,300 kg, 2,865 lb AUW):
Never-exceed speed (VNE) 286 kts (530 km/h, 329 mph)
Max level speed 200 kts (370 km/h, 230 mph)
Max cruising speed 178 kts (330 km/h, 205 mph)
Econ cruising speed 151 kts (280 km/h, 174 mph)
Landing speed 60 kts (110 km/h, 69 mph)
Stalling speed: flaps down 49 kts (90 km/h, 56 mph)
flaps up 54 kts (100 km/h, 62 mph)
Max rate of climb at S/L 810 m (2,655 ft)/min
Service ceiling 7,000 m (22,965 ft)
T-O run 230 m (755 ft)
Landing run 250 m (820 ft)
Range:
with max payload 647 n miles (1,200 km, 745 miles)
with max internal fuel 809 n miles (1,500 km, 932 miles)
with max internal and external fuel 1,080 n miles (2,000 km, 1,242 miles)
g limits +11/-8

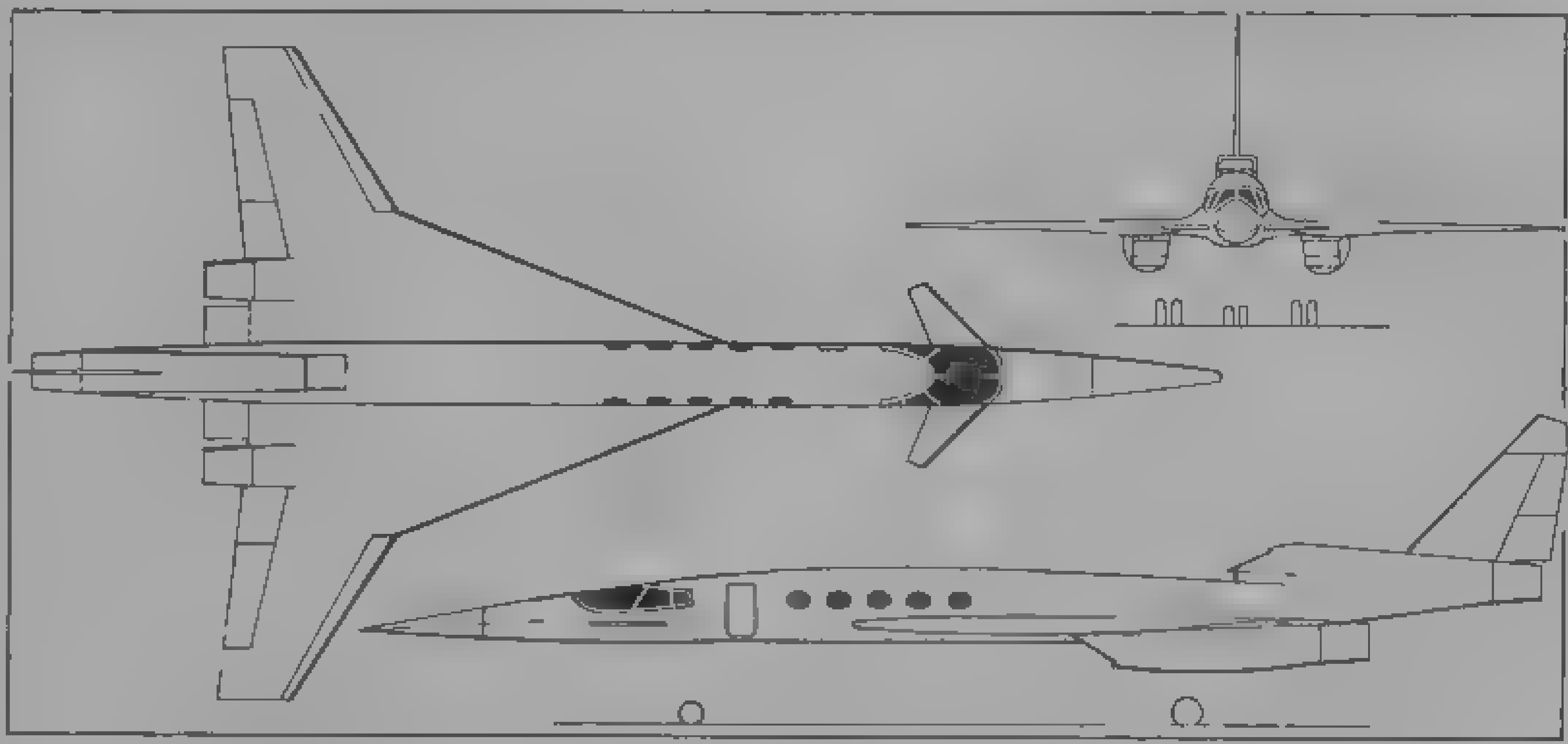
UPDATED

SUKHOI T-60S

The Sukhoi OKB is reported to be developing an intermediate-range bomber, under project designation T-60S, to replace Tu-16s, Tu-22s and some Su-24s. No details yet available. Accompanying artist's impression illustrates possible configuration.

Model of projected Sukhoi S-21 six/10-passenger supersonic transport

1994



Provisional drawing of Sukhoi S-21 supersonic business jet *(Jane's/Mike Keep)*

1994

SUKHOI S-21

TYPE: Supersonic business aircraft.

PROGRAMME: Projected originally as joint programme by Sukhoi and Gulfstream Aerospace of USA, separate studies for aircraft of this type started by Sukhoi 1987, Gulfstream 1988, and recorded subsequently in International section of *Jane's*; first draft of detailed specification of current redesign submitted by Sukhoi October 1991, Gulfstream withdrew from programme 1992, first flight expected originally 1994, now deferred until late 1990s. Series production planned for 2000; claimed current requirement for 150 aircraft.

DESIGN FEATURES: Three-engined low/mid-wing aircraft; wings have compound sweep, with highly swept inner panels, oval section fuselage, all-moving swept foreplanes. Designed supersonic shockwave level 3 to 4 times lower than Concorde, resembling remote thunder at S/L.

FLYING CONTROLS: Digital fly-by-wire AFCS.

LANDING GEAR: Retractable tricycle type with twin wheels on each unit.

POWER PLANT: Three Aviadvigatel D-21A1 turbofans, each 73.5 kN (16,535 lb st).

ACCOMMODATION: Crew of two and six to 10 passengers.

AVIONICS: Development in association with Honeywell.

DIMENSIONS, EXTERNAL:
Wing span 19.92 m (65 ft 4¼ in)
Length overall 37.86 m (124 ft 2½ in)

DIMENSIONS, INTERNAL:
Passenger cabin: Length 5.41 m (17 ft 9 in)
Max width 1.80 m (5 ft 10¾ in)
Max height 1.85 m (6 ft 0¾ in)
Volume 19.90 m³ (702.75 cu ft)

AREAS:
Wings, gross 40.00 m² (1,507.0 sq ft)

WEIGHTS AND LOADINGS (estimated):
Operating weight empty 24,570 kg (54,167 lb)
Normal payload 460 kg (1,015 lb)
Max payload 910 kg (2,006 lb)
Max fuel 26,520 kg (58,465 lb)
Max T-O weight 51,800 kg (114,200 lb)
Max wing loading 370 kg/m² (75.8 lb/sq ft)
Max power loading 235 kg/kN (2.3 lb/lb st)

PERFORMANCE (estimated):
Max cruising speed: supersonic Mach 2.0 (1,150 kts, 2,125 km/h, 1,320 mph)
subsonic Mach 0.95 (547 kts, 1,015 km/h, 630 mph)
Cruising altitude 15,500-19,500 m (50,850-63,975 ft)
T-O and landing run 1,980 m (6,500 ft)
Range, NBAA IFR reserves: supersonic or subsonic 4,000 n miles (7,400 km, 4,600 miles)

OPERATIONAL NOISE LEVELS: Designed to meet FAR Pt 36 standards, with sonic boom intensity less than 5 kg/m² (71 lb/sq in).

VERIFIED

SUKHOI S-51

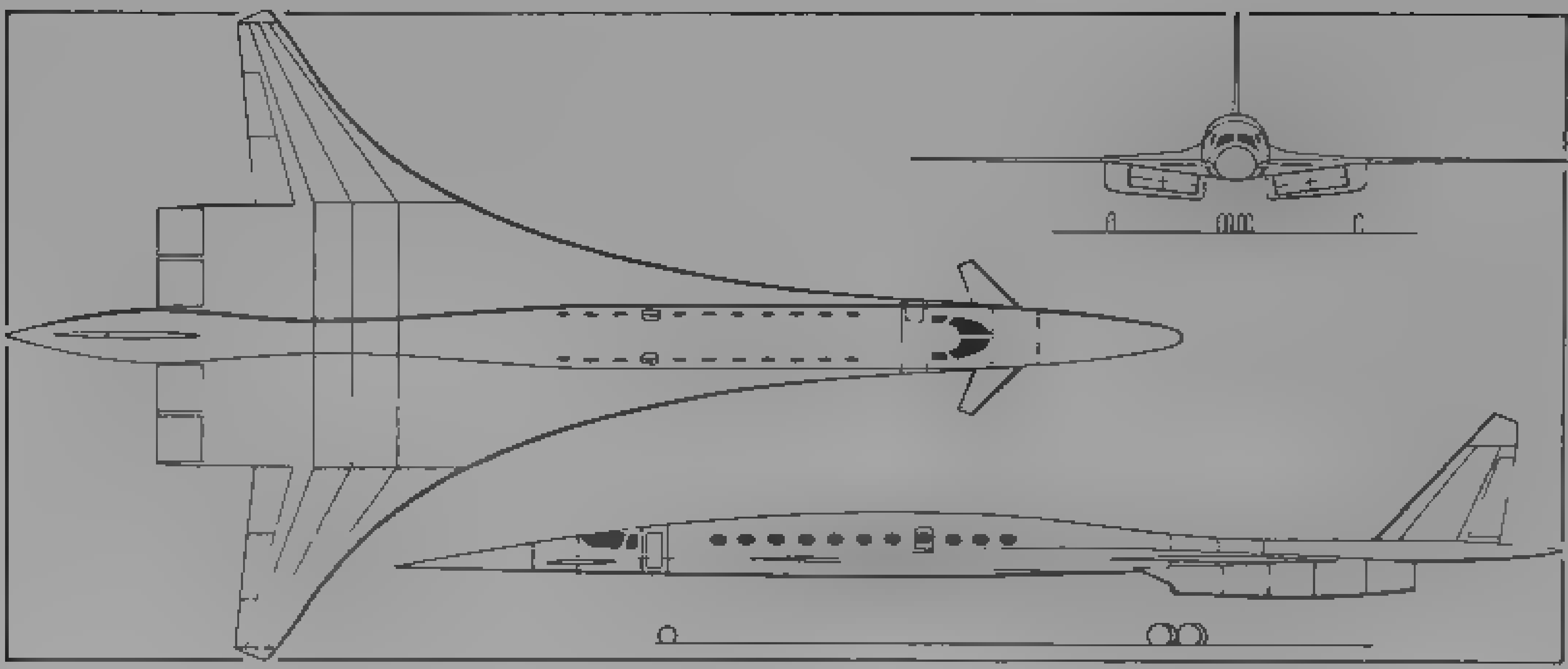
TYPE: Medium-size long-range supersonic transport.

PROGRAMME: At design study stage; projected date of prototype completion 2005, service entry 2010.

DESIGN FEATURES: Rear mounted sweptback low wings, with very long curved root extensions, carrying engine ducts on wide rearward extension of inboard semi-span, sweptback foreplanes, small diameter, long fuselage, with flush windscreen in conical nose; swept vertical tail surfaces. Intended to fly non-stop from Moscow to any airport in Europe and Asian continent, or one-stop to any world capital, range similar when flying supersonic or high subsonic, permitting operation over highly populated areas.

Artist's impression of possible configuration of Sukhoi T-60S supersonic intermediate-range bomber *(Jane's/Keith Fretwell)*

1994



Sukhoi S-51 four-engined supersonic passenger airliner (*Jane's/Mike Keep*)

1994

POWER PLANT: Four R 51 turbojets, each rated at 93.17 kN (20,945 lb st)

ACCOMMODATION: Crew of two, from 50 to 68 passengers

SYSTEMS: Based on experience with S-21 aircraft

DIMENSIONS, EXTERNAL:

Wing span	28.30 m (92 ft 10¼ in)
Length overall	50.50 m (165 ft 8¼ in)

DIMENSIONS, INTERNAL:

Passenger cabin: Length	14.80 m (48 ft 6¾ in)
Max width	2.64 m (8 ft 8 in)
Max height	1.95 m (6 ft 4¾ in)
Volume	62.40 m³ (2,204 cu ft)

AREAS:

Wings, gross	300.00 m² (3,230 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty	39,036 kg (86,060 lb)
Max payload	6,200 kg (13,670 lb)
Max fuel	47,160 kg (103,970 lb)
Max T-O weight	90,700 kg (199,955 lb)
Max wing loading	302.33 kg/m² (61.9 lb/sq ft)
Max power loading	243.4 kg/kN (2.39 lb/lb st)

PERFORMANCE (estimated):

Max supersonic speed	Mach 2.0 (1,145 kts; 2,125 km/h, 1,320 mph)
Max subsonic speed	Mach 0.95 (547 kts, 1,015 km/h, 630 mph)
Service ceiling	17,000-19,000 m (55,775-62,335 ft)
Balanced runway length	2,500 m (8,200 ft)
Max range: Mach 1.4, reduced fuel	2,930 n miles (5,430 km; 3,375 miles)
Mach 2.0 or 0.95	4,965 n miles (9,200 km; 5,715 miles)

OPERATIONAL NOISE LEVELS: Designed to meet FAR Pt 36 standards, with sonic boom intensity less than 5 kg/m² (1.71 lb/sq in)

VERIFIED

SUKHOI S-54

TYPE: Two-seat advanced jet trainer and light combat aircraft

PROGRAMME: Began as one of designs by five OKBs to meet official Russian requirement to replace Aero L-29 and L-39 Albatros; programme launched 1990; configuration refined 1992; avionics and systems units being tested on modified Su-25 and Su-27

DESIGN FEATURES: Described by Sukhoi as scaled-down development of Su-27, with speed, operating altitude and manoeuvrability commensurate with combat aircraft; unconventional all-swept mid-wing configuration, twin outward-canted fins mounted at wing trailing-edges; engine air intakes under wingroots; retractable tricycle landing gear

FLYING CONTROLS: Fly-by-wire as Su-27, via flaperons, all-moving tailplane and rudders; leading-edge flaps, airbrake; preprogrammable to make aircraft easier or harder to fly dependent on pupil's ability; optional 'panic button' to return aircraft to straight and level flight from any attitude and push button spin recovery; optional playback system to record student's every move in flight

LANDING GEAR: Retractable tricycle type, single wheel on each unit; mainwheels retract inward, nosewheel forward; no brake-chute

POWER PLANT: One Soyuz/Tumansky R-195FS turbojet modified from Su-25 power plant, rated at 41.2 kN (9,260 lb st) dry and 60.8 kN (13,670 lb st) with afterburning; optional alternatives could include F404, RB199 and PD33, with minimal airframe modification. Two internal fuel tanks, total capacity 1,660 kg (3,660 lb). Single-point pressure fueling

ACCOMMODATION: Two crew in tandem on K-36 zero/zero ejection seats, under blister canopy, rear seat raised

AVIONICS: Avionics and cockpit interior same as for current and advanced tactical aircraft. Automatic flight control system. Weather radar standard

ARMAMENT: Wingtip mounts for two close-range IR homing air-to-air missiles, two hardpoints under each wing for air-to-air and air-to-surface guided weapons

DIMENSIONS, EXTERNAL:

Wing span	9.08 m (29 ft 9½ in)
Wing chord: at root	4.64 m (15 ft 2¾ in)
at tip	1.18 m (3 ft 10½ in)
Length overall	12.30 m (40 ft 4¼ in)
Height overall	4.47 m (14 ft 8 in)
Tailplane span	5.49 m (18 ft 0¼ in)
Wheel track	2.52 m (8 ft 3¼ in)
Wheelbase	3.45 m (11 ft 4 in)

AREAS:

Wings, gross	26.42 m² (284.4 sq ft)
Flaperons (total)	2.94 m² (31.65 sq ft)
Leading-edge flaps (total)	2.36 m² (25.40 sq ft)
Fins (total)	6.46 m² (69.54 sq ft)
Rudders (total)	1.54 m² (16.58 sq ft)
Tailplane	4.46 m² (48.01 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	4,790 kg (10,560 lb)
Max T-O weight	9,410 kg (20,745 lb)
Max landing weight	7,130 kg (15,718 lb)
Max wing loading	356.2 kg/m² (72.94 lb/sq ft)
Max power loading	154.75 kg/kN (1.52 lb/lb st)

PERFORMANCE (estimated):

Max level speed: at height	Mach 1.55 (890 kts; 1,650 km/h, 1,025 mph)
at S/L	Mach 0.98 (645 kts; 1,200 km/h; 745 mph)
T-O speed	98 kts (180 km/h, 112 mph)
Landing speed	92 kts (170 km/h, 106 mph)
Service ceiling	18,000 m (59,050 ft)
T-O run	380 m (1,250 ft)
Landing run	500 m (1,640 ft)
Range with max fuel: at S/L	440 n miles (820 km, 510 miles)
at height	1,080 n miles (2,000 km, 1,240 miles)
g limits	+9/−3

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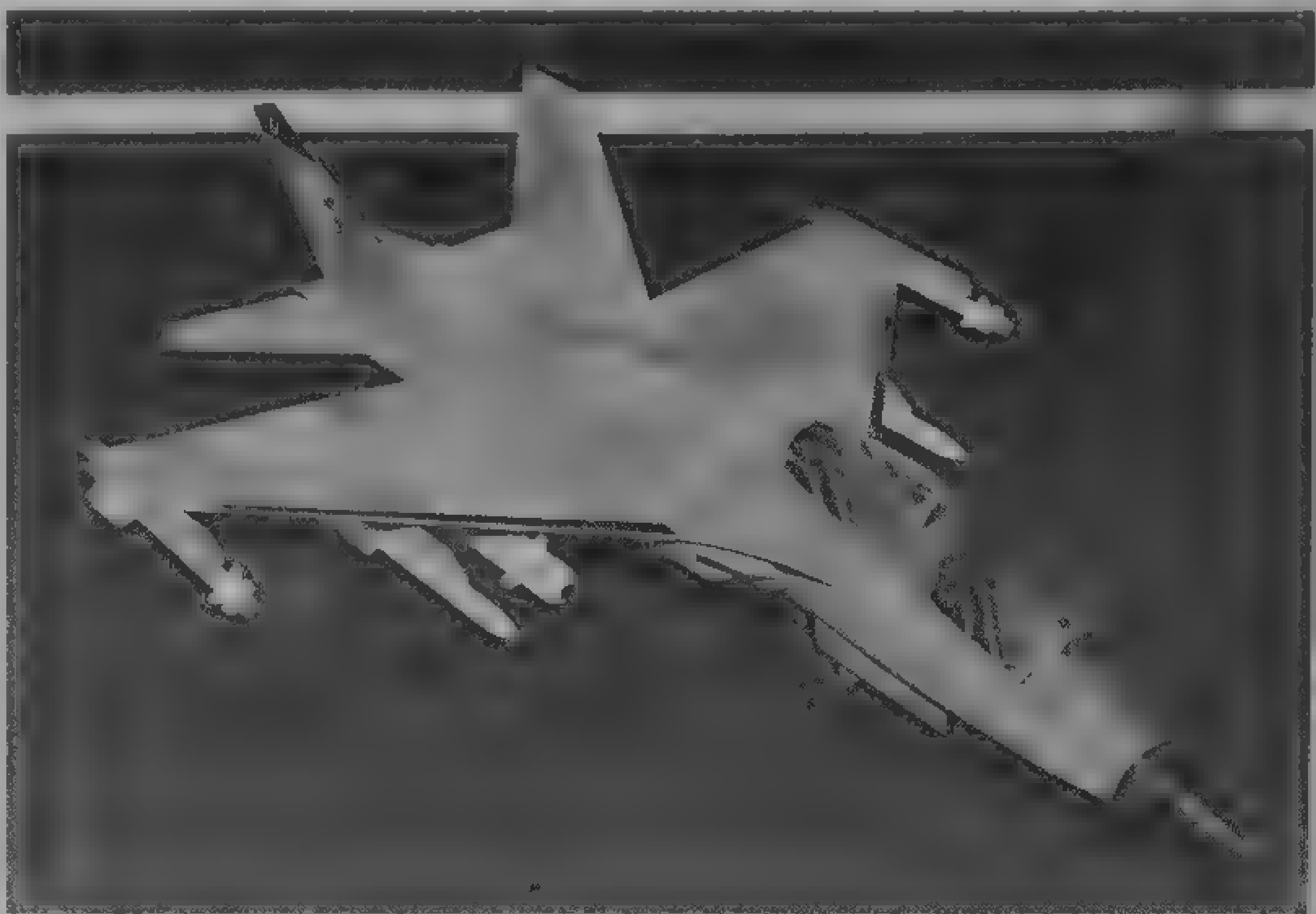


Model of Sukhoi S-54 in fully armed combat configuration (*Piotr Butowski*)

1994

SUKHOI S-80

TYPE: Twin turboprop multipurpose STOL transport

PROGRAMME: First, largest and most advanced design by Sukhoi under konversiya programme of former Soviet industry. Work began 1989 by Sukhoi Europe/Asia joint stock company, with founder members Sukhoi Design Bureau, ASIC, Komsomolsk-on-Amur Aviation Production Association, Rybinsk Motor Engineering Design Bureau, Ramenskoye Instrument Engineering Design Bureau, and Instrument Engineering R&D Institute. Manufacture of five airframes of cargo/passenger version under way at Komsomolsk-on-Amur plant 1993; agreement with General Electric to fit CT7-9B turboprops early 1995; first flight of prototype scheduled 1996, series production to begin 1997

CURRENT VERSIONS: **S-80P**: Basic passenger version

S-80GP: Passenger/cargo transport

S-80A: For service in Arctic

S-80GR: Adapted to carry geological exploration equipment

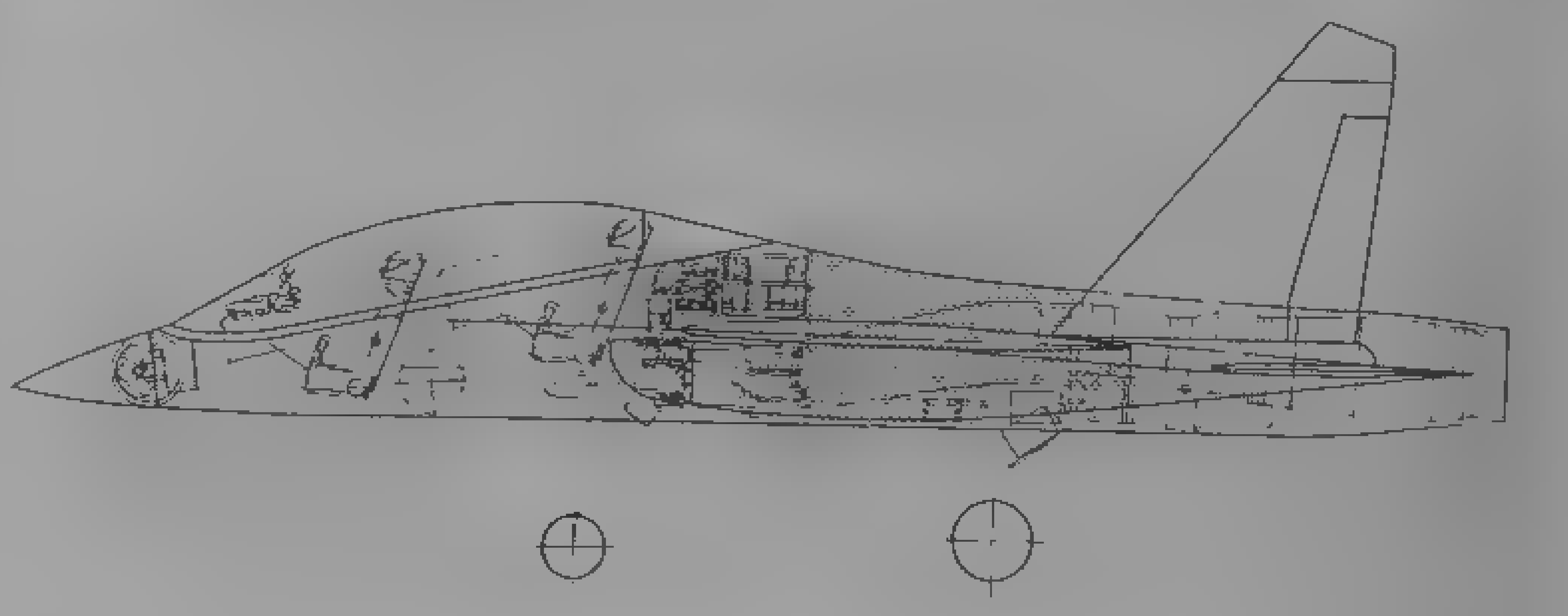
S-80M: Ambulance for 10 stretcher patients and attendant

S-80PT: Patrol/transport version

S-80TD: Military light assault transport

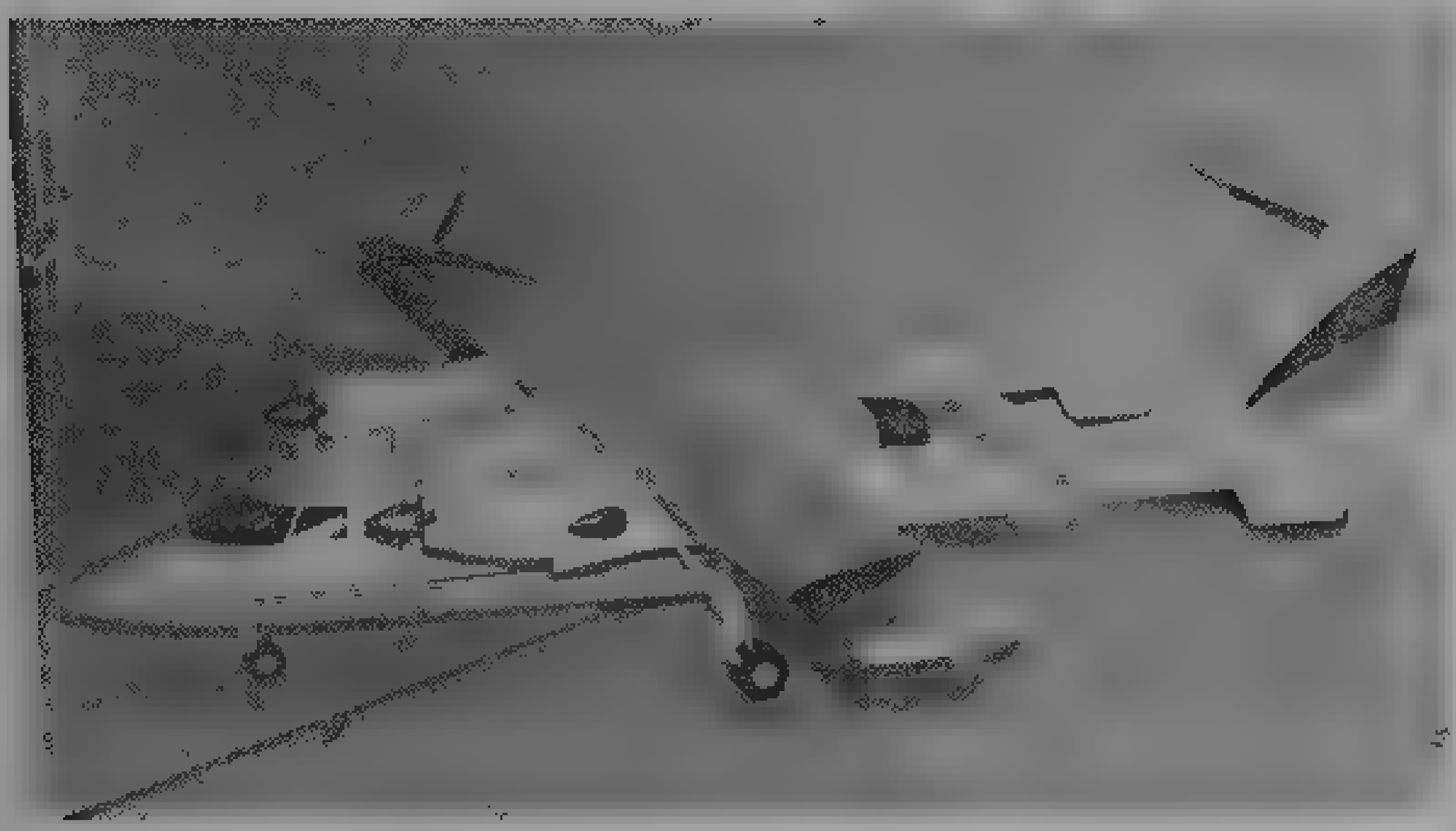
CUSTOMERS: Planned to produce approximately 1,800 to 2,000 S-80s for Russia and former USSR states by 2005

DESIGN FEATURES: Basically conventional high-wing, podded fuselage, twin-boom, rear-loading configuration, but with short tandem-wing surfaces between each tailboom and

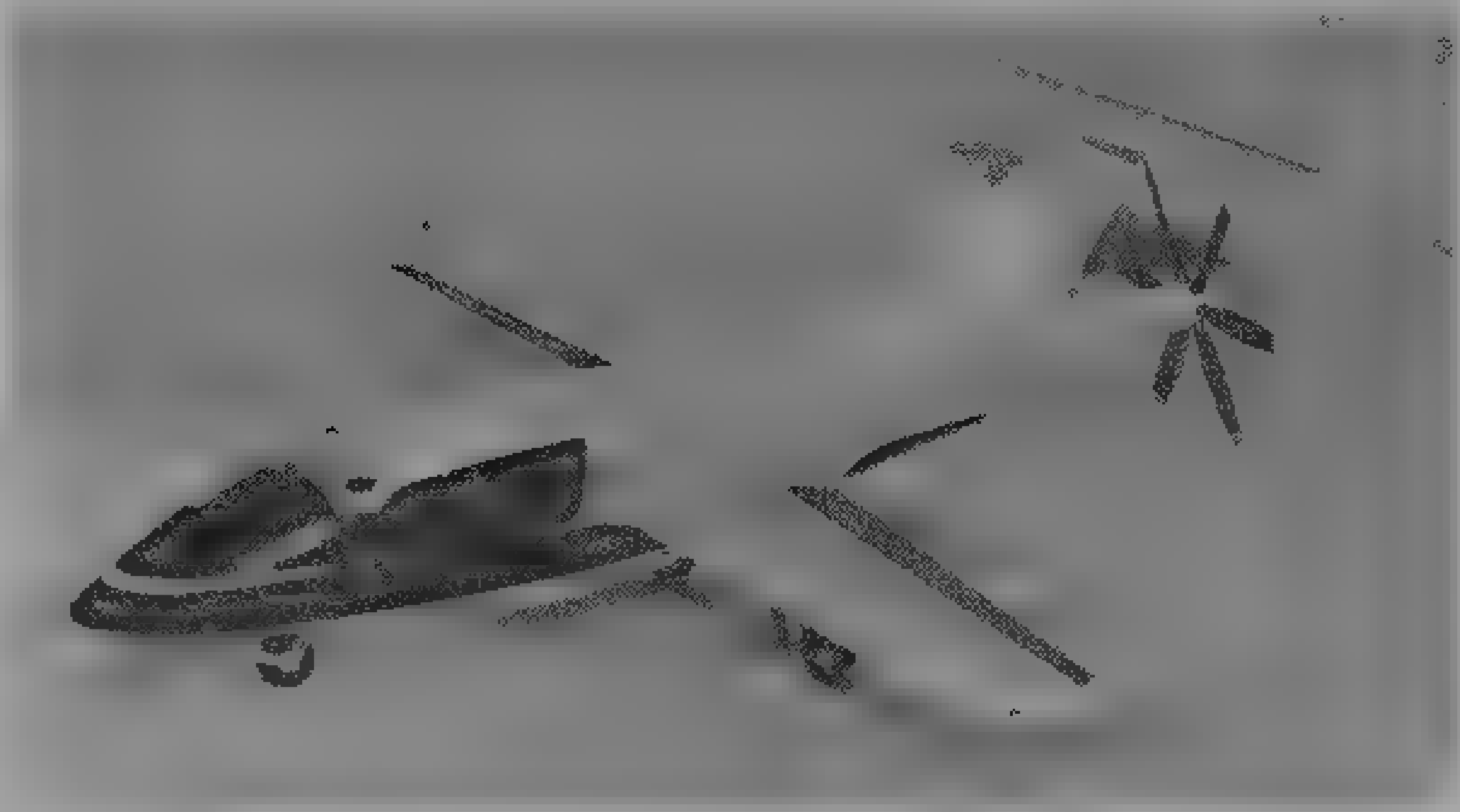


Fuselage cross-section of S-54 advanced trainer/combat aircraft

1994



Model of Sukhoi S-80 in current redesigned configuration *(Brian M. Service)* *1994*



Model of Sukhoi S-84, now with winglets *(Piotr Butowski)* *1994*

rear fuselage, unswept wings with no dihedral or anhedral on large-span inner panels, anhedral and small sweptback winglets on outer panels; sweptback vertical tail surfaces, toed slightly inward, with bridging horizontal surfaces. Systems, accessories and components of Su-25, Su-27 and Su-35 aircraft embodied in S-80. Automatic built-in systems testing.

FLYING CONTROLS: Basic three-axis control; three-view suggests complex wing leading-edge and trailing-edge surfaces to ensure STOL capability.

STRUCTURE: No details, but said to employ "advanced and high technology".

LANDING GEAR: Retractable tricycle type, twin wheels on each unit; main units retract into tailbooms, mainwheel tyre size 660 × 200 mm, nosewheel tyre size 500 × 180 mm, nosewheels steerable ±38°.

POWER PLANT: Two 1,104 kW (1,480 shp) Rybinsk TVD-1500S turboprops, each driving an AV-36 six-blade reversible-thrust propeller, or two 1,395 kW (1,870 shp) General Electric CT7-9B turboprops. Two fuel tanks, total capacity 2,500 litres (660 US gallons; 550 Imp gallons). APU for autonomous operation at remote, unprepared sites.

ACCOMMODATION: Pilot only, or two crew side by side on flight deck, 19 to 26 passengers at 75 cm (29.5 in) seat pitch or 10 stretcher patients in main cabin, or 2,500 kg (5,511 lb) freight or role equipment (use of CT7-9B engines increases maximum payload to 3,500 kg; 7,716 lb). Typical S-80P carries seven passengers in single seats on port side of cabin and 12 in double seats on starboard side, with baggage space, toilet, wardrobe or galley at front, as specified by customer. Available in 'Salon' configuration with nine, 12 or 16 passenger seats. Typical freighter has a row of seats behind flight deck and unobstructed main hold for a small vehicle or cargo. Door at centre of cabin on port side; rear-loading doors and ramp.

SYSTEMS: Electrical system developed by Lucas Aerospace and Avibtec.

AVIONICS: Based on Rockwell Collins and Litton equipment. New airborne radar, advanced flight deck equipment.

EQUIPMENT: Options include equipment for air photography.

DIMENSIONS, EXTERNAL:

Wing span	23.175 m (76 ft 0½ in)
Wing chord: at root	2.16 m (7 ft 1 in)
at tip	1.20 m (3 ft 11¼ in)
Length overall	16.68 m (54 ft 8¾ in)
Height overall	5.56 m (18 ft 3 in)
Tailplane span	4.88 m (16 ft 0¼ in)
Wheel track	5.60 m (18 ft 4½ in)
Wheelbase	6.50 m (21 ft 4 in)
Propeller diameter (each)	2.65 m (8 ft 8⅓ in)
Propeller ground clearance	1.10 m (3 ft 7¼ in)
Distance between propeller centres	5.60 m (18 ft 4½ in)
Passenger door: Height	1.75 m (5 ft 9 in)
Width	0.90 m (2 ft 11½ in)
Service door: Height	1.34 m (4 ft 4¾ in)
Width	0.64 m (2 ft 1¼ in)
Type III emergency exits (each):	
Height	0.905 m (2 ft 11½ in)
Width	0.54 m (1 ft 9¼ in)

DIMENSIONS, INTERNAL:

Cabin: Length	6.30 m (20 ft 8 in)
Max width	2.15 m (7 ft 0¾ in)
Max height	1.90 m (6 ft 2¾ in)
Volume, approx	27.00 m³ (953 cu ft)

AREAS:

Wings, gross	44.00 m² (473.63 sq ft)
Ailerons (total)	3.27 m² (35.20 sq ft)
Trailing-edge flaps (total)	7.051 m² (75.90 sq ft)
Leading-edge slats (total)	4.68 m² (50.38 sq ft)
Fins (total)	6.64 m² (71.47 sq ft)
Rudders (total)	6.22 m² (66.95 sq ft)
Horizontal tail surfaces	5.86 m² (63.08 sq ft)

WEIGHTS AND LOADINGS (A: TVD-1500S engines, B: CT7-9B engines):

Weight empty, equipped: A	6,230 kg (13,735 lb)
Operating weight empty: A	6,500 kg (14,330 lb)
Max payload: A	2,500 kg (5,511 lb)
B	3,500 kg (7,716 lb)
Max fuel: A	2,370 kg (5,225 lb)
Max T-O weight: A	11,000 kg (24,250 lb)
B	12,500 kg (27,555 lb)
Max landing weight: A	10,400 kg (22,925 lb)
Max wing loading: A	250.0 kg/m² (51.20 lb/sq ft)
B	284.1 kg/m² (58.18 lb/sq ft)
Max power loading: A	4.98 kg/kW (8.19 lb/shp)
B	4.48 kg/kW (7.37 lb/shp)

PERFORMANCE (estimated):

Never-exceed speed (V_{NE})	
A	296 kts (550 km/h; 341 mph)
Max level speed at 6,000 m (19,685 ft)	
A	270 kts (500 km/h; 310 mph)
Max cruising speed at 6,000 m (19,685 ft)	
A	259 kts (480 km/h; 298 mph)
B	288 kts (535 km/h; 332 mph)
Econ cruising speed at 6,000 m (19,685 ft)	
A	194 kts (360 km/h; 223 mph)
Stalling speed, flaps down	
A	65 kts (120 km/h; 75 mph)
Max rate of climb at S/L: A	900 m (2,950 ft)/min
Rate of climb at S/L, OEI: A	420 m (1,375 ft)/min
Service ceiling: A	8,000 m (26,250 ft)
T-O run: A	360 m (1,180 ft)
B	600 m (1,970 ft)
T-O to 15 m (50 ft): A	830 m (2,725 ft)
Landing from 15 m (50 ft): A	760 m (2,495 ft)
Landing run with reverse thrust: A	180 m (590 ft)
B	400 m (1,313 ft)
Range: with max payload	
A	675 n miles (1,250 km; 776 miles)
B	1,349 n miles (2,500 km; 1,553 miles)
with max fuel	
A	2,425 n miles (4,500 km; 2,795 miles)

OPERATIONAL NOISE LEVELS: Designed to conform with FAR Pt 36 standards.

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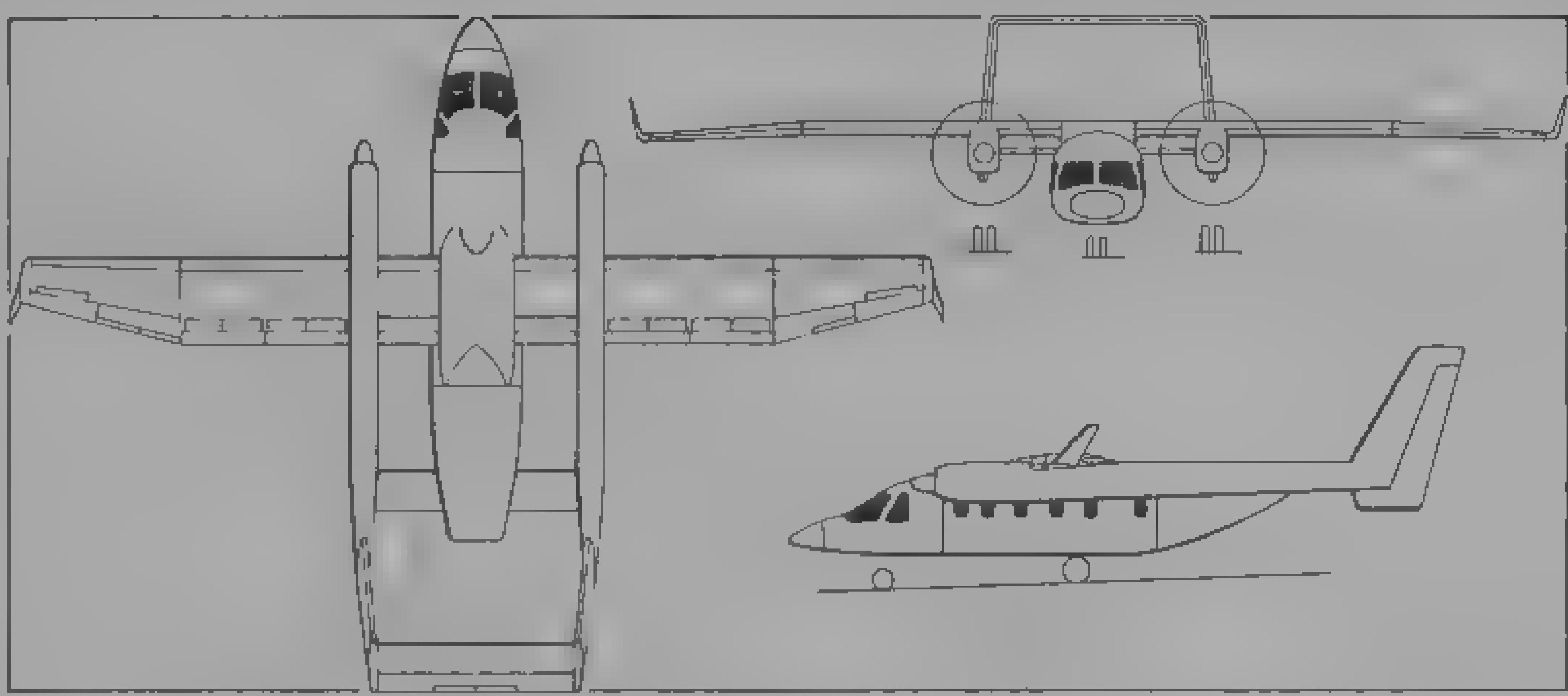
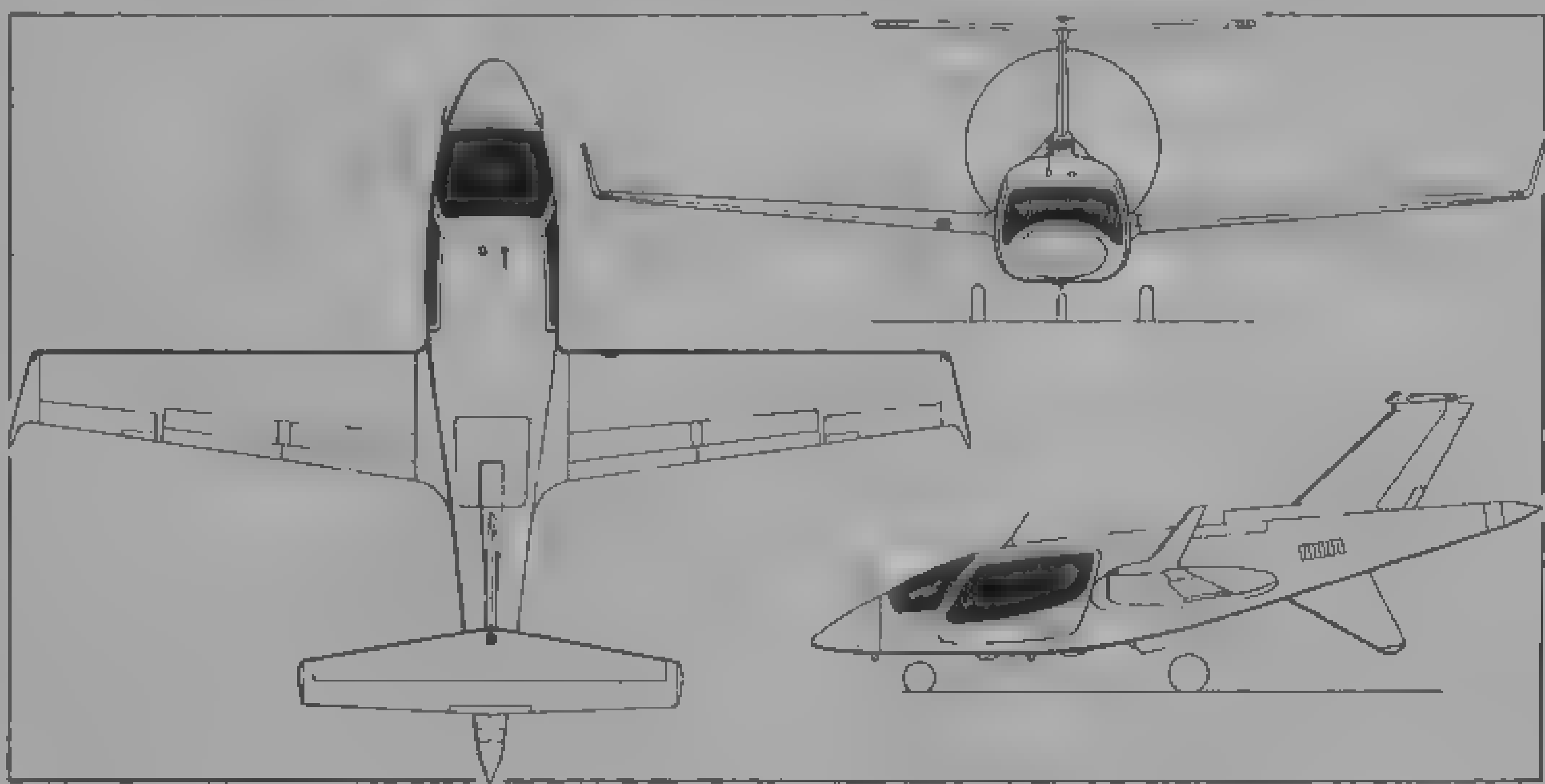


Sukhoi S-80 twin-turboprop multipurpose STOL transport *(Jane's/Mike Keep)* *1994*



Sukhoi S-84 four-seat light multipurpose aircraft *(Jane's/Mike Keep)* *1994*

SUKHOI S-84

TYPE: Four-seat light multipurpose STOL aircraft.

PROGRAMME: Development started June 1993, model of current redesign shown at MosAeroshow '93; production could begin 1996, with certification to AR-23 standards.

DESIGN FEATURES: Cantilever mid-wing monoplane, laminar flow wing section, high-lift trailing-edge surfaces, winglets added 1994; streamline fuselage, with flush canopy, upswept at rear, sweptback fin and T tailplane, clear of propeller arc; sweptback ventral fin protects propeller in tail-down attitude on ground. Pusher propeller at tip of tailcone ensures low cabin noise levels and optimum forward view. Wing sweepback 0°, except for modest sweepforward at roots, thickness/chord ratio 16 per cent at root, 12 per cent at tip, aspect ratio 8.5, dihedral 4° from roots, incidence –2°.

FLYING CONTROLS: Three-axis manual operation; ailerons with spoilers; unswept tailplane carries one-piece horn balanced elevator; electromechanical two-section trailing-edge flaps; trim tab in elevator.

STRUCTURE: All-composites airframe (GFRP and CFRP). Two-spar wings with few ribs, fuselage with longerons and honeycomb skin.

LANDING GEAR: Retractable tricycle type, single wheel on each levered-suspension unit, oleo-pneumatic shock-absorbers, mainwheel tyres size 500 × 170 mm, pressure 3.9 bars (57 lb/sq in); nosewheel tyre size 400 × 150 mm, pressure 2.95 bars (43 lb/sq in); nosewheel steerable ±40°, anti-skid brakes on mainwheels. Designed for operation from grass airfields.

POWER PLANT: One 261 kW (350 hp) Teledyne Continental TSIOL-550-B flat-six piston engine, buried in centre-fuselage behind wings, five-blade propeller. Oil capacity 12 litres (3.2 US gallons; 2.6 Imp gallons).

ACCOMMODATION: Pilot and passenger on individual front seats, two persons on 1.14 m (3 ft 8¾ in) wide rear bench seat. Provision for carrying 400 kg (882 lb) freight instead of passengers, or for ambulance, search and rescue and other missions. Interior air conditioned. Large door with automatically retractable airstairs on each side.

SYSTEMS: Hydraulic system for landing gear actuation, nosewheel steering and spoilers, pressure 148 bars (2,150 lb/sq in). Servo assisted brakes. Electric anti-icing system. Oxygen system standard. Nitrogen system for emergency landing gear extension.

AVIONICS: Designed for AlliedSignal Silver Crown avionics, for day/night VFR/IFR operation, into paved or unpaved fields, including those without ILS aids.

EQUIPMENT: Safety features include quick-response parachute. Options include bar, audio-visual system, TV camera and satcom.

DIMENSIONS, EXTERNAL:
Wing span — 12.55 m (41 ft 2¼ in)
Wing chord: at root — 1.70 m (5 ft 7 in)
at tip — 0.98 m (3 ft 2½ in)
Length overall — 9.71 m (31 ft 10¼ in)
Height overall — 3.94 m (12 ft 11¼ in)
Tailplane span — 5.00 m (16 ft 5 in)
Wheel track — 2.24 m (7 ft 4¼ in)
Wheelbase — 3.57 m (11 ft 8½ in)
Propeller diameter — 2.60 m (8 ft 6½ in)
Propeller ground clearance — 1.06 m (3 ft 5¾ in)
Doors (each): Height — 1.20 m (3 ft 11¼ in)
Width — 1.80 m (5 ft 10¾ in)

AREAS:
Wings, gross — 16.83 m² (181.16 sq ft)
Ailerons (total) — 1.03 m² (11.09 sq ft)
Trailing-edge flaps (total) — 3.60 m² (38.75 sq ft)
Spoilers (total) — 1.28 m² (13.79 sq ft)
Fins (total) — 2.24 m² (24.11 sq ft)
Rudder — 0.48 m² (5.17 sq ft)
Tailplane — 2.28 m² (24.54 sq ft)
Elevator — 2.01 m² (21.64 sq ft)
Winglets — 0.38 m² (4.09 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped — 1,105 kg (2,436 lb)
Max payload — 500 kg (1,102 lb)
Max T-O and landing weight — 1,900 kg (4,188 lb)
Normal T-O weight — 1,700 kg (3,748 lb)
Max zero-fuel weight — 1,615 kg (3,560 lb)
Max wing loading — 112.9 kg/m² (23.12 lb/sq ft)
Max power loading — 7.28 kg/kW (11.97 lb/hp)

PERFORMANCE (estimated):
Never-exceed speed — 235 kts (435 km/h; 270 mph)
Max cruising speed at 3,000 m (9,840 ft) — 200 kts (370 km/h; 230 mph)
Econ cruising speed — 118 kts (220 km/h; 136 mph)
Stalling speed, flaps down — 51 kts (95 km/h; 59 mph)
Max rate of climb at S/L — 540 m (1,770 ft)/min
Service ceiling — 6,000 m (19,685 ft)
T-O run — 340 m (1,115 ft)
T-O to 15 m (50 ft) — 480 m (1,575 ft)
Landing from 15 m (50 ft) — 420 m (1,380 ft)
Landing run — 180 m (590 ft)
Balanced runway length — 600 m (1,970 ft)
Range: with max payload — 1,370 n miles (2,540 km; 1,578 miles)
with max fuel — 2,536 n miles (4,700 km; 2,920 miles)

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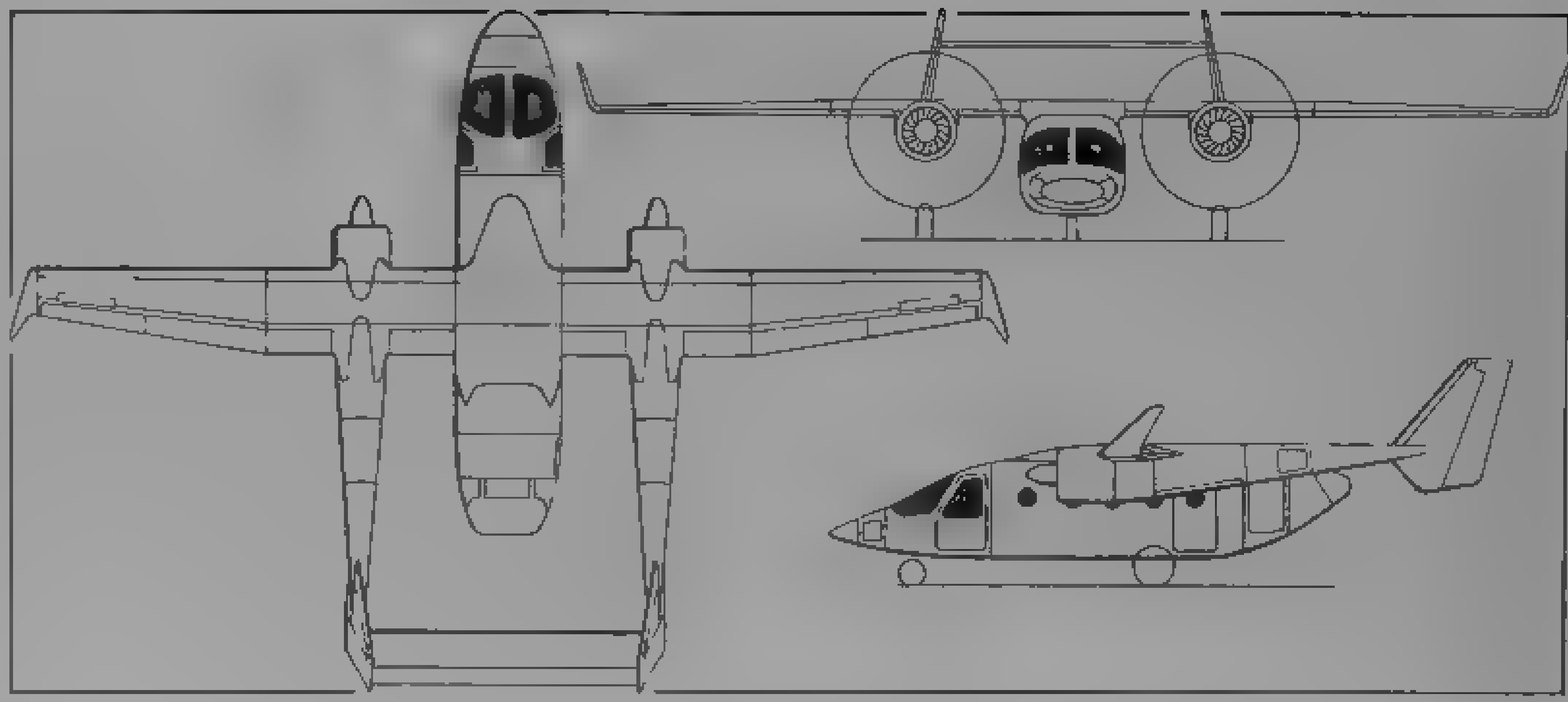


Sukhoi S-986 twin-engined multipurpose light transport *(Jane's/Mike Keep)*

1994

SUKHOI S-986

TYPE: Twin-engined multipurpose light transport.

PROGRAMME: Design started 1993.

DESIGN FEATURES: High-wing, podded fuselage, twin-boom configuration, winglets, inward-canted sweptback fins and rudders. Wing thickness/chord ratio 16 per cent at root, 12 per cent at tip; no dihedral. See three-view drawing for further detail.

FLYING CONTROLS: Conventional three-axis; spoilers forward of ailerons, three-section trailing-edge flaps.

LANDING GEAR: Hydraulically retractable tricycle type, single wheel on each unit. Mainwheels retract rearward into booms.

POWER PLANT: Two 265 kW (355 hp) VOKBM M-14P nine-cylinder radial engines, three-blade MTV-3-B/250-21 propellers. Fuel capacity 550 litres (145 US gallons; 121 Imp gallons). Oil capacity 30 litres (8 US gallons; 6.5 Imp gallons).

ACCOMMODATION: Two crew side by side; cabin will seat up to nine passengers or can be equipped for agricultural, forest patrol and firefighting, or emergency rescue missions. Doors on each side of flight deck and at rear of cabin on port side.

DIMENSIONS, EXTERNAL:
Wing span — 16.00 m (52 ft 6 in)
Wing chord: at root — 1.50 m (4 ft 11 in)
at tip — 0.90 m (2 ft 11½ in)
Length overall — 11.60 m (38 ft 0¾ in)
Fuselage: Length — 9.00 m (29 ft 6½ in)
Depth — 1.80 m (5 ft 10¾ in)
Width — 1.80 m (5 ft 10¾ in)
Height overall — 4.00 m (13 ft 1½ in)
Tailplane span — 4.60 m (15 ft 1 in)
Wheel track — 4.90 m (16 ft 1 in)
Wheelbase — 4.20 m (13 ft 9⅓ in)
Propeller diameter — 2.50 m (8 ft 2½ in)
Distance between propeller centres — 4.90 m (16 ft 1 in)
Cabin door: Height — 1.35 m (4 ft 5¼ in)
Width — 0.80 m (2 ft 7½ in)
Rear hatch: Depth — 1.00 m (3 ft 3¼ in)
Width — 1.20 m (3 ft 11¼ in)
Emergency exit: Height — 0.915 m (3 ft 0 in)
Width — 0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:
Cabin: Length — 5.90 m (19 ft 4¼ in)
Max width and height — 1.68 m (5 ft 6 in)
Floor area — 9.00 m² (96.88 sq ft)
Volume — 16.70 m³ (590.00 cu ft)

AREAS:
Wings, gross — 21.20 m² (228.20 sq ft)
Vertical tail surfaces (total) — 5.60 m² (60.28 sq ft)
Horizontal tail surfaces (total) — 3.50 m² (37.67 sq ft)

WEIGHTS AND LOADINGS:
Weight empty — 2,300 kg (5,070 lb)
Max fuel — 550 kg (1,212 lb)
Max T-O weight — 4,000 kg (8,818 lb)
Max wing loading — 188.7 kg/m² (38.64 lb/sq ft)
Max power loading — 7.55 kg/kW (12.42 lb/hp)

PERFORMANCE (estimated):
Never-exceed speed — 242 kts (450 km/h; 280 mph)
Max level speed — 188 kts (350 km/h; 217 mph)
Econ cruising speed — 113 kts (210 km/h; 130 mph)
Max rate of climb at S/L — 420 m (1,375 ft)/min
Rate of climb at S/L, OEI — 90 m (295 ft)/min
Service ceiling — 4,000 m (13,125 ft)
T-O run — 625 m (2,050 ft)
T-O to 15 m (50 ft) — 800 m (2,625 ft)
Landing from 15 m (50 ft) — 525 m (1,725 ft)
Landing run — 350 m (1,150 ft)
Range with max fuel — 810 n miles (1,500 km; 932 miles)

UPDATED

OTHER AIRCRAFT

There has been no recent news of the **S-86** project for a seven-seat twin-turboprop multipurpose transport, described in the 1994-95 *Jane's*.

NEW ENTRY

TECHNOAVIA

JOINT STOCK COMPANY TECHNOAVIA

7A Kronshtadsky Boulevard, 125212 Moscow
Telephone: 7 (095) 452 58 22, 452 56 03
Fax: 7 (095) 452 56 94
GENERAL DIRECTOR: Viatcheslav Kondratiev
PUBLIC RELATIONS OFFICER: Alexander Lyagushkin

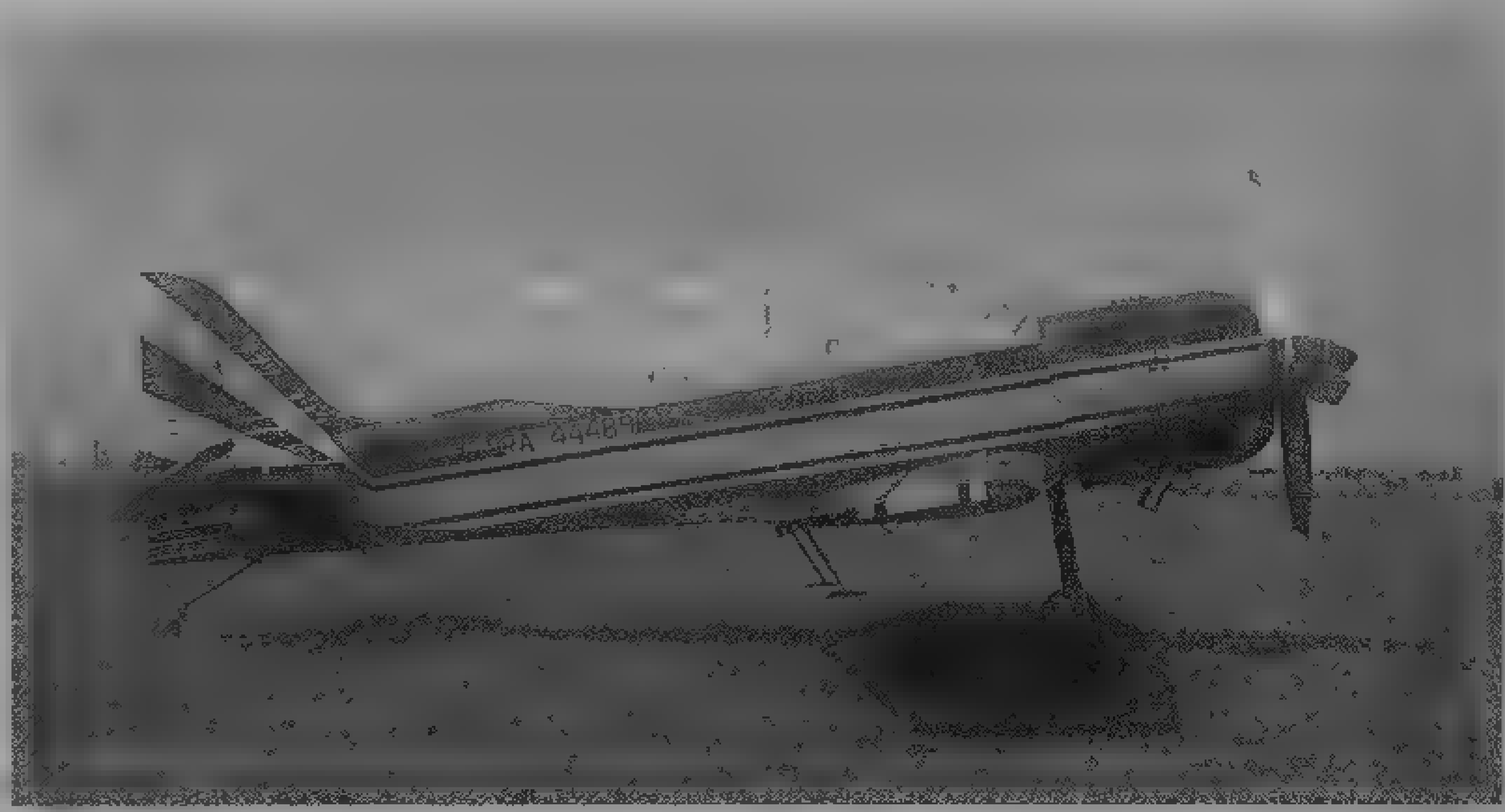
Technoavia formed 1991, acquired rights to Yakovlev Yak-18T and resumed production. Chief Designer Viatcheslav Kondratiev was earlier responsible for Sukhoi Su-26, Su-29 and Su-31 aerobatic light aircraft.

UPDATED

TECHNOAVIA SP-91 SLAVA

TYPE: Two-seat aerobatic training and competition aircraft.

PROGRAMME: Fifty aircraft of this basic design ordered by secessionist Chechnya were embargoed by Russian government; five were taken over and completed in modified form by Technoavia; renamed SP-91 Slava, one of these was undergoing flight testing and development in Moscow in early 1995, one (RA-44489) delivered to Bar Belle Aviation in the UK and three to USA for operational testing in the field. Series production version to be marketed as SP-95, listed separately.



Technoavia SP-91 Slava unlimited aerobatic aircraft *(Austin J. Brown)*

1995

DESIGN FEATURES: Conventional low wing monoplane, capable of unlimited aerobatics, tapered multispar wings of symmetrical section without dihedral or anhedral, damage to one spar or one of four wing attachments in flight would not result in wing failure, unswept horizontal tail surfaces with strut braced tailplane; sweptback vertical surfaces

FLYING CONTROLS: Three-axis, long-span drooping ailerons, horn balanced rudder and elevators Ground-adjustable tab on rudder Two suspended balance tabs on each aileron

STRUCTURE: All metal, with no expensive materials; semi-monocoque fuselage, fluted skin on rear portion of wings and all control surfaces

LANDING GEAR Non-retractable tailwheel type, cantilever mainwheel legs

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial engine, three-blade wooden controllable-pitch propeller

ACCOMMODATION Two seats in tandem

WEIGHTS AND LOADINGS

Weight empty	737 kg (1,625 lb)
Max T-O weight	950 kg (2,094 lb)

PERFORMANCE

Never-exceed speed (VNE)	242 kts (450 km/h, 280 mph)
Max level speed	162 kts (300 km/h, 186 mph)
Stalling speed, erect and inverted flight	57 kts (105 km/h, 66 mph)
Max rate of climb at S/L, pilot only	960 m (3,150 ft)/min
T-O run	70 m (230 ft)
Landing run	150 m (495 ft)
Range with max fuel	377 n miles (700 km, 435 miles)
g limits, pilot only	+12/−10
two persons	+11/−9

NEW ENTRY

TECHNOAVIA SM-92 FINIST

TYPE: Light multipurpose STOL aircraft.

PROGRAMME: Design, to FAR Pt 23 and JAR 23 standards, started July 1992, construction of first of two prototypes (RA-44482) began January 1993; first flight, as SM-92 Finist (name of a bird), made 28 December 1993; production at Smolensk, four and static test airframe built by January 1995 PT6 turboprop version under consideration, with possible assembly in Canada

CURRENT VERSIONS: Basic version for up to seven persons with baggage Convertible under field conditions to transport 600 kg (1,322 lb) freight, two stretcher patients and attendant with medical equipment, to drop six trainee parachutists or four firefighters with parachutes and firefighting equipment. Can carry hopper for 600 kg (1,322 lb) agricultural chemicals in cabin, or cameras for forest surveillance, patrolling electric power lines, gas pipeline inspection and similar duties

CUSTOMERS First delivery (aircraft No. 3, RA-44485) to Mike Crymble in UK, 21 January 1995, when orders totalled 214

COSTS $150,000 excluding radios

DESIGN FEATURES In approximate class of out-of-production DHC-2 Beaver, but less powerful and lower in cost than most used Beavers. General configuration similar to Beaver, including high wings braced by single strut each side, and non-retractable tailwheel landing gear Sweptback fin and rudder; small dorsal fin, tailplane mounted on fin, with single bracing strut each side. Special wing section by Technoavia and TsAGI No sweep, thickness/chord ratio 15 per cent; aspect ratio 10 4, dihedral 2°, incidence 3° at root, 1° at tip Wide CG range

FLYING CONTROLS Conventional three-axis, Frise-type ailerons, electrically operated, three-position (0°, 20°, 40°), two-section Fowler-type flaps on each wing, horn balanced rudder and elevators, with fluted skin, large trim tab in starboard elevator; ground-adjustable tab on ailerons and rudder Ailerons and elevators rod actuated, rudder cable-actuated

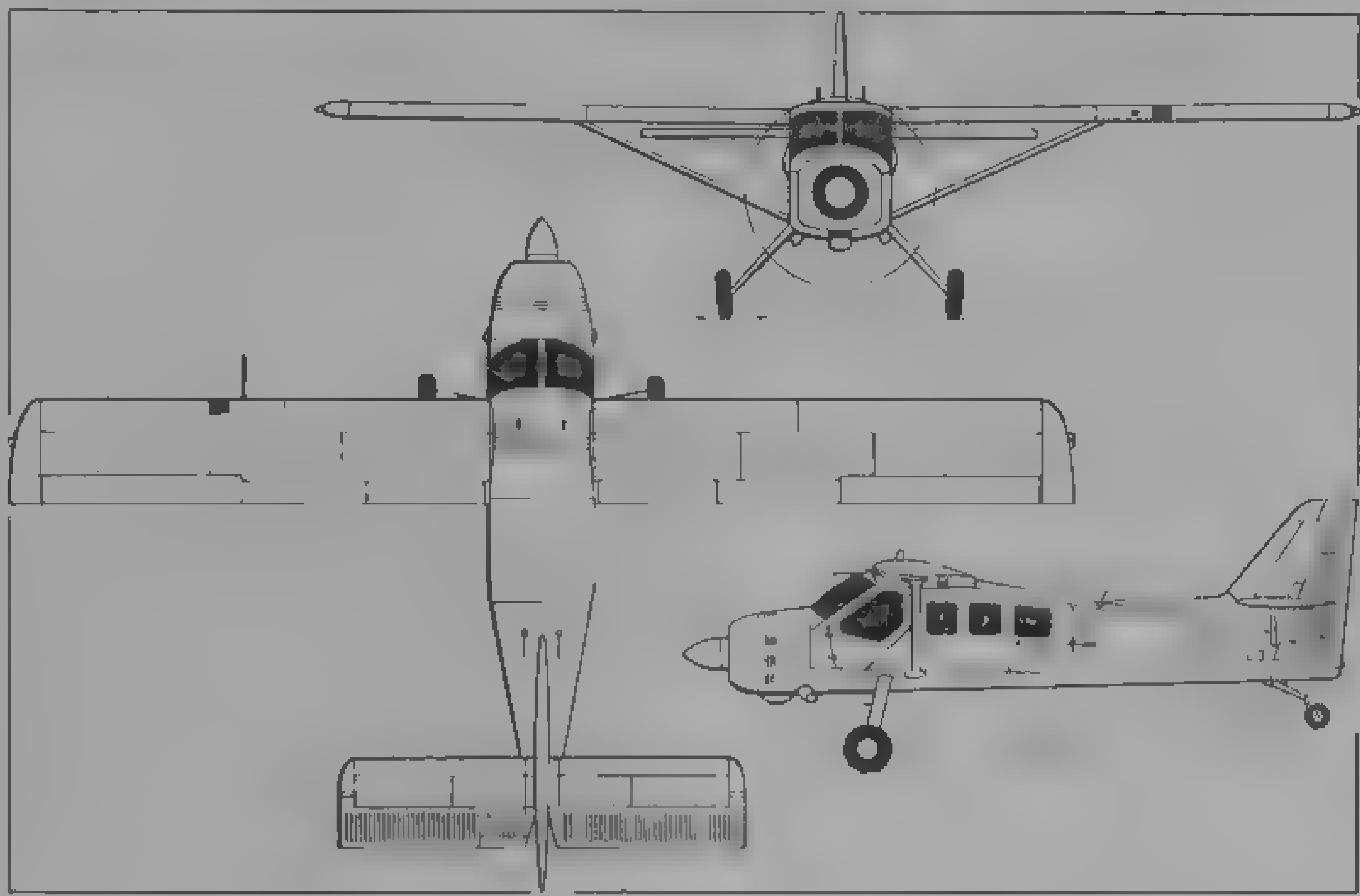
STRUCTURE All-aluminium, stressed-skin semi-monocoque construction. Simple, reliable structure, with no expensive or exotic materials; repair possible under field conditions Airframe life 10,000 hours or 20,000 landings, with "on condition" extension

LANDING GEAR Non-retractable tailwheel type with medium-pressure mainwheel tyres, size 600 × 180 mm Cantilever faired tubular steel main legs; steerable, semi-castoring tailwheel on tubular steel strut Wheel skis and floats optional Pedal-operated wheel brakes, with parking lock.

POWER PLANT: One 265 kW (355 hp) VOKBM M 14P air-cooled nine-cylinder radial engine; Mühlbauer MTV 3 three-blade variable-pitch propeller. Two fuel tanks in wing leading-edge; total capacity 380 litres (100.4 US gallons, 83.5 Imp gallons). Oil capacity 30 litres (8 US gallons, 6.6 Imp gallons)

ACCOMMODATION Pilot and six passengers, in pairs, quickly removable seats with folding armrests and back; dual controls standard for pilot training; adjustable rudder pedals Small baggage container (or medical equipment stowage for ambulance version) on port side at rear of cabin. Forward-hinged, jettisonable door each side of flight deck, large rearward-sliding passenger/freight door on port side of cabin, openable in flight. Blister windows to flight deck and cabin. Steps on mainwheel legs and cable handholds for access to flight deck, removable tubular steel ladder

First production Technoavia SM 92 Finist (*Paul Jackson*) *1995*



Technoavia SM-92 Finist seven-seat STOL aircraft (*Jane's/James Goulding*) *1995*

beneath cabin door Convertible in field to transport 600 kg (1,322 lb) of freight, two stretcher patients and two attendants, six trainee parachutists or four smokejumpers with parachutes and firefighting equipment Provision for carrying hopper for 600 kg (1,322 lb) of agricultural chemicals in cabin, or cameras for forest surveillance, patrolling electric power lines, gas pipeline inspection and similar duties Clearance adequate for underbelly pannier. Cabin heated and ventilated.

SYSTEMS. Pneumatic system for engine starting, pressure 49 bars (710 lb/sq in) 27 V DC electrical system

AVIONICS: *Comms:* AlliedSignal standard two KY96A VHF radios, GPS 150, KR87 ADF and transponder

DIMENSIONS, EXTERNAL

Wing span	14.60 m (47 ft 10¾ in)
Wing chord (constant)	1 40 m (4 ft 7¼ in)
Length overall	9 20 m (30 ft 2¼ in)
Height overall	approx 3.15 m (10 ft 4 in)
fuselage horizontal	3 94 m (12 ft 11 in)
Tailplane span	5 50 m (18 ft 0½ in)
Wheel track	3 20 m (10 ft 6 in)
Propeller diameter	2 60 m (8 ft 6½ in)
Propeller ground clearance (tail up)	0 24 m (9½ in)
Freight door: Width	1.20 m (3 ft 11¼ in)
Height	1.12 m (3 ft 8 in)

DIMENSIONS, INTERNAL

Cabin Width	1 27 m (4 ft 2 in)

WEIGHTS AND LOADINGS

Operating weight empty	1,500 kg (3,307 lb)
Max payload	600 kg (1,322 lb)
Max T-O weight	2,350 kg (5,180 lb)
Max power loading	8.87 kg/kW (14 59 lb/hp)

PERFORMANCE

Never-exceed speed (VNE)	140 kts (260 km/h, 161 mph)
Max cruising speed at S/L	124 kts (230 km/h, 143 mph)
Econ cruising speed at S/L	108 kts (200 km/h, 124 mph)
Stalling speed, flaps 40°, engine idling	54 kts (100 km/h, 62 mph)
Max rate of climb at S/L at max T-O weight	360 m (1,180 ft)/min
Service ceiling	3,000 m (9,840 ft)
T-O and landing run	200 m (660 ft)
Range with max fuel	701 n miles (1,300 km; 807 miles)

UPDATED

TECHNOAVIA SM-94

TYPE: Six-seat light multipurpose aircraft

PROGRAMME: Modification of Yakovlev Yak 18T (which see) in production and service.

DESIGN FEATURES: Generally as Yak-18T but modified to carry six persons, suitable for business, training, liaison, ambulance and other duties, including aerobatics and operation in 'hot and high' environments

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial engine, operating on low-octane Mogas

AVIONICS: Available with Russian or Western avionics and equipment

DIMENSIONS, EXTERNAL

Wing span	11 16 m (36 ft 7¼ in)
Length overall	8.55 m (28 ft 0¾ in)
Tailplane span	3 60 m (11 ft 9¾ in)
Propeller diameter	2.40 m (7 ft 10½ in)

WEIGHTS AND LOADINGS

Max fuel	250 kg (551 lb)
Max T-O weight	1,870 kg (4,122 lb)
Max wing loading	99 5 kg/m² (20.4 lb/sq ft)
Max power loading	7 06 kg/kW (11 6 lb/hp)

PERFORMANCE

Max level speed	162 kts (300 km/h, 186 mph)
Nominal cruising speed	129-140 kts (240-260 km/h, 149-161 mph)
Max rate of climb at S/L	270 m (885 ft)/min
Service ceiling	5,500 m (18,000 ft)
T-O and landing run	300 m (985 ft)
Range with max fuel	728 n miles (1,350 km, 838 miles)
g limits at 1,500 kg (3,307 lb) T-O weight	+6/−3

NEW ENTRY

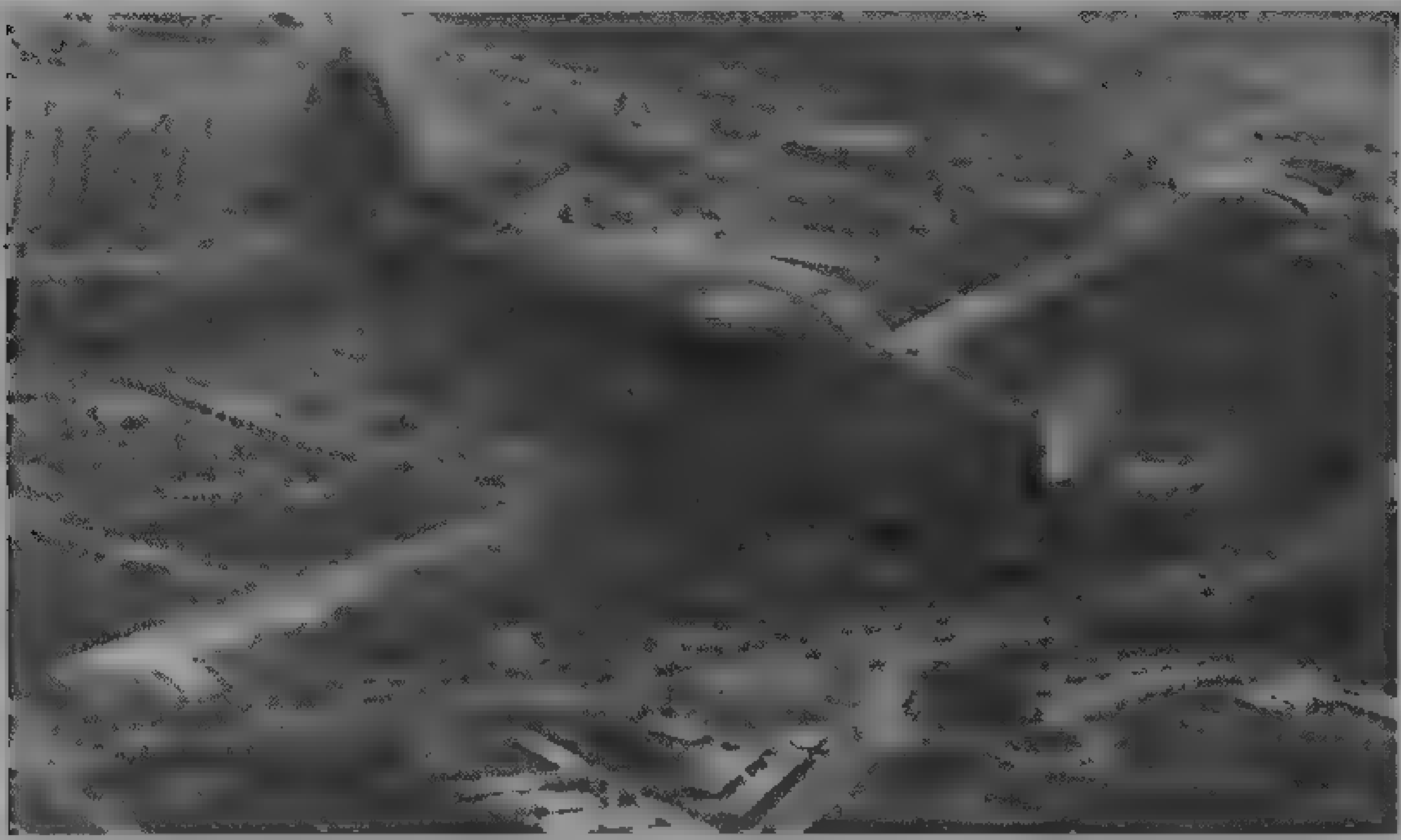
TECHNOAVIA SP-95

TYPE: Two seat aerobatic training and competition aircraft.

PROGRAMME: In 1995, new jigs being built, at Smolensk, for production of this much improved version of SP 91 Slava

DESIGN FEATURES: As SP 91 Conversion from two-seat to single-seat can be done in the field

POWER PLANT One 265 kW (355 hp) VOKBM M 14P nine-cylinder air cooled radial engine, three-blade wooden controllable pitch propeller



Technoavia SM-94 six-seat light multipurpose aircraft

1995

DIMENSIONS, EXTERNAL:
- Wing span: 8.40 m (27 ft 6¾ in)
- Length overall: 7.00 m (22 ft 11¼ in)
- Tailplane span: 3.40 m (11 ft 2 in)
- Propeller diameter: 2.50 m (8 ft 2½ in)

AREAS:
- Wings, gross: 11.70 m² (125.9 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty: 800 kg (1,764 lb)
- Max T-O weight: pilot only: 945 kg (2,083 lb)
  - two persons: 1,080 kg (2,381 lb)
- Max wing loading:
  - pilot only: 80.7 kg/m² (16.5 lb/sq ft)
  - two persons: 92.3 kg/m² (18.9 lb/sq ft)
- Max power loading: pilot only: 3.56 kg/kW (5.87 lb/hp)
  - two persons: 4.07 kg/kW (6.70 lb/hp)

PERFORMANCE (estimated):
- Never-exceed speed (V_{NE}): 242 kts (450 km/h, 280 mph)
- Max level speed: 162 kts (300 km/h, 186 mph)
- Stalling speed, erect and inverted flight: 57 kts (105 km/h, 66 mph)
- Max rate of climb at S/L: 1,020 m (3,346 ft)/min
- T-O run: 70 m (230 ft)
- Landing run: 150 m (495 ft)
- Range with max fuel: 701 n miles (1,300 km, 807 miles)
- g limits: pilot only: +12/−10
  - two persons: +11/−9

NEW ENTRY

TUPOLEV

TUPOLEV JOINT-STOCK COMPANY

15 Akademika Tupoleva, 111250 Moscow
Telephone: 7 (095) 261 24 36, 261 69 80
Fax: 7 (095) 261 71 41

GENERAL DESIGNER: Dr Alexei A. Tupolev
GENERAL DIRECTOR: Valentin T. Klimov
FIRST DEPUTY GENERAL DIRECTOR: Yuri N. Kashtanov
CHIEF DESIGNERS:
- Igor S. Kalygin
- Lev A. Lanovski
- Alexander S. Shengarat
- Yury V. Vorobiev

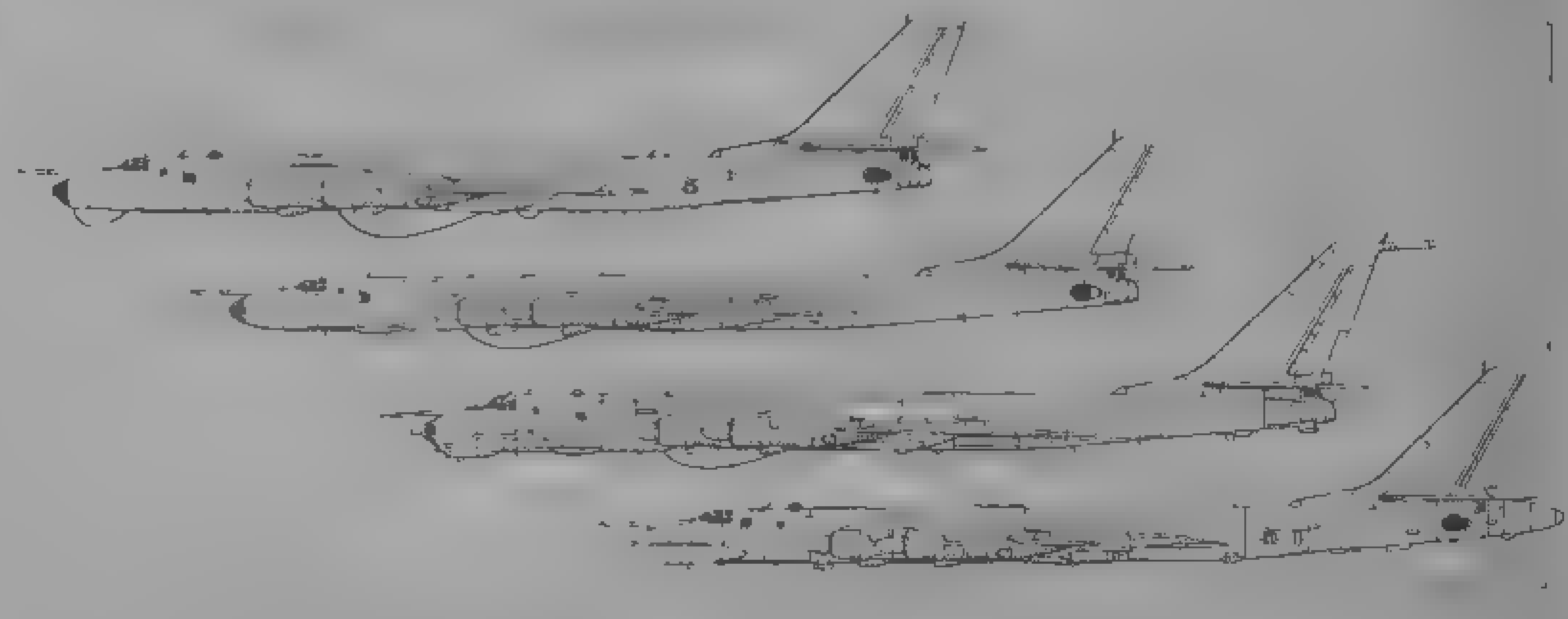
CHIEF ENGINEER: Anatoly V. Sakharov
CHIEF, INFORMATION DEPARTMENT: Valentin I. Shoubine

Andrei Nikolayevich Tupolev was leading figure in Central Aero-Hydrodynamic Institute (TsAGI) in Moscow from when it was founded, in 1918, until his death on 23 December 1972, aged 84. Bureau that bears his name concentrated primarily on large military and civil aircraft until the early 1990s; current effort is 80 per cent civil programmes, with no new military programmes since 1994.

UPDATED

Tupolev Tu-142M ('Bear-F') meets Boeing B-52H Stratofortress at an air display—a situation once seemingly impossible *(Paul Jackson)*

1995



Top to bottom, Tu-95RTs 'Bear-D', Tu-142 'Bear-F' Mod 1, Tu-142M 'Bear-F' Mod 4, Tu-95K-22 'Bear-G' *(Jane's/Dennis Punnett)*

1987

TUPOLEV Tu-95 and Tu-142

NATO reporting name: Bear

TYPE: Four-turboprop long-range bomber and maritime reconnaissance aircraft.

PROGRAMME: **Tu-95/1** prototype, with four 8,950 kW (12,000 ehp) Kuznetsov 2TV-2F turboprops, flew 12 November 1952, was destroyed during testing. **Tu-95/2** with 8,950 kW (12,000 ehp) TV-12 turboprops, flew 16 February 1955. Seven **Tu-95s** (NATO 'Bear-A') took part in 1955 Aviation Day flypast; operational with strategic attack force 1956. **Tu-95M** ('Bear-A') was modernised production version, experimental **Tu-95K** of 1956 air dropped the MiG-19 SM-20 aircraft equipped to test features of the Kh-20 missile system, production **Tu-95K-20** ('Bear-B') of 1959 was armed with a Kh-20 (AS-3 'Kangaroo') air-to-surface missile, **Tu-95KD** of 1961 was similar to Tu-95K-20, with added flight refuelling noseprobe. 'Bear' series remained in almost continuous, latterly small scale, production for 38 years, ending 1992. Variants included **Tu-96** of 1956, a high-altitude high-speed bomber development with NK-16 engines, built but not flown, **Tu-116/114D**, with Tu-95 airframe adapted as civil aircraft. **Tu-119**, a Tu-95M converted but not flown as testbed for a nuclear engine; and production **Tu-126** (NATO 'Moss') AEW&C aircraft (see 1990-91 *Jane's*).

CURRENT VERSIONS: **Tu-95RTs** ('Bear-D'): Maritime reconnaissance aircraft, entered service 1964, glazed nose, undernose radar (NATO 'Short Horn'); large underbelly radome for I band surface search radar ('Big Bulge'); elint blister fairing each side of rear fuselage, nose refuelling probe, variety of blisters and antennae, including streamlined fairing on each tailplane tip. Defensive armament comprises three pairs of 23 mm NR-23 guns in remotely controlled rear dorsal and ventral barbettes and manned tail turret; two glazed blisters on rear fuselage, under tailplane, used for sighting by gunner controlling all these guns; dorsal and ventral barbettes can also be controlled from station aft of flight deck. Housing for I band tail warning radar ('Box Tail') above tail turret is larger than on previous variants; no offensive weapons; tasks include pinpointing of maritime targets for missile launch crews on ships and aircraft that are themselves too distant for precise missile aiming and guidance; about 15 operational, probably converted from 'Bear-A' strategic bombers. A 'Bear-D' was the first Tu-95 seen, 1978, with faired tailcone housing ECM instead of normal tail turret and radome.

Tu-95MR ('Bear-E'): Strategic reconnaissance conversion of Tu-95M ('Bear-A'); armament, refuelling probe and rear fuselage elint fairings as Tu-95RTs, six camera windows in weapons bay, in pairs; seventh window to rear on starboard side.

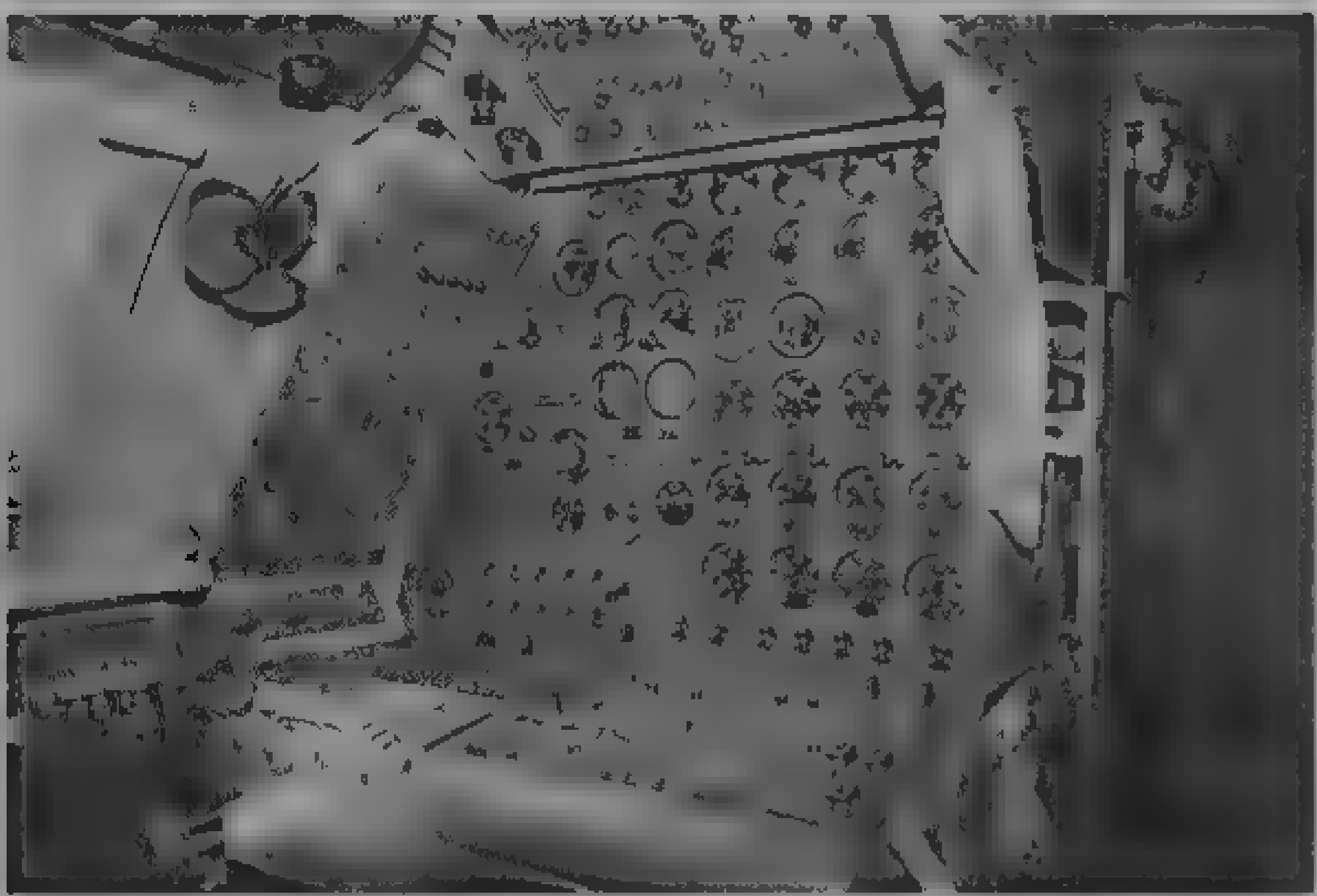
Tu-142 ('Bear-F'): Anti-submarine version, prototype flew 1968; extensively redesigned, with marked wing leading-edge camber and double-slotted flaps, longer fuselage forward of wings, rudder of increased chord. Deployed initially by Naval Aviation 1970, re-entered production mid-1980s. Initial 'Bear-Fs' had 12-wheel main landing gear bogies, retracting into enlarged and lengthened fairings aft of inboard engine nacelles, and undernose radar; main underfuselage J band radar ('Wet Eye') housing considerably farther forward than on 'Bear-D' and smaller; no large blister fairings under and on sides of rear fuselage; two stores bays for sonobuoys, torpedoes, nuclear or conventional depth charges in rear fuselage, approximately 7.5 × 1.85 m (24 ft 6 in × 6 ft) and 3.4 × 1.35 m (11 ft × 4 ft 6 in). Smaller rear bay replaces usual rear ventral gun turret, leaving tail turret as sole defensive gun position, with glazed observation blister each side under tailplane. Later 'Bear-Fs' identified as follows:

Mod 1: Reverted to standard size nacelles and standard four-wheel main landing gear bogies, tyre size 1,500 × 500 mm, pressure 10.35 bars (150 +5/−10 lb/sq in), chin-mounted J band radar deleted, fewer protrusions. Entered service December 1972.

Mod 2 (**Tu-142M**): First flown 4 November 1975, nose lengthened by 2.0 m (6 ft 6¾ in), increasing overall length to approximately 53 m (174 ft), roof of flight deck raised, angle of flight refuelling probe lowered by 4°, inertial navigation system standard. Entered service 1980.

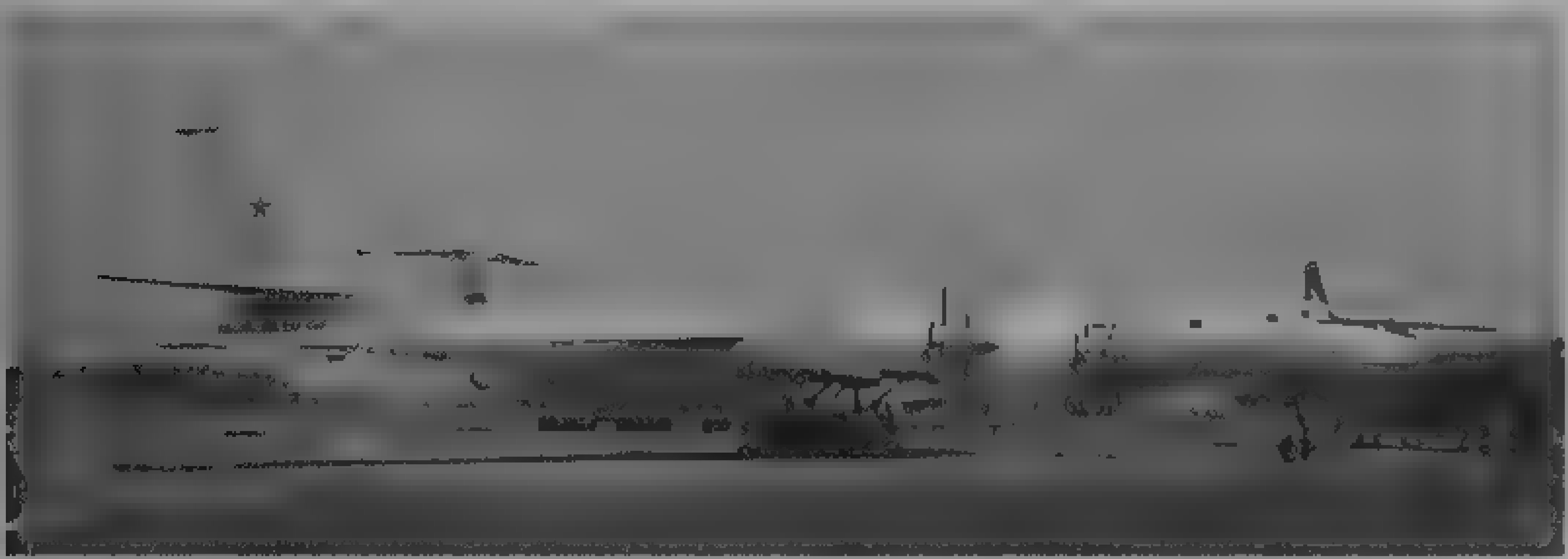
Mod 3 (**Tu-142M**): MAD boom added to fin tip, fairings at tailplane tips deleted. Normal crew of 10.

Mod 4 (**Tu-142M**): Chin radar reinstated, self-protection ECM thimble radome on nose, other fairings added, observation blister each side of rear fuselage deleted, entered service 1985, further deliveries 1991.



Crew positions in the Tu-142M ('Bear-F') include (top left) co-pilot, (above left) flight engineer, facing aft on starboard side, (top right) radio operator, facing aft on port side, and (above right) navigator, starboard side of nose. Additionally, two surveillance equipment operators occupy rearmost positions of the flight deck *(Paul Jackson)*

1995



Tupolev Tu-142M ('Bear-F' Mod 3) of Russian Naval Aviation's Northern Fleet Training Regiment at Pskov *(Paul Jackson)*

1995

The Tu-95K-22 'Bear-G' is a reconfigured 'Bear-B' or 'C' equipped to carry Kh-22 'Kitchen' missiles *(UK Ministry of Defence)*

1986

All versions of Tu-142M can carry eight Kh-35 active radar homing anti-ship missiles in underwing pairs.

Tu-95K-22 ('Bear-G'): Bomber and elint conversion of 'Bear-B/C'; two Kh-22 (AS-4 'Kitchen') air-to-surface missiles, on pylon under each wingroot; new large undernose radome ('Down Beat'); ECM thimble on nose, 'solid' tailcone containing ECM, as on some 'Bear-Ds'; ventral gun turret sole defensive armament.

Tu-95M-5: Missile carrier, with two KSR-5 (AS-6 'Kingfish') missiles, flown 1972.

Tu-95M-55: Flown 1976; carrier for Kh-55 (AS-15A 'Kent') missile.

Tu-95MS ('Bear-H'): Late production version; crew of seven, based on Tu-142 airframe but fuselage approximately same length as Tu-95. Current **Tu-95MS6** ('Bear-H6') version carries six Kh-55 (AS-15A 'Kent') long-range cruise missiles on an internal rotary launcher, the original **Tu-95MS16** ('Bear-H16') carried two more under each wingroot, and a cluster of three between each pair of engines, for a total of 16. Total of 80 built at Kuybyshev; achieved IOC 1984; larger and deeper radome (NATO 'Clam Pipe') built into nose; small fin tip fairing; no elint blister fairings on sides of rear fuselage; ventral gun turret deleted, some aircraft have single twin-barrel 23 mm gun instead of usual pair in tail turret. *Detailed description applies to this version, except where indicated.*

Tu-142MR ('Bear-J'): Identified 1986. Soviet counterpart of US Navy E-6A and EC-130Q Tacamo, with VLF communications avionics to maintain on-station all-ocean link between national command authorities and nuclear missile armed submarines under most operating conditions; large ventral pod for VLF trailing wire antenna several kilometres long, under centre-fuselage in weapons bay area; undernose fairing as 'Bear-F' Mod 4; fintip pod with trailing-edge of kind on some 'Bear-Hs'; satcom dome aft of flight deck canopy; modified 'Bear-F' airframe. With Northern and Pacific Fleets.

Tu-95U: Conversion of Tu-95M for training.

CUSTOMERS: Russia deploys 24 'Bear-G', 28 'Bear-H6' and 37 'Bear-H16'; Ukraine has two 'Bear-A/B', five 'Bear-H6' and 20 'Bear-H16'. Naval Aviation has 24 'Bear-D', 58 'Bear-F' mostly Mod 3/4, few 'Bear-J'. Indian Navy (10 'Bear-F' Mod 3).

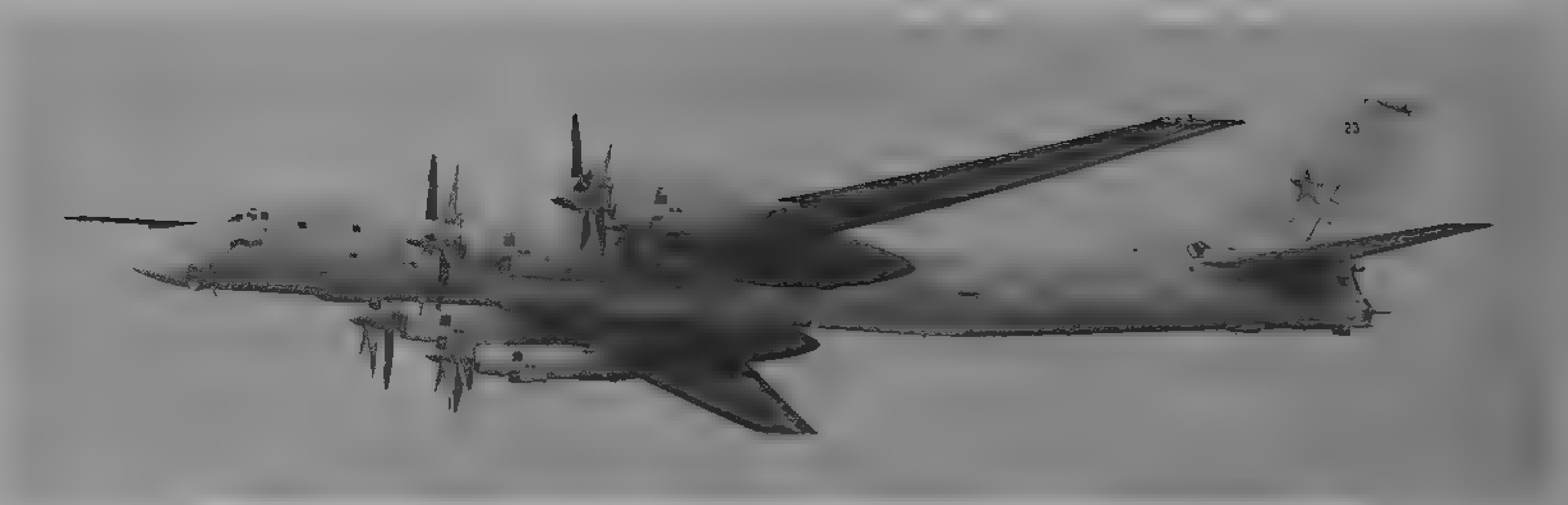
DESIGN FEATURES: Unique large, high-performance, four-turboprop combat aircraft; all-swept high aspect ratio mid-wing configuration, fuselage same diameter as US Boeing B-29/Soviet Tu-4; main landing gear retracts into wing trailing-edge nacelles; contraprops with high tip speeds; slight wing anhedral; sweepback at quarter-chord 37° on inner wings, 35° outer panels.

FLYING CONTROLS: All flying control surfaces hydraulically boosted; three-segment aileron and two-segment area increasing flap each wing; trim tab in each inboard aileron segment; upper-surface spoiler forward of each inboard aileron; adjustable tailplane incidence (3° up/1° down); trim tab in rudder and each elevator.

STRUCTURE: All-metal; four spars in each inner wing, three outboard; three boundary layer fences above each wing; circular section semi-monocoque fuselage containing three pressurised compartments; tail gunner's compartment not accessible from others.

LANDING GEAR: Hydraulically retractable tricycle type; main units consist of four-wheel bogies, tyre size (Tu-95) 1,450 × 450 mm, pressure 10.35 bars (150 +5/−10 lb/sq in) or (Tu-142) 1,500 × 500 mm; twin nosewheels, tyre size 1,140 × 350 mm, pressure 8.27 bars (120 lb/sq in); hydraulic internal expanding brakes; steerable nose unit; all units retract rearward, main units into nacelles built on to wing trailing-edge. No brake-chutes.

POWER PLANT: Four KKBM Kuznetsov NK-12MV turboprops, each 11,033 kW (14,795 ehp), eight-blade contra-rotating Type AV-60N propellers. Fuel in wing tanks, normal capacity 95,000 litres (25,100 US gallons; 20,900 Imp gallons). Single pressure refuelling point under



Tupolev Tu-95MS ('Bear-H') long-range strategic cruise missile carrier of 182 Bomber Regiment at Mozdok *(Paul Jackson)*
1995

Tupolev Tu-95RTs ('Bear-D') maritime reconnaissance variant, equipped with 'Short Horn' radar under nose and belly mounted 'Big Bulge' radar *(Royal Air Force)*
1995

starboard wingtip. Flight refuelling probe above nose extends forward further 0.5 m (1 ft 7 in) as it enters probe, fuel flows through duct on starboard side of front fuselage to main tanks, flush light each side of probe in upper part of nose aids night refuelling

ACCOMMODATION: Crew of seven: pilots side by side on pressurised flight deck, other four crew in forward compartment face rearward, com operator behind pilot, nav/defensive systems operator further aft on port side; flight engineer behind co-pilot, with spare seat for an observer; sixth flight crew member, equivalent to US bombardier/navigator, aft on central seat; gunner in rear turret compartment, with entry via ventral hatch. Remainder of crew enter through hatch in top of nosewheel bay. No ejection seats. Conveyor in flight deck floor carries crew members to hatch in nosewheel bay, with landing gear lowered, in emergency. Astrodome in roof over sixth crew member

SYSTEMS: Flight crew accommodation pressurised. Thermal anti-icing of wing and tailplane leading edges. Gas turbine APU in dorsal fin, with exhaust above tailplane leading edge

AVIONICS ('Bear-D'): *Comms*: SRO-2 IFF ('Odd Rods')

Radar: Four-PRF range J-band circular and sector scan nav radar ('Short Horn'), plus 'Big Bulge'

Flight: A-322Z Doppler radar, A-325Z Tacan, A-321 ADF, A-321B DME and ILS

Mission: Large I-band radar ('Big Bulge') in blister fairing under centre-fuselage, for reconnaissance and to provide data on potential targets for anti-shipping aircraft or surface vessels; in latter mode, PPI presentation is data-linked to missile launch station. I-band tail warning radar (originally 'Bee Hind', later 'Box Tail') in housing at base of rudder

AVIONICS ('Bear-H'): *Comms*: RSBN short-range nav system 'bow and arrow' antenna under 'Box Tail' radome. Triangular D-band IFF antenna on top of nose refuelling probe

Radar: Nav/bombing radar ('Clam Pipe') under nose; weather radar above; duct for cooling air from rear of lower radome to rear fuselage on port side, gun fire control radar ('Box Tail') at base of rudder

Self-defence: ECM fairing each side of weather radar, small pylon-mounted ECM pod each side at base of tail gunner's compartment. IR warning domes, each with about 200 discrete circular windows: under nose and above wings on top of fuselage. 'Ground Bouncer' ECM jamming system with tooth shape antennae to port side of undernose IR warning dome and under rear fuselage; RWR each side of front fuselage and fin. Eight three-tube chaff/flare dispensers in two rows aft of landing gear doors on lower side of each wing pod

ARMAMENT: See notes applicable to individual versions.

EQUIPMENT: Liferaft stowage in front of dorsal fin

DIMENSIONS, EXTERNAL ('Bear-H'):

Wing span	50.04 m (164 ft 2 in)
Wing aspect ratio	8.63
Length overall	49.13 m (161 ft 2¼ in)
Height overall	13.30 m (43 ft 7¾ in)
Wheel track	12.53 m (41 ft 1¼ in)
Propeller diameter	5.60 m (18 ft 4½ in)

AREAS:

Wings, gross	289.9 m² (3,120 sq ft)

WEIGHTS AND LOADINGS (A: 'Bear-H' Mod 3, B: 'Bear-H'):

Weight empty: B	120,000 kg (264,550 lb)
Max fuel: A	87,000 kg (191,800 lb)
Max T-O weight: A	185,000 kg (407,850 lb)
B	187,000 kg (412,258 lb)
Max landing weight: B	135,000 kg (297,620 lb)
Max wing loading: A	594.7 kg/m² (121.8 lb/sq ft)
B	645.1 kg/m² (132.1 lb/sq ft)
Max power loading: A	4.19 kg/kW (6.89 lb/shp)

PERFORMANCE ('Bear-H'):

Max level speed: at S/L	350 kts (650 km/h, 404 mph)
at 7,620 m (25,000 ft)	Mach 0.83 (499 kts, 925 km/h, 575 mph)
at 11,600 m (38,000 ft)	Mach 0.78 (447 kts, 828 km/h; 515 mph)
Nominal cruising speed	384 kts (711 km/h; 442 mph)
T-O speed	162 kts (300 km/h; 187 mph)
Landing speed, approx	146 kts (270 km/h, 168 mph)
Service ceiling: normal	12,000 m (39,370 ft)
with max weapons	9,100 m (29,850 ft)
T-O run	2,540 m (8,335 ft)
Combat radius with 11,340 kg (25,000 lb) payload: unrefuelled	3,455 n miles (6,400 km, 3,975 miles)
with one in-flight refuelling	4,480 n miles (8,300 km, 5,155 miles)

UPDATED

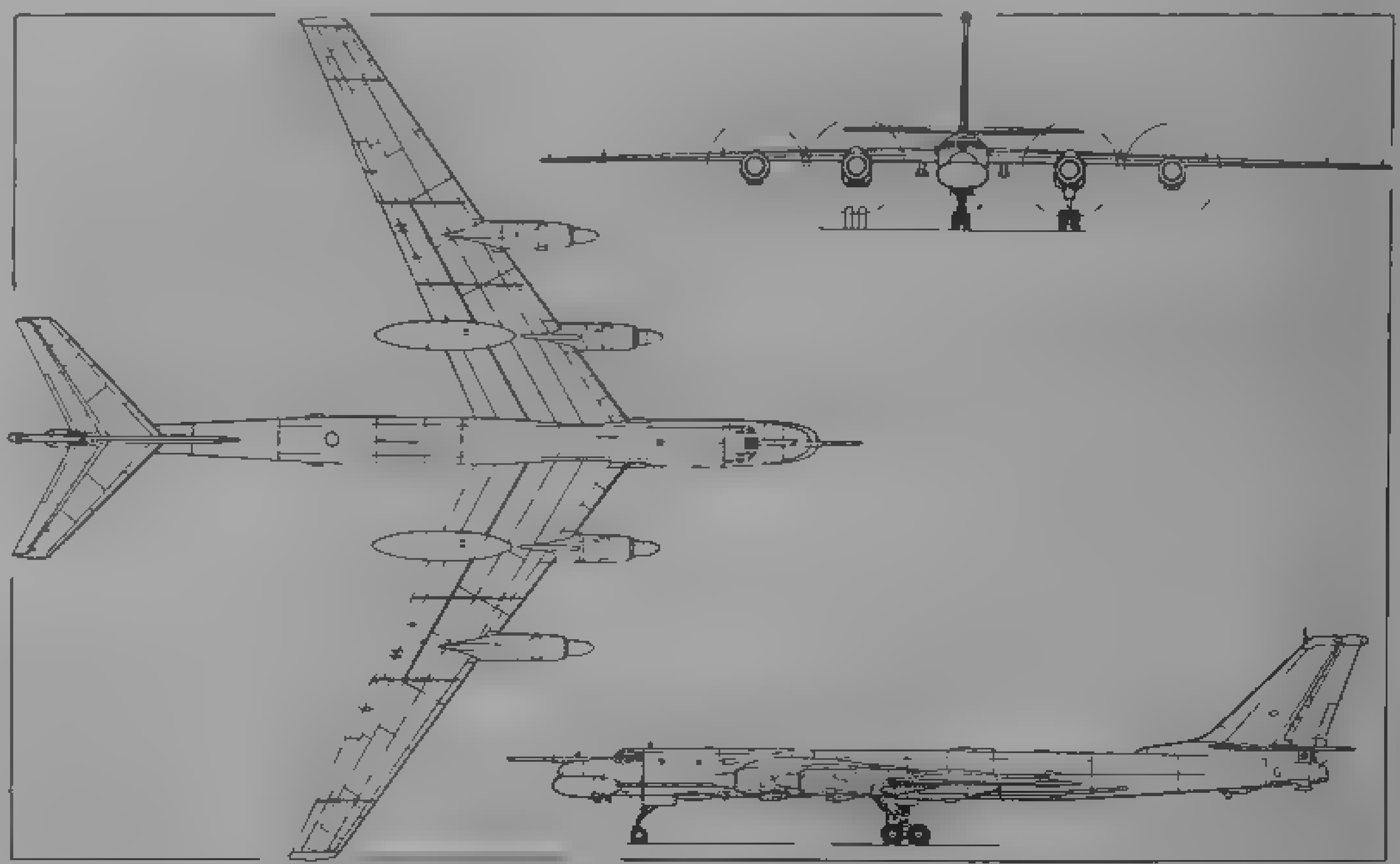
TUPOLEV Tu-22M

NATO reporting name: Backfire

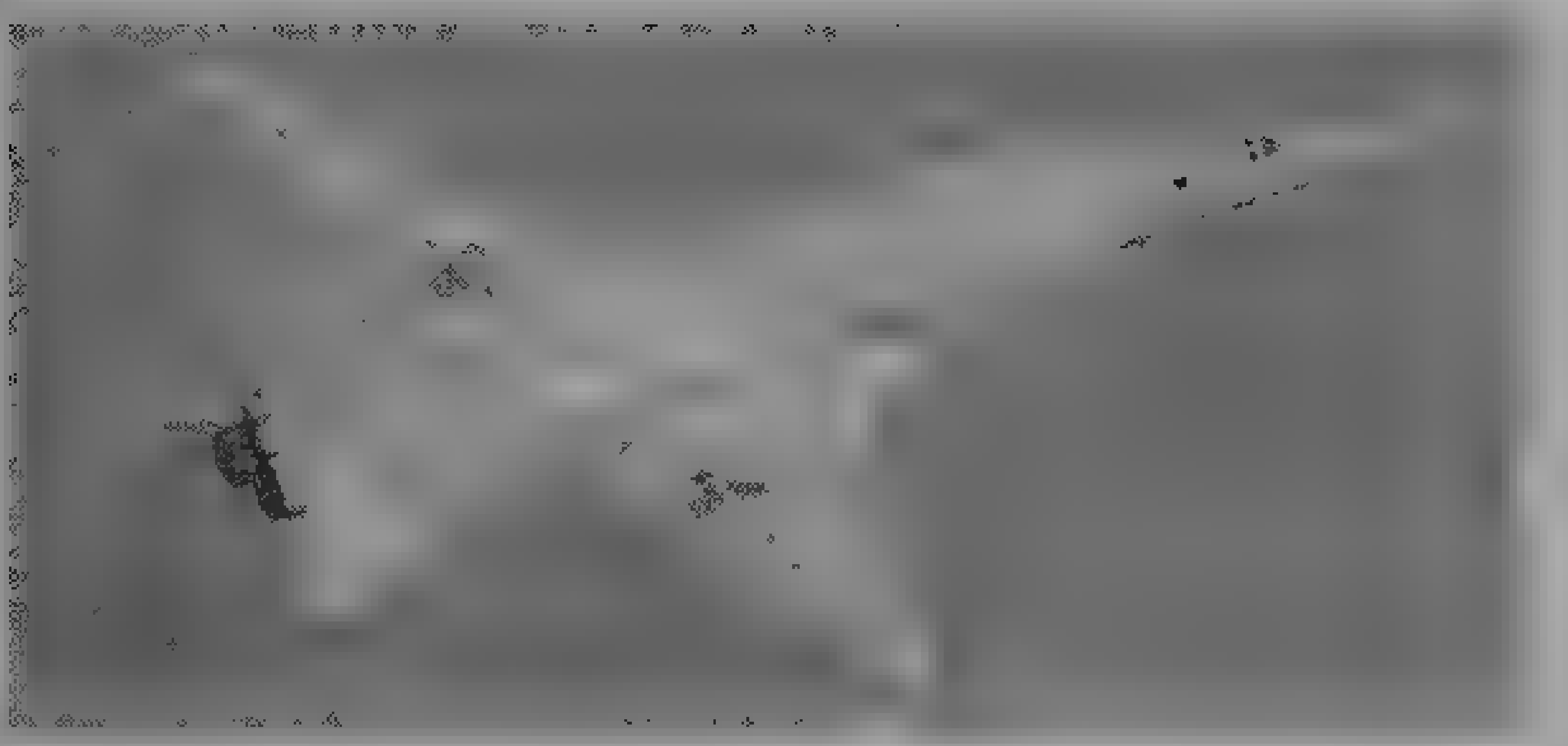
TYPE: Twin-engined variable geometry medium bomber and maritime reconnaissance/attack aircraft

PROGRAMME: NATO revealed existence of a Soviet variable geometry bomber programme Autumn 1969; development had begun 1962, to meet Soviet Air Force requirement, Tu-22MO prototype observed July 1970 on ground near Kazan plant, confirmed subsequently as twin-engined design by Tupolev OKB, first flight Summer 1969, nine Tu-22M-1 preproduction models for development testing, weapons trials and evaluation. First displayed in West at 1992 Farnborough Air Show. Production ended 1993, totalling nine Tu-22MO prototypes, nine Tu-22M-1s, 211 Tu-22M-2s and 268 Tu-22M-3s, or 497 in all

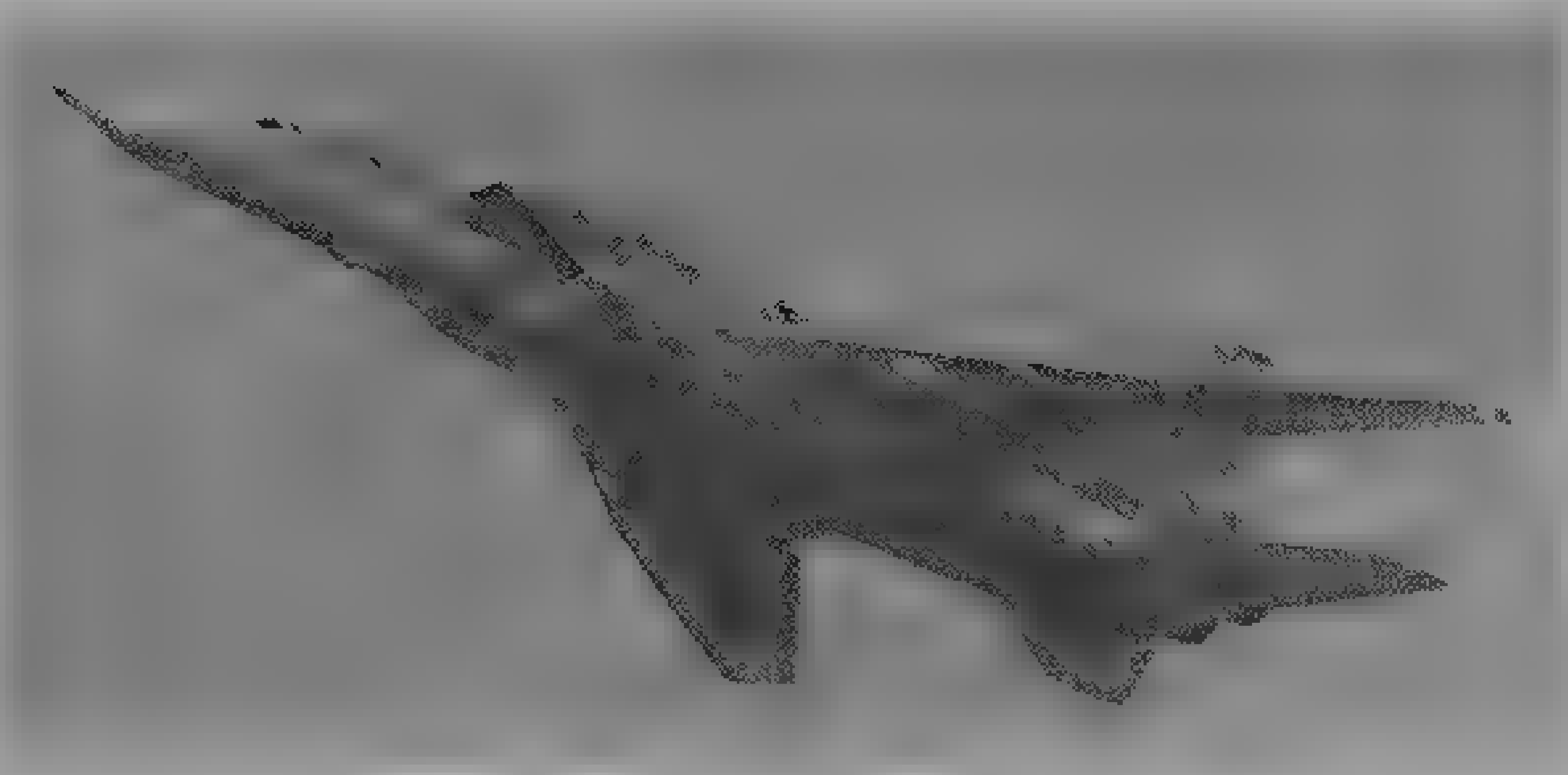
CURRENT VERSIONS: **Tu-22M-2** (Aircraft 45-02; 'Backfire-B'): First series production version, entered service 1976; differs from original Tu-22M-1 ('Backfire-A') in



Tupolev Tu-95MS strategic bomber, known to NATO as 'Bear-H' *(Jane's/Dennis Punnett)*
1987



Tupolev Tu-22M-3 with wings fully spread *(Mark Wagner/Flight International)*
1994



Tupolev Tu-22M-3 with wings fully swept
1993

having increased wing span, and wing trailing-edge pods eliminated except for shallow underwing fairings, no longer protruding beyond trailing edge, wings and tail surfaces changed to almost supercritical section during production, maximum sweep increased from 60° to 65°; slightly inclined lateral air intakes, with large splitter plates, seen usually with optional flight refuelling nose probe removed and its housing replaced by long fairing. Two Kuznetsov/KKBM NK-22 turbofans (each 215.75 kN, 48,500 lb st). Initial armament normally one Kh-22 (NATO AS-4 'Kitchen') air-to-surface missile semi-recessed under fuselage, later aircraft have maximum weapon load of 21,000 kg (46,300 lb), with rack for a Kh-22 under each fixed wing centre-section panel, for a maximum three 'Kitchens', with optional MBDZ-U9-68 external stores racks under engine air intake trunks; two GSh-23 twin-barrel 23 mm guns in UKU 9K-502 tail mounting with barrels side by side horizontally, initially beneath ogival radome, later with drum-shape radome of larger diameter. Two squadrons operational in Afghanistan December 1987 to January 1988.

Tu-22M-3 (Aircraft 45-03; 'Backfire-C'): Advanced long-range bomber and maritime version; entered service with 185th Guards Heavy Bomber Regiment 1983; deployed with Black Sea fleet air force 1985, new engines of approximately 25 per cent higher rating, wedge type engine air intakes, upturned nosecone, no visible flight refuelling probe, weapons load increased, rotary launcher in weapons bay for six Kh-15P (AS-16 'Kickback') short-range attack missiles, provision for four more underwing as alternative to standard two Kh-22 (AS-4 'Kitchens'), single GSh-23 twin-barrel 23 mm gun, with barrels superimposed, in aerodynamically improved tail mounting, beneath large drum-shape radome. Sixteen used to support withdrawal of Soviet forces from Afghanistan October 1988 to January 1989. Modernisation, primarily of bombing and navigation systems, avionics and weapons, is continuing. *Detailed description applies specifically to Tu-22M-3. Cockpit illustration in Addenda.*

A possible **electronic warfare version** has been reported.

CUSTOMERS: Total of 497 built, including prototypes. Russian air forces have 100; Naval Aviation has 165. Estimated 29 in Ukraine (15 Tu-22M with 185 Regiment at Poltava and 14 Tu-22M-3 with 260 Regiment at Stryy).

DESIGN FEATURES: Capable of performing nuclear strike, conventional attack and anti-ship missions; low-level penetration features ensure better survivability than earlier Tupolev bombers, deployment of Kh-15P (AS-16 'Kickback') short-range attack missiles in Tu-22Ms has increased significantly their weapon carrying capability. Low/mid-wing configuration, large-span fixed centre-section and two variable geometry outer wing panels (from 20 to 65° sweepback); no anhedral or dihedral; leading-edge fence towards tip of centre-section each side; basically circular fuselage forward of wings, with ogival dielectric nosecone; centre-fuselage faired into rectangular section air intake trunks, each embodying one fixed and two variable horizontal compression ramps, leading-edge of sidewalls raked at about 65°; 12 auxiliary intake doors in each duct over forward portion of wing, no external area ruling of trunks, all-swept tail surfaces, with large dorsal fin.

FLYING CONTROLS: Automatic high- and low-altitude preprogrammed flight control, with automatic approach. Full-span leading-edge slat, aileron and three-section slotted trailing-edge flaps aft of spoilers/lift dumpers on each outer wing panel, all moving differential horizontal tail surfaces, inset rudder.

LANDING GEAR: Hydraulically retractable tricycle type, rearward-retracting twin nosewheels; each mainwheel bogie comprises three pairs of wheels in tandem, with varying distances between each pair (narrowest track for front pair, widest track for centre pair); mainwheel tyres size 1,030 × 350 mm, pressure 11.75 bars (170 lb/sq in), nosewheel tyres size 1,000 × 280 mm, pressure 9.32 bars (135 lb/sq in), bogies pivot inward from vestigial fairing under centre-section on each side into bottom of fuselage. Brake-chute housed inside large door under rear fuselage.

POWER PLANT: Two Kuznetsov/KKBM NK-25 turbofans, side by side in rear fuselage, each 245.2 kN (55,115 lb st) with afterburning. Integral fuel tanks in centre-fuselage between engine ducts, centre-section carry through structure, forward portion of each fixed wing panel, between spars of variable geometry wing panels and in lower portion of fin. APU in dorsal fin. Provision for JATO rockets.

ACCOMMODATION: Pilot and co-pilot side by side, under upward-opening jettisonable gull-wing doors hinged on centreline, navigator and weapon system officer further aft, with similar doors, as indicated by position of windows between flight deck and air intakes. KT-1 ejection seats for all four crew members.

SYSTEMS: Air conditioning system supplies pressurised crew compartment and specialised equipment compartments; air bled from 12th stage of engine compressors. Three independent hydraulic systems, pressure 207 bars (3,000 lb/sq in), to power flight control system, landing gear actuation, wheelbrakes and wing sweep actuators. Pneumatic system supplied by bottles, pressure 147 bars (2,130 lb/sq in). Three independent electrical systems: 27 V DC system supplied by four GSR-20BK generators (two on each engine), with two storage batteries, 200/115 V three-phase 400 Hz AC system supplied by two GT 60 NZHCH12P generators, 36 V three-phase 400 Hz AC system supplied by two TS 350S04A transformers. Gaseous oxygen system supplied from bottles, pressure 147 bars (2,130 lb/sq in). Electrothermal anti-icing of air intakes, flight deck windows and strike sight window; hot air anti-icing of inlet guide vanes; radioactive ice detector.

AVIONICS: *Comms:* Secure com. Equipment for accurate autonomous nav.

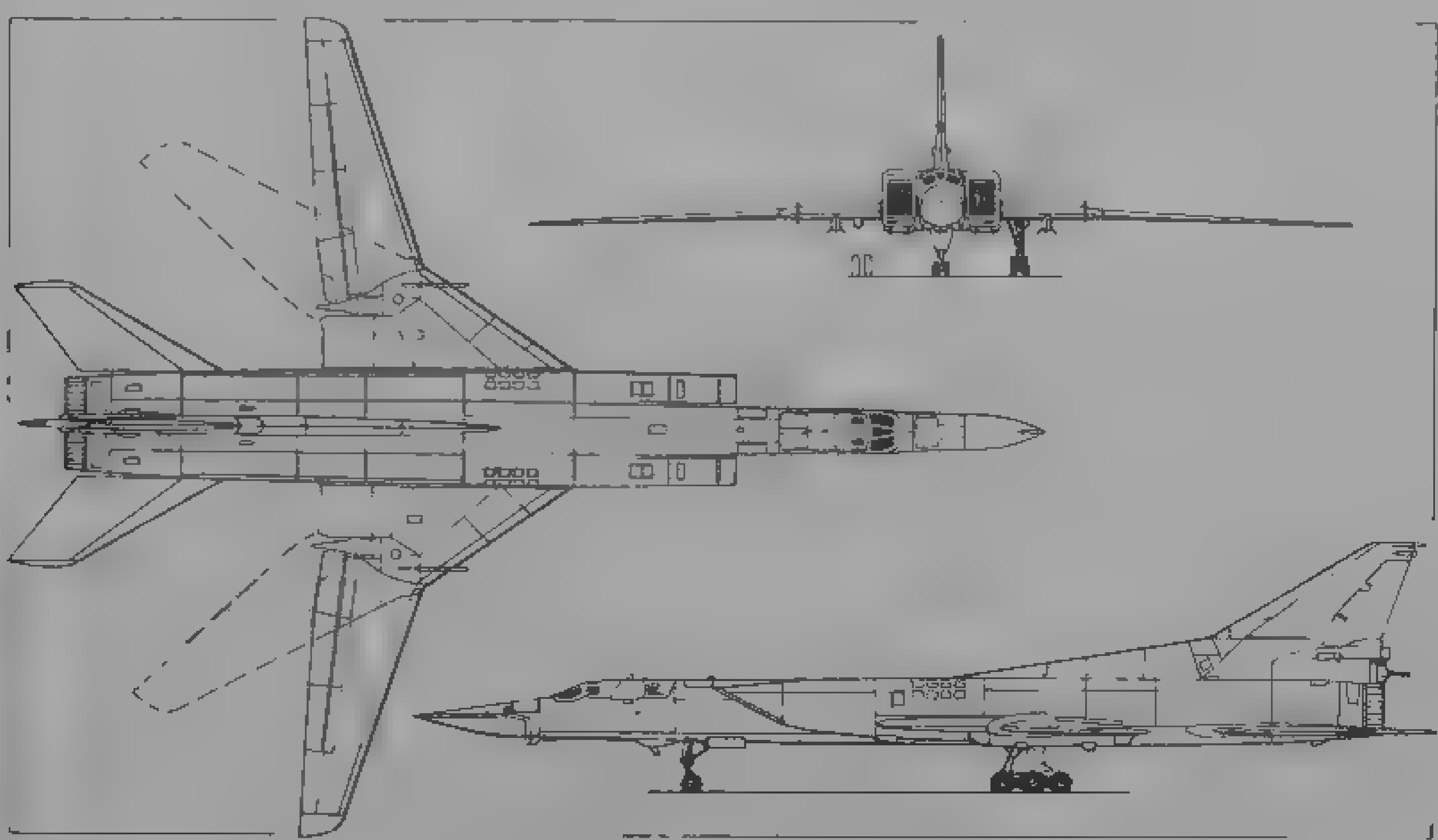
Radar: Large missile targeting and nav radar (NATO 'Down Beat') inside dielectric nosecone, radar ('Box Tail') for tail turret, above guns.

Mission: Strike sight fairing with flat glazed front panel under front fuselage, for video camera to provide visual assistance for weapon aiming from high altitude.

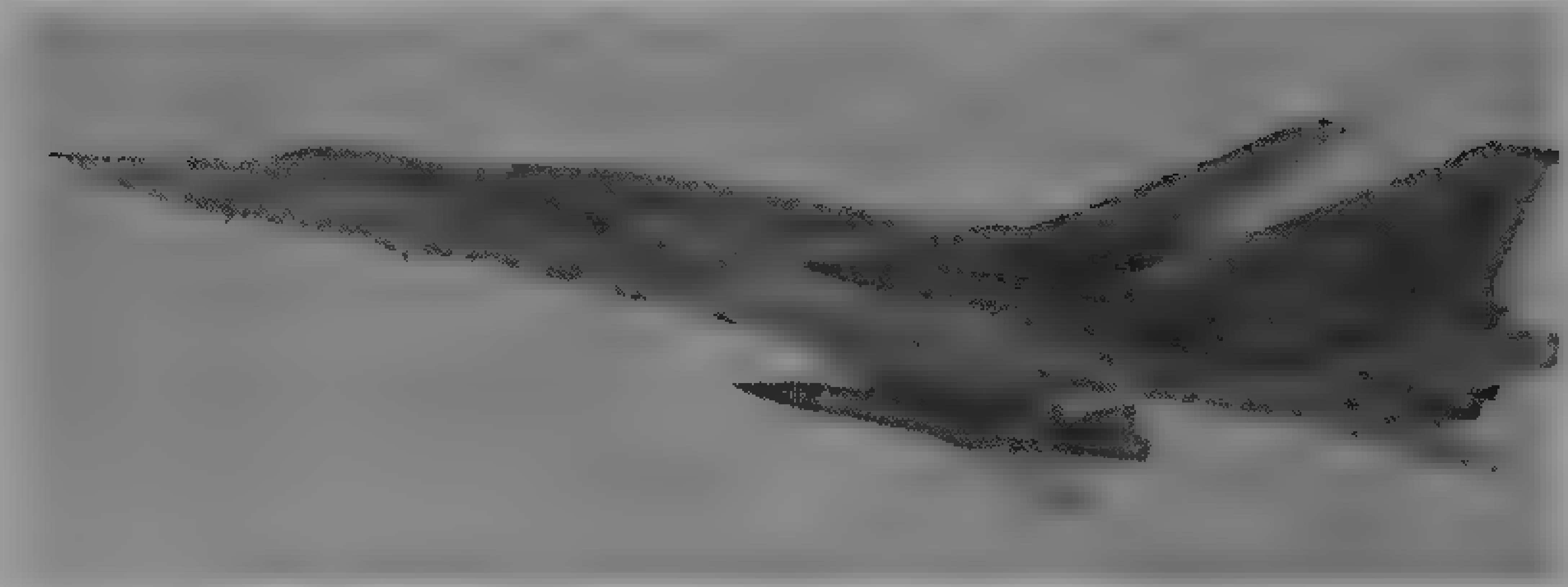
Self-defence: Infra-red missile approach warning sensor above fuselage aft of cockpit, eight chaff/flare multiple dispensers in bottom of each engine duct between wingroot and tailplane, another in each tailplane root fairing.

ARMAMENT: Maximum offensive weapon load three Kh-22 (NATO AS-4 'Kitchen') air-to-surface missiles, one semi-recessed under centre-fuselage, one under fixed centre-section panel of each wing, or 24,000 kg (52,910 lb) of conventional bombs or mines, half carried internally and half on racks under wings and engine air intake trunks. Internal bombs can be replaced by rotary launcher for six Kh-15P (AS-16 'Kickback') short-range attack missiles, with four more underwing as alternative to Kh-22s. Normal weapon load is single Kh-22 or 12,000 kg (26,455 lb) of bombs. Typical loads two FAB-3000, eight FAB-1500, 42 FAB-500 or 69 FAB-250 or -100 bombs (figures indicate weight in kg), or eight 1,500 kg or eighteen 500 kg mines. One GSh-23 twin-barrel 23 mm gun, with barrels superimposed, in radar directed tail mounting.

Tupolev Tu-22M-3 radar-directed rear armament
(Paul Jackson)
1995



Tupolev Tu-22M-3 (NATO 'Backfire-C') bomber and maritime reconnaissance/attack aircraft
(Jane's/Dennis Punnett)
1995



Tupolev Tu-22M-3 ('Backfire-C') with Kh-22 (AS-4 'Kitchen') missiles underwing *(Piotr Butowski)* *1995*

DIMENSIONS, EXTERNAL (Tu-22M-3):

Wing span: fully spread	34.28 m (112 ft 5¾ in)
fully swept	23.30 m (76 ft 5½ in)
Wing aspect ratio: fully spread	6.40
fully swept	3.09
Length overall	42.46 m (139 ft 3¼ in)
Height overall	11.05 m (36 ft 3 in)
Weapons bay: Length	approx 7.00 m (22 ft 11½ in)
Width	approx 1.80 m (5 ft 10¾ in)

AREAS:

Wings, gross: 20° sweep	183.58 m² (1,976.1 sq ft)
65° sweep	175.8 m² (1,892.4 sq ft)

WEIGHTS AND LOADINGS (Tu-22M-3):

Max weapon load	24,000 kg (52,910 lb)
Fuel load	approx 50,000 kg (110,230 lb)
Max T-O weight	124,000 kg (273,370 lb)
Max T-O weight with JATO	126,400 kg (278,660 lb)
Normal landing weight	78,000 kg (171,955 lb)
Max landing weight	88,000 kg (194,000 lb)
Max wing loading (without JATO):	
20° sweep	675.45 kg/m² (138.34 lb/sq ft)
65° sweep	705.35 kg/m² (144.45 lb/sq ft)
Max power loading (without JATO)	253 kg/kN (2.48 lb/lb st)

PERFORMANCE (Tu-22M-3):

Max level speed at high altitude	Mach 1.88 (1,080 kts, 2,000 km/h; 1,242 mph)
at low altitude	Mach 0.86 (567 kts, 1,050 km/h; 652 mph)
Nominal cruising speed at height	485 kts (900 km/h; 560 mph)
T-O speed	200 kts (370 km/h; 230 mph)
Normal landing speed	154 kts (285 km/h; 177 mph)
Service ceiling	13,300 m (43,635 ft)
T-O run	2,000-2,100 m (6,560-6,890 ft)
Normal landing run	1,200-1,300 m (3,940-4,265 ft)
Unrefuelled combat radius:	
supersonic, hi-hi-hi, 12,000 kg (26,455 lb) weapons	810-1,000 n miles (1,500-1,850 km; 930-1,150 miles)
subsonic, lo-lo-lo, 12,000 kg (26,455 lb) weapons	810-900 n miles (1,500-1,665 km; 930-1,035 miles)
subsonic, hi-lo-hi, 12,000 kg (26,455 lb) weapons	1,300 n miles (2,410 km; 1,495 miles)
subsonic, hi-hi-hi, max weapons	1,188 n miles (2,200 km; 1,365 miles)
g limit	+2.5

UPDATED

TUPOLEV Tu-160

NATO reporting name: Blackjack

TYPE: Four-engined variable geometry long range strategic bomber.

PROGRAMME: Designed as Aircraft 70 under leadership of V I Bliznyuk; prototype observed by satellite at Ramenskoye flight test centre 25 November 1981 (photograph in 1982-83 *Jane's*); first flew 19 December 1981; first exceeded Mach 1 February 1985; second prototype lost 1987; US Defense Secretary Frank Carlucci invited to inspect 12th aircraft built, at Kubinka airbase, near Moscow, 2 August 1988; deliveries to 184th Regiment, Priluki air base, Ukraine, began May 1987; production at Kazan airframe plant ended 1992.

CURRENT VERSIONS: **Tu-160** ('Blackjack'): Strategic bomber.

Tu-160SK: Launch vehicle for proposed Burlak-Diana two-stage space vehicle, described separately.

CUSTOMERS: Nineteen deployed at Priluki, Ukraine (184 Regiment), with transfer to Russia anticipated; 12 in Russia in January 1995, five of them with 1st Heavy Bomber Regiment, formed at Engels airbase mid-1992; one at Kazan; six test aircraft at Zhukovsky.

DESIGN FEATURES: Intended for high-altitude standoff role carrying ALCMs and for defence suppression, using short-range attack missiles similar to US Air Force SRAMs, along path of bomber making low-altitude penetration to attack primary targets with free-fall nuclear bombs or missiles; this implies capability of subsonic cruise/supersonic dash at almost Mach 2 at 18,300 m (60,000 ft) and transonic flight at low altitude. About 20 per cent longer than USAF B-1B, with greater unrefuelled combat radius and much higher maximum speed; low-mounted variable geometry wings, with very long and sharply swept fixed root panel, small diameter circular fuselage; horizontal tail surfaces mounted high on fin, upper portion of which is pivoted one-piece all-moving surface; large dorsal fin; engines mounted as widely separated pairs in underwing ducts, each with central horizontal V wedge intakes and jetpipes extending well beyond wing centre-section trailing-edge; manually selected outer wing sweepback 20°, 35° and 65°; when wings fully swept, inboard portion of each trailing-edge flap hinges upward and extends above wing as large fence; unswept tailfin, sweptback horizontal surfaces, with conical fairing for brake-chute aft of intersection.

FLYING CONTROLS: Fly-by-wire. Full-span leading-edge flaps, long span double-slotted trailing-edge flap and inset drooping aileron on each wing; five-section spoilers forward of flaps; all-moving vertical and horizontal one-piece tail surfaces.

STRUCTURE: Slim and shallow fuselage blended with wingroots and shaped for maximum hostile radar signal deflection.

LANDING GEAR: Twin nosewheels retract rearward; main gear comprises two bogies, each with three pairs of wheels; retraction very like that on Tu-154 airliner; as each leg pivots rearward, bogie rotates through 90° around axis of centre pair of wheels, to lie parallel with retracted leg; gear retracts into thickest part of wing, between fuselage and inboard engine on each side, so track relatively small. Nosewheel tyres size 1,080 × 400 mm, mainwheel tyres size 1,260 × 425 mm.

POWER PLANT: Four Samara/Trud NK-321 turbofans, each 137.3 kN (30,865 lb st) dry, 245.2 kN (55,115 lb st) with afterburning. In-flight refuelling probe retracts into top of nose.

ACCOMMODATION: Four crew members in pairs, on individual Zvezda K-36D ejection seats; one window each side of flight deck can be moved inward and rearward for ventilation on ground; flying controls use fighter type sticks rather than yokes or wheels; crew enter via nosewheel bay.

AVIONICS: Systems utilise around 100 computers and processors.

Radar: Nav/attack radar in slightly upturned dielectric nosecone claimed to provide terrain-following capability.

Flight: Astro-inertial nav with map display.

Instrumentation: No HUD or CRTs.

Mission: Strike sight fairing with flat glazed front panel, under forward fuselage, for video camera to provide visual assistance for weapon aiming.

Self-defence: Active ECM jamming system.

ARMAMENT: No guns. Internal stowage for free-fall bombs, short-range attack missiles or ALCMs; a rotary launcher can be installed in each of two 12.80 m (42 ft) long weapon bays, carrying 12 Kh-15P (AS-16 'Kickback') SRAMs or six Kh-55MS (AS-15 'Kent') ALCMs.

DIMENSIONS, EXTERNAL:

Wing span: fully spread (20°)	55.70 m (182 ft 9 in)
35° sweep	50.70 m (166 ft 4 in)
fully swept (65°)	35.60 m (116 ft 9¾ in)
Length overall	54.10 m (177 ft 6 in)
Height overall	13.10 m (43 ft 0 in)
Tailplane span	13.25 m (43 ft 5¾ in)
Wheel track	5.40 m (17 ft 8½ in)
Wheelbase	17.88 m (58 ft 8 in)

AREAS:

Wings, gross: fully spread	360.0 m² (3,875 sq ft)

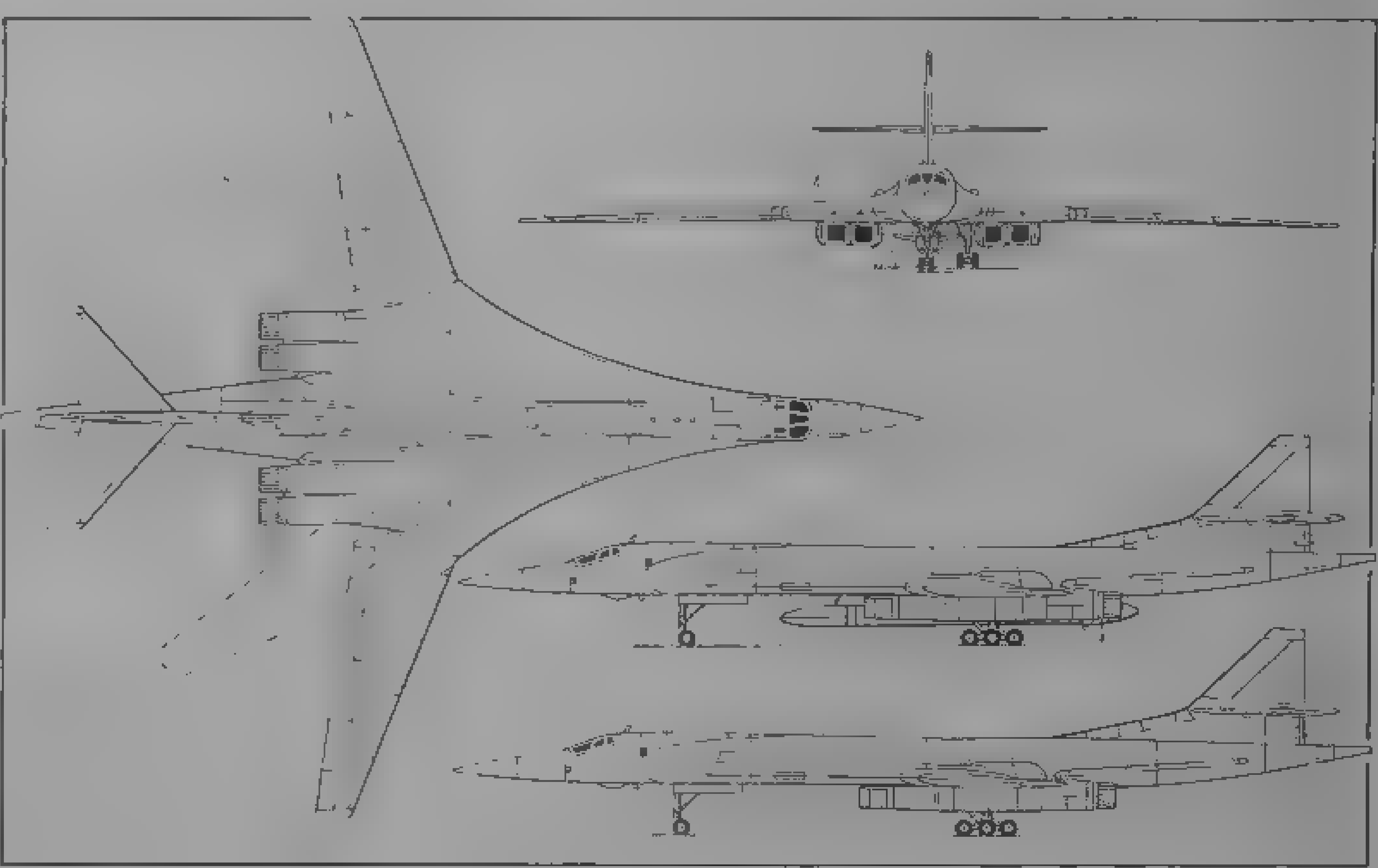
WEIGHTS AND LOADINGS:

Weight empty	118,000 kg (260,140 lb)
Max fuel	160,000 kg (352,735 lb)
Max weapon load	40,000 kg (88,185 lb)
Normal T-O weight	267,600 kg (589,950 lb)
Max T-O weight	275,000 kg (606,260 lb)
Max landing weight	155,000 kg (341,710 lb)
Max power loading	280 kg/kN (2.75 lb/lb st)

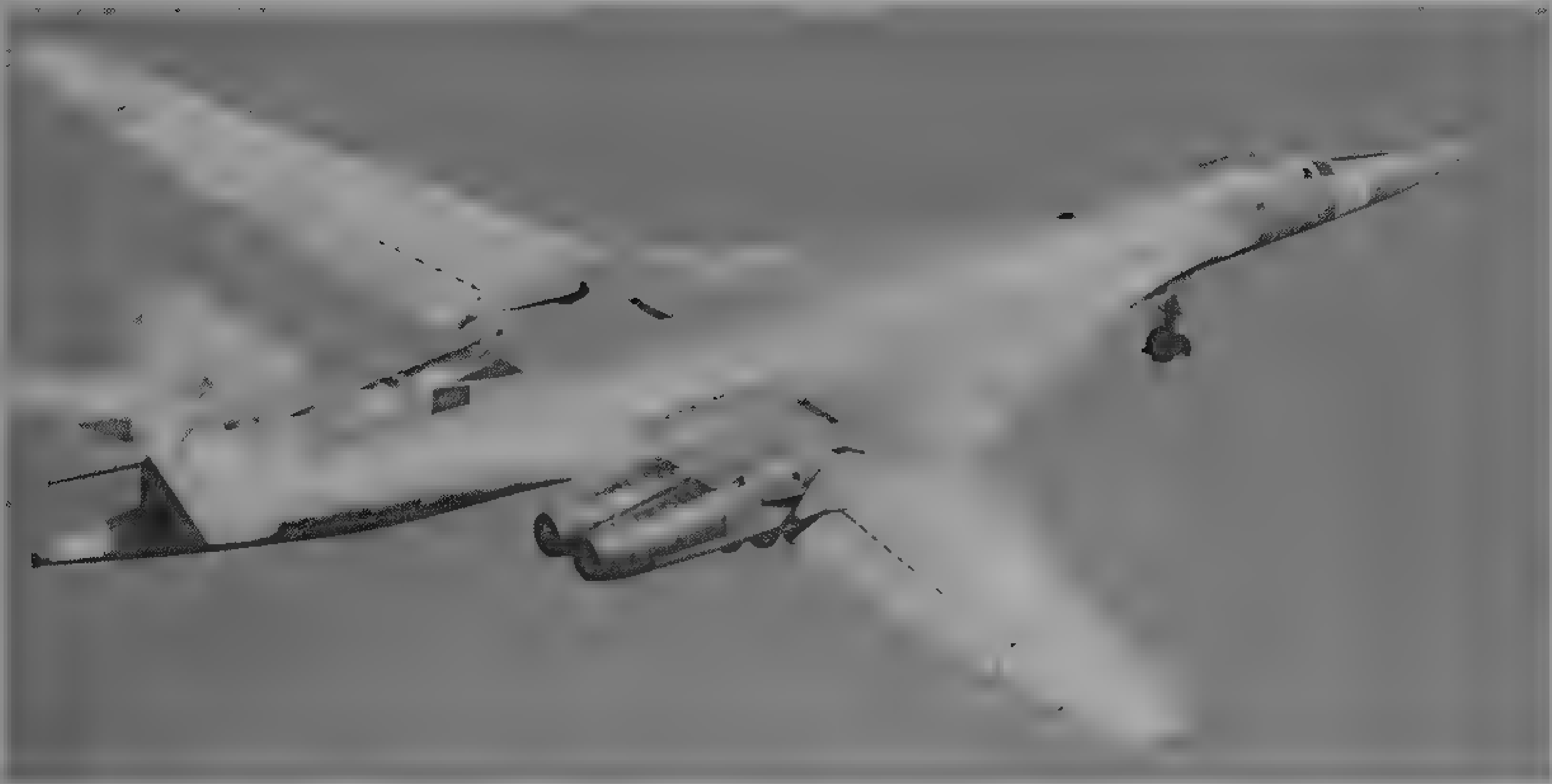
PERFORMANCE:

Max level speed at 12,200 m (40,000 ft)	Mach 2.05 (1,200 kts, 2,220 km/h; 1,380 mph)

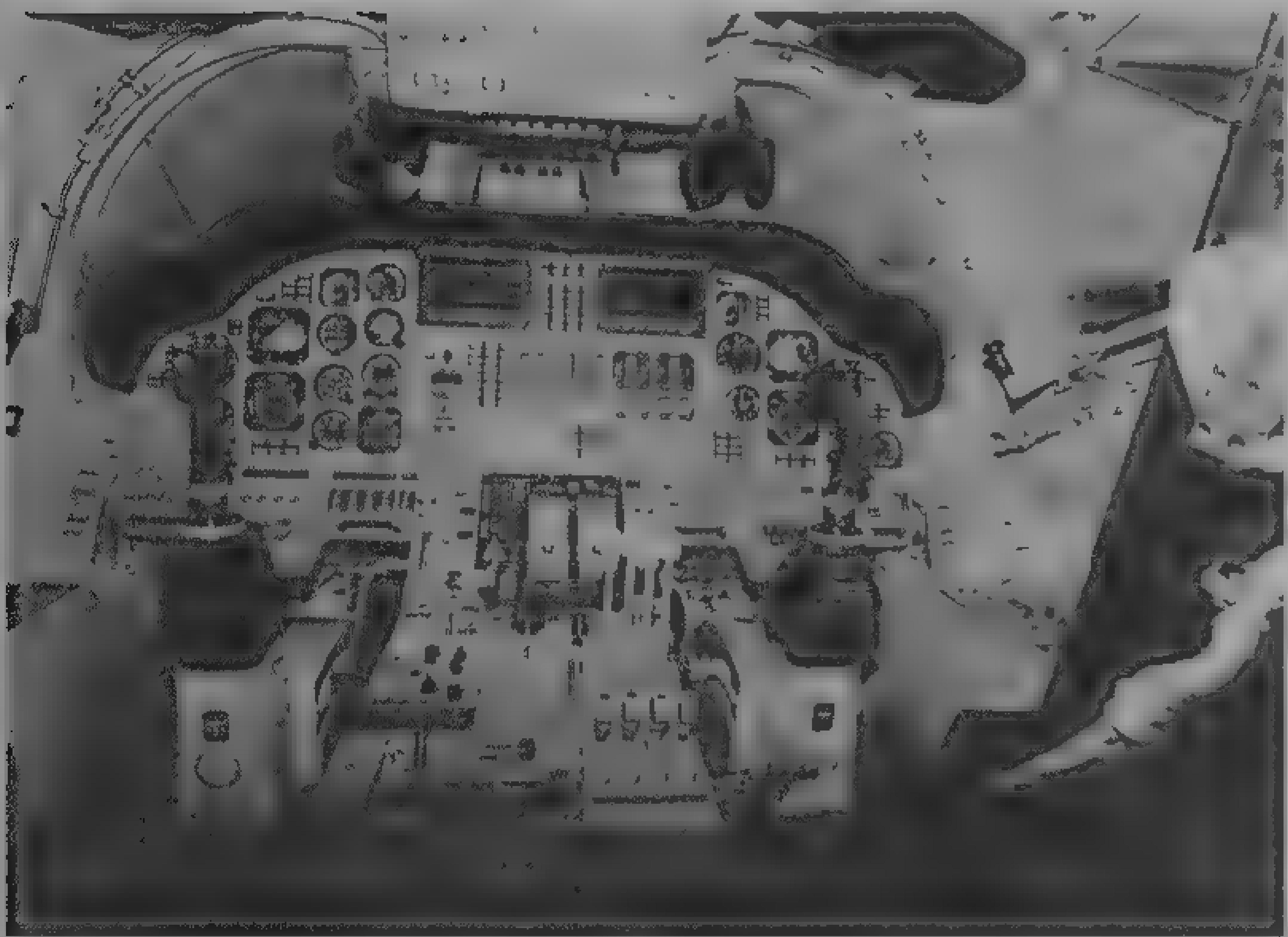
Tupolev Tu-160 making first Western appearance at 1995 Paris Salon, posing as Tu-160SK satellite launcher *(Paul Jackson)* *1995*



Three-view drawing of Tupolev Tu-160 strategic bomber, with additional side view of Tu-160SK *(Jane's/Dennis Punnett)* *1994*



Tupolev Tu-160 strategic bomber, known to NATO as 'Blackjack' (*Mark Wagner/Flight International*) *1994*



Cockpit of Tupolev Tu-160 supersonic strategic bomber *1993*

Cruising speed at 13,700 m (45,000 ft)
Mach 0.9 (518 kts, 960 km/h, 596 mph)
Max rate of climb at S/L 4,200 m (13,780 ft)/min
Service ceiling 15,000 m (49,200 ft)
T-O run at max AUW 2,200 m (7,220 ft)
Landing run at max landing weight 1,600 m (5,250 ft)
Radius of action at Mach 1.5
1,080 n miles (2,000 km, 1,240 miles)
Max unrefuelled range
6,640 n miles (12,300 km, 7,640 miles)
g limit +2

UPDATED

TUPOLEV Tu-160SK

TYPE: Conversion of Tu-160 bomber as space launch vehicle.
PROGRAMME: Announced at Asian Aerospace '94, Singapore, proposed by Russian partners MKB Raduga, OKB MEI and Tupolev, with German company OHB System.
COSTS: Payload launch cost $6,000 to 8,000/kg.
DESIGN FEATURES: Commercialised version of Tu-160 bomber (which see), as carrier component of Burlak aviation space launch complex, Burlak Diana two-stage rocket, carrying payload, under fuselage on centreline mount. System utilises Il-76 control aircraft.
ACCOMMODATION: Crew of four.

DIMENSIONS, EXTERNAL: As Tu-160 bomber, except:
Burlak rocket: Length overall 22.50 m (73 ft 10 in)
Fin span 5.0 m (16 ft 5 in)
Diameter 1.60 m (5 ft 3 in)
Burlak payload module: Length 3.50 m (11 ft 5¾ in)
Diameter 1.40 m (4 ft 7 in)

WEIGHTS AND LOADINGS:
Burlak launch weight 28,500 kg (62,830 lb)
Max Burlak payload: 200 km (124 mile) equatorial orbit
1,100 kg (2,425 lb)
200 km (124 mile) polar orbit 775 kg (1,708 lb)
1,000 km (620 mile) equatorial orbit
825 kg (1,818 lb)
1,000 km (620 mile) polar orbit 550 kg (1,212 lb)
Max T-O weight 275,000 kg (606,260 lb)
PERFORMANCE:
Max level speed, clean Mach 2.35
Speed for Burlak launch at 13,500 m (44,300 ft)
Mach 1.7
Nominal cruising speed
Mach 0.77 (459 kts, 850 km/h, 528 mph)
Required runway length 3,500 m (11,500 ft)
Nominal range:
with Burlak 2,968 n miles (5,500 km; 3,418 miles)
clean 5,936 n miles (11,000 km; 6,836 miles)

UPDATED

TUPOLEV Tu-24

TYPE: Single-engined general purpose monoplane.
PROGRAMME: Design started 1993, full scale mockup first shown at MosAeroshow '93, prototype construction began 1994.
CURRENT VERSIONS: **Tu-24SH**: Basic agricultural version, for chemicals and fertilisers.
Tu-24P: Patrol and surveillance, no external dispensing equipment.
Tu-24R: Fish shoals and sea animal survey.
Tu-24S: Ambulance, for doctor and stretcher patient.
Tu-24ST: Sport and parachutist training.
Tu-24T: Transport for five passengers or up to 800 kg (1,763 lb) freight.
Tu-24U: Trainer, pilot and student side by side.
COSTS: Basic aircraft approximately $100,000.
DESIGN FEATURES: Cantilever low-wing monoplane; unswept constant-chord wings and horizontal tail surfaces; slats on outer wings deploy automatically at angle of attack of 16°;

Mockup of Tu-24SH agricultural aircraft (VOKBM M-14PS radial engine) (*Piotr Butowski*) *1994*

cambered tips, unswept vertical tail surfaces, with dorsal fin, enclosed cabin for one or two persons side by side, with hopper in cabin aft of seats in basic agricultural version; door on port side. Designed for high manoeuvrability in agricultural use. Wing thickness/chord ratio 16 per cent, aspect ratio 6.04, dihedral 4°, incidence 3°

FLYING CONTROLS: Conventional manually operated three-axis, automatic slats on wings, trim tab in port elevator; ailerons droop with flaps

STRUCTURE: All-metal, primarily D16T aluminium alloy

LANDING GEAR: Non-retractable tailwheel type; mainwheels carried on side Vs and half axles, with built-in shock-absorbers

POWER PLANT: One 265 kW (355 hp) VOKBM M-14PS nine-cylinder air-cooled radial engine, three-blade variable-pitch propeller

ACCOMMODATION: See individual versions. Air conditioning available

SYSTEMS: Pneumatic system for engine starting, wheelbrakes and operation of agricultural equipment, pressure 50 bars (735 lb/sq in)

DIMENSIONS, EXTERNAL:

Wing span	13.00 m (42 ft 8 in)
Wing chord (constant)	2.15 m (7 ft 0¼ in)
Length overall, tail up	9.30 m (30 ft 6¼ in)
Height overall, tail up	4.60 m (15 ft 1 in)
Wheel track	3.00 m (9 ft 10¼ in)
Propeller diameter	2.50 m (8 ft 2½ in)

AREAS:

Wings, gross	28.0 m² (301.4 sq ft)

WEIGHTS AND LOADINGS:

Max chemicals, agricultural version	900 kg (1,985 lb)
Max T-O weight	2,100 kg (4,630 lb)
Max wing loading	75.0 kg/m² (15.36 lb/sq ft)

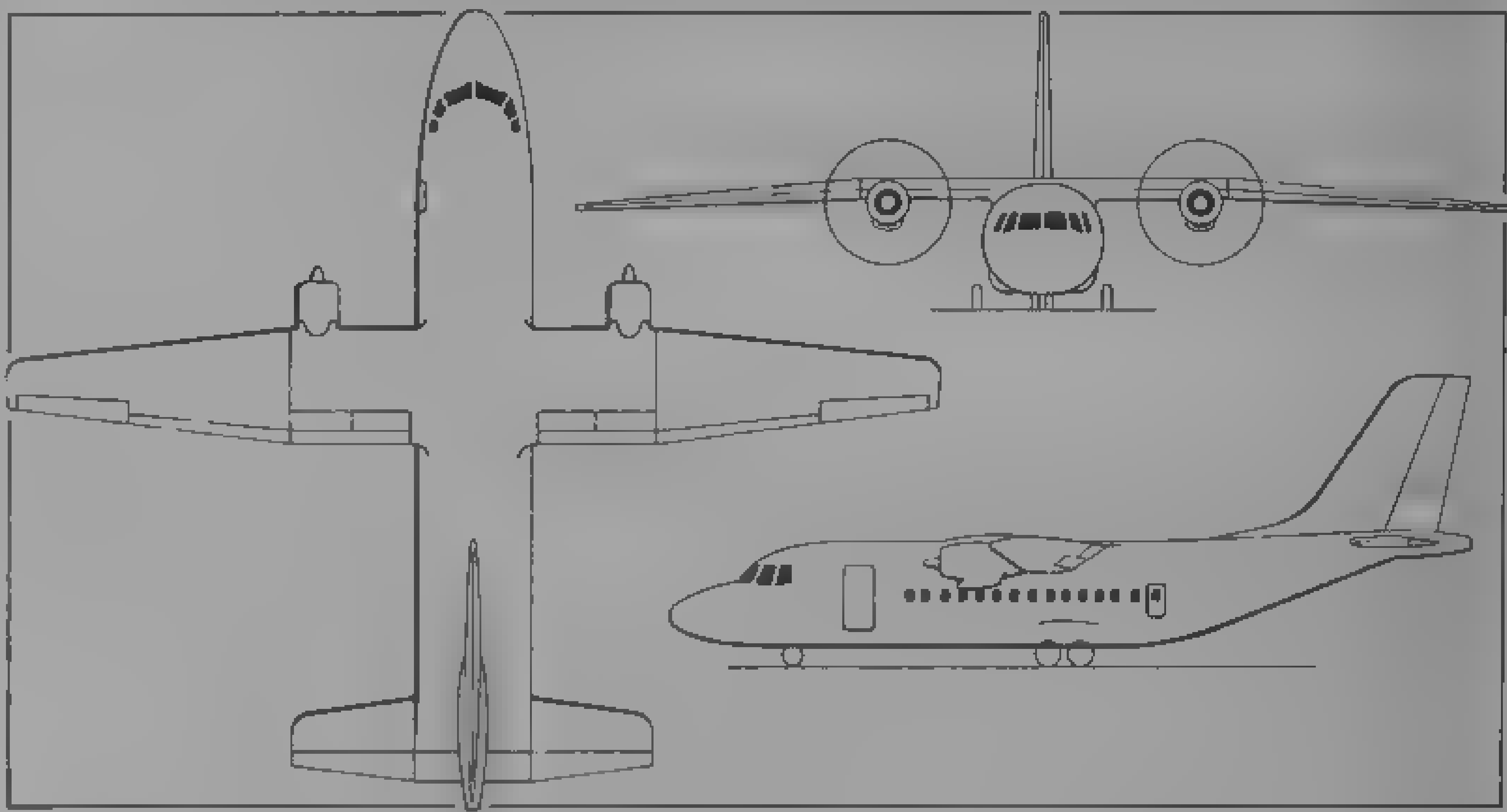
PERFORMANCE (estimated):

Max level speed	135 kts (250 km/h, 155 mph)
Nominal cruising speed	108 kts (200 km/h, 124 mph)
Spraying speed	65-75 kts (120-140 km/h, 75-87 mph)
Max rate of climb at S/L	270 m (885 ft)/min
Service ceiling	3,000 m (9,840 ft)
T-O run	180 m (590 ft)
Landing run	100 m (328 ft)
Balanced runway length	600 m (1,970 ft)
Ferry range	1,080 n miles (2,000 km, 1,240 miles)

UPDATED

Model of Tupolev Tu-130 short-range transport *(Piotr Butowski)*

1995



Tupolev Tu-130 twin-turboprop passenger/freight transport *(Jane's/Mike Keep)*

1994

TUPOLEV Tu-34

TYPE: Twin-turboprop STOL light transport

PROGRAMME: Project launched late 1990, design enlarged and revised 1993, finalised September 1994, production design under way 1995, construction of prototypes to begin early 1997, first flight scheduled late 1997, with FAR Pt 23/AR-23 certificat on 1998. Delivery of first of 400 production aircraft planned 1998

COSTS: Officially announced programme cost $22 million; standard production aircraft $1.4 million

DESIGN FEATURES: Intended to provide high degree of comfort, and multipurpose capability, from unimproved airfields. Shoulder-wing monoplane; unswept high-lift wings, with minimal anhedral from roots. Wide cabin section of fuselage tapers sharply to sweptback vertical tail surfaces, with unswept T tailplane and twin ventral fins. Engines mounted on trailing-edge of centre-section, driving pusher propellers

FLYING CONTROLS: Manually operated three-axis controls, incidence of tailplane electrically adjustable, trim tabs on port aileron, horn balanced elevator and rudder; full-span leading-edge slats, trailing-edge Fowler-type flaps and ailerons outboard of engines, two-section spoiler/airbrakes forward of flap on each wing

STRUCTURE: Basically aluminium alloy and glassfibre-based composites

LANDING GEAR: Retractable tricycle type, single wheel on each unit; nosewheel retracts forward, mainwheels rearward, upward and inward into fuselage; oleo-pneumatic shock-absorbers. Tyre size 400 × 150 mm on nosewheel, 600 × 180 mm on mainwheels. Electrically actuated brakes, with anti-skid units, on mainwheels. Floats and skis under development. Minimum ground turning radius 9.50 m (31 ft 2 in)

POWER PLANT: Two Allison 250 or Turbomeca Arrius 1D turboprops; each 313 to 335 kW (420 to 450 shp); four-blade fully feathering reversible-pitch constant-speed propellers. Fuel capacity 760 litres (200 US gallons; 167 Imp gallons)

ACCOMMODATION: Pilot and five/six passengers or equivalent freight. Door forward of wing on port side, with emergency exit opposite, separate door to baggage hold, behind rear seats. Cabin air conditioned and pressurised

DIMENSIONS, EXTERNAL:

Wing span	13.40 m (43 ft 11½ in)
Length overall	10.00 m (32 ft 9¾ in)
Tailplane span	3.80 m (12 ft 5⅝ in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase	3.425 m (11 ft 3 in)
Propeller diameter	1.80 m (5 ft 10¾ in)
Distance between propeller centres	3.00 m (9 ft 10¼ in)

DIMENSIONS, INTERNAL:

Cabin: Max width	1.55 m (5 ft 1 in)
Max height	1.34 m (4 ft 4¾ in)

AREAS:

Wings, gross	17.4 m² (187.3 sq ft)

WEIGHTS AND LOADINGS:

Max payload	700 kg (1,543 lb)
Max T-O weight	2,520 kg (5,555 lb)

PERFORMANCE (estimated):

Max cruising speed at 7,600 m (24,935 ft)	259 kts (480 km/h, 298 mph)
Stalling speed, flaps down	52 kts (96 km/h, 60 mph)
T-O and landing run	150 m (493 ft)
Balanced runway length	less than 400 m (1,313 ft)
Range: with max payload	377 n miles (700 km, 435 miles)
with max fuel	1,133 n miles (2,100 km, 1,305 miles)

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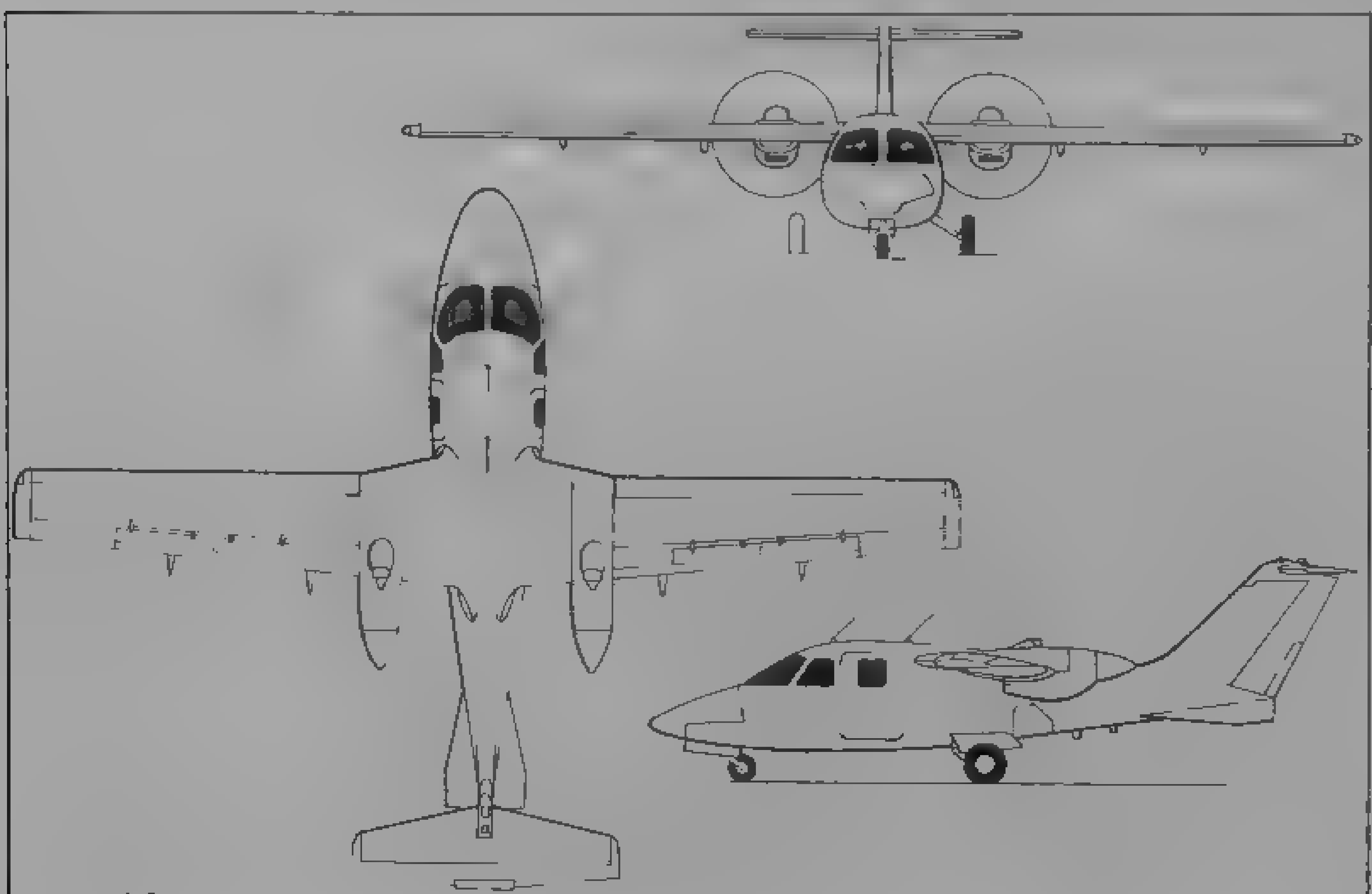


Tupolev Tu-34 six/seven-seat light utility aircraft *(Jane's/James Goulding)*

1995

TUPOLEV Tu-130

TYPE: Twin-turboprop short range passenger/freight transport

PROGRAMME: Announced and shown in form of wind tunnel model MosAeroshow '93, under active development in various forms, prototype planned to fly 1996

Tupolev Tu-154M medium-range airliner (three Aviadvigatel D-30KU-154-II turbofans) *(Peter J. Cooper)*

1995

DESIGN FEATURES: Conventional high-wing monoplane, wing in three sections, no dihedral or anhedral on centre-section, slight anhedral on outer panels, unswept wings and horizontal tail surfaces, sweptback vertical surfaces, rectangular wide-body fuselage with upswept tail embodying rear-loading ramp/door

LANDING GEAR: Retractable tricycle type, twin-wheel nose unit, each main unit comprises two wheels in tandem, retracting into long fairings on sides of fuselage.

POWER PLANT: Two 1,838 kW (2,465 shp) Klimov TV7-117C turboprops, provision for operating on propane-butane mixture and liquefied natural gas

ACCOMMODATION: Up to 53 passengers, basically five-abreast with single aisle, with galley and toilet, doors at front and rear on port side, rear-loading ramp of constant width in "beaver-tail"; alternative freight or vehicles, including four large pallets

DIMENSIONS, EXTERNAL

Wing span	26.54 m (87 ft 1 in)
Length overall	22.75 m (74 ft 7¾ in)
Height overall	8.30 m (27 ft 2¾ in)
Wheel track	3.60 m (11 ft 9¾ in)
Rear-loading ramp: Length	3.50 m (11 ft 5¾ in)
Width	2.80 m (9 ft 2¼ in)

DIMENSIONS, INTERNAL

Freight hold: Length	8.50 m (27 ft 10¾ in)
Width	2.80 m (9 ft 2¼ in)
Height	2.20 m (7 ft 2¾ in)
Floor area	23.8 m² (256.3 sq ft)
Volume	52.4 m³ (1,850 cu ft)

AREAS

Rear-loading ramp	9.8 m² (105.5 sq ft)

WEIGHTS AND LOADINGS

Max payload	5,000 kg (11,023 lb)
Max T-O weight	21,000 kg (46,300 lb)

PERFORMANCE (estimated, at max T-O weight):

Nominal cruising speed	270-280 kts (500-520 km/h, 310-323 mph)
Nominal cruising height	7,000 m (22,965 ft)
Balanced runway length	1,800 m (5,905 ft)
Range: with max payload	1,080 n miles (2,000 km; 1,242 miles)
with 3,000 kg (6,615 lb) payload	2,160 n miles (4,000 km, 2,485 miles)

VERIFIED

TUPOLEV Tu-136

TYPE: Cryogenic-fuelled twin-turboprop transport

PROGRAMME: Projected variant of Tu-130 powered by liquid natural gas, service entry nine years after go-ahead.

NEW ENTRY

TUPOLEV Tu-154M and Tu-154S

NATO reporting name: Careless

TYPE: Three-turbofan medium-range transport.

PROGRAMME: Basic Tu-154 announced Spring 1966 to replace Tu-104, Il-18 and An-10 on Aeroflot medium/long stages up to 3,240 n miles (6,000 km; 3,725 miles); SSSR-85000, first of six prototype/preproduction models flew 4 October 1968, regular services began 9 February 1972, 606 prototype and production Tu-154s and Tu-154As, Bs and B-2s with uprated turbofans and other refinements delivered, over 500 to Aeroflot (last described 1985-86 *Jane's*), prototype Tu-154M (SSSR 85317), converted from standard Tu-154B-2 (see 1990-91 *Jane's*), first flew 1982; first two production aircraft delivered to Aeroflot from GAZ 27 Kuybyshev December 1984, almost 290 built by March 1995; production continues; five delivered, 12 ordered 1994. Total Tu-154 production (all variants) almost 900

CURRENT VERSIONS: **Tu-154M**: Basic airliner with alternative standard configurations for up to 180 passengers; executive version available, with all passenger seats removed can carry light freight. *Detailed description applies to this version*

Tu-154M2: Modernised version; two Perm/Soloviev PS-90A turbofans, consuming 62 per cent as much fuel per passenger as Tu-154M, area navigation system. Intended to fly 1995. Life 20,000 hours or 15,000 cycles

Tu-154S: Specialised freight version, announced Autumn 1982; offered primarily as Tu-154B conversion, unobstructed main cabin cargo volume 72 m³ (2,542 cu ft); freight door 2.80 m (9 ft 2¼ in) wide and 1.87 m (6 ft 1½ in) high in port side of cabin, forward of wing, with ball mat inside and roller tracks full length of cabin floor, typical load nine standard international pallets 2.24 × 2.74 m (88 × 108 in) plus additional freight in standard underfloor baggage holds, volume 38 m³ (1,341 cu ft), nominal range 1,565 n miles (2,900 km, 1,800 miles) with 20,000 kg (44,100 lb) cargo

CUSTOMERS: Total of more than 750 Tu-154s in commercial use in January 1995, including 129 with Aeroflot and 44 with Aeroflot Russian International. Known Tu-154M operators number 66.

DESIGN FEATURES: Conventional all-swept low-wing configuration, two podded turbofans on sides of rear fuselage, third in extreme rear fuselage with intake at base of fin, nacelle to house retracted main landing gear on trailing-edge of each wing, wing sweep 35° at quarter-chord, anhedral on outer panels, geometric twist along span, circular section fuselage; sweepback at quarter-chord 40° on T tailplane; leading-edge sweep 45° on fin

FLYING CONTROLS: Hydraulically actuated ailerons, triple-slotted flaps, four-section spoilers forward of flaps on each wing, electrically actuated slats on outer 80 per cent each wing leading-edge, tab in each aileron, electrically actuated variable incidence tailplane; rudder and elevators hydraulically actuated by irreversible servo controls; tab in each elevator

STRUCTURE: All-metal, riveted three-spar wings, centre spar extending to just outboard of inner edge of aileron, semi-monocoque fail-safe fuselage; rudder and elevators of honeycomb sandwich construction

LANDING GEAR: Hydraulically retractable tricycle type, main bogies, each three pairs of wheels in tandem, retract rearward into fairings on wing trailing-edge; rearward-retracting anti-shimmy twin-wheel nose unit, steerable through ±63°; disc brakes and anti-skid units on mainwheels

POWER PLANT: Three Aviadvigatel D-30KU-154-II turbofans, each 104 kN (23,380 lb st), in pod each side of rear fuselage and inside extreme rear of fuselage, two lateral engines have clamshell thrust reversers. Integral fuel tanks in wings: four tanks in centre-section and two in outer wings; all fuel fed to collector tank in centre-section and thence to engines, single-point refuelling

ACCOMMODATION: Crew of three, two pilots and flight engineer, with provisions for navigator and five cabin staff. Two passenger cabins, separated by service compartments, alternative configurations for 180 economy class passengers, 164 tourist class with hot meal service, or 154 tourist/economy plus separate first class cabin seating eight to 24 persons, mainly six-abreast seating with centre aisle; washable non-flammable materials used for all interior furnishing. Fully enclosed baggage containers. Toilet, galley and wardrobe to customer's requirements. Executive and light cargo configurations available. Passenger doors forward of front cabin and between cabins on port side, with emergency and service doors opposite, all four doors open outward, six emergency exits: two overwing and one immediately forward of engine nacelle each side. Two pressurised baggage holds under floor of cabin, with two inward-opening doors; smaller unpressurised hold under rear of cabin

SYSTEMS: Air conditioning pressure differential 0.58 bar (8.4 lb/sq in). Three independent hydraulic systems, working pressure 207 bars (3,000 lb/sq in), powered by engine-driven pumps; Nos. 2 and 3 systems each have additional electric back-up pump, systems actuate landing gear retraction and extension, nosewheel steering, and operation of ailerons, rudder, elevators, flaps and spoilers. Three-phase 200/115 V 400 Hz AC electrical system supplied by three 40 kVA alternators, additional 36 V 400 Hz AC and 27 V DC systems and four storage batteries, TA-92 APU in rear fuselage. Hot air anti-icing of wing, fin and tailplane leading-edges, and engine air intakes, wing slats heated electrically. Engine fire extinguishing system in each nacelle; smoke detectors in baggage holds

AVIONICS: Avionics meet ICAO standards for Cat II weather minima

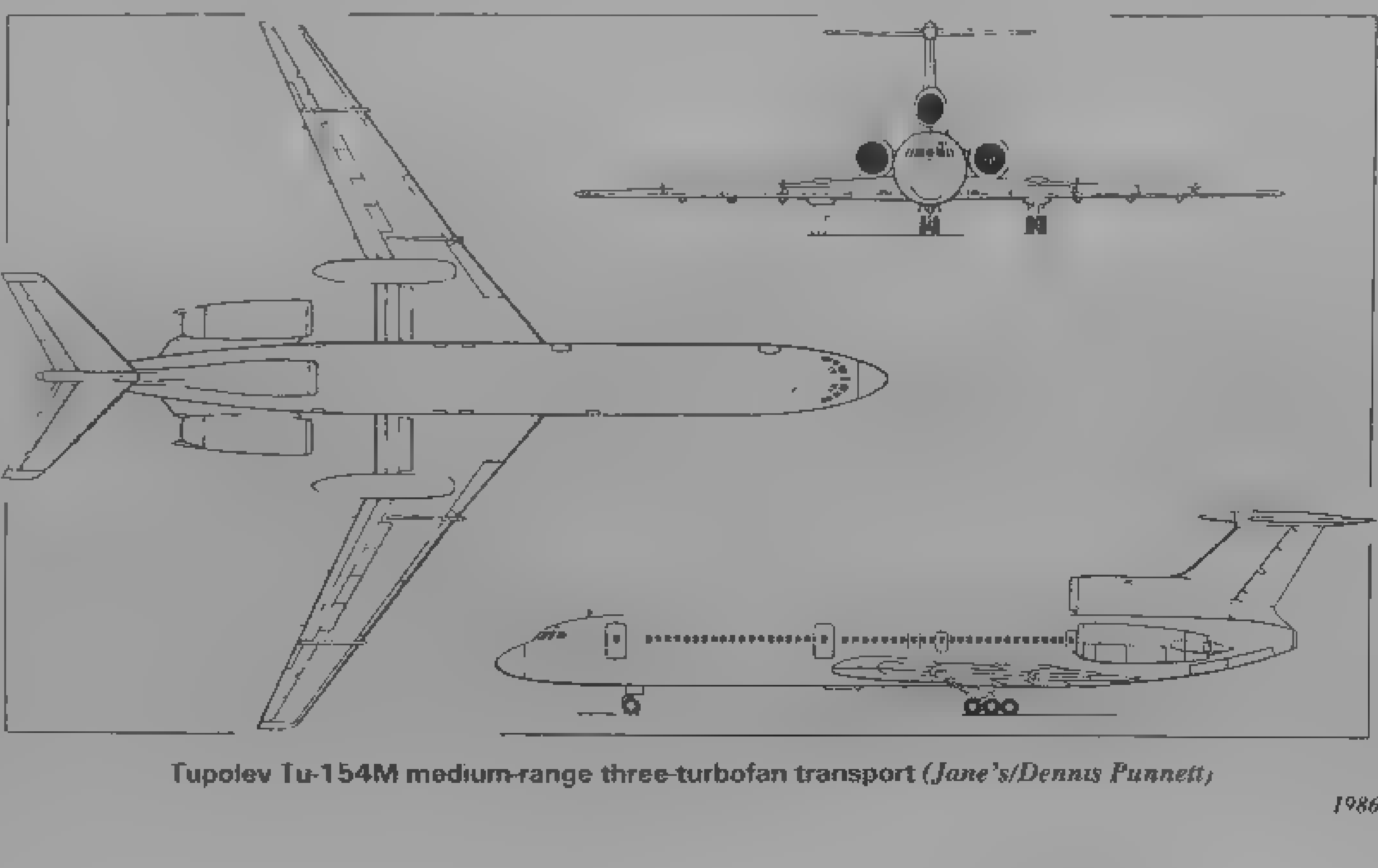
Comms: Dual HF and VHF com and emergency VHF, voice recorder, and transponder

Radar: Weather radar

Flight: Automatic flight control system operates throughout flight except during take-off to 400 m (1,312 ft) and landing from 30 m (100 ft); automatic go-round and automatic speed control provided by autothrottle down to 10 m (33 ft) on landing; triplex INS, Doppler and GPWS

DIMENSIONS, EXTERNAL

Wing span	37.55 m (123 ft 2½ in)
Wing aspect ratio	7.0
Length overall	47.90 m (157 ft 1¾ in)
Height overall	11.40 m (37 ft 4¾ in)
Diameter of fuselage	3.80 m (12 ft 5½ in)
Tailplane span	13.40 m (43 ft 11½ in)



Tupolev Tu-154M medium-range three-turbofan transport *(Jane's/Dennis Punnett)*

1986

Wheel track	11.50 m (37 ft 9 in)
Wheelbase	18.92 m (62 ft 1 in)
Passenger doors (each): Height	1.73 m (5 ft 7 in)
Width	0.80 m (2 ft 7½ in)
Height to sill	3.10 m (10 ft 2 in)
Servicing door: Height	1.28 m (4 ft 2½ in)
Width	0.61 m (2 ft 0 in)
Emergency door: Height	1.28 m (4 ft 2½ in)
Width	0.64 m (2 ft 1¼ in)
Emergency exits (each): Height	0.90 m (2 ft 11½ in)
Width	0.48 m (1 ft 7 in)
Main baggage hold doors (each)	
Height	1.20 m (3 ft 11¼ in)
Width	1.35 m (4 ft 5 in)
Height to sill	1.80 m (5 ft 10¾ in)
Rear (unpressurised) hold: Height	0.90 m (2 ft 11½ in)
Width	1.10 m (3 ft 7¼ in)
Height to sill	2.20 m (7 ft 2½ in)
DIMENSIONS, INTERNAL	
Cabin: Width	3.58 m (11 ft 9 in)
Height	2.02 m (6 ft 7½ in)
Volume	163.2 m³ (5,763 cu ft)
Main baggage holds: front	21.5 m³ (759 cu ft)
rear	16.5 m³ (582 cu ft)
Rear underfloor hold	5.0 m³ (176 cu ft)
AREAS	
Wings, gross	201.45 m² (2,169 sq ft)
Horizontal tail surfaces (total)	42.20 m² (454.24 sq ft)
WEIGHTS AND LOADINGS	
Basic operating weight empty	55,300 kg (121,915 lb)
Max payload	18,000 kg (39,680 lb)
Max fuel	39,750 kg (87,633 lb)
Max T-O weight	100,000 kg (220,460 lb)
Max landing weight	80,000 kg (176,366 lb)
Max zero-fuel weight	74,000 kg (163,140 lb)
Max wing loading	496.4 kg/m² (101.6 lb/sq ft)
Max power loading	320.5 kg/kN (3.14 lb/lb st)
PERFORMANCE	
Max cruising speed	513 kts (950 km/h, 590 mph)
Max cruising height	11,900 m (39,000 ft)
Balanced field length for T-O and landing	2,500 m (8,200 ft)
Range, with max payload	2,105 n miles (3,900 km, 2,425 miles)
with 12,000 kg (26,455 lb) payload	2,805 n miles (5,200 km, 3,230 miles)
with max fuel and 5,450 kg (12,015 lb) payload	3,563 n miles (6,600 km, 4,100 miles)

UPDATED

TUPOLEV Tu-156

TYPE: Cryogenic-fuelled three-turbofan transport

PROGRAMME: Details of 1988-89 flight trials of Tu-155, a Tu-154 modified with a Kuznetzov NK-88 turbofan operating on liquid hydrogen and liquefied natural gas fuels, last appeared in 1990-91 *Jane's*. Tupolev announced mid-1994 Russian government funding for conversion of three Tu-154s to Tu-156 standard, delivery of 12 NK-89 turbofans and six cryogenic fuel systems, an installation to supply liquefied natural gas (LNG) will be established at Samara. Delivery of first Tu-156 scheduled for 1998.

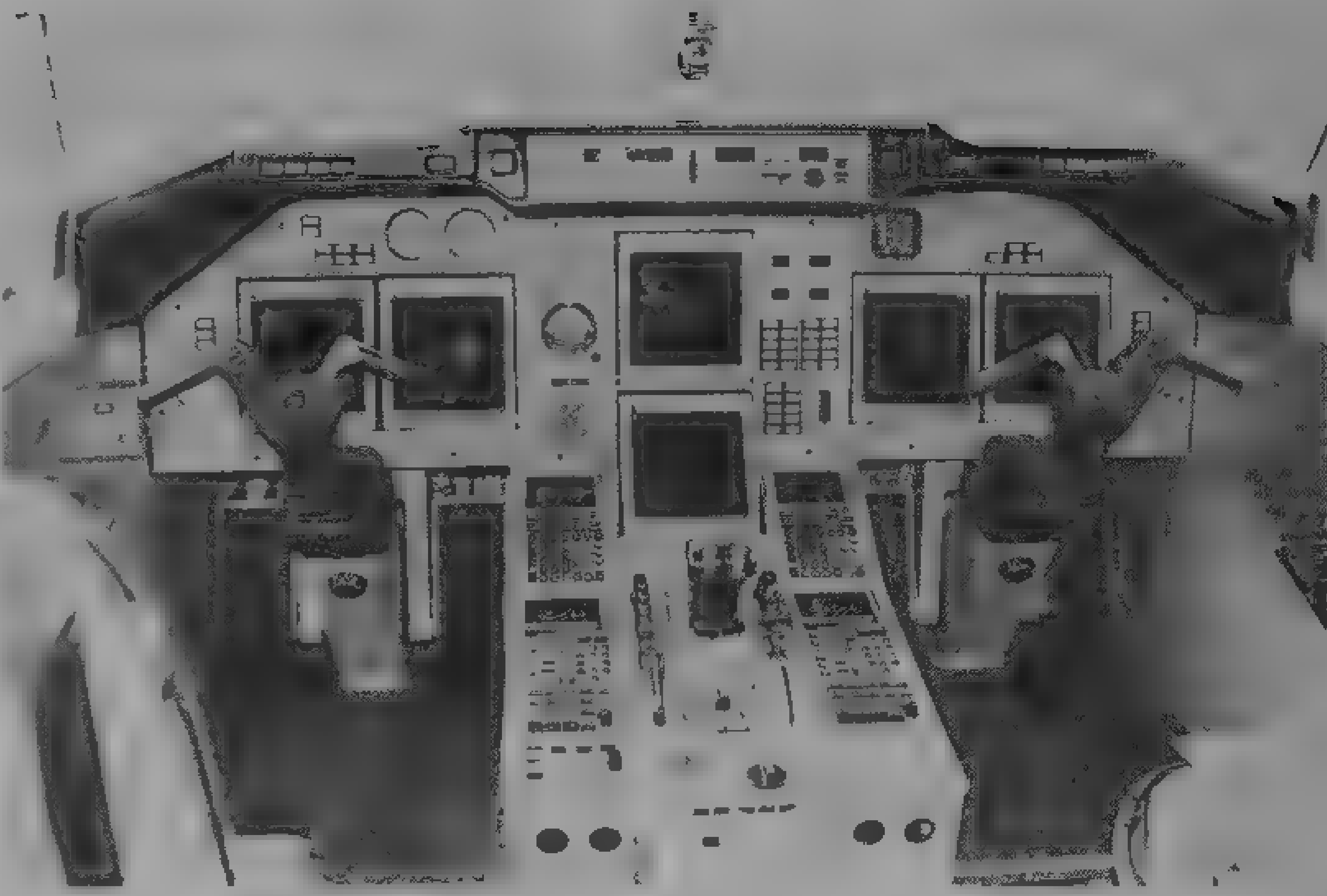
CURRENT VERSIONS: **Tu-156S:** Initial kerosene/LNG powered conversion of Tu-154B carrying 13,000 kg (28,660 lb) of LNG plus 10,000 kg (22,046 lb) of kerosene, payload 14,500 kg (31,967 lb) or 130 passengers range 1,457 n miles (2,700 km, 1,677 miles

Tu-156M. Developed version converted from Tu-154M, carrying 135 passengers, fuel load and performance as Tu-156S.

Tu-156M2 Proposal only, converted from Tu-154M2 20,000 kg (44,092 lb) of LNG only carried in two tanks above centre-fuselage allowing passenger load increase to 160, NK-94 engines, range 2,159 n miles (4,000 km, 2,485 miles)

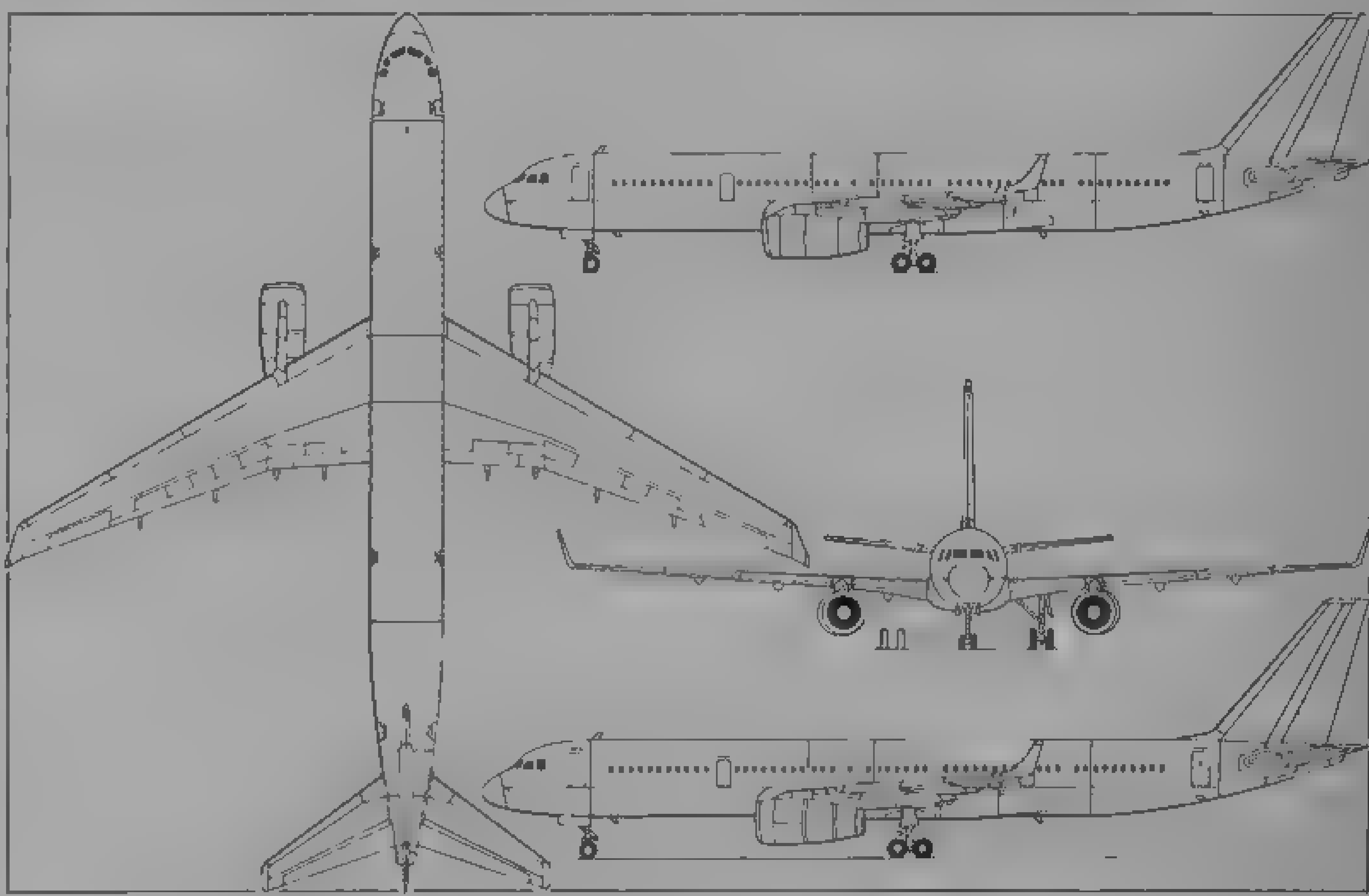
POWER PLANT: Experimental power plant will be Samara/Trud NK-89, tanks for cryogenic fuel will be mounted in rear of cabin and in forward baggage hold of Tu-156S/M. Aircraft will operate on mixed LNG/kerosene, as Tu-155. Tu-156M2 to have NK-94 engines, wholly LNG powered

NEW ENTRY



Cockpit of Tupolev Tu-204-220 twin-turbofan airliner *(Peter J. Cooper)*

1993



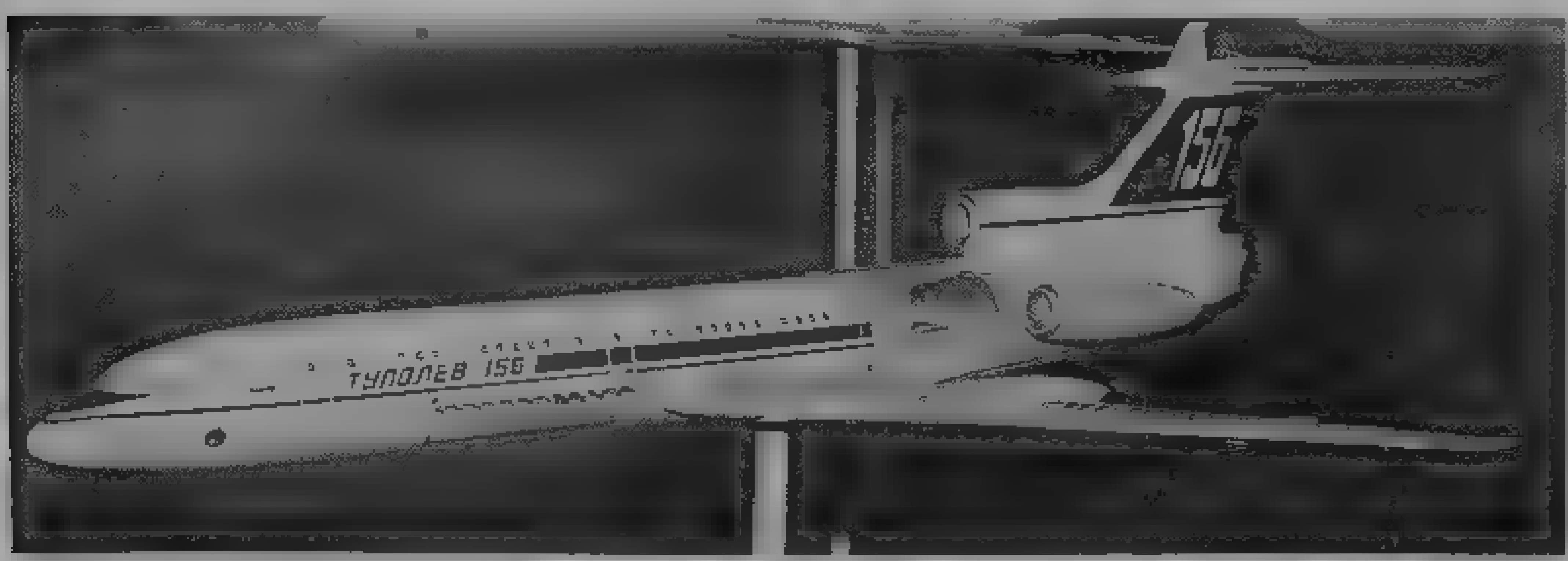
Tupolev Tu-204-200 medium-range transport (two Aviadvigatel PS-90A turbofans), with additional side view (top) of Tu-204-220 *(Jane's/Mike Keep)*

1994

TUPOLEV Tu-204/224/234

TYPE: Twin-turbofan medium-range airliner

PROGRAMME: Development to replace Tu-154 announced 1983, preliminary details available Spring 1985, programme finalised 1986; first prototype (SSSR-64001), with PS-90AT engines, flown 2 January 1989 by Tupolev chief test pilot A Talalakine, three more prototypes followed, plus two for structural and fatigue testing. second version, with RB211-535E4-B engines, flew 14 August 1992 and was demonstrated at Farnborough Air Show in following month, production of basic Tu-204 series by Aviastar at Ulyanovsk began 1990. Tu 204-200 by KAPO at Kazan and Aviastar in 1994, 16 completed by beginning of 1995. Russian certification of basic Tu-204 received 12 January 1995



Model of Tupolev Tu-156M-2 cryogenic aircraft *(Paul Jackson)*

1995

CURRENT VERSIONS: **Tu-204**: Basic medium-haul airliner for up to 214 passengers or maximum payload of 21,000 kg (46,295 lb), 158.3 kN (35,580 lb st) Aviadvigatel PS-90A turbofans. Marketed 1989

Tu-204-100: Extended-range version, additional fuel, dimensions, payload and power plant unchanged, maximum T-O weight 103,000 kg (227,070 lb). Marketed 1993

Tu-204-100C: As Tu-204-100. Payload increased at expense of reduced maximum range. Marketed 1994

Tu-204-120: As Tu-204-100, but with Rolls-Royce RB211-535 E4 turbofans, Russian avionics; prototype flew 14 August 1992. Marketed 1994

Tu-204-122: As Tu-204-120, but with Rockwell Collins avionics

Tu-204C: Cargo version of Tu 204-100, described separately

Tu-204-200: Further increase in payload and T-O weight, additional fuel in wing centre-section and adjacent baggage hold, dimensions and power plant as Tu-204-100: marketed 1994, deliveries to begin 1995

Tu-204-200C: As Tu-204-200. Payload increased at expense of reduced maximum range. Marketed 1994.

Tu-204-220. As Tu-204-200, but 191.7 kN (43,100 lb st) Rolls-Royce RB211-535E4 or RB211-535F5 turbofans, **funded and marketed by British Russian Aviation Corporation (BRAVIA), Moor House, London Wall, London EC2Y 5ET, UK (Tel: +44 71 382 8279. Fax +44 71 382 8271)** Available 1996. Tupolev-funded variant with 185.5 kN (41,700 lb st) Pratt & Whitney PW2240 turbofans, programme at low priority

Tu-204-222: As Tu-204-220, but with Rockwell Collins avionics

Tupolev Tu 204-220 with Rolls-Royce RB211 535E4 turbofans (*Paul Jackson*)

1995

Tu-204-230 With 176.5 kN (39,683 lb st) Samara NK-93 propfans. At initial project stage.

Tu-224 and **Tu-234** (formerly Tu-204-300): Announced 1994; trunk route versions with shorter fuselage. short-range and mid-range models for 166 passengers, long-range model for 99 to 160 passengers. Tu-224 has RB211-535 engines, Tu-234 has 158.3 kN (35,580 lb st) PS-90P engines.

CUSTOMERS: GTK Rossiya state transport company (two), Moscow Airways (one), Oriol Avia (three), Vnukovo Airlines (three). Russian government placed initial order in Autumn 1994 for 12 Tu-204s and three Tu-204-200s for state-owned leasing company, orders and options totalled 272 January 1995

DESIGN FEATURES: Conventional low/mid-wing configuration, with all surfaces sweptback, and winglets; wing dihedral from roots; sweepback 28°, supercritical section; thickness/chord ratio 14 per cent at root, 9 to 10 per cent at tip; negative twist, semi-monocoque oval section pressurised fuselage, torsion box of fin forms integral fuel tank, used for automatic trimming of CG in flight, design life 45,000 flights or 60,000 flight hours

FLYING CONTROLS: Triplex digital fly-by-wire, with triplex analog back-up; conventional 'Y' control yokes selected after evaluation of alternative sidestick on Tu-154 testbed, inset aileron outboard of two-section double-slotted flap on each wing trailing-edge, two-section upper surface airbrake forward of each centre-section flap; five-section spoiler forward of each outer flap, four-section leading-edge slat over full span of each wing, conventional rudder and elevators, no tabs

STRUCTURE: Approximately 18 per cent of airframe by weight of composites, three-piece two-spar wing, with metal structure, part composite skin, carbonfibre skin on spoilers, airbrakes and flaps; glassfibre wingroot fairings, all-metal fuselage, utilising aluminium-lithium and titanium, nose radome and some access panels of composites; extensive use of composites in tail unit, particularly for leading edges of fixed surfaces and for rudder and elevators

LANDING GEAR: Hydraulically retractable tricycle type, electrohydraulically steerable twin-wheel nose unit (±10° via rudder pedals; ±70° by electric steering control) retracts forward; four-wheel bogie main units retract inward into wing/fuselage fairings. Carbon disc brakes, electrically controlled. Tyre size 1,070 × 390 mm on mainwheels, 840 × 290 mm on nosewheels

POWER PLANT: Two turbofans (see notes on versions), underwing in composite cowlings. Tu-204-200 series carries fuel in six integral tanks in wings, in centre-section and adjacent baggage hold, and in tailfin, total capacity 40,730 litres (10,760 US gallons; 8,960 Imp gallons); torsion box of fin forms integral fuel tank for automatic trimming of CG in flight, as well as for optional standard use.

ACCOMMODATION: Can be operated by pilot and co-pilot, but Aeroflot specified requirement for a flight engineer, provision for fourth seat for instructor or observer. Three basic single-aisle passenger arrangements in Tu-204, 204-100 and 204-200 series: (1) 190 seats, with 12 seats four-abreast in first class cabin at front at pitch of 99 cm (39 in), 35 business class seats six-abreast at pitch of 96 cm (38 in) in centre cabin, and 143 tourist class seats six-abreast at pitch of 81 cm (32 in) at rear, (2) 196 seats, with 12 seats four-abreast at pitch of 99 cm (39 in) in first class cabin at front and 184 six-abreast tourist class seats at pitch of 81 cm (32 in) at rear, (3) 214 seats, all six abreast at tourist class pitch of 81 cm (32 in). Tu-224/234 series has 166 seats at 81 cm (32 in) pitch in short/mid-range models, 99 seats at 93 cm (36.5 in) or 160 seats at 81 cm (32 in) pitch in long-range model. All configurations have buffet/galley and toilet immediately aft of flight deck, and two more toilets, large buffet/galley and service compartment at rear of passenger accommodation, overhead stowage for hand baggage. Other layouts optional, with increased galley and toilet provisions. Passenger doors at front and rear of cabin on port side, service doors opposite. Type I emergency exit doors fore and aft of wing each side; inflatable slide for emergency use at each of eight doors. Tu-204-200 has two underfloor baggage/freight holds for total of eight 4D-3-46 international class containers, three in forward hold, five in rear hold. Fully automatic container loading system, manual back-up

SYSTEMS: Triplex fly-by-wire digital control system, with triplex analog back-up. Three independent hydraulic systems, pressure 207 bars (3,000 lb/sq in). Ailerons, elevators, rudder, spoilers and airbrakes operated by all three systems, flaps, leading-edge slats, brakes and nosewheel steering operated by two systems; landing gear retraction and extension by all three systems. Electrical power supplied by two 200/115 V 400 Hz AC generators and a 27 V DC system. Type TA-12-60 APU in tailcone

AVIONICS: Avionics of Russian design, or integrated by Sextant Avionique or Honeywell, with standard nav/com equipment by Collins or Bendix/King optional

Comms: VHF and HF radio, intercom

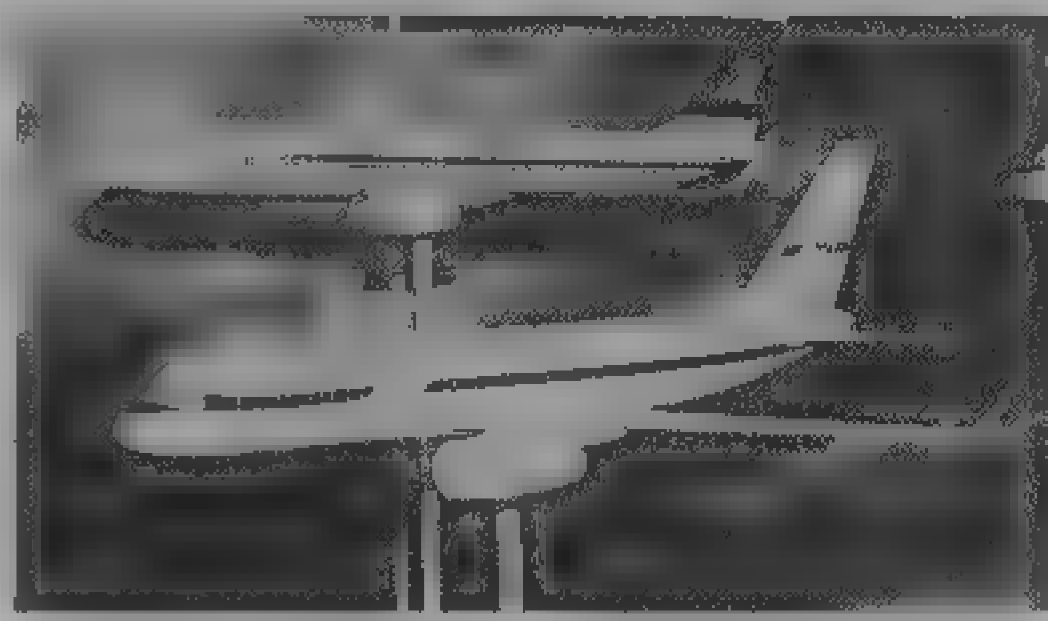
Radar: Weather radar

Flight: Triplex automatic flight control, VOR, DME, automatic approach and landing system, for operation to ICAO Cat IIIa minima. INS and satellite nav

Instrumentation: EFIS equipment comprises two colour CRTs for flight and nav information for each pilot, plus two central CRTs for engine and systems data

DIMENSIONS, EXTERNAL (A: 204, B: 204-200, C: 204-220, D: 234 short-range, E: 234 mid-range, F: 234 long-range)

Wing span: A, B, C	42.00 m (137 ft 9½ in)
D, E, F	40.88 m (134 ft 1½ in)
Wing aspect ratio: A, B, C	9.67
Length overall: A, B, C	46.00 m (150 ft 11 in)
D, E, F	40.20 m (131 ft 10¾ in)
Fuselage cross-section: all	3.80 m × 4.10 m (12 ft 5½ in × 13 ft 5½ in)
Height overall: all	13.90 m (45 ft 7¼ in)
Tailplane span: A, B, C	15.00 m (49 ft 2½ in)
Wheel track: A, B, C	7.82 m (25 ft 8 in)
Wheelbase: A, B, C	17.00 m (55 ft 9¼ in)
Passenger doors (each): Height: all	1.85 m (6 ft 0¾ in)
Width: all	0.84 m (2 ft 9 in)
Service doors (each): Height: all	1.60 m (5 ft 3 in)
Width: all	0.65 m (2 ft 1½ in)
Emergency exit doors (each): Height: all	1.44 m (4 ft 8¾ in)
Width: all	0.61 m (2 ft 0 in)
Baggage holds: Height to sill: all	2.71 m (8 ft 10¾ in)



Model of Tupolev Tu-224/234 short-fuselage version (foreground) with standard Tu-204 for comparison (*Paul Jackson*)

1995

DIMENSIONS, INTERNAL

Cabin, excl flight deck: Length: A, B, C	30.18 m (99 ft 0 in)
Max width: all	3.57 m (11 ft 8¼ in)
Max height: all	2.28 m (7 ft 6 in)
Fwd cargo hold: Height: all	1.162 m (3 ft 9¾ in)
Volume: A, B, C	11.00 m³ (388 cu ft)
Rear cargo hold: Height: A, B, C	1.162 m (3 ft 9[illegible])
Volume: A, B, C	15.4 m³ (544 cu ft)
Bulk volume: A, B, C	5.4 m³ (190 cu ft)

AREAS

Wings, gross: A, B, C	182.4 m² (1,963.4 sq ft)
D, E, F	184.17 m² (1,982.5 sq ft)

WEIGHTS AND LOADINGS

Operational weight empty: A	58,300 kg (128,530 lb)
B, C	59,000 kg (130,070 lb)
Max payload: A	21,000 kg (46,296 lb)
B, C: weight limited	25,200 kg (55,555 lb)
C: space limited (196 seats)	19,565 kg (43,132 lb)
D, E	18,000 kg (39,682 lb)
F	16,000 kg (35,273 lb)
Max baggage/freight: fwd hold: C	3,625 kg (7,990 lb)
rear hold: C	5,075 kg (11,190 lb)
Max fuel: A	24,000 kg (52,910 lb)
B, C	32,7[illegible] kg (72,[illegible] lb)
Max ramp weight: C	111,750 kg (246,360 lb)
Max T-O weight: A	94,600 kg (208,550 lb)
B, C	110,750 kg (244,155 lb)
D	84,800 kg (186,950 lb)
E, F	103,000 kg (227,070 lb)
Max landing weight: C	89,500 kg (197,310 lb)
Max zero-fuel weight: C	84,200 kg (185,625 lb)
Max wing loading: A	518.6 kg/m² (106.2 lb/sq ft)
B, C	607.2 kg/m² (124.4 lb/sq ft)
D	460.4 kg/m² (94.3 lb/sq ft)
E, F	559.3 kg/m² (114.5 lb/sq ft)
Max power loading: A	298.8 kg/kN (2.93 lb/lb st)
B	349.8 kg/kN (3.43 lb/lb st)
C	288.9 kg/kN (2.83 lb/lb st)
D	267.8 kg/kN (2.63 lb/lb st)
E, F	325.3 kg/kN (3.19 lb/lb st)

Tupolev Tu-204 190- to 214-seat airliner (*Paul Jackson*)

1995

Tupolev Tu-204 third prototype in Aeroflot markings (*Paul Jackson*)

1995

PERFORMANCE:
- Nominal cruising speed at 11,100-12,100 m (36,400-39,700 ft): A, B — 448 kts (830 km/h, 515 mph)
  - D, E, F — 448-458 kts (830-850 km/h, 515-528 mph)
- Approach speed: D — 119 kts (220 km/h, 137 mph)
  - E, F — 122 kts (225 km/h; 140 mph)
- T-O run: D — 1,450 m (4,760 ft)
  - E, F — 2,050 m (6,725 ft)
- Required landing runway: D, F — 1,800 m (5,905 ft)
  - E — 1,900 m (6,235 ft)
- Range: with max payload
  - A — 1,565 n miles (2,900 km; 1,800 miles)
  - B — 3,415 n miles (6,330 km, 3,930 miles)
  - D — 1,295 n miles (2,400 km; 1,490 miles)
  - E — 3,585 n miles (6,650 km, 4,130 miles)
  - F — 3,885 n miles (7,200 km, 4,475 miles)
  - with design payload
    - D — 1,835 n miles (3,400 km; 2,110 miles)
    - E — 4,075 n miles (7,550 km, 4,690 miles)
    - F — 4,990 n miles (9,250 km, 5,750 miles)

TUPOLEV/ORIOL-AVIA Tu-204 FREIGHTER

TYPE: Twin-turbofan medium-range freighter

PROGRAMME: General technical specification for converting Tu-204 passenger aircraft to freighter configuration issued by Tupolev and Oriol-Avia Airlines May 1993. Offered initially for Tu-204-100 series ordered by Aeroflot, with PS-90A engines, maximum T-O weight of 94,600 kg (208,550 lb), maximum landing weight of 88,200 kg (194,445 lb), maximum zero-fuel weight of 79,300 kg (174,825 lb), and maximum fuel weight of 24,000 kg (52,910 lb). Applicable to all other Tu-204 versions by means of work listed in Tupolev/ARISC (Aviation Register Interstate Committee) approved supplementary specification. Prototype RA-64010 delivered to Aeroflot Russian International Airlines 7 April 1995.

CUSTOMERS: ARIA (4 for 1995 delivery); Oriol-Avia Airlines (2); all Tu-204-100 conversions.

DESIGN FEATURES: Main deck cargo door installed on port side forward of wing, redundant passenger doors deactivated, cargo door operating controls, hydraulic, electrical and warning/indication systems installed; cargo door operable in wind speeds up to 54 km/h (33 mph). Courier compartment immediately aft of flight deck, with 9g cargo restraint bulkhead barrier to rear, three forward-facing seats, tip-up seat at front, storage and buffet facilities. Main deck floor reinforced for maximum loading capability of 280 kg/m² (57.3 lb/sq ft), maximum weight of loaded 2.24 × 2.74 m (88 × 108 in) pallet 1,500 kg (3,306 lb). (In later-model Tu-204s allowable loading will be 410 kg/m²; 84 lb/sq ft, with maximum weight of 3,100 kg, 6,834 lb for 2.24 × 2.74 m; 88 × 108 in or 2.24 × 3.18 m; 88 × 125 in pallet). New sandwich flooring with non-slip surface, sealed against water ingress. Cargo handling/restraint system installed, typically ball mat and sill protector at door and rollers with side guidance (powered if required). All passenger-related provisions removed. Top-hinged cargo door opening length 3.405 m (11 ft 2 in), height 2.19 m (7 ft 2 in).

ACCOMMODATION: All existing windows retained, also front toilet.

SYSTEMS: Cabin overhead air conditioning distribution system deleted. Temperature on flight deck and in cabin controllable 16 to 26°C (61 to 79°F); pressurisation unchanged. Flight deck/courier interphone. Fire extinguishers and cabin smoke detection system provided. Cabin lighting compatible with freighter configuration.

WEIGHTS AND LOADINGS:

Weight empty	55,040 kg (121,340 lb)
Operating weight empty	55,840 kg (123,105 lb)
Max payload	23,460 kg (51,720 lb)
Fuel with max payload	15,300 kg (33,730 lb)
Max T-O weight	94,600 kg (208,550 lb)
Max zero-fuel weight	79,300 kg (174,825 lb)

UPDATED

TUPOLEV Tu-204C FREIGHTER

TYPE: Twin-turbofan medium-range freighter

PROGRAMME: Tupolev has developed a full freighter configuration for embodiment on the production line in new build aircraft, applicable to all versions, including those with Rolls-Royce power. Marketed 1993.

DESIGN FEATURES: Basically as Tupolev/Oriol-Avia conversion, described separately, but main cabin windows deleted; heat/noise insulation panels of lightweight construction. All engineering details adaptable to customer's requirements.

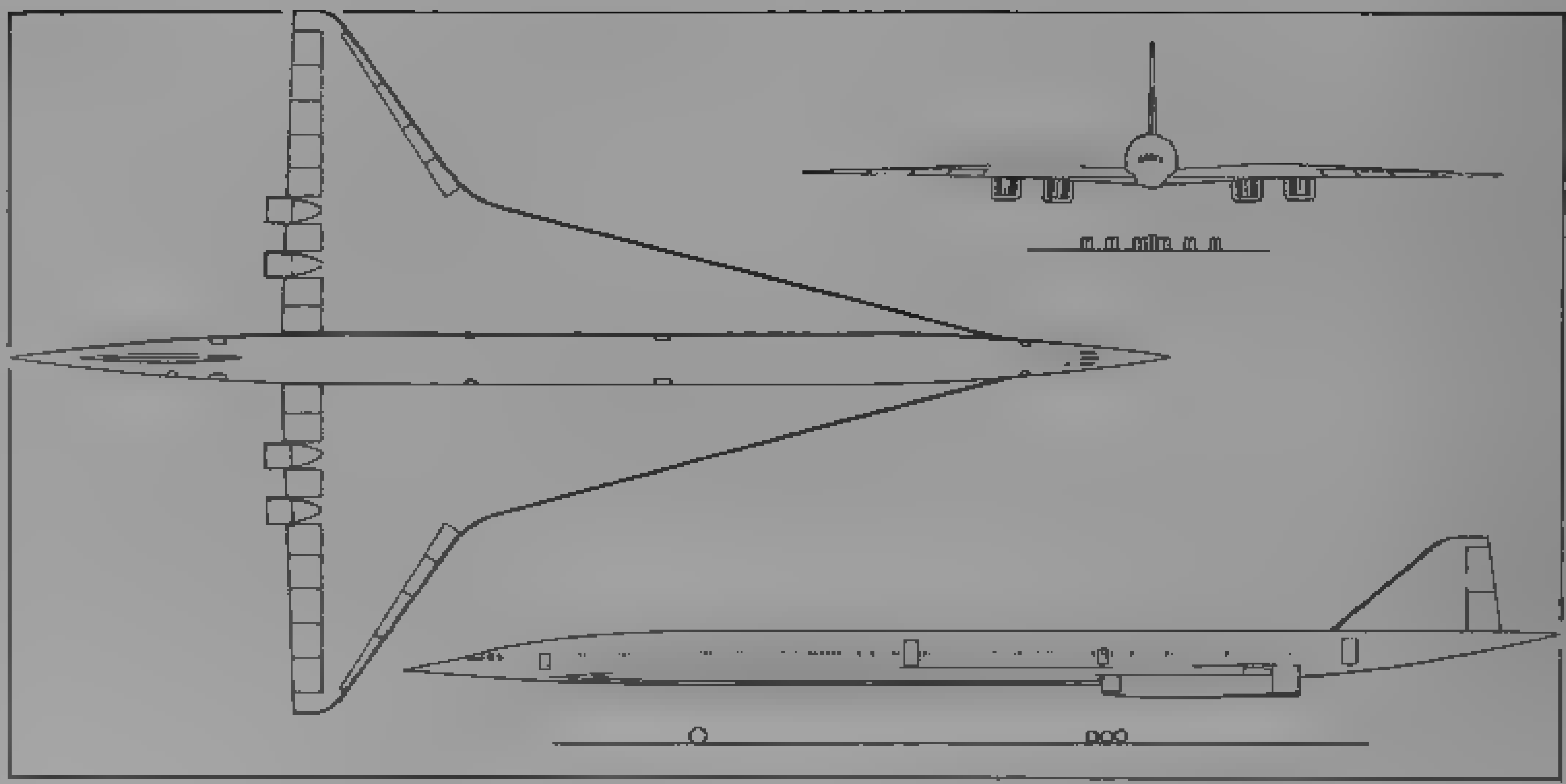
VERIFIED

TUPOLEV Tu-216

TYPE: Cryogenic-fuelled twin-turbofan airliner

PROGRAMME: Projected version of Tu-204 with two Samara NK-94 turbofans and 21,000 kg (46,297 lb) of liquid natural gas fuel in two tanks above front and centre fuselage. 210 passengers, range 2,321 n miles (4,300 km; 2,671 miles).

NEW ENTRY



Provisional three-view of projected Tu-244 supersonic transport *(Jane's/Mike Keep)* *1994*

TUPOLEV Tu-224/234

Described under Tu-204 heading.

NEW ENTRY

TUPOLEV Tu-244

TYPE: Second generation supersonic airliner

PROGRAMME: Ongoing programme based on more than 30 years of Tupolev SST research, development and testing; several Tu-144 first-generation SSTs in use as flying laboratories for ecology, noise and aerodynamic research, one on behalf of USA, sponsored by Rockwell, Boeing and NASA, from 1995. Details of competing designs in International section under Supersonic Airliner Studies.

DESIGN FEATURES: Current projected configuration shown in accompanying illustration. Programme directed at estimating SST market capacity; evaluating compatibility with environment in terms of sonic boom, engine noise and emission, and so on; ensuring high fuel/take-off weight ratio (51 to 52 per cent, compared with 49.5 to 50 per cent in Tu-144); providing high lift/drag ratio at all phases of flight (K9.5 at Mach 2 and K15 at Mach 0.9, compared with K8.1 at Mach 2 for Tu-144). Wing sweepback 75° inboard, 35° outboard.

POWER PLANT: Four turbofans, each 324 kN (72,750 lb st).

ACCOMMODATION: Nominal seating for 300 passengers.

AVIONICS: For operation to ICAO Cat IIIa standards.

DIMENSIONS, EXTERNAL:

Wing span	54.47 m (178 ft 8½ in)
Length overall	88.70 m (291 ft 0 in)
Height overall	15.80 m (51 ft 10 in)

AREAS:

Wings, gross	1,200 m² (12,917 sq ft)

WEIGHTS AND LOADINGS:

Max zero-fuel weight	172,000 kg (379,180 lb)
Max T-O weight	350,000 kg (771,605 lb)
Max wing loading	291.7 kg/m² (59.75 lb/sq ft)
Max power loading	270 kg/kN (2.65 lb/lb st)

PERFORMANCE (estimated):

Nominal cruising speed at 18,000-19,000 m (59,000-62,335 ft)	Mach 2.05
Max range	4,965 n miles (9,200 km; 5,715 miles)

OPERATIONAL NOISE LEVELS: Designed to meet FAR Pt 36 Chapter 3 noise requirements.

UPDATED

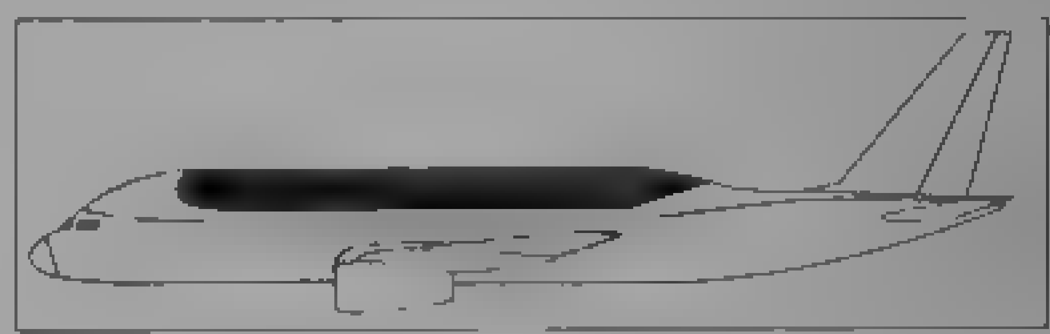
TUPOLEV Tu-304/306

TYPE: Projected 450-seat, twin-turbofan airliner.

CURRENT VERSIONS: **Tu-304:** Conventionally fuelled version, based on Tu-204.

Tu-306: Cryogenic-fuelled version, large tank above centre fuselage for 60,000 kg (132,277 lb) of liquid natural gas; TB7-46 engines, range 4,859 n miles (9,000 km, 5,592 miles).

NEW ENTRY



Profile of Tupolev Tu-306, indicating storage tank for liquid natural gas fuel *(Jane's/Paul Jackson)* *1995*

TUPOLEV Tu-324

TYPE: Twin-turbofan regional transport and business jet

PROGRAMME: Announced at 1995 Paris Air Show; manufacture by Kazan Aviation Production Organisation.

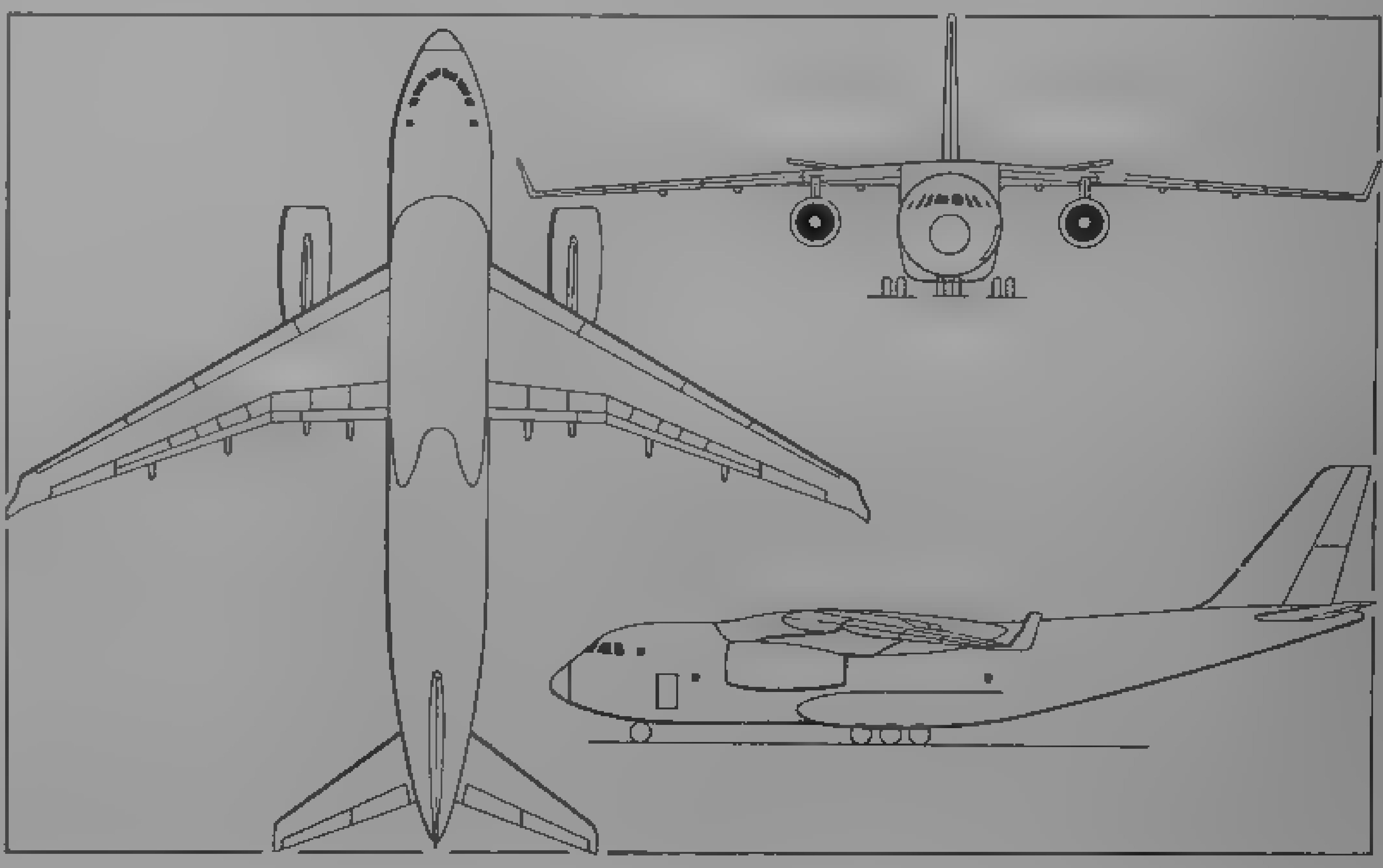
CURRENT VERSIONS: **Tu-324:** Basic transport for 30 to 50 passengers.

Tu-324A: Long-range VIP and business jet.

DESIGN FEATURES: Wings scaled down from Tu-204.

POWER PLANT: Two Soyuz R-126-300 turbofans in pods on sides of rear fuselage.

ACCOMMODATION: Two crew and 30 business class or 50 tourist passengers in Tu-324, up to four VIP or eight to 10 executive passengers in Tu-324A. Versions planned for ambulance and patrol duties.



Tupolev Tu-330 twin-turbofan freight transport *(Jane's/Mike Keep)* *1994*

DIMENSIONS, EXTERNAL (A: Tu-324, B: Tu-324A):

Wing span: A, B	24.70 m (81 ft 0½ in)
Length overall: A	26.20 m (85 ft 11½ in)
B	23.20 m (76 ft 1½ in)
Height overall: A, B	7.30 m (23 ft 11½ in)

WEIGHTS AND LOADINGS:

Max payload: A	5,000 kg (11,025 lb)
B	3,000 kg (6,615 lb)
Max T-O weight: A	24,630 kg (54,300 lb)
B	25,400 kg (56,000 lb)

PERFORMANCE (estimated):

Nominal cruising speed:
A, B — 431 kts (800 km/h; 497 mph)
Balanced runway length: A — 1,800 m (5,910 ft)
B — 1,950 m (6,400 ft)
Range: A, 50 passengers — 1,350 n miles (2,500 km; 1,553 miles)
A, 30 passengers — 2,455 n miles (4,550 km; 2,827 miles)
B, 3,000 kg (6,615 lb) payload — 3,183 n miles (5,900 km; 3,666 miles)
B, 1,000 kg (2,204 lb) payload — 4,262 n miles (7,900 km; 4,909 miles)

NEW ENTRY

TUPOLEV Tu-330

TYPE: Twin-turbofan freight transport.

PROGRAMME: Announced Spring 1993 as replacement for Antonov An-12, first 10 being built at Kazan, first flight scheduled 1997, for service from 1998.

DESIGN FEATURES: See accompanying three-view drawing. Wing design basically similar to Tu-204, engine pylons as Tu-204, rear-loading ramp.

FLYING CONTROLS: Each wing has four-section leading-edge flaps, three-section trailing-edge flaps, eight spoilers forward of flaps, and aileron. Elevators and rudder each in two sections.

LANDING GEAR: Retractable tricycle type; twin-wheel nose unit, each main unit three pairs of wheels in tandem.

POWER PLANT: Two Aviadvigatel PS-90A turbofans. Rolls-Royce, General Electric and Pratt & Whitney turbofans under consideration for export sales. Proposed cryogenic fuelled version with Samara NK-94 engines and 20,000 kg (44,092 lb) of liquid natural gas is designated **Tu-338**.

DIMENSIONS, EXTERNAL:

Wing span over winglets	43.50 m (142 ft 8½ in)
Length overall	42.00 m (137 ft 9½ in)
Height overall	14.00 m (45 ft 11¼ in)
Rear-loading ramp: Length, width	4.00 m (13 ft 1½ in)

DIMENSIONS, INTERNAL:

Cargo hold: Length	19.50 m (63 ft 11¾ in)
Width	4.00 m (13 ft 1½ in)
Height	3.55 m (11 ft 7¾ in)

AREAS:

Wings, gross	196.5 m² (2,115.2 sq ft)

WEIGHTS AND LOADINGS:

Design payload	35,000 kg (77,160 lb)
Max T-O weight	103,500 kg (228,175 lb)

PERFORMANCE (estimated):

Nominal cruising speed at 11,000 m (36,000 ft) — 431-458 kts (800-850 km/h; 497-528 mph)
Nominal range: with 20,000 kg (44,090 lb) payload — 3,020 n miles (5,600 km; 3,480 miles)
with 30,000 kg (66,135 lb) payload — 1,620 n miles (3,000 km; 1,865 miles)

UPDATED

TUPOLEV Tu-334

TYPE: Twin-turbofan medium-range airliner.

PROGRAMME: Under development as replacement for Tu-134s in Russian airline service; static test airframe at TsAGI; first prototype scheduled to fly mid-1995 with D-436T1 engines, second and third identical prototypes to fly late 1995, intended to enter service late 1996 or early 1997. Preparations for series production completed at Kiev and Taganrog.

CURRENT VERSIONS: **Tu-334-100**: Basic version, with D-436T1 engines, for 92 mixed class or 102 tourist class passengers. Prototypes are of this version.

Tu-334-200: Basically similar to Tu-334-100; D-436T2 or BR 715-55 engines, lengthened fuselage for 110 to 126 passengers, increased wing span and overall height, four-wheel bogies on main landing gear units.

DESIGN FEATURES: To meet urgent requirements of CIS airlines, Tu-334's wings have much in common with those of Tu-204 and its fuselage is shortened version of that of Tu-204, with identical flight deck; configuration is all-swept low/mid-wing, with rear-mounted engines and T tail; wings have supercritical section, 24° sweepback, with winglets; circular-section semi-monocoque fuselage; wings have dihedral from roots.

FLYING CONTROLS: Main and standby fly-by-wire, emergency hydraulic and mechanical back-up, except for ailerons. Two-section trailing-edge flap, two airbrakes forward of inner flap and two spoilers forward of outer flap on each wing; four-section leading-edge slat over full span each wing; conventional ailerons, elevators and two-section rudder; no tabs.

STRUCTURE: Composites and other lightweight materials make up 20 per cent of structure by weight.

LANDING GEAR: Retractable tricycle type; twin wheels on each unit of Tu-334-100; four-wheel bogies on main units of Tu-334-200; main units retract inward into wing/fuselage fairings; trailing-link mainwheel legs on Tu-334-100.

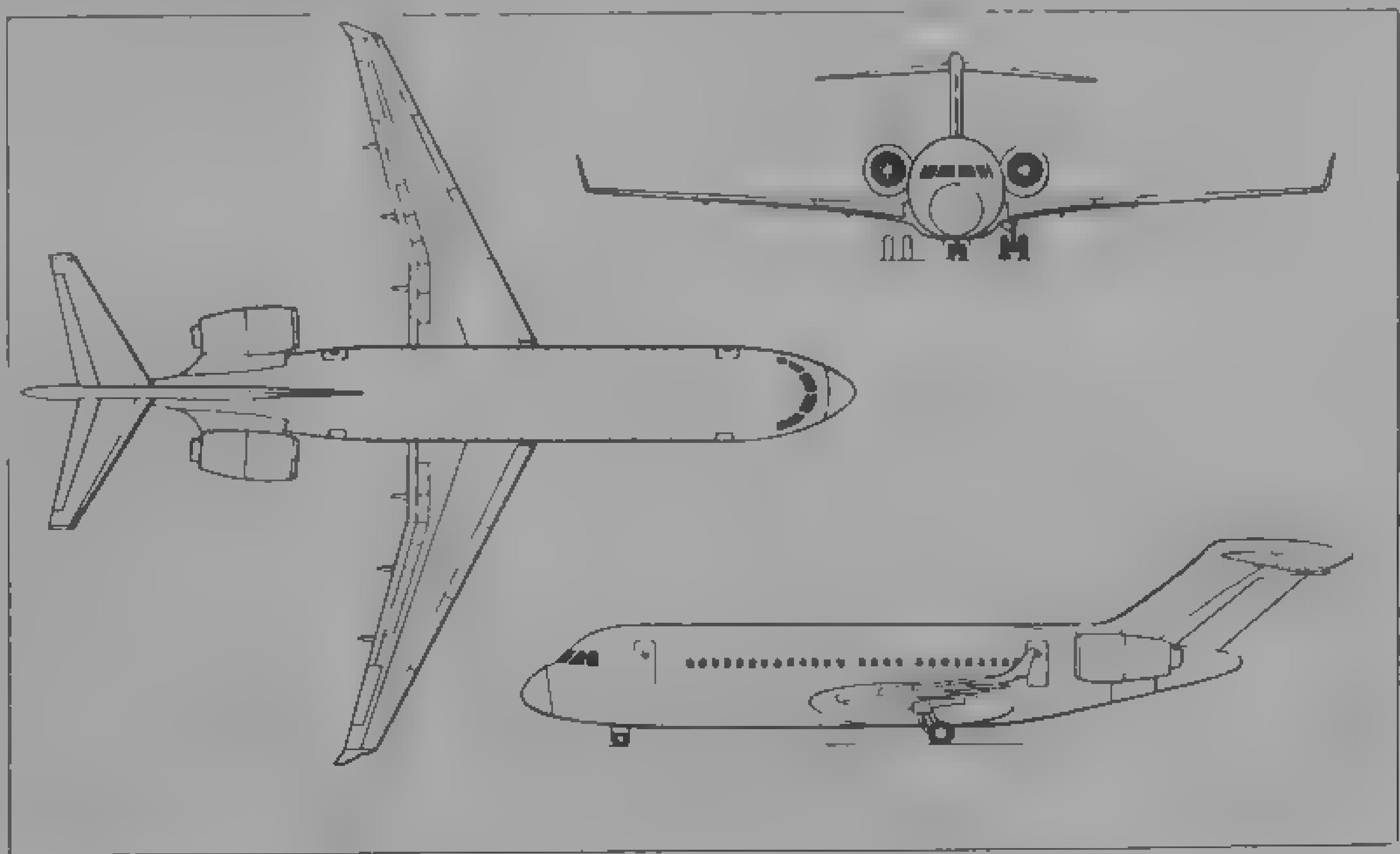
POWER PLANT: Two ZMKB Progress D-436T1 turbofans, each rated at 73.55 kN (16,535 lb st) on Tu-334-100. Two ZMKB Progress D-436T2 turbofans, each rated at 80.5 kN (18,100 lb st) on Tu-334-200. BMW Rolls-Royce BR 715-55 turbofans alternative both versions.

ACCOMMODATION (Tu-334-100): Crew of two or three on flight deck; provision for fourth seat for instructor or observer. Two basic single-aisle passenger arrangements: (1) 92 seats, with eight seats four-abreast in first class cabin at front, at pitch of 99 cm (39 in) and with 73 cm (28.75 in) aisle, and 84 tourist class seats six-abreast at 79 cm (31 in) pitch and with 47 cm (18.5 in) aisle; (2) 102 seats, all tourist, at 79 cm (31 in) pitch. Both configurations have buffet/galley and toilet immediately behind flight deck, a further buffet/galley, toilet and service compartment at rear; overhead stowage for hand baggage. Passenger doors at front and rear of cabin on port side; service doors opposite. Underfloor baggage/freight holds, doors on starboard side.

ACCOMMODATION (Tu-334-200): Flight deck unchanged. Two basic single-aisle passenger arrangements: (1) 110 seats with eight seats four-abreast in first class cabin at front, at pitch of 99 cm (39 in), and 102 tourist class seats six-abreast at 81 cm (32 in) pitch; (2) 126 seats, all tourist, at

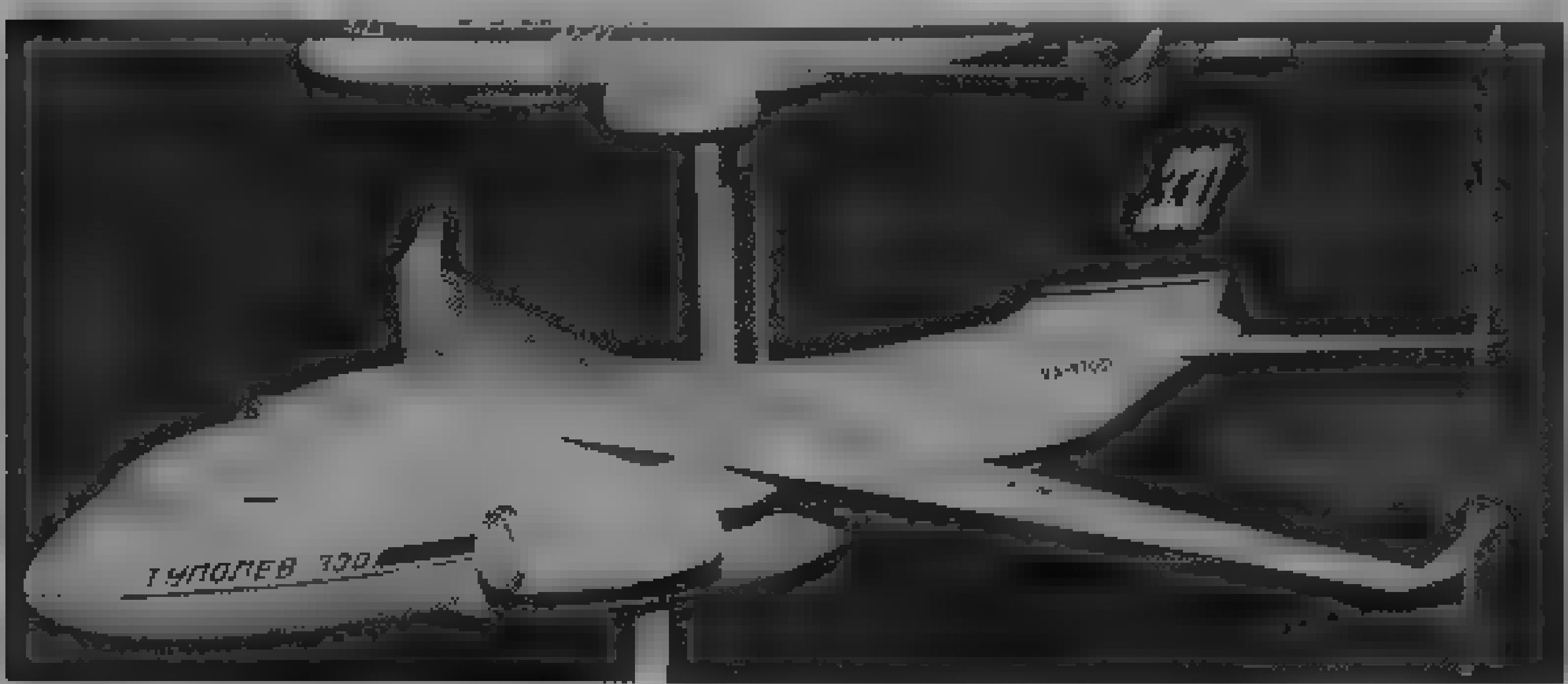
Reassembly at Zhukovsky of prototype Tu-334, for first flight

1995



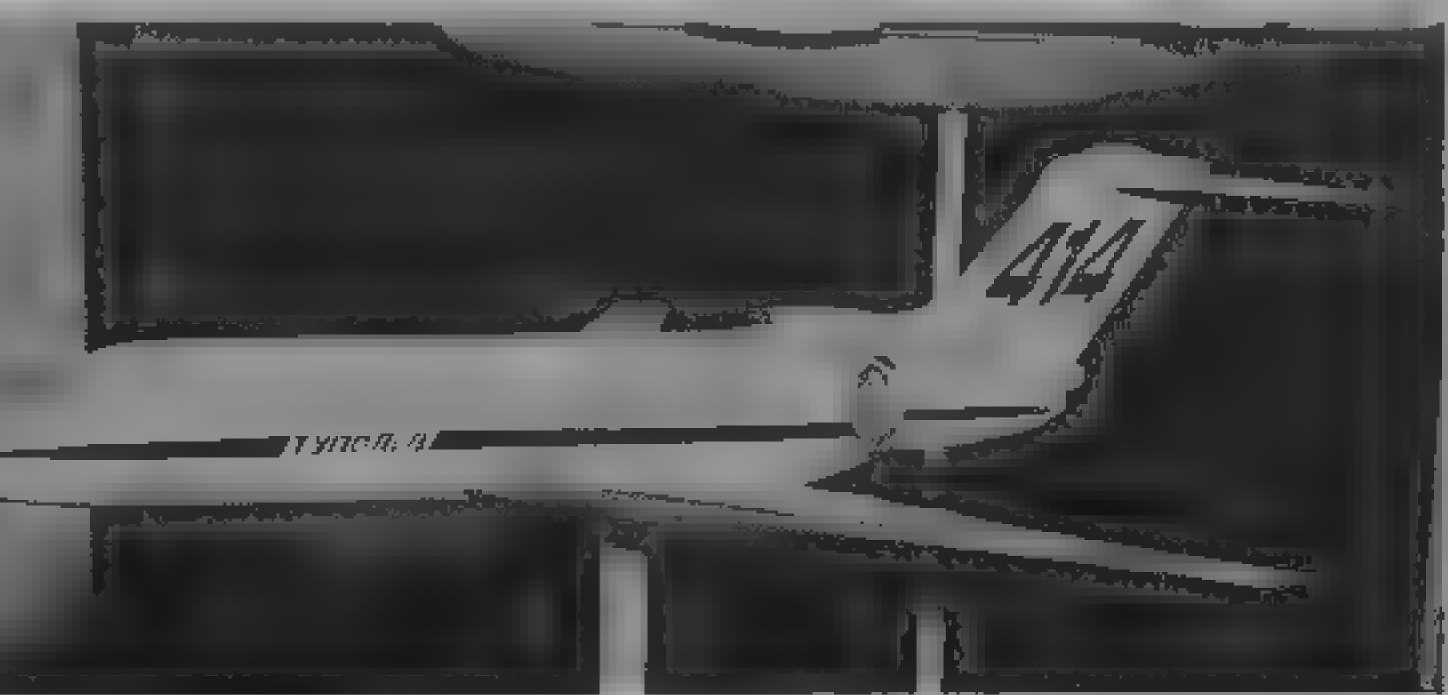
Tupolev Tu-334-100 twin-turbofan medium-range transport (*Jane's/Dennis Punnett*)

1995



Model of Tupolev Tu-330 (*Paul Jackson*)

1995



Model of Tupolev Tu-414 (*Paul Jackson*)

1995

81 cm (32 in) pitch. Facilities as Tu-334-100, plus emergency exit over wing each side.

AVIONICS: *Instrumentation*: EFIS standard, with six CRTs. Equipment for landings in ICAO Cat. IIIa conditions.

DIMENSIONS, EXTERNAL:

Wing span: 100	29.77 m (97 ft 8 in)
200	32.61 m (107 ft 0 in)
Wing aspect ratio: 100	10.17
200	10.62
Length overall: 100	31.26 m (102 ft 6¾ in)
200	35.16 m (115 ft 4½ in)
Fuselage cross-section:	
100, 200	3.80 m × 4.10 m (12 ft 5½ in × 13 ft 5½ in)
Height overall: 100	8.63 m (28 ft 3¾ in)
200	9.05 m (29 ft 8¼ in)
Wheelbase: 100	11.75 m (38 ft 6¾ in)

DIMENSIONS, INTERNAL:

Cabin: Length: 100	17.84 m (58 ft 6¼ in)
Height above aisle, 100, 200	2.155 m (7 ft 0¾ in)
beneath hand baggage racks:	
100, 200	1.70 m (5 ft 7 in)
Floor width: 100, 200	3.50 m (11 ft 5¾ in)
Volume: 100	118.0 m³ (4,167 cu ft)
Baggage holds:	
Max length: 100, forward	4.10 m (13 ft 5¼ in)
100, rear	3.00 m (9 ft 10 in)
Max height: 100	1.20 m (3 ft 11¼ in)
Total volume: 100	16.20 m³ (572 cu ft)

AREAS:

Wings, gross: 100	83.226 m² (895.8 sq ft)
200	100.0 m² (1,076.4 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: 100	30,050 kg (66,250 lb)
200	34,375 kg (75,785 lb)
Max payload: 100	11,000 kg (24,250 lb)
200	13,500 kg (29,760 lb)
Max fuel: 100	9,540 kg (21,030 lb)
200	13,790 kg (30,400 lb)
Max T-O weight: 100	46,100 kg (101,630 lb)
200	54,800 kg (120,810 lb)
Max wing loading: 100	553.9 kg/m² (113.5 lb/sq ft)
200	548.0 kg/m² (112.2 lb/sq ft)
Max power loading: 100	313.4 kg/kN (3.07 lb/lb st)
200	340.4 kg/kN (3.34 lb/lb st)

PERFORMANCE (estimated):

Nominal cruising speed at 10,600-11,100 m (34,775-36,400 ft):

100	431-442 kts (800-820 km/h, 497-510 mph)
200	431 kts (800 km/h, 497 mph)

Balanced runway length at 30°C:

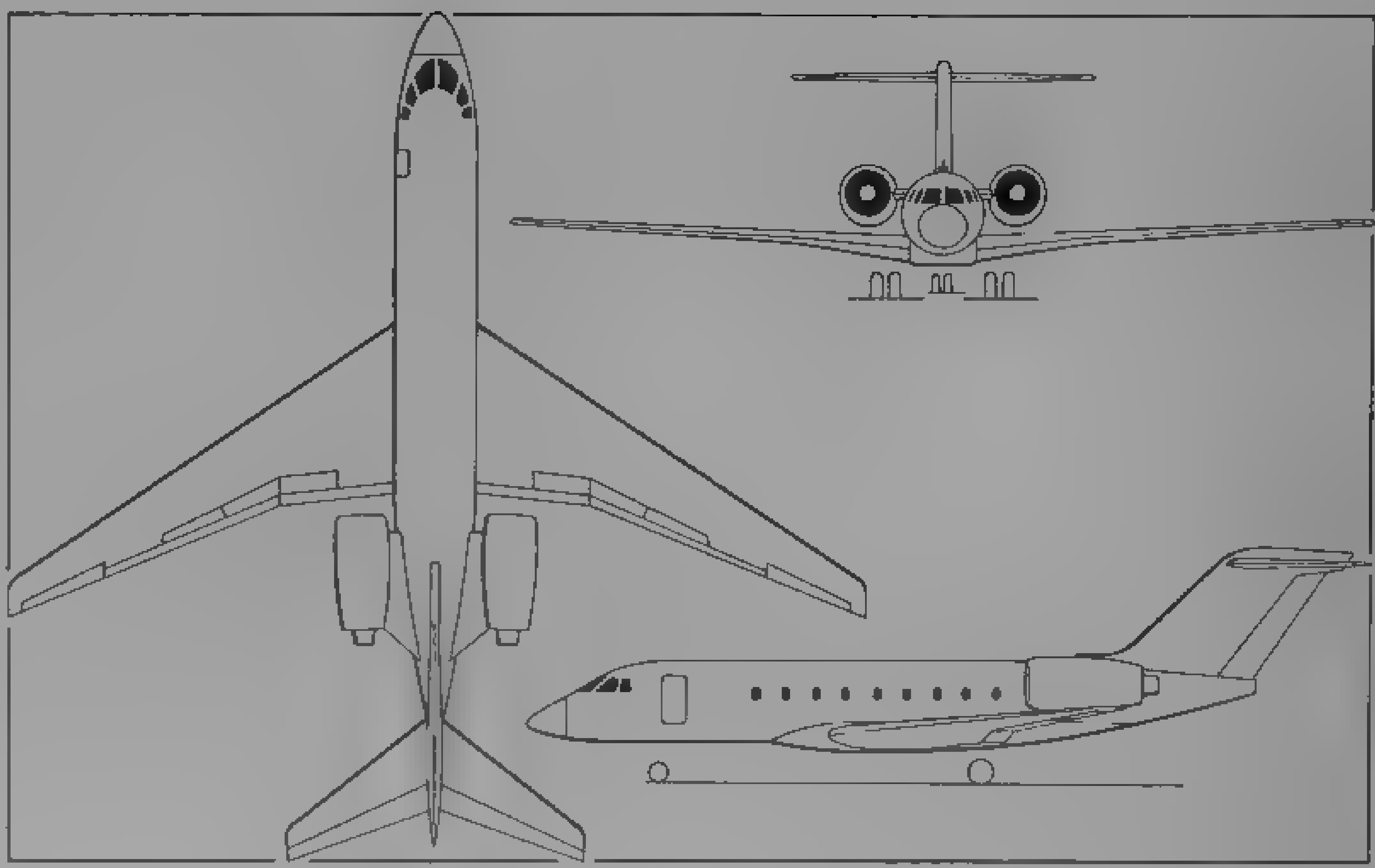
100, 200	2,200-2,300 m (7,220-7,545 ft)

Range:

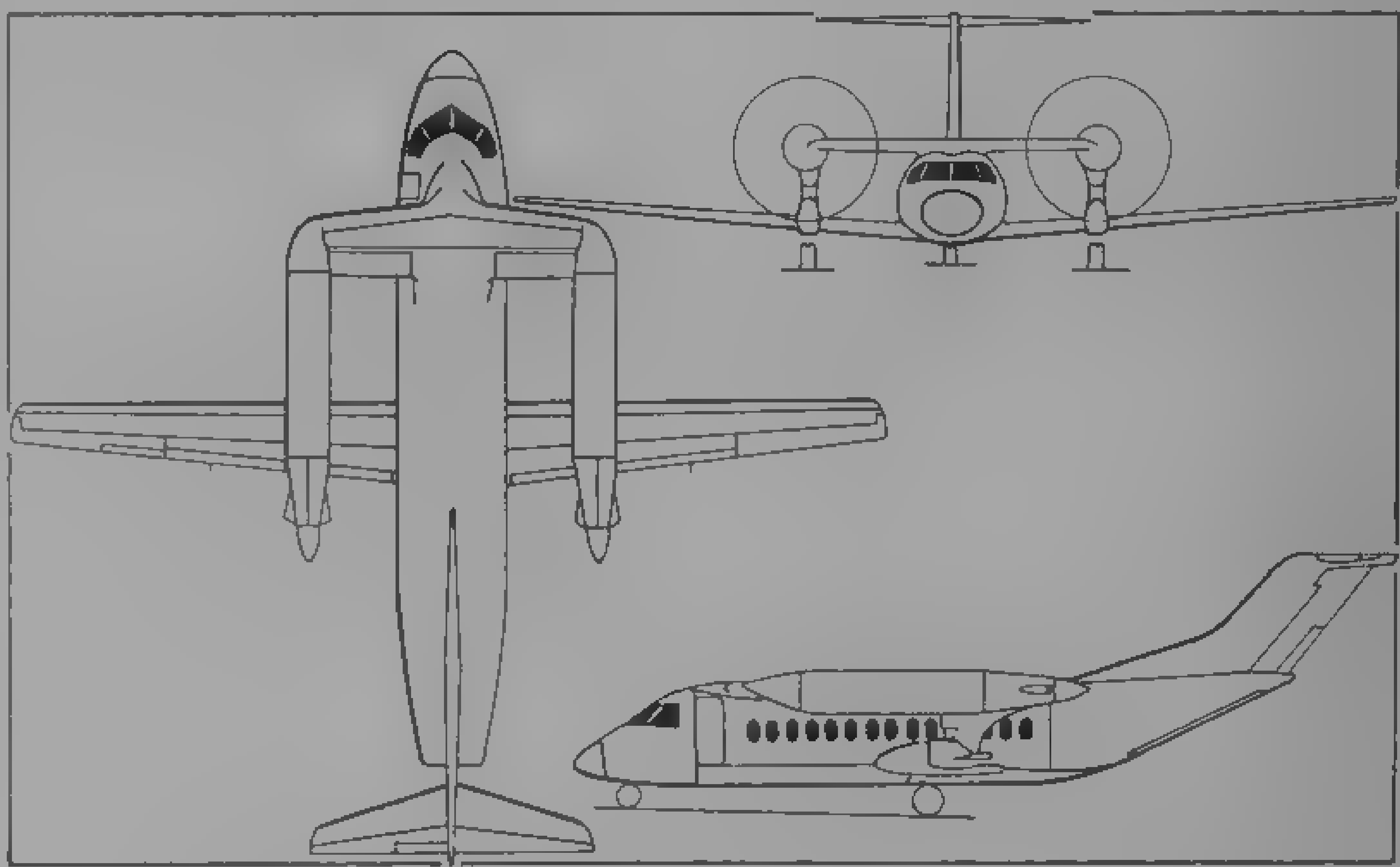
100, with 9,251 kg (20,395 lb) payload (102 passengers) 1,080 n miles (2,000 km, 1,242 miles)

200, with 11,970 kg (26,385 lb) payload (126 passengers) 1,187 n miles (2,200 km, 1,367 miles)

UPDATED



Tupolev Tu-414 twin-turbofan long-range business aircraft/regional transport *(Jane's/Mike Keep)* 1994



The projected Tupolev C-Prop cryogenic-fuelled turboprop transport *(Jane's/Paul Jackson)* 1995

TUPOLEV Tu-336

TYPE: Cryogenic-fuelled twin-turbofan airliner.

PROGRAMME: Projected version of Tu-334 with 8,000 kg (17,637 lb) of liquid natural gas in faired tank extending a most full length of cabin roof; Samara NK-112 engines; 120 passengers, range 647 n miles (1,200 km, 745 miles).

NEW ENTRY

TUPOLEV Tu-414

TYPE: Twin-turbofan long-range business aircraft/regional transport.

PROGRAMME: Announced at Asian Aerospace '94, Singapore.

DESIGN FEATURES: Conventional all-sweptback low-wing monoplane, with T tailplane; engine pod on each side of rear fuselage; dihedral constant from wingroots.

FLYING CONTROLS: Three-axis ailerons, elevators and rudder; long span two-section trailing-edge flaps on each wing; three-section spoilers forward of flaps.

LANDING GEAR: Retractable tricycle type; twin wheels on each unit.

POWER PLANT: Two BMW Rolls-Royce BR 710 turbofans, each 66.28 kN (14,900 lb st).

ACCOMMODATION: Two crew on flight deck, eight to 19 passengers in business versions, 30 passengers in regional transport.

DIMENSIONS, EXTERNAL:

Wing span	28.80 m (94 ft 6 in)
Length overall	28.20 m (92 ft 6¼ in)
Height overall	7.80 m (25 ft 7 in)

WEIGHTS AND LOADINGS:

Max payload	3,300 kg (7,275 lb)
Max T-O weight	40,000 kg (88,185 lb)

PERFORMANCE (estimated):

Nominal cruising speed	464 kts (860 km/h, 534 mph)
Balanced runway length	2,040 m (6,700 ft)

Range: with eight passengers 5,700 n miles (10,560 km, 6,560 miles)

with 30 passengers 4,590 n miles (8,500 km, 5,280 miles)

VERIFIED

TUPOLEV C-PROP

TYPE: Project for cryogenic-fuelled twin-turboprop transport.

PROGRAMME: Brief details announced at 1994 Farnborough Air Show.

DESIGN FEATURES: Tandem wing basic configuration, pusher turboprops on pylons above wings, fuel tanks in form of booms between foreplanes and engine nacelles; other details shown in accompanying three-view drawing.

POWER PLANT: Two 1,119 kW (1,500 shp) Pratt & Whitney Canada PT6A-67 turboprops, driving pusher propellers.

ACCOMMODATION: Basic payload of 32 passengers or three freight pallets, each 2.24 × 3.18 m (88 × 125 in) or 2.24 × 2.74 m (88 × 108 in).

DIMENSIONS, EXTERNAL:

Wing span	22.50 m (73 ft 9¾ in)
Length overall	21.00 m (68 ft 10¾ in)
Height overall	6.60 m (21 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin: Length	9.68 m (31 ft 9 in)
Max width	2.60 m (8 ft 6¼ in)
Max height	2.20 m (7 ft 2½ in)

WEIGHTS AND LOADINGS:

Max payload	3,400 kg (7,495 lb)
Max fuel (liquid gas)	2,400 kg (5,290 lb)
Max T-O weight	13,500 kg (29,760 lb)
Max power loading	6.03 kg/kW (9.92 lb/shp)

PERFORMANCE (estimated):

Nominal cruising speed at 8,000 m (26,250 ft) 242 kts (450 km/h, 280 mph)

Balanced runway length	620 m (2,035 ft)

Range with 32 passengers 810 n miles (1,500 km, 932 miles)

NEW ENTRY

OTHER AIRCRAFT

See *Jane's Aircraft Upgrades* for **Tu-16** and **Tu-22**, both withdrawn from Russian Air Force; 55 Tu-22s in Ukraine in January 1995, but being deactivated.

NEW ENTRY

ULAN-UDE

ULAN-UDE AIRCRAFT PRODUCTION ASSOCIATION

1 Khorinskaya Street, 670009 Ulan-Ude, Buryat Republic
Telephone: 7 (830122) 3 06 38 or 3 74 75
Fax: 7 (830122) 3 01 47
Telex: 288110 AVIA

GENERAL DIRECTOR: Yury N. Kravtsov

Founded in 1939, the Ulan-Ude Aircraft Production Association manufactures a wide range of products, from helicopters and fixed-wing aircraft to spares and domestic equipment. Its current products include modern developments of the Mil Mi-8/Mi-17 series of helicopters and Sukhoi Su-25UB combat trainers. It expects to manufacture the new Kamov Ka-62 helicopter.

NEW ENTRY

ULYANOVSK

ULYANOVSK AVIATION INDUSTRIAL COMPLEX "AVIASTAR"

Antonov pr 1, 432062 Ulyanovsk
Telephone: 7 (8422) 20 12 14
Fax: 7 (8422) 20 95 61
Telex: 263803 STAR SU
DIRECTOR GENERAL: Victor Mikhailov
COMMERCIAL DIRECTOR: Nikolai Kachalov

Opened in 1982, this large production facility manufactures the Antonov An-124, An-225 and Tu-204 transport aircraft

NEW ENTRY

YAKOVLEV

JOINT-STOCK COMPANY A. S YAKOVLEV DESIGN BUREAU

68 Leningradsky Prospekt, 125315 Moscow
Telephone: 7 (095) 157 17 34
Fax: 7 (095) 157 47 26
CHAIRMAN AND GENERAL DESIGNER: Alexander N Dondukov
PRESIDENT AND GENERAL DIRECTOR: Oleg F Demchenko
FIRST VICE-PRESIDENT AND FIRST DEPUTY GENERAL DESIGNER:
Vladimir G Dmitriev
VICE-PRESIDENT AND DEPUTY GENERAL DIRECTOR (EXTERNAL ECONOMIC RELATIONS): Arkady I. Gurtovoy
DEPUTY GENERAL DIRECTOR (FLIGHT TESTS): Andrei A. Sinitsin
VICE-PRESIDENTS AND CHIEF DESIGNERS:
Vladimir G Dmitriev (Yak 242, Yak 46)
Nicolas N Dolzhenkov (Yak-130)
Vladimir A Mitkin (Yak-48/IAI Galaxy)
Alexei G Rakhimbaev (Yak-42, Yak-142)
CHIEF DESIGNERS:
Sergei A Yakovlev (Yak-3, Yak-40TL, YAK-77)
Dmitry K. Drach (Yak-54, Yak-55M, Yak-112)
Yuri I. Yankevich (Yak 18T, Yak 52, Yak 58, UAV)
CHIEFS OF DEPARTMENTS:
Marketing and Sales: Anatoly S Ivanov
Exterior: Evgeny M. Tarasov
Information/Press Service: Yuri V Zasypkin

Founder of this OKB, Alexander Sergeyevich Yakovlev, died on 22 August 1989, aged 83. He was one of most versatile Soviet designers. Products of his OKB ranged from transonic long-range fighters to Yak-24 tandem-rotor helicopter, an operational V/STOL carrier-based fighter and a variety of training, competition aerobatic and transport aircraft

More than 200 aircraft designs and variants have been completed by Yakovlev since 1927, of which about 100 have been manufactured in series. By 1995, about 70,000 aircraft of Yakovlev design had been built

Current Yak Corporation formed in 1992 to engage in aircraft marketing, design, development, production, sales and after-sales support, includes A. S. Yakovlev Design Bureau, and Saratov and Smolensk airframe plants. From 1991, Skorost Industrial Association has co-operated in production of Yak-242. Hyundai-Yak Aerospace Co Ltd created in 1994, as a joint venture with Hyundai Group of South Korea, to develop, market and sell a wide range of small and medium size aircraft. Collaborative agreements concluded with Israel Aircraft Industries on Yak-48/Astra Galaxy design and production, and with Aermacchi of Italy on Yak-130

UPDATED

YAKOVLEV Yak-3

TYPE: Reproduction single-seat piston-engined fighter

PROGRAMME: Prototype of original wooden-skinned Yak-3 flew 1943, all-metal version flew 1945, deliveries to Soviet air forces began July 1944, totalled 4,848 (of 36,737 Yakovlev single-engined Second World War fighters), described often as lightest weight and most agile monoplanes of 1939-45 period. All metal version now available with Western power plant and uprated instrumentation, new build 'prototype' (0740101) displayed 1993 Paris Air Show, 20 being built to meet orders from Gunnell Museum, USA, six completed by January 1995

DESIGN FEATURES: Precise reproduction in metal of Second World War airframe, except for repositioned carburettor air intake above engine cowling to suit changed engine. Conventional cantilever low-wing configuration, with tapered, round-tipped wings

POWER PLANT: Reconditioned 925 kW (1,240 hp) Allison V 1710 12-cylinder V liquid-cooled piston engine replaces original 1,240/1,300 hp VK-105PF-2; three-blade propeller. Fuel capacity 320 litres (84 5 US gallons, 70 4 Imp gallons)

DIMENSIONS, EXTERNAL:	
Wing span	9 20 m (30 ft 2¼ in)
Length overall	8 49 m (27 ft 10¼ in)
AREAS:	
Wings, gross	14 85 m² (159 8 sq ft)
WEIGHTS AND LOADINGS:	
Max T-O weight	2,697 kg (5,945 lb)
Max wing loading	181 6 kg/m² (37 15 lb/sq ft)
Max power loading	2 91 kg/kW (4 80 lb/hp)
PERFORMANCE:	
Max level speed: at height	350 kts (648 km/h, 402 mph)
at S/L	307 kts (570 km/h; 354 mph)
Time to turn 360° at 1 000 m (3 280 ft)	19 s

UPDATED

YAKOVLEV Yak-18T

TYPE: Four-seat multipurpose light aircraft

PROGRAMME: Prototype first flew Summer 1967 as extensively redesigned cabin version of veteran Yak-18 trainer; produced subsequently in large series at Smolensk including trainer, ambulance, communications and light freight versions; last described in 1989-90 *Jane's*; production resumed to meet new contracts, one from Philippine Air Force for 20 aircraft, now manufactured also by Technoavia (which see)

DESIGN FEATURES: Conventional cantilever low wing monoplane; three-section two-spar wings, semi-monocoque fuselage of basically square section; strut- and wire-braced tail surfaces; wing section Clark YH, thickness/chord ratio 14 5 per cent at root, 9 3 per cent at tip; dihedral 7° 20' on outer panels only

STRUCTURE: All-metal construction, except for fabric covering on parts of outer wing panels, ailerons and tail surfaces

LANDING GEAR: Tricycle type, single wheel on each unit, pneumatic retraction, mainwheels inward into centre section, nosewheel rearward; oleo-nitrogen shock-absorbers, castoring nosewheel is non-steerable, tyres size 500 × 150 mm on mainwheels, 400 × 150 mm on nosewheel, pneumatic brakes on mainwheels

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P radial piston engine; two-blade variable-pitch metal propeller. Wing root fuel tanks, capacity 208 litres (55 US gallons, 45 75 Imp gallons)

ACCOMMODATION: Cabin seats four persons in pairs, with forward-hinged jettisonable door each side, rear bench seat, removable for freight carrying, ambulance configuration accommodates pilot, stretcher patient and medical attendant, baggage compartment aft of rear seat

Reproduction Yakovlev Yak-3 fighter with Allison engine *(Brian M. Service)*

1993

Yakovlev Yak 18T four-seat light aircraft built by Technoavia *(Peter R. March)*

1995

Yakovlev Yak-42D short/medium-range transport of Skoda Air at Moscow-Bykovo *(Mark Wagner/Flight International)*

1995

SYSTEMS: Pneumatic system for landing gear and flaps, electrical system includes red panel lighting, nav and landing lights, and fin-tip anti-collision beacon.

AVIONICS: *Comms*: 1 HF radio, intercom.

Instrumentation: Radio compass, radio altimeter and flight recorder standard.

DIMENSIONS, EXTERNAL:

Wing span	11.16 m (36 ft 7¼ in)
Wing chord, mean	1.74 m (5 ft 8½ in)
Length overall	8.39 m (27 ft 6½ in)
Height overall	2.80 m (9 ft 2¼ in)
Tailplane span	3.54 m (11 ft 7½ in)
Wheel track	3.12 m (10 ft 2¾ in)
Wheelbase	1.955 m (6 ft 5 in)

AREAS:

Wings, gross	18.8 m² (202.4 sq ft)
Ailerons (total)	1.92 m² (20.66 sq ft)
Fin	0.718 m² (7.73 sq ft)
Rudder	0.982 m² (10.57 sq ft)
Tailplane	1.95 m² (21.00 sq ft)
Elevators (total)	1.235 m² (13.30 sq ft)

WEIGHTS AND LOADINGS (A: instructor and one pupil, B: four persons):

Max payload: A	306 kg (675 lb)
B	436 kg (960 lb)
Max T-O weight: A	1,500 kg (3,307 lb)
B	1,650 kg (3,637 lb)
Max wing loading: A	80 kg/m² (16.4 lb/sq ft)
B	88 kg/m² (18.0 lb/sq ft)
Max power loading: A	5.66 kg/kW (9.32 lb/hp)
B	6.22 kg/kW (10.25 lb/hp)

PERFORMANCE (at max T-O weight):

Max level speed: A, B	159 kts (295 km/h; 183 mph)
Max cruising speed: B	135 kts (250 km/h; 155 mph)
Max rate of climb at S/L: B	300 m (985 ft)/min
Service ceiling: A, B	5,500 m (18,000 ft)
T-O run: A	330 m (1,085 ft)
B	400 m (1,315 ft)
Landing run: A	400 m (1,315 ft)
B	500 m (1,640 ft)
Range with max fuel, with reserves:	
A	350 n miles (650 km; 403 miles)
B	485 n miles (900 km; 560 miles)

UPDATED

YAKOVLEV Yak-42

NATO reporting name: Clobber

TYPE: Three-turbofan short/medium-range passenger transport.

PROGRAMME: Three prototypes ordered initially; first prototype (SSSR 1974) flew 7 March 1975, with 11° wing sweepback and furnished in 100-seat local service form, with carry-on baggage and coat stowage fore and aft of cabin; second prototype (SSSR 1975) had 23° sweepback and more cabin windows, representative of 120-seat version with three more rows of seats and no carry-on baggage areas; third prototype (SSSR 1976, later SSSR 42303) introduced small refinements (described in previous editions of *Jane's*); flight testing proved 23° wing superior; first series of production aircraft, built to replace some Aeroflot Tu-134s, generally similar to SSSR 42303 as exhibited 1977 Paris Air Show; changes for production included substitution of four-wheel main landing gear bogies for twin-wheel units on prototypes; scheduled service on Aeroflot's Moscow-Krasnodar route began late 1980.

CURRENT VERSIONS: **Yak-42**: Basic standard, *described in detail*.

Yak-42A: Experimental version displayed at 1993 Paris Air Show, similar to Yak-42D but with Western avionics. Production version, with AlliedSignal avionics, designated **Yak-142** (which see).

Yak-42B: As Yak-42A but Bendix/King nav system and flight deck CRTs.

Yak-42D: Increased fuel, range increased to 1,185 n miles (2,200 km; 1,365 miles) with 120 passengers; about 20 delivered by early 1991, production continues, seven built in 1993.

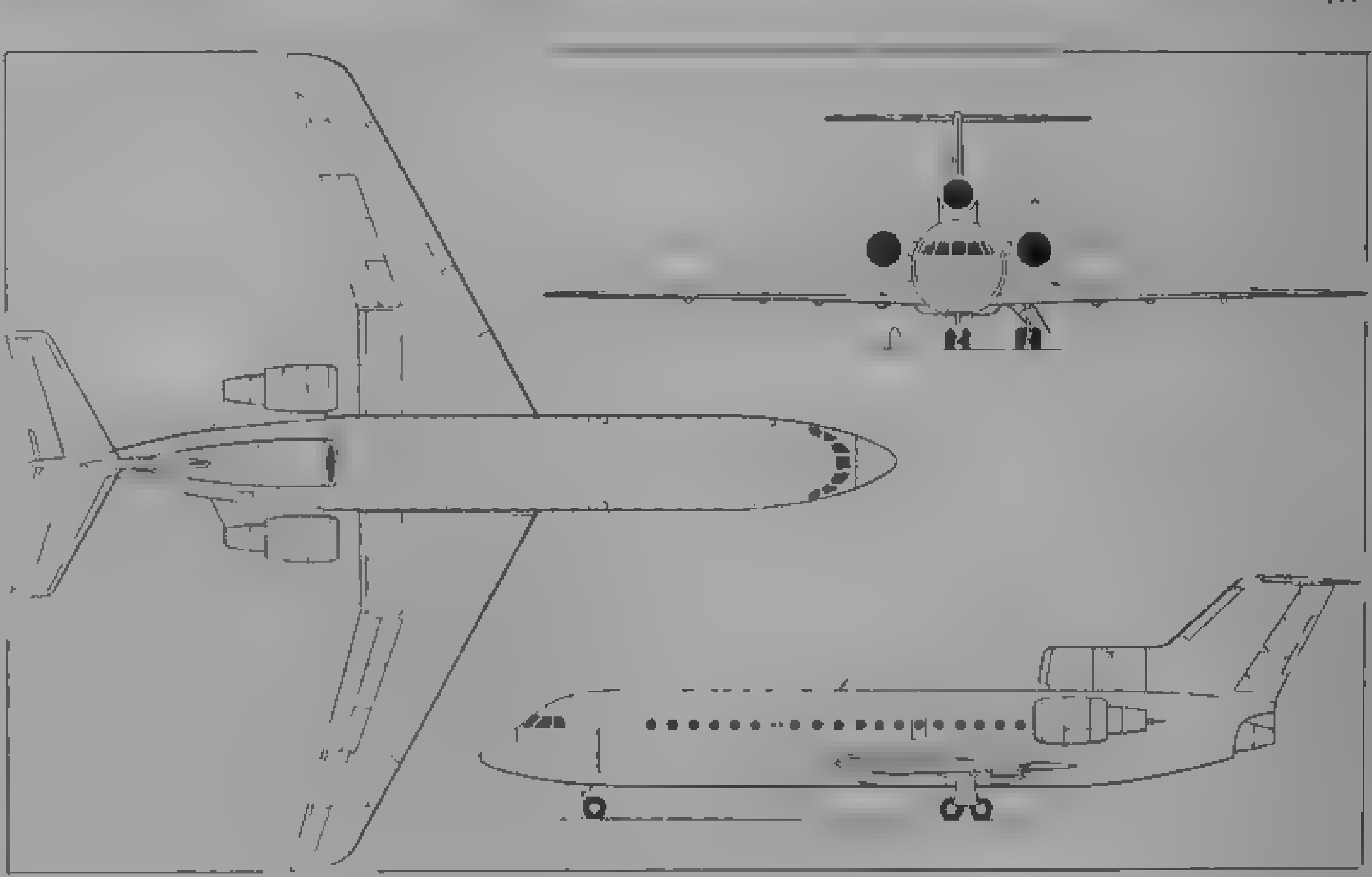
Yak-42E-LL: Propfan testbed; starboard D-36 turbofan replaced by ZMKB Progress D-236 geared propfan (8,090 kW; 10,850 shp), driving SV-36 tractor contraprops with eight forward blades and six rear blades; propeller diameter 4.2 m (13 ft 9½ in). First flown 15 March 1991, exhibited 1991 Paris Air Show.

Yak-42F: Basically standard Yak-42 adapted for electro-optical research, equipment in very large cylindrical pod under inboard panel of each wing. Unknown number used by Aeroflot for Earth resources and environmental survey.

Yak-42T: Freighter, with 2.50 m × 2.00 m (8 ft 2½ in × 6 ft 6¾ in) cargo door in upper deck; maximum freight load 12,000 kg (26,455 lb), including standard eight containers in underfloor holds.

CUSTOMERS: More than 130 built by January 1995, mostly for Aeroflot and its successors; four for Cubana, six for China General Aviation Corporation. Prototype and five preseries aircraft built at GAZ 11; 27 early production aircraft at GAZ 11 between 1978 and 1981, subsequent production at Smolensk 1981-1992 and GAZ 9, Saratov, from 1991. Seven delivered in 1993; 16 ordered and eight delivered in 1994.

DESIGN FEATURES: Basic design objectives simple construction, reliability in operation, economy, and ability to operate in remote areas with widely differing climatic conditions; design is in accordance with CIS civil airworthiness standards and US FAR 25, engines conform with international smoke and noise limitations, and aircraft is intended to operate in ambient temperatures from −50 to +50°C; APU for engine starting and services removes need for ground equipment.



Yakovlev Yak-42 three-turbofan short/medium-range passenger transport *(Jane's/Dennis Punnett)*

1982

Conventional all-swept low-wing configuration, two podded turbofans on sides of rear fuselage, third in extreme rear fuselage with intake at base of fin; no wing dihedral or anhedral; sweepback 23° at quarter-chord; basically circular fuselage, blending into oval rear section; T tail.

FLYING CONTROLS: Hydraulically actuated, two-section ailerons, each with servo tab on inner section, trim tab on outer section; two-section single-slotted trailing-edge flap, three-section spoiler forward of outer flap, full-span leading-edge flap on each wing; one-piece variable incidence tailplane (from 1° up to 12° down), trim tab in each elevator, trim tab and spring servo tab in rudder.

STRUCTURE: All-metal; two-spar torsion box wing structure; riveted, bonded and welded semi-monocoque fuselage.

LANDING GEAR: Hydraulically retractable tricycle heavy-duty type, made by Hydromash, four-wheel bogie main units retract inward into flattened fuselage undersurface, twin nosewheels retract forward, hydraulic back-up for extension only, emergency extension by gravity; oleo-nitrogen shock-absorbers, steerable nose unit of levered suspension type; low-pressure tyres, 930 × 305 mm on nosewheels, hydraulic disc brakes on mainwheels; nosewheel brakes to stop wheel rotation after take-off.

POWER PLANT: Three ZMKB Progress D-36 three-shaft turbofans, each 63.74 kN (14,330 lb st); centre engine, inside rear fuselage, has S-duct air intake, outboard engines in pod on each side of rear fuselage, no thrust reversers. Integral fuel tanks between spars in wings, capacity approximately 23,175 litres (6,120 US gallons; 5,100 Imp gallons).

ACCOMMODATION: Crew of two side by side, with provision for flight engineer, two or three cabin attendants. Single passenger cabin, with 120 seats six-abreast, at pitch of 75 cm (29.5 in), with centre aisle 45 cm (17.7 in) wide, in high-density configuration. Alternative 104-passenger (96 tourist, eight first class) local service configuration, with carry-on baggage and coat stowage compartments fore and aft of cabin. Main airstair door hinges down from undersurface of rear fuselage; second door forward of cabin on port side, with integral airstairs, service door opposite

Galley and crew coat stowage between flight deck and front vestibule; passenger coat stowage and toilet between vestibule and cabin, second coat stowage and toilet at rear of cabin. Two underfloor holds for cargo, mail and baggage in nets or standard containers, loaded through door on starboard side, forward of wing; chain-drive handling system for containers built into floor, forward hold for six containers, each 2.2 m³ (77.7 cu ft); rear hold takes two similar containers. Provision for convertible passenger/cargo interior, with enlarged loading door on port side of front fuselage. Two emergency exits, overwing and forward of wing, each side. All passenger and crew accommodation pressurised, air conditioned, and furnished with non-flammable materials.

SYSTEMS: TA-12 APU standard, for engine starting, and for power and air conditioning supply on ground and, if necessary, in flight.

AVIONICS: Flight and navigation equipment for operation by day and night under adverse weather conditions, with landings on concrete or unpaved runways in ICAO Cat. II weather minima down to 30 m (100 ft) visibility at 300 m (985 ft).

Flight: Type SAU-42 automatic flight control system and automatic navigation system standard.

DIMENSIONS, EXTERNAL:

Wing span	34.88 m (114 ft 5¼ in)
Wing aspect ratio	8.11
Length overall	36.38 m (119 ft 4½ in)
Fuselage diameter	3.80 m (12 ft 5½ in)
Height overall	9.83 m (32 ft 3 in)
Tailplane span	10.80 m (35 ft 5 in)
Wheel track	5.63 m (18 ft 5¾ in)
Wheelbase	14.78 m (48 ft 6 in)
Passenger door (fwd): Height	1.50 m (4 ft 11 in)
Width	0.83 m (2 ft 8½ in)
Passenger entrance (rear): Height	1.78 m (5 ft 10 in)
Width	0.81 m (2 ft 7¾ in)
Cargo door (convertible version):	
Height	2.025 m (6 ft 7¾ in)
Width	3.23 m (10 ft 7 in)
Baggage/cargo hold door: Height	1.35 m (4 ft 5 in)
Width	1.145 m (3 ft 9 in)
Height to sill	1.45 m (4 ft 9 in)

DIMENSIONS, INTERNAL:

Cabin: Length	19.89 m (65 ft 3 in)
Max width	3.60 m (11 ft 9¾ in)
Max height	2.08 m (6 ft 9¾ in)
Baggage compartment volume (100-seater):	
fwd	19.8 m³ (700 cu ft)
rear	9.5 m³ (335 cu ft)

AREAS:

Wings, gross	150.0 m² (1,615 sq ft)
Vertical tail surfaces (total)	23.29 m² (250.7 sq ft)
Horizontal tail surfaces (total)	27.60 m² (297.1 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped:	
104 seats	34,500 kg (76,058 lb)
120 seats	34,515 kg (76,092 lb)
Max payload	13,000 kg (28,660 lb)
Max fuel	18,500 kg (40,785 lb)
Max ramp weight	57,300 kg (126,320 lb)
Max T-O weight	57,000 kg (125,660 lb)
Max landing weight	51,000 kg (112,433 lb)
Max wing loading	380.0 kg/m² (77.8 lb/sq ft)
Max power loading	298.1 kg/kN (2.92 lb/lb st)

PERFORMANCE:

Max cruising speed at 7,620 m (25,000 ft)	437 kts (810 km/h; 503 mph)
Econ cruising speed at 9,100 m (29,850 ft)	399 kts (740 km/h; 460 mph)
T-O speed	119 kts (220 km/h; 137 mph) IAS
Approach speed	114 kts (210 km/h; 131 mph) IAS
Max cruising height	9,600 m (31,500 ft)
T-O balanced field length	2,200 m (7,220 ft)
Landing from 15 m (50 ft)	1,100 m (3,610 ft)
Range at econ cruising speed, with 3,000 kg (6,615 lb) fuel reserves:	
with max payload	745 n miles (1,380 km; 857 miles)
with 120 passengers (10,800 kg; 23,810 lb payload)	1,025 n miles (1,900 km; 1,180 miles)
with 104 passengers (9,360 kg; 20,635 lb payload)	1,240 n miles (2,300 km; 1,430 miles)
with max fuel and 42 passengers	2,215 n miles (4,100 km; 2,545 miles)

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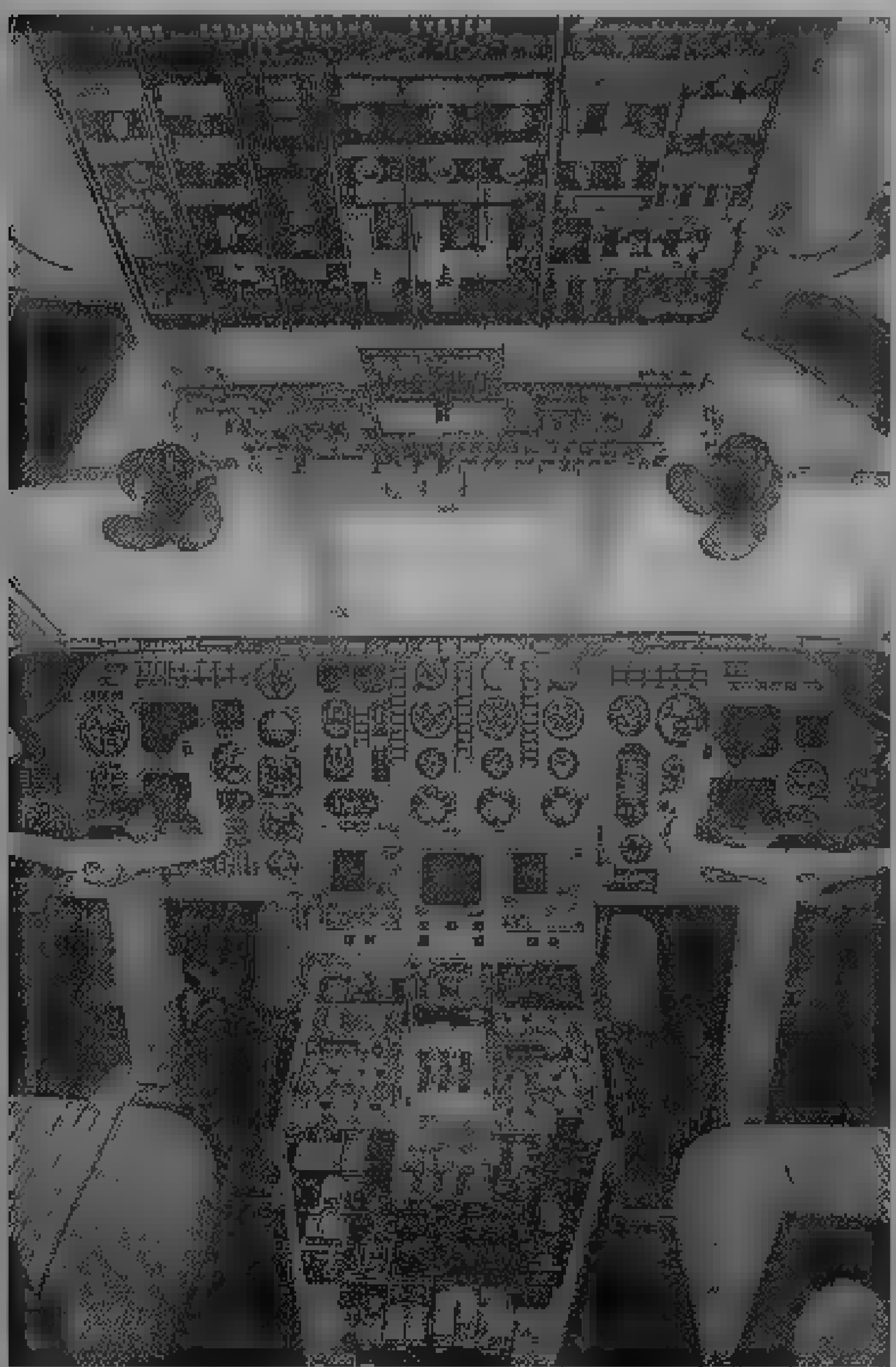


Flight deck of Yakovlev Yak-142 (*Mark Wagner/Flight International*)

1995

YAKOVLEV Yak-142

TYPE: Three-turbofan short/medium-range passenger transport.

PROGRAMME: Developed from Yak-42 via experimental Yak-42A, displayed at 1993 Paris Air Show; production beginning at Saratov.

DESIGN FEATURES: Improvements compared with Yak-42 include flight deployable wing spoilers to increase rate of descent, wide flap setting range for improved T-O performance and rate of climb, even in hot and high conditions; larger port-side cabin door, for improved compatibility with passenger boarding walkways, in addition to rear airstair; improved passenger comfort; state of the art digital avionics; EFIS cockpit displays, redesigned engine air intakes that lower noise levels to meet latest ICAO standards (Ch 3, Appendix 16); and addition of TA-12 APU, able to be started at up to 5,000 m (16,400 ft). Other features as Yak-42, except:

AVIONICS: SAU-4201 Cat. II qualified flight control system with autothrottle capability. AlliedSignal equipment includes KNS-660 flight data control system, KAD-480 air data system.

Comms: KHF 950 HF, RIA 35A ILS, RVA-36A VOR, DMA-37A DME, RTA-44A VHF com, DFA-75A ADF.

Radar: RDR-4A weather radar.

Instrumentation: EFIS-10 system with five colour CRTs and KAH 460 AHR, ALA 52A radio altimeter, TPA 81A TCAS II, TRA-67A Mode S transponder.

DIMENSIONS AND WEIGHTS: As Yak-42, except:

Passenger door (fwd): Height	1.70 m (5 ft 7 in)
Width	0.85 m (2 ft 9½ in)

PERFORMANCE: As Yak-42, except:

Max cruising speed	400 kts (740 km/h; 460 mph)
Optimum cruising height	9,600 m (31,500 ft)
FAR balanced field length: ISA at S/L	1,800 m (5,905 ft)
ISA + 20°C at 1,525 m (5,000 ft)	2,200 m (7,220 ft)

VERIFIED

YAKOVLEV Yak 242

TYPE: Twin-turbofan short-range airliner.

PROGRAMME: Superseded three-engined Yak-42M; first of two prototypes to fly in second half of 1990s.

CUSTOMERS: Aeroflot requirement for 200 aircraft in this category, stated some years ago, still firm.

DESIGN FEATURES: Much more than a stretched Yak 42; only fuselage cross-section is not new; wings have supercritical section devised in collaboration with TsAGI, with 25° sweepback, increased span and higher aspect ratio, double-slotted trailing-edge flaps, and winglets, together with new turbofans, this gives increased performance, digital fly-by-wire flight controls and five-CRT EFIS standard, avionics upgraded for ICAO Cat. IIIa minima.

FLYING CONTROLS: Fly-by-wire.

LANDING GEAR: Hydraulically retractable tricyle type; four-wheel bogie main units, twin nosewheels.

POWER PLANT: Two Aviadvigatel PS-90A12 turbofans, each 118 kN (26,525 lb st).

ACCOMMODATION: Crew of two side by side on flight deck, provision for flight engineer if required, 130 to 180 passengers, (1) single class cabin configuration for 180 passengers at 75 cm (29.5 in) pitch, 162 at 78 cm (30.7 in) pitch, or 156 at 81 cm (31.9 in) pitch, all six-abreast with centre aisle; (2) 12 four-abreast in first class cabin at front at 96 cm (37.8 in) pitch and 126 at 78 cm (30.7 in) pitch, or (3) 12 first class, 24 business class at 87 cm (34.25 in) pitch and 96 at 78 cm (30.7 in) pitch. Doors at front and rear of cabin, with service doors opposite; two emergency exits each side, over wing.

AVIONICS: *Instrumentation*: BendixKing flat-panel flight deck displays.

DIMENSIONS, EXTERNAL:

Wing span	36.25 m (118 ft 11¼ in)
Length overall	38.00 m (124 ft 8 in)

AREAS:

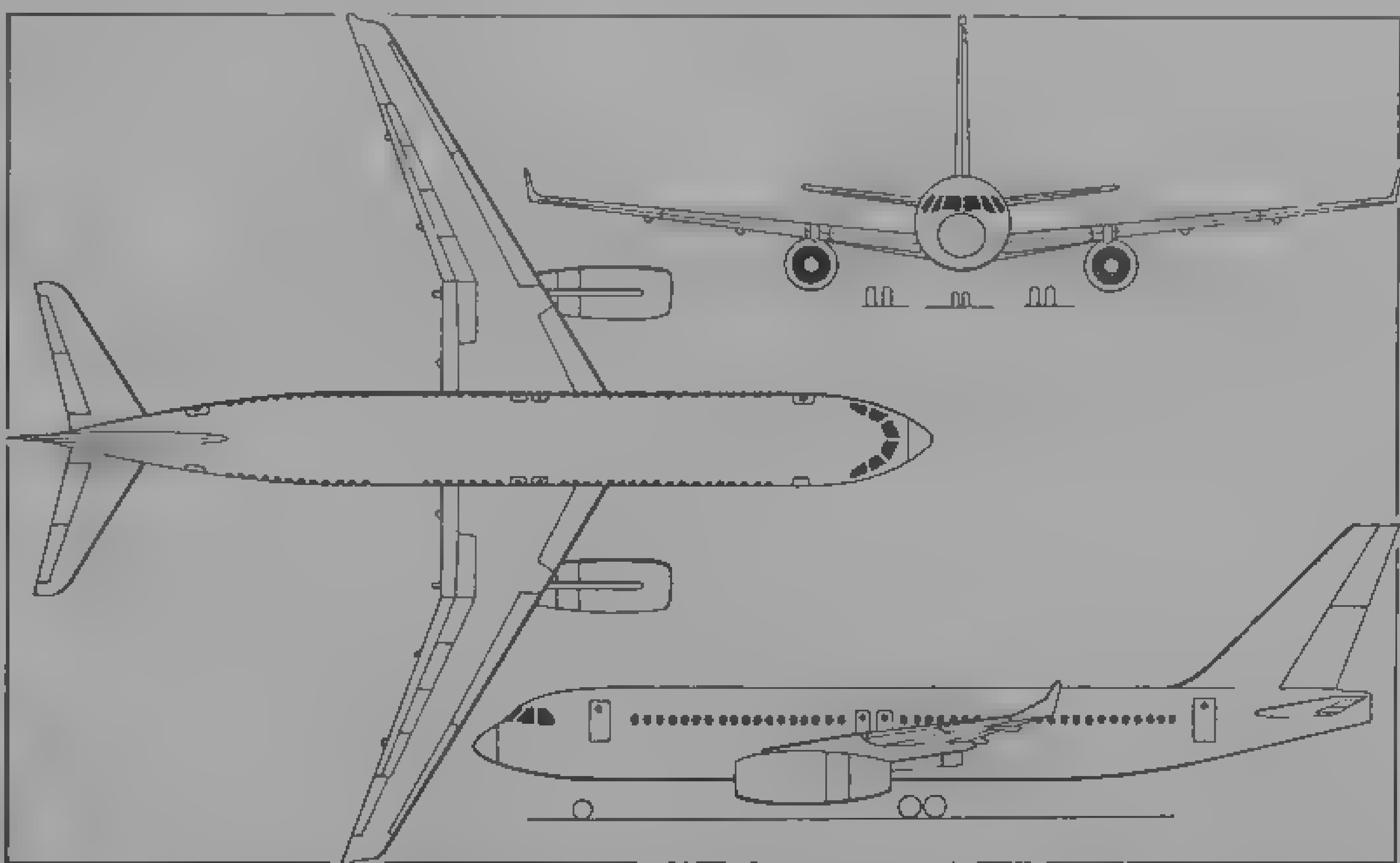
Wings, gross	120.0 m² (1,292 sq ft)

WEIGHTS AND LOADINGS:

Operating weight, equipped	38,400 kg (84,655 lb)
Normal fuel	14,000 kg (30,865 lb)
Max fuel	22,000 kg (48,500 lb)
Max payload	18,000 kg (39,680 lb)
Max T-O weight	64,600 kg (142,415 lb)

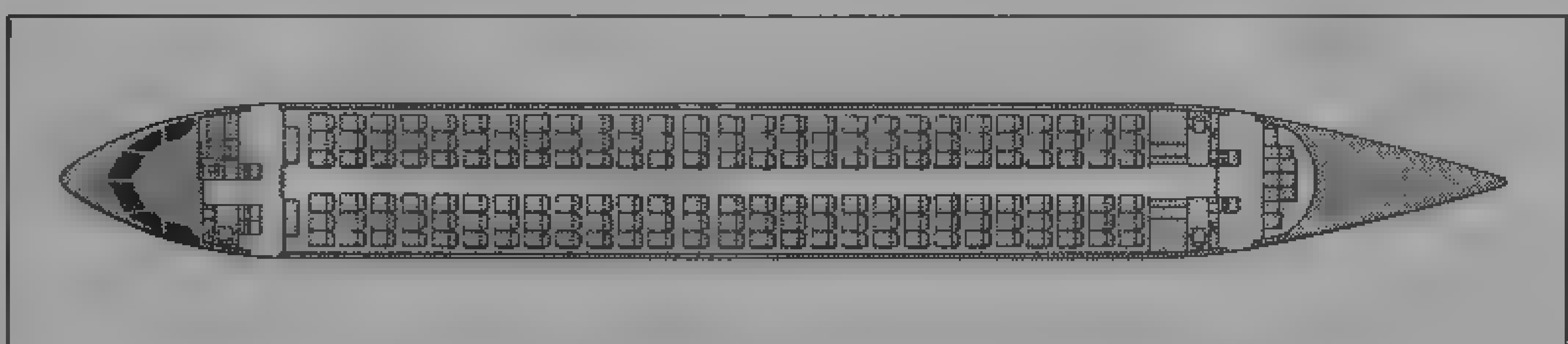
PERFORMANCE (estimated):

Nominal cruising speed at 11,100-11,600 m (36,400-38,050 ft)	431-458 kts (800-850 km/h; 497-528 mph)
Required runway length	2,200 m (7,220 ft)



Yakovlev Yak 242 twin-turbofan short-range passenger transport (*Jane's/Mike Keep*)

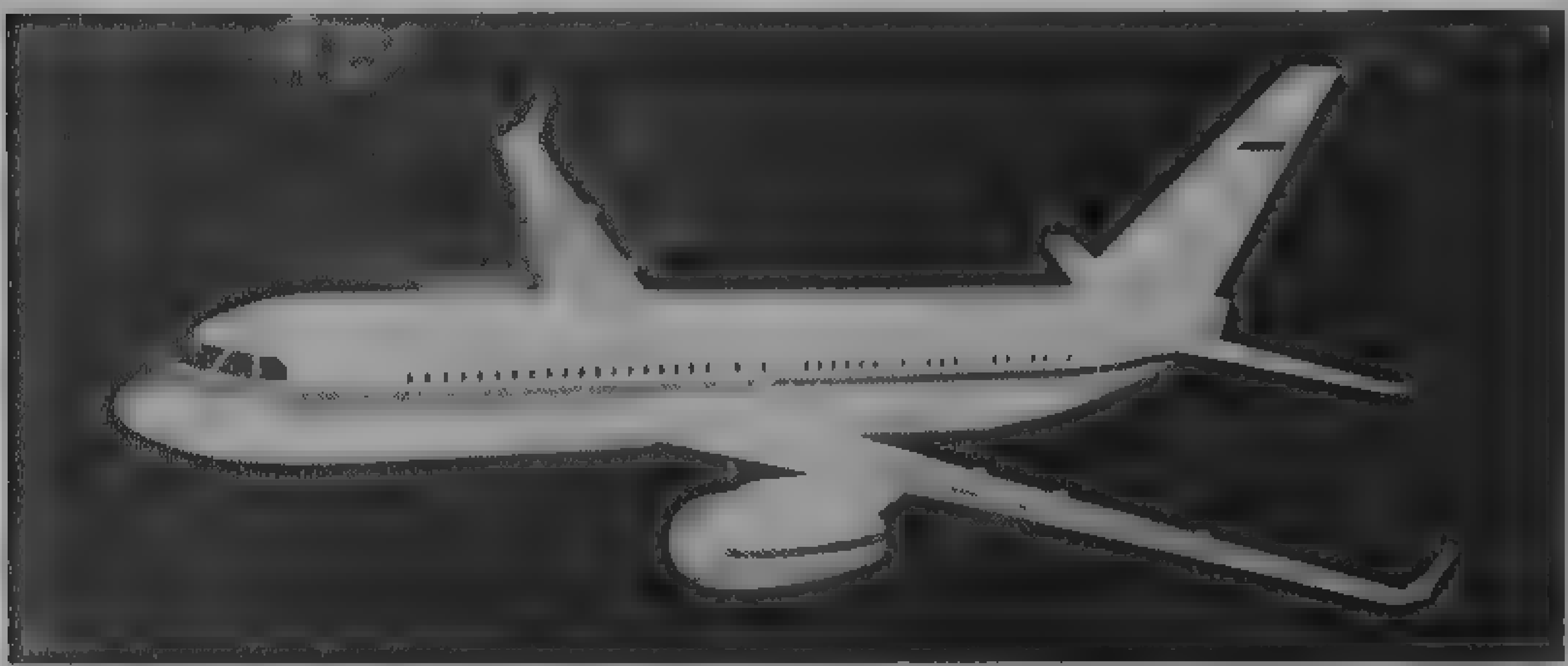
1994



Typical cabin layout of Yakovlev Yak-242 passenger transport (*Jane's/Mike Keep*)

1994

Mockup of Yakovlev Yak 242 flight deck (*Mark Wagner/Flight International*) *1995*



Model of Yakovlev Yak 242 twin-turbofan airliner (*Brian M. Service*) *1993*

Range. CAR reserves
with max payload 863 n miles (1,600 km, 994 miles)
with normal payload 1,457 n miles (2,700 km 1,677 miles)
with max fuel 2 700 n miles (5,000 km, 3,107 miles)

UPDATED

YAKOVLEV Yak-46-1

TYPE Twin-turbofan short/medium range passenger transport

PROGRAMME Design study announced early 1991, included in State Air Transport Programme to year 2000, adopted by Russian Transport Minister 22 May 1992

CURRENT VERSIONS Four versions projected: single class with up to 168 seats, mixed class for 12 first class and 114 tourist passengers, convertible passenger/freighter; casualty evacuation version

DESIGN FEATURES Conventional low-wing monoplane with underwing engines; supercritical high aspect ratio wings, sweptback 25°, with winglets, all swept tail surfaces, with tailplane mounted on tailcone

FLYING CONTROLS Fly by wire

LANDING GEAR Hydraulically retractable tricycle type; four-wheel bogie main units, twin nosewheels

POWER PLANT Two Samara/SSPE/Trud high bypass turbofans, each rated at 107 9 kN (24,250 lb st)

ACCOMMODATION Crew of two side by side on flight deck provision for flight engineer if required, typically 150 seats six abreast with centre aisle, galley, toilets, seats for flight attendants front and rear Doors at front and rear of cabin on port side, service doors opposite, two emergency exits each side over wing

AVIONICS Integrated flight and nav/com systems for operation to ICAO Cat IIIa standards

DIMENSIONS EXTERNAL

Wing span	36 25 m (118 ft 11¼ in)
Length overall	38 80 m (127 ft 3½ in)

AREAS

Wings, gross	120 0 m² (1,292 sq ft)

WEIGHTS AND LOADINGS

Weight empty, equipped	34,840 kg (76,808 lb)
Max payload	17,500 kg (38,580 lb)
Max T-O weight	60,200 kg (132,715 lb)
Max wing loading	501 7 kg/m² (102.7 lb/sq ft)
Max power loading	278.7 kg/kN (2.74 lb/lb st)

PERFORMANCE (estimated)

Nominal cruising speed	448-458 kts (830-850 km/h, 515-528 mph)
Nominal cruising height	11,100 m (36,400 ft)
Balanced runway length, ISA	2,100 m (6,890 ft)

Range with max payload 1,187 n miles (2,200 km, 1,367 miles)
with normal payload 1,863 n miles (3,450 km 2,143 miles)

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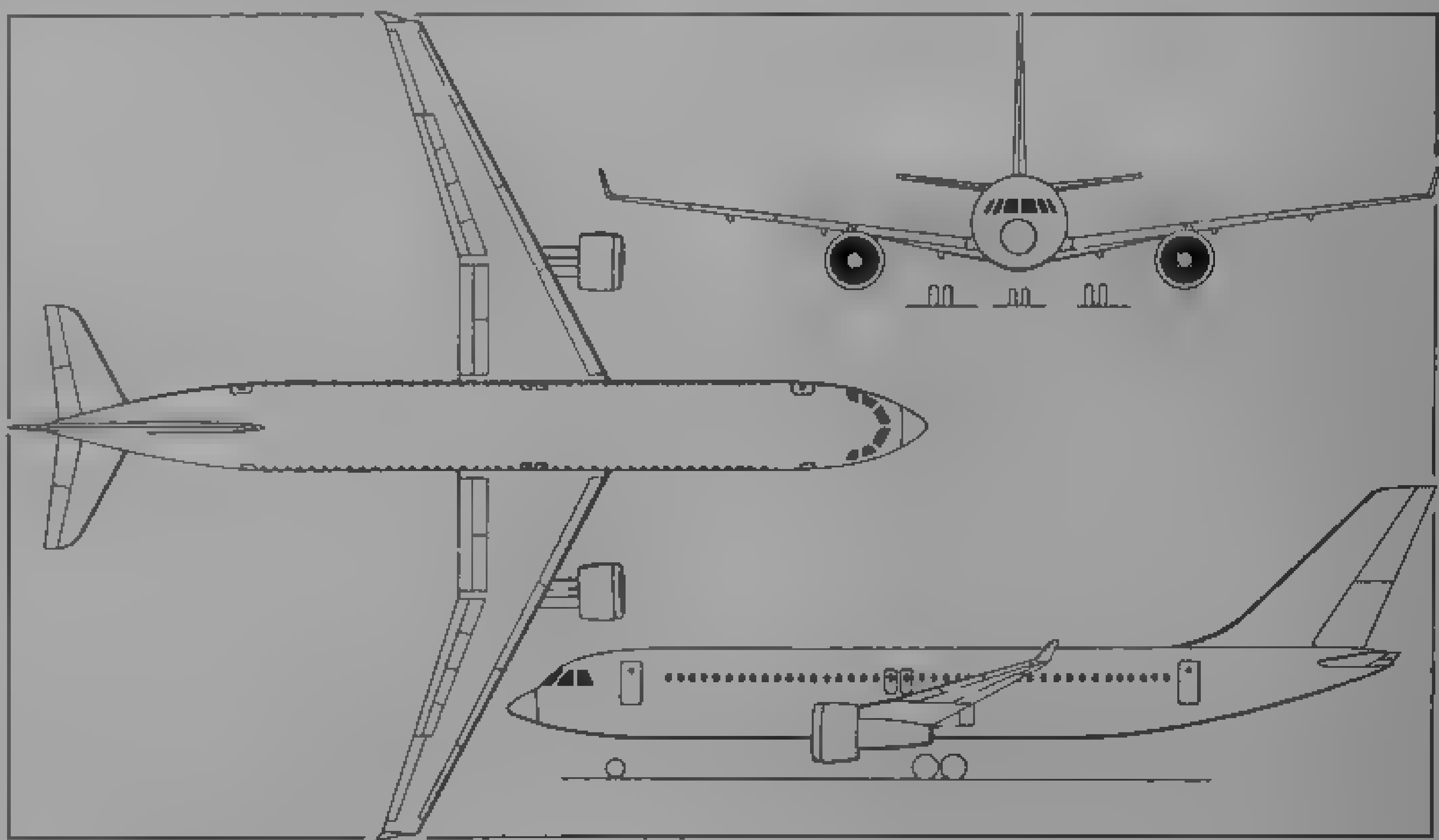
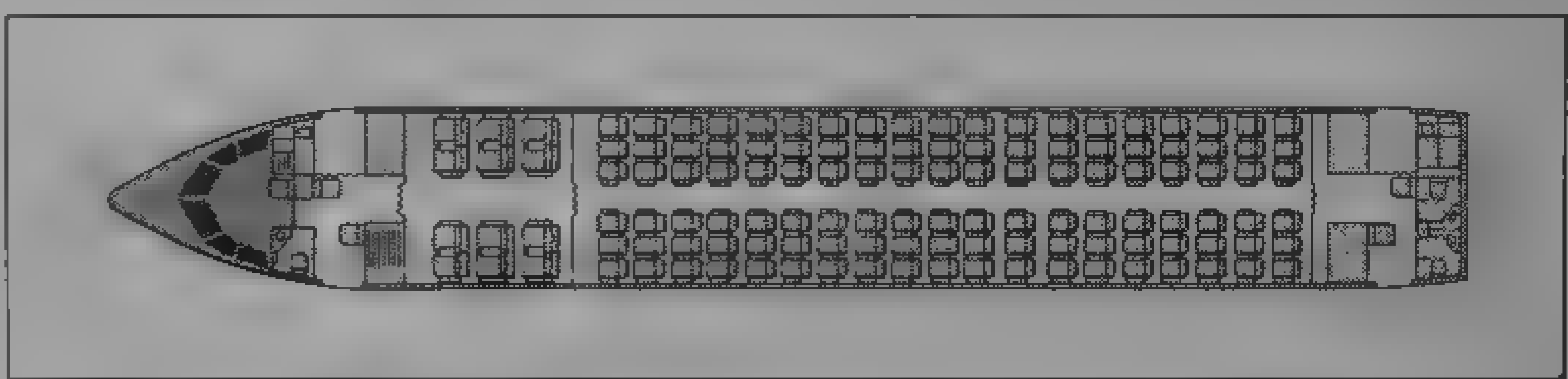


Yakovlev Yak 46-1 twin-turbofan short/medium-range airliner (*Jane's/Mike Keep*) *1994*



Typical cabin layout of the Yakovlev Yak 46-1 passenger transport (*Jane's/Mike Keep*) *1994*

YAKOVLEV Yak-46-2

TYPE Twin propfan short/medium range passenger transport

PROGRAMME Design study and model shown at Moscow Aerospace '90 Air Show, development dependant on propfan progress

CURRENT VERSIONS As for Yak-46-1

DESIGN FEATURES Despite sharing Yak-46 type designation, this aircraft is entirely different from Yak-46-1, except for same basic fuselage and accommodation, it has wings mounted further rearward, new rear fuselage and tail unit, with two side-mounted pusher propfans on pylons

FLYING CONTROLS Fly-by-wire

POWER PLANT Two ZMKB Progress D-27 propfans, each rated at 109 8 kN (24,690 lb st), driving contraprops, one with eight blades, other with six blades

ACCOMMODATION As for Yak 46-1

AVIONICS As for Yak 46-1

DIMENSIONS EXTERNAL

Wing span	35 50 m (116 ft 5¾ in)
Length overall	41 00 m (134 ft 6 in)
Propeller diameter (each)	3 80 m (12 ft 5¾ in)

AREAS

Wings, gross	120 0 m² (1,292 sq ft)

WEIGHTS AND LOADINGS

Weight empty, equipped	37,300 kg (82,230 lb)
Max payload	17,500 kg (38,580 lb)
Max T-O weight	61,300 kg (135,140 lb)
Max wing loading	510 8 kg/m² (104 6 lb/sq ft)
Max power loading	279 1 kg/kN (2 74 lb/lb st)

PERFORMANCE (estimated)

Nominal cruising speed	448 kts (830 km/h, 515 mph)
Nominal cruising height	11,100 m (36,400 ft)
Balanced runway length, ISA	2,100 m (6,890 ft)

Range with max payload 971 n miles (1,800 km, 1,118 miles)
with normal payload 1 888 n miles (3,500 km; 2,175 miles)

VERIFIED

YAKOVLEV Yak-52

Tandem two-seat piston-engined primary trainer produced as Iak 52 by Aerostar SA in Romania (which see)

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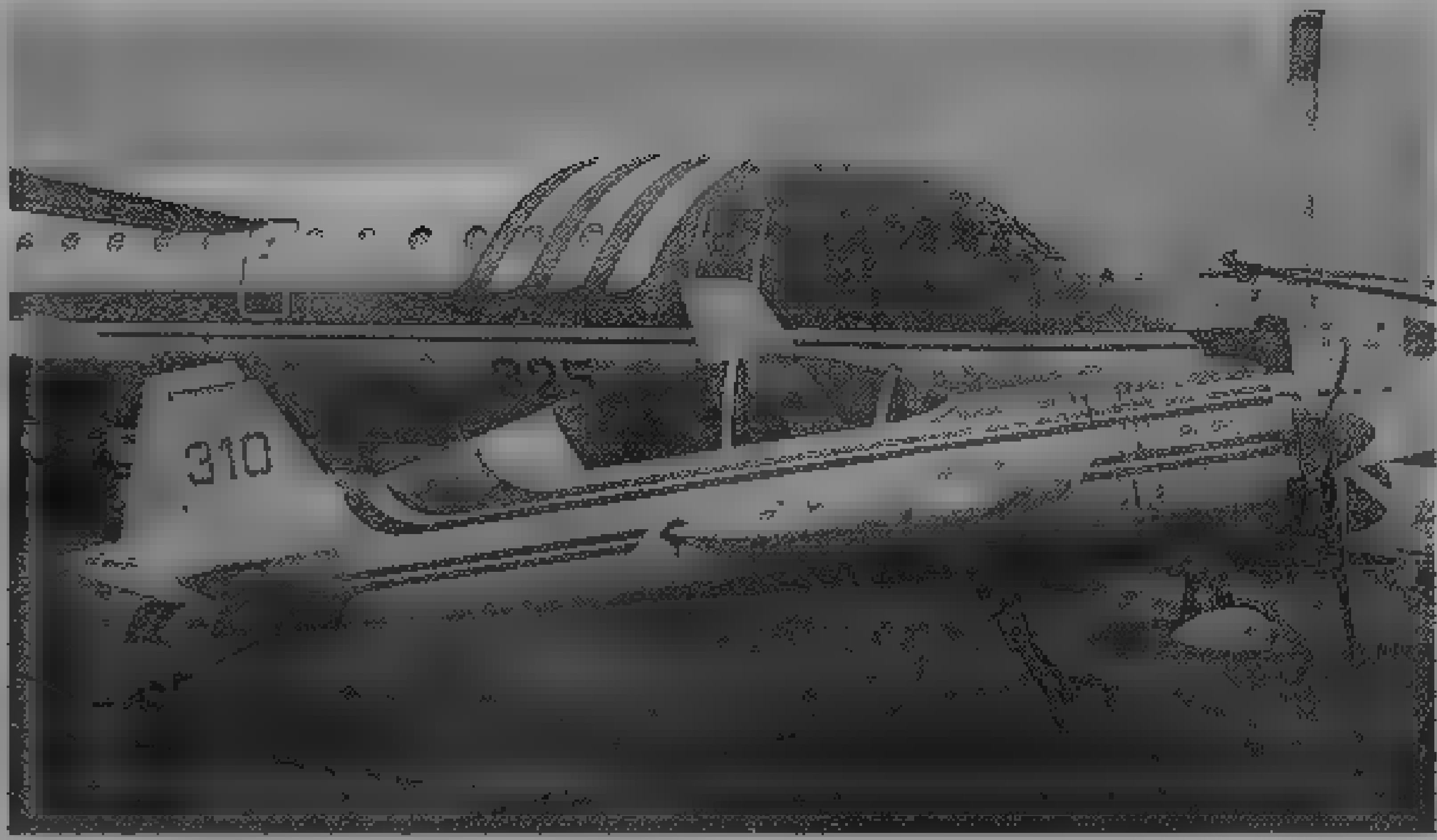
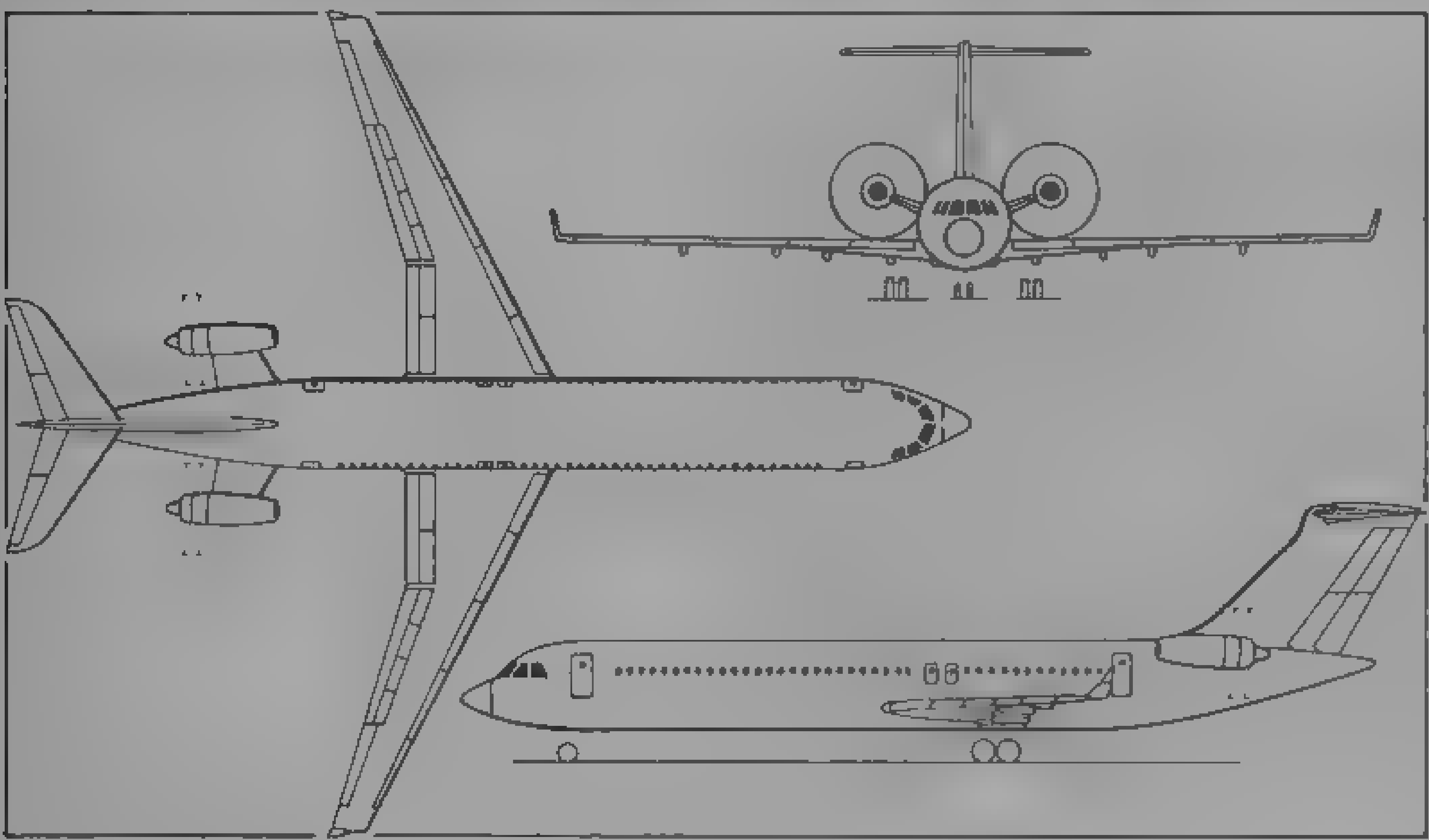
Projected Yakovlev Yak-46-2 twin-propfan airliner *(Jacques Marmain)* 1991



Prototype Yak-54 aerobatic aircraft *(Paul Jackson)* 1995



Yakovlev Yak-46-2, the projected twin-propfan derivative of the Yak-46-1 *(Jane's/Mike Keep)* 1994

YAKOVLEV Yak-54

TYPE: Tandem two-seat sporting and aerobatic training aircraft

PROGRAMME: Announced 1992, prototype at 1993 Paris Air Show, first flown 24 December 1993. In production from 1995

DESIGN FEATURES: Conventional mid-wing configuration, symmetrical section; no dihedral, anhedral or incidence; almost full-span ailerons, elevators and rudder all horn balanced, each aileron has large suspended balance tab; non-retractable tailwheel type landing gear, with cantilever main legs and small wheels. Designed on basis of systems and units of Yak-55M

STRUCTURE: All-metal, two-spar wings; semi-monocoque fuselage; conventional tail unit, titanium spring main landing gear legs

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial engine; three-blade variable-pitch propeller

ACCOMMODATION: Two seats in tandem under continuous transparent canopy, hinged to starboard

DIMENSIONS, EXTERNAL:

Wing span	8.16 m (26 ft 9¼ in)
Length overall	6.91 m (22 ft 8 in)

AREAS:

Wings, gross	12.89 m² (138.75 sq ft)

WEIGHTS AND LOADINGS:

Max T-O weight: one pilot	850 kg (1,874 lb)
two occupants	990 kg (2,182 lb)
Max wing loading	76.8 kg/m² (15.73 lb/sq ft)
Max power loading	3.74 kg/kW (6.15 lb/hp)

PERFORMANCE (estimated):

Never-exceed speed	243 kts (450 km/h; 280 mph)
Stalling speed	60 kts (110 km/h; 69 mph)
Rate of roll	345°/s
Rate of climb at S/L	900 m (2,950 ft)/min
Ferry range	377 n miles (700 km; 435 miles)
g limits	+9/-7

UPDATED

YAKOVLEV Yak-55M

TYPE: Single-seat aerobatic competition aircraft

PROGRAMME: Original Yak-55 made unanticipated appearance at 11th World Aerobatic Championships, Spitzerberg, Austria, August 1982; considerable subsequent refinement, including early change to stronger, tapered wings of thinner section for 1984 Championships; current Yak-55M, with further refinements, accompanied Soviet team to 1989 European Aerobatic Championships in Hungary; series production began 1991

DESIGN FEATURES: Mid-wing configuration; symmetrical section, no dihedral, anhedral or incidence; almost full-span ailerons, elevators and rudder all horn balanced, with ground adjustable tab, each aileron also has large suspended balance tab, non-retractable tailwheel type landing gear, with bowed cantilever main legs and small wheels

STRUCTURE: All-metal, two-spar wings; semi-monocoque fuselage, conventional tail unit, titanium spring main landing gear legs, rearward sliding canopy

POWER PLANT: One 265 kW (355 hp) VOKBM M-14P nine-cylinder air-cooled radial engine, two-blade controllable-pitch propeller; wing fuel tanks, capacity 120 litres (31.5 US gallons; 26 Imp gallons)

DIMENSIONS, EXTERNAL:

Wing span	8.10 m (26 ft 6¾ in)
Wing aspect ratio	5.13
Length overall	7.00 m (22 ft 11½ in)
Height overall	2.80 m (9 ft 2¼ in)
Tailplane span	3.15 m (10 ft 4 in)
Wheel track	2.24 m (7 ft 4¼ in)

AREAS:

Wings, gross	12.8 m² (137.8 sq ft)

WEIGHTS AND LOADINGS:

Max T-O weight	840 kg (1,852 lb)
Max wing loading	65.6 kg/m² (13.44 lb/sq ft)
Max power loading	3.13 kg/kW (5.14 lb/hp)

PERFORMANCE:

Max level speed	243 kts (450 km/h; 280 mph)
Stalling speed	57-60 kts (105-110 km/h, 66-69 mph)
Max rate of climb at S/L	930 m (3,050 ft)/min
Rate of roll	345°/s
g limits	+9/-6

UPDATED

YAKOVLEV Yak-58

TYPE: Six-seat light multipurpose aircraft

PROGRAMME: Shown in model form at Moscow Aerospace '90 Air Show; full-scale mockup exhibited February 1991, prototype (RA-01003) first flew 26 December 1993, at Tbilisi, Georgia, lost in accident 27 May 1994, second prototype flew 10 October 1994, two more completed, plus two static test airframes, by January 1995, OKB claims receipt of 250 letters of intent to purchase

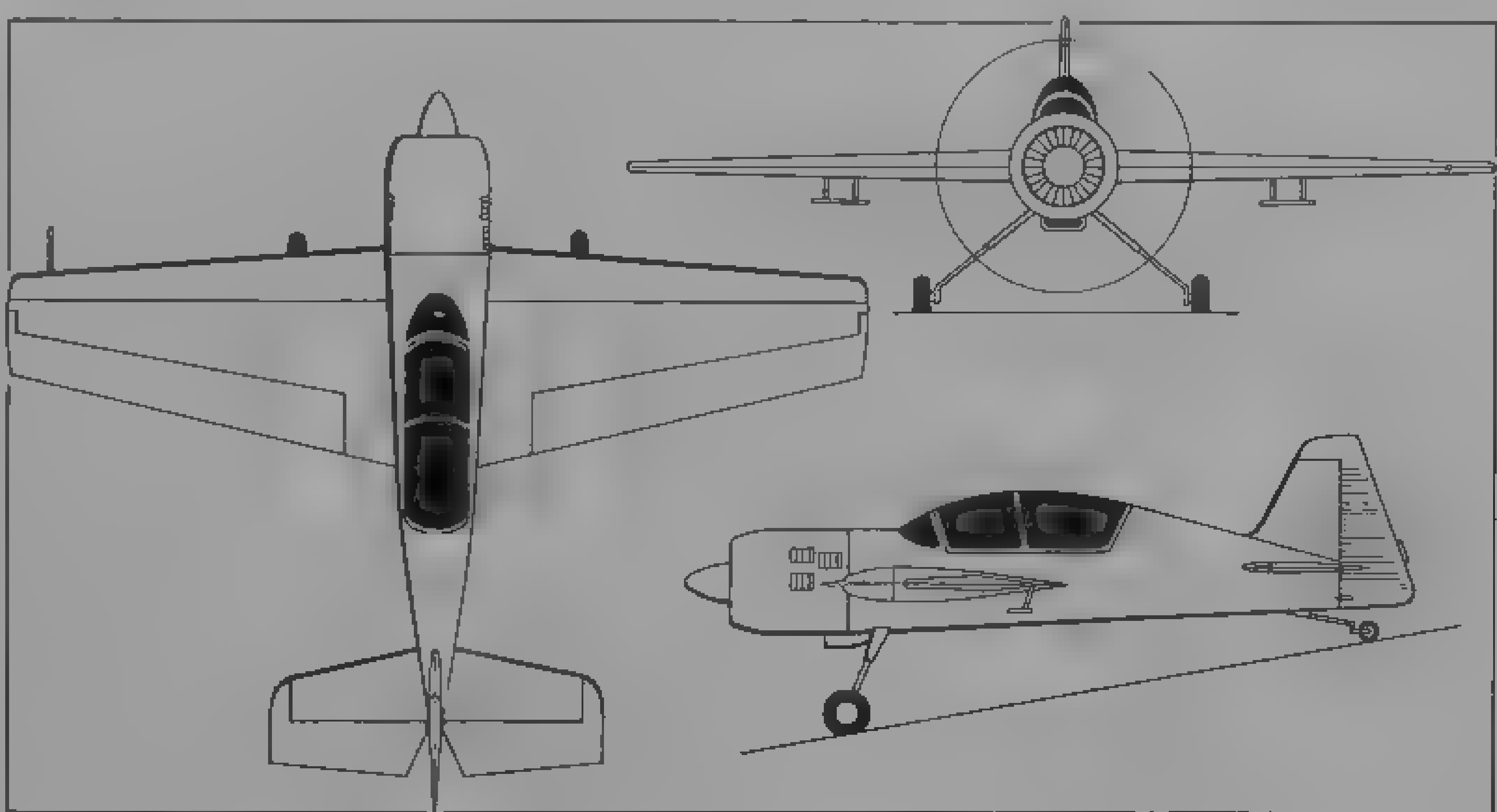
DESIGN FEATURES: Constant-chord unswept wing with dihedral from roots and cambered tips, fuselage pod mounted above wing, with annular duct at rear to house air-cooled pusher engine, short twin booms carry sweptback and slightly toed-in tailfins and bridging horizontal tail surface

FLYING CONTROLS: Mechanical control system for ailerons, twin rudders and elevator; pneumatically operated trailing-edge flaps

LANDING GEAR: Pneumatically actuated retractable tricycle type, single wheel and low-pressure tyre on each trailing-link unit, for operation from unprepared strips, mainwheels retract inward, nosewheel forward

POWER PLANT: One 265 kW (355 hp) VOKBM M-14PT nine-cylinder radial engine enclosed in annular duct, three-blade variable-pitch pusher propeller. Location reduces noise in cabin

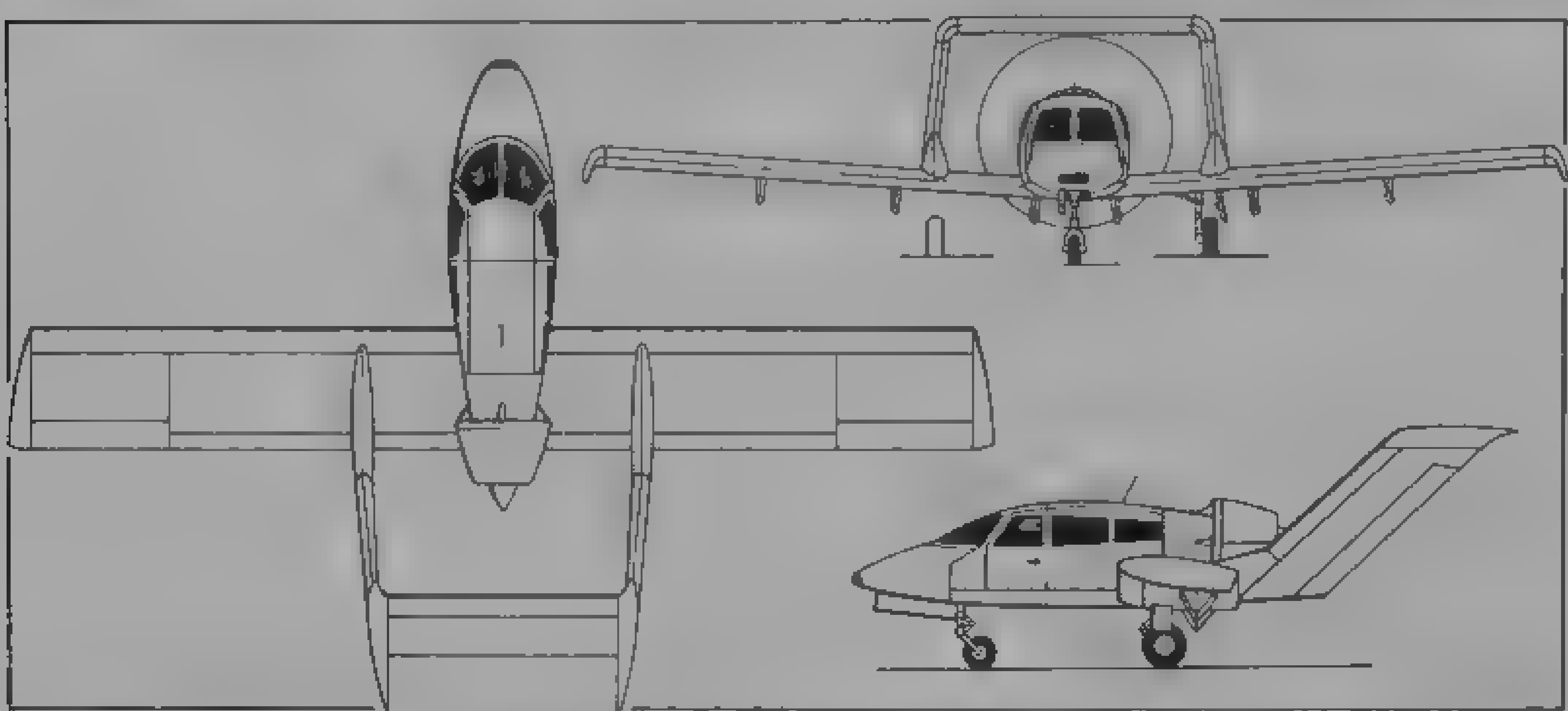
ACCOMMODATION: Six persons in pairs in enclosed cabin, large sliding door on starboard side, facilitating freight loading when passenger seats removed, or despatch of parachutists. Planned uses include business, taxi and ambulance transport, surveillance of forests, high tension cables, oilfields and fisheries; mail and freight operation



Yakovlev Yak-54 (VOKBM M-14P radial engine) *(Jane's/Mike Keep)* 1994

Yakovlev Yak 55M single seat aerobatic competition aircraft *(Peter R. March)*
1995

Yakovlev Yak-58 six-seat business aircraft (VOKBM M-14PT engine) *(Henry Dodds)*
1995



Yakovlev Yak-58 business aircraft (VOKBM M-14PT nine-cylinder piston engine) *(Jane's/Mike Keep)*
1994

Model of Yakovlev Yak-77 twin-turbofan long-range business transport *(Mike Jerram)*
1994

Cockpit of Yak-58 *(Piotr Butowski)*
1994

SYSTEMS: Two independent pneumatic systems for flaps and landing gear actuation and engine starting

DIMENSIONS, EXTERNAL:

Wing span	12.70 m (41 ft 8 in)
Wing aspect ratio	8.06
Length overall	8.55 m (28 ft 0½ in)
Height overall	3.16 m (10 ft 4½ in)

AREAS:

Wings, gross	20.0 m² (215.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	1,270 kg (2,800 lb)
Max payload	450 kg (992 lb)
Max T-O weight	2,100 kg (4,630 lb)
Max wing loading	105.0 kg/m² (21.5 lb/sq ft)
Max power loading	7.84 kg/kW (12.9 lb/hp)

PERFORMANCE (estimated):

Max level speed	162 kts (300 km/h; 186 mph)
Max cruising speed	153 kts (285 km/h; 177 mph)
Landing speed	68 kts (125 km/h; 78 mph)
Service ceiling	4,000 m (13,125 ft)
T-O run	610 m (2,000 ft)
Landing run	600 m (1,970 ft)
Range with max payload, 45 min reserves	more than 540 n miles (1,000 km; 620 miles)

UPDATED

YAKOVLEV Yak-77

TYPE: Twin-turbofan long-range executive/regional transport

PROGRAMME: Announced Spring 1993, first flight scheduled 1996

DESIGN FEATURES: All-swept low-wing configuration, TsAGI high-efficiency wing section, with compound sweepback and winglets, tailplane near tip of tailfin, rear-mounted turbofan pods. Designed to conform with FAR Pt 25 and JAR-25 requirements

LANDING GEAR: Retractable tricycle type, twin wheels on each unit

POWER PLANT: Two Allison GMA 3000 series turbofans

ACCOMMODATION: Two crew side by side on flight deck, main cabin able to accommodate eight business passengers or 32 in regional transport configuration, with changes only to cabin arrangements. Lengthened versions for 50 to 70 passengers projected

AVIONICS: Collins Pro Line 4 system

DIMENSIONS, EXTERNAL:

Wing span	21.55 m (70 ft 8½ in)
Length overall	20.45 m (67 ft 1¼ in)
Height overall	7.46 m (24 ft 5¾ in)
Tailplane span	6.53 m (21 ft 5 in)

WEIGHTS AND LOADINGS:

Max payload	3,500 kg (7,715 lb)
Payload, executive version	900 kg (1,985 lb)
Max T-O weight	25,200 kg (55,555 lb)

PERFORMANCE (estimated):

Max cruising speed	Mach 0.8
Econ cruising speed at 12,200 m (40,000 ft)	Mach 0.75
Balanced runway length (ISA)	2,200 m (7,220 ft)
Max range, with reserves: eight-seat executive	5,400 n miles (10,000 km; 6,215 miles)
32-seat regional	3,240 n miles (6,000 km; 3,725 miles)

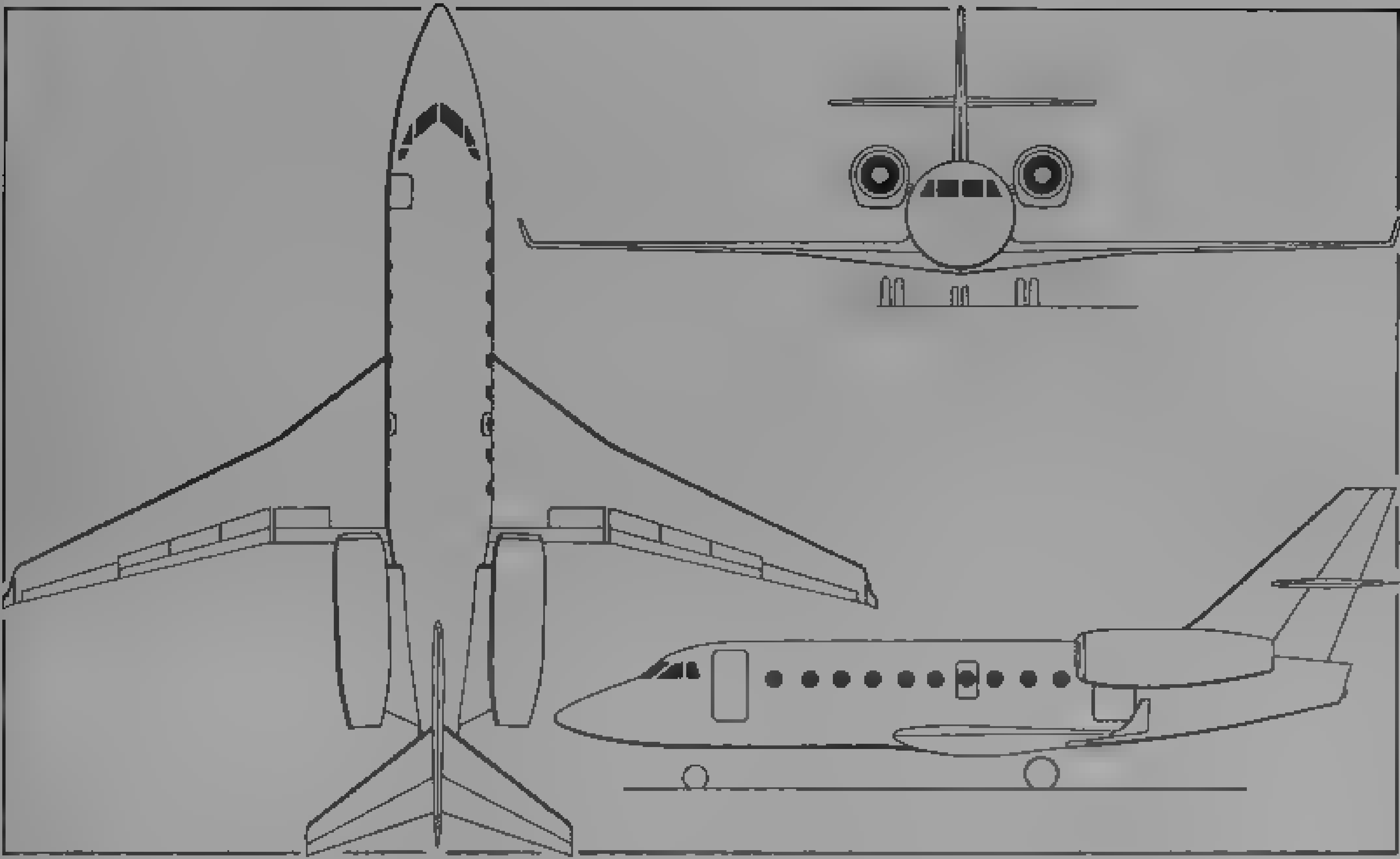
VERIFIED

YAKOVLEV Yak-112

TYPE: Four-seat multipurpose light aircraft

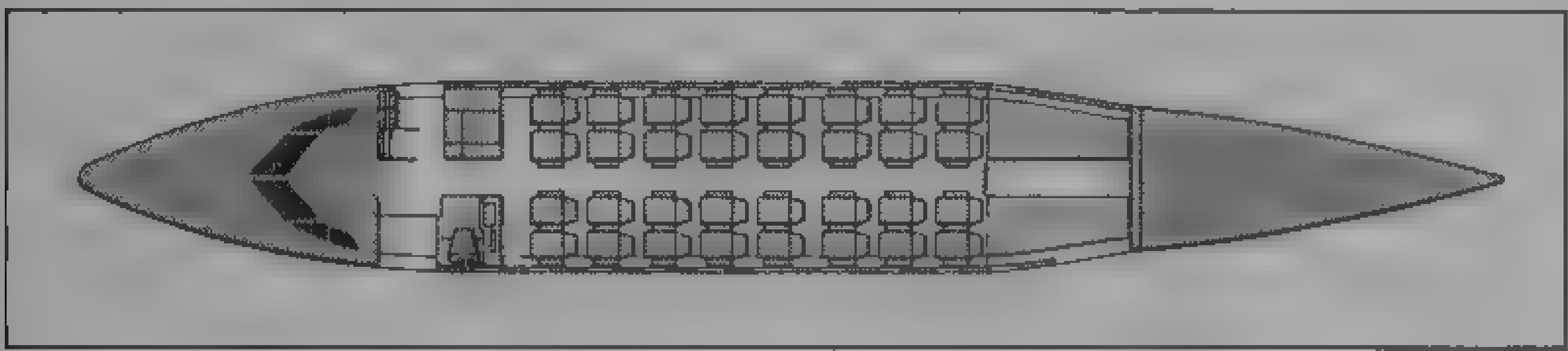
PROGRAMME: Winner of 1988 official design competition for two-seat primary trainer for CIS aero clubs, developed subsequently to current four-seat configuration; model shown at Moscow Aerospace '90 and full-scale mockup at 1991 Paris Air Show; first flight of prototype (RA-00001) 20 October 1992; production at Irkutsk

CURRENT VERSIONS: Intended to carry passengers, light cargo and mail, for pilot training, glider towing, ambulance duties, forest, pipeline and cable patrol, fisheries surveillance and agricultural use



Yakovlev Yak-77 twin-turbofan executive/regional transport *(Jane's/Mike Keep)*

1994



Typical cabin arrangement of Yakovlev Yak-77 *(Jane's/Mike Keep)*

1994

CUSTOMERS: Orders totalled 500 mid-1993, exports primarily to India and South America

DESIGN FEATURES: Conventional high-wing configuration, constant-chord unswept wing, dihedral 1°; cambered wingtips, single bracing strut each side; pod and boom fuselage, with heavily glazed cabin offering exceptional all-round view, swept tail fin, composites used extensively

LANDING GEAR: Non-retractable tricycle type; single wheel, with low-pressure tyre, on each unit, cantilever spring mainwheel legs, floats and skis optional

POWER PLANT: One 157 kW (210 hp) six-cylinder Teledyne Continental IO-360-ES, Hartzell two-blade two-position propeller

ACCOMMODATION: Four persons in pairs in enclosed cabin

AVIONICS: Bendix/King avionics

DIMENSIONS, EXTERNAL:

Wing span	10.25 m (33 ft 7½ in)
Wing aspect ratio	6.63
Length overall	6.96 m (22 ft 10 in)
Height overall	2.90 m (9 ft 6 in)

AREAS:

Wings, gross	16.96 m² (182.6 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	775 kg (1,709 lb)
Max payload	270 kg (595 lb)
Max T-O weight	1,260 kg (2,778 lb)
Max wing loading	74.29 kg/m² (15.21 lb/sq ft)
Max power loading	8.03 kg/kW (13.23 lb/hp)

PERFORMANCE:

Max cruising speed	135 kts (250 km/h; 155 mph)
Econ cruising speed	102 kts (190 km/h; 118 mph)
Landing speed	68 kts (125 km/h; 78 mph)
Service ceiling	4,000 m (13,125 ft)
T-O and landing run	500 m (1,640 ft)
Range, 45 min reserves:	
with max payload	458 n miles (850 km; 528 miles)
with max fuel	648 n miles (1,200 km; 745 miles)

UPDATED

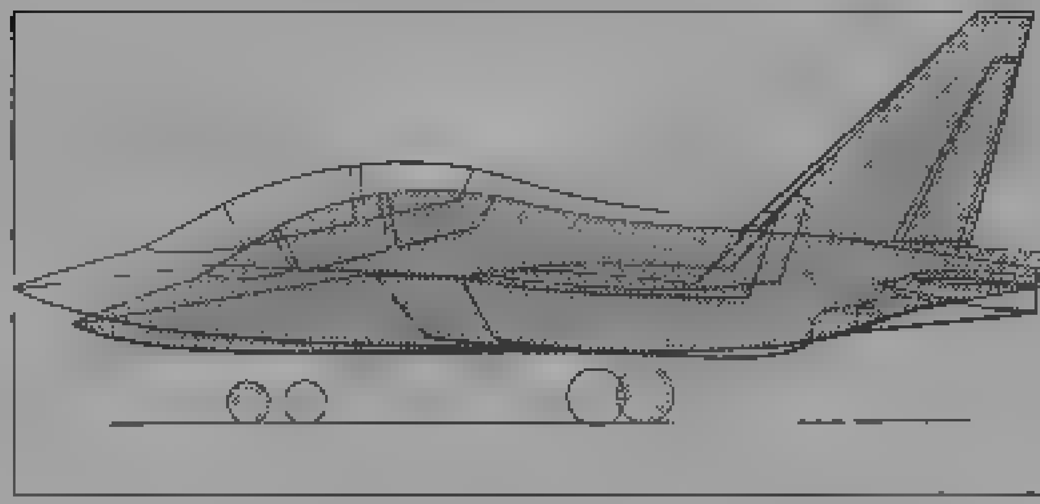
YAKOVLEV Yak-130D

TYPE: Two-seat light fighter/attack/reconnaissance combat aircraft; advanced air defence and deck trainer; special mission target drone aircraft

PROGRAMME: One of designs by five OKBs to meet official Russian requirement for 200 aircraft to replace Aero L-29 and L-39 Albatros for all aspects of flying training, basic to combat simulation, and combat; known initially as Yak UTS, now being developed in partnership with Aermacchi of Italy, prototype shown to press 30 November 1994, first flight scheduled for mid-1995; navalised version proposed for carrier training, tender now includes Penza (Russia)/CAE Electronics (Canada) simulators and Yak 54 for screening and primary training. To be manufactured at Saratov SAZ plant and Sokol plant, Nizhny Novgorod

Yakovlev Yak-112 four-seat multipurpose lightplane *(Paul Jackson)*

1995



Production Yak 130 (shaded) compared with prototype *(Jane's/James Goulding)*

1995

DESIGN FEATURES: Unconventional all-swept mid-wing monoplane, except for straight wing and tailplane trailing-edges; no dihedral or anhedral, winglets, full-span leading-edge slats permit flight at angles of attack up to 35°, low-mounted tailplane, with dogtooth leading-edge; engines in ducts under wingroots, beneath LERX extending almost to windscreen. Wing leading-edge sweepback 31°. Design service life 15,000 flying hours and 25,000 landings. See accompanying three-view for further details

FLYING CONTROLS: Avionika full-authority three-channel digital fly-by-wire system developed from that of Yak-141 V/STOL combat aircraft prototype inherently stable, production aircraft intended to have 5 per cent longitudinal instability to reproduce handling characteristics of MiG-29/Su-27 series. Controllability can be changed to simulate other types

LANDING GEAR: Retractable tricycle type, single wheel on each unit, mainwheels retract into engine ducts; low-pressure tyres

POWER PLANT: Two RD-35M turbofans (Klimov-modified ZMKB Progress DV 2s), each 21.6 kN (4,850 lb st)

ACCOMMODATION: Two crew in tandem under blister canopy, on Zvezda K-36 zero/zero ejection seats, rear seat raised

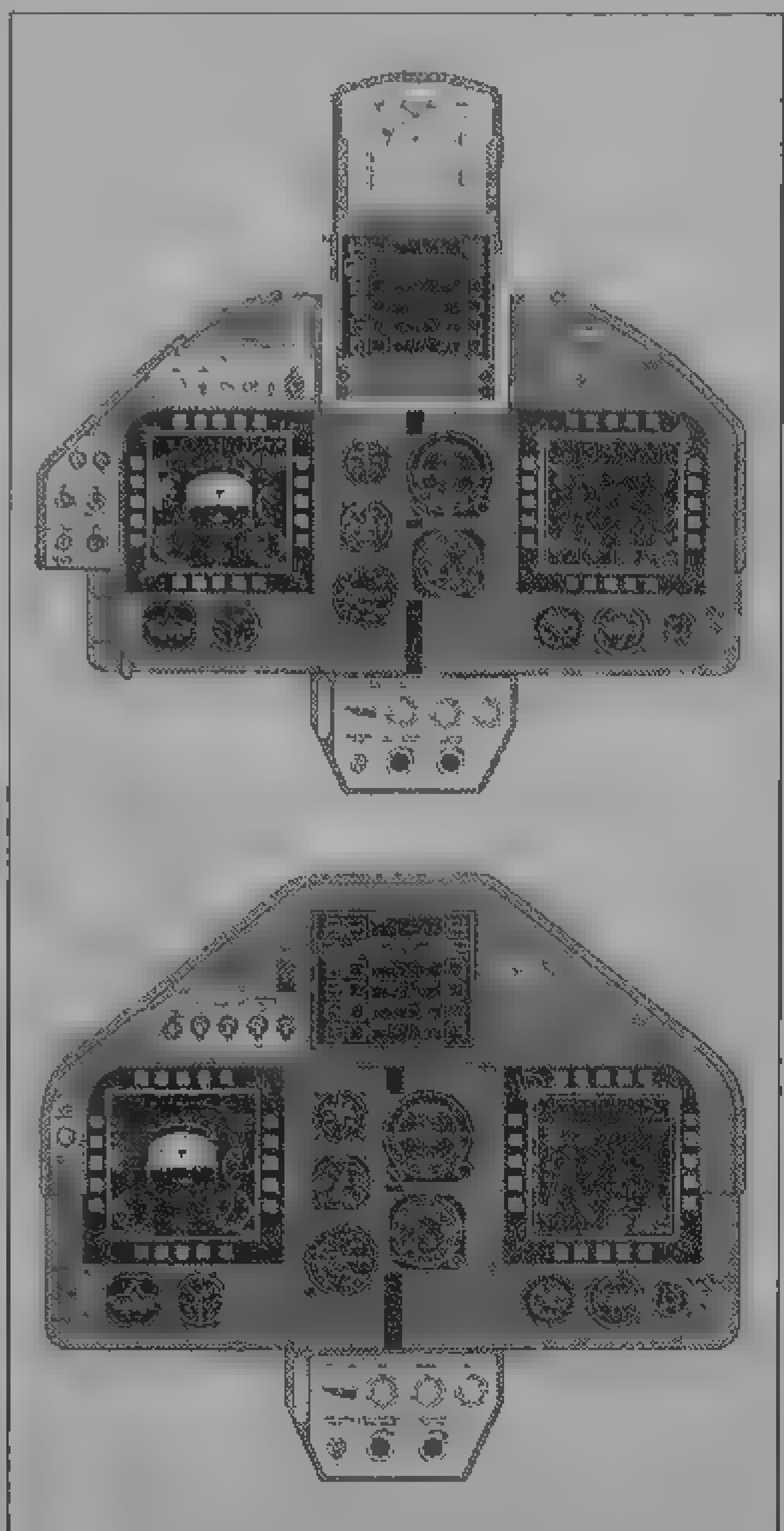
AVIONICS: Western avionics optional to replace standard Russian equipment

Radar: Optional

Flight: Nav computer, INS with GPS receiver, air data system, short-range radio nav and ILS, ADF and radio altimeter. IFF

Instrumentation: HUD in front cockpit as part of collimated flight and sighting display in conjunction with pilot's helmet-mounted target designator; two CRTs in each cockpit with standby electromechanical flight/nav instruments

Mission: Optical weapon aiming computer and weapons control system, simulator of moving targets, guidance



Front/student's (top) and rear/instructor's instrument panels of Yak-130. Western versions will have three MFDs

1995

commands, weapons preparation and tactical situations, flight data and crew actions recorder; TV monitor of eyes and hands positions, with video recorder, in front cockpit

ARMAMENT (optional): Seven (optionally nine) hardpoints for guns, missiles, guided and unguided bombs

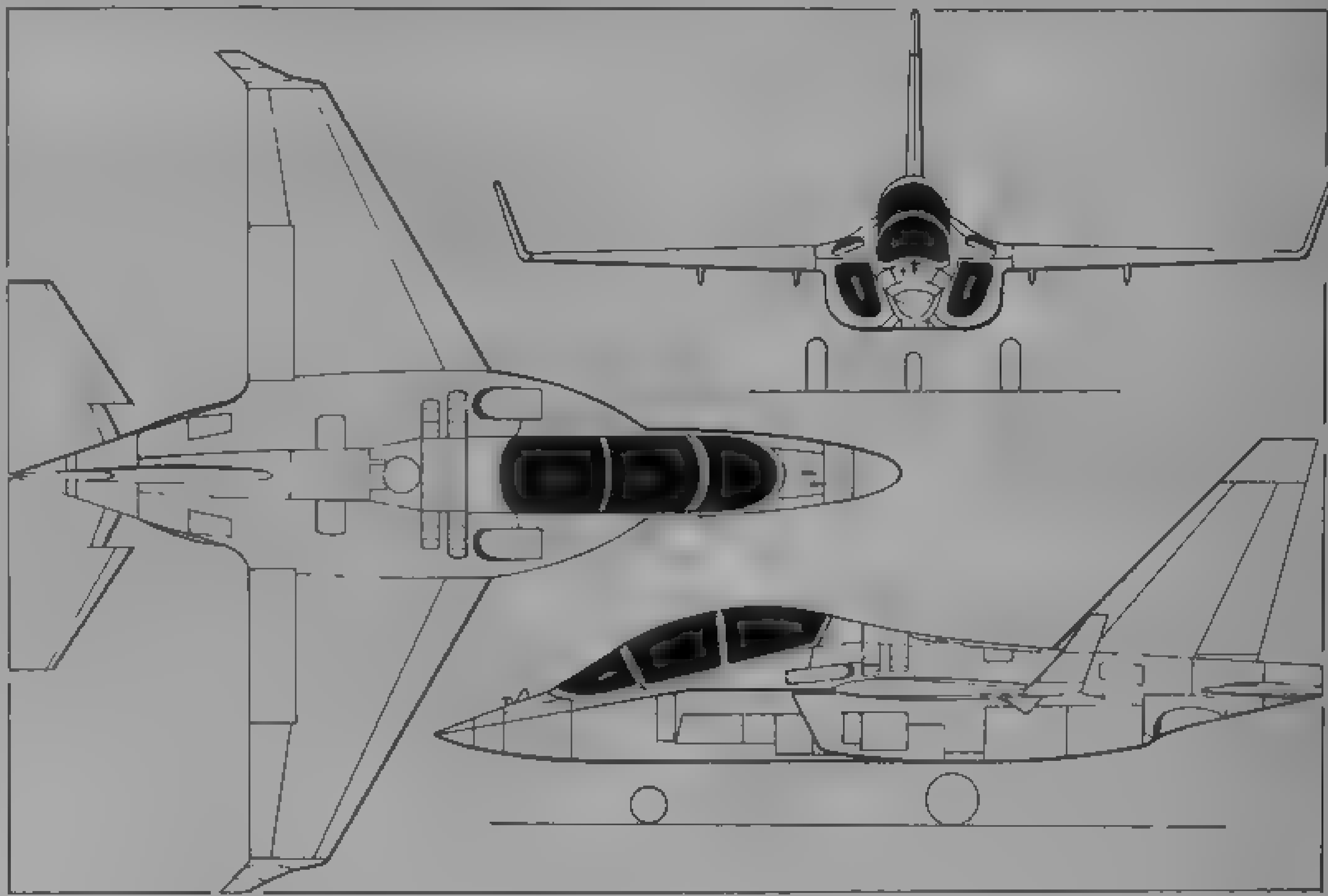
DIMENSIONS, EXTERNAL:	
Wing span	10.64 m (34 ft 11 in)
Length overall	11.90 m (39 ft 0½ in)
Height overall	4.70 m (15 ft 5 in)
Wheel track	2.50 m (8 ft 2½ in)
Wheelbase	4.00 m (13 ft 1½ in)
AREAS:	
Wings, gross	23.5 m² (253.0 sq ft)
WEIGHTS AND LOADINGS:	
Max fuel: internal	1,650 kg (3,637 lb)
with external tank	2,200 kg (4,850 lb)
Normal T-O weight	6,000 kg (13,230 lb)
Max T-O weight	8,500 kg (18,740 lb)
Max power loading	197.0 kg/kN (1.93 lb/lb st)
PERFORMANCE (estimated):	
Max level speed at height	512-540 kts (950-1,000 km/h; 590-620 mph)
T-O speed	108 kts (200 km/h; 125 mph)
Landing speed	105 kts (195 km/h; 122 mph)
Service ceiling	more than 12,000 m (39,370 ft)
T-O run	380 m (1,250 ft)
Landing run	670 m (2,200 ft)
Max ferry range with conformal tank	1,185 n miles (2,200 km; 1,365 miles)
Sustained *g* limit at 4,575 m (15,000 ft)	+5
g limits	+8/−3

Prototype Yak-130D on exhibition at Paris prior to first flight ***(Paul Jackson)*** *1995*

OTHER AIRCRAFT

See *Jane's Aircraft Upgrades* for Yak-40TL twin-turbofan conversion of three-engined Yak-40 transport

NEW ENTRY



Three-view of Yakovlev Yak-130D advanced trainer/combat aircraft ***(Jane's/James Goulding)*** *1995*

SINGAPORE

SA

SINGAPORE AEROSPACE LTD

540 Airport Road, Paya Lebar, Singapore 1953
Telephone: 65 287 1111
Fax: 65 280 9713 and 280 8213
Telex: RS 43255 SAMKG
CHAIRMAN AND CEO: Quek Poh Huat
VICE-PRESIDENT MARKETING: Michael Ng
CORPORATE COMMUNICATIONS: Shirley Tan

Formed early 1982 as government owned Singapore Aircraft Industries Ltd, controlled by Ministry of Defence Singapore Technology Holding Company Pte Ltd; renamed Singapore Aerospace April 1989. 15,000 m² (161,450 sq ft) new factory at Paya Lebar opened October 1983; total 1994 workforce nearly 4,000.

Assembled 30 SIAI-Marchetti S.211s (see under Agusta in Italian section) and 17 of 22 Super Pumas for Republic of Singapore Air Force, is partner in EC 120 helicopter programme with Eurocopter and CATIC (see International section); to manufacture 100 shipsets of nosewheel doors worth $12 million for Boeing 777 (option for another 100), and 150 sets of passenger doors for Fokker 100.

Subsidiaries include:

Singapore Aerospace Engineering Pte Ltd
Seletar West Camp, Singapore 2879
Telephone: 65 481 5955
Fax: 65 482 0245
Telex: RS 25507 SAMAIR
VICE-PRESIDENT/GENERAL MANAGER: Bob Tan

Maintenance, modification and repair of civil and military aircraft and helicopters, upgrade programmes for A-4 Skyhawk and F-5E Tiger II (see 1994-95 *Jane's* and current *Jane's Aircraft Upgrades*), assembled S.211 jet trainers.

Singapore Aerospace Systems Pte Ltd
505A Airport Road, Paya Lebar, Singapore 1953
Telephone: 65 287 2222
Fax: 65 284 4414
Telex: RS 55851 SAERO
VICE-PRESIDENT/GENERAL MANAGER: Foo Hee Liat

Maintenance, overhaul and repair of civil and military aircraft components and equipment, authorised service centre for Aerospatiale, Bell Helicopter Textron, Grimes Aerospace, IMI Marston, Lucas Aerospace and Rockwell Collins.

UPDATED

SOUTH AFRICA

AEROTEK

AERONAUTICAL SYSTEMS TECHNOLOGY (Division of Council for Scientific and Industrial Research)

PO Box 395, Pretoria 0001
Telephone: 27 (12) 841 4866
Fax: 27 (12) 841 4332
SENIOR DESIGN MANAGER: Eric Sparrow
PROGRAMME MANAGER: Dr A. J. Vermeulen

Designed ACE turboprop trainer (described in Atlas entry); has developed all-composites Hummingbird observation aircraft.

UPDATED

AEROTEK HUMMINGBIRD

TYPE: Two-seat observation and utility light aircraft.

PROGRAMME: Prototype first flight (ZU-AFU) 8 May 1993; no subsequent information received.

CUSTOMERS: Intended for civil/police patrol and surveillance market as alternative to helicopters.

DESIGN FEATURES: Strut-braced high-wing monoplane with T tail, pod and boom fuselage, helicopter-like view from cockpit. Tailplane/elevator/rudder removable for transportation and storage.

Wing section NASA GA(W)-1 (constant); dihedral 2°; washout 1°; no sweepback.

FLYING CONTROLS: Conventional mechanical (pushrods and cables) for primary surfaces. Plain ailerons of 25 per cent chord, Fowler flaps of 30 per cent chord.

STRUCTURE: All-composites (GFRP and Nomex). Single wing strut each side. Fin integral with fuselage. Tailplane and elevator each of one-piece construction.

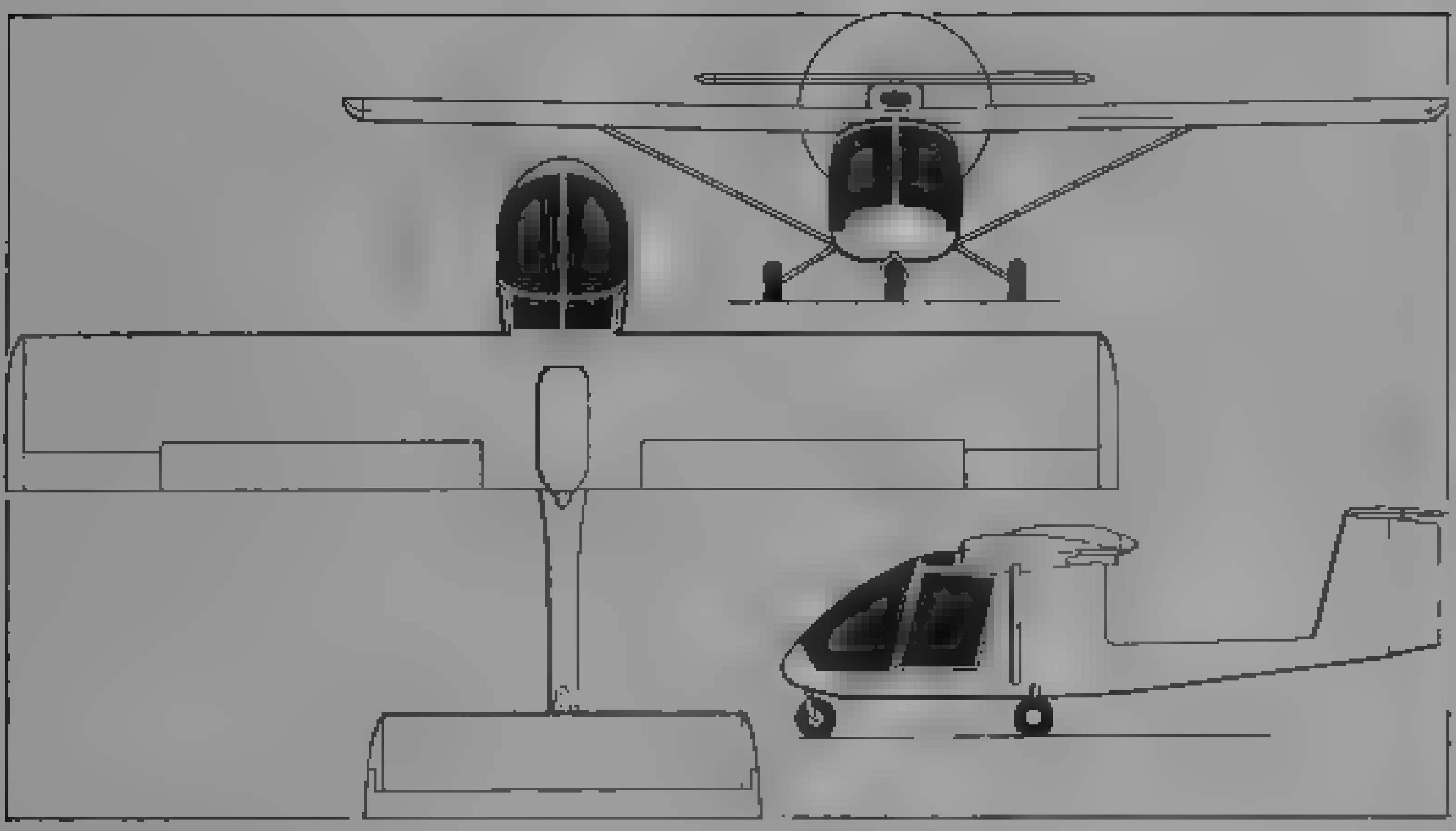
LANDING GEAR: Non-retractable tricycle type, with single wheel and size 5.00-5 tyre on each unit; nosewheel steerable. Cantilever self-sprung mainwheel legs and independent mainwheel brakes.

POWER PLANT: One 74.6 kW (100 hp) Norton NR 642-GF 90 rotary engine, reduced from 7,000 to 2,550 rpm through integral gearbox and driving a two-blade, two-position pusher propeller. Fuel tank in each wing, combined capacity 80 litres (21.1 US gallons; 17.6 Imp gallons). Rotax 914 engine optional.

ACCOMMODATION: Two seats side by side in fully enclosed and extensively glazed cabin, second seat removable; provision for third seat behind front pair in emergency. Forward-opening window/door each side.

AVIONICS: *Instrumentation:* VFR instrumentation to JAR-VLA standard.

DIMENSIONS, EXTERNAL:	
Wing span	10.90 m (35 ft 9¼ in)
Wing aspect ratio	7.27
Length overall	6.50 m (21 ft 4 in)
Height overall	2.10 m (6 ft 10¾ in)
Elevator span	4.00 m (13 ft 1½ in)
DIMENSIONS, INTERNAL:	
Cockpit: Max width	1.27 m (4 ft 2 in)
AREAS:	
Wings, gross	16.35 m² (176.0 sq ft)
Vertical tail surfaces (total)	1.60 m² (17.22 sq ft)
Horizontal tail surfaces (total)	4.00 m² (43.06 sq ft)



Aerotek Hummingbird two-seat observation light aircraft *(Jane's/Mike Keep)* 1993

Prototype Aerotek Hummingbird (100 hp Norton NR 642-GF-90 rotary engine) 1994

WEIGHTS AND LOADINGS:

Weight empty	320 kg (705 lb)
Max T-O weight	620 kg (1,367 lb)
Max wing loading	37.9 kg/m² (7.77 lb/sq ft)
Max power loading	8.32 kg/kW (13.67 lb/hp)

PERFORMANCE (estimated):

Max level speed at S/L	105 kts (195 km/h; 121 mph)
Cruising speed at S/L, 70% power	90 kts (167 km/h; 103 mph)
Loiter speed, 10° flap	41 kts (76 km/h; 47 mph)
Stalling speed, flaps down	30 kts (56 km/h; 35 mph)
Max rate of climb at S/L	220 m (725 ft)/min
Service ceiling	4,575 m (15,000 ft)
T-O and landing run	less than 100 m (328 ft)
Endurance at max cruising speed	4 h 30 min

UPDATED

ATLAS

ATLAS AVIATION (PTY) LIMITED (A Division of Denel (Pty) Ltd)

Atlas Road, PO Box 11, Kempton Park 1620, Transvaal
Telephone: 27 (11) 927 9111
Fax: 27 (11) 395 1103
Telex: 742403 BONAERO
CEO: J. J. Eksteen
PUBLIC RELATIONS MANAGER: Patricia Wilson

Atlas Aircraft Corporation (see 1991-92 and earlier *Jane's*) founded 1964 by Bonuskor as private company; delivered first Impala Mk 1 (Aermacchi MB-326) jet trainers to SAAF 1966; incorporated into Armscor Group 1969; has manufacturing, design and development facilities for airframes, engines, missiles and avionics; developed Cheetah from Mirage III, Rooivalk from Puma, Oryx (Super Puma) from Puma, V3B and V3C dogfight missiles, and many weapons installations. Restructuring of Armscor on 1 April 1992 created Denel as self-sufficient commercial industrial group, in which Atlas Aviation is military aircraft manufacturing branch of Simera in Denel Aerospace Group; Atlas workforce over 5,000 in 1994-95.

UPDATED

ATLAS/AEROTEK ACE

TYPE: Tandem two-seat turboprop trainer.

PROGRAMME: Design started September 1985 by government research agency Aerotek (which see), initially as demonstrator for composites manufacturing technology (Project Ovid); then known simply as NGT turboprop trainer; first flight of Atlas built prototype 29 April 1991, proposed later that year as replacement for South African Air Force T-6G Harvards, but not selected, now being marketed for export as ACE (All-Composites Evaluator). Following initial flight testing, tail surfaces modified, including addition of tailplane strakes. Civil registration in September 1993 (ZU-AHE); foreign debut at Dubai in October 1993. Prototype badly damaged in wheels-up landing 14 February 1995 after losing pitch control; a second prototype has been ordered.

CURRENT VERSIONS: **ACE 1**: For intermediate training. Prototype is to this standard. *Detailed description applies to this version except where indicated.*

ACE 2: For advanced training; project only. Main difference is more powerful engine (894 kW; 1,200 shp P&WC PT6A-68C).

DESIGN FEATURES: Objectives were pilot comfort, good view, high performance, aerobatics and simplicity to meet NATO trainer specification. Straight tapered wing, slightly sweptback vertical tail, stepped tandem cockpits, fully aerobatic to FAR Pt 23+ standards.

FLYING CONTROLS: Ailerons, one-piece elevator and rudder conventional mechanical, inset tab in rudder and starboard half of elevator; electric trim in all three axes. Single slotted trailing-edge flaps, airbrake under fuselage in line with flaps. Oil system permits up to 30 seconds of inverted flight.

STRUCTURE: All-composites (GFRP/CFRP) airframe: one-piece wing with honeycomb box main spar, auxiliary spar and integral fuel tanks, one-piece fuselage, tailplane and control surfaces. 15,000 hour airframe life.

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel and oleo-pneumatic shock absorber on each unit. Main units retract inward, steerable nose unit rearward. Dunlop wheels and tyres, size 6.50-10 on main units, 6.00-6 on nose unit; tyre pressures 5.52 and 3.79 bars (80 and 55 lb/sq in) respectively. Parker Cleveland hydraulic mainwheel brakes. Minimum ground turning radius 7.00 m (22 ft 11½ in).

POWER PLANT: One 559 kW (750 shp) Pratt & Whitney Canada PT6A-25C turboprop, driving a Hartzell T10178(H)-8R three-blade metal constant-speed, reversible-pitch propeller. Integral fuel tank in each wing, combined capacity 600 litres (158.5 US gallons; 132 Imp gallons). Provision for two 330 litre (87.2 US gallon; 72.6 Imp gallon) underwing tanks, raising total capacity to 1,260 litres (332.9 US gallons; 277.2 Imp gallons). Overwing gravity refuelling point each side. Oil capacity 10.5 litres (2.8 US gallons; 2.3 Imp gallons).

ACCOMMODATION: Pupil (in front) and instructor on tandem Martin-Baker Mk 16L seats, ejecting through canopy; rear seat raised. One-piece framed canopy, opening sideways to starboard. Baggage compartment in rear fuselage.

SYSTEMS: High-pressure hydraulic system for landing gear, flaps and airbrake, separate system for wheel brakes and emergency landing gear extension. Electrical system 28 V DC. High-pressure gaseous oxygen system. De-icing of propeller blades, air intake, pitots and AoA vanes.

AVIONICS: *Comms:* Dual VHF and comm radios; intercom. ATC transponder.

Flight: ADF, VOR, DME, AHRS, ILS and marker beacon receiver.

Instrumentation: EFIS LCDs.

ARMAMENT: Three hardpoints (including one wet) under each wing for training gun packs, bombs, rockets and pair of auxiliary fuel tanks.

DIMENSIONS, EXTERNAL (ACE 1 and 2):

Wing span	10.80 m (35 ft 5¼ in)
Wing aspect ratio	6.48
Length overall	10.80 m (35 ft 5¼ in)
Height overall	4.10 m (13 ft 5½ in)
Fuselage: Max width	1.00 m (3 ft 3¼ in)
Tailplane span	4.30 m (14 ft 1¼ in)
Wheel track	3.90 m (12 ft 9½ in)
Wheelbase	3.20 m (10 ft 6 in)
Propeller diameter	2.36 m (7 ft 9 in)

AREAS (ACE 1 and 2):

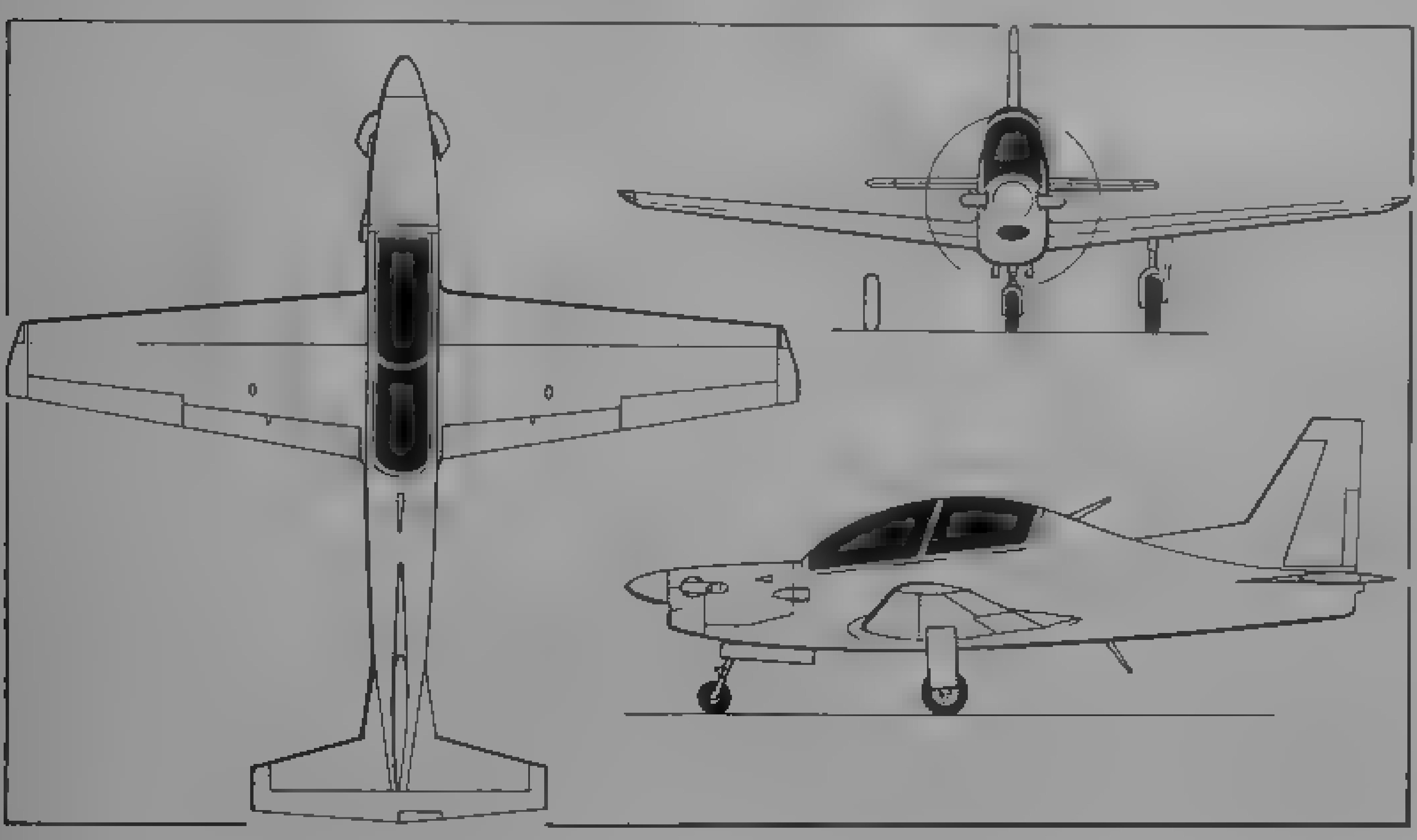
Wings, gross	18.00 m² (193.75 sq ft)
Vertical tail surfaces (total)	2.00 m² (21.53 sq ft)
Horizontal tail surfaces (total)	4.32 m² (46.50 sq ft)

WEIGHTS AND LOADINGS:

Basic weight empty: ACE 1	1,545 kg (3,406 lb)
ACE 2	1,820 kg (4,012 lb)
Max external stores load: ACE 1	1,000 kg (2,205 lb)
Max T-O weight:	
ACE 1, Aerobatic, clean	2,200 kg (4,850 lb)
ACE 1 with external stores	3,200 kg (7,054 lb)
ACE 2, Aerobatic, clean	2,475 kg (5,456 lb)
Max wing loading:	
ACE 1, Aerobatic, clean	122.2 kg/m² (25.03 lb/sq ft)
ACE 1 with external stores	177.8 kg/m² (36.41 lb/sq ft)
ACE 2, Aerobatic, clean	137.5 kg/m² (28.16 lb/sq ft)
Max power loading:	
ACE 1, Aerobatic, clean	3.94 kg/kW (6.47 lb/shp)
ACE 1 with external stores	5.72 kg/kW (9.41 lb/shp)
ACE 2, Aerobatic, clean	2.77 kg/kW (4.55 lb/shp)

PERFORMANCE (ACE 1 at clean Aerobatic max T-O weight, ISA):

Never-exceed speed (V_{NE})	320 kts (592 km/h; 368 mph)
Max operating speed (V_{MO})	300 kts (555 km/h; 345 mph) EAS
Max level speed at 1,525 m (5,000 ft)	270 kts (500 km/h; 311 mph)
Econ cruising speed at 4,575 m (15,000 ft)	200 kts (370 km/h; 230 mph)
Stalling speed, engine idling:	
flaps up	72 kts (134 km/h; 83 mph) EAS
flaps down	65 kts (121 km/h; 75 mph) EAS
Max rate of climb at S/L	838 m (2,750 ft)/min



Atlas/Aerotek ACE trainer powered by P&WC PT6A-25C or -68C turboprop *(Jane's/James Goulding)* 1995

Prototype ACE turboprop trainer developed by Atlas and Aerotek

1995

Service ceiling	10,060 m (33,000 ft)
Sustained turn rate at 1,525 m (5,000 ft)	20.7°/s
T-O run	340 m (1,116 ft)
T-O to 15 m (50 ft): flaps up	420 m (1,378 ft)
T-O flap setting	365 m (1,198 ft)
Landing from 15 m (50 ft): flaps up	430 m (1,411 ft)
landing flap setting	375 m (1,231 ft)
landing run	300 m (985 ft)
Max range at 7,620 m (25,000 ft), 45 min reserves	1,100 n miles (2,037 km, 1,266 miles)
Max endurance at 7,620 m (25,000 ft)	5 h 30 min
g limits	+7/−3.5

PERFORMANCE: (ACE 2, estimated, at clean Aerobatic max T-O weight, ISA)

Never-exceed speed (V_{NE})	340 kts (629 km/h, 391 mph)
Max operating speed (V_{MO})	320 kts (592 km/h, 368 mph) EAS
Max level speed: at S/L	290 kts (537 km/h, 334 mph)
at 1,525 m (5,000 ft)	310 kts (574 km/h, 357 mph)
Stalling speed, flaps down	69 kts (128 km/h, 80 mph) EAS
Max rate of climb at S/L	1,356 m (4,450 ft)/min
Time to 4,575 m (15,000 ft)	3 min 30 s
Service ceiling	12,500 m (41,000 ft)
Sustained turn rate at 1,525 m (5,000 ft)	24°/s
Max roll rate at 240 kts (444 km/h, 276 mph)	130°/s
T-O to 15 m (50 ft), T-O flap setting	420 m (1,378 ft)
Landing from 15 m (50 ft), landing flap setting	430 m (1,411 ft)
Max range at 7,620 m (25,000 ft), 45 min reserves	940 n miles (1,741 km, 1,082 miles)
Max endurance at 7,620 m (25,000 ft)	4 h 12 min

UPDATED

ATLAS CSH-2 ROOIVALK (RED KESTREL)

TYPE: Combat support helicopter (battlefield attack development of French AS 330 Puma).

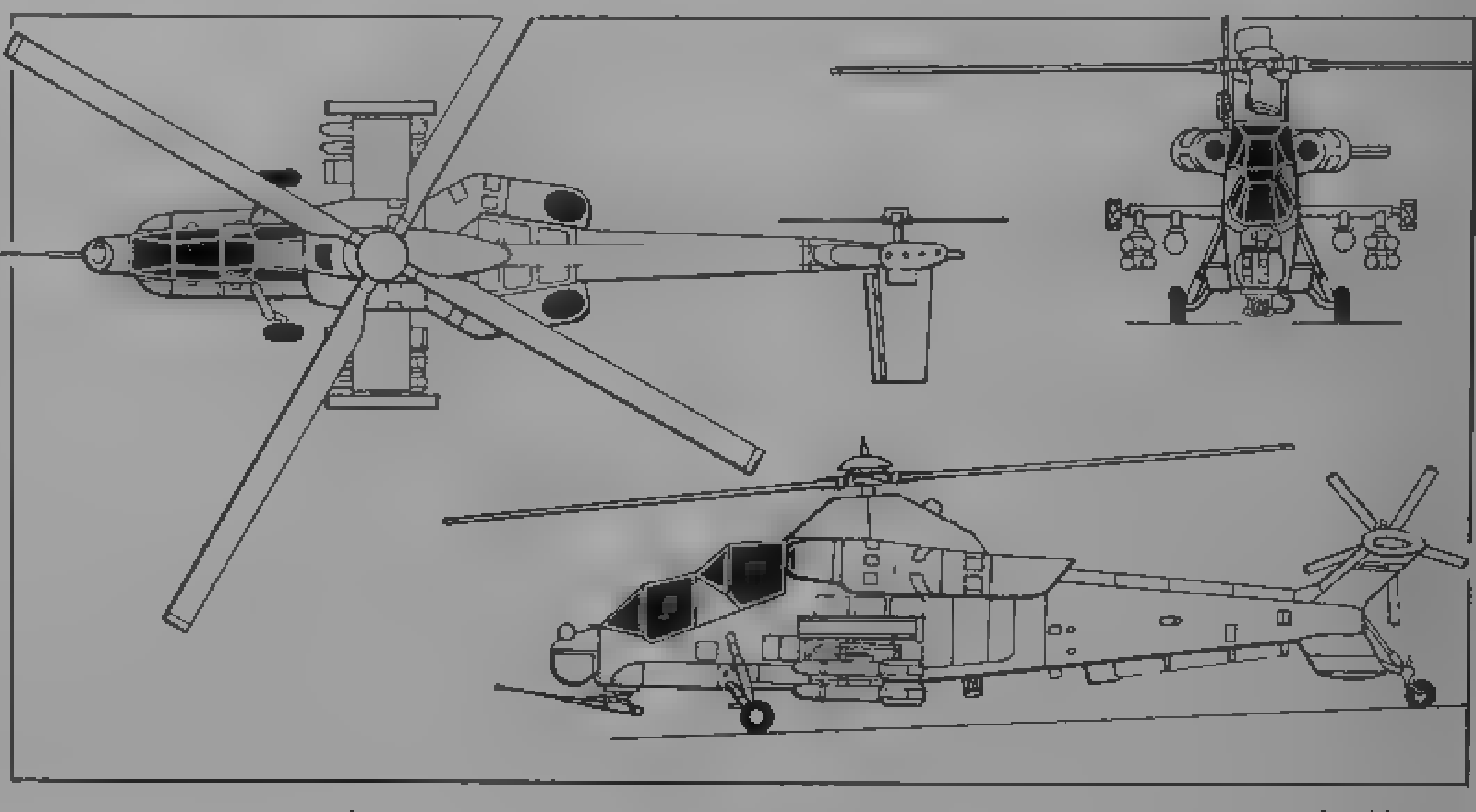
PROGRAMME: For background to Rooivalk programme, see 1994-95 and earlier editions. Design of Rooivalk **XDM** (experimental development model) first prototype (originally designated XH-2, later CSH-2) began late 1984 to meet South African Air Force user requirement specification, leading to public roll-out 15 January and first flight 11 February 1990; ending of war in Namibia and subsequent defence cuts removed SAAF need for the aircraft and programme temporarily halted later in 1990, but restarted as mainly company funded venture with reported export interest and discussions with possible development partners 1990-91. **ADM** (advanced demonstration model) second prototype, with fully integrated avionics and full weapons system, made first flight during second quarter of 1992 and later registered ZU-AHC; over 400 hours flown by XDM and over 200 hours by ADM by early 1995. third prototype (**EDM**, engineering development model, with sponsons for ammunition storage and additional avionics) to fly May 1996; certification and service entry due 1998. South African Air Force order for four in October 1993 increased to 16 mid-March 1994. Submitted (partnered by Marshall of Cambridge) as unsolicited bid for British Army requirement in 1993-94, but subsequently eliminated.

CUSTOMERS: South African Air Force, 16 to equip two squadrons. Malaysia reportedly announced intention to purchase.

DESIGN FEATURES: Based on reverse engineering of SA 330 Puma dynamics system to Super Puma equivalent

Atlas artist's drawing of CSH-2 Rooivalk, armed with wingtip air-to-air missiles, 22-round pods of 68 mm unguided rockets, four-round anti-tank missile pods and a chin-mounted 20 mm gun

1994



Production version of Atlas Rooivalk twin-turbine combat support helicopter ***(Jane's/James Goulding)***

1995

Second (ADM) prototype of the CSH-2 Rooivalk during firing trials of F2 gun

1995

standard, engines moved aft to clear stepped tandem cockpits, rear drive taken inboard and forward to modified transmission. Nose-mounted target acquisition turret and chin-mounted gun, sweptback stub-wings for weapon carriage. Four-blade fully articulating main rotor rotates at 265 to 290 rpm, five-blade, starboard-mounted tail rotor rotates at 1,279 rpm. Rotor brake fitted. Fixed leading-edge slat on horizontal stabiliser.

Low radar/visual/infra-red/acoustic signatures, optimised for NOE operation, NVG-compatible 'glass' cockpit; primary missions anti-armour and close air support; integrated digital nav/attack system. Performance includes 52 per cent excess hover power and 50 knots (92 km/h; 57 mph) sideways flight.

FLYING CONTROLS: Duplex digital AFCS with automatic height hold, hover capture and hover hold; HOCAS (hands on collective and stick) controls.

TDATS sensors and GA-1 20 mm gun on Rooivalk ADM *(Paul Jackson)*

1995

STRUCTURE: Crash resistant primary structure, of aluminium alloy, is of I-beam and monocoque construction; rotor blades and fuselage secondary structures of composites sandwich. Integral access ladders in fuselage, engine cowls form work platforms.

LANDING GEAR: Forward-mounted main gear with two-stage high-absorption main legs, fully castoring tailwheel at base of lower fin. Gear designed to withstand landing impact of up to 6 m (20 ft)/s.

POWER PLANT: Two Topaz (locally upgraded Turbomeca Makila 1A2) turboshafts, each rated at 1,491 kW (2,000 shp) for T-O and 1,548 kW (2,075 shp) for 30 seconds emergency operation; rear drive turned to drive forward into rear of transmission. Infra-red heat suppressors on exhausts, particle separators on intakes. Main gearbox mounted on vibration isolation system using tuned beam to isolate fuselage from rotor vibrations (claimed to have one of lowest vibration levels in its class). Transmission rated at 2,243 kW (3,008 shp) for T-O and 1,817 kW (2,436 shp) maximum continuous from both engines; single-engine transmission ratings are 1,548 kW (2,076 shp) maximum contingency and, 1,481 kW (1,986 shp) maximum continuous. Transmission has 40 minutes run dry capability at reduced power settings. Fuel tankage (self-sealing) in fuselage, under stub-wings (three 618 litre, 163.3 US gallon, 135.9 Imp gallon tanks for total of 1,854 litres, 489.8 US gallons, 407.8 Imp gallons). Pressure refuelling and defuelling. Provision for 750 litre (198 US gallon; 165 Imp gallon) drop tank on each inboard underwing station.

ACCOMMODATION: Pilot (rear) and co-pilot/weapons officer in stepped, tandem cockpits with crashworthy seats and armour protection. Access to cockpits via gull-wing starboard side window panels. All transparencies flat-plate or single curvature. Dual flight controls.

SYSTEMS: Environmental control system for cockpit air conditioning. Two independent hydraulic systems, each at 175 bars (2,538 lb/sq in) pressure, at 170 bars (2,465 lb/sq in) flow rate is 12 litres (3.2 US gallons; 2.6 Imp gallons)/min in right-hand system and 27 litres (7.1 US gallons; 5.9 Imp gallons)/min in left-hand system.

Electrical power from two 20 kVA alternators providing 200 V three-phase and 115 V single-phase AC at 400 Hz, with two transformer rectifiers and two 24 V 31 Ah

Rooivalk ADM prototype displays its external stores capability at Farnborough in 1994 *(Kenneth Munson)*

1995

batteries for 28 V DC power. Full or partial electric de-icing, demisting optional.

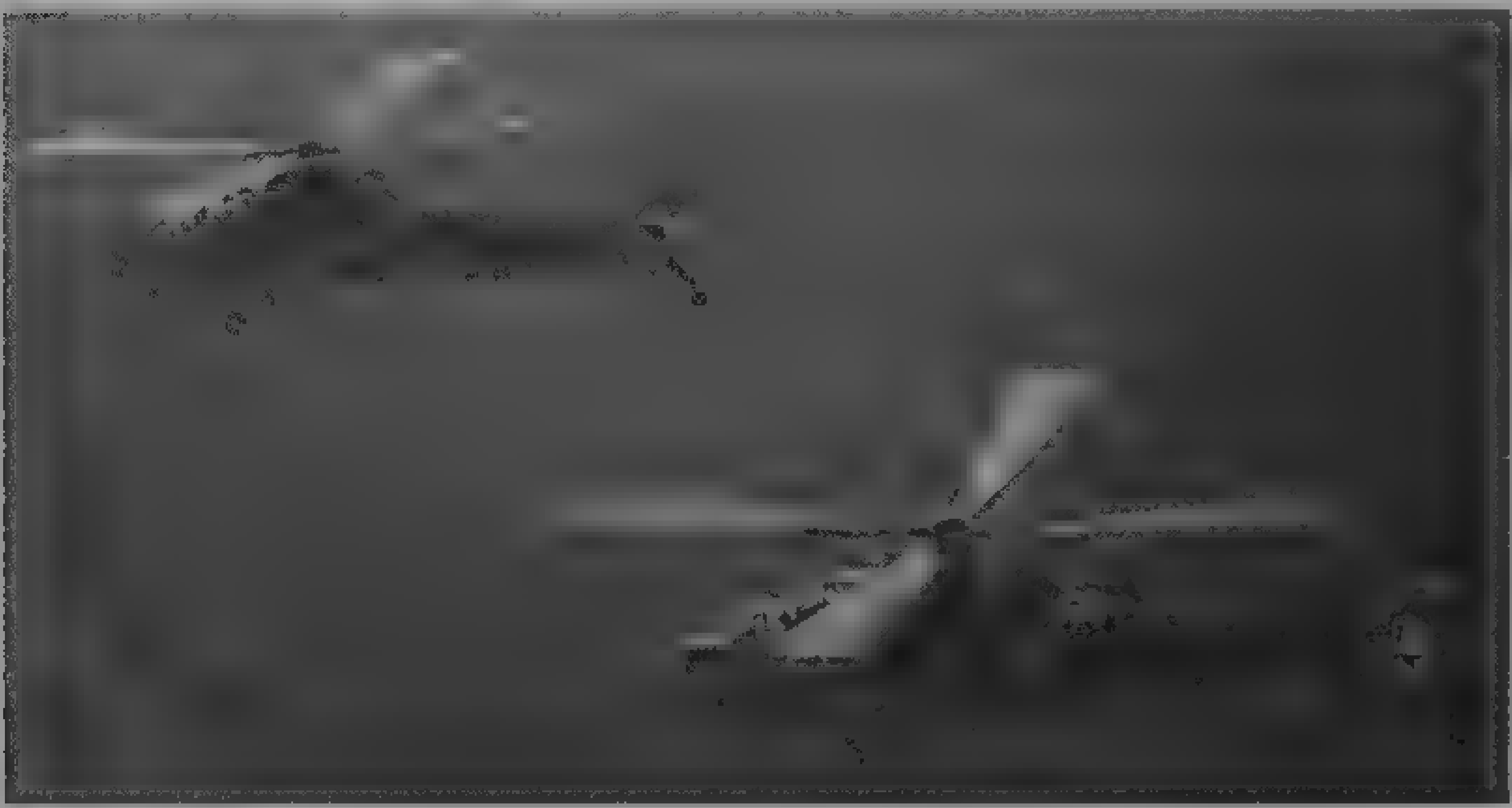
Crew oxygen system, and fire detection and extinguishing systems, standard.

AVIONICS: All-digital, interfaced to dual-redundant mission computers and MIL-STD-1553B databuses; stores management system conforms to MIL-STD-1760A. Avionics prime contractor is ATE (Advanced Technologies and Engineering), supported by 15 subcontractors.

Comms: Frequency-agile transceivers: dual V/UHF (30 to 400 MHz) for normal use and single HF (2 to 30 MHz) for NOE flights, intercom/audio system, IFF transponder.

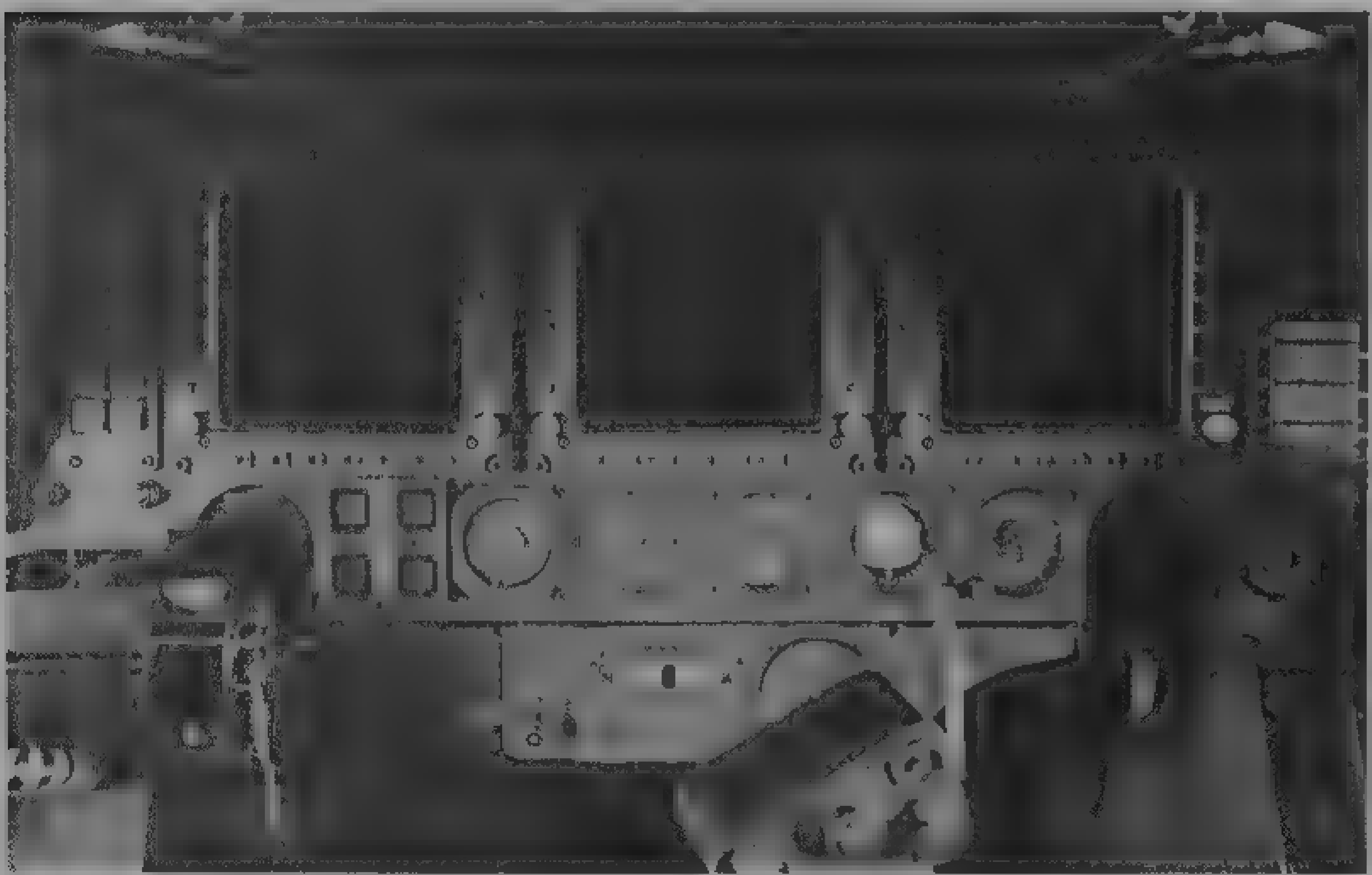
Flight: Duplex four axis digital AFCS, incorporating three-axis strapdown ring laser gyro AHRS, eight-channel GPS, Doppler radar velocity sensor, J-band radar altimeter, heading sensor unit (magnetometer), air data unit and omnidirectional airspeed sensor, all interfaced to two redundant navigation computers. Autopilot has one-touch autohover and attitude hold. Nav/attack system programmed by preloaded cartridge, can hold up to five flight plans (100 waypoints), which can be edited in flight by either crew member.

Instrumentation: Integrated flight management system, with two 160 × 160 mm (6.3 × 6.3 in) MFDs,



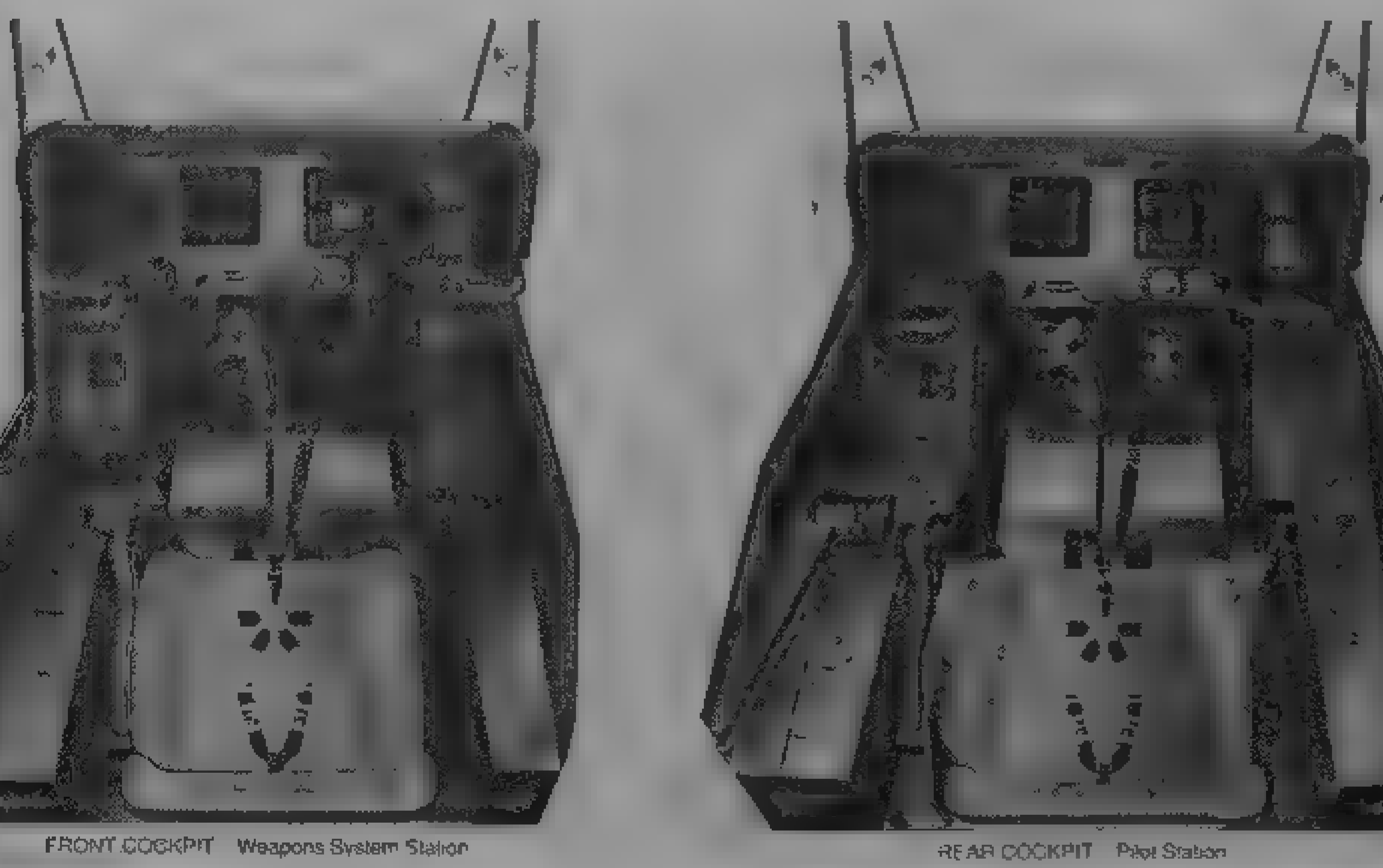
The two Rooivalk prototypes (XDM nearest camera) have flown more than 600 hours

1995



Rooivalk cockpit with multifunction displays and back up instruments. Production aircraft will have only two MFDs

1995



Production configuration of Rooivalk cockpits

1995

helmet-mounted display and position management system in each cockpit. Both cockpits have a back-up basic instrument panel for 'get home' capability in the event of computer or power failure. MFDs show flight control, navigation (including moving map on pilot's display), threat warning/EW, fire/weapons control and TDATS imagery, and can copy to each other. Cockpit instruments compatible with NVGs.

Mission: Nose-mounted, gyrostabilised turret contains target detection, acquisition and tracking system (TDATS), incorporating a three fields of view FLIR with automatic guidance and tracking, an LLTV camera and a laser rangefinder; associated equipment includes crew members' helmet sights, missile command link and tracking goniometer. Helmet sights display both flight and weapon data, and can cue both the TDATS turret and the gun turret.

Self-defence: Optimised ECM can include radar and laser warning receivers, chaff/flare dispensers and jammers.

ARMAMENT: Kentron GA-1 Rattler 20 mm gun in TC-20 hydraulically steerable chin mounting, or longer barrel 20 mm Armscor F2, cleared also for 30 mm weapon. F2 has up to 700 rounds of ammunition, firing rate of 740 rds/min, and slew rate of 90°/s. Gun linked to TDATS and helmet sights. One wingtip and two articulated underwing stores stations each side. Launchers for eleven or twenty-two × 68 mm unguided rockets and/or four-round launchers for ZT 35 Swift or ZT 4 laser-guided anti-tank missiles on underwing pylons; two V3C Darter infra-red air-to-air missiles at each wingtip. Kentron is prime contractor for weapons integration. Final weapon mix for SAAF to be decided.

DIMENSIONS, EXTERNAL:

Main rotor diameter 15.58 m (51 ft 1½ in)
Tail rotor diameter 3.04 m (9 ft 11¾ in)
Length: fuselage, excl gun, tail rotor turning 16.39 m (53 ft 9¼ in)
overall, rotors turning 18.73 m (61 ft 5¼ in)
Wing span over AAMs 5.20 m (17 ft 0¾ in)
Fuselage: Max width 1.28 m (4 ft 2½ in)
Max depth (belly to top of rotor head) 4.00 m (13 ft 1½ in)
Height: over tail rotor 4.445 m (14 ft 7 in)
to top of rotor head 4.59 m (15 ft 0¾ in)
overall 5.185 m (17 ft 0¼ in)
Wheel track 2.78 m (9 ft 1½ in)
Wheelbase 11.77 m (38 ft 7½ in)

AREAS:

Main rotor disc 190.6 m² (2,052.1 sq ft)
Tail rotor disc 7.27 m² (78.23 sq ft)

WEIGHTS AND LOADINGS:

Weight empty 5,910 kg (13,029 lb)
Max internal fuel weight 1,469 kg (3,238 lb)
External weapons load with full internal fuel 1,563 kg (3,446 lb)
Max external load (with 1,000 kg, 2,205 lb fuel) 2,032 kg (4,480 lb)
Typical mission T-O weight 7,500 kg (16,535 lb)
Max T-O weight 8,750 kg (19,290 lb)
Max disc loading 45.91 kg/m² (9.40 lb/sq ft)
Max power loading 3.90 kg/kW (6.41 lb/shp)

PERFORMANCE (at 7,500 kg, 16,535 lb combat weight, except where indicated. A: ISA at S/L, B: ISA + 27°C at 1,525 m, 5,000 ft):

Never exceed speed (VNE)
A, B 167 kts (309 km/h, 192 mph)
Max cruising speed
A 150 kts (278 km/h, 172 mph)
Max rate of climb at S/L: A 670 m (2,200 ft)/min
B 457 m (1,500 ft)/min
Rate of climb at S/L, OEI
A 512 m (1,680 ft)/min
Service ceiling: A 6,100 m (20,000 ft)
B 5,150 m (16,900 ft)
Hovering ceiling IGE: A 5,545 m (18,200 ft)
B 3,110 m (10,200 ft)
Hovering ceiling OGE: A 5,030 m (16,500 ft)
B 2,410 m (7,900 ft)
Range with max internal fuel, no reserves
A 380 n miles (704 km, 437 miles)
B 507 n miles (940 km, 584 miles)
Range at max T-O weight with external fuel
A 680 n miles (1,260 km, 783 miles)
B 720 n miles (1,335 km, 829 miles)
Endurance with max internal fuel, no reserves
A 3 h 36 min
B 4 h 55 min
Endurance at max T-O weight with external fuel
A 6 h 52 min
B 7 h 22 min
g limits +2.6/-0.5

UPDATED

ATLAS ORYX

TYPE: Twin-turboshaft multirole military helicopter.

PROGRAMME: South African helicopter industrialisation programme, launched 1978, had by early 1980s given Atlas capability to manufacture most critical components for in-service Alouette IIIs and SA 330 Pumas, and to build complete Pumas.

First upgraded Puma was XTP-1, flown 1986 (see 1989-90 *Jane's*), first Oryx delivered to SAAF in 1988 and first locally manufactured Topaz engines in 1990. Programme, comprising upgraded and new-build aircraft, due for completion in 1995

CUSTOMERS: South African Air Force; part equips No 15 Squadron at Durban Airport, No 17 at Swartkop, No 19 at Louis Trichardt and No 22 at Ysterplaat

DESIGN FEATURES: Puma fuselage re-engineered to Super Puma/Cougar standard and lightened by use of composites; power plant and transmission similar to those of Rooivalk, greatly increased fuel load in sponson tanks, dust and sand filters, modernised avionics. Performance is aimed to be identical at sea level and 3,050 m (10,000 ft) and 25 to 30 per cent better than Puma, for 25 to 30 per cent lower operating cost

POWER PLANT: Two 1,491 kW (2,000 shp) Topaz turboshafts

AVIONICS: New, NVG-compatible 'glass' cockpit, with displays redesigned for single-pilot operation. Features include

Radar: All-weather radar with ground-mapping capability

Flight: GPS navigation

NEW ENTRY

OTHER AIRCRAFT

Readers are referred to *Jane's Aircraft Upgrades* for Atlas **Cheetah** and **Puma Gunship** modernisation programmes, last appearance in *All the World's Aircraft* was in the 1994-95 edition

NEW ENTRY

Open panels demonstrate the accessibility of power train and other systems in the Rooivalk attack helicopter *(Paul Jackson)*

1995

PROFESSIONAL AVIATION

PROFESSIONAL AVIATION SERVICES (PTY) LTD

Terminal Building, Lanseria Airport, PO Box 3171, Randburg, Johannesburg 2125
Telephone: 27 (11) 659 2860
Fax: 27 (11) 659 1336/1331
Telex: 4-21865 SA

DIRECTORS:
R. C. H. Garbett
C. T. Garbett

Formed 1979; buys, sells, charters, leases and manages many types of fixed-wing aircraft and helicopters; maintains and supports aircraft, can arrange civil turboprop conversions of DC-3/C-47s (four converted by September 1992). Decribed in 1994-95 *Jane's*, entry now transferred to *Jane's Aircraft Upgrades*. Contrary to previous information, conversion of SAAF C-47s is undertaken by SAAF, not Professional Aviation

UPDATED

SPAIN

AISA

AERONAUTICA INDUSTRIAL SA

AISA no longer produces complete aircraft; details of recent activities appeared in the 1994-95 and previous *Jane's*. The company was acquired by CASA in 1994

UPDATED

CASA

CONSTRUCCIONES AERONAUTICAS SA

Avenida de Aragón 404, PO Box 193, E-28022 Madrid
Telephone: 34 (1) 585 7000
Fax: 34 (1) 585 7666/7
Telex: 41696 and 41726 CASA E

WORKS: Getafe, Illescas, Tablada, San Pablo, San Fernando, Puerto Real and Cádiz

PRESIDENT AND CHAIRMAN OF THE BOARD:
Raúl Herranz de Miguel

VICE-PRESIDENT COMMERCIAL:
Juan Alonso Castro

PUBLIC RELATIONS AND PRESS MANAGER:
José de Sanmillán

Founded 1923, owned 99.2852 per cent by TENEO 0.7098 per cent by DASA (Germany) and 0.005 per cent by others; INI ready to reduce its holding in favour of other European interests

CASA formed Industria de Turbopropulsores (ITP) in 1989 to make parts for and assemble turbojets, including EJ200 for Eurofighter 2000, F404 for F/A-18, possibly R-R Pegasus for Spanish Matadors (Harriers) and eventually for CASA AX. Compania Espanola de Sistemas Aeronauticas (CESA) formed with 40 per cent holding by Lucas Aerospace; CASA space division greatly extended, largely automated composites assembly plant opened at Illescas, near Toledo, January 1991

Largest current programme is 4.2 per cent share in Airbus, makes horizontal tail, landing gear doors, wing ribs and skins, leading/trailing-edges and passenger doors for A300/310/320/330/340, many in composites. Second largest programme is share in Eurofighter 2000 with membership of avionics, control systems, flight management and structure teams, shares starboard wing with BAe and rear fuselage with Alenia, CASA responsible for integration and software creation for communications system. Own programmes include C-212 Aviocar and CN-235 (latter shared with IPTN through Airtech); looking for partner for AX fighter/trainer

Contract to design, stress, test and manufacture whole wing of Saab 2000 won October 1989; designed and is making tailplane of McDonnell Douglas MD-11, makes outer flaps for Boeing 757, tail components for Spanish Sikorsky S-70s, member of European Future Large Aircraft Group and (with Airbus partners and Boeing) of Very Large Commercial Transport Group (see Euroflag and UHCA/VLCT/NLA entries in International section)

Maintenance Division has for nearly 40 years maintained and modernised some 7,900 aircraft and helicopters and 145,000 components for different customers, principally USAF and Spanish Air Force, this Division currently performing major F-5 modernisation programme, plus other work on F-4, F/A-18, CASA's own aircraft, AV-8A/B, C-130 and various types of helicopter

CASA's seven factories have 335,000 m² (3,605,900 sq ft) covered floorspace; 1993 workforce 9,200

UPDATED

CASA AX

Government funded prefeasibility and feasibility studies under way since 1989 for this advanced trainer and light attack aircraft to succeed Spanish F-5As and Bs from about 2000; joint studies being carried out in search for international partnership to launch development phase no later than 1996; could use afterburning F404 or alternative

UPDATED

CASA C-101 AVIOJET

Spanish Air Force designation: E 25 Mirlo (Blackbird)
Chilean Air Force designations: T 36 and A 36 Halcón (Hawk)

TYPE: Tandem two-seat basic and advanced trainer and attack aircraft

PROGRAMME: First flight 27 June 1977, four prototypes; first flight Spanish production aircraft 1979; nav/attack system modernisation of DD completed 1992. No recent sales

CURRENT VERSIONS: See earlier editions for C-101EB (1983-84) and C-101BB (1993-94). Latest versions are

C-101CC: Light attack version, powered by 19.13 kN (4,300 lb st) AlliedSignal TFE731-5-1J with military power reserve (MPR) rating of 20.91 kN (4,700 lb st), first flight 16 November 1983, designations **CC-02** for Chile, **CC-04** for Jordan. *Description applies to this version except where indicated*

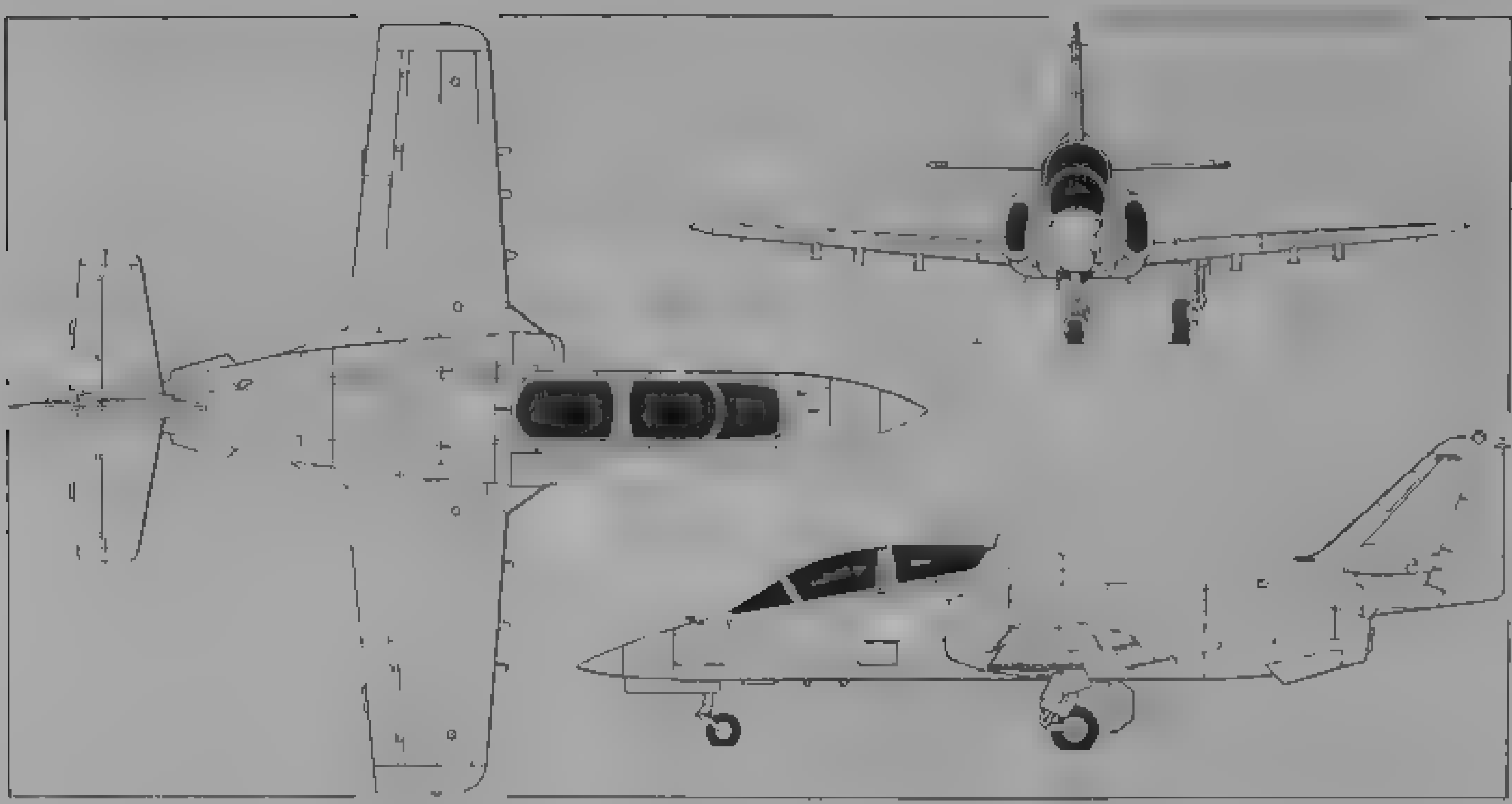
C-101DD: Enhanced training and attack version, first flight (EC-DVQ) 20 May 1985, avionics include GEC-Marconi HUD, weapon aiming computer and inertial platform, engine as for C-101CC, prototype/demonstrator only

CUSTOMERS: Spanish Air Force 88 EB (E.25 Mirlo) delivered from 17 March 1980; serving with Spanish Academia General del Aire, Grupo de Escuelas de Matacan, Ala 21 and Patrulla Aguila display team. Chilean Air Force 14 BB-02 (**T-36 Halcón**) plus 23 CC-02 (**A-36 Halcón**) of which 22 being assembled and part manufactured in Chile by ENAER (which see). Honduras four BB-03 with custom avionics; 16 CC-04 delivered to Royal Jordanian Air Force 1987-88. Four XE.25 prototypes and two demonstrators

POWER PLANT: One AlliedSignal TFE731 non-afterburning turbofan (see variants for details), with lateral intake on each side of fuselage abreast of second cockpit. Fuel in one 1,155 litre (305 US gallon, 254 Imp gallon) fuselage bag tank, one 575 litre (152 US gallon, 126.5 Imp gallon) integral tank in wing centre section, and two outer wing integral tanks, for ferry missions, each of 342 litres (90.4 US gallons, 75.25 Imp gallons). Total internal fuel capacity 1,730 litres (457 US gallons; 380.5 Imp gallons) normal, 2,414 litres (637.8 US gallons; 531 Imp gallons) maximum. Fuel system permits up to 30 seconds of inverted flight. Pressure refuelling point beneath port air

CASA C-101CC demonstrator

1995



CASA C-101CC Aviojet light attack aircraft *(Jane's/Dennis Punnett)*

1983

intake; gravity fuelling point for each tank. No provision for external fuel tanks. Oil capacity 8.5 litres (2.2 US gallons; 1.8 Imp gallons).

ACCOMMODATION: Crew of two in tandem, on Martin-Baker Mk 10L zero/zero ejection seats, under individual canopies which open sideways to starboard and are separated by internal screen. Rear (instructor's) seat elevated 32.5 cm (12¾ in). Cockpit pressurised and air conditioned by engine bleed air. Dual controls standard.

AVIONICS (C-101CC): *Comms:* Magnavox AN/ARC-164A UHF, Collins AN/ARC-186 VHF, Andrea AN/AIC-18 interphone, Teledyne/CASA AN/APX-101 IFF/SIF. Dorne & Margolin DMELT 8.1 ELT.

Flight: VIR-31A VOR/ILS, DME-42 and ADF-60 (all Collins); Lear Siegler LSI 6000D gyro platform, ADI 500C, RD-550A HSI, Honeywell STARS IVC flight director. Collins AN/ARN-118 Tacan optional.

Mission: CASA SCAR 81 armament control system, Avimo RGS2 gunsight in each cockpit.

Self-defence: General Instrument AN/ALR-66 RWR and Vinten Vicon 78 chaff/flare dispenser optional.

AVIONICS (C-101DD): *Comms:* Collins AN/ARC-182(V) UHF/VHF-AM/FM and AN/ARC-186 VHF-AM/FM.

Flight: Collins VIR-130A VOR/ILS, Alenia radar altimeter; Litton LN-39A inertial platform.

Mission: GEC Marconi FD 4513 HUDWAC and Alenia mission computer, linked with INS to MIL-STD-1553B digital databus; HOTAS controls; video camera and rear seat monitor.

ARMAMENT: Large bay below rear cockpit suitable for quick-change packages, including 30 mm DEFA 553 cannon pod with 130 rounds, twin 12.7 mm Browning M3 machine gun pod with 220 rds/gun, reconnaissance camera, ECM package or laser designator. Six underwing hardpoints, capacities 500 kg (1,102 lb) inboard, 375 kg (827 lb) centre and 250 kg (551 lb) outboard; total external stores load 2,250 kg (4,960 lb). Typical armament can include one 30 mm cannon with up to 130 rounds, or two 12.7 mm guns, in fuselage, and four LAU-10 pods of 5 in rockets, six 250 kg BR250 bombs, four LAU-3/A rocket launchers, four 125 kg BR125 bombs and two LAU-3/A launchers, two AGM-65 Maverick missiles, or two AIM-9L Sidewinders or Matra Magics.

DIMENSIONS, EXTERNAL:

Wing span	10.60 m (34 ft 9⅜ in)
Length overall	12.50 m (41 ft 0 in)
Height overall	4.25 m (13 ft 11¼ in)
Wheel track (c/l of shock struts)	3.18 m (10 ft 5¼ in)
Wheelbase	4.77 m (15 ft 7¾ in)

AREAS:

Wings, gross	20.00 m² (215.3 sq ft)

WEIGHTS AND LOADINGS (C-101CC and DD):

Weight empty, equipped	3,470 kg (7,650 lb)
Max fuel weight	1,882 kg (4,149 lb)
Max external stores load	1,840 kg (4,056 lb)
T-O weight, clean	5,000 kg (11,023 lb)
Max T-O and landing weight	6,300 kg (13,890 lb)
Max wing loading	315.0 kg/m² (64.52 lb/sq ft)
Max power loading	301.0 kg/kN (2.95 lb/lb st)

PERFORMANCE (C-101CC and DD at 4,350 kg, 9,590 lb AUW, CC in training configuration with 50% normal fuel, except where indicated):

Max limiting Mach number	0.80
Max level speed	450 kts (834 km/h; 518 mph)
Max rate of climb at S/L	1,950 m (6,397 ft)/min
Service ceiling	13,410 m (44,000 ft)
T-O run	560 m (1,835 ft)
Landing run	480 m (1,575 ft)
Typical interdiction radius (lo-lo-lo) with four 250 kg bombs and 30 mm gun, 5 min over target, 30 min reserves	260 n miles (482 km; 299 miles)
Typical close air support radius (lo-lo-lo) with four 19 × 2.75 in rocket launchers and 30 mm gun, 30 min loiter over battle area, 5 min over target, 30 min reserves	250 n miles (463 km; 287 miles)
Typical photo-reconnaissance radius (hi-lo-hi), 30 min reserves	740 n miles (1,370 km; 852 miles)
Armed patrol mission, no underwing stores, 100 n mile (185 km; 115 mile) transit from base to patrol area, with one 30 mm or two 12.7 mm guns, 45 min reserves	3 h 30 min at 200 kts (370 km/h; 230 mph) at S/L
Max endurance	7 h
g limits:	
at 4,900 kg (10,802 lb) AUW	+7.5/–3.9
at 6,300 kg (13,890 lb) AUW	+5.5/–2

UPDATED

CASA C-212 SERIES 300 AVIOCAR

TYPE: Twin-turboprop general purpose transport.

PROGRAMME: See 1991-92 and previous editions for early history; Series 100 last described in 1981-82 *Jane's* and Series 200 in 1987-88 edition. Series 300 certificated to FAR Pts 25, 121 and 135 in December 1987.

CURRENT VERSIONS: **300 Airliner:** Standard seating for 26 passengers, or 24 if toilet included.

300 Utility: Standard seating for 23 passengers, or 21 if toilet included, with maximum capacity for 26.

300M: Military troop/cargo/general purpose transport.

300ASW: Anti-submarine version; described separately.

300DE: Elint/ECM version; described separately.

300MP: Maritime patrol version; described separately.

300P: As standard Series 300 but powered by 820 kW (1,100 shp) P&WC PT6A-65 turboprops for improved hot and high performance. Spanish certification 1989; no announced orders up to Spring 1995.

CUSTOMERS: Total 447 of all versions (208 civil/239 military) sold by November 1994, of which nearly all delivered, including 164 Series 100 and approximately 240 Series 200. Over 30 Series 300 then ordered, including Series 300M for air forces of Bolivia (one), Botswana (two), Chile (two), Colombia (two), France (five), Lesotho (three), Panama (three) and Thailand (two), plus nine Series 300MPs (see separate entry) and at least 10 civil examples including six for Thailand Ministry of Agriculture. Military customers for Series 100/200 listed in 1991-92 and earlier editions. Above includes production in Indonesia by IPTN (which see).

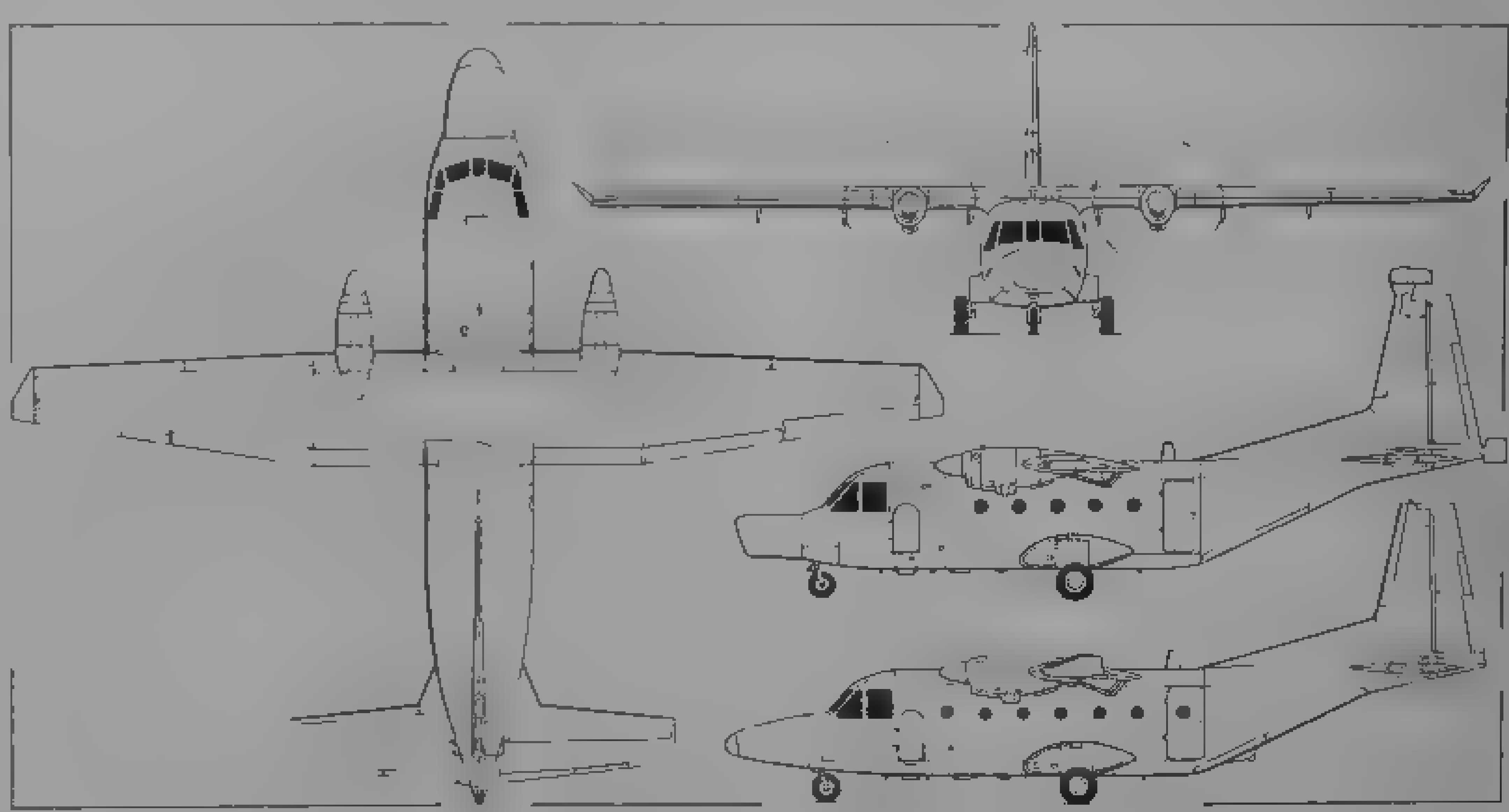
DESIGN FEATURES: Wing section NACA 65_3-218, no dihedral, incidence 2° 30′, swept winglets canted upwards at 45°; meets FAR Pt 36 noise limits.

FLYING CONTROLS: Mechanical, fixed incidence tailplane; trim tab in port aileron, trim and geared tabs in rudder and each elevator; double-slotted flaps.

STRUCTURE: All-metal light alloy fail-safe structure, unpressurised, two-spar tailplane and fin. Wing centre-section, forward and rear passenger doors and dorsal fin manufactured by AISA.

LANDING GEAR: Non-retractable tricycle type, with single mainwheels and single steerable nosewheel. CASA oleo-pneumatic shock absorbers. Goodyear wheels and tyres, main units size 11.00-12 Type III (10 ply rating), nose unit size 24-7.7 Type VII (8 ply rating). Tyre pressure 3.86 bars (56 lb/sq in) on main units, 4.0 bars (58 lb/sq in) on nose unit. Goodyear hydraulic disc brakes on mainwheels. No brake cooling. Anti-skid system optional.

POWER PLANT: Two AlliedSignal TPE331-10R-513C turboprops, each flat rated at 671 kW (900 shp) and equipped with automatic power reserve (APR) system providing 690 kW (925 shp) in event of one engine failing during take-off. Dowty Aerospace R-334/4-82-F/13 four-blade constant-speed fully feathering reversible-pitch propellers. Fuel in four integral wing tanks, with total capacity of 2,040 litres (539 US gallons; 449 Imp gallons), of which 2,000 litres (528 US gallons; 440 Imp gallons) usable. Gravity refuelling point above each tank. Single pressure



CASA C-212 Series 300 Aviocar, with additional side view (centre) of C-212DE (ECM) version *(Jane's/Dennis Punnett)*

1992

refuelling point in starboard wing leading-edge. Additional fuel can be carried in one 1,000 litre or two 750 litre (264 or 198 US gallon, 220 or 165 Imp gallon) optional ferry tanks inside cabin, and/or two 500 litre (132 US gallon, 110 Imp gallon) auxiliary underwing tanks. Oil capacity 4.5 litres (1.2 US gallons, 1.0 Imp gallon) per engine.

ACCOMMODATION: Crew of two on flight deck, cabin attendant in civil version. For troop transport role, main cabin can be fitted with 25 inward-facing seats along cabin walls, to accommodate 24 paratroops with instructor/jumpmaster, or seats for 25 fully equipped troops. As ambulance, cabin is normally equipped to carry 12 stretcher patients and four medical attendants. As freighter, up to 2,700 kg (5,952 lb) of cargo can be carried in main cabin, including two LD1, LD727/DC-8 or three LD3 containers, or light vehicles. Cargo system, certificated to FAR Pt 25, includes roller loading/unloading system and 9 *g* barrier net. Photographic version equipped with two Leica RC-20/30 vertical cameras and darkroom. Navigation training version has individual desks/consoles for instructor and five pupils, in two rows, with appropriate instrument installations.

Civil passenger transport version has standard seating for up to 26 in mainly three-abreast layout at 72 cm (28.5 in) pitch, with provision for quick change to all-cargo or mixed passenger/cargo interior. Toilet, galley and 400 kg (882 lb) capacity baggage compartment standard, plus additional 150 kg (330 lb) in nose bay. VIP transport version can be furnished to customer's requirements.

Forward/outward-opening door on port side immediately aft of flight deck, forward/outward opening passenger door on port side aft of wing, inward-opening emergency exit opposite each door on starboard side. Additional emergency exit in roof of forward main cabin. Two-section underfuselage loading ramp/door aft of main cabin is openable in flight for discharge of paratroops or cargo, and can be fitted with optional external wheels for door protection during ground manoeuvring. Interior of rear-loading door can be used for additional baggage stowage in civil version. Entire accommodation heated and ventilated; air conditioning optional.

SYSTEMS: Freon cycle or (on special mission versions) engine bleed air air conditioning system optional. Hydraulic system, operating at service pressure of 138 bars (2,000 lb/sq in), provides power via electric pump to actuate mainwheel brakes, flaps, nosewheel steering and rear cargo ramp/door. Hand pump for standby hydraulic power in case of electrical failure or other emergency. Electrical system supplied by two 9 kW starter/generators, three batteries and three static converters. Pneumatic boot and engine bleed air de-icing of wing and tail unit leading-edges, electric de-icing of propellers and windscreens. Oxygen system for crew (including cabin attendant), two portable oxygen cylinders for passenger supply. Engine and cabin fire protection systems.

AVIONICS: *Comms*: Collins VHF, ATC transponder, intercom (with Gables control) and PA system standard. Collins HF, UHF and second transponder, and Fairchild CVR optional.

Radar: Bendix/King weather radar standard.

Flight: Collins VOR/ILS, ADF, DME and radio altimeter, and Honeywell AFCS and directional gyro, standard; second Collins ADF, Global Omega nav, Dorne & Margolin marker beacon receiver and Fairchild flight data recorder optional.

Instrumentation: Blind-flying instrumentation standard.

ARMAMENT: (military versions, optional): Two machine gun pods or two rocket launchers, or one launcher and one gun pod, on hardpoints on fuselage sides (capacity 250 kg, 551 lb each).

DIMENSIONS, EXTERNAL:

Wing span	20.28 m (66 ft 6½ in)
Wing chord: at root	2.50 m (8 ft 2½ in)
at tip	1.25 m (4 ft 1¼ in)
Wing aspect ratio	10.03
Length overall	16.15 m (52 ft 11¾ in)
Fuselage: Max width	2.30 m (7 ft 6½ in)
Height overall	6.60 m (21 ft 7¾ in)
Tailplane span	8.40 m (27 ft 6¾ in)
Wheel track	3.10 m (10 ft 2 in)
Wheelbase	5.46 m (17 ft 11 in)
Propeller diameter	2.79 m (9 ft 2 in)
Propeller ground clearance (min)	1.27 m (4 ft 2 in)
Distance between propeller centres	5.27 m (17 ft 3¼ in)
Passenger door (port, rear):	
Height	1.58 m (5 ft 2¼ in)
Width	0.70 m (2 ft 3½ in)
Crew and servicing door (port, fwd):	
Max height	1.10 m (3 ft 7¼ in)
Width	0.58 m (1 ft 10¾ in)
Rear-loading door: Max length	3.66 m (12 ft 0 in)
Max width	1.70 m (5 ft 7 in)
Max height	1.80 m (5 ft 10¾ in)
Emergency exit (stbd, fwd): Height	1.10 m (3 ft 7¼ in)
Width	0.58 m (1 ft 10¾ in)
Emergency exit (stbd, rear): Height	0.94 m (3 ft 1 in)
Width	0.55 m (1 ft 9¾ in)

DIMENSIONS, INTERNAL:

Cabin (excl flight deck and rear-loading door):	
Length: passenger	7.22 m (23 ft 8¼ in)
cargo/military	6.50 m (21 ft 4 in)
Max width	2.10 m (6 ft 10¾ in)
Max height	1.80 m (5 ft 10¾ in)
Floor area: passenger	13.51 m² (145.4 sq ft)
cargo/military	12.21 m² (131.4 sq ft)
Volume: passenger	23.7 m³ (837 cu ft)
cargo/military	22.0 m³ (777 cu ft)
Cabin volume incl flight deck and rear loading door	30.4 m³ (1,073.6 cu ft)
Baggage compartment volume	3.6 m³ (127 cu ft)

AREAS:

Wings, gross	41.0 m² (441.33 sq ft)
Ailerons (total, incl tab)	7.50 m² (80.73 sq ft)
Trailing-edge flaps (total)	14.92 m² (160.60 sq ft)
Fin, incl dorsal fin	4.22 m² (45.42 sq ft)
Rudder, incl tab	2.05 m² (22.07 sq ft)
Tailplane	9.01 m² (96.98 sq ft)
Elevators (total, incl tabs)	3.56 m² (38.32 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's weight empty	3,780 kg (8,333 lb)
Weight empty, equipped (cargo)	4,400 kg (9,700 lb)
Max payload: cargo	2,700 kg (5,952 lb)
300M	2,820 kg (6,217 lb)
Max fuel: standard	1,600 kg (3,527 lb)
with underwing auxiliary tanks	2,400 kg (5,291 lb)
Max T-O weight: standard	7,700 kg (16,975 lb)
300M	8,100 kg (17,857 lb)
Max ramp weight	7,750 kg (17,085 lb)
Max landing weight	7,450 kg (16,424 lb)
Max zero-fuel weight	7,100 kg (15,653 lb)
Max cabin floor loading	732 kg/m² (150 lb/sq ft)
Max wing loading: standard	187.8 kg/m² (38.46 lb/sq ft)
300M	197.6 kg/m² (40.46 lb/sq ft)
Max power loading: standard	5.74 kg/kW (9.43 lb/shp)
300M	6.04 kg/kW (9.92 lb/shp)

PERFORMANCE (at max T-O weight. A: passenger version, B: freighter, C: 300M at 8,000 kg, 17,637 lb MTOW):

Max operating speed (VMO):	
A, B, C	200 kts (370 km/h; 230 mph)
Max cruising speed at 3,050 m (10,000 ft):	
A, B, C	191 kts (354 km/h; 220 mph)
Econ cruising speed at 3,050 m (10,000 ft):	
A, B, C	162 kts (300 km/h; 186 mph)
Stalling speed in T-O configuration:	
A, B, C	78 kts (145 km/h, 90 mph)
Max rate of climb at S/L: A, B, C	497 m (1,630 ft)/min
Rate of climb at S/L, OEI: A, B, C	95 m (312 ft)/min
Service ceiling: A, B, C	7,925 m (26,000 ft)
Service ceiling, OEI: A, B, C	3,380 m (11,100 ft)
FAR T-O distance: A, B	817 m (2,680 ft)
FAR landing distance: A, B	866 m (2,840 ft)
MIL-7700C T-O to 15 m (50 ft):	
C	610 m (2,000 ft)
MIL-7700C landing from 15 m (50 ft):	
C	462 m (1,516 ft)
MIL-7700C landing run: C	285 m (935 ft)
Required runway length for STOL operation:	
C	384 m (1,260 ft)
Range (civil operation, IFR reserves):	
with 25 passengers, at max cruising speed	237 n miles (440 km, 273 miles)
with 1,713 kg (3,776 lb) payload	773 n miles (1,433 km, 890 miles)
Range (military operation):	
with max payload	450 n miles (835 km, 519 miles)
with max standard fuel and 2,120 kg (4,674 lb) payload	907 n miles (1,682 km, 1,045 miles)
with max standard and auxiliary fuel and 1,192 kg (2,628 lb) payload	1,447 n miles (2,680 km; 1,665 miles)

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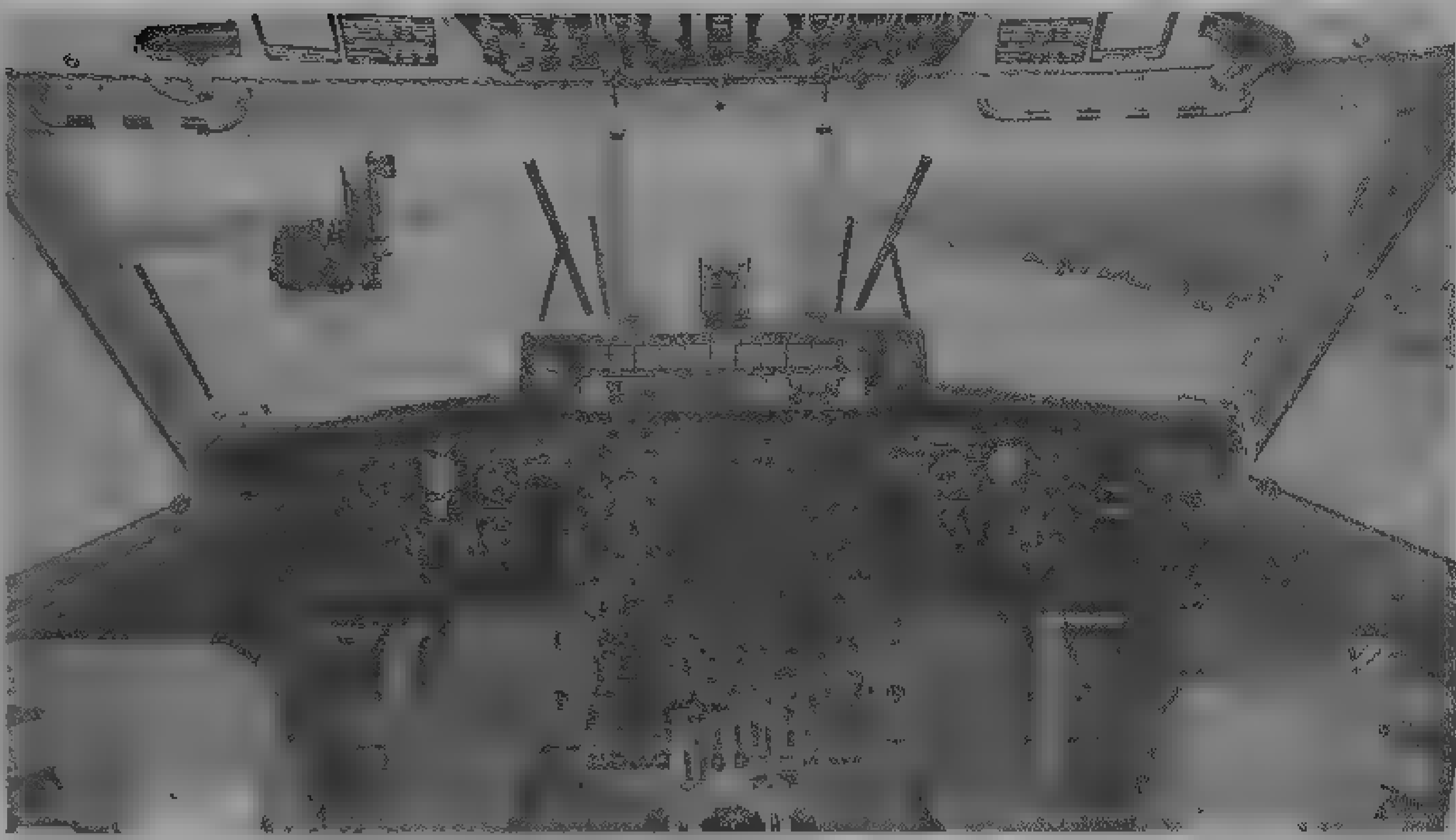


Flight deck of the CASA C-212M

1995

CASA C-212-300M Aviocar of the Panamanian Air Force

1995

CASA C-212 PATRULLERO (SPECIAL MISSION VERSIONS)

TYPE: Specialised adaptations of standard C-212 Series 300.

CURRENT VERSIONS: **ASW**: Anti-submarine version, 360° scan radar under fuselage, ESM.

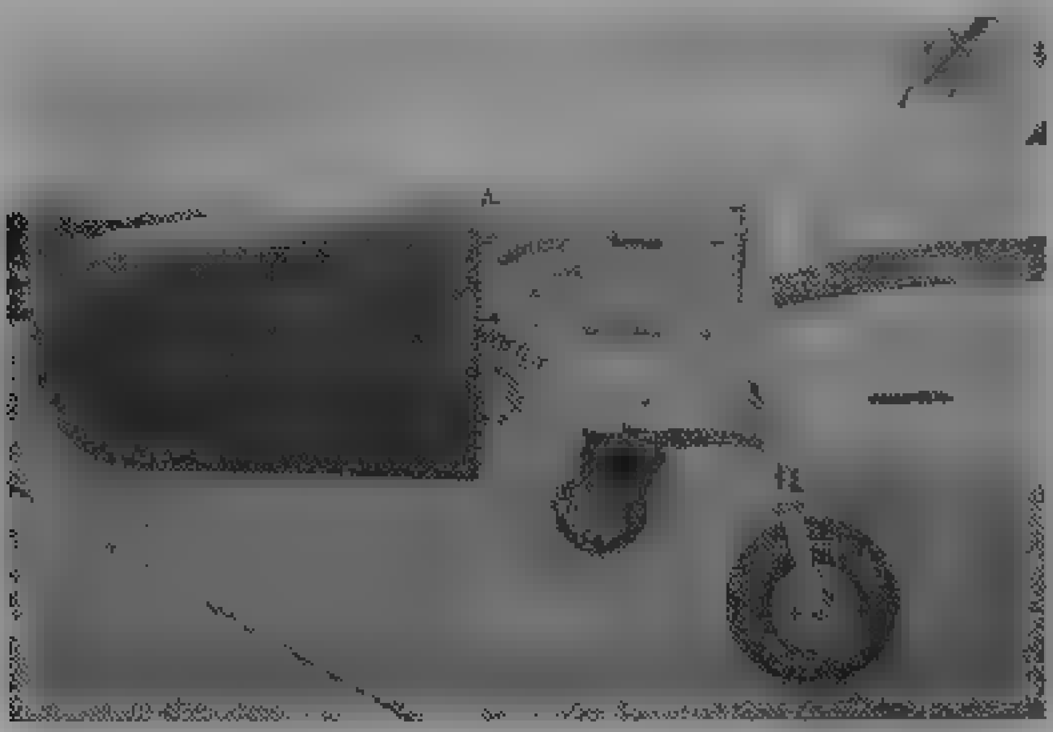
DE: Elint/ECM version, see Equipment paragraph; development began 1981.

MP: Maritime patrol version; nose- or belly-mounted search radar in enlarged radome, FLIR; additional antennae.

CUSTOMERS: Deliveries of versions based on Series 100/200 listed in 1991-92 and earlier *Jane's*; customers for Series 300-based variants include Argentine Prefectura Naval (five MP), Portuguese Air Force (two MP for No. 401 Squadron) and Spanish Ministry of Finance/Customs Service (two MP).

POWER PLANT: As C-212 Series 300. Two 500 litre (132 US gallon; 110 Imp gallon) underwing auxiliary fuel tanks.

ACCOMMODATION: Flight crew of two; four systems operators in ASW version, radar operator and two observer stations in MP version. Radar console, weapon controls and intervalometer added to flight deck, nav/com boxes in rack aft of pilot, starboard rack behind pilot contains radar, sonobuoy, MAD and ESM boxes; three consoles on starboard side of cabin: (1) radar control and display, ESM and intercom, (2) tactical display, MAD recorder and intercom, (3) sonobuoy controls, acoustic controls and displays. Radar



Nose radar (and optional FLIR) detail of the C-212 300MP Patrullero

1995

Artist's impression of CASA's projected 68/78-seat CASA 3000

1994

repeater console and searchlight controls added to flight deck. nav/com (including UHF/DF and VLF/Omega) and radar in rack behind pilot, radar operator console on starboard side of cabin, observer stations at rear

AVIONICS (ASW) *Comms.* Dual VHF, single HF and UHF radios, intercom IFF/SIF

Radar 360° scan underfuselage radar

Flight Autopilot, flight director, UHF/DF, VLF/Omega

Mission. MAD, OTPI, tactical and sonobuoy processing systems, ESM

AVIONICS (MP) *Comms:* As for ASW version. Nose- or belly mounted AN APS 128 100 kW search radar with 360° scan

Mission FLIR

EQUIPMENT (MP): Sonobuoy and smoke marker launchers searchlight

EQUIPMENT (DE) Automatic signal interception classification and identification, jamming emitters map for plotting location and characteristics of hostile radars

ARMAMENT (ASW): Can include torpedoes such as Mk 46 and Sting Ray, air-to-surface missiles such as AS15TT and Sea Skua, unguided air-to-surface rockets

UPDATED

CASA 3000

TYPE. Twin-turboprop regional airliner

PROGRAMME. Market studies completed September 1991, definition phase completed May 1993. Launch decision still dependent on market situation, no go-ahead given up to mid-1995

DESIGN FEATURES. Conventional twin-engined low-wing configuration, carbonfibre wing, wing and tailplane non-swept but with marked dihedral, sweptback vertical tail Designed for Cat II landings (Cat IIIa optional) and flight into known icing conditions

FLYING CONTROLS: Ailerons operated mechanically, all other control surfaces electrohydraulically One aileron and two spoilers on each wing, latter operable symmetrically on ground to act as airbrakes, two independent elevators, with artificial feel (Q-feel) and stall warning (stick shaker and stick pusher) capability, two (vertically split) rudder surfaces operated electrically (fly-by-wire). Two-segment hydraulically operated single-slotted flaps on each wing, maximum deflection 40°

STRUCTURE: Mainly of aluminium alloys, with extensive metal to metal bonding, composites for radome, movable control surfaces, fairings, trailing-edges, cabin flooring, and possibly other structural components. Primary structure designed for 60,000 hour service life

LANDING GEAR Retractable tricycle type, with twin wheels on each unit All units retract forward Designed for service life of 75,000 landings, following safe-life criteria

POWER PLANT: Two turboprops, each rated at 3,244 kW (4,350 shp) for T-O (3,579 kW, 4,800 shp with APR), each driving an 880 rpm six-blade propeller FADEC engine control system. Fuel capacity 6,460 litres (1,706 US gallons, 1,421 Imp gallons)

ACCOMMODATION. Flight crew of pilot, co-pilot and observer Basic cabin arranged for 72 passengers in mainly four-abreast seating at 81 cm (32 in) pitch, with galley and stowage areas at front and toilet at rear, plus one attendant seat at front and one at rear Baggage compartment aft of passenger area. Alternative layouts for 78 passengers at 76 cm (30 in) pitch (high density), or 68 in mixed class (22 at 86 cm: 34 in and 46 at 32 in). Passenger door at front and rear on port side, service door at front and rear, and baggage compartment door at rear, on starboard side Entire accommodation pressurised and air conditioned

SYSTEMS Cabin pressure differential of 0 48 bar (7 0 lb/sq in), providing 2,285 m (7,500 ft) environment at altitude of 9,450 m (31,000 ft)

AVIONICS. *Flight.* Navigation control and sensors, central radio tuning units, aircraft systems monitoring sensors and flight management system connected through digital buses to two avionics computers. Options to include GPS ACARS (ARINC communication and reporting system) and MLS

Instrumentation: Two primary flight parameter displays, two multifunction displays, two EICAS displays and Cat. II (optionally Cat IIIa) autopilot all deriving data from avionics computers

DIMENSIONS EXTERNAL	
Wing span	27 66 m (90 ft 9 in)
Length overall	29 70 m (97 ft 5¼ in)
Height overall	8.68 m (28 ft 5¾ in)
Wheel track (c/l of shock-struts)	9 24 m (30 ft 3¾ in
Wheelbase	10 428 m (34 ft 2½ in)
Propeller fuselage clearance	1 16 m (3 ft 9¾ in)
DIMENSIONS INTERNAL	
Cabin Max width	2.64 m (8 ft 8 in)
Width at floor	2.27 m (7 ft 5½ in)
Max height	1 97 m (6 ft 5½ in)
Baggage compartment volume	13 9 m³ (491 cu ft)
Carry-on baggage volume	9 8 m³ (346 cu ft)
WEIGHTS AND LOADINGS	
Operating weight empty	16,700 kg (36,817 lb)
Max payload	8,000 kg (17,637 lb)
Max T-O weight	28,300 kg (62,391 lb)
Max landing weight	27,800 kg (61,288 lb)
Max zero-fuel weight	24,700 kg (54,454 lb)
Max power loading	
without APR	4 36 kg/kW (7 17 lb/shp)
with APR	3 95 kg/kW (6.50 lb/shp)
PERFORMANCE (estimated)	
Max cruising speed	350 kt (648 km/h, 403 mph)
FAR 25 T-O balanced field length at max T-O weight	
ISA at S/L	1,350 m (4,430 ft)
ISA + 20°C at 610 m (2,000 ft)	1,600 m (5,250 ft)
Range at max cruising speed with 72 passengers and baggage	1,000 n miles (1,852 km, 1,151 miles)

UPDATED

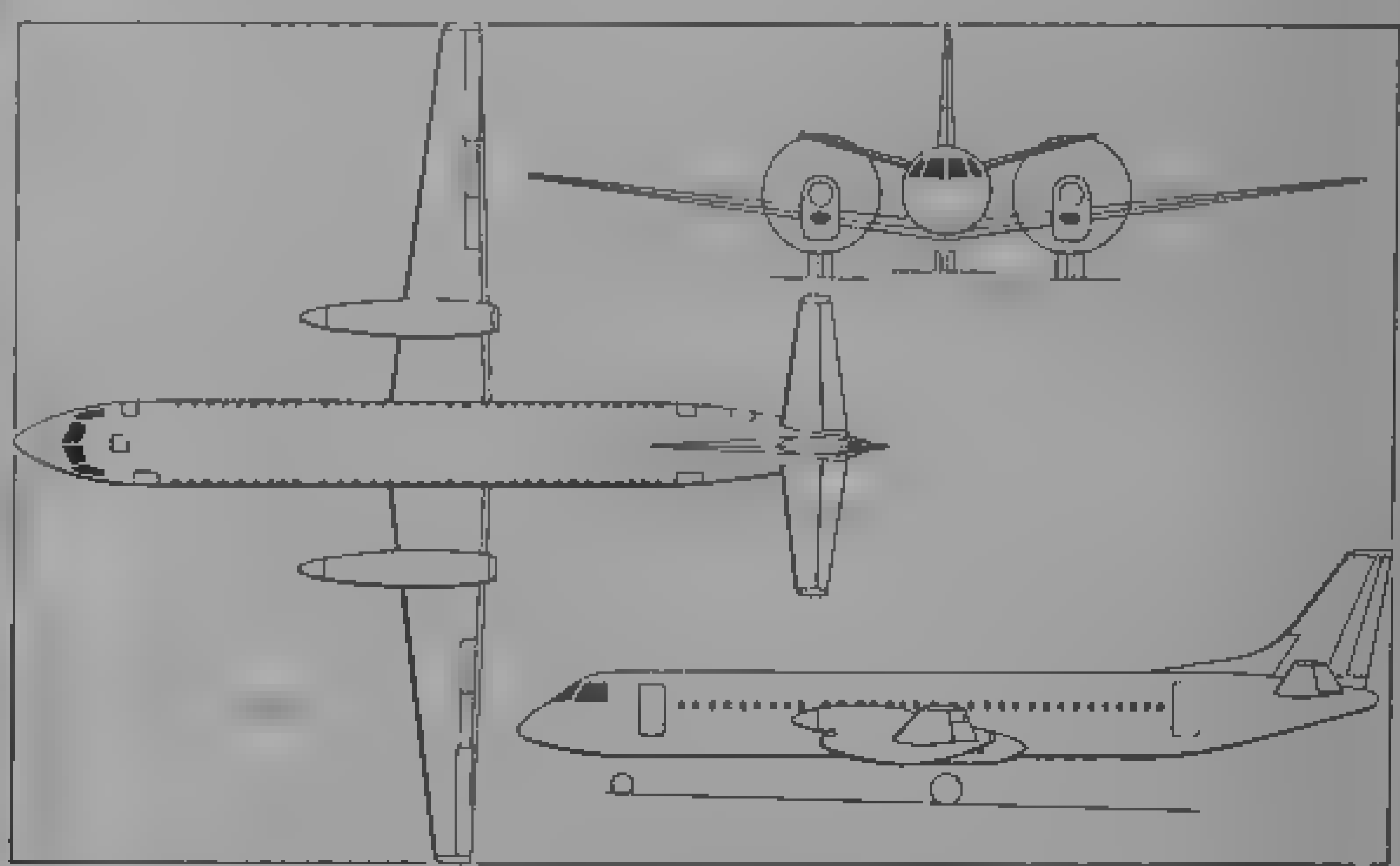
OTHER AIRCRAFT

See under Airtech in International section for CASA/IPTN **CN-235** twin-turboprop transport

NEW ENTRY

CASA 3000 flight deck mockup

1994



Preliminary drawing of the CASA 3000 twin-turboprop regional airliner *(Jane's/Mike Keep)*

1995

SWEDEN

ASL

ASL HAGFORS AERO AB

Flygplatsen, S-683 93 Råda
Telephone 46 (563) 602 20
Fax. 46 (563) 605 22
MARKETING MANAGER Håkan Johansson

Joint venture company formed June 1993 by Aviation Scotland Ltd and Lvan Invest AB to manufacture modified version of ARV Super2 in Sweden

UPDATED

ASL OPUS 280

TYPE: Two-seat light cabin monoplane.

PROGRAMME: Modified ARV Super2. Now manufactured at Hagfors, Sweden. Initial production from assembly of Scottish built kits. JAR-VLA certification early 1995 Original prototype Island Aircraft ARV 1 Super2 (G-OARV) first flew 11 March 1985, piloted by Hugh Kendall: two further trials/demonstrator aircraft in programme which resulted in BCAR Section K certification July 1986; production halted 1987 but resumed 1988 for short period. Design and manufacturing rights purchased late 1991 by Aviation Scotland Ltd and facilities transferred to Burnbank, relaunched November 1991 at Copex '91 UK show at Sandown, overseas relaunch at Copex Caribbean and Latin American show in Miami February 1992, CAA A1 approval received October 1992: first Aviation Scotland aircraft flew November 1992 with AE 75 engine manufactured by Mid-West Aero-Engines, MWAE rotary engine, in testbed Super2 G-BMWG, flew January 1993 for engine development purposes, Aviation Scotland

received CAA certification to carry out modifications in March 1993 but programme transferred entirely to Sweden during 1994. JAR-VLA certificate received March 1995 first deliveries due June 1995

CURRENT VERSIONS: **Super2**: Basic original version, with AE 75 engine.

Opus 280: Developed in Sweden with Rotax 912A four-cylinder four-stroke engine. *Description applies to this version.*

ARV K1 Super2. Kit version of standard Super2 with MWAE 75D two-stroke engine.

Rotary prototype: Version powered by MWAE 100R twin-rotor rotary engine giving 71 kW (95 hp) at 7,500 rpm; engine certification testing by Mid-West Aero Engines at Staverton, UK.

CUSTOMERS: Total of 32 Super2s built by early 1994 (seven by Aviation Scotland). UK production then discontinued. Aircraft c/n 033 to Sweden in October 1994 as SE-KYP for demonstrations. Four Opus 280s ordered by June 1995, when first two due for delivery to Bromma Flight School.

DESIGN FEATURES: Design objective low initial cost and low maintenance cost; engine with aluminium radiator in recessed duct in rear fuselage, superplastically formed aluminium alloy pressings to save weight. Designed to BCAR Section K and FAR Pt 23; also intended to be suitable for home building in kit form under auspices of Popular Flying Association. Wing section NACA 2415 (modified); 5° 12′ forward sweep.

FLYING CONTROLS: Mass balanced ailerons operated by torque tube through leading-edge of manually operated, three-position, plain flaps; single-spar mass balanced rudder and elevator with trim tab.

STRUCTURE: Single-spar aluminium alloy wing, cold bonded and flush riveted. Single uncompromised main bulkhead carries wings, bracing struts, controls, seats, fuel tank and main landing gear; conventional double beam forward of main bulkhead carries firewall, nose landing gear and engine; front fuselage skinning in four panels, rear fuselage of aluminium alloy construction with single curvature skinning. Tail unit conventional aluminium alloy structure with three-spar fixed surfaces. Airframe corrosion-treated.

LANDING GEAR: Non-retractable tricycle type. Cantilever main legs of tapered steel leaf spring. All three wheels size 3.50 × 6.0, with tyres size 13 × 4.00-6, pressure 1.72 bars (25 lb/sq in). Hydraulic disc brakes. Nose leg with gas filled damper and rubber in tension springing.

POWER PLANT: One 59.7 kW (80 hp) Rotax 912A flat-four engine driving two-blade propeller. Fuel capacity 75 litres (19.8 US gallons; 16.5 Imp gallons).

ACCOMMODATION: Enclosed cabin seating two side by side, shoulder location of wing with forward sweep, low panel line and close cowling of small engine combine to provide optimum view from cabin, particularly in turns. Seats adjustable for height, and fold to reveal baggage compartment; additional storage space under seats. Rearward-hinged canopy is one-piece Perspex moulding with GFRP frame. Dual controls standard.

SYSTEMS: Wheel disc brakes operated hydraulically. Electrical system 12 V, with alternator and 12 V 18 Ah battery.

AVIONICS: To customers' requirements.

Comms: Optional Bendix/King or Becker nav/com; Narco transponder.

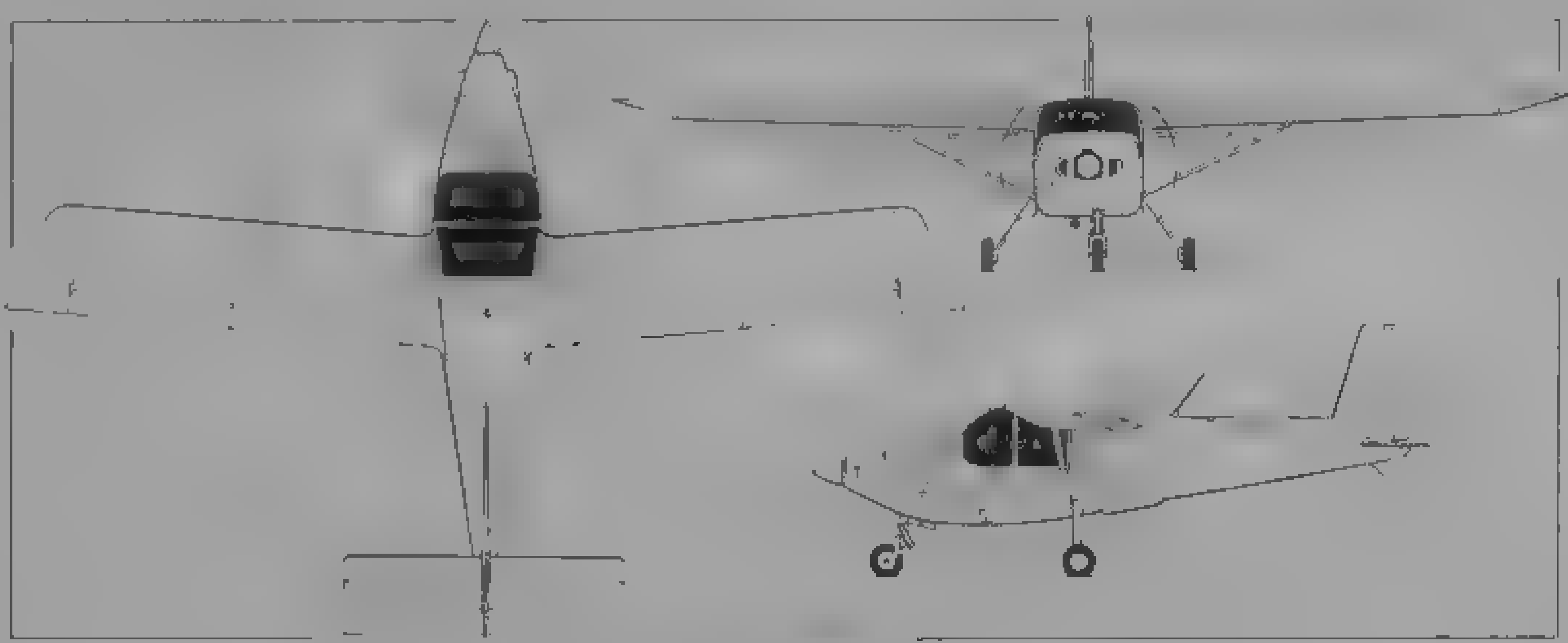
EQUIPMENT: Standard equipment includes three basic flight instruments plus engine instruments. Optional vacuum instruments driven by dual venturis mounted under front fuselage. Landing and navigation lights.

Aviation Scotland Super2 registered in Sweden as Opus 280 demonstrator

1995

DIMENSIONS, EXTERNAL:	
Wing span	8.69 m (28 ft 6 in)
Width, wings folded	2.54 m (8 ft 4 in)
Wing aspect ratio	8.78
Length overall	5.49 m (18 ft 0 in)
Height overall	2.31 m (7 ft 7 in)
Tailplane span	2.54 m (8 ft 4 in)
Wheel track	1.83 m (6 ft 0 in)
Wheelbase	1.74 m (5 ft 8½ in)
Propeller diameter	1.70 m (5 ft 7 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	1.27 m (4 ft 2 in)
Max width	0.99 m (3 ft 3 in)
Max height	1.09 m (3 ft 7 in)
AREAS:	
Wings, gross	8.59 m² (92.5 sq ft)
Ailerons (total)	0.60 m² (6.5 sq ft)
Trailing-edge flaps (total)	0.89 m² (9.6 sq ft)
Fin	0.59 m² (6.4 sq ft)
Rudder	0.26 m² (2.8 sq ft)
Tailplane	1.23 m² (13.2 sq ft)
Elevators, incl tab	0.55 m² (5.9 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	330 kg (728 lb)
Max T-O and landing weight	530 kg (1,168 lb)
Max wing loading	61.7 kg/m² (12.6 lb/sq ft)
Max power loading	8.87 kg/kW (14.60 lb/hp)
PERFORMANCE (at max T-O weight):	
Never-exceed speed (VNE)	134 kts (248 km/h; 154 mph)
Max level speed	104 kts (193 km/h; 120 mph)
Cruising speed, (75% power)	95 kts (176 km/h; 109 mph)
Stalling speed, power off, 40° flap	45 kts (84 km/h; 52 mph)
Max rate of climb at S/L	198 m (650 ft)/min
T-O run	272 m (893 ft)
T-O to 15 m (50 ft)	492 m (1,614 ft)
Landing from 15 m (50 ft)	462 m (1,516 ft)
Landing run	184 m (604 ft)
Range	410 n miles (759 km; 471 miles)
g limits	+3.8/–1.5

UPDATED



ASL Opus 280 two-seat monoplane (*Jane's/Dennis Punnett*)

1993

IG JAS

INDUSTRIGRUPPEN JAS AB

PRESIDENT AND CEO: Hans Ahlinder
CHIEF PROGRAMME MANAGER: Ingemar Nycander
PUBLIC RELATIONS: Jan Ahlgren

JAS Industry Group formed 1981 to represent Saab-Scania, Ericsson, Volvo Flygmotor and FFV Aerotech in JAS 39 Gripen programme; acts as contractor for Försvarets Materielverk (Defence Materiel Administration, FMV) and co-ordinates JAS 39 Gripen programme within Sweden.

INTERNATIONAL MARKETING:
Saab Military Aircraft, S-581 88 Linköping
MANAGING DIRECTOR: Hans Ahlinder
MARKETING DIRECTOR: Jan Hammarström

International marketing of JAS 39 Gripen is responsibility of Saab Military Aircraft (which see) and British Aerospace, with the JAS Industry Group partners as subcontractors. Workshare on export orders would be Saab 55/BAe 45 per cent under agreement signed 12 June 1995.

UPDATED

Saab artist's impression of the two-seat JAS 39B Gripen SK

1994

JAS 39 GRIPEN (GRIFFIN)

TYPE: Single-seat all-weather, all-altitude interceptor, attack and reconnaissance aircraft.

PROGRAMME: Funded definition and development began June 1980; initial proposals submitted 3 June 1981; government approved programme 6 May 1982, initial FMV development contract 30 June 1982 for five prototypes and 30 production aircraft, with options for next 110; overall go-ahead confirmed Spring 1983; first test runs of RM12 engine January 1985; Gripen HUD first flown in Viggen testbed February 1987; study for two-seat JAS 39B authorised July 1989.

First of five single-seat prototypes (39-1) rolled out 26 April 1987, made first flight 9 December 1988 but lost in landing accident after fly-by-wire problem 2 February

Gripen with wingtip Rb74 (AIM 9 Sidewinder) AAMs. Paired stores, reading inward, are RBS 15F, Rakkapapsnos 70 six-round rocket pod, DWS 39 and Rb75 (Maverick), in front of nose are AIM 120 AMRAAM (left) and radar-guided Mica AAMs

1995

Four early production JAS 39As awaiting delivery to F7 Wing of the Swedish Air Force in 1994

1995

1989, subsequent first flights 4 May 1990 (39-2), 20 December 1990 (39-4), 25 March 1991 (39-3) and 23 October 1991 (39-5); total Gripen sorties 1,869 by 30 May 1995; modified Viggen (37-51) retired at end of 1991 after assisting with avionics trials (nearly 250 flights), two single-seat fatigue test airframes (39-51 discarded 1993; 39-52 began 16,000 hour programme, August 1993); second production batch (110 aircraft) approved 3 June 1992; first production Gripen (39 101) made first flight 10 September 1992 and joined test programme in lieu of 39-1, flight test results in many cases (acceleration, speed, range, turn performance) better than specification due to lower zero drag, flight test programme continuing into 1995, including high-AoA and spin trials by 39-2 beginning in Spring 1995. Total programme is 1,800 hours in 2,200 sorties by six trials aircraft.

First production aircraft for Swedish Air Force (39 102) made first flight 4 March 1993 and was handed over to FMV 8 June 1993, flight control software modified following loss of 39 102 in crash on 8 August 1993 and installed from December 1994, further software upgrade to new generation P11 standard first flown 22 March 1995 in trials aircraft and due for introduction to production Gripens from Autumn 1995, modified control stick introduced with production aircraft 39 108 (first flight 11 April 1995).

Initial 30 aircraft to be delivered 1993-96 (five in 1994), next 110 in 1996-2002; first unit is F7 Wing at Såtenäs, maintenance training begun May 1994 at Linköping; conversion scheduled to begin 1 October 1995, IOC April 1996. First flight of JAS 39B (39 800) due second quarter 1996, delivery second quarter 1998, first production trainer in final assembly by mid-1995.

CURRENT VERSIONS: **JAS 39A:** Standard single-seater. *Description applies to this version except where indicated.*

JAS 39B. Two-seater (Gripen SK), with 0.655 m (2 ft 1¾ in) fuselage plug and lengthened cockpit canopy. Primary roles conversion and tactical training, but also combat-capable. Avionics essentially as for JAS 39A and both cockpits identical, except no HUD in rear; instead, HUD image from front seat can be presented on flight data display in rear cockpit. Redesigned environmental control system. Reduced fuel; no internal gun. Prototype entered final assembly 1 September 1994, fatigue test specimen (39-71) also being built.

JAS 39C and D: Potential improved Swedish versions of A and B with enhanced data handling capability.

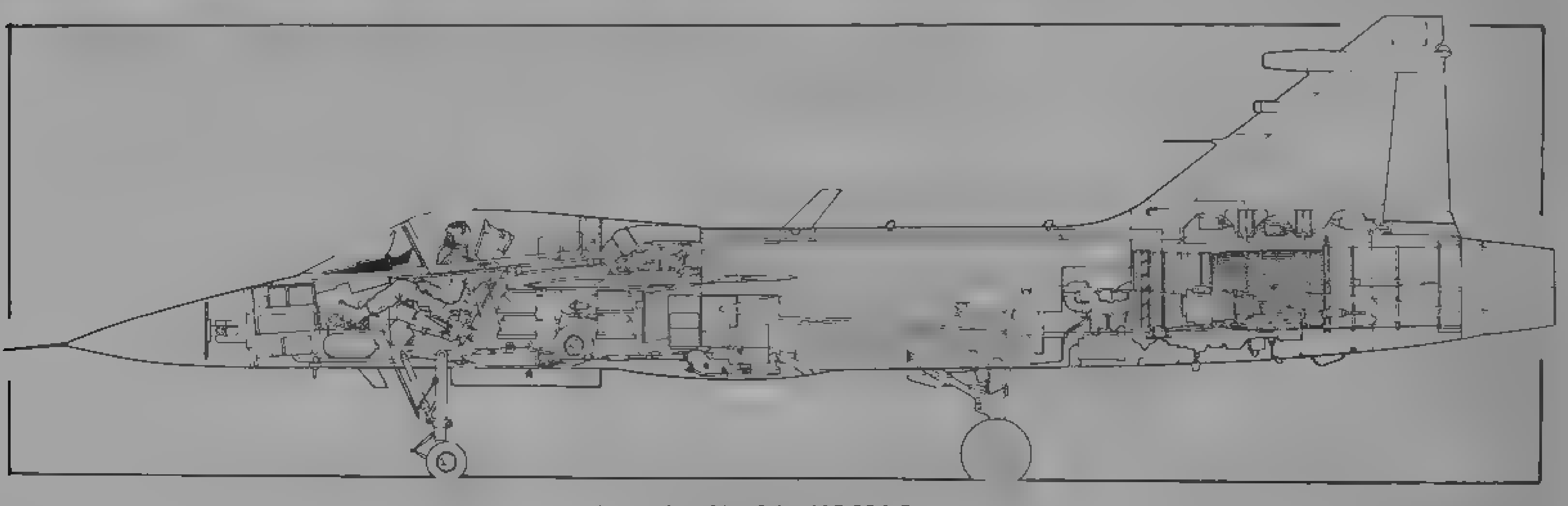
JAS 39X: Potential future export version, to upgraded standard of C/D.

CUSTOMERS: Current production of 140 will equip eight squadrons by 2002. Eventual Swedish Air Force requirement approximately 280, to equip 16 squadrons, second eight replacing JA and AJS Viggens, first 30 ordered with prototypes and full-scale development 30 June 1982, next 110 will include 14 JAS 39Bs. Aircraft 39 101 to 39 109 handed over by May 1995, with 110 and [illegible] on flight test 112 to 126 then in final assembly and 127 to 145 under construction. Required third batch expected to be to JAS 39C/D standard with engine and computer upgrades.

COSTS: Planned cost of SEK25.7 billion in 1982, increased to SEK48.5 billion 1991 by inflation. FMV has reported total cost increase of SEK9.3 billion for period 1982-2001, total budget SEK60.2 billion decided by Swedish Parliament 1993. SEK22.7 billion spent by 1 July 1993, including SEK14.5 billion to IG JAS. Up to SEK300 million approved late 1991 for JAS 39B development. Costs for 300-aircraft programme estimated in 1994 as SEK15 billion for development and SEK48 billion for production.

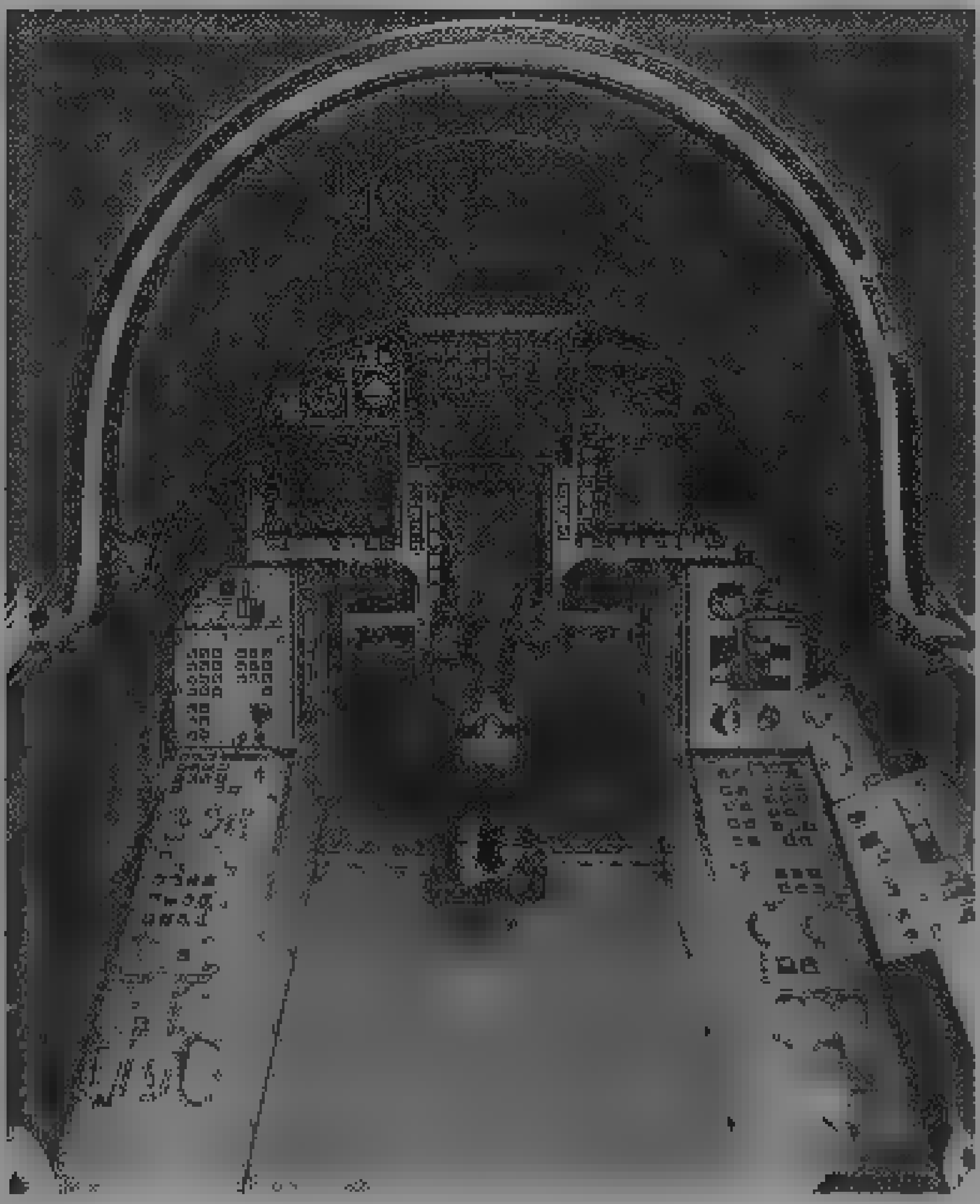
DESIGN FEATURES: Intended to replace AJ/SH/SF/JA/AJS versions of Saab Viggen, in that order, and remaining J 35 Drakens, partners are Saab Military Aircraft, Ericsson Radar Electronics, Volvo Flygmotor and FFV Aerotech, to operate from 800 m (2,625 ft) Swedish V90 road strips, simplified maintenance and quick turnround with ground crew comprising one technician and five conscripts.

Delta wing with squared tips for missile rails has approximately 45° leading-edge sweepback.



Inboard profile of the JAS 39A Gripen

1994



Cockpit of the JAS 39A

1995

Prototype 39-2 in experimental all-black finish, carrying four Rb74 and two AIM-120 air-to-air missiles

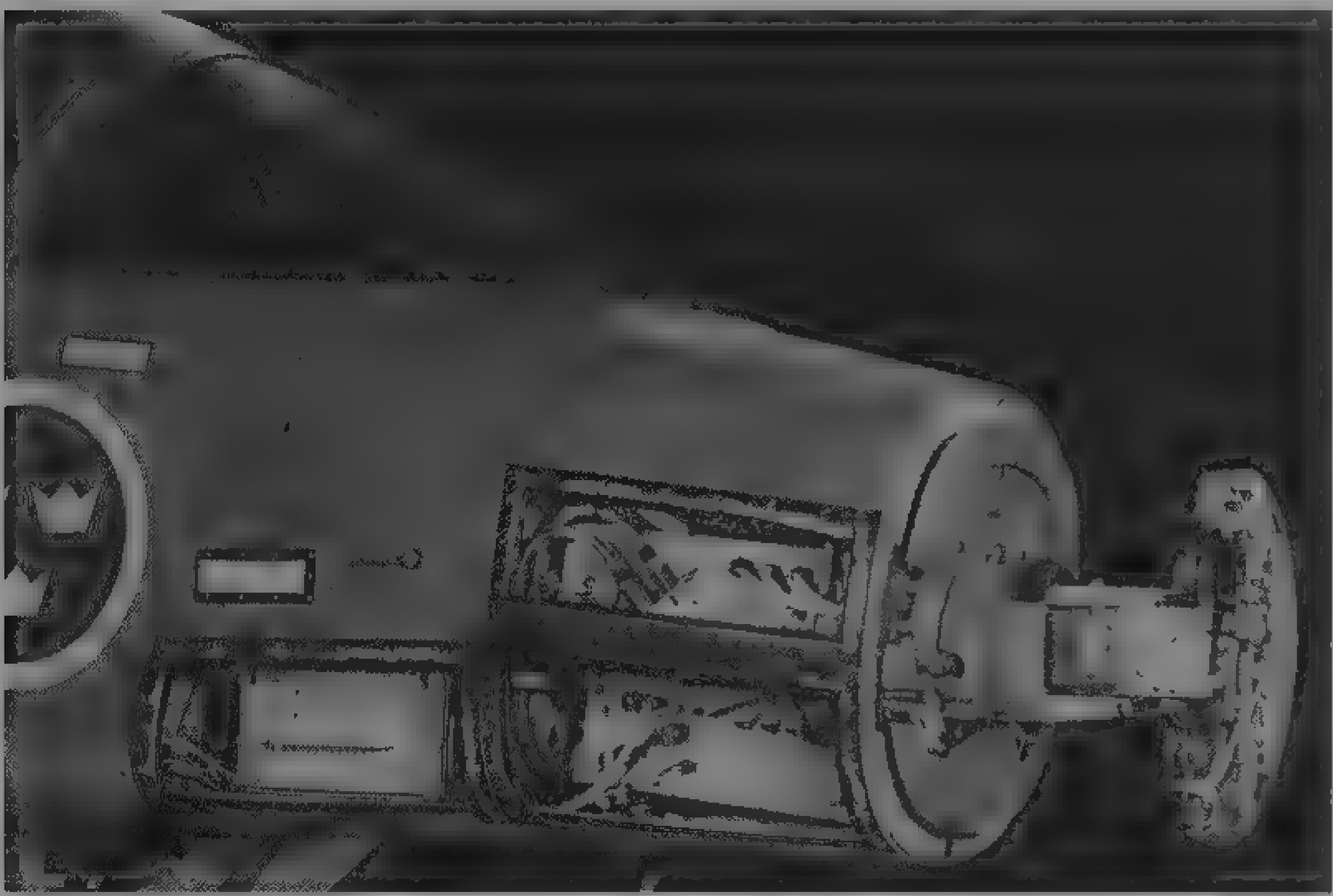
1995

independently movable foreplanes have leading-edge sweep of approximately 43°.

FLYING CONTROLS: Lear Astronics (Lot 1) or Lockheed Martin SA11 (Lot 2) triplex fly-by-wire system with Moog electrically signalled servo valves on powered control units, Saab Combitech aircraft motion sensors and throttle actuator, mini-stick and HOTAS controls.

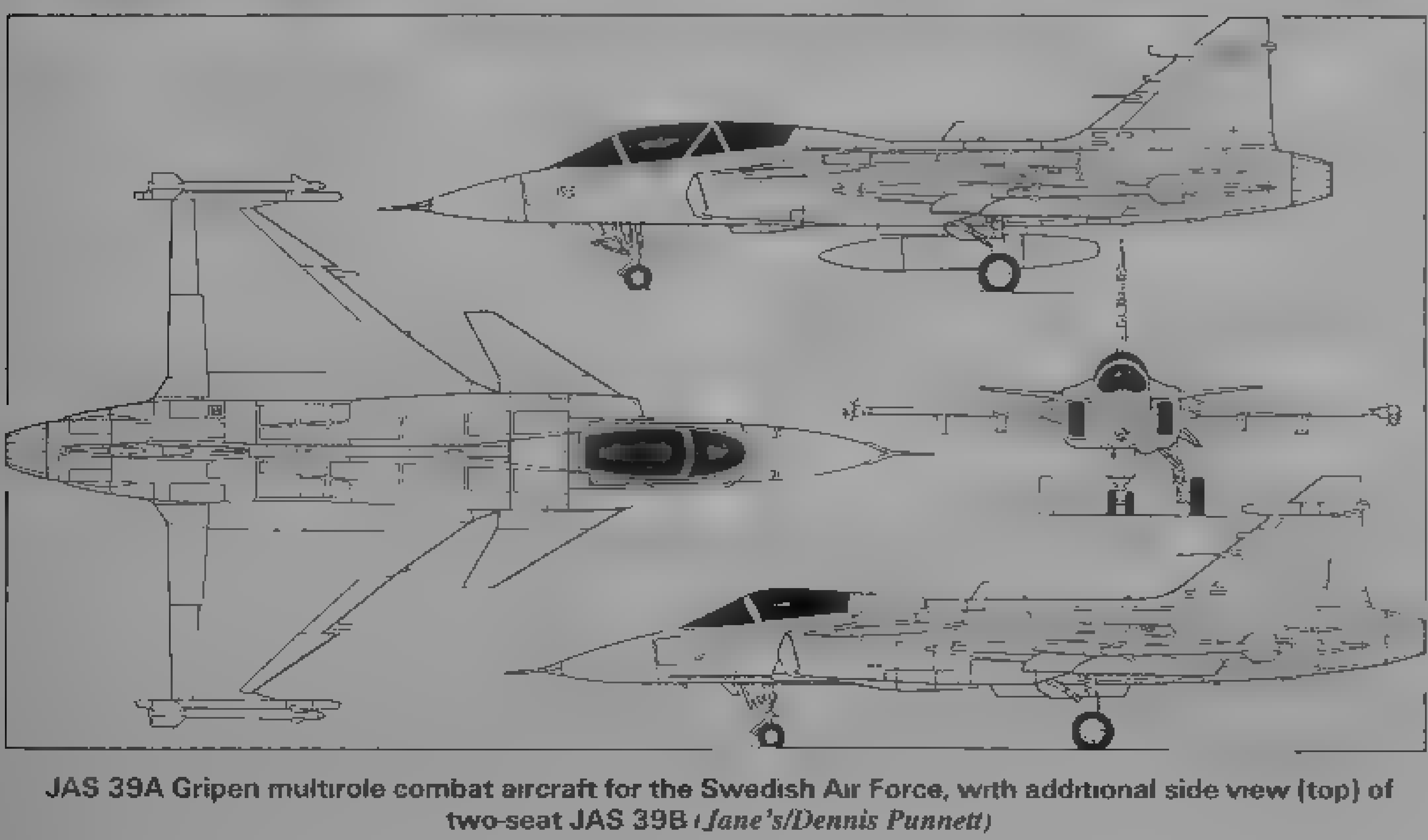
Leading-edge with dog tooth and automatic flaps (one inboard/one outboard of dog-tooth, inner one outboard of canard) on Lucas Aerospace 'geared hinge' rotary actuators; two elevon surfaces at each trailing-edge; individual all moving foreplanes, which also 'snowplough' for aerodynamic braking after landing; airbrake each side of rear fuselage.

STRUCTURE: First 3½ carbonfibre wing sets produced by BAe; all subsequent carbonfibre parts (30 per cent of airframe) made by Saab, including wing boxes, foreplanes, fin and all major doors and hatches.



Ericsson/GMAv PS-05/A radar installation in JAS 39 nose

1995



JAS 39A Gripen multirole combat aircraft for the Swedish Air Force, with additional side view (top) of two-seat JAS 39B (*Jane's/Dennis Punnett*)

1993

LANDING GEAR: AP Precision Hydraulics retractable tricycle gear, single mainwheels retracting hydraulically forward into fuselage, steerable twin-wheel nose unit retracts rearward. Goodyear wheels and tyres. Carbon disc brakes and ABS anti-skid units. Nosewheel braking. Entire gear designed for high rate of sink.

POWER PLANT: One General Electric/Volvo Flygmotor RM12 (F404-GE-400) turbofan, rated initially at approximately 54 kN (12,140 lb st) dry and 80.5 kN (18,100 lb st) with afterburning. Near-rectangular intakes, each with splitter plate. Fuel in integral tanks in fuselage and wings. Intertechnique fuel management system.

ACCOMMODATION: Pilot only in JAS 39A, on Martin-Baker S10LS zero/zero ejection seat. Hinged canopy (opening sideways to port) and one-piece windscreen by Lucas Aerospace. Two seats in tandem in JAS 39B.

SYSTEMS: Hymatic environmental control system for cockpit air conditioning, pressurisation and avionics cooling. Hughes-Treitler heat exchanger. Two hydraulic systems, with Dowty equipment and Abex pumps. Sundstrand main electrical power generating system (40 kVA constant speed, constant frequency at 400 Hz) comprises an integrated drive generator, generator control unit and current transformer assembly. Lucas Aerospace auxiliary and emergency power system, comprising gearbox-mounted turbine, hydraulic pump and 10 kVA AC generator, to provide auxiliary electric and hydraulic power in event of engine or main generator failure. In emergency role, the turbine is driven by engine bleed or APU air; if this is not available the stored energy mode, using thermal batteries is selected automatically. Microturbo APU and air turbine starter for engine starting, cooling air and standby electrical power.

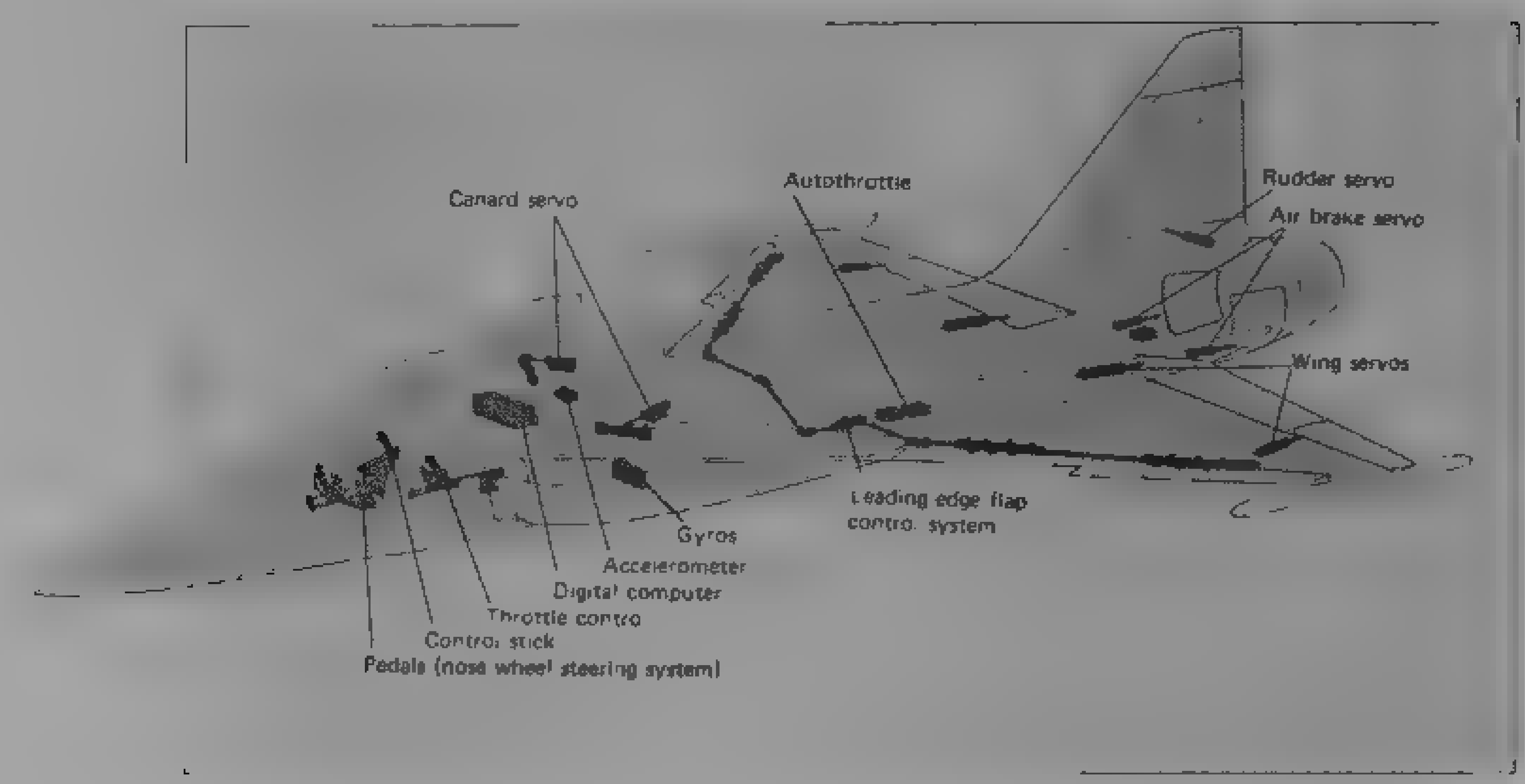
AVIONICS: *Comms*: CelsiusTech dual VHF/UHF transceivers and IFF. Retrofit planned with tactical radio systems (TARAS).

Radar: Ericsson/GMAv PS-05/A multimode pulse Doppler target search and acquisition (lookdown/shootdown) radar (weight 156 kg; 344 lb). For fighter missions, system provides fast target acquisition at long range, search and multitarget track-while-scan, quick scanning and lock on at short ranges; and automatic fire control for missiles and cannon. In attack and reconnaissance roles, operating functions are search against sea and ground targets, mapping, with normal and high resolution, and navigation.

Flight: Ericsson SDS 80 central computing system (D80 computer, Pascal/D80 high order language and programming support environment; upgraded D80E computer flown mid-1994 and introduced from 39.108); three MIL-STD-1553B databuses, one of which links flight data, navigation, flight control, engine control and main systems; Honeywell laser INS and radar altimeter; Nordmicro air data computer. BAe three-axis strapdown gyromagnetic unit provides standby attitude and heading information.

Instrumentation: Ericsson EP-17 electronic display system, incorporating Kaiser wide-angle HUD and using advanced diffraction optics to combine symbology and video images, PP1 or PP2 display processors (PP12 in Production Lot 2 for colour imagery); three Ericsson CRT HDDs. Left-hand (flight data) HDD normally replaces all conventional flight instruments; central display shows computer generated map of area surrounding aircraft with tactical information superimposed; right hand CRT is a multisensor display showing information on targets acquired by radar, FLIR and weapon sensors. Minimum of conventional analog instruments for back-up only.

Mission: FLIR pod, carried under starboard air intake trunk, forward of wing leading-edge, for attack and reconnaissance missions at night, providing heat picture of target on right-hand HDD.



JAS 39 Gripen triplex digital flight control system

1994

Self defence: Radar warning equipment; CelsiusTech countermeasures, including chaff/flare and jamming.

ARMAMENT: Internally mounted 27 mm Mauser BK27 automatic cannon in port side of lower front fuselage and two wingtip-mounted Rb74 (AIM-9L) Sidewinder infra-red AAMs standard. (No internal gun in JAS 39B.) Five other external hardpoints (two under each wing and one on centreline) for short- and medium-range air-to-air missiles such as Rb74, Mica or AIM-120 AMRAAM, air-to-surface missiles such as Rb75 (Maverick); anti-shipping missiles such as Saab RBS 15F; DASA DWS 39 munitions dispenser; conventional or retarded bombs; air-to-surface rockets, or external fuel tanks.

DIMENSIONS, EXTERNAL:

Wing span	8.40 m (27 ft 6¾ in)
Length overall: JAS 39A	14.10 m (46 ft 3 in)
JAS 39B	14.755 m (48 ft 5 in)
Height overall	4.50 m (14 ft 9 in)
Wheel track	2.40 m (7 ft 10½ in)
Wheelbase: JAS 39A	5.20 m (17 ft 0¾ in)
JAS 39B	5.90 m (19 ft 4¼ in)

WEIGHTS AND LOADINGS:

Operating weight empty	6,622 kg (14,600 lb)
Internal fuel weight	2,268 kg (5,000 lb)
T-O weight, clean	approx 8,500 kg (18,740 lb)
Max T-O weight with external stores	approx 13,000 kg (28,660 lb)

PERFORMANCE:

Max level speed	supersonic at all altitudes
T-O and landing strip length	approx 800 m (2,625 ft)
g limit	+9

UPDATED

MFI

MALMÖ FORSKNINGS & INNOVATIONS

Kantyxegatan 21, S-213 76 Malmö
Telephone: 46 (40) 21 99 50
Fax: 46 (40) 21 81 11
CHIEF DESIGNER: Håkan Langebro

MFI has manufactured various designs by Björn Andreasson, including BA-12 Slandan (see Microlights section, 1992-93 *Jane's*), BA-14 and earlier MFI-9. A recent move, and preoccupation with manufacture of new floor panels for Swedish Navy ASW helicopters slowed development of BA-14B, company hoped to resume flight testing during 1994, but no confirmation received up to mid-1995. MFI also developed MFI-11 (new version of MFI-9B), last described in 1994-95 *Jane's*.

UPDATED

MFI BA-14B

TYPE: Two/four-seat trainer and utility aircraft.

PROGRAMME: Construction of BA-14 Starling (SE-KFV, first flight 25 August 1988), designed by Bjorn Andreasson, began 1987, became joint venture project between MFI and FFV Aerotech, but later redesigned by MFI to FAR Pt 23A, development delayed by other work, but resumption of flight testing apparently still awaited.

CUSTOMERS: Production not yet begun.

DESIGN FEATURES: Strut-braced, no-dihedral high wing with approximately 3° forward sweep; sweptback vertical tail with dorsal fin, upswept rear fuselage with baggage/freight door amidships.

FLYING CONTROLS: Ailerons, mass balanced rudder, and all-moving tailplane with large inset tab; mechanical actuation; plain flaps.

STRUCTURE: Mostly composites: GFRP wing with CFRP reinforced spar caps; fuselage GFRP/CFRP semi-monocoque. Wing carry through structure of welded steel tube.

LANDING GEAR: Non-retractable tricycle type, with mainwheels on arched GFRP leaf spring and nosewheel on shock-strut. Mainwheel brakes. Twin-float gear optional.

POWER PLANT: One 119 kW (160 hp) Textron Lycoming IO-320 flat-four engine, driving a Hoffmann HO-V72A variable-pitch wood/GFRP propeller. Fuel capacity 80 litres (21 US gallons; 17.6 Imp gallons).

ACCOMMODATION: Two seats side by side under large one-piece transparent canopy. Provision for two further seats. Baggage compartment aft of seats.

DIMENSIONS, EXTERNAL:

Wing span	9.00 m (29 ft 6¼ in)
Wing aspect ratio	7.71
Length overall	7.20 m (23 ft 7½ in)
Height overall	2.90 m (9 ft 6¼ in)
Propeller diameter	1.85 m (6 ft 0¾ in)

AREAS:

Wings, gross	10.50 m² (113.02 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	615 kg (1,356 lb)
Max T-O weight	900 kg (1,984 lb)
Max wing loading	85.71 kg/m² (17.55 lb/sq ft)
Max power loading	7.55 kg/kW (12.40 lb/hp)

PERFORMANCE:

Max level speed at S/L	124 kts (230 km/h; 143 mph)
Max cruising speed at S/L	113 kts (210 km/h; 130 mph)
Econ cruising speed at S/L	108 kts (200 km/h; 124 mph)
Stalling speed, power off	46 kts (84 km/h; 53 mph)
Max rate of climb at S/L	335 m (1,100 ft)/min
T-O and landing run	250 m (821 ft)
g limits	+4.4/–2.2

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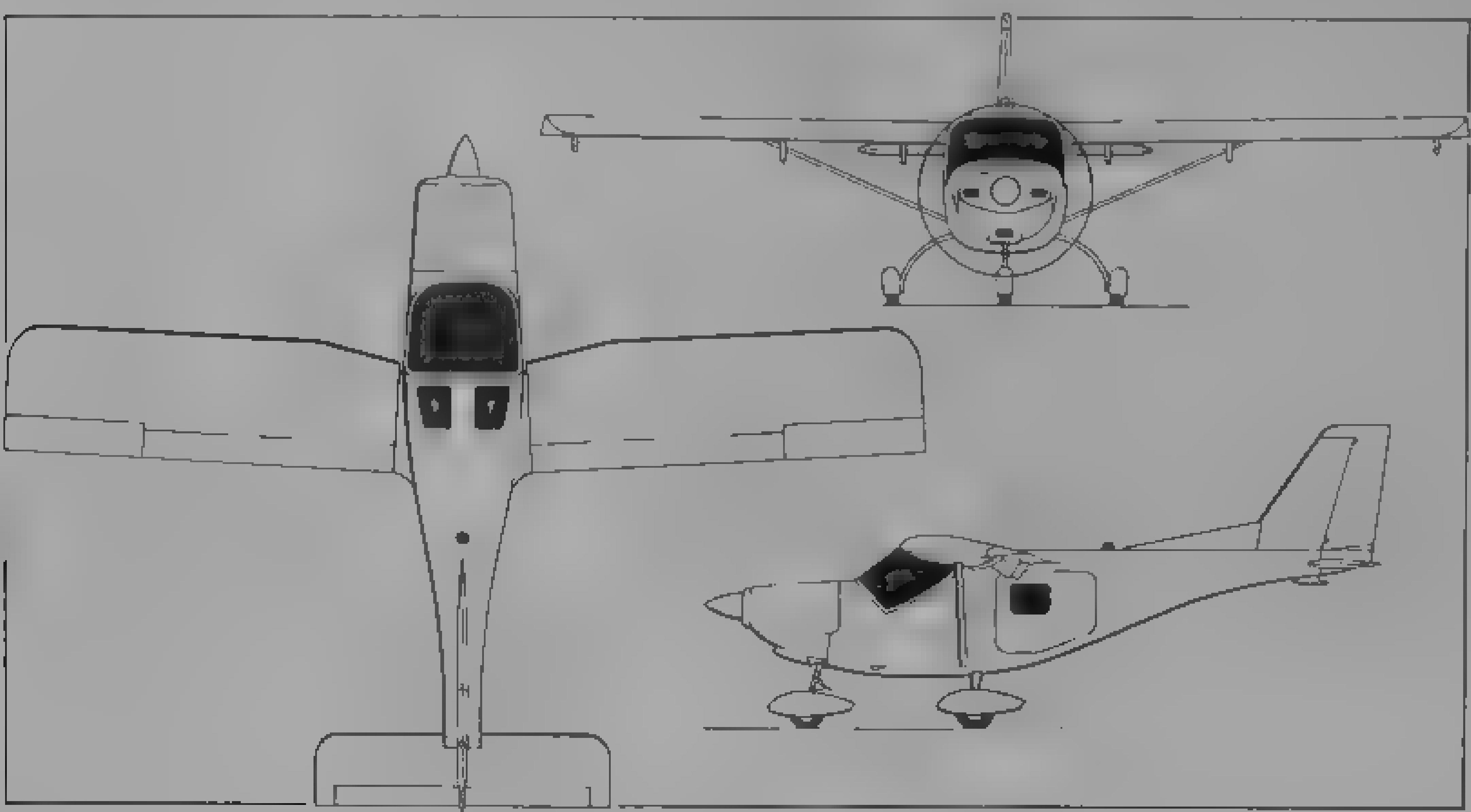


MFI BA-14B training and utility aircraft (*Jane's/Mike Keep*)

1993

MFI MFI-11

TYPE: Two-seat light aircraft in landplane or floatplane versions.

PROGRAMME: Developed 1991-92; prototype (SE-XDK) made first flight 1 August 1992, flight testing completed by end of 1993, but production plans suspended indefinitely. Full description in 1994-95 edition.

UPDATED

SAAB

SAAB AB

S-581 88 Linköping
Telephone: 46 (13) 18 70 00
Fax: 46 (13) 18 18 02
PRESIDENT AND CEO: Bengt Halse

Saab Military Aircraft
S-581 88 Linköping
Telephone: 46 (13) 18 00 00
Fax: 46 (13) 18 18 02
GENERAL MANAGER: Hans Ahlinder
VICE-PRESIDENTS:
Billy Fredriksson (Development)
Tommy Ivarsson (Strategic Planning)
Jan Hammarström (Marketing and Sales)
Lars Gissler (Administration)
Milton Mobärg (Product Support)
GENERAL PROJECT MANAGER JAS 39: Göran Berseus
PUBLIC RELATIONS DIRECTOR: Jan Ahlgren
WORKS: Linköping

Saab Aircraft
S-581 88 Linköping
Telephone: 46 (13) 18 20 00
Fax: 46 (13) 18 38 33
PRESIDENT: Hans Krüger
VICE-PRESIDENTS:
Johan Öster (Operations)
Martin Craigs (Marketing and Sales)
Henry Sténson (Public Relations)
WORKS: Linköping and Malmö
MARKETING SUBSIDIARIES:

Saab Aircraft International Ltd, Leworth House, 14-16 Sheet Street, Windsor, Berkshire SL4 1BG, UK
Telephone: 44 (1753) 859991
Fax: 44 (1753) 858884
Telex: 847815 SFIWIN G
PRESIDENT: Martin Craigs
PUBLIC RELATIONS: Mike Savage

Saab Aircraft of America Inc, Loudoun Tech Center, 21300 Ridgetop Circle, Sterling, Virginia 22170, USA
Telephone: 1 (703) 406 7200
Fax: 1 (703) 406 7272
PRESIDENT: Jack Faherty
PUBLIC RELATIONS: Ron Sherman

Saab Service Partner AB (Subsidiary of Saab-Scania AB)

PRESIDENT: Stellan Eklöf

Original Svenska Aeroplan AB founded at Trollhättan 1937 to make military aircraft; amalgamated 1939 with Aircraft Division of Svenska Järnvägsverkstaderna rolling stock factory at Linköping, renamed Saab Aktiebolag May 1965, merged with Scania-Vabis 1968 to combine automotive interests; Malmö Flygindustri acquired 1968. More than 4,000 military and commercial aircraft delivered since 1940; has held dealership for McDonnell Douglas (formerly Schweizer/Hughes) helicopters in Scandinavia and Finland since 1962.

Former Aircraft Division (see 1991-92 *Jane's*) reorganised from 31 March 1992 into Saab Military Aircraft (producing JAS 39 Gripen), Saab Aircraft AB (producing Saab 340B and 2000) and Saab Service Partner AB (Last named provides plant, operations, personnel, computer support, airfield, transportation and other service activities for the other two.) Subcontract work includes wing flaps and airbrakes for McDonnell Douglas MD-80 series. New Saab 340 building at Linköping, opened July 1982, extended in 1986 and 1991 to cater for increased Saab 340 production and Saab 2000 assembly, now exceeds 60,000 m² (645,834 sq ft).

Creation of Saab Defense announced 2 February 1994, combining activities of Saab Missiles, Saab Instruments and Saab Training Systems (all previously part of Saab Combitech AB) with those of Saab Military Aircraft. Saab Defense, Saab Aircraft AB, Saab Combitech AB and Saab Service Partner AB together formed Saab Aircraft & Defense business of Saab-Scania AB. Total Saab-Scania workforce 26,945 at January 1995, of these, about 5,200 in Saab Defense, 1,700 in Saab Aircraft and 900 in Saab Combitech.

Dissolution of Saab-Scania Group agreed on 22 February 1995 and effective from 16 May 1995. Saab AB (workforce 7,800) now comprises Saab Service Partner and five product companies

Saab Military Aircraft*
Saab Dynamics*
Saab Training Systems*
Saab Aircraft
Saab Combitech

*Form Business Area Saab Defense

UPDATED

SAAB MILITARY AIRCRAFT

Principal activity is production of **JAS 39 Gripen**, described under IG JAS heading in this section. Agreement signed with British Aerospace Defence on 12 June 1995 for joint marketing, adaptation, manufacture and support of Gripen in the export market.

UPDATED

OTHER AIRCRAFT

Details of the **AJS 37 Viggen** upgrade and **Sk 60** engine retrofit will be found in *Jane's Aircraft Upgrades*.

NEW ENTRY

SAAB AIRCRAFT AB

Principal programmes are Saab 340B and Saab 2000 regional airliners.

VERIFIED

SAAB 340B

Swedish Air Force designation: Tp 100/100B

TYPE: Twin-turboprop regional and business transport.

PROGRAMME: Go-ahead for joint Saab-Fairchild 340 programme given September 1980; Saab took over programme November 1985; Fairchild continued as subcontractor until 1987, when designation changed to Saab 340; first flight (SE-ISF) 25 January 1983, first flight of first production 340A (fourth aircraft, SE-E04) 5 March 1984, Swedish certification 15 May 1984, followed by 10 European civil aviation directorates and US FAA sharing FAR/JAR certification June 1984, first operator Crossair, first corporate 340A delivered November 1985; 340B announced late 1987, certificated 3 July 1989; 200th Saab 340 delivered 14 August 1990, 300th on 20 May 1992, 4 million flight hours passed in August 1994; 340BPlus introduced February 1994.

CURRENT VERSIONS: **340A**: Initial production version delivered from June 1984 to September 1989, when 340B introduced; 340A engine power increased from 1,215 kW (1,630 shp) to 1,294 kW (1,735 shp) and propeller enlarged mid-1985, earlier aircraft retrofitted, improved cabin by Metair, meeting 1990 fire regulations, introduced mid-1988. Total of 159 built, including three prototypes, full description in 1989-90 *Jane's*.

340B: Hot and high version, first flight April 1989, replaced 340A from c/n 160 onwards, first delivery (Crossair) September 1989, powered by GE CT7-9B with APR, improved payload/range, higher weights and increased tailplane span. *Detailed description applies to this version.*

340 AEW&C: (SAF designation **Tp 100B**, SAF mission system **FSR 890**) Saab 340B with dorsal Ericsson PS-890 Erieye side-looking airborne reconnaissance radar, FSR 890 mission system and avionics suite comprises a high-performance, long-range E/F-band (S-band) pulse Doppler SLAR with fixed active phased-array antenna, IFF/SSR interrogator (Mk 12 IFF, Modes 1-4) interface to 2 to 18 GHz tactical ESM system, INS/GPS navigation, voice/datalink communications in HF and VHF/UHF bands (4,800 bits/s for U/VHF data), and multifunction workstations for up to three optional operators monitoring radar performance, fighter control and other functions performed by land stations fed by datalink. Erieye range coverage is typically 189 n miles (350 km, 217 miles) against fighter-sized targets, even at low altitude and in heavy clutter, sea surveillance mode included, 360° coverage with performance optimised in 150° sectors each side.

Prototype, ordered February 1993, made first flight (SE-C42/100002) 17 January 1994 (minus antenna), first flight with antenna 1 July 1994, five more ordered by Swedish Air Force 23 December 1993, deliveries to begin in 1996. Total order valued at approximately SEK500 million. Antenna unit is 9 m (29 5 ft) long and weighs more than 900 kg (1,984 lb). APU fitted in tailcone for electrical power and third air cycle pack in cargo compartment for mission system cooling.

340BPlus: 340B with 2000 features, launched February 1994, improvements to cabin comfort, airfield performance and lower maintenance costs, first example (c/n 359) delivered to AMR Eagle/Wings West Airline 10 April 1994. 'Generation III' interior with 20 per cent increase in overhead bin volume, improved lighting, new passenger service units, redesigned passenger seats and toilet, active noise control system to lower cabin noise level by approximately 6 dBA, optional extended wingtips (0 61 m; 2 ft on each wing), permitting up to 680 kg (1,500 lb) increase in allowable T-O weight and reducing T-O field length by up to 122 m (400 ft). New low-pressure tyres (5 8 bars, 84 lb/sq in) optional.

Saab 340 AEW&C prototype taking off for its first flight with Ericsson dorsal radar on 1 July 1994 *1995*

340BPlus SAR-200: Rescue version for Japan Maritime Safety Agency; Telephonics AN/APS-143(V) 360° search radar beneath fuselage, FSI AN/AAQ-22 turreted FLIR, GPS and VLF/Omega, wide windows, flare and marker launch system, and rescue pack dropping hatch. JMSA requirement for 10, first funded in 1995 for delivery in 1997.

CUSTOMERS: More than 400 firm orders for 340A, 340B and 340BPlus by 30 August 1994, of which 366 delivered by January 1995.

Customers for 340A were Aigle Azur (one), Air Nelson (eight), Brit Air (six), Business Air (five), Business Express (17), Chautauqua Airlines (two), Comair (19), Crossair (eight), Deutsche BA (nine), Finnaviation (five), Formosa Airlines (three), Kendell Airlines (six), LAPA (two), Northwest Airlink (25), Nusantara Saku (two), Riga Airlines Express (one), Simmons/AMR Airlines (16), Skyways (four), Swedair (11), TAN (one) and unannounced (two), plus four corporate sales.

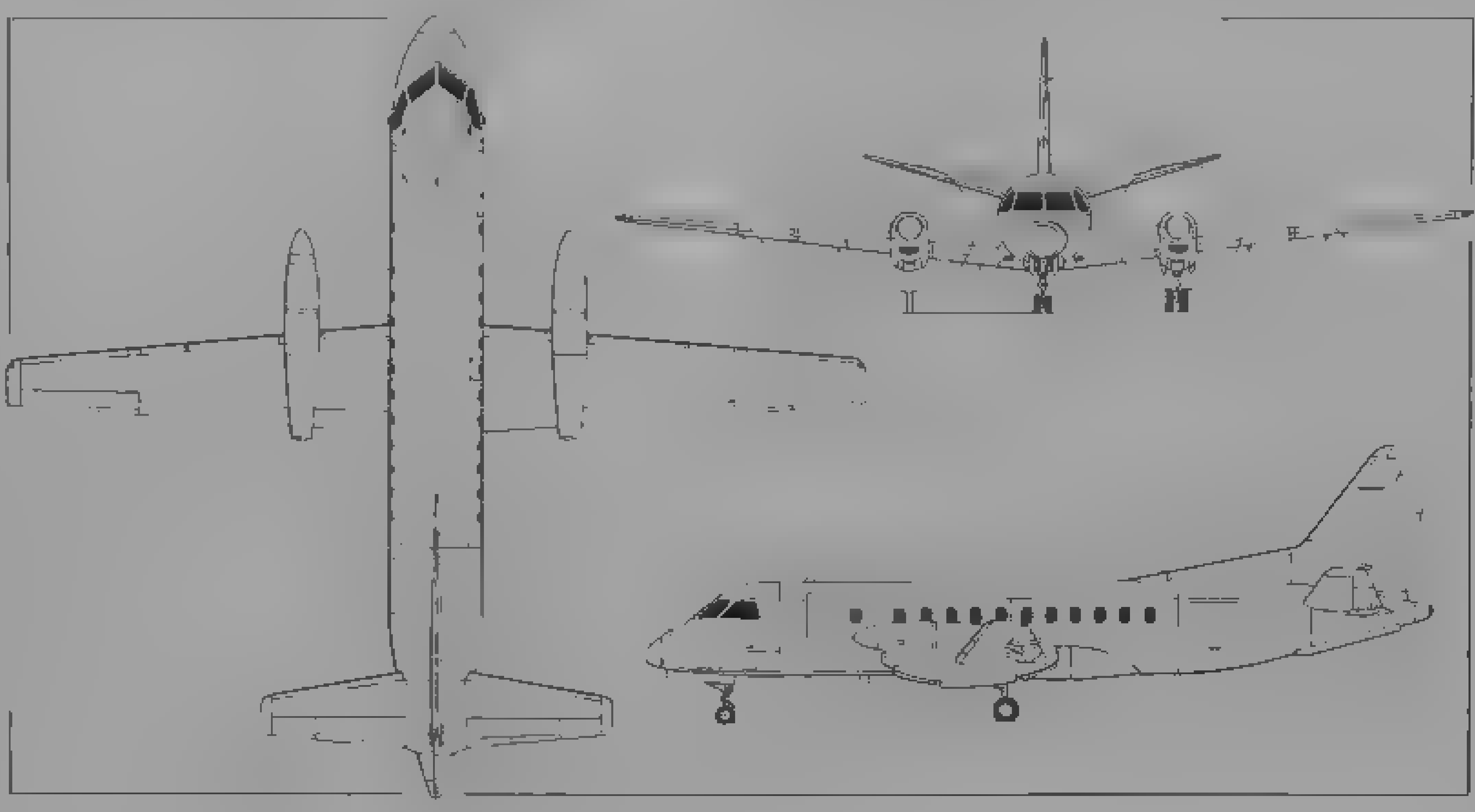
Saab 340B and 340BPlus ordered by Aer Lingus Commuter (four), AMR Eagle (100), Business Express (56), Calm Air (two 340BPlus), Chautauqua Airlines (four), China Southern Airlines (four), Crossair (15), Finnaviation (one), Formosa Airlines (six), Golden Air (one), Hazelton Airlines (five, including one 340BPlus), Japan Air Commuter (eight), KLM Cityhopper (12), Northwest Airlink (11), Regional Airlines (eight), Skyways (four), Skywest (one), Tatra Air (two) and Swedish government (one Tp 100 and six Tp 100B), plus one unannounced.

COSTS: 340 AEW&C, equipment only, $25 million (plus airframe, plus installation).

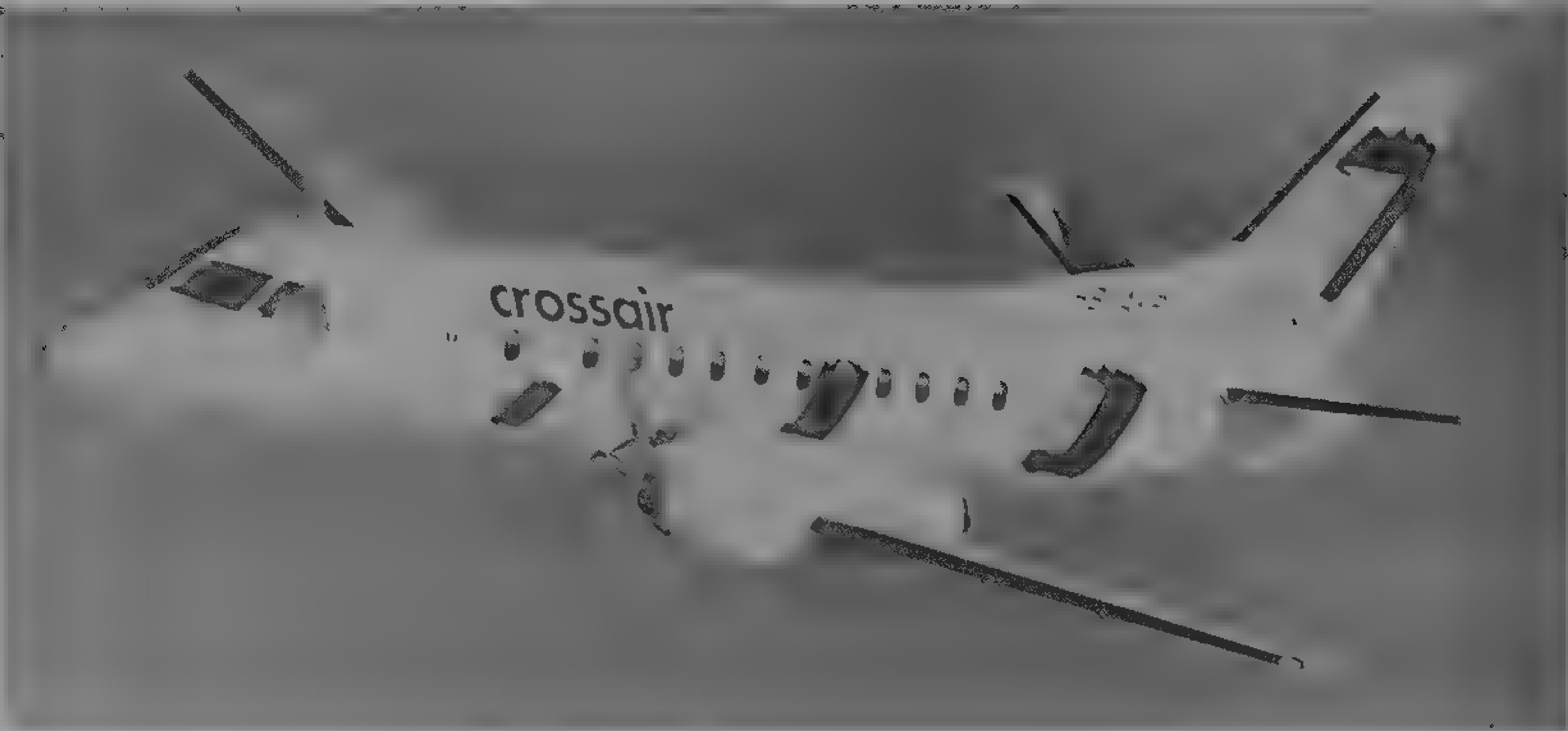
DESIGN FEATURES: Wing section NASA MS(1)-0313, tapered planform with quarter-chord sweep 3° 36', thickness/chord ratio 16 per cent at root, 12 per cent at tip, dihedral 7° from root; incidence 2° at root, swept fin, dihedral tailplane, pressurised cabin with circular cross-section.

FLYING CONTROLS: Mechanical controls, fixed tailplane, trimmable ground tab in each aileron and elevator, trimmable spring tab in rudder, all tabs actuated electromechanically, small strakes under rear fuselage, hydraulically actuated single-slotted flaps. Collins APS-85 autopilot system.

STRUCTURE: Fail-safe mainly all metal structure, two-spar wing, stringers and skins of 2024/7075 aluminium alloy, built in three sections, all doors of aluminium honeycomb, double-shell GFRP radome, CFRP sandwich cabin floor, flaps have aluminium spars, honeycomb panels faced with



Saab 340B regional airliner (two General Electric CT7-9B turboprops) *(Jane's/Dennis Punnett)* *1990*

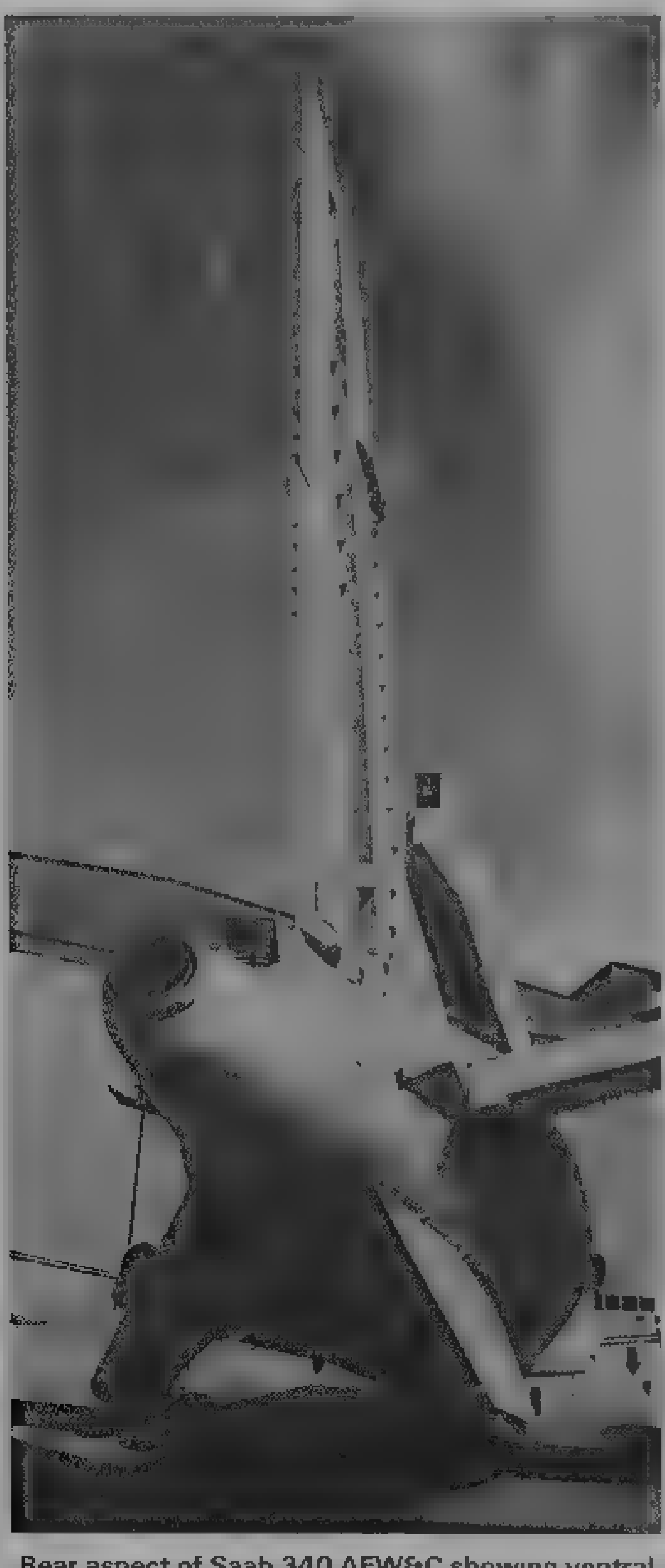


Saab 340BPlus with extended wingtips in the livery of Swiss operator Crossair

1995

aluminium sheet and Kevlar leading- and trailing-edges, ailerons, rudder and elevators have Kevlar skins and GFRP leading-edges, fin integral with fuselage; tailplane and fin contain aluminium honeycomb, mainwheel doors Kevlar sandwich. Propeller blades are moulded glassfibre/polyurethane foam/carbonfibre.

LANDING GEAR: Retractable tricycle type, of AP Precision Hydraulics design and manufacture, with twin Goodyear wheels and oleo-pneumatic shock absorber on each unit. Hydraulic actuation. All units retract forward, main units into engine nacelles. Hydraulically steerable nose unit (±60°), with shimmy damper. Mainwheel tyres size 24 × 7.7-10, pressure 8.27 bars (120 lb/sq in); nosewheel tyres size 17.5 × 6.25-6, pressure 4.0 bars (58 lb/sq in). Independent Goodyear carbon hydraulic disc brakes on main units, with Hydro Aire anti-skid control. Minimum ground turning radius 8.90 m (29 ft 2½ in).



Rear aspect of Saab 340 AEW&C showing ventral strakes, APU exhaust and multiplicity of vortex generators *(Paul Jackson)*

1995

POWER PLANT: Two General Electric CT7-9B turboprops, each rated at 1,305 kW (1,750 shp) for normal T-O and 1,394 kW (1,870 shp) with automatic power reserve. Dowty (Hamilton Standard optional) four-blade slow-turning constant-speed propellers, with full autofeathering and reverse pitch capability. Fuel in two integral tanks in each wing, total capacity 3,220 litres (850.5 US gallons; 708 Imp gallons). Single-point pressure refuelling inlet in starboard outer wing leading-edge. Overwing gravity refuelling point in each wing. Oil capacity 13.8 litres (3.65 US gallons, 3.04 Imp gallons).

ACCOMMODATION: Two pilots and provision for observer on flight deck, attendant's seat (forward, port) in passenger cabin. Main cabin accommodates up to 37 passengers (35 standard), in 12 rows of three, with aisle, and rearward-facing seat(s) on starboard side at front. One or both rearward-facing seats can be replaced by an optional galley module and/or baggage/wardrobe module. Seat pitch 76 cm (30 in). Standard provision for galley, wardrobe or storage module on port side at front of cabin, regardless of installations on starboard side. Toilet at front or rear of cabin. In former case, QC operation (conversion from passenger to freight interior or vice versa) is possible. Also available is a VIP-to-airliner convertible, as well as a fixed-installation combi with 19 passengers and 1,500 kg (3,307 lb) of cargo.

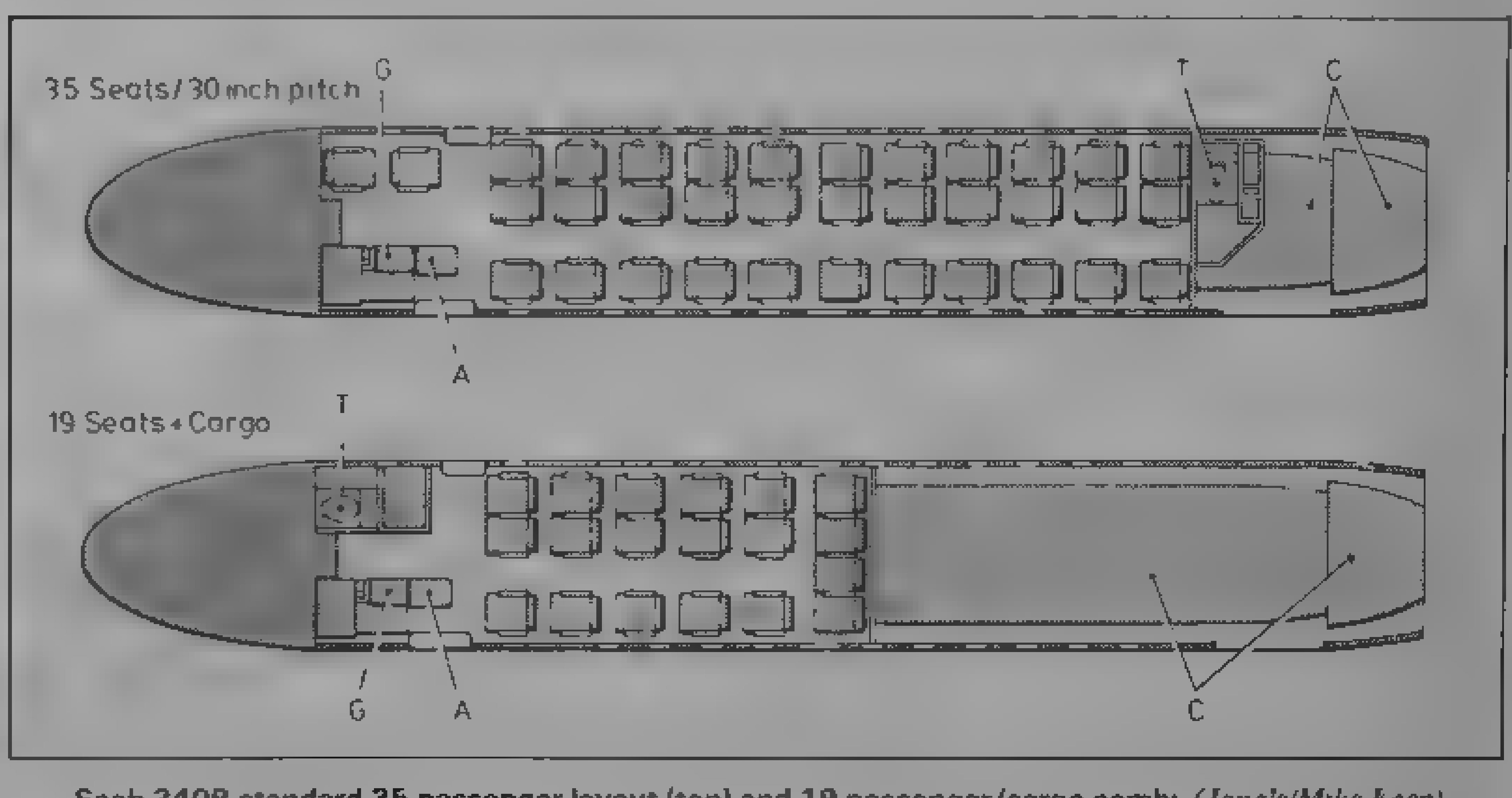
Passenger door (plug type) at front of cabin on port side with separate forward-stowing airstair. Type II emergency exit opposite this on starboard side, and Type III over wing on each side. Crew escape hatch in flight deck roof. Baggage space under each passenger seat; overhead stowage bins. Main baggage/cargo compartment aft of passenger cabin (from which it is accessible), with large plug type door on port side. Entire accommodation pressurised, including baggage compartment.

SYSTEMS: Hamilton Standard ECS (maximum pressure differential 0.48 bar; 7.0 lb/sq in) maintains S/L cabin environment up to altitude of 3,660 m (12,000 ft) and 1,525 m (5,000 ft) environment up to 7,620 m (25,000 ft).

Single on-demand hydraulic system, operating at up to 207 bars (3,000 lb/sq in), for actuation of landing gear, wheel and propeller braking, nosewheel steering and wing flaps. System is powered by single 28 V DC electric motor-driven pump, rated delivery 9.5 litres (2.5 US gallons; 2.1 Imp gallons)/min. Self-pressurising main reservoir with 5.08 litres (0.18 cu ft) capacity, operating at pressure of 1.79 to 2.69 bars (26 to 39 lb/sq in). Hydraulic back-up via four accumulators and pilot operated handpump, working via 2.5 litre (0.09 cu ft) emergency reservoir.

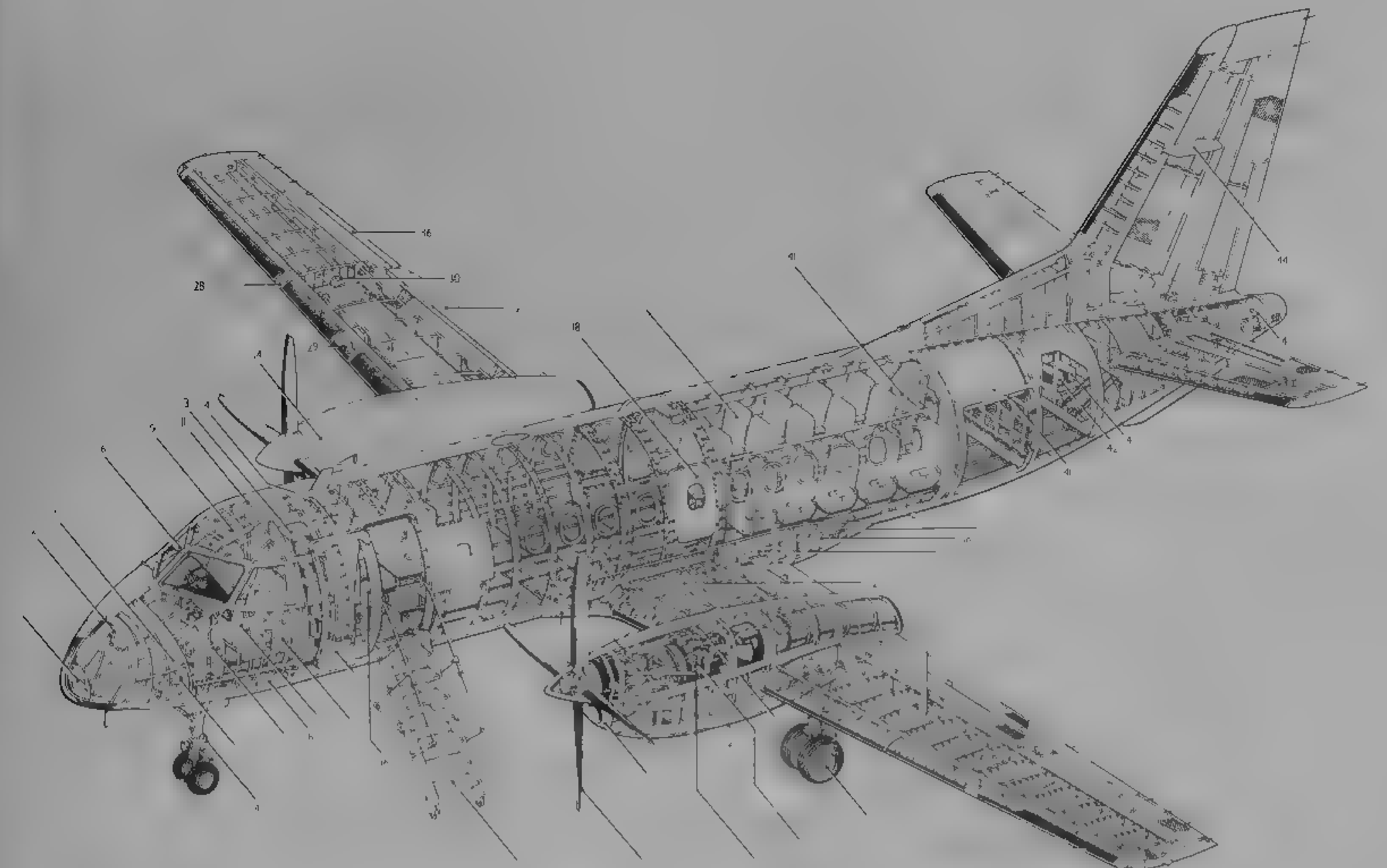
Electrical power supplied by two 28 V 400 A DC engine-driven starter/generators, each connected to separate busbar. Variable frequency 115/200 V for heating circuits provided by two 26 kVA AC generators; single-phase 115 V and 26 V AC at 400 Hz for avionics provided by static inverters. Two 43 Ah Ni/Cd batteries for ground power and engine starting, standby 5 Ah lead-acid battery for emergency use. External power receptacle.

Engine bleed air for air conditioning, pressurisation and pneumatic boot de-icing of wing and tail unit leading-edges. Oxygen system (11.2 litre, 2.96 US gallon; 2.46 Imp gallon cylinder operating at 127.5 bars, 1,850 lb/sq in pressure) includes portable and first aid units. Plug in connections for oxygen masks. Flight deck windows have electric anti-icing and electrically driven windscreen wipers. Cox & Co electric anti-icing for engine air intakes, propellers, AoA and OAT sensors and pitot heads. Demisting by means of air conditioning system. Kidde engine fire detection system. No APU, except in 340 AEW&C.



Saab 340B standard 35-passenger layout (top) and 19-passenger/cargo combi. *(Jane's/Mike Keep)*
A: attendant's seat, C: cargo, G: galley, T: toilet

1993



Saab 340B, cutaway drawing key

1 Weather radar
2 Radar transceiver
3 Nose gear actuating rod
4 Nosewheel steering cam
5 Hydraulic bay
6 Windscreen
7 Angle of incidence sensor
8 Electrical system access
9 Pilot's overhead control panel
10 Ground communication port
11 Flight deck escape hatch
12 ASI antennae
13 Main avionics bay
14 Office
15 Passenger door
16 Cabin attendant's seat
17 Airstair
18 Overwing emergency exit
19 Landing light
20 Three-abreast passenger seating
21 Composite-blade propeller
22 Electrically anti-iced engine air intake
23 Engine-driven AC generator
24 DC starter/generator
25 General Electric CT7-9B turboprop
26 Engine accessory gearbox
27 Pneumatic de-icing boot
28 Air flow detector
29 Pressure refuelling point
30 Gravity refuelling point
31 Wing outboard fuel tank
32 Wing inboard fuel tank
33 Carbon disc brakes
34 Propeller brake (optional)
35 Single-slotted flap
36 Aileron tabs
37 Air conditioning unit
38 Main battery (one of two)
39 Power supply distribution box
40 Cargo door
41 Toilet
42 Flight data recorder
43 Cockpit voice recorder
44 VOR/LOC antenna
45 Discharge valves

1993

AVIONICS: *Comms* Dual Collins VHF, Collins PA, Telephonics cabin interphone, Fairchild cockpit voice recorder

Radar Colour weather radar standard

Flight: Collins APS-85 AFCS, VOR/ILS, LAS flight data recorder and GPWS standard

Instrumentation Dual electronic flight instrument display (EFIS), standby gyro horizon indicator and magnetic compass standard.

DIMENSIONS, EXTERNAL:

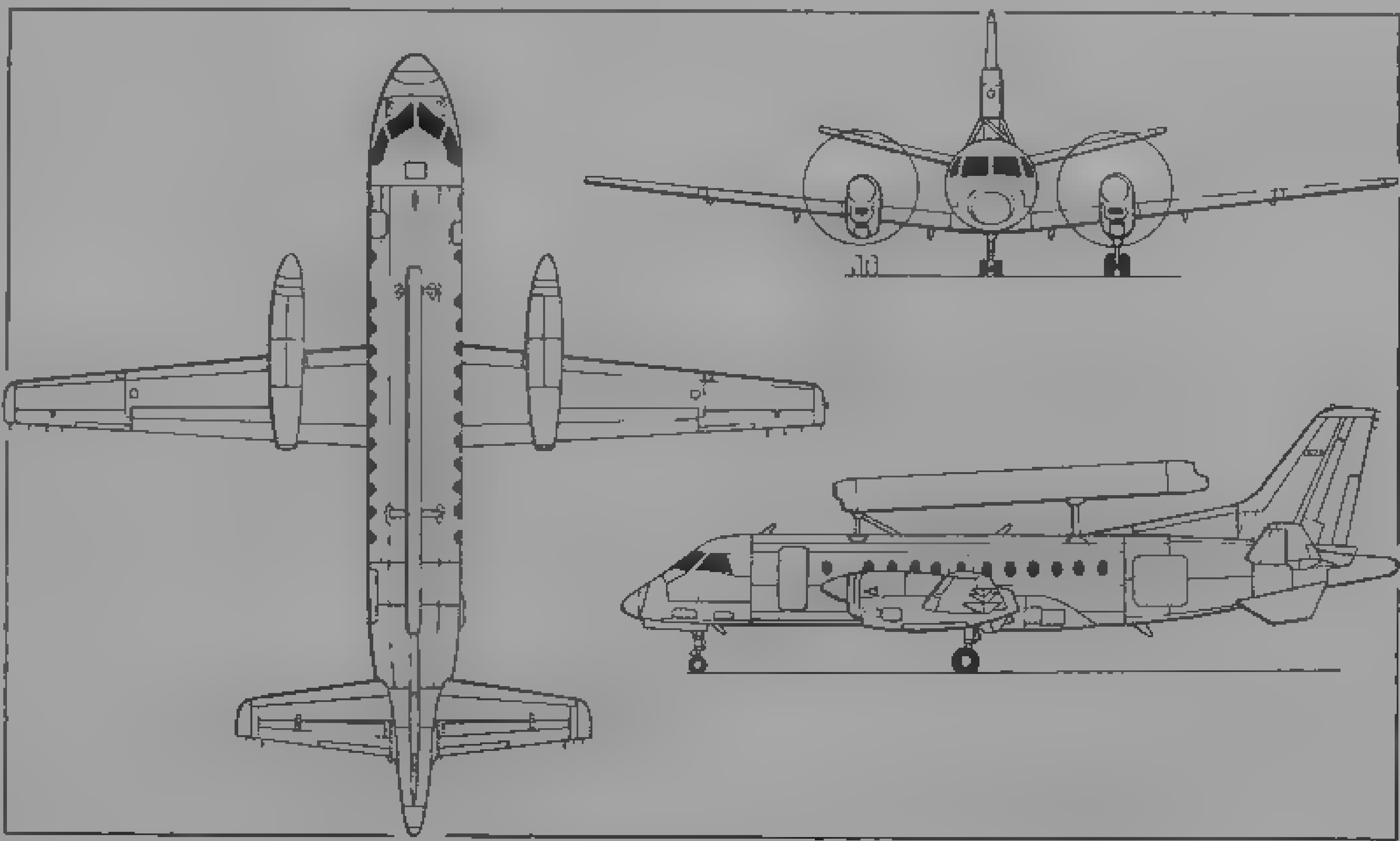
Wing span	21.44 m (70 ft 4 in)
Wing aspect ratio	10.99
Length overall	19.73 m (64 ft 8¾ in)
Fuselage: Max diameter	2.31 m (7 ft 7 in)
Height overall	6.97 m (22 ft 10½ in)
Tailplane span	9.24 m (30 ft 3¾ in)
Wheel track	6.71 m (22 ft 0 in)
Wheelbase	7.14 m (23 ft 5 in)
Propeller diameter	3.35 m (11 ft 0 in)
Propeller ground clearance	0.51 m (1 ft 8 in)
Passenger door: Height	1.60 m (5 ft 3 in)
Width	0.69 m (2 ft 3¼ in)
Height to sill	1.63 m (5 ft 4 in)
Cargo door: Height	1.30 m (4 ft 3 in)
Width	1.35 m (4 ft 5 in)
Height to sill	1.66 m (5 ft 5½ in)
Emergency exit (fwd, stbd): Height	1.32 m (4 ft 4 in)
Width	0.51 m (1 ft 8 in)
Emergency exits (overwing, each):	
Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck, toilet and galley:	
Length	10.39 m (34 ft 1 in)
Max width	2.16 m (7 ft 1 in)
Width at floor	1.70 m (5 ft 7 in)
Max height	1.83 m (6 ft 0 in)
Volume	33.4 m³ (1,179.5 cu ft)
Baggage/cargo compartment volume	
with rear toilet	6.8 m³ (240.0 cu ft)
with fwd toilet	8.3 m³ (293.1 cu ft)

AREAS:

Wings, gross	41.81 m² (450.0 sq ft)
Ailerons (total)	2.12 m² (22.84 sq ft)
Trailing-edge flaps (total)	8.07 m² (86.84 sq ft)
Fin (incl dorsal fin)	7.77 m² (83.64 sq ft)
Rudder (incl tab)	2.76 m² (29.71 sq ft)
Tailplane	11.28 m² (121.42 sq ft)
Elevators (total, incl tabs)	3.29 m² (35.40 sq ft)



Saab 340 AEW&C/Tp 100B surveillance aircraft (*Jane's/James Goulding*)

1995

WEIGHTS AND LOADINGS:
Operating weight empty 8,140 kg (17,945 lb)
Max payload (weight limited) 3,880 kg (8,554 lb)
Max fuel load 2,581 kg (5,690 lb)
Max ramp weight 13,210 kg (29,123 lb)
Max T-O weight 13,155 kg (29,000 lb)
Max landing weight 12,930 kg (28,505 lb)
Max zero-fuel weight 12,020 kg (26,500 lb)
Max wing loading 314.6 kg/m² (64.44 lb/sq ft)
Max power loading (with APR) 4.72 kg/kW (7.75 lb/shp)

PERFORMANCE (at max T-O weight, ISA, except where indicated):
Max operating speed (VMO) 250 kts (463 km/h, 288 mph)
Max operating Mach number (MMO) 0.5
Max cruising speed:
at 4,575 m (15,000 ft) 282 kts (522 km/h, 325 mph)
at 6,100 m (20,000 ft) 280 kts (519 km/h, 322 mph)
Best range cruising speed at 7,620 m (25,000 ft) 252 kts (467 km/h, 290 mph)
Stalling speed: flaps up 106 kts (197 km/h, 123 mph)
T-O flap 95 kts (176 km/h, 110 mph)
approach flap 92 kts (171 km/h, 106 mph)
landing flap 88 kts (164 km/h, 102 mph)
Max rate of climb at S/L 610 m (2,000 ft)/min
Rate of climb at S/L, OEI 160 m (525 ft)/min
Service ceiling: standard 7,620 m (25,000 ft)
optional 9,450 m (31,000 ft)
Service ceiling, OEI (1.1% net gradient at 95% MTOW) 3,810 m (12,500 ft)
T-O to 15 m (50 ft) at S/L:
JAR 1,290 m (4,233 ft)
FAR 1,322 m (4,338 ft)
T-O to 15 m (50 ft) at 1,525 m (5,000 ft):
JAR (low flap setting) 1,835 m (6,021 ft)
FAR 1,657 m (5,437 ft)
Landing from 15 m (50 ft) at max landing weight at S/L:
JAR 1,035 m (3,396 ft)
FAR 1,065 m (3,495 ft)
Landing from 15 m (50 ft) at max landing weight at 1,525 m (5,000 ft): JAR 1,165 m (3,823 ft)
FAR 1,200 m (3,937 ft)
Runway LCN: flexible pavement 8
rigid pavement 10
Range with 35 passengers and baggage, reserves for 45 min hold at 1,525 m (5,000 ft) and 100 n mile (185 km, 115 mile) diversion:
at max cruising speed 805 n miles (1,491 km, 927 miles)
at long-range cruising speed 935 n miles (1,732 km, 1,076 miles)
Range with 37 passengers, reserves as above:
at max cruising speed 695 n miles (1,288 km, 800 miles)
at long-range cruising speed 795 n miles (1,473 km, 915 miles)

OPERATIONAL NOISE LEVELS (FAR Pt 36, Appendix C):
T-O 78.6 EPNdB
Sideline 85.9 EPNdB
Approach 91.6 EPNdB

UPDATED

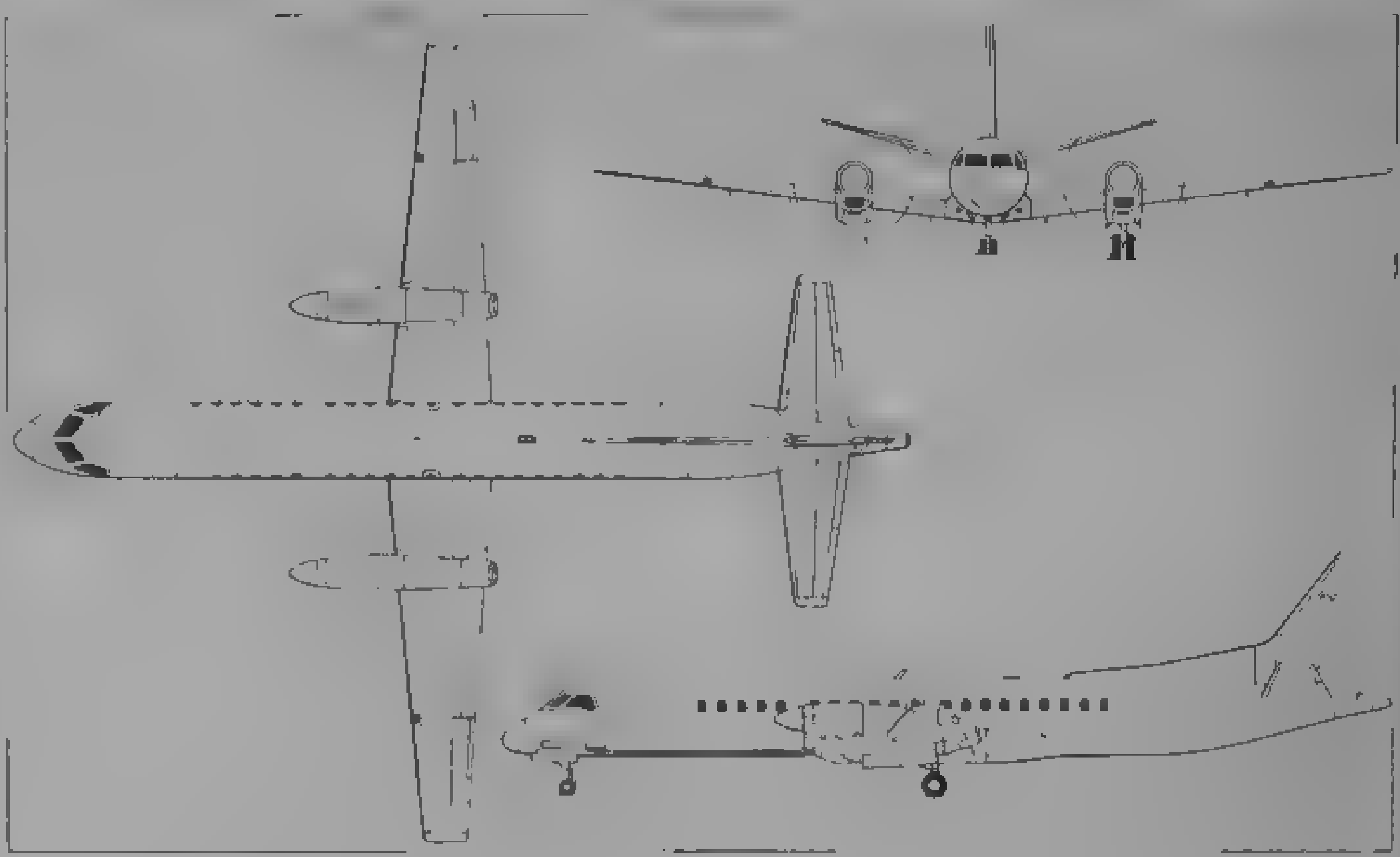
SAAB 2000

TYPE: Twin-turboprop regional transport.

PROGRAMME: Definition started Autumn 1988; launched 15 December 1988 with Crossair commitment for 25 firm and 25 on option, formal go-ahead May 1989. Allison GMA (now AE) 2100 selected as power plant July 1989, first metal cut February 1990; major subcontractor items delivered 1991 by Westland (rear fuselage, March), Valmet (tail unit, July), CASA (wing, August) and Allison (engines, August); first aircraft (SE-001) rolled out 14 December 1991 and made first flight 26 March 1992. Three aircraft in certification programme, of which c/n 002 made first flight 3 July 1992, followed by 003 on 28 August; 003 first to production standard; static and fatigue test airframes also completed; first flight of production aircraft (SE-004) 17 March 1993; engine certificated 23 April 1993. Saab 2000 certification, initially to JAR 25 (Amendment 13) and FAR 25 (Amendment 70), received on 31 March and 29 April 1994 respectively; will be extended later to include Cat IIIa operation; 2,798 hours flown in 1,518 sorties by first four aircraft (3,235 hours in 1,859 sorties by all eight then flying) up to 30 August 1994; powered elevator control system (PECS) first flown on development aircraft 19 May 1994; deliveries began with 006 (HB-IZC) to Crossair on 30 August 1994, service entry September 1994; five delivered to Crossair by 31 October 1994, further three by March 1995. Status at 31 December 1994: 11 flown: five (005-009) delivered, two (010-011) in customer preparation, and four Saab flight test (001-004).

COSTS: Swedish government lent Saab between $163 million and $187 million (1989) for development between 1989 and 1994, to be repaid from sales from 31st aircraft until 2009. Finnish Flygplansfabriken investing $8.4 million (1989) and ADCO $5.3 million (1989) in Valmet tail unit subcontract; total Valmet agreement valued at $69.8 million (1989); Westland rear fuselage production contract worth £40 million (1990).

Saab 2000 in the colours of German operator Deutsche BA *1994*



Saab 2000 short/medium-range 50/58-passenger regional transport *(Jane's/Dennis Punnett)* *1989*

CUSTOMERS: Firm orders for 42 by March 1995 included Air Marshall Islands (two), Crossair (20), Regional Airlines (three), Salenia (five), Deutsche BA (five), and General Motors Air Transportation System (three, in executive shuttle configuration); options at same date totalled 128 including Air Marshall Islands (two), AMR Eagle (50), Brit Air (four), Business Express (10), Calm Air (two), Crossair (25), Deutsche BA (five), Kendell Airlines (two), Salenia (five) and Skywest (20). Second recipient following Crossair was Deutsche BA on 17 March 1995 (013/D-ADSA).

DESIGN FEATURES: Objective to combine jet speeds with turboprop economy, aiming at 360 knots (667 km/h, 414 mph) cruising speed, climb to 6,100 m (20,000 ft) in 10 minutes and cruising altitudes between 5,485 m and 9,450 m (18,000 and 31,000 ft). CAD/CAM designed throughout; same fuselage cross-section as 340B, but longer; same wing section, but span stretched 15 per cent to give 33 per cent more area, engines farther outboard.

FLYING CONTROLS: Rod and cable control linkages for ailerons and (initially) for elevators, with electrically actuated trim tab in each aileron and each elevator, plus spring tab in each elevator. Initial production have MECS (mechanical elevator control system), powered (electrically signalled hydraulic) elevator control system (PECS) standard on production aircraft from c/n 010 (HB-IZG), first flight 2 December 1994, and available for retrofit to earlier airframes. Electrically signalled, hydraulically powered rudder, with dual Dowty actuators; hydraulically actuated single slotted flaps with offset hinges.

STRUCTURE: Wing and fuselage primary structures of metal/metal bonded aluminium alloy, as in Saab 340B, with honeycomb sandwich fin, tailplane and doors, two spar wings, fin and tailplane; composites for ailerons (CFRP/Nomex), flaps (CFRP skins), wing/body fairings (Kevlar/Nomex), nosecone (GFRP/Nomex), rudder and elevators (GFRP leading-edges and CFRP skins), dorsal fin, propeller blades, and cabin floor (carbonfibre sandwich); superplastic formed/diffusion bonded titanium nacelle firefloors.

Major subcontractors are CASA (wing, including design, stressing and testing), Westland Engineering (rear fuselage and, with Hispano-Suiza, engine cowlings), Valmet (fin, rudder, tailplane and elevators) and Fischer Advanced Composites (dorsal fin).

LANDING GEAR: AP Precision Hydraulics retractable tricycle type, with twin wheels and oleo-pneumatic shock-absorbers on each unit, all units retract forward. ABS wheels and carbon brakes; Goodyear tyres; Hydro Aire anti-skid system, Ozone Inc nosewheel steering.

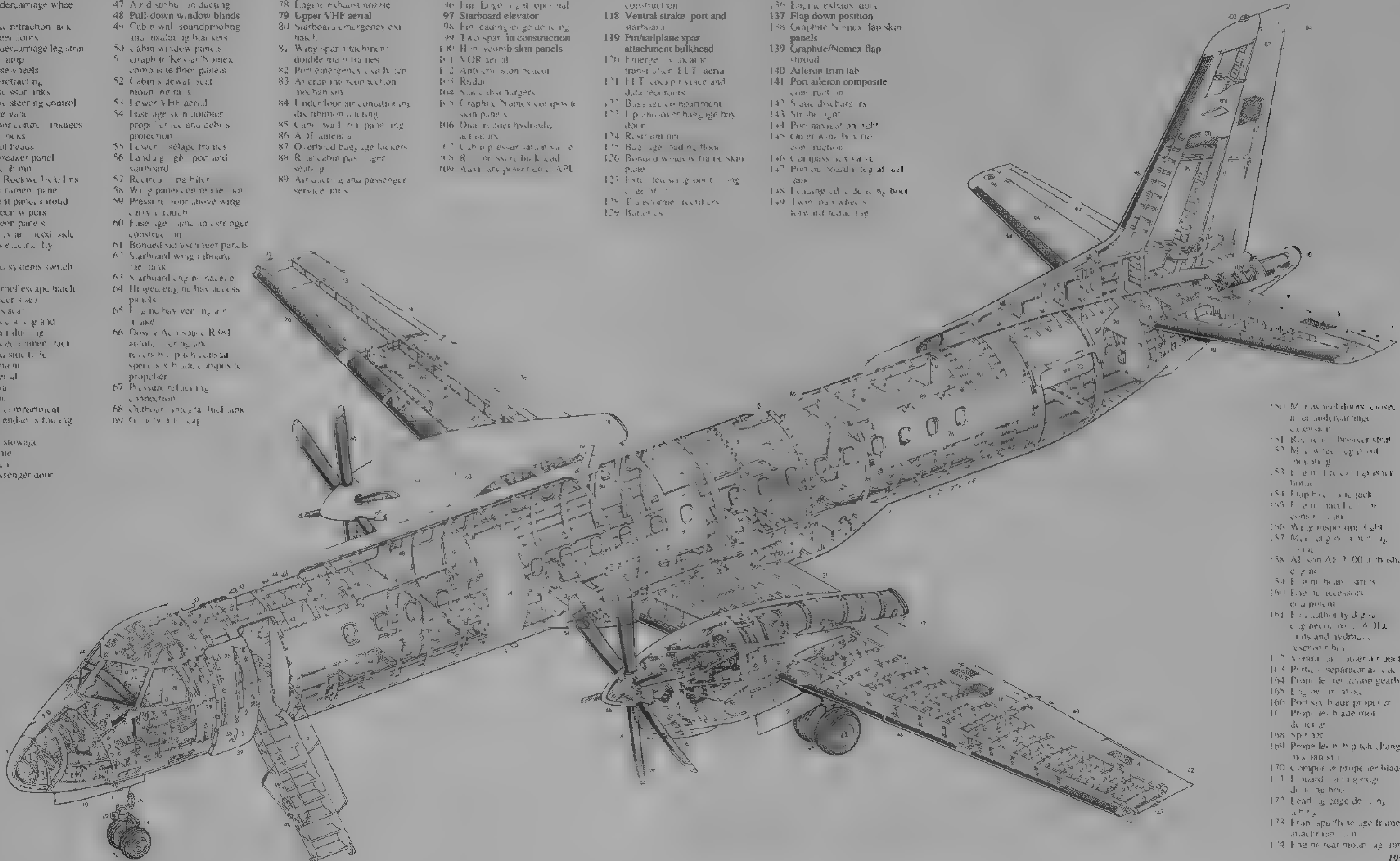
POWER PLANT: Two Allison AE 2100A turboprops, each flat rated at 3,076 kW (4,125 shp) with APR (S/L, ISA, at 1,100 rpm); Lucas Aerospace full dual channel FADEC (single-lever control of engines and propellers). Dowty Aerospace R381 slow-turning, constant-speed propellers with six swept blades, full autofeathering and reverse pitch; propellers 950 rpm in cruise, blades of both propellers held in phase at all times. Fuel in two integral tanks in each outer wing, total usable capacity 5,185 litres (1,370 US gallons; 1,140 Imp gallons). Single pressure refuelling point in starboard outer wing panel, overwing gravity refuelling point in each wing.

ACCOMMODATION: Flight crew of three or four, including cabin attendant(s). Standard AIM Aviation (UK) 'European' cabin has 50 seats three-abreast at 81 cm (32 in) pitch with single aisle, but cabin length can be extended for additional galley and wardrobe space by moving rear bulkhead aft into baggage space, permitting seating to be increased to 58 at 76 cm (30 in) pitch. Main baggage compartment aft of passenger cabin, with door on port side; provision for additional, smaller baggage area at front of cabin on starboard side. Passenger airstair door at front on port side; service/emergency door at rear on starboard side, overwing Type III emergency exit each side. Entire accommodation pressurised and air conditioned. Ultra Electronics active noise control (ANC) system standard, employing 72 microphones and 37 loudspeakers in cabin interior which continually monitor noise levels and, via a microprocessor electronic systems controller, generate an anti-phase sound field to lower cabin noise level by more than 8 dBA.

SYSTEMS: Hamilton Standard Recircair ECS, using engine bleed air; maximum pressure differential 0.48 bar (7.0 lb/sq in). Hydraulic system, with Abex pumps, for landing gear, flap, elevator and rudder actuation. Goodrich pneumatic boot de-icing system for wing/fin/tailplane

Saab 2000, cutaway drawing key

1 Radome
2 Weather radar scanner
3 Scanner mounting and tracking mechanism
4 Radar transceiver
5 Temperature probe
6 Sloping front pressure bulkhead
7 Oxygen bottle
8 Nose undercarriage wheel bay
9 Hydraulic retraction jack
10 Nosewheel doors
11 Nose undercarriage leg strut
12 Taxying lamp
13 Twin nosewheels, forward-retracting
14 Torque scissor links
15 Hydraulic steering control
16 Incidence vane
17 Underfloor control linkages and gust locks
18 Dual pitot heads
19 Circuit breaker panel
20 Control column
21 Six-tube Rockwell Collins EFIS instrument panel
22 Instrument panel shroud
23 Windscreen wipers
24 Windscreen panels, electrically heated; side windows electrically de-iced
25 Overhead systems switch panel
26 Cockpit roof escape hatch
27 First officer's seat
28 Captain's seat
29 Avionics cooling and cockpit air ducting
30 Avionics equipment rack
31 Starboard side hatch compartment
32 TCAS aerial
33 GPS aerial
34 Wardrobe
35 Stowage compartment
36 Cabin attendant's folding seat
37 Airstairs stowage compartment
38 Door latch
39 Main passenger door
40 Airstairs
41 Folding handrail
42 Entry lobby
43 Hand baggage stowage
44 ATC 1 and 2 aerials
45 Overhead baggage lockers
46 Three-abreast passenger seating, 50-seat standard layout, 81 cm (32 in) pitch
47 Air distribution ducting
48 Pull-down window blinds
49 Cabin wall soundproofing and insulating blankets
50 Cabin window panels
51 Graphite/Kevlar/Nomex composite floor panels
52 Cabin sidewall seat mounting rails
53 Lower VHF aerial
54 Fuselage skin doubler, propeller ice and debris protection
55 Lower fuselage frames
56 Landing lights, port and starboard
57 Recirculating filter
58 Wing panel centreline joint
59 Pressure floor above wing carry-through
60 Fuselage frame and stringer construction
61 Bonded skin/stringer panels
62 Starboard wing inboard fuel tank
63 Starboard engine nacelle
64 Hinged engine bay access panels
65 Engine bay venting air intake
66 Dowty Aerospace R381 aerodynamically and acoustically optimised, constant-speed six-blade composite propeller
67 Pressure refuelling connection
68 Outboard integral fuel tank
69 Fuel filler cap
70 Leading-edge de-icing boot
71 Starboard navigation light
72 Strobe light
73 Starboard aileron
74 Aileron tab
75 Aileron control linkage
76 Starboard one-piece single-slotted flap
77 Ventral flap hinges
78 Engine exhaust nozzle
79 Upper VHF aerial
80 Starboard emergency exit hatch
81 Wing spar attachment double main frames
82 Port emergency exit hatch
83 Aileron interconnection mechanism
84 Underfloor air conditioning distribution ducting
85 Cabin wall trim panelling
86 ADF antenna
87 Overhead baggage lockers
88 Rear cabin passenger seating
89 Air ducting and passenger service units
90 Galley unit
91 Rear lobby with service emergency door and attendant's seat
92 Composite fin root fillet
93 HF aerial
94 Tailplane leading-edge de-icing boot
95 Starboard tailplane
96 Fin logo light (optional)
97 Starboard elevator
98 Fin leading-edge de-icing
99 Two-spar fin construction
100 Honeycomb skin panels
101 VOR aerial
102 Anti-collision beacon
103 Rudder
104 Static dischargers
105 Graphite/Nomex composite skin panels
106 Dual rudder hydraulic actuators
107 Cabin pressure outflow valve
108 Rear pressure bulkhead
109 Auxiliary power unit (APU)
110 APU exhaust
111 Tail navigation light
112 Elevator spring tab
113 Trim tab
114 Port elevator composite construction
115 Static dischargers
116 Port logo light
117 Two-spar tailplane construction
118 Ventral strake, port and starboard
119 Fin/tailplane spar attachment bulkhead
120 Emergency locator transmitter (ELT) aerial
121 FDT cockpit voice and data recorders
122 Baggage compartment
123 Up-and-over baggage bay door
124 Restraint net
125 Baggage loading floor
126 Bonded window frame skin plate
127 Extended wing root fairing construction
128 Transformer rectifiers
129 Batteries
130 Air conditioning pack, port and starboard
131 Wing spar bolted attachment joint
132 Drag link
133 Port inboard fuel tank bay
134 Wing panel bonded stringer construction, three-spar
135 Port single-slotted flap
136 Engine exhaust duct
137 Flap down position
138 Graphite/Nomex flap skin panels
139 Graphite/Nomex flap shroud
140 Aileron trim tab
141 Port aileron composite construction
142 Static dischargers
143 Strobe light
144 Port navigation light
145 Outer wing box rib construction
146 Compass flux valve
147 Port outboard integral fuel tank
148 Leading-edge de-icing boot
149 Twin mainwheels, forward-retracting
150 Mainwheel doors, closed after undercarriage extension
151 Retraction breaker strut
152 Main undercarriage pivot mounting
153 Engine fire extinguisher bottles
154 Flap hydraulic jack
155 Engine nacelle construction
156 Wing inspection light
157 Main engine mounting strut
158 Allison AE 2100A turboshaft engine
159 Engine bearer struts
160 Engine accessory equipment
161 Full authority digital engine control (FADEC), oil and hydraulic reservoirs
162 Ventral oil cooler air duct
163 Particle separator air duct
164 Propeller reduction gearbox
165 Engine air intake
166 Port six-blade propeller
167 Propeller blade root de-icing
168 Spinner
169 Propeller hub pitch change mechanism
170 Composite propeller blades
171 Inboard leading-edge de-icing boot
172 Leading-edge de-icing, drains
173 Front spar/fuselage frame attachment joint
174 Engine rear mounting frame


1993

Fourth Saab 2000 in the livery of launch customer Crossair

1994

leading-edges and engine intakes. Electrical system has two 45 kVA variable frequency engine-driven generators for three-phase 115/200 V AC power and three 28 V DC batteries. Electric anti-icing of propeller blades, Swedlow electrically heated windscreen panels. Sundstrand APU for engine starting and ECS. Scott oxygen system. Pacific Scientific fire detection and Kidde-Graviner fire extinguishing systems

AVIONICS: *Comms:* Com/nav/pulse package and radio tuning units standard

Radar: Collins WXR 840 solid state weather radar standard; turbulence detecting weather radar optional

Flight: AHRS and digital air data system standard, flight management system optional

Instrumentation: Collins Pro Line IV package with six CRT displays, integrated avionics processing system (IAPS) and EICAS standard, TCAS optional

DIMENSIONS, EXTERNAL:
Wing span 24.76 m (81 ft 2¾ in)
Wing aspect ratio 11.00
Length overall 27.03 m (88 ft 8¼ in)
Fuselage: Max diameter 2.31 m (7 ft 7 in)
Height overall 7.73 m (25 ft 4 in)
Tailplane span 10.36 m (34 ft 0 in)
Wheel track 8.23 m (27 ft 0 in)
Wheelbase 10.97 m (36 ft 0 in)
Min ground turning radius 18.85 m (61 ft 10 in)
Propeller diameter 3.81 m (12 ft 6 in)
Propeller ground clearance 0.46 m (1 ft 6 in)
Passenger door: Height 1.60 m (5 ft 3 in)
Width 0.69 m (2 ft 3 in)
Height to sill 1.81 m (5 ft 11¼ in)
Baggage door (rear, port):
Height 1.30 m (4 ft 3 in)
Width 1.35 m (4 ft 5 in)
Height to sill 1.85 m (6 ft 0¾ in)
Service/emergency door (rear, stbd):
Height 1.22 m (4 ft 0 in)
Width 0.61 m (2 ft 0 in)
Emergency exits (overwing, each):
Height 0.91 m (3 ft 0 in)
Width 0.51 m (1 ft 8 in)

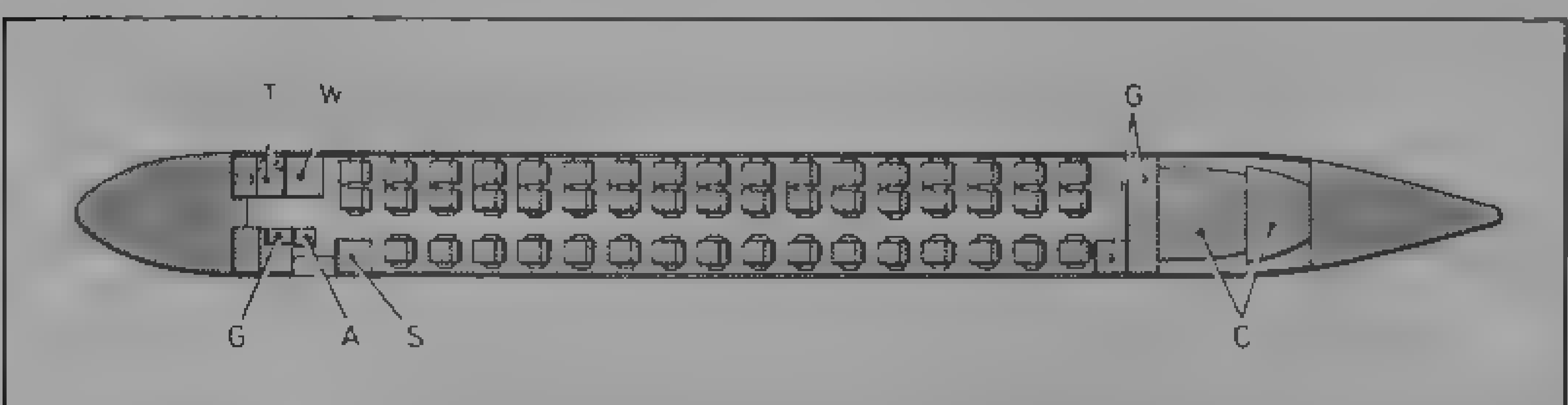
DIMENSIONS, INTERNAL:
Cabin, excl flight deck, toilet and galley:
Length 17.25 m (56 ft 7¼ in)
Max width 2.16 m (7 ft 1 in)
Width at floor 1.70 m (5 ft 7 in)
Max height 1.83 m (6 ft 0 in)
Volume 52.7 m³ (1,860.0 cu ft)
Baggage/cargo compartment:
Volume 10.2 m³ (360.0 cu ft)

AREAS:
Wings, gross 55.74 m² (600.0 sq ft)
Vertical tail surfaces (total) 13.01 m² (140.0 sq ft)
Horizontal tail surfaces (total) 18.35 m² (197.5 sq ft)

WEIGHTS AND LOADINGS:
Operating weight empty 13,800 kg (30,423 lb)
Max payload (weight limited) 5,900 kg (13,007 lb)
Max fuel load 4,165 kg (9,182 lb)
Max ramp weight 23,000 kg (50,706 lb)
Max T-O weight 22,800 kg (50,265 lb)
Max landing weight 22,000 kg (48,501 lb)
Max zero-fuel weight 19,700 kg (43,431 lb)
Max wing loading 394.7 kg/m² (80.84 lb/sq ft)
Max power loading 3.58 kg/kW (5.88 lb/shp)

PERFORMANCE (at max T-O weight ISA, except where indicated):
Max operating speed (VMO):
below 3,050 m (10,000 ft) 250 kts (463 km/h, 288 mph) IAS
above 3,050 m (10,000 ft) 270 kts (500 km/h, 311 mph) IAS
Max operating Mach number (MMO) 0.62
Max cruising speed:
at 7,620 m (25,000 ft) 366 kts (678 km/h, 421 mph)
at 9,450 m (31,000 ft) 353 kts (653 km/h, 406 mph)
Long-range cruising speed at 9,450 m (31,000 ft) 300 kts (556 km/h, 345 mph)
Max rate of climb at S/L 725 m (2,380 ft)/min
Rate of climb at S/L, OEI 183 m (600 ft)/min
Time to 6,100 m (20,000 ft) 10 min
Service ceiling 9,450 m (31,000 ft)
Service ceiling, OEI, at 95% of MTOW:
ISA 5,334 m (17,500 ft)
ISA + 10°C 4,297 m (14,100 ft)
T-O to 15 m (50 ft): at S/L 1,360 m (4,465 ft)
at 1,525 m (5,000 ft) 1,680 m (5,515 ft)
Landing from 15 m (50 ft) at max landing weight:
at S/L 1,250 m (4,105 ft)
at 1,525 m (5,000 ft) 1,390 m (4,560 ft)
Runway LCN (paved runways) max 15
Range at 9,450 m (31,000 ft) with 50 passengers and baggage, reserves for 45 min hold at 1,525 m (5,000 ft) and 100 n mile (185 km, 115 mile) diversion:
at max cruising speed 1,255 n miles (2,324 km, 1,444 miles)
at long-range cruising speed 1,425 n miles (2,639 km, 1,640 miles)

OPERATIONAL NOISE LEVELS (estimated):
T-O 89.0 EPNdB
Sideline 94.0 EPNdB
Approach 98.0 EPNdB



Saab 2000 standard 50-passenger layout *(Jane's/Mike Keep)*
A: attendant's seat, C: baggage/cargo, G: galley, S: stowage, T: toilet, W: wardrobe

1993

UPDATED

SWITZERLAND

FFA

FFA FLUGZEUGWERKE ALTENRHEIN AG

CH 9423 Altenrhein
Telephone: 41 (71) 43 51 11
Fax: 41 (71) 43 53 30
Telex: 881569 FFA CH
PRESIDENT: Charles Bronimann
CHIEF ENGINEER: A. Gasser
VICE-PRESIDENT MARKETING: J. E. Watts-Phillips

Originated as Swiss branch of German Dornier company, becoming all Swiss in 1948, acquired by Justus Dornier group in Zurich January 1987, taking present name 1 June 1987. Privately owned since 1991. Activities include producing spares for Swiss built Northrop F-5E/F and parts for F/A-18, overhaul and maintenance for Swiss Air Force and general aviation, and subcontract work for various foreign aircraft manufacturers. Current workforce (1995) about 120.

UPDATED

FFA AS 202/26A1 (194 kW, 260 hp AEIO-540 engine) *1994*

FFA AS 202/18A BRAVO

TYPE: Two/three-seat trainer and sporting aircraft.

PROGRAMME: Originally a joint venture with SIAI-Marchetti of Italy, then became independent Swiss programme: first flight by AS 202/15 Swiss prototype (HB-HEA) 7 March 1969, 34 of this version built (see 1981-82 *Jane's*), plus one prototype AS 202/26A (1985-86 edition), AS 202/18A made first flight (HB-HEY) 22 August 1974, certificated by Swiss 12 December 1975, UK CAA on 10 December 1987 and FAA on 17 December 1976.

CURRENT VERSIONS: **AS 202/18A:** Two/three-seat aerobatic version, subtypes include **A2** (higher maximum T-O/landing weight, extended canopy, electric trim), **A3** (as A2 but mechanical trim, 24 V electrics) and **A4** (as A2 but with British CAA approved special instrumentation); A4s of BAe Flying College named **Wren**. *Full description in 1991-92 and earlier editions, following shortened version applies to 18A4 except where indicated.*

AS 202/26A1: Designed for higher performance, especially in hot/high locations. Prototype made first flight 1978 but not put into production then, certification work currently suspended to concentrate on 32TP (which see). Powered by 194 kW (260 hp) Textron Lycoming AEIO-540-D4B5 flat-six engine with two-blade constant-speed metal propeller (three-blade expected for final version), 24 V electrical system, as in 18A3, air conditioning to be available as option.

AS 202/32TP: Turboprop version, described separately.

CUSTOMERS: Total of 180 AS 202/15s and 18s delivered, latest delivery, one 18A4 to Japan Airlines training school at Nappa, California, USA.

DESIGN FEATURES: Typical low-wing, fixed-gear lightplane configuration, angular flying surfaces, sweptback vertical tail. Wing section NACA 63_2618 (modified) at centreline, 63_2415 at tip; thickness/chord ratio 17.63 per cent at root, 15 per cent at tip, dihedral 5° 43′ from roots; incidence 3°, quarter-chord sweepback 0° 40′.

FLYING CONTROLS: Mechanical, single-slotted ailerons and mass balanced rudder; ground adjustable tab on each aileron, electrically actuated trim tab in starboard elevator. 18A4 also has electrically actuated rudder tab. Single-slotted flaps, fixed incidence tailplane.

STRUCTURE: All-aluminium fail-safe except for glassfibre fairings and engine cowling, single-spar wings and tail with riveted honeycomb laminate skins.

LANDING GEAR: Non-retractable tricycle type, with steerable nosewheel. Rubber cushioned FFA shock-absorber struts. Mainwheel tyres size 6.00-6; nosewheel tyre size 5.00-5. Tyre pressure (all units) 2.41 bars (35 lb/sq in). Independent hydraulically operated disc brake on each mainwheel.

POWER PLANT: One 134 kW (180 hp) Textron Lycoming AEIO-360-B1F flat-four engine, driving a Hartzell HC-C2YK-1BF/F7666A-2 two-blade constant-speed propeller; Hoffmann three-blade propeller optional. Two wing leading-edge rubber fuel tanks with total capacity of 170 litres (44.9 US gallons; 37.4 Imp gallons). Refuelling point above each wing. Starboard tank has additional flexible fuel intake for aerobatics. Christen 801 fully aerobatic oil system, capacity 7.6 litres (2 US gallons, 1.6 Imp gallons).

ACCOMMODATION: Seats for two persons side by side in Aerobatic versions, under rearward-sliding jettisonable transparent canopy. Space at rear in Utility versions for third seat or 100 kg (220 lb) of baggage. Dual controls, cabin ventilation and heating standard.

SYSTEMS: Hydraulic system for brake actuation. One 12 V 60A engine-driven alternator (24 V in A3) and one 25 Ah battery provide electrical power for engine starting, lighting instruments, communications and navigation installations; 28 V electrical system optional.

AVIONICS: To customer's requirements. Provision for VHF radio, VOR, ADF, Nav-O-Matic 200A autopilot, blind-flying instrumentation or other special equipment.

EQUIPMENT: Clutch and release mechanism for glider towing optional.

DIMENSIONS, EXTERNAL:

Wing span	9.78 m (32 ft 1 in)
Wing aspect ratio	6.90
Length overall	7.50 m (24 ft 7¼ in)
Height overall	2.81 m (9 ft 2¾ in)
Tailplane span	3.67 m (12 ft 0½ in)
Wheel track	2.25 m (7 ft 4½ in)
Wheelbase	1.85 m (6 ft 0¾ in)
Propeller diameter	1.88 m (6 ft 2 in)

AREAS:

Wings, gross	13.86 m² (149.2 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped: 18A4	710 kg (1,565 lb)
26A1	793 kg (1,748 lb)
Max useful load (incl fuel):	
18A4, Aerobatic	177 kg (390 lb)
18A4, Utility	248 kg (546 lb)
26A1	467 kg (1,029 lb)
Max T-O weight:	
18A4, Aerobatic	1,010 kg (2,226 lb)
18A4, Utility	1,080 kg (2,380 lb)
26A1, Aerobatic	1,140 kg (2,513 lb)
26A1, Utility	1,260 kg (2,778 lb)
Max landing weight:	
26A1	1,200 kg (2,645 lb)
Max wing loading:	
18A4, Aerobatic	72.9 kg/m² (14.92 lb/sq ft)
18A4, Utility	77.1 kg/m² (15.96 lb/sq ft)
26A1, Aerobatic	82.25 kg/m² (16.85 lb/sq ft)
26A1, Utility	90.91 kg/m² (18.62 lb/sq ft)
Max power loading:	
18A4, Aerobatic	7.53 kg/kW (12.37 lb/hp)
18A4, Utility	7.84 kg/kW (12.86 lb/hp)
26A1, Aerobatic	5.88 kg/kW (9.67 lb/hp)
26A1, Utility	6.50 kg/kW (10.68 lb/hp)

PERFORMANCE (18A4, at Utility category max T-O weight):

Never-exceed speed (VNE)	173 kts (320 km/h, 199 mph)
Max level speed at S/L	130 kts (241 km/h, 150 mph)
Max cruising speed (75% power) at 2,440 m (8,000 ft)	122 kts (226 km/h; 141 mph)
Econ cruising speed (55% power) at 3,050 m (10,000 ft)	109 kts (203 km/h, 126 mph)
Stalling speed, engine idling:	
flaps up	62 kts (115 km/h, 71 mph)
flaps down	49 kts (90 km/h, 56 mph)
Max rate of climb at S/L	244 m (800 ft)/min
Service ceiling	5,180 m (17,000 ft)
T-O run at S/L	215 m (705 ft)
T-O to 15 m (50 ft) at S/L	415 m (1,360 ft)
Landing from 15 m (50 ft)	465 m (1,525 ft)
Landing run	210 m (690 ft)
Range with max fuel, no reserves	615 n miles (1,140 km; 707 miles)
Max endurance	5 h 30 min
g limits	+4.4/−2.2

PERFORMANCE (26A1, at Aerobatic category max T-O weight):

Max permissible diving speed (VD)	232 kts (429 km/h; 267 mph)
Never exceed speed (VNE)	214 kts (396 km/h, 246 mph)
Max level speed at S/L	146 kts (270 km/h, 168 mph)
Design manoeuvring speed (VA)	134 kts (248 km/h, 154 mph)
Stalling speed: flaps up	60 kts (112 km/h, 70 mph)
flaps down	51 kts (95 km/h, 59 mph)
Max rate of climb at S/L	426 m (1,398 ft)/min
T-O run at S/L	170 m (558 ft)
T-O to 15 m (50 ft)	310 m (1,017 ft)
Landing from 15 m (50 ft)	460 m (1,510 ft)
Landing run	200 m (657 ft)
g limits	+6/−3

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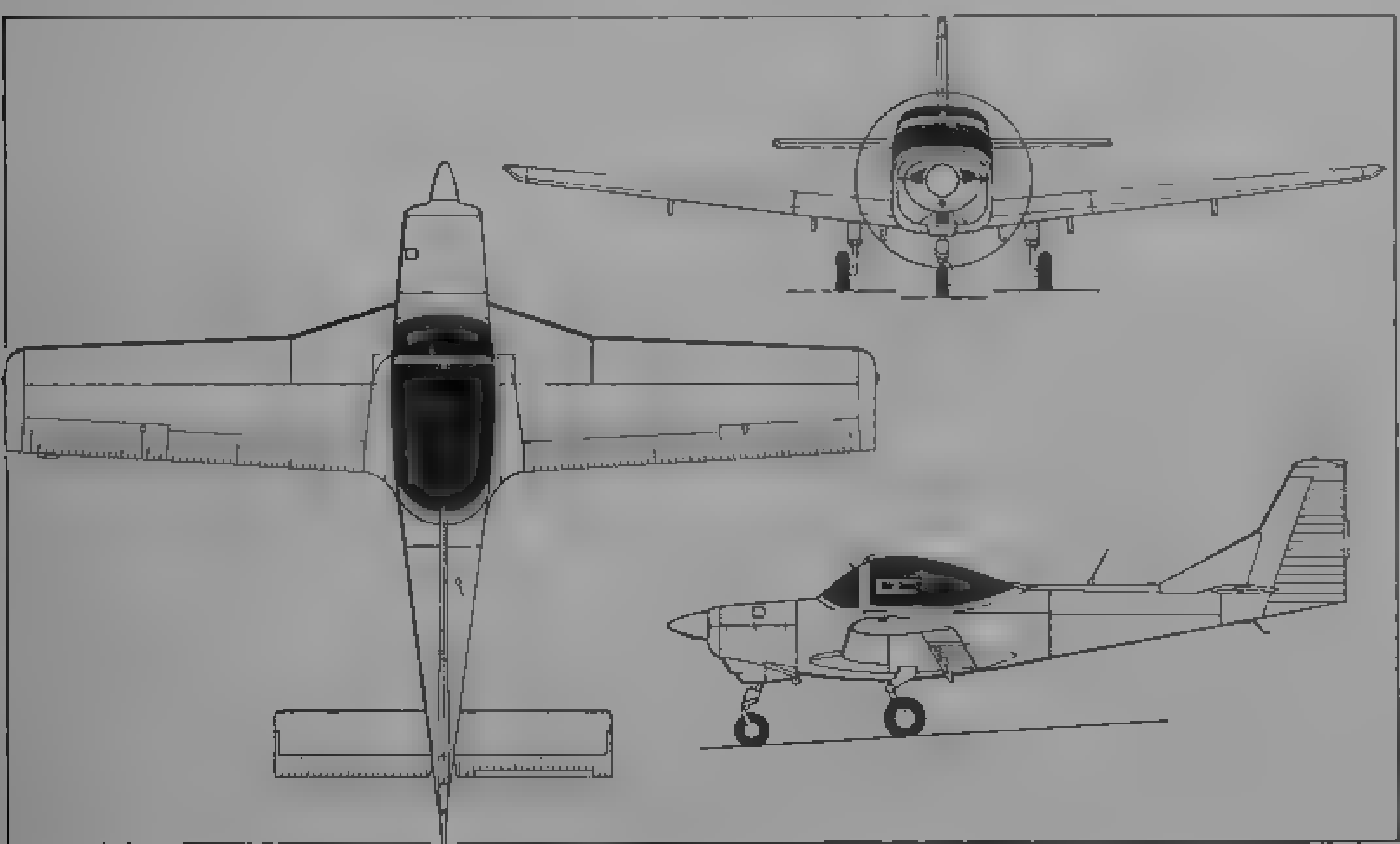


AS 202/26A1 Bravo two/three-seat trainer and sporting aircraft ***(Jane's/Mike Keep)*** *1994*

FFA AS 202/32TP TURBINE BRAVO

TYPE: Two/three-seat trainer, glider tug and sporting aircraft.

PROGRAMME: Introduced 1992 (prototype HB-HFJ, first flight 20 July); initial certification will be in Utility category, permitting use in glider towing role. Certification work completed, provisional type certificate was expected by end of January 1995 and full certificate by mid year.

CUSTOMERS: One delivered 1993 to Alpine Segelflugschule at Schanis, Switzerland.

Description as for AS 202/18A4 except as follows.

DESIGN FEATURES: Rapid T-O and climb to release point; dive brakes permit rapid descent after glider release; slow propeller rpm and quiet engine allow acceptance in heavily populated and other sensitive areas.

POWER PLANT: One 313 kW (420 shp) Allison 250-B17D turboprop, maximum continuous rating 275 kW (369 shp) at 2,030 rpm, driving a Hartzell HC-B3TF-7A/10173N-19R three-blade constant-speed propeller. Two wing leading-edge rubber fuel tanks with combined capacity of 170 litres (44.9 US gallons; 37.4 Imp gallons), plus two wingtip tanks with combined capacity of 114 litres (30.1 US gallons; 25.1 Imp gallons), giving total capacity of 284 litres (75 US gallons; 62.5 Imp gallons). Overwing refuelling point each side, plus point in each wingtip tank.

DIMENSIONS, EXTERNAL: As AS 202/18A4 except:

Wing span	9.95 m (32 ft 7¾ in)
Wing aspect ratio	7.04
Length overall	7.778 m (25 ft 6¼ in)
Wheelbase	1.869 m (6 ft 1½ in)
Propeller diameter	2.08 m (6 ft 10 in)

AREAS: As AS 202/18A4 except:

Wings, gross	14.056 m² (151.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	780 kg (1,719 lb)
Max T-O weight, Utility	1,080 kg (2,381 lb)
Max landing weight	1,050 kg (2,315 lb)
Max wing loading	76.83 kg/m² (15.74 lb/sq ft)
Max power loading	4.36 kg/kW (7.17 lb/shp)

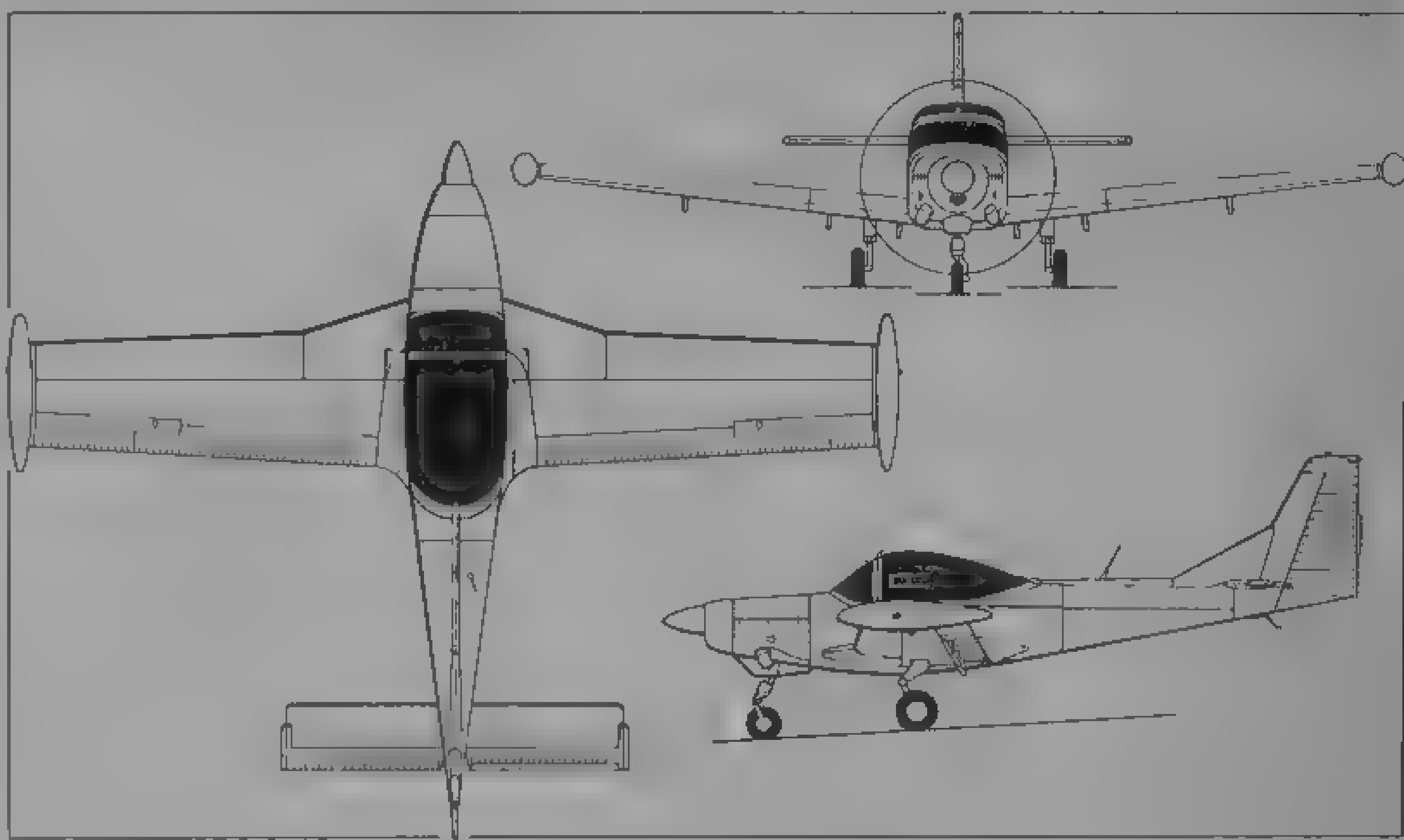
PERFORMANCE (at Utility max T-O weight):

Max permissible diving speed (V_D)	210 kts (389 km/h; 241 mph)
Max operating speed (V_{MO})	175 kts (324 km/h; 201 mph)
Design manoeuvring speed (V_A)	130 kts (241 km/h; 149 mph)
Stalling speed: flaps up	62 kts (115 km/h; 72 mph)
flaps down	53 kts (99 km/h; 61 mph)
Max rate of climb at S/L	579 m (1,900 ft)/min
T-O run at S/L	155 m (509 ft)
T-O to 15 m (50 ft)	300 m (985 ft)
Landing from 15 m (50 ft)	465 m (1,526 ft)
Landing run	210 m (689 ft)
g limits	+4.4/−2.2 (Utility)
	+6/−3 (Aerobatic)

UPDATED

Prototype AS 202/32TP (313 kW; 420 shp Allison 250-B17D turboprop)

1994



AS 202/32TP Turbine Bravo, developed from the piston-engined 18A4 *(Jane's/Mike Keep)*

1994

PILATUS

PILATUS FLUGZEUGWERKE AG

CH-6370 Stans
Telephone: 41 (41) 63 61 11
Fax: 41 (41) 61 33 51
Telex: 866202 PIL CH

CHAIRMAN: Ernst Thomke

PRESIDENT AND CEO: Oscar J. Schwenk

VICE-PRESIDENTS:
Erich Bucenmann (Production)
Oscar Brundler (Finance and Controlling)
Oliver Masefeld (R & D)
Andrea Muggli (Logistics)
Walter Odermatt (Marketing and Sales)

Formed December 1939, now part of Oerlikon-Buhrle Group; purchased assets of Britten-Norman (Bembridge) Ltd of UK 24 January 1979, which now operates as Pilatus Britten-Norman Ltd.

Current products include PC-6 Turbo-Porter, PC-7 and PC-7 Mk II Turbo Trainer, PC-9 and PC-12; overhauls Swiss Air Force aircraft and helicopters; modified (Mk II) PC-9 declared winner of US Air Force/Navy JPATS trainer competition.

UPDATED

PILATUS PC-6 TURBO-PORTER

US Army designation: UV-20A Chiricahua

TYPE: Single-turboprop multipurpose STOL utility transport.

PROGRAMME: First flight piston-engined prototype 4 May 1959 (see contemporary *Jane's*); current PC-6/B2-H4 introduced mid-1985. Production continuing at about 20 per year in 1995.

CURRENT VERSIONS: **Early versions**: PC-6/A, A1, A2, B, B1, B2 and C2-H2 with various turboprops (see 1974-75 *Jane's*); about 40 produced as agricultural aircraft with spray or dusting gear.

PC-6/B2-H4: Gross weight for FAR Pt 23 passenger carrying increased by 600 kg (1,323 lb), giving up to 570 kg (1,257 lb) greater payload for CAR 3 operations; changes include turned-up wingtips, enlarged dorsal fin, uprated mainwheel shock-absorbers, new tailwheel assembly and slight airframe reinforcement. H4 changes can be retrofitted to B2-H2. *Description applies to B2-H4.*

CUSTOMERS: Total of over 500 (all versions) produced, including licence manufacture in USA; in service in more than 50 countries; military operators include Argentina, Austria, Colombia, Dubai, Ecuador, France, Iran, Mexico, Myanmar, Peru, Switzerland, Thailand and US Army.

DESIGN FEATURES: Wing section NACA 64-514 (constant) with span-increasing wingtip fairings; dihedral 1°; incidence 2°.

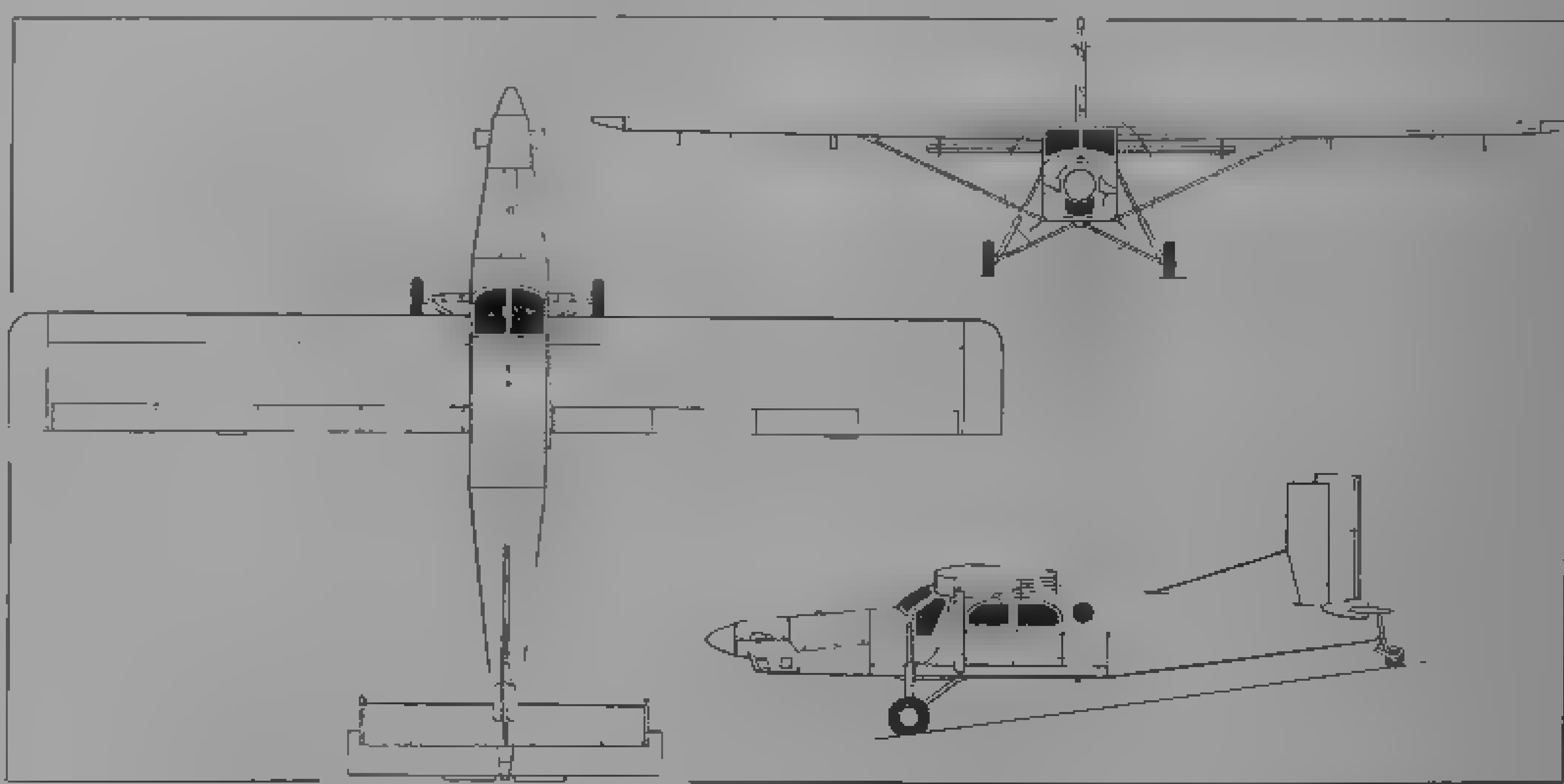
FLYING CONTROLS: Mechanical primary surfaces; Flettner tabs on elevator, geared aileron tabs, electrically actuated double-slotted flaps, electrically actuated variable incidence tailplane.

STRUCTURE: All-metal, single-strut wing bracing.

LANDING GEAR: Non-retractable tailwheel type. Oleo shock-absorbers of Pilatus design in all units. Steerable/lockable tailwheel. Goodyear Type II mainwheels and GA 284 tyres size 24 × 7 or 7.50 × 10 (pressure 2.21 bars; 32 lb/sq in); oversize Goodyear Type III wheels and tyres optional, size 11.0 × 12, pressure 0.88 bar (12.8 lb/sq in). Goodyear tailwheel with size 5.00-4 tyre. Goodyear disc brakes. Pilatus wheel/ski gear and (from July 1994) plain or amphibious floats optional.

POWER PLANT: One 507 kW (680 shp) Pratt & Whitney Canada PT6A-27 turboprop (flat rated at 410 kW; 550 shp at S/L), driving a Hartzell HC-B3TN-3D/T-10178 C or CH or T10173 C or CH constant-speed fully feathering reversible-pitch propeller with Beta mode control. Standard fuel in integral wing tanks, usable capacity 644 litres (170 US gallons; 142 Imp gallons). Two underwing auxiliary tanks, each of 245 litres (65 US gallons; 54 Imp gallons), available optionally. Oil capacity 12.5 litres (3.3 US gallons; 2.75 Imp gallons).

ACCOMMODATION: Cabin has pilot's seat forward on port side, with one passenger seat alongside, and is normally fitted with six quickly removable seats, in pairs, to rear of these for additional passengers. Up to 11 persons, including pilot, can be carried in 2-3-3-3 high density layout; or up to 10 parachutists, or two stretchers plus three attendants in ambulance configuration. Floor level, flush with door sill, with seat rails. Forward-opening door beside each front



Pilatus PC-6/B2-H4 Turbo-Porter with optional port-side double door *(Jane's/Dennis Punnett)*

1993

seat. Large rearward-sliding door on each side of main cabin. Optional double door, without central pillar, on port side. Hatch in floor 0.58 × 0.90 m (1 ft 10¾ in × 2 ft 11½ in), openable from inside cabin, for aerial camera or supply dropping. Starboard side door in rear fuselage 0.50 × 0.80 m (1 ft 7 in × 2 ft 7 in) permits stowage of six passenger seats or accommodation of freight items up to 5.0 m (16 ft 5 in) in length. Walls lined with lightweight soundproofing and heat insulation material. Adjustable heating and ventilation systems. Dual controls optional.

SYSTEMS: Cabin heated by engine bleed air. Scott 8500 oxygen system optional. 200 A 30 V starter/generator and 24 V 34 Ah (optionally 40 Ah) Ni/Cd battery.

AVIONICS: VFR or IFR packages (mainly Bendix/King) to customer's requirements.

Instrumentation: Standard instruments comprise ASI, VSI, barometric altimeter, directional gyro and magnetic compass.

EQUIPMENT: Generally to customer's requirements, but can include gear for parajumping role, stretchers for ambulance role, aerial photography and survey gear, agricultural equipment, or 800 litre (211 US gallon, 176 Imp gallon) water tank in cabin, with quick release system, for firefighting role. Stainless steel 1,330 litre (351.5 US gallon, 292.5 Imp gallon) agricultural tank, installed behind front seats, can also be used in firebombing role. With 46- or 62-nozzle underwing spraybooms, aircraft can spray a 45 m (148 ft) swath; optional ULV system (four to six atomisers or two to six Micronairs) can increase swath width to 400 m (1,310 ft).

DIMENSIONS, EXTERNAL:

Wing span	15.87 m (52 ft 0¾ in)
Wing chord, constant	1.90 m (6 ft 3 in)
Wing aspect ratio	8.35
Length overall	10.90 m (35 ft 9¼ in)
Height overall (tail down)	3.20 m (10 ft 6 in)
Elevator span	5.12 m (16 ft 9½ in)
Wheel track	3.00 m (9 ft 10 in)
Wheelbase	7.87 m (25 ft 10 in)
Propeller diameter	2.56 m (8 ft 5 in)
Cabin sliding doors (port/starboard):	
Max height	1.04 m (3 ft 5 in)
Width	1.58 m (5 ft 2¼ in)

DIMENSIONS, INTERNAL:

Cabin, from back of pilot's seat to rear wall:	
Length	2.30 m (7 ft 6½ in)
Max width	1.16 m (3 ft 9½ in)
Max height (at front)	1.28 m (4 ft 2½ in)
Height at rear wall	1.18 m (3 ft 10½ in)
Floor area	2.67 m² (28.6 sq ft)
Volume	3.28 m³ (107 cu ft)

AREAS:

Wings, gross	30.15 m² (324.5 sq ft)
Ailerons (total)	3.83 m² (41.2 sq ft)
Flaps (total)	3.76 m² (40.5 sq ft)
Fin	1.70 m² (18.3 sq ft)
Rudder, incl tabs	0.96 m² (10.3 sq ft)
Tailplane	4.03 m² (43.4 sq ft)
Elevator, incl tab	2.11 m² (22.7 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	1,270 kg (2,800 lb)
Max fuel weight: internal	508 kg (1,120 lb)
underwing	392 kg (864 lb)
Max payload:	
with reduced internal fuel	1,130 kg (2,491 lb)
with max internal fuel	1,062 kg (2,341 lb)
with max internal and underwing fuel	571 kg (1,259 lb)
Max T-O weight, Normal (CAR 3):	
wheels (standard)	2,800 kg (6,173 lb)
skis	2,600 kg (5,732 lb)
Max landing weight: wheels	2,660 kg (5,864 lb)
skis	2,600 kg (5,732 lb)
Max cabin floor loading	488 kg/m² (100 lb/sq ft)
Max wing loading (Normal):	
wheels	92.87 kg/m² (19.03 lb/sq ft)
skis	86.23 kg/m² (17.67 lb/sq ft)
Max power loading (Normal):	
wheels	6.83 kg/kW (11.22 lb/shp)
skis	5.13 kg/kW (8.43 lb/shp)

PERFORMANCE (at max T-O weight, ISA, Normal category):

Never-exceed speed (V_{NE})	151 kts (280 km/h; 174 mph) IAS
Econ cruising speed at 3,050 m (10,000 ft)	115 kts (213 km/h; 132 mph)
Stalling speed, power off, flaps down	52 kts (96 km/h; 60 mph)
Max rate of climb at S/L	287 m (941 ft)/min
Max operating altitude	7,620 m (25,000 ft)
T-O run at S/L	197 m (646 ft)
Landing run at S/L	127 m (417 ft)
Max range at 115 kt (213 km/h; 132 mph) at 3,050 m (10,000 ft), no reserves:	
with max payload	394 n miles (730 km; 453 miles)
with max internal fuel	500 n miles (926 km; 576 miles)
with max internal and underwing fuel	870 n miles (1,612 km; 1,002 miles)
g limits	+3.72/−1.5

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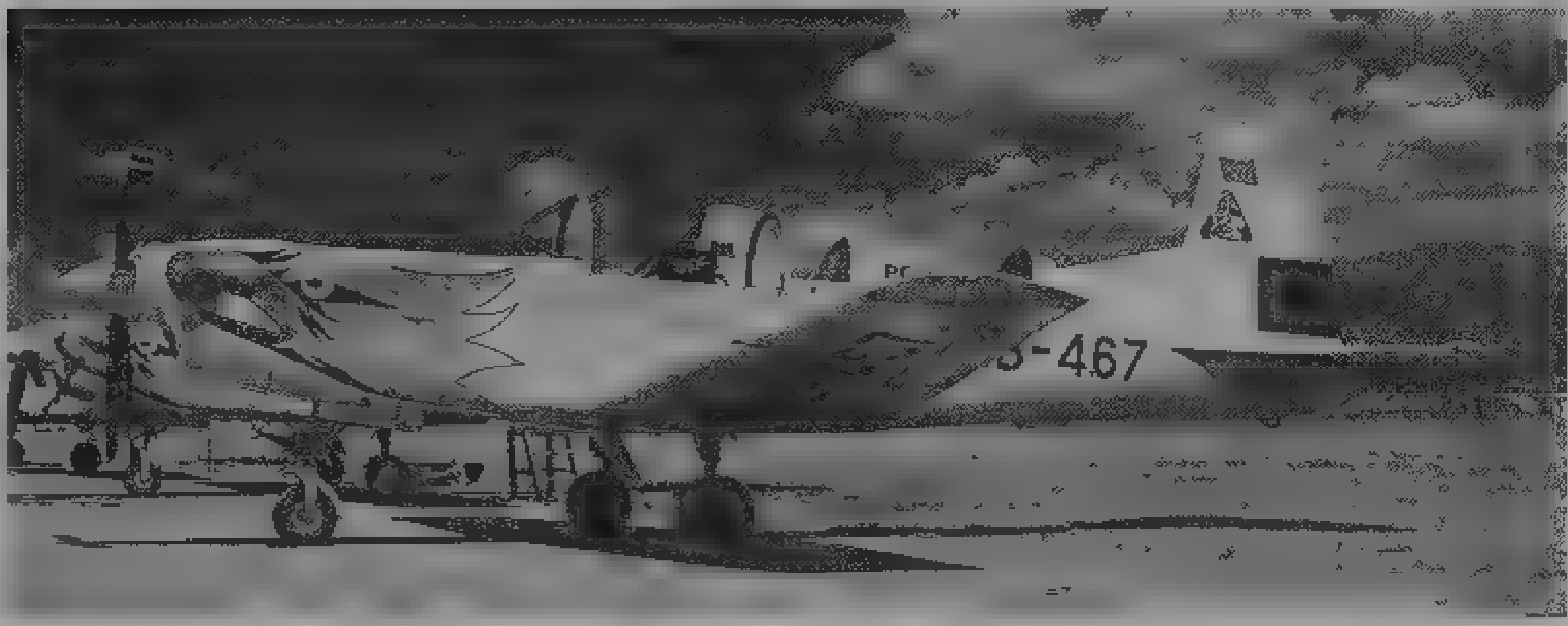
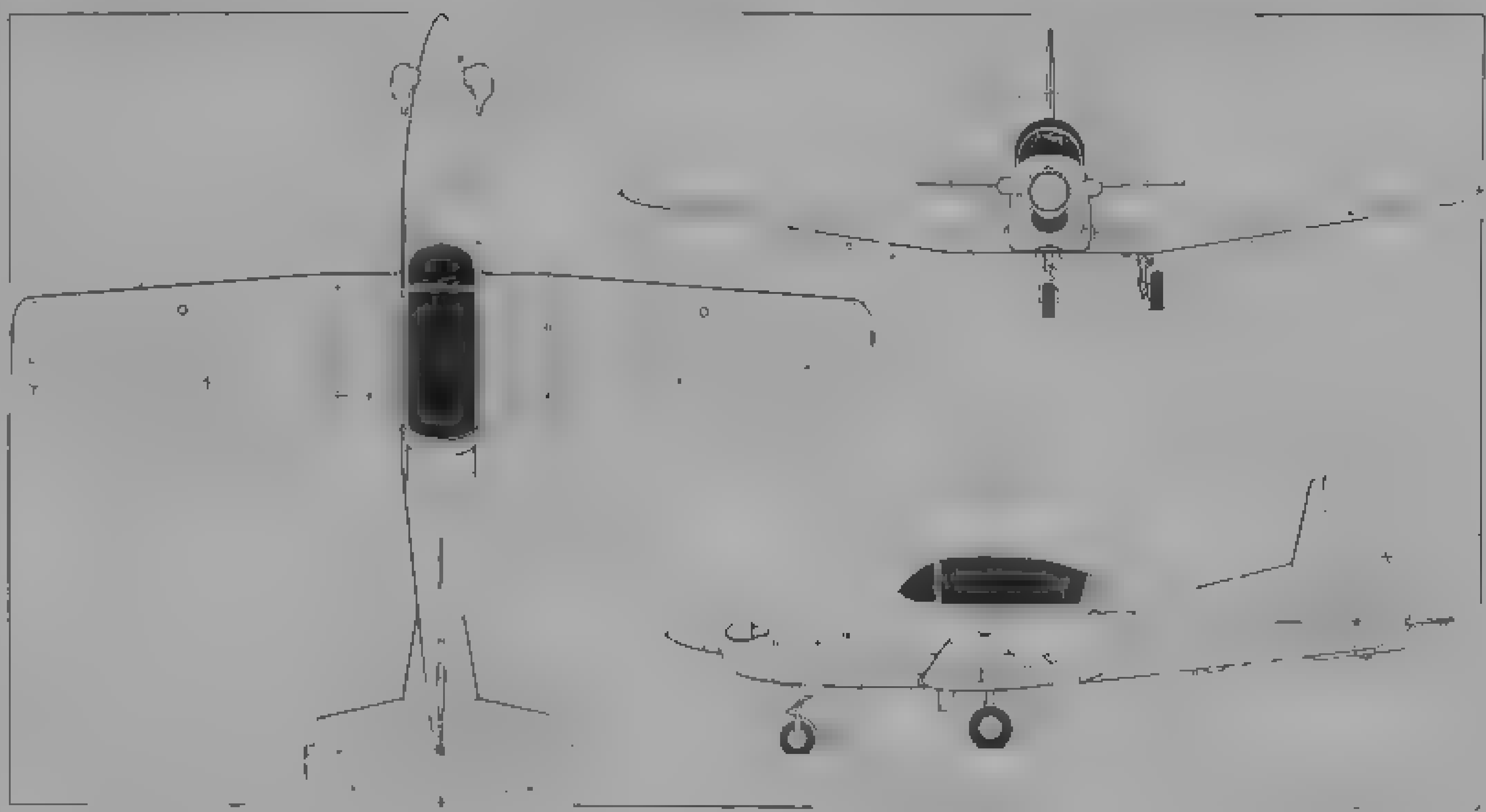


PC-7 Turbo-Trainers of the Bolivian Air Force

1995



Pilatus PC-7 Turbo-Trainer (Pratt & Whitney Canada PT6A-25A turboprop) (*Jane's/Dennis Punnett*)

1993

PILATUS PC-7 TURBO-TRAINER

Swiss Air Force designation: PC-7/CH

TYPE: Two-seat turboprop trainer.

PROGRAMME: First flight production PC-7, 18 August 1978; Swiss federal civil Aerobatic category certification 5 December 1978; first deliveries December 1978. Swiss Utility category 6 April 1979; French DGAC certification 16 May 1983; US FAR Pt 23 certification 12 August 1983; meets selected group of US military trainer category specifications.

CURRENT VERSIONS: **PC-7**: Standard version, *to which detailed description applies*.

PC-7 Mk II: Modified version for South Africa; described separately.

CUSTOMERS: Total deliveries (excluding South Africa) over 440 by early 1995; customers (see also 1992-93 *Jane's*) include air forces of Abu Dhabi, Angola, Austria, Bolivia, Chile, France (for CEV), Guatemala, Iran, Iraq, Malaysia, Mexico, Myanmar, Netherlands, Switzerland, Uruguay and four undisclosed countries; others include four US private owners. French Patrouille ECCO formation display team operates four with smoke generators.

DESIGN FEATURES: Constant chord centre-section and tapered outer sections with 1° quarter-chord sweepback; wing section NACA 64₂A 415 at root and 64₁A 612 at tip; dihedral 7° on outer panels. Six underwing stations for external stores.

FLYING CONTROLS: Elevators and rudder cable operated; mass balanced ailerons pushrod operated; trim tab in starboard half of elevator, anti-servo tab in rudder, trim tab in port aileron; strakes under rear fuselage and at tailplane leading-edges; dorsal fin; electrically operated split flaps extending under fuselage.

STRUCTURE: All-metal with some GFRP fairings on wings and fuselage; one-piece single-spar wing with auxiliary spar, ribs and stringer-reinforced skin; tail surface structure similar to wing.

LANDING GEAR: Electrically actuated retractable tricycle type, with emergency manual extension. Mainwheels retract inward, nosewheel rearward. Oleo-pneumatic shock absorber in each unit. Castoring nosewheel, with shimmy dampers. Goodrich mainwheels and tyres, size 6.50-8, pressure 4.5 bars (65 lb/sq in). Goodrich nosewheel and tyre, size 6.00-6, pressure 2.75 bars (40 lb/sq in). No mainwheel doors. Goodrich hydraulic disc brakes on mainwheels. Parking brake.

POWER PLANT: One 485 kW (650 shp) Pratt & Whitney Canada PT6A-25A turboprop, flat rated at 410 kW (550 shp at S/L), driving a Hartzell HC-B3TN-2/T10173C-8 three-blade constant-speed fully feathering propeller. Fuel in integral tanks in outer wing leading-edges, total usable capacity 474 litres (125 US gallons; 104 Imp gallons). Overwing refuelling point on each tank. Engine oil system permits up to 30 seconds of inverted flight. Provision for

Malaysian Police PC-6/B2-H4 Turbo-Porter with wing-mounted radar and underwing fuel tanks

1995

Pilatus PC 7 Mk II prototype in the former insignia of the South African Air Force

1994

two 152 or 240 litre (40 or 63.5 US gallon; 33.5 or 52.75 Imp gallon) underwing drop tanks. Oil capacity 16 litres (4.2 US gallons, 3.5 Imp gallons)

ACCOMMODATION: Adjustable seats for two persons in tandem (instructor at rear), beneath rearward-sliding jettisonable Plexiglas canopy. Martin-Baker Mk CH 15A lightweight ejection seats, available optionally, offer safe escape for both occupants at speeds between 60 knots on runway and 300 knots in the air (111 and 556 km/h, 69 and 345 mph), and at altitudes up to 6,700 m (22,000 ft). Dual controls standard. Cockpits ventilated and heated by engine bleed air, which can also be used for windscreen de-icing. Space for 25 kg (55 lb) of baggage aft of seats, with external access

SYSTEMS: Freon air conditioning and oxygen systems standard. Hydraulic system for mainwheel brakes only. No pneumatic system. 28 V DC operational electrical system incorporating Lear Siegler 30 V 200 A starter/generator and Marathon 36 Ah or 42 Ah Ni/Cd battery; two static inverters for AC power supply. Ground power receptacle in port side of rear fuselage. Goodrich propeller electric de-icing system optional

AVIONICS: *Flight*: Basic flight and navigation instrumentation in both cockpits, except for magnetic compass (front cockpit only). Additional nav and com equipment to customer's requirements

EQUIPMENT: Landing/taxying light standard on each mainwheel leg. Optional equipment includes hood to screen pupil from rear cockpit during IFR training

DIMENSIONS, EXTERNAL:

Wing span	10.40 m (34 ft 1 in)
Wing chord: mean aerodynamic	1.64 m (5 ft 5 in)
mean geometric	1.60 m (5 ft 3 in)
Wing aspect ratio	6.52
Length overall	9.78 m (32 ft 1 in)
Height overall	3.21 m (10 ft 6 in)
Tailplane span	3.40 m (11 ft 2 in)
Wheel track	2.54 m (8 ft 4 in)
Wheelbase	2.32 m (7 ft 7 in)
Propeller diameter	2.36 m (7 ft 9 in)

AREAS:

Wings, gross	16.60 m² (179.0 sq ft)
Ailerons (total)	1.621 m² (17.45 sq ft)
Trailing-edge flaps (total)	2.035 m² (21.90 sq ft)
Fin, incl dorsal fin	1.062 m² (11.43 sq ft)
Rudder, incl tab	0.959 m² (10.32 sq ft)
Tailplane	1.783 m² (19.19 sq ft)
Elevators, incl tab	1.395 m² (15.02 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility category):

Basic weight empty	1,330 kg (2,932 lb)
Max T-O weight: A	1,900 kg (4,188 lb)
U	2,700 kg (5,952 lb)
Max ramp weight: U	2,711 kg (5,976 lb)
Max landing weight	
A (military specification)	1,804 kg (3,977 lb)
A (FAR Pt 23)	1,900 kg (4,188 lb)
U	2,565 kg (5,655 lb)
Max zero-fuel weight	1,664 kg (3,668 lb)
Max wing loading: A	114.5 kg/m² (23.44 lb/sq ft)
U	162.7 kg/m² (33.31 lb/sq ft)
Max power loading: A	4.63 kg/kW (7.61 lb/shp)
U	6.59 kg/kW (10.82 lb/shp)

PERFORMANCE (at max T-O weight, ISA, except where indicated):

Never-exceed speed (VNE)	
A, U	270 kts (500 km/h, 310 mph) EAS
Max operating speed	
A, U	270 kts (500 km/h, 310 mph) EAS
Max cruising speed at 6,100 m (20,000 ft)	
A	222 kts (412 km/h, 256 mph)
U	196 kts (364 km/h, 226 mph)
Econ cruising speed at 6,100 m (20,000 ft):	
A	171 kts (317 km/h; 197 mph)
U	165 kts (305 km/h, 190 mph)
Manoeuvring speed	
A	175 kts (325 km/h, 202 mph) EAS
U	181 kts (335 km/h, 208 mph) EAS
Max speed with flaps and landing gear down	
A, U	135 kts (250 km/h, 155 mph) EAS
Stalling speed, flaps and landing gear up, power off	
A	71 kts (131 km/h, 82 mph) EAS
U	83 kts (154 km/h, 96 mph) EAS
Stalling speed, flaps and landing gear down, power off	
A	64 kts (119 km/h, 74 mph) EAS
U	74 kts (138 km/h, 86 mph) EAS
Max rate of climb at S/L: A	655 m (2,150 ft)/min
U	393 m (1,290 ft)/min
Time to 5,000 m (16,400 ft): A	9 min
U	17 min
Max operating altitude	7,620 m (25,000 ft)
Service ceiling: A	10,060 m (33,000 ft)
U	7,925 m (26,000 ft)
T-O run at S/L: A	240 m (787 ft)
U	780 m (2,560 ft)
T-O to 15 m (50 ft) at S/L: A	400 m (1,312 ft)
U	1,180 m (3,870 ft)
Landing from 15 m (50 ft) at S/L at max landing weight	
A	510 m (1,675 ft)
U	800 m (2,625 ft)
Landing run at S/L at max landing weight	
A	295 m (968 ft)
U	505 m (1,655 ft)
Max range at cruise power at 5,000 m (16,400 ft), 5% fuel plus 20 min reserves	
A	647 n miles (1,200 km; 745 miles)
U	1,420 n miles (2,630 km; 1,634 miles)
Endurance at 6,100 m (20,000 ft), with reserves	
A, at max speed	3 h 0 min
A, for max range	4 h 22 min
U, at max speed	2 h 36 min
U, for max range	3 h 45 min
g limits: A	+6/−3
U	+4.5/−2.25

UPDATED

PILATUS PC-7 MK II TURBO-TRAINER

SAAF name: Astra

TYPE: Two-seat turboprop trainer

PROGRAMME: Launched 1992 and developed to bid for South African Air Force requirement; first of two prototypes (HB-HMR) made first flight 28 September 1992; SAAF contract announced June 1993, first production aircraft started January 1994 and made first flight August 1994, 12 kits delivered by 1 January 1995 and continuing at 2½ per month, for assembly by Atlas

CUSTOMERS: South African Air Force (60), to replace AT-6G Harvard/Texans

DESIGN FEATURES: Reduced-drag airframe based on that of PC-9; higher powered PT6A-25 engine with four-blade propeller; Martin-Baker CH 11A ejection seats standard; optimised flying controls

FLYING CONTROLS: Generally as for PC-9 except that ventral airbrake is optional, stall strips and ventral fin added to improve stall characteristics and directional stability

STRUCTURE: Generally as for PC-7/PC-9, but some components (flaps, tailplanes, elevators, rudder and engine cowlings) of South African (Atlas) manufacture

LANDING GEAR: As described for PC-7, but with hydraulic actuation, Dunlop tyres and higher tyre pressures (main wheels 4.62 bars; 67 lb/sq in, nosewheel 3.79 bars; 55 lb/sq in). Steering ±61° by differential braking, nosewheel steering (±12°) standard. Simera is landing gear subcontractor. Minimum ground turning radius 11.125 m (36 ft 6 in), based on nosewheel

POWER PLANT: One 522 kW (700 shp) Pratt & Whitney Canada PT6A-25C turboprop, driving a Hartzell HC-D4N-2A four-blade constant-speed fully feathering propeller. Two integral wing fuel tanks and collector tanks, each of 235 litres (62.1 US gallons, 51.7 Imp gallons) capacity, plus a 12 litre (3.2 US gallon, 2.6 Imp gallon) aerobatic tank, giving total internal capacity of 482 litres (127.3 US gallons, 106 Imp gallons). Provision for 155 litre (41 US gallon, 34 Imp gallon) long-range auxiliary tank or 246 litre (65 US gallon, 54 Imp gallon) ferry tank under each wing. Single overwing gravity fuelling point each side. Oil capacity 16 litres (4.25 US gallons; 3.5 Imp gallons). Capability for 30 seconds of inverted flight

ACCOMMODATION: Instructor and pupil in tandem on Martin-Baker CH 11A ejection seats. Canopy opens sideways to starboard. Cockpits unpressurised

SYSTEMS: Vapour cycle air conditioning system. Hydraulic system, pressure 207 bars (3,000 lb/sq in), for landing gear actuation and optional airbrake and nosewheel steering; system maximum flow rate 18.8 litres (4.97 US gallons; 4.13 Imp gallons)/min. Electrical system (28 V DC) powered by 200 A starter/generator and 24 V Ni/Cd battery. Gaseous oxygen system

AVIONICS (Astra): ATE of South Africa is overall systems integrator; all of South African origin except ADF and panel displays.

Comms: Dual Barcom VHF radios, ESD intercom and transponder

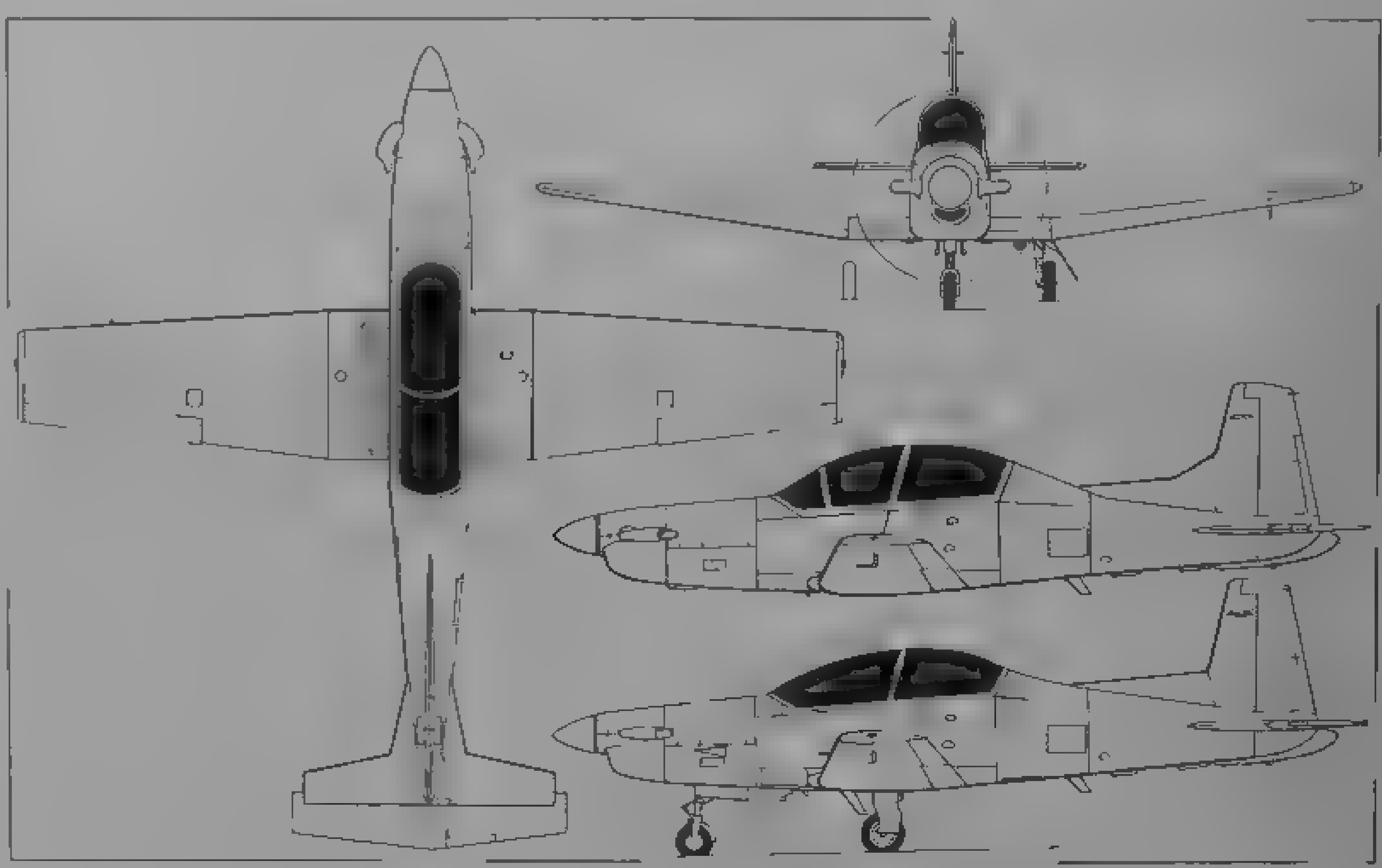
Flight: ESD VOR/ILS and DME, Kentron AHRS, Collins ADF, Avitronics flight management system computer.

Instrumentation: Plessey Telumat mode selection panel, XCel MFDs; Sextant Avionique flat panel displays, altimeters and other instrumentation provided by SAAF.

ARMAMENT: Engineered to inhibit fitment of weapons.

DIMENSIONS, EXTERNAL:

Wing span	10.12 m (33 ft 2¼ in)
Wing chord, at root	1.88 m (6 ft 2 in)
at tip	1.14 m (3 ft 9 in)
Wing aspect ratio	6.29



Pilatus PC-9 basic/advanced trainer, with additional side view (top) of JPATS Mk II *(Jane's/Dennis Punnett)*

1993

Length overall	10 13 m (33 ft 2¾ in)
Fuselage. Max width	0 972 m (3 ft 2¼ in)
Height overall	3 26 m (10 ft 8¼ in)
Tailplane span	3 70 m (12 ft 1¾ in)
Wheel track	2 54 m (8 ft 4 in)
Wheelbase	2 312 m (7 ft 7 in)
Propeller diameter	2.44 m (8 ft 0 in)
Propeller ground clearance	0 388 m (1 ft 3¼ in)

DIMENSIONS, INTERNAL:

Baggage compartment volume	0 14 m³ (4 94 cu ft)

AREAS: As for PC-9 except:

Tailplane	1 98 m² (21 31 sq ft)
Elevators (total, incl tab)	1 64 m² (17 65 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility category):

Basic weight empty, equipped	1 670 kg (3,682 lb)
Max T-O weight: A	2,250 kg (4,960 lb)
U	2,700 kg (5,952 lb)
Max ramp weight: A	2,260 kg (4,982 lb)
U	2,710 kg (5 974 lb)
Max landing weight: A	2,250 kg (4,960 lb)
U	2 565 kg (5,655 lb)
Max zero-fuel weight: A, U	1 900 kg (4,189 lb)
Max wing loading: A	138 1 kg/m² (28 29 lb/sq ft)
U	165 7 kg/m² (33 95 lb/sq ft)
Max power loading: A	4 31 kg/kW (7 09 lb/shp)
U	5 18 kg/kW (8 50 lb/shp)

PERFORMANCE (at max Aerobatic T-O weight):

Never-exceed (V_{NE}) and max level speed
300 kts (555 km/h, 345 mph)

Max cruising speed at 3 050 m (10 000 ft)
250 kts (463 km/h, 288 mph)

Stalling speed, engine idling:

flaps up	79 kts (147 km/h, 91 mph)
flaps down	70 kts (130 km/h, 81 mph)
Max rate of climb at S/L	824 m (2,705 ft)/min
Service ceiling	8,380 m (27,500 ft)
T-O run	260 m (853 ft)
T-O to 15 m (50 ft)	530 m (1,739 ft)
Landing from 15 m (50 ft)	485 m (1,592 ft)
Landing run	365 m (1,198 ft)

Range with max internal fuel, 5% and 20 min reserves
730 n miles (1,352 km, 840 miles)

Endurance at 243 kts (450 km/h, 279 mph) 1 h 30 min

UPDATED

PILATUS PC-9

TYPE: Two-seat turboprop trainer

PROGRAMME: Design began May 1982; aerodynamic elements tested on PC-7 1982-83, first flights by two preproduction PC-9s, HB-HPA on 7 May 1984 and HB-HPB on 20 July 1984, aerobatic certification 19 September 1985

CURRENT VERSIONS: **Standard PC-9**: *Description applies to this version*

PC-9/A: Australian version

PC-9B: German target towing version, operated for Luftwaffe by civilian company, increased fuel for 3 hours 20 minutes mission, two Southwest RM-24 winches on inboard pylons with targets stowed aft of winch, TAS 06 acoustic scoring system

PC-9 Mk II: Modified for US Air Force/Navy JPATS trainer programme; described separately

CUSTOMERS: Total sales more than 200 to 11 customers including Germany (10) and eight air forces including those of Australia (67), Cyprus (two), Iraq (20), Myanmar (four), Saudi Arabia (30), Switzerland (12) and Thailand (20)

DESIGN FEATURES: Meets FAR Pt 23 (Amendments 1 to 28) and special Swiss federal civil conditions for both Aerobatic and Utility categories; complies with selected parts of US military training specifications, approximately 9 per cent structural commonality with standard PC-7, parallel chord wing centre-section; tapered outer panels with quarter-chord sweepback 1°. Wing section PIL15M825 at root, PIL12M850 at tip; dihedral 7° from centre-section incidence 1° at root, twist −2

FLYING CONTROLS: Cable operated elevator and rudder; mass balanced, electrically actuated trim tab in starboard half of elevator; electrically actuated trim/anti-balance tab in rudder controlled from rocker switch on power control lever ailerons operated by pushrods, electrically operated lateral trim, hydraulically operated split flaps, hydraulically operated airbrake panel under centre-fuselage

STRUCTURE: All metal with some GFRP wing/fuselage fairings; one-piece wing with auxiliary spar, ribs and stringer reinforced skin

LANDING GEAR: Retractable tricycle type, with hydraulic actuation in both normal and emergency modes. Mainwheels retract inward into wing centre-section, nosewheel rearward, all units enclosed by doors when retracted. Oleo-pneumatic shock-absorber in each leg. Hydraulically actuated nosewheel steering. Goodrich wheels and tyres, with Goodrich multipiston hydraulic disc brakes on main wheels. RAAF version has low-pressure tyres for grass field operation. Parking brake

POWER PLANT: One 857 kW (1,150 shp) Pratt & Whitney Canada PT6A-62 turboprop, flat rated at 708 kW (950 shp), driving a Hartzell HC-D4N ZA/09512A four-blade constant-speed fully feathering propeller. Single lever engine control. Fuel in two integral tanks in wing leading edges, total usable capacity 535 litres (141 3 US gallons, 117 7 Imp gallons). Overwing refuelling point on each side. Fuel system includes 12 litre (3 2 US gallon, 2.6 Imp gallon) aerobatics tank in fuselage, forward of front cockpit, which permits up to 60 s of inverted flight. Provision for two 154 or 248 litre (40.7 or 65 5 US gallon, 33 9 or 54.5 Imp gallon) drop tanks on centre underwing attachment points. Total oil capacity 16 litres (4 2 US gallons, 3 5 Imp gallons)

ACCOMMODATION: Two Martin-Baker Mk CH 11A adjustable ejection seats, each with integrated personal survival pack and fighter-standard pilot equipment. Stepped tandem arrangement with rear seat elevated 15 cm (6.3 in). Seats operable, through canopy, at zero height and speeds down to 60 knots (112 km/h; 70 mph). Anti g system optional. One-piece acrylic Perspex windscreen, one-piece framed canopy, incorporating rollover bar, opens sideways to starboard. Dual controls standard. Cockpit heating, cooling, ventilation and canopy demisting standard. Space for 25 kg (55 lb) of baggage aft of seats, with external access

SYSTEMS: AiResearch ECS, using air cycle and engine bleed air, for cockpit heating/ventilation and canopy demisting. Fairey Systems hydraulic system, pressure 207 bars (3,000 lb/sq in), for actuation of landing gear, mainwheel doors, nosewheel steering, flaps and airbrake, system maximum flow rate 18 8 litres (4 97 US gallons, 4 14 Imp gallons)/min. Bootstrap oil/oil reservoir, pressurised at 3 45 to 207 bars (50 to 3,000 lb/sq in). Oil/nitrogen accumulator, also charged to 207 bars (3,000 lb/sq in), provides emergency hydraulic power for flaps and landing gear. Primary electrical system (28 V DC operational, 24 V nominal) powered by Lear Siegler 30 V 200 A starter/generator and 24 V 40 Ah battery, two static inverters supply 115/26 V AC power at 400 Hz. Ground power receptacle. Electric anti icing of pitot tube, static ports and AoA transmitter standard, electric de-icing of propeller blades optional. Diluter demand oxygen system, selected and controlled individually from panel in each cockpit

AVIONICS: Both cockpits fully instrumented to customer specifications, with Logic computer operated integrated engine and systems data display. Customer-specified equipment provides flight environmental, attitude and direction data, and ground-transmitted position determining information

Comms: Single or dual VHF, UHF and/or HF radios to customer's requirements. Audio integrating system controls audio services from com, nav and interphone systems

Optional equipment includes Bendix/King CRT displays (electronic ADI and HSI, standard on PC-9/A), J E T HUDs, encoding altimeter and ELT

EQUIPMENT: Retractable 250 W landing/taxying light in each main landing gear leg bay

DIMENSIONS, EXTERNAL:

Wing span	10.19 m (33 ft 5¼ in)
Wing chord: mean aerodynamic	1.65 m (5 ft 5 in)
mean geometric	1 61 m (5 ft 3½ in)
Wing aspect ratio	6 29
Length overall	10.175 m (33 ft 4¼ in)
Height overall	3 26 m (10 ft 8¼ in)
Wheel track	2 54 m (8 ft 4 in)
Propeller diameter	2 44 m (8 ft 0 in)

AREAS:

Wings, gross	16 29 m² (175.3 sq ft)
Ailerons (total)	1 57 m² (16 90 sq ft)
Trailing-edge flaps (total)	1.77 m² (19 05 sq ft)
Airbrake	0 30 m² (3 23 sq ft)
Fin	0 86 m² (9 26 sq ft)
Rudder, incl tab	0 90 m² (9 69 sq ft)
Tailplane	1 80 m² (19 38 sq ft)
Elevator, incl tab	1 60 m² (17 22 sq ft)

WEIGHTS AND LOADINGS (A: Aerobatic, U: Utility):

Basic weight empty	1,685 kg (3,715 lb)
Max T-O weight: A	2,250 kg (4,960 lb)
U	3,200 kg (7,055 lb)
Max ramp weight: A	2,260 kg (4,982 lb)
U	3,210 kg (7,077 lb)
Max landing weight: A	2,250 kg (4,960 lb)
U	3 100 kg (6,834 lb)
Max zero-fuel weight: A	1,900 kg (4,188 lb)
Max wing loading: A	138.1 kg/m² (28 3 lb/sq ft)
U	196.4 kg/m² (40 2 lb/sq ft)
Max power loading: A	3.18 kg/kW (5.22 lb/shp)
U	4 52 kg/kW (7.42 lb/shp)

PERFORMANCE (at appropriate max T-O weight, ISA, propeller speed 2,000 rpm):

Max permissible diving speed (V_D): A, U
Mach 0 73 (360 kts, 667 km/h, 414 mph EAS)

Max operating speed: A, U
Mach 0 68 (320 kts, 593 km/h, 368 mph EAS)

Max level speed:

A at S/L 270 kts (500 km/h, 311 mph)

A at 6,100 m (20 000 ft)
300 kts (556 km/h, 345 mph)

Max manoeuvring speed:

A	210 kts (389 km/h, 242 mph) EAS
U	200 kts (370 km/h, 230 mph) EAS

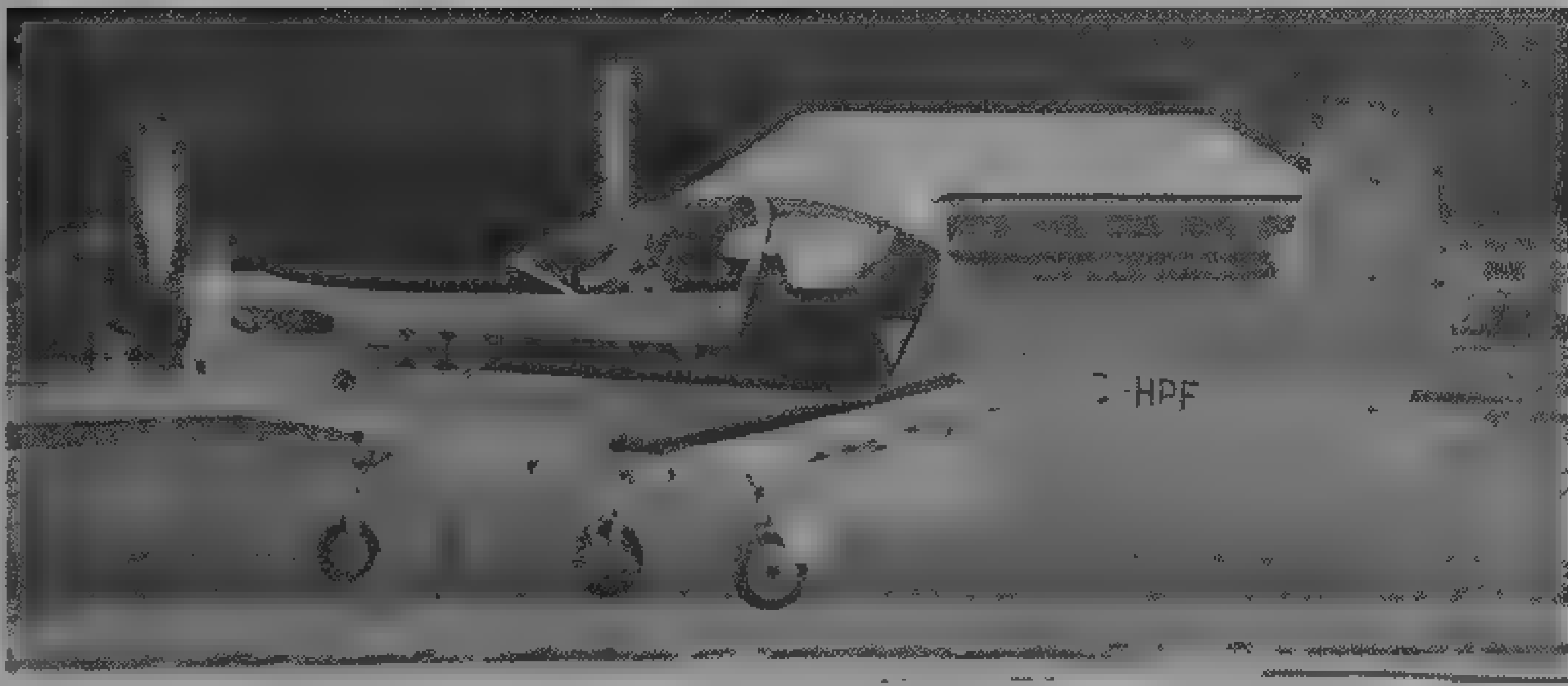
Max speed with flaps and/or landing gear down:

A and U 150 kts (278 km/h, 172 mph) EAS

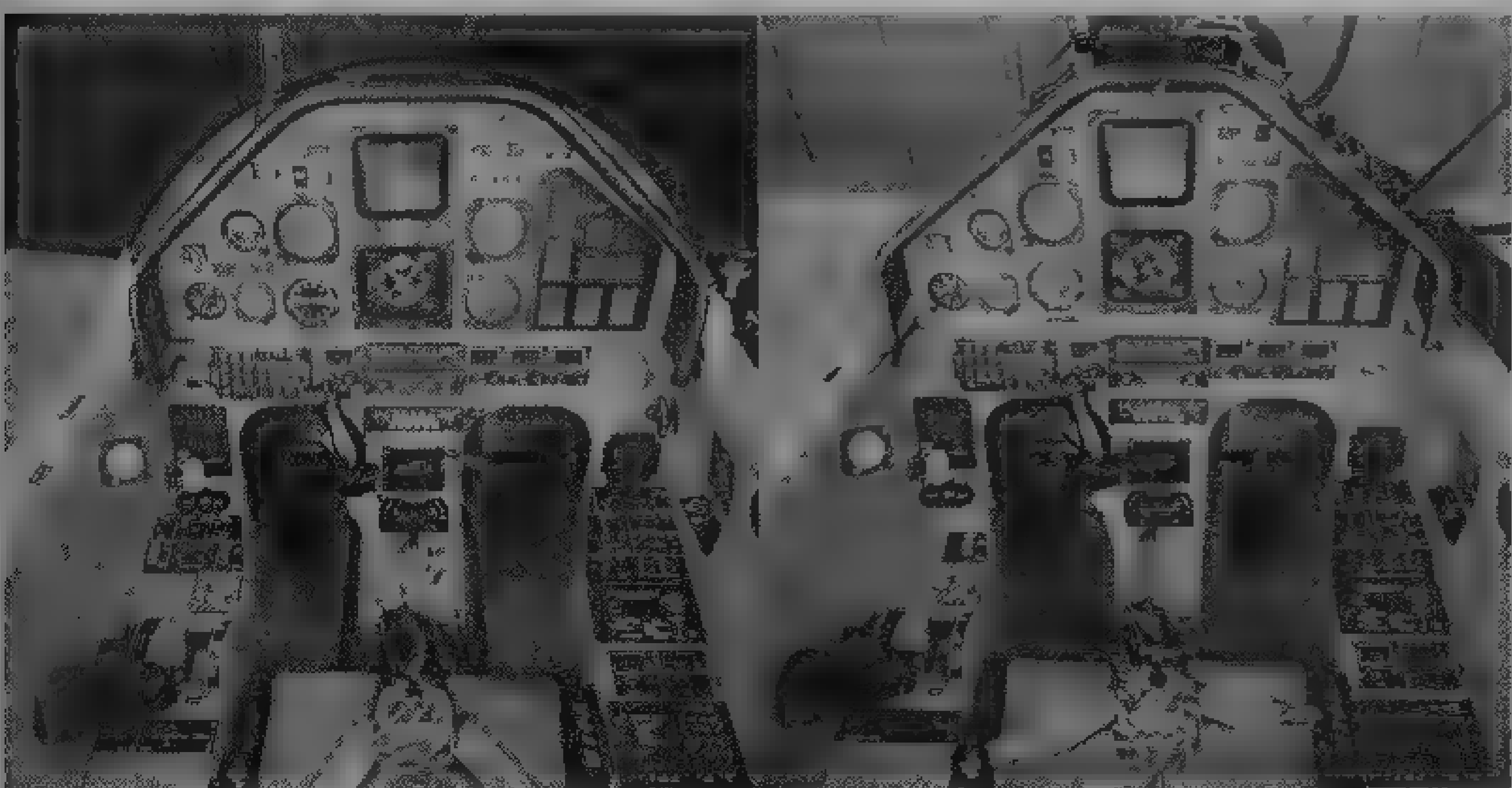
Stalling speed, engine idling:

A, flaps and landing gear up
79 kts (147 km/h, 91 mph) EAS

U, flaps and landing gear up
93 kts (172 km/h, 107 mph) EAS



Pilatus PC-9 (one Pratt & Whitney Canada PT6A-62 turboprop) *(Paul Jackson)* 1995



Front (left) and rear cockpits of the PC-9, showing EFIS and LCD engine displays 1993

A, flaps and landing gear down
70 kts (130 km/h, 81 mph) EAS
U, flaps and landing gear down
86 kts (159 km/h 99 mph) EAS
Max rate of climb at S/L: A 1,247 m (4,090 ft)/min
Time to 4,575 m (15,000 ft): A 4 min 30 s
Max operating altitude 7,620 m (25,000 ft)
Service ceiling 11,580 m (38,000 ft)
T-O run at S/L: A 227 m (745 ft)
T-O to 15 m (50 ft) at S/L: A 375 m (1,231 ft)
Landing from 15 m (50 ft) at S/L: A 540 m (1,772 ft)
Landing run at S/L:
A (normal braking action) 417 m (1,368 ft)
Max range at cruise power at 7,620 m (25,000 ft), 5% fuel plus 20 min reserves
887 n miles (1,642 km, 1,020 miles)
Endurance (typical mission power settings)
2 sorties of 1 h duration plus 20 min reserves
g limits: A +7/-3.5
U +4.5/-2.25

UPDATED

PILATUS/RAYTHEON PC-9 Mk II

TYPE: Modified PC-9 for US JPATS competition.

PROGRAMME: Entered for US Air Force/Navy JPATS trainer programme following August 1990 agreement with Beech Aircraft Corporation (now Raytheon, which see); two PC-9s supplied by Pilatus as demonstrators, one of which (N26BA) converted as engineering testbed, making first flight with new engine and canopy September 1992; it flew more than 260 hours on engineering development. Beech also manufactured (designation PD373) two production prototypes (first flight 23 December 1992 by N8284M, second aircraft, N209BA, made first flight July 1993). Declared JPATS winner June 1995.

DESIGN FEATURES: Approximately 70 per cent redesign including strengthened fuselage, pressurised cockpits with larger and more birdstrike resistant canopy (no penetration by 2 kg; 4 lb bird at 270 kts; 500 km/h; 311 mph); more powerful engine, increased fuel capacity and single-point pressure fuelling, new digital avionics.

STRUCTURE: Generally as for standard PC-9, but modified dorsal fin; possible use of honeycomb panels in fuselage; empty weight increased by approximately 317.5 kg (700 lb).

POWER PLANT: One 1,274 kW (1,708 shp) Pratt & Whitney Canada PT6A-68 turboprop, flat rated at 895 kW (1,200 shp). Wing tank fuel capacity increased to 700 litres (185 US gallons, 154 Imp gallons). Overwing and single-point pressure refuelling.

ACCOMMODATION: Martin-Baker US Mk 16LA zero/zero ejection seats, rear seat position modified to improve instructor's view. Cockpits pressurised (maximum differential 0.24 bar; 3.5 lb/sq in). Canopy deeper, strengthened with extra frame at front, and made from more impact resistant acrylic.

AVIONICS: All-digital.

UPDATED

PILATUS PC-12

TYPE: Single-turboprop pressurised utility/business transport.

PROGRAMME: Announced at NBAA Show October 1989; first flight P 01 (HB-FOA) 31 May 1991; announced October 1991 that parent company Oerlikon Buhrle would fund remaining development cost to make PC-12 a single company programme; more than 290 hours in 295 flights by November 1992; first flight of second prototype (HB-FOB) 28 May 1993; Swiss certification to FAR Pt 23 Amendment 42 (covering FAR Pt 135 commercial and Pt 91 general operations) received 30 March 1994, FAA type approval 15 July 1994.

CURRENT VERSIONS: **Standard**: Nine-passenger combi.
Detailed description applies to standard PC-12 except where indicated.
Executive: Six-passenger combi.
PC-12F: Planned freighter version.
Military: Planned future version.

CUSTOMERS: Total of 33 firm orders and 12 options by 1 December 1994. Nine aircraft (including prototypes) built by 1 January 1995, further 24 planned during 1995. Customer deliveries began September 1994 (N312 to USA); six delivered by 31 December 1994 (USA five, Japan one). Subsequent deliveries include two to Royal Flying Doctor Service in South Australia.

COSTS: Basic price $1.95 million (1994).

DESIGN FEATURES: Claimed 100 knots (185 km/h, 115 mph) faster than Cessna Caravan I and longer range than Raytheon Super King Air B200; can fly three 200 n mile sectors in six hour flight; to be approved for single/two-pilot VFR/IFR operation into known icing.

Wing sections (modified NASA GA(W)-1 series), LS(1)-0417-MOD at root and LS(1)-0313 at tip, help to reduce tailplane loads; latter's T mounting reduces trim changes with power and protects against lorry strikes; CG range 25 to 46 per cent of MAC. Modifications following early flight trials include introduction of winglets, increased wing span, paired elevators instead of single surface, sweptback tailplane tips, addition of tailplane/fin bullet fairing, and enlarged dorsal fin and ventral strakes.

Pilatus PC-9 in target towing configuration

1995

FLYING CONTROLS: Mechanical, by push/pull rods and cables, servo tab in each aileron, electrically actuated Flettner tab in rudder, short span mass balanced ailerons, electrically actuated Fowler flaps cover 67 per cent of wing trailing-edge; electrically actuated (dual redundant) variable incidence tailplane.

STRUCTURE: All-metal basic structure; composites for ventral strakes and dorsal fin (Kevlar/honeycomb sandwich), wingtips (glassfibre), fairings, engine cowling (glassfibre/honeycomb sandwich) and interior trim; titanium firewall; two-spar wing with integral fuel tankage; airframe to be proved for 20,000 hour life.

Swiss Federal Aircraft Factory makes rudder, tailplane and elevators. Second production location being sought, probably in USA.

LANDING GEAR: Nardi hydraulically retractable tricycle type, with single wheel on each unit, nosewheel steerable ±60°. Suitable for operation from grass strips. Goodrich wheels and tyres on all units: size 8.50-10, pressure 3.79 bars (55 lb/sq in) on main gear; size 17.5 × 6.25-6, pressure 4.14 bars (60 lb/sq in) on nose unit. Propeller ground clearance maintained with nose leg compressed and nosewheel tyre flat. Main gear retracts inward into wings, nose gear rearward under flight deck. Minimum ground turning radius about nosewheel 4.12 m (13 ft 6¼ in).

POWER PLANT: One 1,197 kW (1,605 shp) Pratt & Whitney Canada PT6A-67B turboprop, flat rated to 895 kW (1,200 shp) for T-O and 746 kW (1,000 shp) for climb and cruise. Hartzell HC-E4A-3D/E10477K constant-speed, fully feathering reversible-pitch four-blade aluminium propeller, turning at 1,700 rpm. Two integral fuel tanks in wings, total capacity 1,540 litres (407 US gallons, 339 Imp gallons), of which 1,522 litres (402 US gallons, 335 Imp gallons) are usable. Gravity fuelling point in top of each wing. Oil capacity 11 litres (2.9 US gallons, 2.4 Imp gallons).

ACCOMMODATION: Two-seat flight deck, approved for single pilot, but dual controls and second flight instrument panel optional. Limit of nine passengers under FAR Pt 23, or business layout for six, both with toilet. Downward opening airstair crew/passenger door at front, upward opening cargo door at rear, both on port side; Type III emergency exit above wing on starboard side.

SYSTEMS: Westland ECS, maximum pressure differential 0.4 bar (5.8 lb/sq in). Vickers Systems (Germany) hydraulic system, pressure 207 bars (3,000 lb/sq in), for landing gear actuation. Lucas electrical power system (28 V DC) supplied by two engine-driven starter/generators (300 A main and 100 A standby) and 24 V 40 Ah Ni/Cd battery, with two 150 VA static inverters for 115/26 V AC power at 400 Hz. Goodrich pneumatic boot de-icing of wing and tailplane leading-edges; Goodrich electric de-icing of propeller blades; electric heating for windscreen, bleed air de-icing of engine air intake. Oxygen system for crew and passengers.

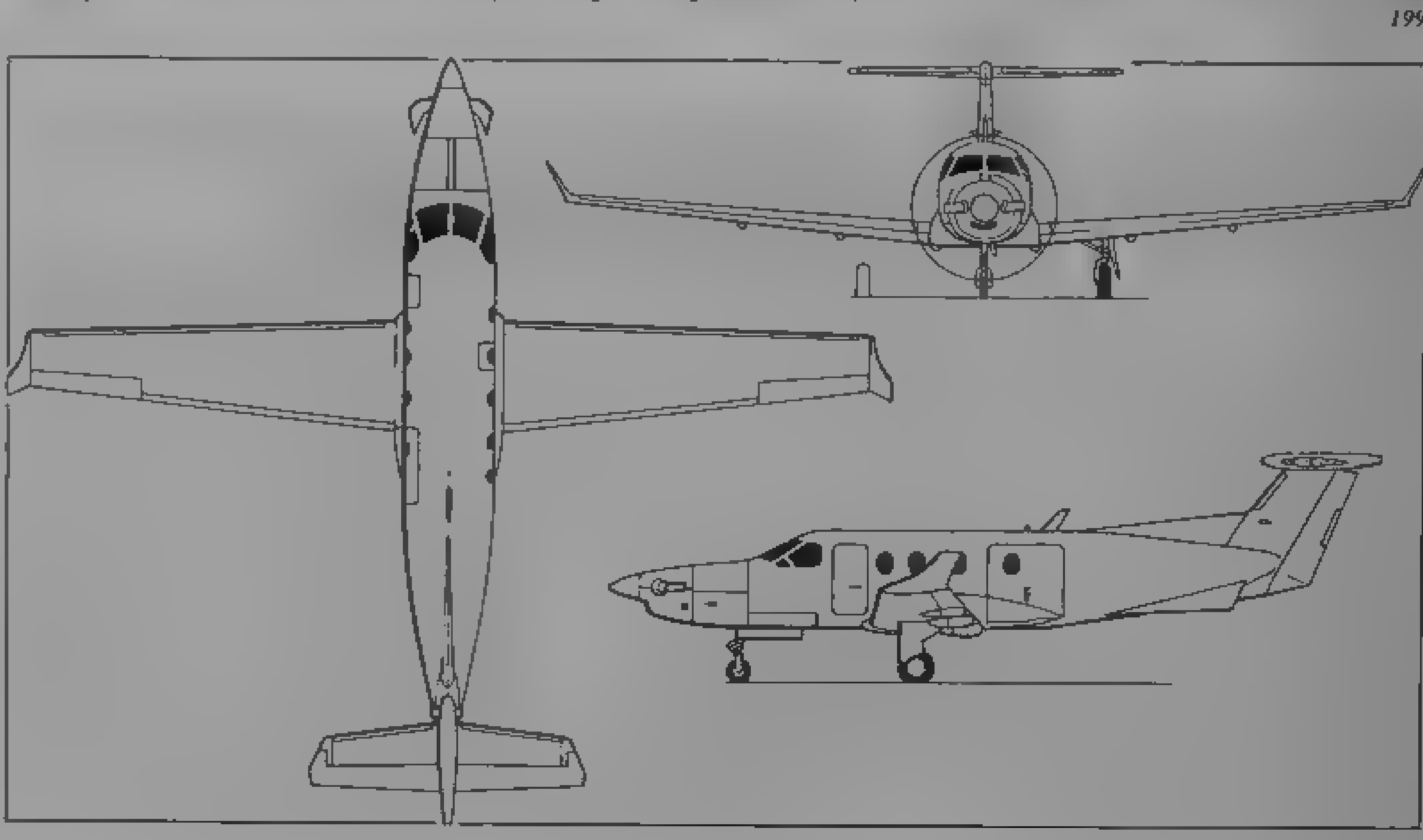
AVIONICS: *Comms*: Bendix/King dual KX 155 VHF transceivers, KMA 24H audio control panel and intercom and KT 71 transponder, and Narco ELT-910 emergency locator transmitter, standard. Bendix/King HF radio optional.

Radar: Bendix/King RDS 82CP weather radar optional.

Flight: Bendix/King KFC 325 AFCS, KN 63 DME, KR

First production Pilatus PC-12 nine-passenger, single-turboprop pressurised utility and business transport

1995

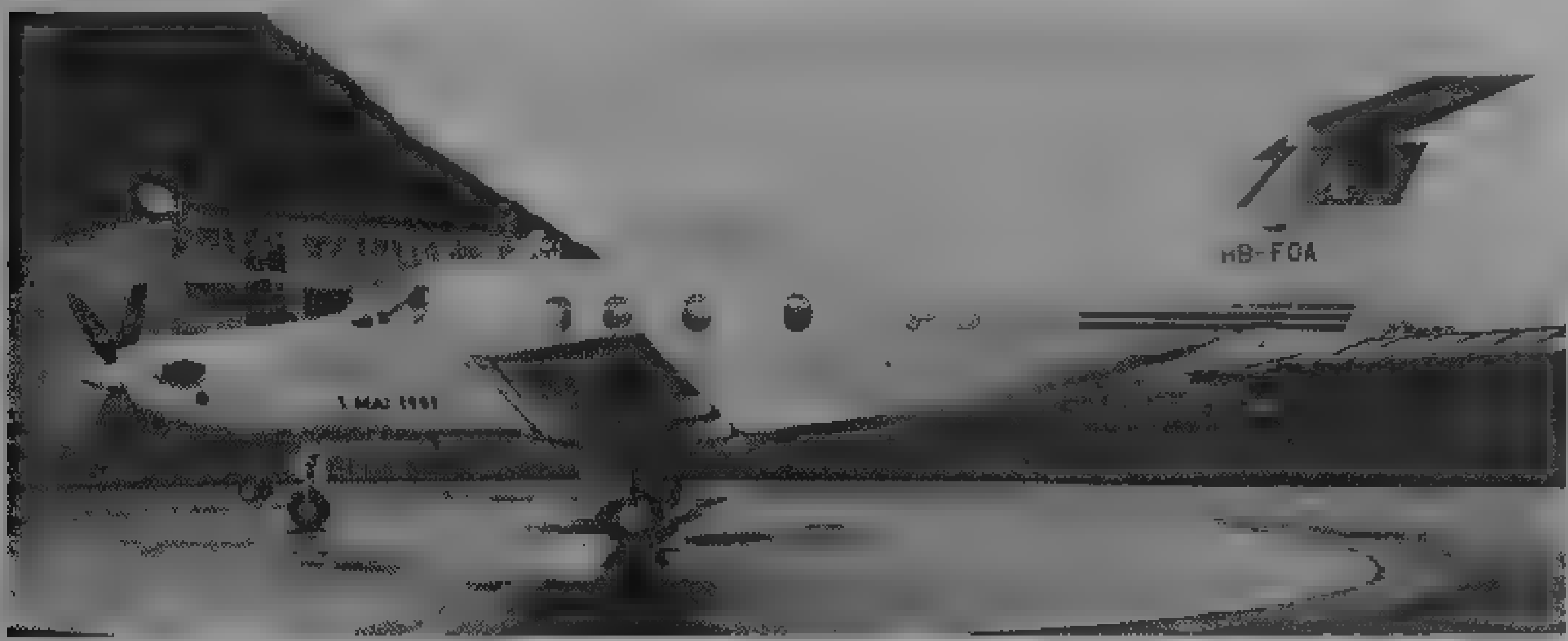


Pilatus PC-12 pressurised light utility and business transport *(Jane's/Mike Keep)*

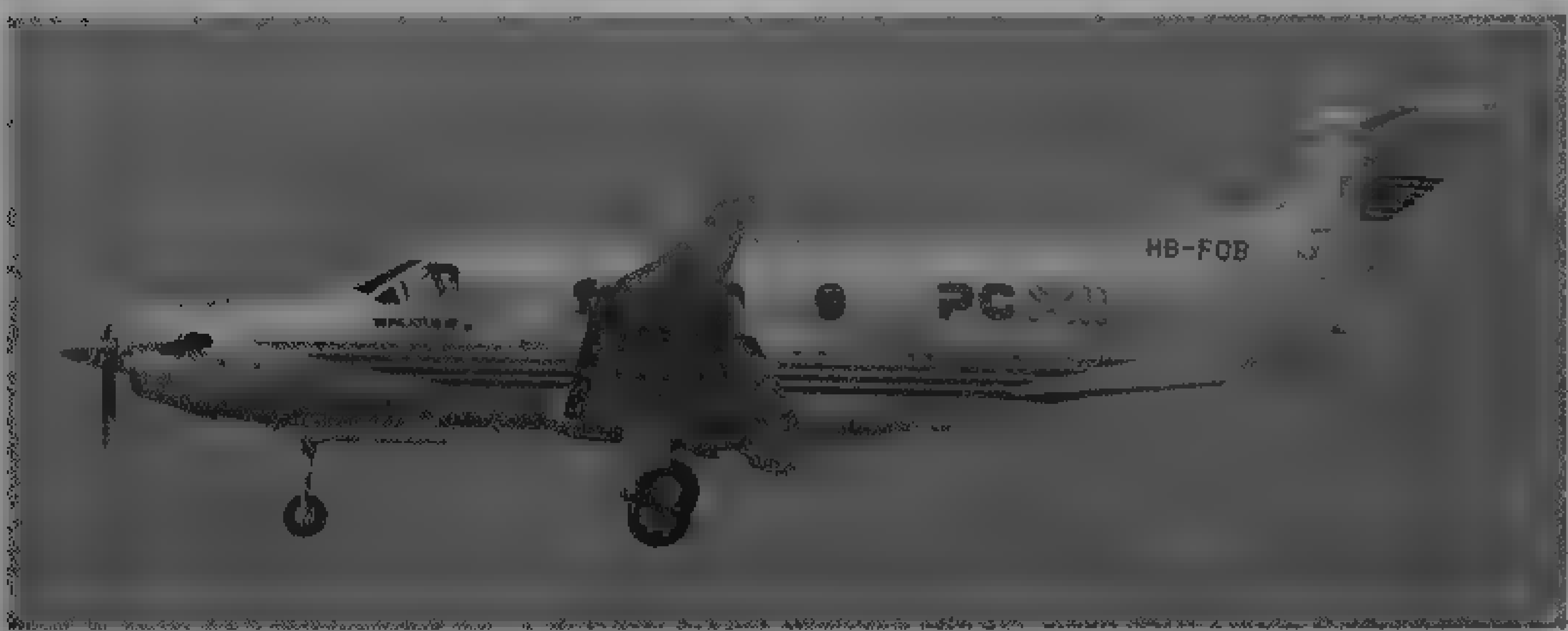
1995

87 ADF, KNI 58C RMI KR 21 marker beacon receiver, KI 204 CDI, KAS 297C altitude/vertical speed preselector and KEA 130A encoding altimeter standard. Bendix/King GPS optional

Instrumentation Bendix/King EFS 40 EFIS with 102 mm (4 in) display standard, MFD for EFS 40, and co-pilot EFIS panel, optional



Above: Roll-out photograph of the first Pilatus PC-12 with original wing. Below: Second PC-12 modified with winglets, extended dorsal fin, rear fuselage strakes and enlarged fairing at tailplane/fin intersection *(Paul Jackson)* 1995



DIMENSIONS, EXTERNAL

Wing span	16.08 m (52 ft 9 in)
Wing aspect ratio	10.02
Length overall	14.38 m (47 ft 2¼ in)
Height overall	4.26 m (13 ft 11¾ in)
Elevator span	5.15 m (16 ft 10¾ in)
Wheel track	4.53 m (14 ft 10⅜ in)
Wheelbase	3.54 m (11 ft 7⅜ in)
Propeller diameter	2.67 m (8 ft 9 in)
Propeller ground clearance	0.32 m (1 ft 0½ in)
Passenger door: Height	1.35 m (4 ft 5¼ in)
Width	0.64 m (2 ft 1¼ in)
Cargo door: Height	1.32 m (4 ft 4 in)
Width	1.40 m (4 ft 7 in)
Emergency exit: Height	0.69 m (2 ft 3¼ in)
Width	0.48 m (1 ft 7 in)

DIMENSIONS, INTERNAL

Cabin: Length, excl flight deck	5.16 m (16 ft 11 in)
Max width	1.53 m (5 ft 0¼ in)
Width at floor	1.30 m (4 ft 3¼ in)
Max height	1.45 m (4 ft 9 in)
Baggage compartment volume	1.12 m³ (39.5 cu ft)

AREAS

Wings, gross	25.81 m² (277.8 sq ft)

WEIGHTS AND LOADINGS

Weight empty	2,386 kg (5,260 lb)
Max fuel load	1,200 kg (2,645 lb)
Max payload	1,197 kg (2,639 lb)
Max ramp weight	4,020 kg (8,862 lb)
Max T-O and landing weight	4,000 kg (8,818 lb)
Max zero fuel weight	3,700 kg (8,157 lb)
Max wing loading	155.0 kg/m² (31.75 lb/sq ft)
Max power loading	4.47 kg/kW (7.35 lb/shp)

PERFORMANCE

Max permissible diving speed	280 kts (518 km/h; 322 mph) CAS
Max operating speed	240 kts (444 km/h, 276 mph) CAS
Max cruising speed at 6,100 m (20,000 ft)	267 kts (494 km/h, 307 mph)
Stalling speed: flaps and gear up	85 kts (158 km/h, 98 mph)
flaps and gear down	61 kts (113 km/h, 71 mph)
Max rate of climb at S/L	622 m (2,040 ft)/min
Max operating altitude	9,145 m (30,000 ft)
Service ceiling	10,670 m (35,000 ft)
T-O run	310 m (1,018 ft)
T-O to 15 m (50 ft)	555 m (1,82[illegible] ft)
Landing from 15 m (50 ft)	560 m (1,838 ft)
Landing run	425 m (1,395 ft)
Max IFR range at 232 kt (430 km/h, 267 mph) at 9,145 m (30,000 ft), 45 min reserves	1,600 n miles (2,963 km; 1,841 miles)
g limits: flaps up	+3.4/−1.36
flaps down	+2.0

UPDATED

SWISS FEDERAL AIRCRAFT FACTORY (F+W)

EIDGENÖSSISCHES FLUGZEUGWERK—FABRIQUE FÉDÉRALE D'AVIONS—FABBRICA FEDERALE DI AEROPLANI

CH-6032 Emmen
Telephone: 41 (41) 59 41 11
Fax: 41 (41) 55 25 88
Telex: 868 505 FWE CH
MANAGING DIRECTOR: Hansjurg Kobelt

Swiss government official aircraft and missile research, development, production, maintenance and modification establishment. Emmen factory has 140,000 m² (1,506,950 sq ft) floor space, 1994-95 workforce about 650

R&D activities include aerodynamics and flight mechanics department, with four wind tunnels for speeds up to Mach 4 to 5 and test cells for piston and jet engines with and without afterburners, all with digital data acquisition and processing, wind tunnel work done for customers worldwide, including subsonic testing for spacecraft, work for surface transport designers and building industry. Structural and systems engineering department deals with aircraft, helicopters and space hardware, with specialities in fatigue analysis and testing of entire aircraft structures. Electronics and missile systems department deals with all system aspects of aircraft and helicopter avionics and missiles. Fourth R&D department is for prototype fabrication, flight test, instrumentation and system environmental testing

Production department can handle mechanical sheet metal and composites and electronic, electrical, electromechanical and electro-optical subassemblies. Recently completed programmes include Swiss Air Force Mirage III improvement, assembly of 19 BAe Hawk Mk 66s and integration of 12 Super Pumas for Swiss Air Force. Current work includes production of slats for McDonnell Douglas MD-80 series and wingtips and fences for Airbus A320, development, manufacture and delivery of Rafale drop tanks to Dassault Aviation, maintenance of Boeing 737s and Super Pumas. F+W will assemble 32 of the 34 single- and two-seat F-18 Hornets being acquired by the Swiss Air Force (final delivery due 1999), and will establish engineering support and develop and manufacture low-drag pylons for these aircraft. F+W is sole source manufacturer of Dragon anti-tank missile, TOW missile programme begun 1986; Stinger missile programme begun 1989, co-fabrication with Contraves of all payload fairings for Ariane IV and V space launchers, development and production of TVD-ergometer spaceborne astronaut trainer

Proprietary products include acoustic systems for failure and flight envelope warning, all-electronic linear AoA and g indicators, scoring indicators for air-to-air and air-to-ground shooting with microcomputer-based ground station, multi-component strain gauge balances for forces from few hundred grammes to several tonnes, helicopter remote cargo hook with prerotation, automatic self-locking latch system and long-line ASA, and a modular helicopter container system. F+W took part in KZD 95 target drone development, subsequently developed and delivered Ranger UAVs with hydraulic launcher and ground support (see *Jane's Unmanned Aerial Vehicles and Targets*)

UPDATED

TAIWAN

AIDC

AERO INDUSTRY DEVELOPMENT CENTER

PO Box 90008-10-2, Taichung 40722
Telephone: 886 (4) 256 2379
Fax: 886 (4) 256 2282
OTHER WORKS: Kangshan
DIRECTOR GENERAL: Gen Wen-Li Lin
VICE-DIRECTOR GENERAL: Dr Shih-sen Wang

Established 1969 to succeed Bureau of Aircraft Industry (BAI), formed 1946, which moved to Taiwan in 1948, now subsidiary of government Chung Shan Institute of Science and Technology (CSIST). Occupies 120 ha (296.5 acre) site, current workforce over 6,000 in 1995

Produced 118 Bell UH-1H (Model 205) helicopters under licence 1969-76 for Chinese Nationalist Army, built PL-1A prototype (based on Pazmany PL-1) and 55 PL-1B Chien Shou primary trainers for Republic of China Air Force between 1968 and 1974 (see 1975-76 *Jane's*), built 248 Northrop F-5E Tiger IIs and 36 two-seat F-5Fs under licence between 1974 and 1986 (see 1986-87 edition). Designed and produced T-CH-1 Chung Hsing turboprop basic trainer (see 1981-82 *Jane's*); developed and produced AT-3 Tzu-Chung twin-turbofan advanced trainer (1994-95 *Jane's*); now producing IDF Ching-Kuo fighter

Ministry of National Defence announced in 1994 intention to restructure AIDC into a privatised corporation, new business development unit set up by early 1994, 3½ year privatisation programme approved by Taiwan government 16 May 1995. New company to be named Han Hsiang Aerospace Industry Company

UPDATED

AIDC CHING-KUO

TYPE: Single-seat air superiority fighter

PROGRAMME: IDF (Indigenous Defensive Fighter) programme initiated May 1982 after US refusal to allow purchase of Northrop F-20 Tigershark or GD F-16; US development assistance received for airframe (General Dynamics), engine (Garrett), radar (Westinghouse) and various subsystems; design frozen 1985, named after former Taiwan president in 1988. Four flying prototypes built (three single-seat and one two-seat), with first flights 28 May 1989 (77-8001), 27 September 1989 (78-8002), 10 January 1990 (78-8003) and 10 July 1990 (two-seater, 79-8004), of which '002 lost 12 July 1991 following vibration during transonic acceleration, modified intakes on '003, total prototype flying hours 1,400 by 1 January 1995

Preproduction batch of 10 started October 1990, all of these handed over to RoCAF by 19 November 1993, Sky Sword I missile launch demonstrated late 1992; 120 production aircraft authorised, first production aircraft delivered to RoCAF January 1994, average production rate of two per month in 1994-95

CUSTOMERS: Original Republic of China Air Force requirement for 250 reduced in 1993 to 130, including 28 two-seaters, to be delivered by end of 1998 to replace six squadrons of F/TF-104Gs, IOC 1995. Total of 34 (10 preproduction, 16 single- and eight two-seat production)

Line-up of Ching-Kuos, preproduction aircraft nearest

1995

IDFs delivered by 1 January 1995, replacing F-104Gs with three squadrons of RoCAF 3rd Tactical Fighter Wing at Ching Chuan Kang AB: No 7 (instructor training, evaluation and tactics), No.8 (conversion completed 28 December 1994, became operational 1 January 1995 with 22 aircraft) and No.28 (converting 1994-95).

COSTS: Reported programme cost of $6 billion (1993) for 130 aircraft, flyaway bare aircraft $23 million.

DESIGN FEATURES: Collective project name An Hsiang (Safe Flight), individual programme names for airframe (Ying Yang: Soaring Eagle), engine (Yun Han: Cloud Man), avionics (Tien Lei: Sky Thunder) and main missile armament (Tien Chien: Sky Sword).

Slightly swept blended wing/body with large leading-edge strakes and tip-mounted missiles, fixed intakes; transonic area rule, 8,000 hour airframe design life.

FLYING CONTROLS: Lear Astronics digital fly-by-wire control system. Sidestick controller. Near-full-span flaperons and large all-moving tailerons controlled jointly with leading-edge flaps by fly-by-wire system, strakes designed to shed large vortices over wing at high angles of attack.

STRUCTURE: All-metal initially, but some composites since introduced (tailplane and flaperons).

LANDING GEAR: Retractable tricycle type of Menasco design, with single wheel and oleo-pneumatic shock-absorber on each unit. Nose unit retracts forward, main units inward/upward into engine air intake trunks.

POWER PLANT: Two ITEC (AlliedSignal/AIDC) TFE1042-70 (F125) turbofans initially, side by side in rear fuselage, each developing 26.80 kN (6,025 lb st) dry and 42.08 kN (9,460 lb st) with afterburning and fitted with FADEC. Elliptical air intakes, with splitter plates, mounted low on centre-fuselage beneath wingroots. Internal fuel capacity approximately 2,517 litres (665 US gallons; 554 Imp gallons).

ACCOMMODATION: Pilot only, on Martin-Baker Mk 12 zero/zero ejection seat. One-piece bubble canopy, hinged at rear and opening upward. (Canopy of preproduction aircraft and two-seaters opens sideways to port.) Cockpit(s) pressurised and air conditioned.

SYSTEMS: AiResearch ECS. Westinghouse variable speed constant-frequency electrical power generating system.

AVIONICS: *Radar:* Golden Dragon 53 (GD-53) multimode pulse Doppler radar, modified version of Lockheed Martin AN/APG-67 (V) incorporating also some elements of Westinghouse AN/APG-66, has range of approximately 81 n miles (150 km; 93 miles), capability for air and sea search, and lookdown/shootdown capability.

Flight: Honeywell H423 inertial navigation system.

Instrumentation: Bendix/King cockpit displays (two multifunction and one HUD). (No second HUD in two-seater.) Digital databus and data processor.

ARMAMENT: One 20 mm M61A Vulcan cannon in port side of fuselage. Photo-Sonics gun camera. Six attachment points for external stores: two under fuselage, one under each wing and one at each wingtip. First prototype at roll-out shown with four Sky Sword I short-range infra-red homing air-to-air missiles (two underwing and two at wingtips). Other combinations may include two medium-range Sky Sword II radar homing air-to-air missiles under fuselage in addition to four Sky Sword Is, or three Hsiung Feng II (Male Bee II) sea skimming anti-shipping missiles (under wings and fuselage) plus two wingtip Sky Sword Is. In attack role, underwing and underfuselage hardpoints could be occupied by Maverick (or similar) missiles, single or cluster bombs, or rocket pods.

DIMENSIONS, EXTERNAL:

Wing span, incl missile rails	8.53 m (28 ft 0 in)
over wingtip missiles	9.00 m (29 ft 6 in)
Length overall: excl nose probe	13.26 m (43 ft 6 in)
incl nose probe	14.48 m (47 ft 6 in)
Height overall	4.42 m (14 ft 6 in)

WEIGHTS AND LOADINGS (estimated):

Internal fuel weight	1,950 kg (4,300 lb)
Max T-O weight	9,072 kg (20,000 lb) class

PERFORMANCE (estimated):

Max level speed	approx Mach 1.7
Max rate of climb at S/L	15,240 m (50,000 ft)/min
Service ceiling	16,760 m (55,000 ft)
g limit	+6.5

CHINGO-KUO PRODUCTION

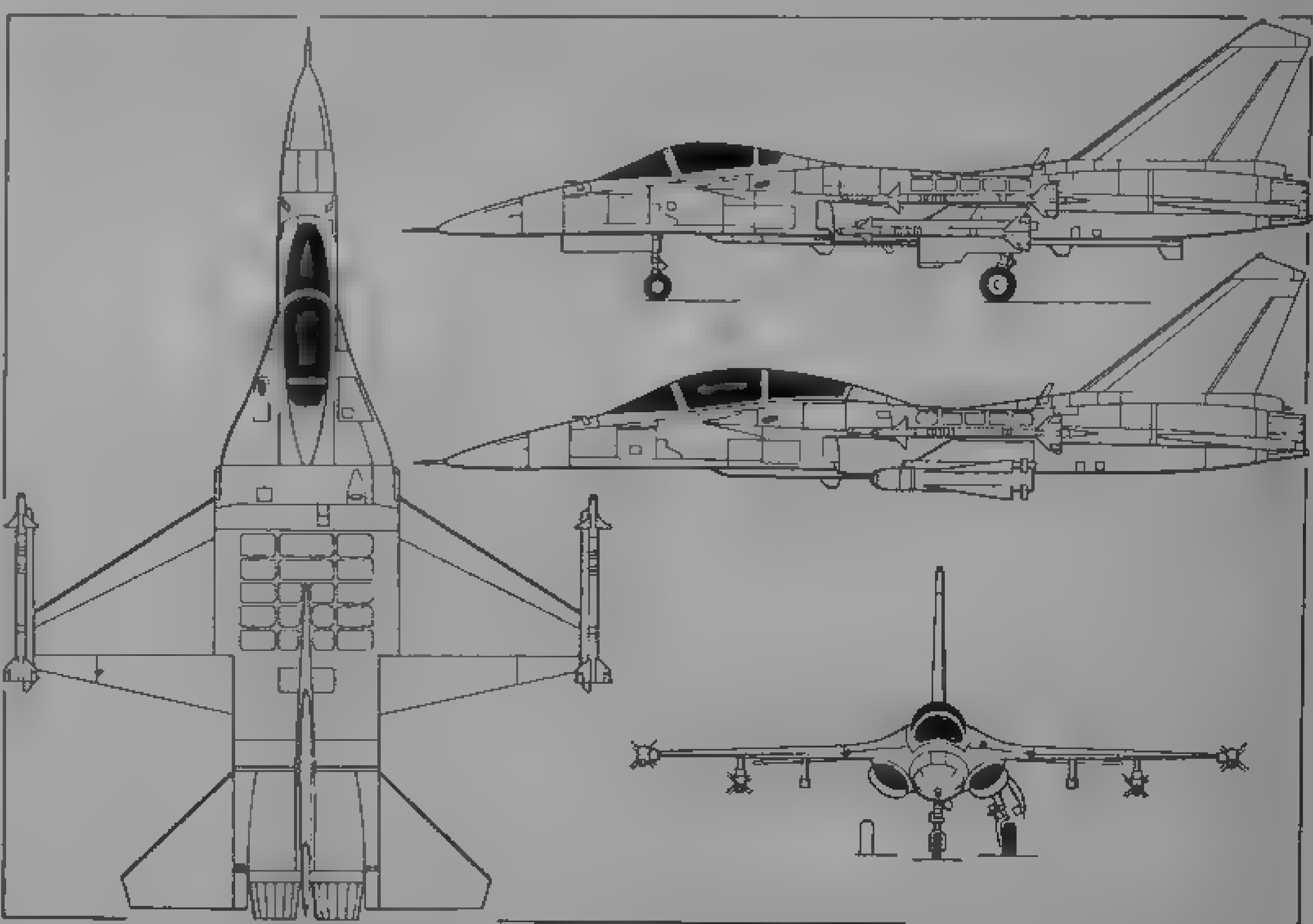
	Single-seat Qty	Single-seat First aircraft	Two-seat Qty	Two-seat First aircraft
Prototypes	3	77-8001/10001	1	79-8004/10004
Preproduction	6	81-8007/1401	4	81-8005/1601
Lot 1	16	83-8016/1407	8	83-8015/1605
Lot 2*		84-8040/1423		84-8039/1613

* Proceeding

UPDATED

Fourth prototype (first two-seat) Ching-Kuo

1994



AIDC Ching-Kuo fighter (two ITEC TFE1042-70 turbofans) with additional side view (lower) of two-seat version (*Jane's/James Goulding*)

1995

AIDC AT 3 TZU CHUNG

TYPE: Tandem two-seat twin-turbofan military trainer and close support aircraft.

PROGRAMME: Development contract placed July 1975; first flights of two prototypes (69-6001/0801 and 71-6002/0802) 16 September 1980 and 30 October 1981; production started March 1982, first flight of production aircraft (73-6003/0803) 6 February 1984, deliveries began March 1984, completed 1989; wingroot leading edge improvements flight tested 1992. AIDC plans further conversions to AT 3A and 3B.

CURRENT VERSIONS: **AT-3**: Standard trainer, of which 20 converted for close support role, described in 1994-95 and earlier *Jane's*.

AT 3A Lui-Meng: Single-seat ground and maritime attack version, equipped with nav/attack system avionics. Prototype (71-7002/0902, converted from second AT 3 prototype) first flown 1989.

AT-3B: Two-seat flight trainer and close air support version, with same nav/attack system as AT-3A. Prototype only (converted from standard AT 3, 75-6025) and first flown 1989.

CUSTOMERS: RoCAF (61 AT-3), total 63 built, including prototypes.

UPDATED

TAC

TAIWAN AEROSPACE CORPORATION

Room 2901, 333 Keelung Road, Sector 1, Taipei
Telephone: 886 (2) 345 0030
Fax: 886 (2) 757 6451
WORKS: Taichung

Established 27 September 1991 as intended foundation for civil aircraft industry, 29 per cent owned by Taiwan government; start-up capital $200 to 250 million; aim was to develop national manufacturing capability for aircraft, engines, avionics and materials by 2000.

Planned joint venture with British Aerospace to co-produce Avro RJ family in Taiwan (see 1994-95 *Jane's*) failed to materialise, but joint venture with Swearingen (see US section) as partner in SJ30 business jet announced late 1994. Also in late 1994, TAC acquired Taiwan-based Air Asia overhaul and maintenance company, which it plans to modernise and expand.

UPDATED

TURKEY

TAI

TUSAŞ AEROSPACE INDUSTRIES INC (TUSAŞ Havacılık ve Uzay Sanayi A. Ş.)

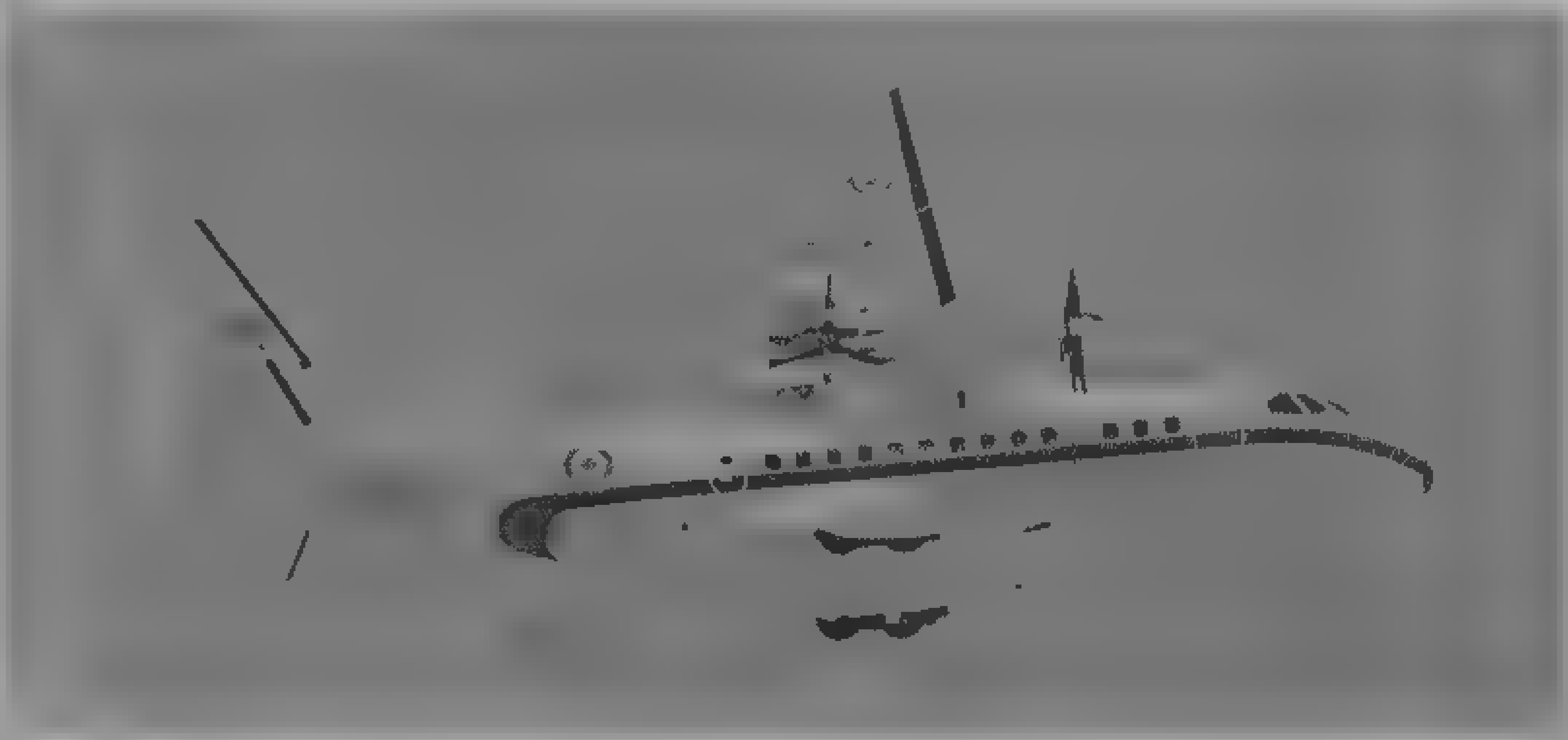
PO Box 18, TR-06692 Kavaklıdere, Ankara
Telephone: 90 (312) 811 18 00
Fax: 90 (312) 811 14 25
MANAGING DIRECTOR: Jerry R Jones
DEPUTY MANAGING DIRECTOR: Dr Birol Altan
DIRECTOR OF PROGRAMMES: Kaya Ergenç

Formed 15 May 1984, shareholders (by percentage) are TUSAS (49), Turkish Armed Forces Foundation (1.9), Turkish Air League (0.1), Lockheed Martin of Turkey Inc (42) and General Electric (7), TAI aims to produce modern weapon systems, aircraft and helicopters, modernise aircraft, conduct R&D and develop and manufacture weapon systems.

R&D activities are carried out in collaboration with Lockheed Martin, NASA and NATO AGARD. TAI is engaged in design and development of a UAV and the HD-19, a 19-passenger or cargo aircraft; it is also participating in the Future Large Aircraft programme (see Euroflag in International section).

TAI site of 230 ha (568.3 acres) includes 130,000 m² (1,399,300 sq ft) covered floor area; 62,500 m² (672,675 sq ft) main assembly building, factory contains facilities and high technology machinery including large chemical processing and milling plant and advanced computer capability to manufacture modern aircraft, workforce 2,287 at beginning of 1995, TAI had then trained 908 Turkish employees and 64 others at its training centre.

UPDATED



Airtech CN 235M assembled by TAI, in Turkish Air Force service as a VIP transport
1994

TAI (AIRTECH) CN-235M

TAI assembling and producing parts for 50 of 52 Airtech CN-235s (see International section) ordered by Turkey 1991. First flight by Turkish assembled CN-235 (055) made 24 September 1992; 15 delivered by early 1995, comprising five Stage II aircraft, five Stage III, and five Stage IV (Stage I being two CASA built pattern aircraft).

UPDATED

Artist's impression of projected TAI HD-19 passenger and cargo aircraft
1995

TAI (LOCKHEED MARTIN) F-16C/D FIGHTING FALCON

TAI under contract to Lockheed Martin to co-produce 152 of 160 F-16C/D for Turkish Air Force under Peace Onyx programme and to manufacture rear and centre-fuselages and wings for US Air Force; first F-16C delivered to Turkish Air Force 30 November 1987; 157 delivered by early 1995. Agreement signed early 1992 for further 40 F 16C/Ds, 40 more ordered early 1994, 46 of 240 total (first deliveries Spring 1994) are for Egyptian Air Force.

TAI also installing Loral ALQ-178 ECM in Turkish Air Force F 16s from 1993.

UPDATED

TAI (SIKORSKY) UH-60L BLACK HAWK

TAI co-producing last 50 of 95 UH-60Ls ordered under $1.1 billion contract of 8 December 1992; production started August 1994 and to run for four years. Further orders may follow.

UPDATED

TAI HD-19

TYPE: Dual purpose passenger/cargo aircraft.

PROGRAMME: Design work finished in early 1994, funding being sought for project launch.

DESIGN FEATURES: Designed for semi prepared strips, basic variant will have capacity for 19 passengers, 30-seat version also planned.

NEW ENTRY

UKRAINE

ANTONOV

ANTONOV DESIGN BUREAU

1 Tupolev Street, 252062 Kiev
Telephone: 38 (044) 442 61 24, 442 70 98
Fax: 38 (044) 442 70 98, 449 99 96
Telex: 131309 OZON SU
GENERAL DESIGNER: Pyotr Vasilyevich Balabuyev

Antonov OKB was founded in 1946 by Oleg Konstantinovich Antonov, who died 4 April 1984, aged 78. In current production are An-32 at Kiev, An-72/74 at Kharkov, An-124 at Kiev and Ulyanovsk. Small An-2 and An-28 are built by PZL Mielec, Poland, plus small batch production of An-2 (as Y 5B) in China. More than 22,000 aircraft of over 100 types and versions of Antonov design have been built, more than 1,500 have been exported, to 42 countries.

UPDATED

ANTONOV An-2

NATO reporting name: Colt

TYPE: Single-engined general purpose biplane.

PROGRAMME: Prototype flew as SKh 1 on 31 August 1947. More than 5 000 An 2s were built at Kiev, ending in mid 1960s, 300 still serve in Russian air forces. Production transferred to PZL Mielec, Poland, from where more than 11,950 delivered from 1960 onwards, production continuing at low volume. China acquired licence and has built **Yunshuji-5 (Y-5)** versions 1957 to date. (See SAMC entry in Chinese section.)

UPDATED

ANTONOV An-12

NATO reporting name: Cub

TYPE: Four-turboprop transport and electronic warfare aircraft; described in previous editions

PROGRAMME: Prototype flew 1958, with Kuznetsov NK-4 turboprops, as rear loading development of An-10 airliner, approximately 1,350 built with AI-20K engines for military and civil use, ending in USSR in 1973. GAZ (Plant) 34 at Tashkent produced some 830 in 1961-72, GAZ 40 at Voronezh approximately 343 in 1961-73, GAZ 90 at Ulan Ude about 170 in 1968-71, plus dozen from GAZ 22 at Kazan

An-12BP ('Cub') was standard medium-range paratroop and cargo transport of Soviet Military Transport Aviation (VTA) from 1959, replacement with Il-76 began 1974, but 350 remain in air force service plus 125 'Cub-A/B/C/D' electronic warfare conversions. Shaanxi Aircraft Company, China, manufactures redesigned **Yunshuji-8 (Y-8)** transport version and derivatives (see SAC, China)

UPDATED

ANTONOV An-24

NATO reporting name: Coke

Production of An-24 twin-turboprop short-haul transport at Irkutsk (GAZ 39), Ulan Ude (GAZ 90) and Kiev (GAZ 473) ended in 1979, after about 1,465 had been delivered, 100 remain in Russian air force inventory. Versions known as **Y7-100** and **-200** (which see) continue in production at Xian in China

UPDATED

ANTONOV An-26

NATO reporting name: Curl

TYPE: Twin-turboprop pressurised short-haul transport

PROGRAMME: First exhibited 1969 Paris Air Show; approximately 1,410 built by GAZ 473 at Kiev, 1968-85, before superseded in production by An-32, derivative **Y7H-500** built by Xian Aircraft Company (see XAC, China)

CURRENT VERSIONS: **An-26** ('Curl-A') Original version, electrically/manually operated conveyor flush with cabin floor for freight handling

An-26B ('Curl-A') Improved version, announced 1981, to carry three standard freight pallets, each 2.44 m (8 ft) long, 1.46 m (4 ft 9½ in) wide and 1.60 m (5 ft 3 in) high, with total weight of 5,500 kg (12,125 lb). Improved freight handling equipment

An-26BRL: Special version for research into pack ice formations and to act as airborne guide to help ships navigate around ice floes. Additional internal fuel tanks for 11 hours endurance. Small stub wing attached to fuselage below rear window; a number of small pods under fuselage. Five An-26Bs converted to BRL

An-26L (L: laboratoriya): Special version equipped for airfield calibration missions

An-26M: Ambulance version, typically for 24 stretcher patients and medical attendant

An-26P: Firefighting version

An-26RTR ('Curl-B'): Radio technicheskaya razvyedchik signals intelligence (sigint) version, many short blade antennae mounted above and below fuselage; about 100 in service

CUSTOMERS: Military An-26s assigned to air commands in CIS regiments and squadrons; exported to at least 27 air forces. Angolan and Mozambique aircraft have bomb racks. Civil operators worldwide have 425, of which Aeroflot and its successors operate more than 200, available as military reserve

DESIGN FEATURES: Generally similar to earlier An-24RT specialised freighter, with auxiliary turbojet, more powerful turboprops and redesigned 'beaver tail' rear fuselage. Oleg Antonov's special loading ramp forms underside of rear fuselage when retracted, slides forward under rear of cabin to facilitate direct loading and when airdropping cargo. Wing anhedral 2° on outer panels, incidence 3°; sweepback on outer panels 6° 50′ at quarter-chord, 9° 41′ on leading-edge; swept vertical and horizontal tail; tailplane dihedral 9°

FLYING CONTROLS: Mechanical controls, mass balanced servo compensated ailerons with electrically operated glassfibre trim tabs, manual tab in each elevator; electrical trim/servo tab in rudder; hydraulically actuated tracked and slotted TsAGI flaps, single-slotted on centre-section, double-slotted outboard of nacelles

STRUCTURE: Conventional light alloy, two-spar wing, built in centre, two inner and two detachable outer sections, with skin attached by electric spot welding, bonded/welded semi-monocoque fuselage in front, centre and rear portions, with 'bimetal' (duralumin titanium) bottom skin for protection during operation from unpaved airfields; blister on each side of fuselage forward of rear ramp carries track to enable ramp to slide forward; large dorsal fin, ventral strake each side of ramp

LANDING GEAR: Hydraulically retractable tricycle type; twin wheels on each unit. Emergency extension by gravity. All units retract forward. Shock absorbers of oleo-nitrogen type on main units, nitrogen-pneumatic type on nose unit. Mainwheel tyres size 1,050 × 400 mm, pressure 5.9 bars (85 lb/sq in). Nosewheel tyres size 700 × 250 mm, pressure 3.9 bars (57 lb/sq in). Hydraulic disc brakes and anti-skid units on mainwheels. Nosewheels steered hydraulically ±45° while taxying and controllable ±10° during take-off and landing. Minimum ground turning radius 22.3 m (73 ft 2 in)

POWER PLANT: Two 2,074 kW (2,780 ehp) ZMKB Progress AI-24VT turboprops, four-blade constant-speed fully feathering propellers. One 7.85 kN (1,765 lb st) RU 19A-300 auxiliary turbojet in starboard nacelle for use, as required, during take-off, climb and level flight, and for self-contained starting of main engines. Two independent but interconnected fuel systems, with 5,500 kg (12,125 lb) of fuel in integral tanks in inner wings and 10 bag tanks in centre-section. Pressure refuelling socket in starboard engine nacelle. Gravity fuelling point above each tank area. Carbon dioxide inert gas system to create fireproof condition inside fuel tanks

ACCOMMODATION: Crew of five (pilot, co-pilot, radio operator, flight engineer and navigator), station at rear of cabin on starboard side for loading supervisor or load dispatcher. Optional domed observation window for navigator on port side of flight deck. Toilet on port side aft of flight deck crew door, small galley and oxygen bottle stowage on starboard side. Emergency escape hatch in door immediately aft of flight deck. Large downward-hinged rear ramp/door, hinged to an anchorage mounted on tracks running forward under blister fairings. Ramp/door slides forward under fuselage for direct loading on to cabin floor or for airdropping freight. When doing so, its rear is supported by the pivoted swinging arm on each side which raises and lowers door in alternative fixed hinge mode. Door can be locked in any intermediate position

Electrically powered mobile winch, capacity 2,000 kg (4,409 lb), hoists crates through rear entrance and runs on rail in cabin ceiling to position payload. Electrically and manually operated conveyor, capacity 4,500 kg (9,920 lb), flush with cabin floor of original An-26, facilitates loading and airdropping freight. An-26B has removable rollgangs, mechanism for moving pallets inside hold, and moorings, enabling two men to load and unload three pallets in 30 minutes. Rollgangs can be stowed against sides of cabin. Both versions accommodate motor vehicles, including GAZ-69 and UAZ-469 military vehicles, or cargo up to 1.50 m (59 in) high by 2.10 m (82.6 in) wide. Height of rear edge of cargo door surround above cabin floor is 1.50 m (4 ft 11 in). Cabin pressurised and air conditioned, optional tip-up seats along each wall for total of 38 to 40 persons. Conversion to troop transport, or to An-26M ambulance, takes 20 to 30 minutes in the field

SYSTEMS: Air conditioning hot air tapped from 10th compressor stage of each engine, with heat exchanger and turbocooler in each nacelle. Cabin pressure differential 0.29 bar (4.27 lb/sq in). Main and emergency hydraulic systems, pressure 151.7 bars (2,200 lb/sq in), for landing gear retraction, nosewheel steering, flaps, brakes, windscreen wipers, propeller feathering and operation of cargo ramp and emergency escape doors. Hand pump to operate doors only and to build up pressure in main system. Electrical system includes two 27 V DC starter/generators on engines, standby generator on auxiliary turbojet, and three storage batteries for emergency use. Two engine-driven alternators provide 115 V 400 Hz single-phase AC supply, with standby inverter. Basic source of 36 V 400 Hz three-phase AC supply is two inverters, with standby transformer. Permanent oxygen system for pilot, installed equipment for other crew members and three portable bottles for personnel in cargo hold. Bleed air thermal de-icing system for wing and tail unit leading edges. Electric windscreen de-icing. Electric de-icing system for propeller blades and hubs, hot air system for engine air intakes

AVIONICS: *Comms:* Two VHF transceivers, HF, intercom.

Radar: Weather/navigation radar

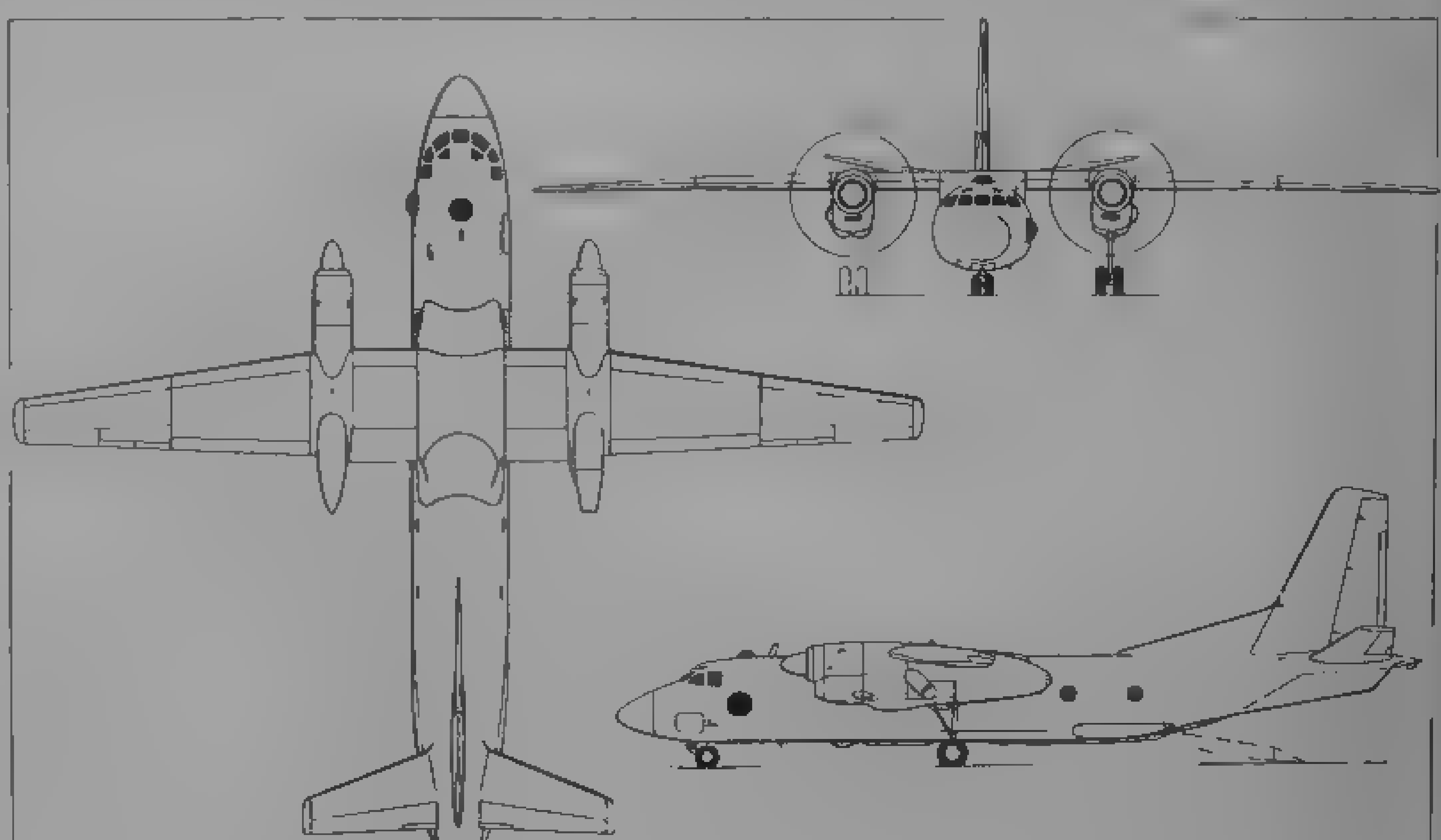
Flight: Two ADF, radio altimeter, glide path receiver,

Antonov An-26 of the Hungarian Air Force *(Paul Jackson)*

1995

This photograph shows port water tank and flare pack of An-26P water-bomber *(David Stephens)*

1994



Antonov An-26 twin-turboprop short-haul transport *(Jane's/Dennis Punnett)*

1976

glide slope receiver, marker beacon receiver. Optional flight director system, astrocompass and autopilot.

Instrumentation: Directional gyro and flight recorder standard.

Self-defence: Provision for chaff/flare dispensers pylon-mounted on each side of lower fuselage below wings (seen on Afghan aircraft).

EQUIPMENT: Parachute static line attachments and retraction devices, tiedowns, jack to support ramp sill, flight deck curtains, sun visors and windscreen wipers standard. Optional OPB-1R sight for pinpoint dropping of freight, medical equipment, and liquid heating system. Provision for water bombing equipment on An-26P.

ARMAMENT: Provision for bomb rack on fuselage below each wingroot trailing-edge.

DIMENSIONS, EXTERNAL:

Wing span	29.20 m (95 ft 9½ in)
Wing aspect ratio	11.7
Length overall	23.80 m (78 ft 1 in)
Height overall	8.575 m (28 ft 1 in)
Width of fuselage	2.90 m (9 ft 6 in)
Depth of fuselage	2.50 m (8 ft 2½ in)
Tailplane span	9.975 m (32 ft 8¾ in)
Wheel track (c/l shock struts)	7.90 m (25 ft 11 in)
Wheelbase	7.65 m (25 ft 1¼ in)
Propeller diameter	3.90 m (12 ft 9½ in)
Propeller ground clearance	1.23 m (4 ft 0½ in)
Crew door (stbd, front): Height	1.40 m (4 ft 7 in)
Width	0.60 m (1 ft 11½ in)
Height to sill	1.47 m (4 ft 9¾ in)
Loading hatch (rear): Length	3.15 m (10 ft 4 in)
Width at front	2.40 m (7 ft 10½ in)
Width at rear	2.00 m (6 ft 6¾ in)
Height to sill	1.47 m (4 ft 9¾ in)
Height to top edge of hatchway	3.015 m (9 ft 10¾ in)
Emergency exit (in floor at front):	
Length	1.02 m (3 ft 4¼ in)
Width	0.70 m (2 ft 3½ in)
Emergency exit (top): Diameter	0.65 m (2 ft 1½ in)
Emergency exits (one each side of hold):	
Height	0.60 m (1 ft 11¾ in)
Width	0.50 m (1 ft 7¾ in)

DIMENSIONS, INTERNAL:

Cargo hold: Length of floor	11.50 m (37 ft 8¾ in)
Width of floor	2.78 m (9 ft 1½ in)
Max height	1.91 m (6 ft 3 in)

AREAS:

Wings, gross	74.98 m² (807.1 sq ft)
Vertical tail surfaces (total, incl dorsal fin)	15.85 m² (170.61 sq ft)
Horizontal tail surfaces (total)	19.83 m² (213.45 sq ft)

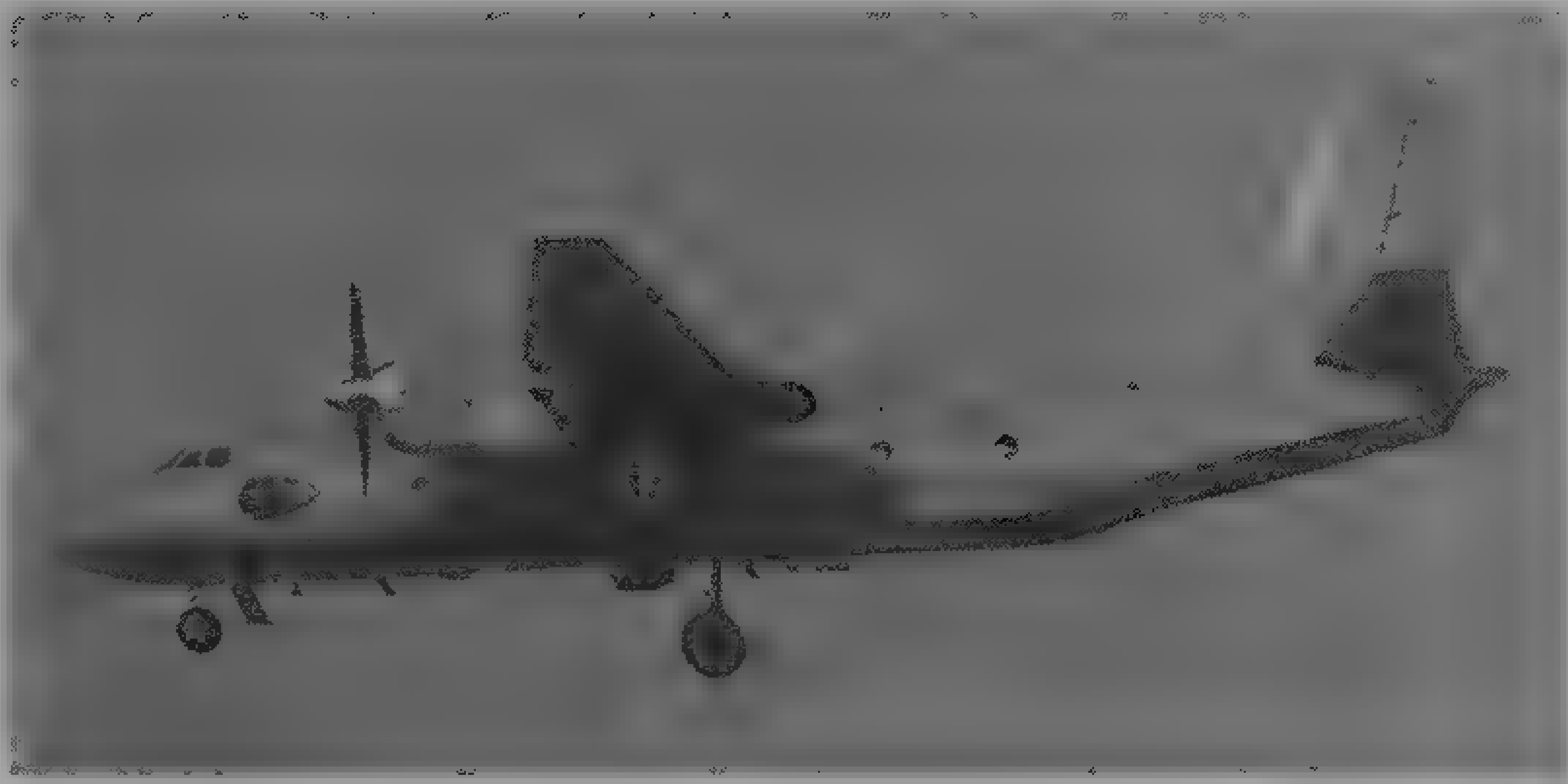
WEIGHTS AND LOADINGS:

Weight empty	14,750 kg (32,518 lb)
Normal payload	4,500 kg (9,920 lb)
Max payload	5,500 kg (12,125 lb)
Normal T-O and landing weight	23,000 kg (50,706 lb)
Max T-O and landing weight	24,000 kg (52,911 lb)
Max wing loading	320.1 kg/m² (65.6 lb/sq ft)
Max power loading	5.79 kg/kW (9.52 lb/ehp)

PERFORMANCE (at normal T-O weight):

Cruising speed at 6,000 m (19,685 ft)	235 kts (435 km/h, 270 mph)
T-O speed	116 kts (215 km/h, 134 mph)
Landing speed	102 kts (190 km/h, 118 mph)
Max rate of climb at S/L	480 m (1,575 ft)/min
Service ceiling	7,500 m (24,600 ft)
T-O run, on concrete	870 m (2,855 ft)
T-O to 15 m (50 ft)	1,240 m (4,068 ft)
Landing from 15 m (50 ft)	1,740 m (5,709 ft)
Landing run, on concrete	650 m (2,135 ft)
Range, no reserves:	
with max payload	669 n miles (1,240 km, 770 miles)
with max fuel	1,434 n miles (2,660 km, 1,652 miles)

UPDATED



An-26RTR sigint version, known to NATO as 'Curl-B' *(Jon Lake)*

1995

ANTONOV An-28

NATO reporting name: Cash

An-28 manufactured in PZL Mielec works in Poland (see Polish section).

VERIFIED

ANTONOV An-32

NATO reporting name: Cline

Indian Air Force name: Sutlej

TYPE: Twin-turboprop short/medium-range transport.

PROGRAMME: Prototype (SSSR-83966, converted An-26) first exhibited 1977 Paris Air Show, second prototype (new build) SSSR-21132; export deliveries to India began 1984. Indian contract completed prior to other deliveries; current production, 40 a year, largely for CIS armed forces, from GAZ 473 at Kiev.

CURRENT VERSIONS: **An-32**: Basic version, *as described in detail*. Specialised versions available for fisheries surveillance, agricultural and air ambulance use, last-named complete with operating theatre.

An-32B: First seen early 1993; reported to be upgraded with approximately 149 kW (200 shp) additional power from each turboprop to provide increase of 500 kg (1,100 lb) maximum payload.

An-32P (protivopozharny): Firefighting version; quickly removable tank on each side of fuselage; total water capacity 8,000 kg (17,635 lb); able to drop 30 smoke-jumpers; provision for flare packs to induce atmospheric precipitation artificially over fire; maximum T-O weight 29,000 kg (63,930 lb); cruising speed 215 knots (400 km/h, 248 mph); operating speed 124 to 130 knots (230 to 240 km/h, 143 to 149 mph); radius of action 80 n miles (150 km, 93 miles). An-32P has not been built in series.

CUSTOMERS: CIS air forces and government agencies (50 with Russian air forces, about 100 with Department of Agriculture); air forces of Afghanistan, Bangladesh, India (123 named Sutlej after a Punjabi river), Peru (24) and Sri Lanka (3). Civil operators have about 75, including Aeroflot (28), Air Ukraine (4), Azerbaijan Airlines (2), Aerolit (4), Antau (6), Aviatrans (3), Moscow Airways (2).

DESIGN FEATURES: Development of An-26, with triple-slotted trailing-edge flaps outboard of engines, automatic leading-edge slats, enlarged ventral fins and full-span slotted tailplane; improved landing gear retraction, de-icing and air conditioning, electrical system and engine starting; large increase in power compared with An-26 improves take-off performance, service ceiling and payload under hot and high conditions; overwing location of engines reduces possibility of stone or debris ingestion, but requires nacelles of considerable depth to house underwing landing gear; operation possible from unpaved strips at airfields 4,000 to 4,500 m (13,125 to 14,750 ft) above sea level in ambient temperature of ISA + 25°C; APU helps to ensure independence of ground servicing equipment, including onboard engine starting at these altitudes.

FLYING CONTROLS: As An-26 except for high-lift wings (see Design Features).

STRUCTURE: Generally as An-26.

LANDING GEAR: Hydraulically retractable tricycle type, basically as An-26. All shock absorbers of oleo-nitrogen type. Tyre sizes and pressures unchanged.

POWER PLANT: Two ZMKB Progress AI-20D Series 5 turboprops, each 3,760 kW (5,042 ehp), four-blade constant-speed reversible pitch propellers; TG-16M APU in rear of starboard landing gear fairing.

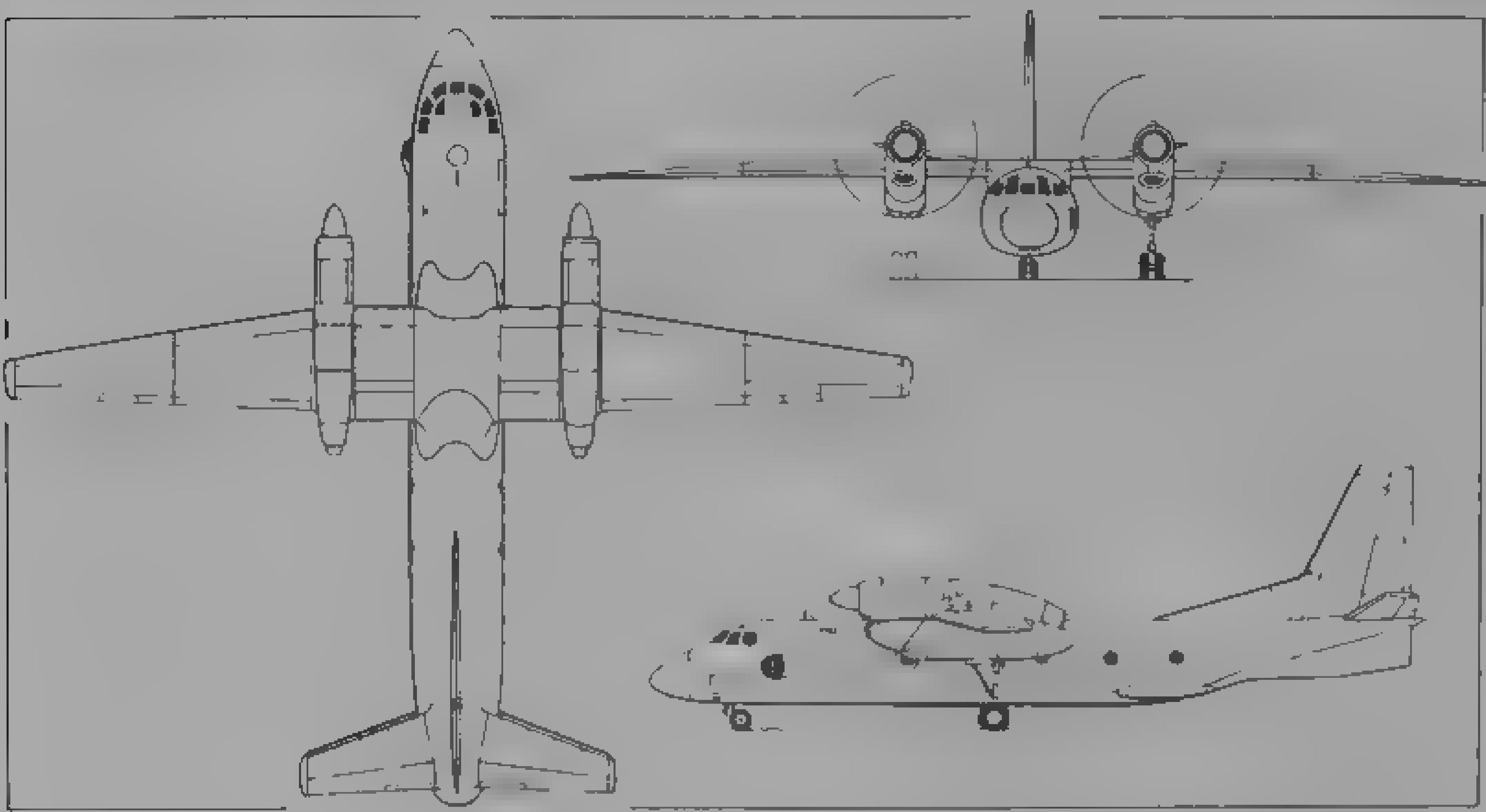
ACCOMMODATION: Crew of three (pilot, co-pilot and navigator), with provision for flight engineer. Rear-loading hatch and forward-sliding ramp/door, as An-26, plus winch and hoist, capacity 3,000 kg (6,615 lb), for freight handling. Cargo or vehicles can be airdropped by parachute, including extraction of large loads by drag parachute, with aid of removable roller conveyors and guide rails on floor of hold. Payloads include 12 freight pallets,

Antonov An-32 short/medium-range transport of the Russian Air Force *(Alex Hay Porteous)*

1995

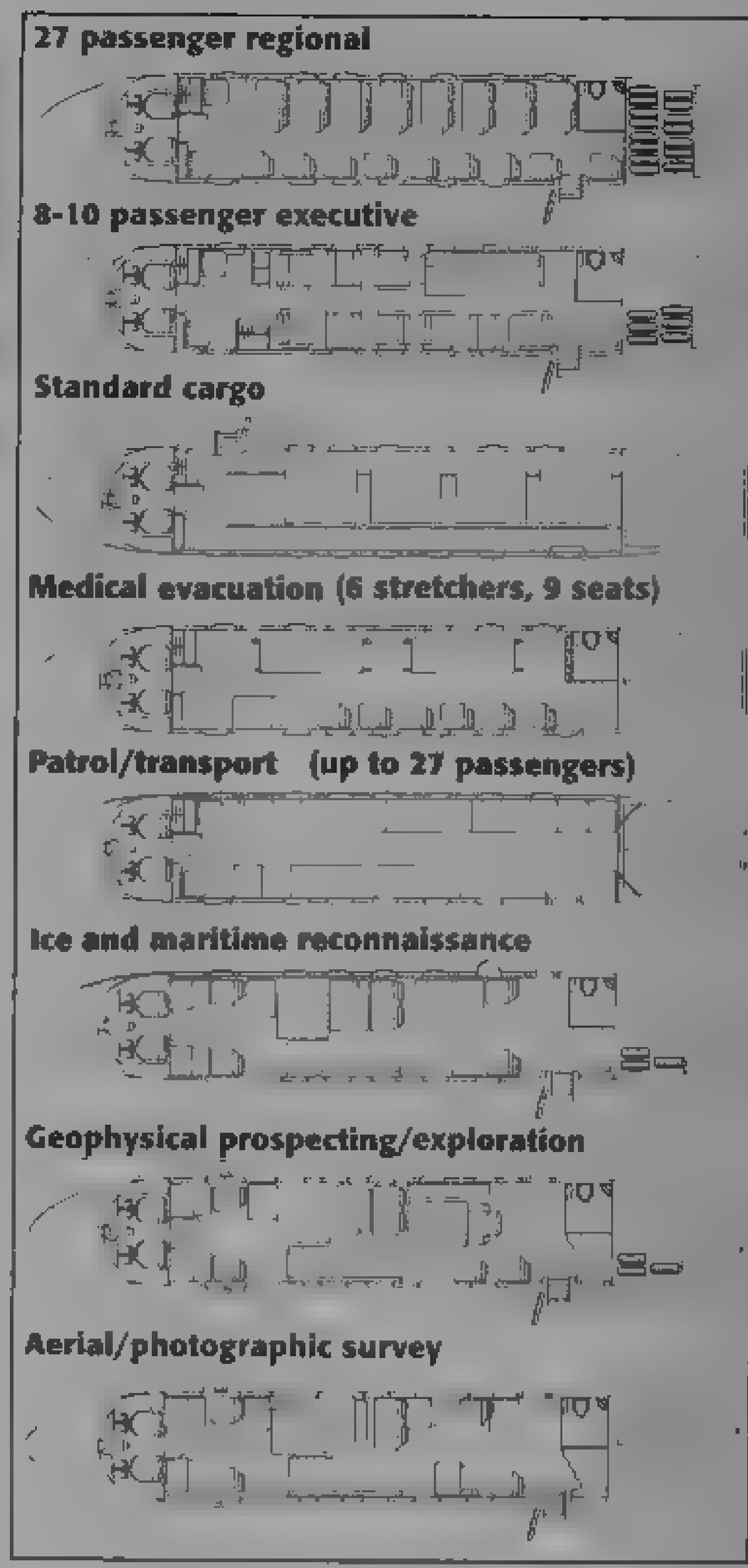
Antonov An-32P Firekiller at 1993 Paris Air Show *(Paul Jackson)*

1995



Antonov An-32 transport powered by two ZMKB Progress AI-20D turboprops *(Jane's/Dennis Punnett)*

1987



Alternative cabin configurations for An-38 current and projected versions

1995

50 passengers or 42 parachutists and a jumpmaster on row of tip-up seats along each cabin wall, or 24 stretcher patients and up to three medical personnel

SYSTEMS: Accommodation fully pressurised and air conditioned. Systems basically as An-26 but generally improved

AVIONICS: Basically as An-26

EQUIPMENT: Basically as An-26

ARMAMENT: Provision for four bomb racks, two on each side of fuselage below wings (fitted to aircraft for Peru)

DIMENSIONS, EXTERNAL: As for An-26, except

Length overall	23.78 m (78 ft 0¼ in)
Height overall	8.75 m (28 ft 8 in)
Tailplane span	10.23 m (33 ft 6¾ in)
Propeller diameter	4.70 m (15 ft 5 in)
Propeller ground clearance	1.55 m (5 ft 1 in)

DIMENSIONS, INTERNAL:

Cargo hold: Length	15.68 m (51 ft 5¼ in)
Max width	2.78 m (9 ft 1½ in)
Max height	1.84 m (6 ft 0½ in)
Volume	66.0 m³ (2,330 cu ft)

AREAS:

Wings, gross	74.98 m² (807.1 sq ft)
Ailerons (total)	6.12 m² (65.88 sq ft)
Flaps (total)	15.00 m² (161.46 sq ft)
Vertical tail surfaces (total, incl dorsal fin)	17.22 m² (185.36 sq ft)
Horizontal tail surfaces (total)	20.30 m² (218.5 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	16,800 kg (37,038 lb)
Weight empty, equipped	17,308 kg (38,158 lb)
Max payload	6,700 kg (14,770 lb)
Max fuel	5,445 kg (12,004 lb)
Max fuel with max payload	2,267 kg (4,998 lb)
Max ramp weight	27,250 kg (60,075 lb)
Max T-O weight	27,000 kg (59,525 lb)
Max landing weight	25,000 kg (55,115 lb)
Max wing loading	360.1 kg/m² (73.75 lb/sq ft)
Max power loading	3.59 kg/kW (5.90 lb/ehp)

PERFORMANCE:

Max cruising speed	286 kts (530 km/h; 329 mph)
Econ cruising speed	254 kts (470 km/h; 292 mph)
Landing speed	100 kts (185 km/h; 115 mph)
Optimum cruising height	8,000 m (26,250 ft)
Service ceiling	9,400 m (30,840 ft)
Service ceiling, OEI	4,800 m (15,750 ft)
T-O run on concrete	760 m (2,495 ft)
T-O to 15 m (50 ft)	1,200 m (3,940 ft)
Landing run	470 m (1,542 ft)
Range: with max payload	647 n miles (1,200 km; 745 miles)
with max fuel	1,360 n miles (2,520 km; 1,565 miles)

UPDATED

ANTONOV An-38

TYPE: Twin-turboprop light multipurpose regional airliner

PROGRAMME: Details announced, and model displayed, at 1991 Paris Air Show; initial batch of six: one prototype (01001, first flight 23 June 1994, with TPE331 engines), four trials aircraft, one for static testing at Kiev; second aircraft scheduled to fly August 1995, certification to ICAO Cat. II standards expected second quarter 1996; series production of An-38 and An-38K under way by Novosibirsk Aircraft Production Association, building up to 60 to 100 aircraft per year

CURRENT VERSIONS: **An-38-100**: With AlliedSignal TPE331 engines.

An-38-200: With Omsk MKB 'Mars' TVD-20 engines

An-38K: Convertible version of An-38-100; large upward-hinging side door at rear on port side; able to carry four LD-3 or five LD-3K containers; cargo handling equipment removable for conversion to 30-passenger transport.

A version with RKBM TVD-1500 engines is projected. All versions can be equipped for aerial photography, survey, forest patrol, VIP transport, ambulance (six stretchers, nine seated, with attendant), fishery and ice patrol duties

CUSTOMERS: In mid-1995, orders for 150 from Russian airlines, including An-38-100s for Vostok Airlines; options on 200 for export

DESIGN FEATURES: Developed from PZL Mielec (Antonov) An-28 (see Polish section) to replace An-24s, Let L-410s and Yak-40s. New high-efficiency engines, lengthened passenger cabin; optional weather radar and automatic flight control system, improved sound and vibration insulation, wheel or ski landing gear; rear cargo door and cargo handling system; able to operate from unpaved runways, operating temperatures from −50 to +45°C, including 'hot and high' conditions. Service life 30,000 hours. Maintenance requirement four man-hours/flying hour.

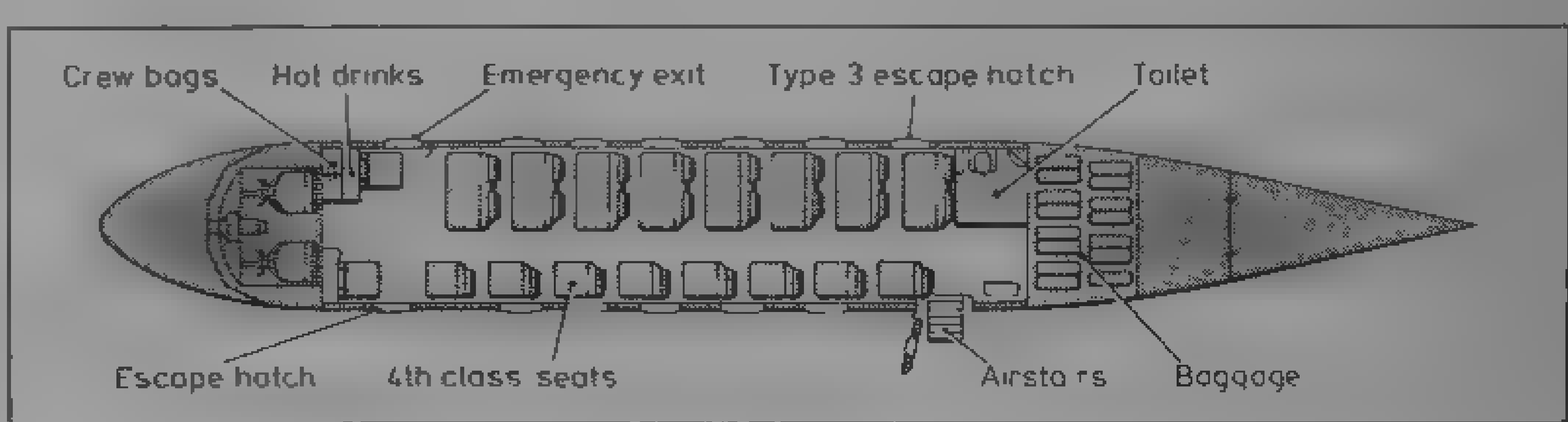
POWER PLANT: Two Omsk MKB 'Mars' TVD-20 turboprops, each 1,029 kW (1,380 shp), driving AV-36 quiet reversible-pitch propellers, or two AlliedSignal TPE331-14GR-801E turboprops, each 1,227 kW (1,645 shp), driving Hartzell HC-B5MA five-blade propellers. Lucas starter-generators. An-38K has 2,860 litres (755.5 US gallons; 629 Imp gallons) fuel

ACCOMMODATION: Two crew side by side on flight deck; passenger cabin equipped normally with 26 seats, basically three abreast; 27 seats optional; ambulance version for six stretchers, nine seated casualties and medical attendant, and executive versions with eight to 10 seats available; seats and baggage compartment can be folded quickly against cabin wall to provide clear space for 2,500 kg (5,510 lb) of freight. Cabin door with airstairs on port side, with service door opposite; emergency exit each side. Cargo door under upswept rear fuselage sides forward under cabin for direct loading/unloading of freight

AVIONICS: Russian, AlliedSignal and United Instruments or other avionics optional for VFR or IFR flying, including equipment for ICAO Cat. I approach and satellite navigation

DIMENSIONS, EXTERNAL:

Wing span	22.06 m (72 ft 4½ in)
Length overall	15.54 m (51 ft 0 in)



Antonov An-38 cabin arranged for 24 passengers and an attendant *(Jane's/Mike Keep)*

1994

Height overall 4.30 m (14 ft 1¼ in)
Span over tailfins 5.14 m (16 ft 10½ in)
Wheel track 3.43 m (11 ft 3 in)
Wheelbase 6.27 m (20 ft 7 in)
Propeller diameter 2.85 m (9 ft 4 in)
Cargo door: An-38-100
  Length 2.20 m (7 ft 2½ in)
  Width 1.40 m (4 ft 7 in)

DIMENSIONS, INTERNAL (An-38K)
Cargo hold: Length 8.80 m (28 ft 10½ in)
  Width 1.65-1.87 m (5 ft 5 in-6 ft 1½ in)
  Height 1.75-1.80 m (5 ft 8¾ in-5 ft 10¾ in)
  Volume 23.5 m³ (830 cu ft)

WEIGHTS AND LOADINGS (A, An-38-100; K, An-38K)
Weight empty: A 5,087 kg (11,215 lb)
Max payload: A 2,500 kg (5,510 lb)
  K 3,200 kg (7,055 lb)
Max T-O weight: A 8,800 kg (19,400 lb)
  K 9,400 kg (20,725 lb)

PERFORMANCE (estimated)
Nominal cruising speed at 3,000 m (9,840 ft):
  A, K 188-205 kts (350-380 km/h; 217-236 mph)
T-O run: K 480 m (1,575 ft)
Landing run: K 440 m (1,445 ft)
Balanced field length: A 850 m (2,790 ft)
Range, 45 min fuel reserves:
  A, with 26 passengers 323 n miles (600 km; 372 miles)
  A, with 17 passengers 782 n miles (1,450 km; 901 miles)
  A, max, with nine passengers 890 n miles (1,650 km; 1,025 miles)
  K, with max payload 183 n miles (340 km; 211 miles)
  K, with max fuel and 1,800 kg (3,968 lb) payload 798 n miles (1,480 km; 920 miles)

UPDATED

ANTONOV An-70

TYPE: Four-propfan medium-size wide-body transport.

PROGRAMME: Development began 1975 to replace some An-12s remaining in air force service; announced by *Izvestia* 20 December 1988; at 1991 Paris Air Show Antonov OKB reported prototype under assembly at Kiev; funding passed from former Soviet Air Force to Ukrainian government in 1992; preliminary details released and model displayed at Moscow Aero Engine and Industry Show April 1992; prototype first flight 16 December 1994; lost following in-flight collision with An-72 on 10 February 1995; second aircraft being completed for 1996 first flight; planned production at Kiev and Samara, Russia; entry into service 1997.

CURRENT VERSIONS: **An-70**: Military transport, *as described in detail.*

An-70T: Commercial transport, generally as An-70.

An-70TK: Convertible cargo/passenger transport, with seats in removable modules.

DESIGN FEATURES: First aircraft to fly powered only by propfans. Slightly larger than projected international Euroflag transport, much smaller than US McDonnell Douglas C-17A; conventional high-wing configuration, with wings and tail surfaces slightly sweptback; supercritical wing section; anhedral from roots; loading ramp/doors under upswept rear fuselage with adjustable sill height and built-in cargo handling system; horizontal tail surfaces on rear fuselage; propfans mounted conventionally on wing leading-edge. Design life 20,000 cycles and 45,000 flying hours in 25 years. Operable 3,500 hours per year, with eight to 10 man-hours of maintenance per flying hour. Cost-effective with only 200 flying hours per month.

FLYING CONTROLS: Conventional three-axis Fly-by-wire system with three digital and six analog channels, back-up by unique fly-by-hydraulics system, in which pilot or autopilot inputs are relayed to actuators by commands in hydraulic control channels, unaffected by electromagnetic interference. Double-slotted trailing-edge flaps in two sections on each wing; three-section spoilers forward of each outer flap.

STRUCTURE: Approximately 28 per cent of airframe, by weight, made of composites, including complete tail unit, ailerons and flaps. Wings manufactured at Chkalov plant, Tashkent, Uzbekistan.

LANDING GEAR: Twin-wheel nose unit; each main unit has three pairs of wheels in tandem, retracting into large fairing on side of cabin; can operate from unpaved surfaces of bearing ratio 8 kg/cm² (114 lb/sq in).

POWER PLANT: Four ZMKB Progress D-27 propfans, each 10,290 kW (13,800 shp). Stupino SV-27 contrarotating propellers, each with eight composites blades in front and six at rear. Reversible-pitch blades of scimitar form, with electric anti-icing. Export version proposed with CFM56-5A1 turbofans.

ACCOMMODATION: Three flight crew (two pilots and flight engineer) plus loadmaster; provision for converting cockpit for two-crew operation; seats in forward fuselage for two cargo attendants; freight loaded via rear ramp. Freight can be carried on PA-5.6 rigid pallets, PA-3, PA-4 and PA-6.8 flexible pallets, in UAK-2.5, UAK-5 and UAK-10 containers; unpackaged freight, wheeled and tracked vehicles, food and perishables can be carried; seats for 170 troops can be installed; crew door at front of cabin on port side; cargo hold pressurised and air conditioned.

SYSTEMS: Aircraft systems automated to simplify operation and decrease probability of crew errors.

AVIONICS: Flight data, navigation and radio-navigation systems to ARINC 700 requirements; digital multiplex data interface equivalent to US 1553B.

Comms: VHF and HF radio.

Flight: Laser INS, SKI-77 HUD, flight management system, designed for operation in adverse weather and for landing in ICAO Cat. II and IIIa conditions. BASK-70 onboard diagnostic system collects data from subsystems, registering and analysing 8,000 in-flight parameters.

Instrumentation: Colour digital CRT displays.

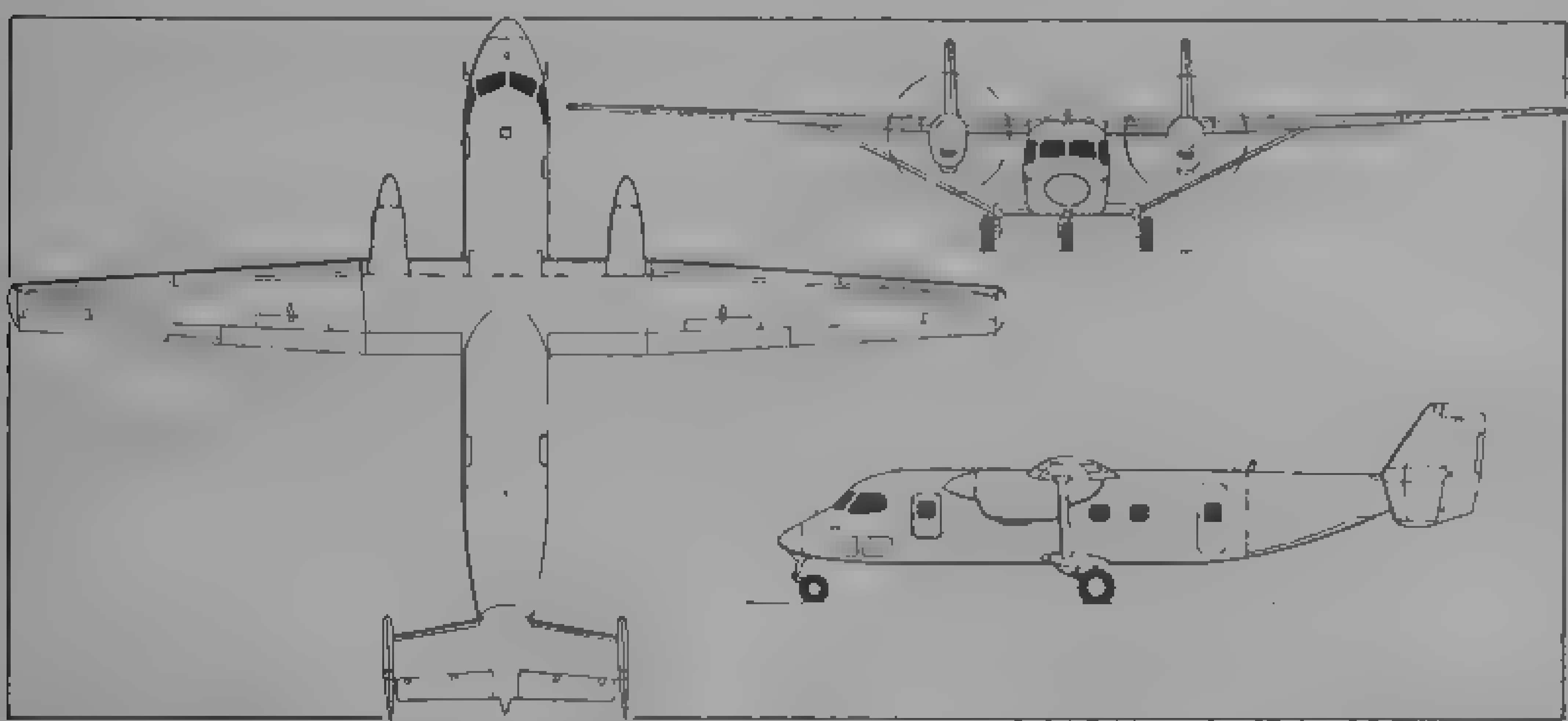
DIMENSIONS, EXTERNAL
Wing span 44.06 m (144 ft 6¾ in)
Length overall 40.25 m (132 ft 0¾ in)
Height overall 16.10 m (52 ft 10 in)
Propeller diameter 4.50 m (14 ft 9 in)
Rear-loading aperture: Height 4.10 m (13 ft 5½ in)
  Width 4.00 m (13 ft 1½ in)

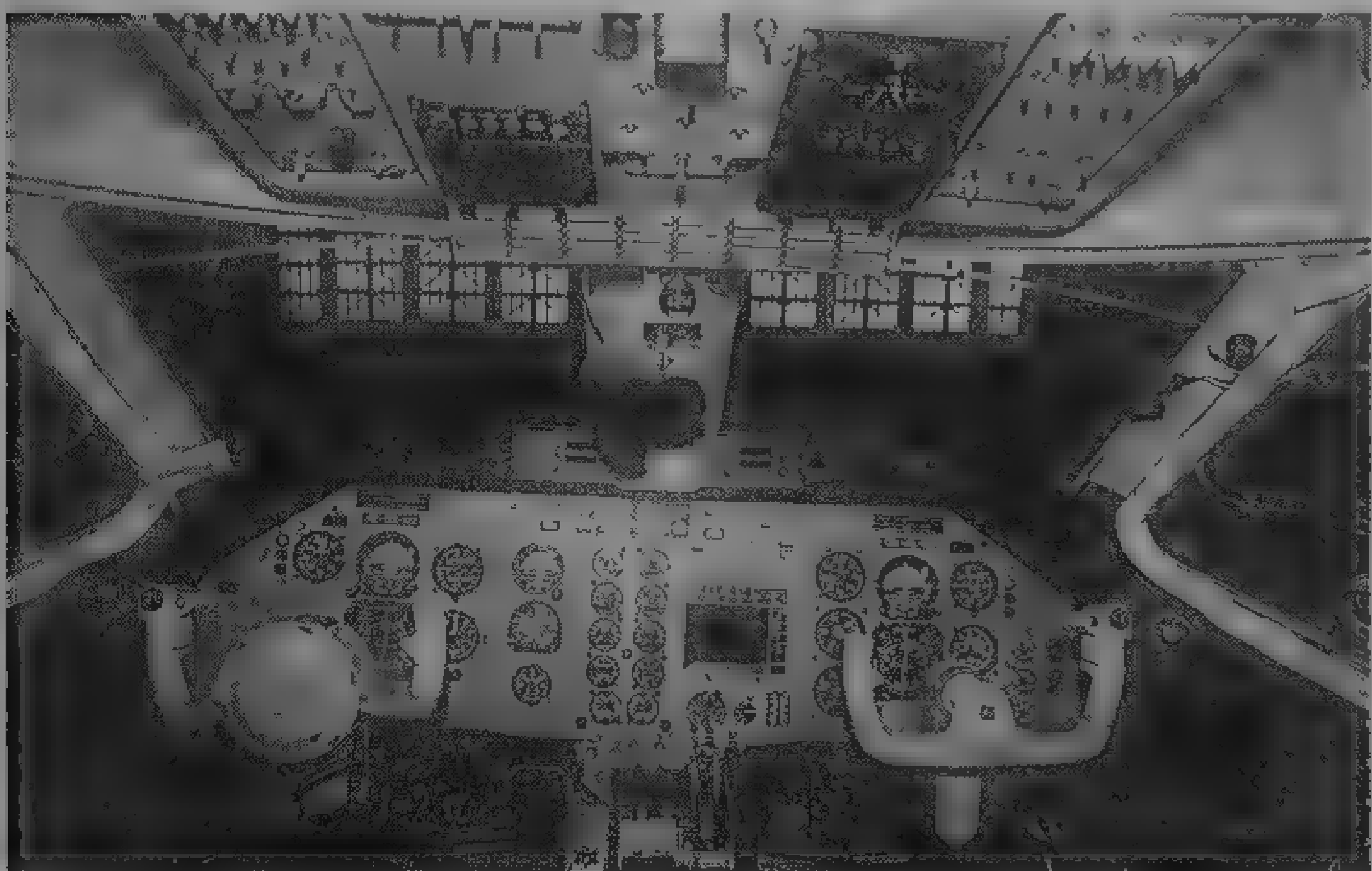
DIMENSIONS, INTERNAL
Cargo hold: Floor length 18.60 m (61 ft 0¼ in)
  Floor length, incl ramp 22.40 m (73 ft 6 in)
  Floor width 4.00 m (13 ft 1½ in)
  Height 4.10 m (13 ft 5½ in)

WEIGHTS AND LOADINGS
Normal payload (incl 5,000 kg; 11,025 lb on ramp) 30,000 kg (66,135 lb)
Normal payload from unpaved runway 20,000 kg (44,090 lb)
Max payload 35,000 kg (77,160 lb)
Normal T-O weight 112,000 kg (246,900 lb)
Max T-O weight 130,000 kg (286,600 lb)
Max T-O weight from unpaved runway 100,000 kg (220,460 lb)
Max power loading 3.16 kg/kW (5.19 lb/shp)

PERFORMANCE (estimated)
Nominal cruising speed 405-431 kts (750-800 km/h; 466-497 mph)
Cruising height 8,600-9,600 m (28,200-31,500 ft)
T-O run: normal T-O weight 1,500 m (4,920 ft)
  max T-O weight 1,800 m (5,905 ft)

Antonov An-38-100 prototype making Western debut at Paris 1995 *(Paul Jackson)*
1995


Antonov An-38, stretched version of the An-28 *(Jane's/Mike Keep)*
1995


Flight deck of Antonov An-38-100 *(Mark Wagner/Flight International)*
1995

An-70 pressurised propfan-powered transport prototype *(Sergey Sergeyev)*

1995

Runway length at max T-O weight
  for T-O 1,720 m (5,645 ft)
  for landing 1,950 m (6,400 ft)
Landing run 1,900 m (6,235 ft)
Range with 20,000 kg (44,090 lb) payload
  from 600-800 m (1,970-2,625 ft) unpaved runway
  1,618 n miles (3,000 km; 1,864 miles)
  at normal T-O weight
  2,885 n miles (5,350 km; 3,325 miles)
  at max T-O weight
  3,910 n miles (7,250 km; 4,505 miles)
Range with 30,000 kg (66,135 lb) payload
  at normal T-O weight
  1,670 n miles (3,100 km; 1,925 miles)
  at max T-O weight
  2,985 n miles (5,530 km; 3,435 miles)

UPDATED

ANTONOV An-72 and An-74

NATO reporting name: Coaler

TYPE: Twin-turbofan light STOL transport.

PROGRAMME: First of two prototype An-72s, built at Kiev, flew 22 December 1977; after eight preseries aircraft, manufacture transferred to Kharkov; An-74 polar transport announced February 1984; An-72P maritime patrol version demonstrated 1992; production of An-72/74 variants currently 20 a year.

CURRENT VERSIONS: **An-72** ('Coaler-C'): Light STOL transport for military use; extended wings, lengthened fuselage and other changes compared with An-72 ('Coaler-A') prototypes; ZMKB Progress D-36 Series 2A engines; crew of two or three.

An-72P/An-76: Maritime patrol version, described separately.

An-74-200 ('Coaler-B'): For all-weather operation including Arctic flying to assist in setting up scientific stations on ice floes, airdrop supplies to motorised expeditions and observe changes in icefields; flight crew of five; D-36 Series 3A engines of unchanged rating; wing, tail unit and engine air intake de-icing, advanced navigation aids, including inertial navigation system; provision for wheel/ski landing gear; much increased fuel capacity; airframe identical with An-72 except for two blister windows at rear of flight deck and front of cabin on port side and larger nose radome; maximum T-O weight increased to 36,500 kg (80,465 lb), payload 7,500 kg (16,535 lb); range with maximum payload, 1 hour reserve 1,160 n miles (2,150 km; 1,335 miles).

An-74T-200 ('Coaler-B'): Cargo version, payload 10,000 kg (22,045 lb); loading winch, roller conveyors in floor; crew of two. Range with maximum payload, 1 hour reserve 675 n miles (1,250 km; 776 miles).

An-74TK-200 ('Coaler-B'): Convertible cargo/passenger aircraft with 52 folding passenger seats or all-cargo or all-passenger or combi layouts. Built-in loading equipment. Crew of two. Range with 10,000 kg (22,045 lb) payload, 1 hour reserve 430 n miles (800 km; 497 miles).

An-74T-100 ('Coaler-B'): As An-74T-200, with navigator station (crew of four).

An-74TK-100: As An-74TK-200, with navigator station (crew of four).

CUSTOMERS: More than 150 An-72/74s built, most of them for military use; 20 in Russian air forces, four in Peruvian Air Force.

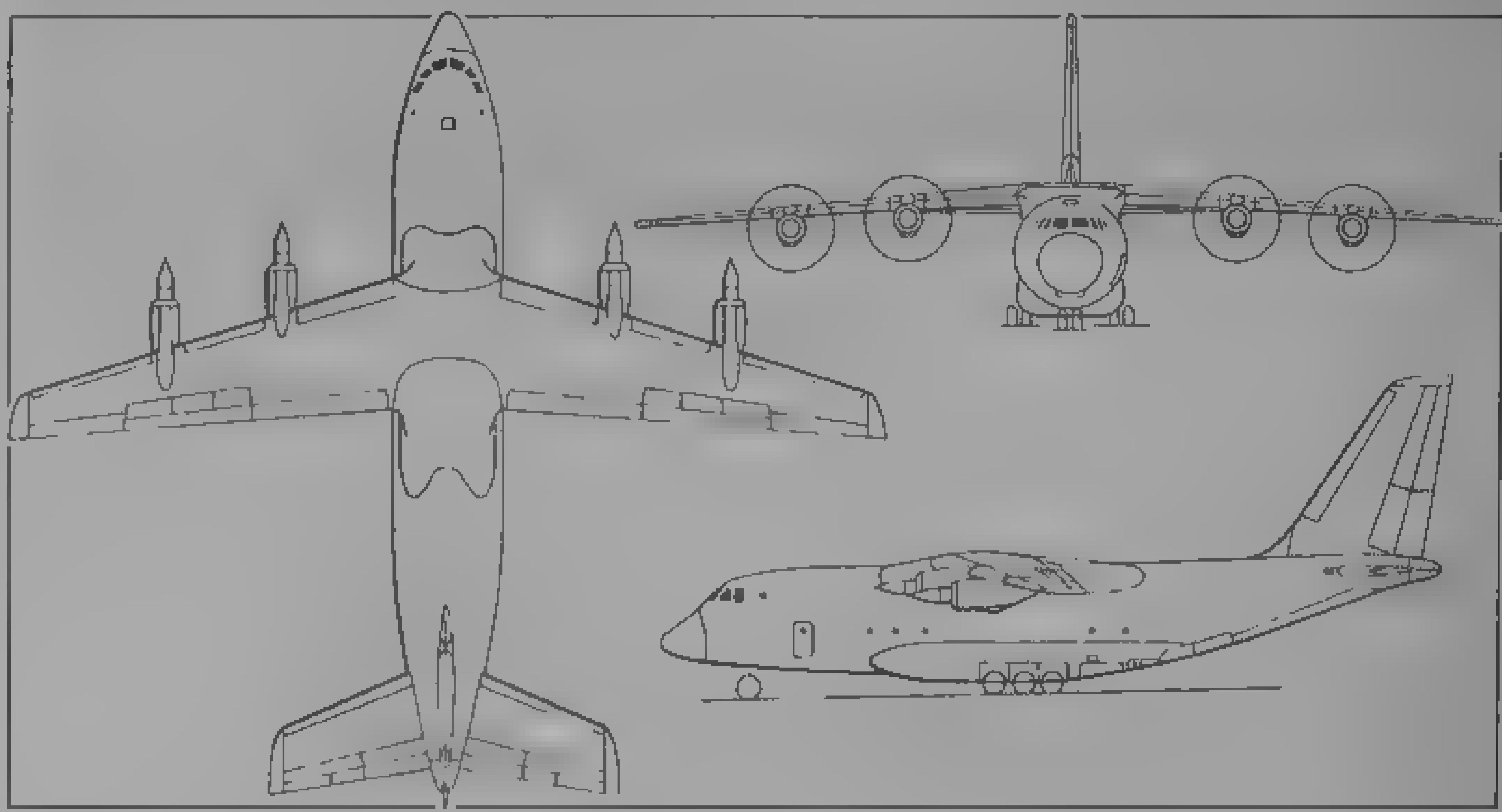
COSTS (An-74): Approximately $12.5 million.

DESIGN FEATURES: Primary role as STOL replacement for turboprop An-26, with emphasis on freight carrying; ejection of exhaust efflux over upper wing surface and down over large multislotted flaps gives considerable increase in lift; special ramp/door as An-26; low-pressure tyres and multiwheel landing gear for operation from unprepared strips, ice or snow; high-set engines avoid foreign object ingestion; wing leading-edge sweepback 17°, anhedral approximately 10° on outer wings; normal T-O flap setting 25 to 30°, maximum deflection 60°; sweptback fin and rudder.

FLYING CONTROLS: Power actuated ailerons, with two tabs in port aileron, one starboard; double-hinged rudder, with tab in lower portion of two-section aft panel; during normal flight only lower rear rudder segment is used, both rear segments used in low-speed flight; forward segment is actuated automatically to offset thrust asymmetry; horn balanced and mechanically actuated, aerodynamically balanced elevators, each with two tabs; hydraulically actuated full-span wing leading-edge flaps outboard of nacelles; trailing-edge flaps double-slotted in exhaust efflux, triple-slotted between nacelles and outer wings; four-section spoilers forward of triple-slotted flaps, two outer sections on each side raised before landing, remainder opened automatically on touchdown by sensors actuated by weight on main landing gear; inverted leading-edge slat on tailplane linked to wing flaps.

STRUCTURE: All-metal multispar wings mounted above fuselage; wing skin, spoilers and flaps of titanium aft of engine nacelles; circular semi-monocoque fuselage, with rear ramp/door; tapered fairing forward of T tail fin/tailplane junction, blending into ogival rear fairing.

LANDING GEAR: Hydraulically retractable tricycle type, primarily of titanium. Rearward-retracting steerable twin-wheel nose unit. Each main unit comprises two trailing arm legs in tandem, each with a single wheel, retracting inward through 90° so that wheels lie horizontally in bottom of fairings, outside fuselage pressure cell.



Antonov An-70 transport (four ZMKB Progress D-27 propfans) *(Jane's/Mike Keep)*

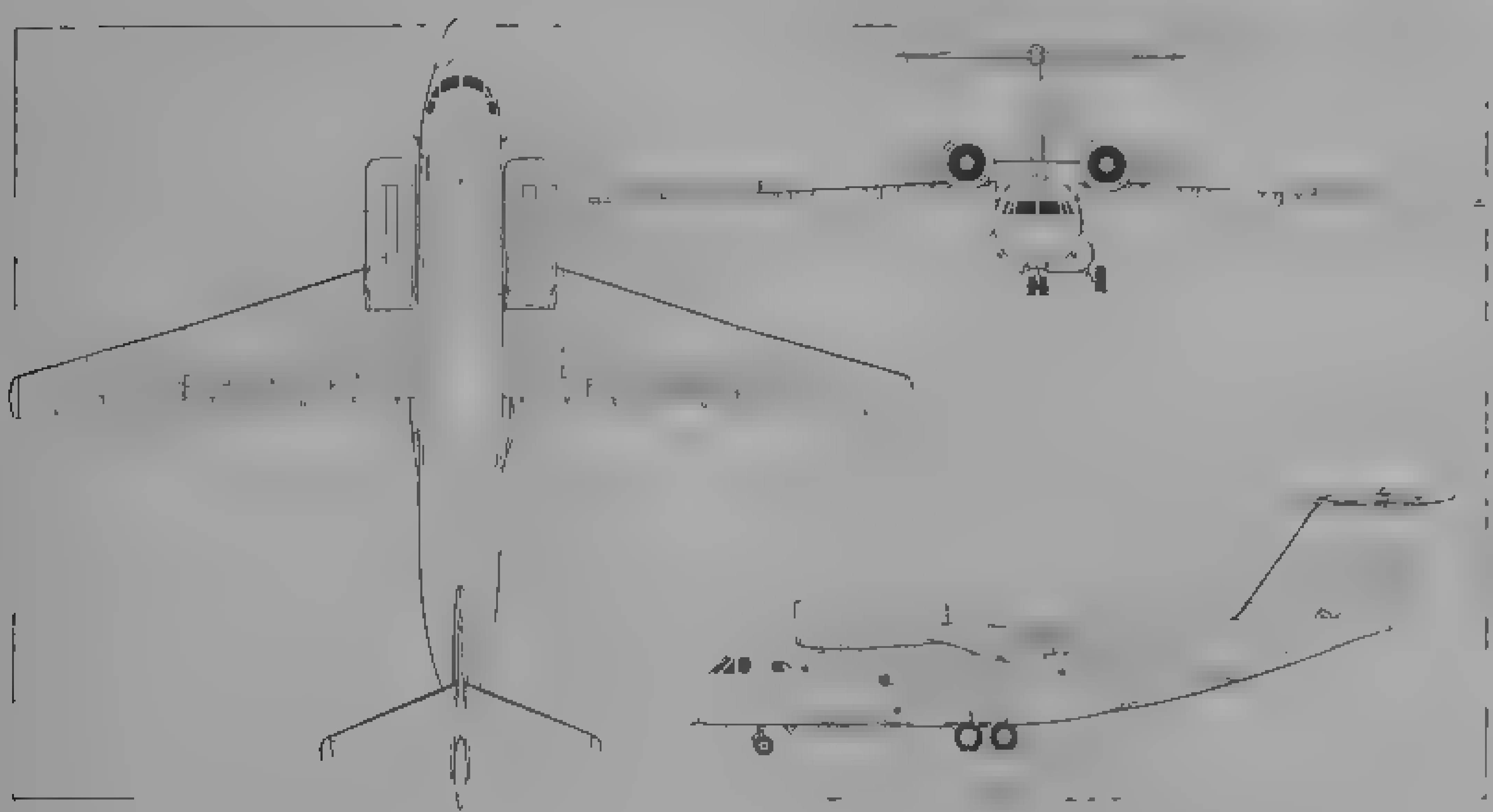
1994

Antonov An-74 at the Myasishchev Space Centre, Krasnoy *(Mark Wagner/Flight International)*

1995

Antonov An-72 ('Coaler-C') twin-turbofan STOL transport in military service *(Mark Wagner/Flight International)*

1994



Antonov An-74 ('Coaler-B') STOL transport (two ZMKB Progress D-36 turbofans) *(Jane's/Dennis Punnett)*

1992

Oleopneumatic shock-absorber in each unit. Low-pressure tyres, size 720 × 310 mm on nosewheels, 1,050 × 400 mm on mainwheels. Hydraulic disc brakes. Telescopic strut hinges downward, from rear of each side fairing, to support fuselage during direct loading of hold with ramp/door under fuselage.

POWER PLANT: Two ZMKB Progress D-36 high-bypass ratio turbofans, each 63.74 kN (14,330 lb st). Integral fuel tanks between spars of outer wings. Thrust reversers standard.

ACCOMMODATION: Pilot and co-pilot/navigator side by side on flight deck of basic An-72, plus flight engineer, with provision for fourth person. Heated windows. Two windscreen wipers. Flight deck and cabin pressurised and air conditioned. Main cabin designed primarily for freight, including four UAK 2.5 containers or four PAV 2.5 pallets each weighing 2,500 kg (5,511 lb). An-72 has folding seats along sidewalls and removable central seats for 68 passengers. It can carry 57 parachutists, and has provision for 24 stretcher patients, 12 seated casualties and an attendant in ambulance configuration. An-74 can carry eight mission staff in combi role, in two rows of seats, with tables and with two bunks, one on each side of cabin aft of seats. Bulged observation windows on port side for navigator and hydrologist. Provision for wardrobe and galley. Movable bulkhead between passenger and freight compartments, with provision for 1,500 kg (3,307 lb) of freight in rear compartment. Downward-hinged and forward sliding rear ramp/door for loading trucks and tracked vehicles, and for direct loading of hold from trucks, as described under An-26 entry. It is openable in flight, enabling freight loads of up to 7,500 kg (16,535 lb), with a maximum of 2,500 kg (5,511 lb) per individual item, to be airdropped by parachute extraction system. Removable mobile winch, capacity 2,500 kg (5,511 lb), assists loading of containers up to 1.90 × 2.44 × 1.46 m (6 ft 3 in × 8 ft × 4 ft 9½ in) in size, pallets 1.90 × 2.42 × 1.46 m (6 ft 3 in × 7 ft 11 in × 4 ft 9½ in) in size, and other bulky items. Cargo straps and nets stowed in lockers on each side of hold when not in use. Provision for roller conveyors in floor. Main crew and passenger door at front of cabin on port side. Emergency exit and servicing door at rear of cabin on starboard side.

SYSTEMS: Air conditioning system for comfort to altitude of 10,000 m (32,800 ft), with independent temperature control in flight deck and main cabin areas. Used to refrigerate main cabin when perishable goods carried. Maximum cabin pressure differential 0.49 bars (7.1 lb/sq in). Hydraulic system for landing gear, flaps and ramp. Electrical system powers auxiliary systems, flight deck equipment, lighting and mobile hoist. Thermal de-icing system for leading edges of wings and tail unit (including tailplane slat), engine air intakes and cockpit windows. Provision for APU in starboard landing gear fairing. This can be used to heat cabin under cold ambient conditions, servicing personnel can gain access to major electric, hydraulic and air conditioning components without stepping outside.

AVIONICS: *Comms*: HF com, VHF com/nav, 'Odd Rods' IFF standard.

Radar: Navigation/weather radar in nose.

Flight: ADF. Doppler based automatic navigation system, linked to onboard computer, is preprogrammed before take-off on push-button panel to right of map display.

Instrumentation: Failure warning panels above windscreen display red lights for critical failures, yellow lights for non-critical failures, to minimise time spent on monitoring instruments and equipment.

An-74 has enhanced avionics, including INS.

DIMENSIONS, EXTERNAL:

Wing span	31.89 m (104 ft 7½ in)
Wing aspect ratio	10.31
Length overall (An-72)	28.07 m (92 ft 1¼ in)
Fuselage: Max diameter	3.10 m (10 ft 2 in)
Height overall	8.65 m (28 ft 4½ in)
Wheel track	4.15 m (13 ft 7½ in)
Wheelbase	8.12 m (26 ft 7¾ in)
Crew/passenger door: Height	1.65 m (5 ft 5 in)
Width	0.90 m (2 ft 11½ in)
Rear-loading door: Length	7.10 m (23 ft 3½ in)
Width	2.40 m (7 ft 10½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	10.50 m (34 ft 5¼ in)
Width at floor level	2.15 m (7 ft 0½ in)
Height	2.20 m (7 ft 2½ in)

AREAS:

Wings, gross	98.53 m² (1,060.6 sq ft)

WEIGHTS AND LOADINGS (An-72):

Weight empty	19,050 kg (42,000 lb)
Max fuel	12,950 kg (28,550 lb)
Max payload: normal	10,000 kg (22,045 lb)
Max T-O weight:	
from 1,800 m (5,905 ft) runway	34,500 kg (76,060 lb)
from 1,500 m (4,920 ft) runway	33,000 kg (72,750 lb)
from 1,000 m (3,280 ft) runway	27,500 kg (60,625 lb)
Max landing weight	33,000 kg (72,750 lb)
Max wing loading	349.8 kg/m² (71.62 lb/sq ft)
Max power loading	270.6 kg/kN (2.65 lb/lb st)

PERFORMANCE (An-72, A: at T-O weight of 33,000 kg; 72,750 lb, B: at T-O weight of 27,500 kg; 60,625 lb on 1,000 m; 3,280 ft unprepared runway):

Max level speed at 10,000 m (32,800 ft):	
A	380 kts (705 km/h; 438 mph)
Cruising speed at 10,000 m (32,800 ft):	
A, B	297-324 kts (550-600 km/h; 342-373 mph)
Approach speed: A	97 kts (180 km/h; 112 mph)
Service ceiling: A	10,700 m (35,100 ft)
B	11,800 m (38,715 ft)
Service ceiling, OEI: A	5,100 m (16,730 ft)
B	6,800 m (22,300 ft)
T-O run: A	930 m (3,052 ft)
B	620 m (2,035 ft)
T-O to 10.7 m (35 ft): A	1,170 m (3,840 ft)
B	830 m (2,725 ft)
Landing run: A	465 m (1,525 ft)
B	420 m (1,380 ft)

Range, with 45 min reserves:

A with max payload	430 n miles (800 km; 497 miles)
A with 7,500 kg (16,535 lb) payload	1,080 n miles (2,000 km; 1,240 miles)
A with max fuel	2,590 n miles (4,800 km; 2,980 miles)
B with 5,000 kg (11,020 lb) payload	430 n miles (800 km; 497 miles)
B with max fuel	1,760 n miles (3,250 km; 2,020 miles)

PERFORMANCE (An-74-200):

Generally as for An-72 except:

Range, with 2 h reserves:

with max payload	620 n miles (1,150 km; 715 miles)
with 5,000 kg (11,020 lb) payload	1,726 n miles (3,200 km; 1,988 miles)
with 1,500 kg (3,307 lb) payload	2,860 n miles (5,300 km; 3,293 miles)

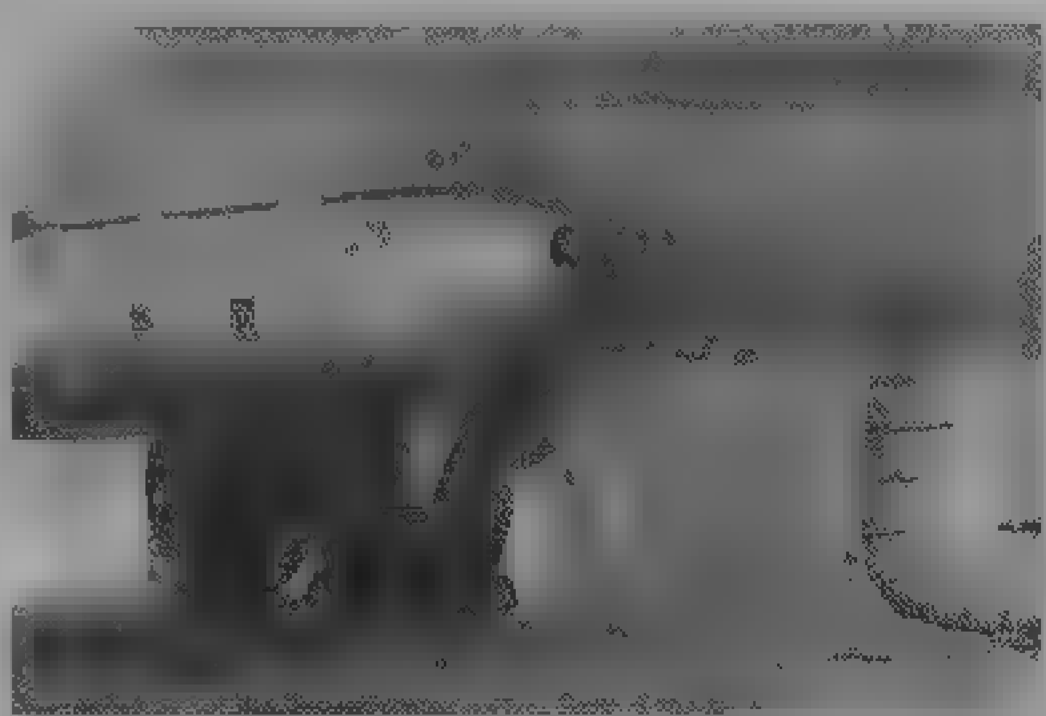
UPDATED

ANTONOV An-72P (An-76)

NATO reporting name: Coaler

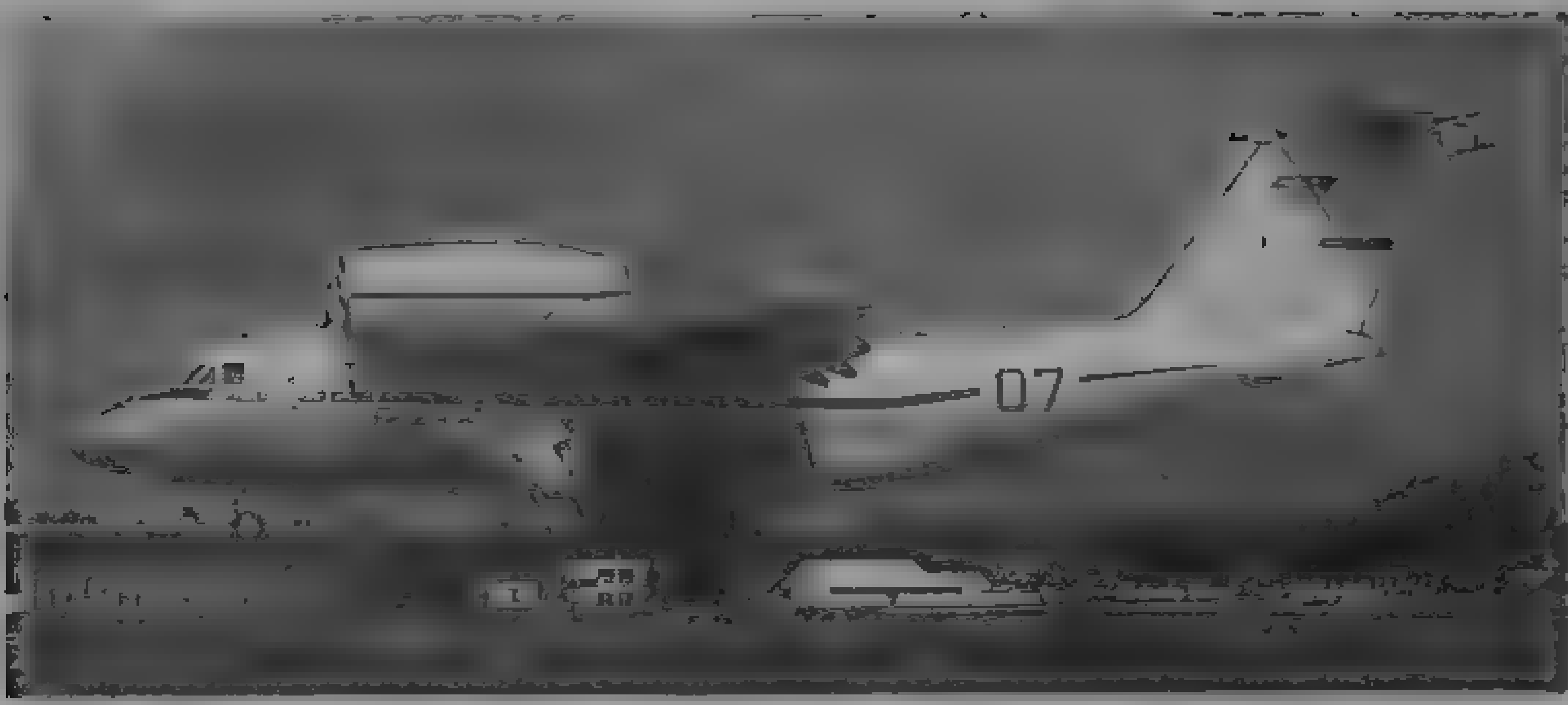
TYPE: Twin-turbofan STOL maritime patrol aircraft.

PROGRAMME: First seen 1992, displayed at 1992 Farnborough Air Show, in production. Upgraded version, with Israel avionics and armament, marketed by Israel Aircraft Industries.



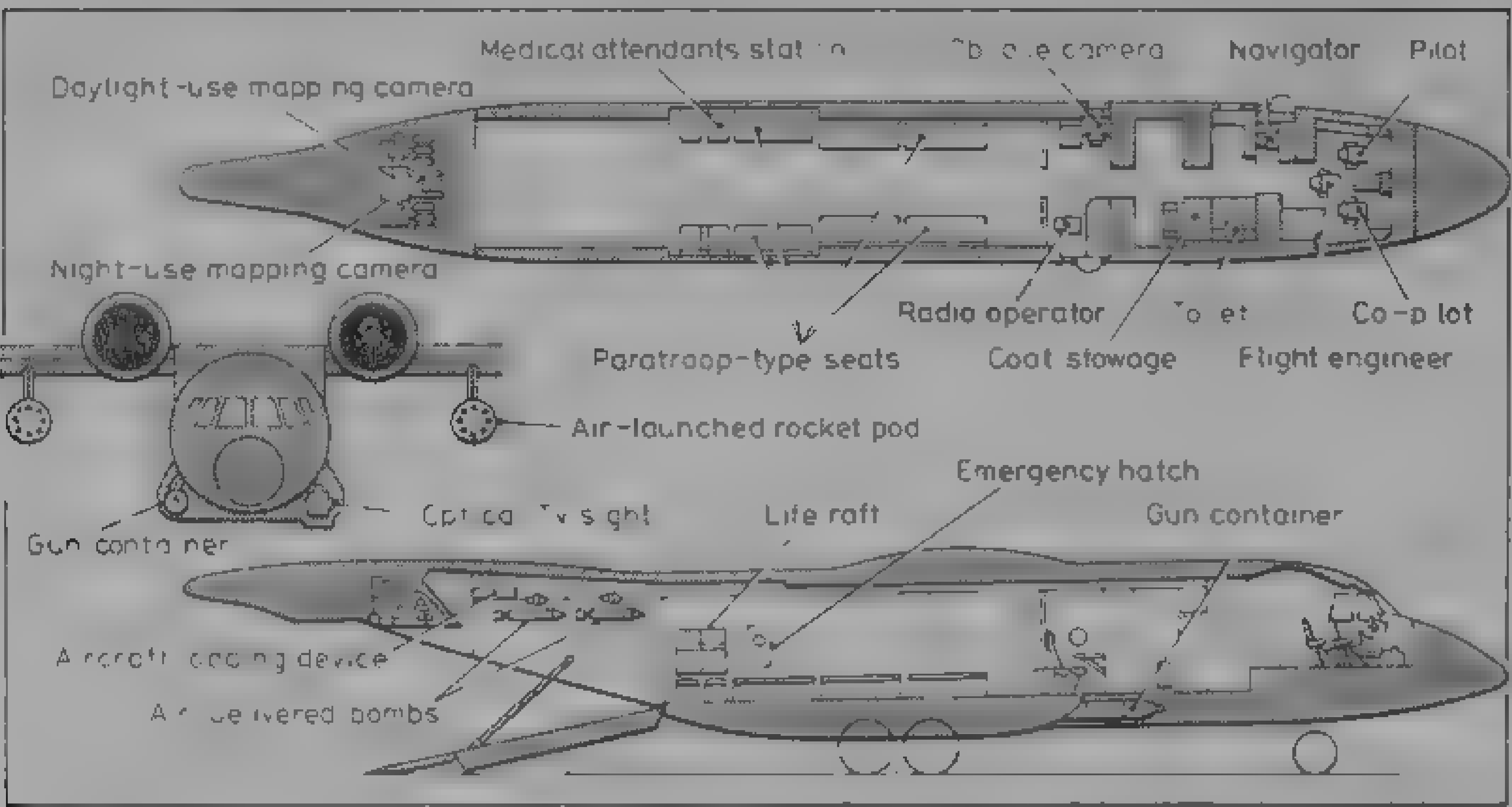
Rotating sensor turret under fuselage of An-72P/An-76 upgraded by Israel Aircraft Industries *(Kenneth Munson)*

1994



Antonov An-72P/An-76 STOL maritime patrol aircraft (*Paul Jackson*)

1995



Disposition of equipment and armament in the military Antonov An-72P/An-76. The ramp moves down and forward to lie underneath the fuselage when bombs are dropped from the cargo gantry (*Jane's/Mike Keep*)

1993

CUSTOMERS: Initial order 20 for Russian military use

COSTS: Israeli upgraded version quoted at $15 to 20 million early 1994

DESIGN FEATURES: Basically identical to An-72 transport intended for armed surveillance of coastal areas within 200 n miles (370 km, 230 miles) of shore, day and night in all weathers

ACCOMMODATION: For maritime missions, flight crew of five with navigator and radio operator stationed by bulged windows at rear of flight deck on port side and immediately forward of wing leading-edge on starboard side respectively. Provision in main cabin for 40 persons on sidewall and centreline removable seats, including ramp-mounted seats, or 22 fully equipped paratroops, or 16 stretcher patients and medical attendant; or up to 5,000 kg (11,025 lb) of ammunition, equipment or vehicles, with seats stowed

AVIONICS: Permit automated navigation at all stages of flight precise fixing of coordinates, speed and heading of surface ships, air-to-air and air-to-surface communication with aircraft, ships and coastguard to support missions. Digital cockpit avionics in IAI upgraded version. TV scanning system in port main landing gear fairing. IAI version offered with Elta EL/M 2022A maritime surveillance radar, El Op day/night long-range observation system, and Elisra electronic warfare suite

EQUIPMENT: Oblique camera on port side opposite radio operator's station; daylight and night mapping cameras in tailcone; SFP-2A flares for night use

ARMAMENT: One 23 mm GSh-23L gun, with 250 rounds, in pod forward of starboard main landing gear fairing. UB-32M rocket pack under each wing, four 100 kg (220 lb) bombs in roof of hold, above rear loading hatch with ramp slid forward under cabin to make release practicable. Israeli upgraded version can carry IAI Griffin laser guided bomb underwing

Other data generally as for An-72 transport except:

WEIGHTS AND LOADINGS:

Mission load	650 kg (1,433 lb)
Max T-O weight	37,500 kg (82,670 lb)

PERFORMANCE:

Patrol speed at 500-1,000 m (1,640-3,280 ft)	162-189 kts (300-350 km/h, 186-217 mph)
Service ceiling	10,100 m (33,135 ft)
Field requirement	1,400 m (4,600 ft)
Max endurance	7 h to 7 h 18 min

UPDATED

ANTONOV An-124

NATO reporting name: Condor

TYPE: Long range heavy-lift four-turbofan freight transport

PROGRAMME: Bureau design number 305. Prototype (SSSR-680125) first flew 26 December 1982; second aircraft (SSSR-680210) similarly built at Kiev; first production aircraft (SSSR-82002 *Ruslan*, named after giant hero of Russian folklore immortalised by Pushkin) exhibited 1985 Paris Air Show; lifted payload of 171,219 kg (377,473 lb) to 10,750 m (35,269 ft) on 26 July 1985, exceeding by 53 per cent C-5A Galaxy's record for payload lifted to 2,000 m and setting 20 more records; entered service January 1986, transporting units of US/Canadian Euclid 154 tonne dumper truck for Yakut diamond miners; set closed circuit distance record 6-7 May 1987 by flying 10,880.625 n miles (20,150.921 km, 12,521.201 miles) in 25 hours 30 minutes; deliveries to VTA, to replace An-22, began 1987; in September 1990, during Gulf crisis, an An-124 carried 451 Bangladeshi refugees from Amman to Dacca, after being fitted with chemical toilets, a 570 litre (150 US gallon, 125 Imp gallon) drinking water tank and foam rubber cabin lining in lieu of seats. Two records set by Air Foyle with An-124s: heaviest commercial air cargo movement of three 43 tonne transformers and ancillary equipment, totalling 143 tonnes, from Barcelona, Spain, to Noumea, New Caledonia, and single heaviest cargo item comprising 120 tonne Liebherr crane from Krivoy Rog, Ukraine, to Berlin, Germany

CURRENT VERSIONS: **An-124**: Basic transport, *as described in detail*

An-124-100: Commercial transport, civil type certificate granted by AviaRegistr of Interstate Aviation Committee of CIS on 30 December 1992. Maximum T-O weight restricted to 392,000 kg (864,200 lb) and maximum payload to 120,000 kg (264,550 lb)

An-124-100M: As An-124-100, but with Western avionics, including Litton LTN-92 INS and LTN 2001 GPS, and Rockwell Collins satcom, ACARS, weather radar and TCAS-2. Crew reduced to four by removal of radio operator and navigator. Deliveries scheduled to begin late 1995

An-124-102: Flight deck EFIS equipped, with dual sets of CRTs. Crew reduced to three (two pilots and flight engineer)

An-124FFR: Proposed firefighting water-bomber, able to drop 200 tonnes of fire retardants. Convertible to freighter

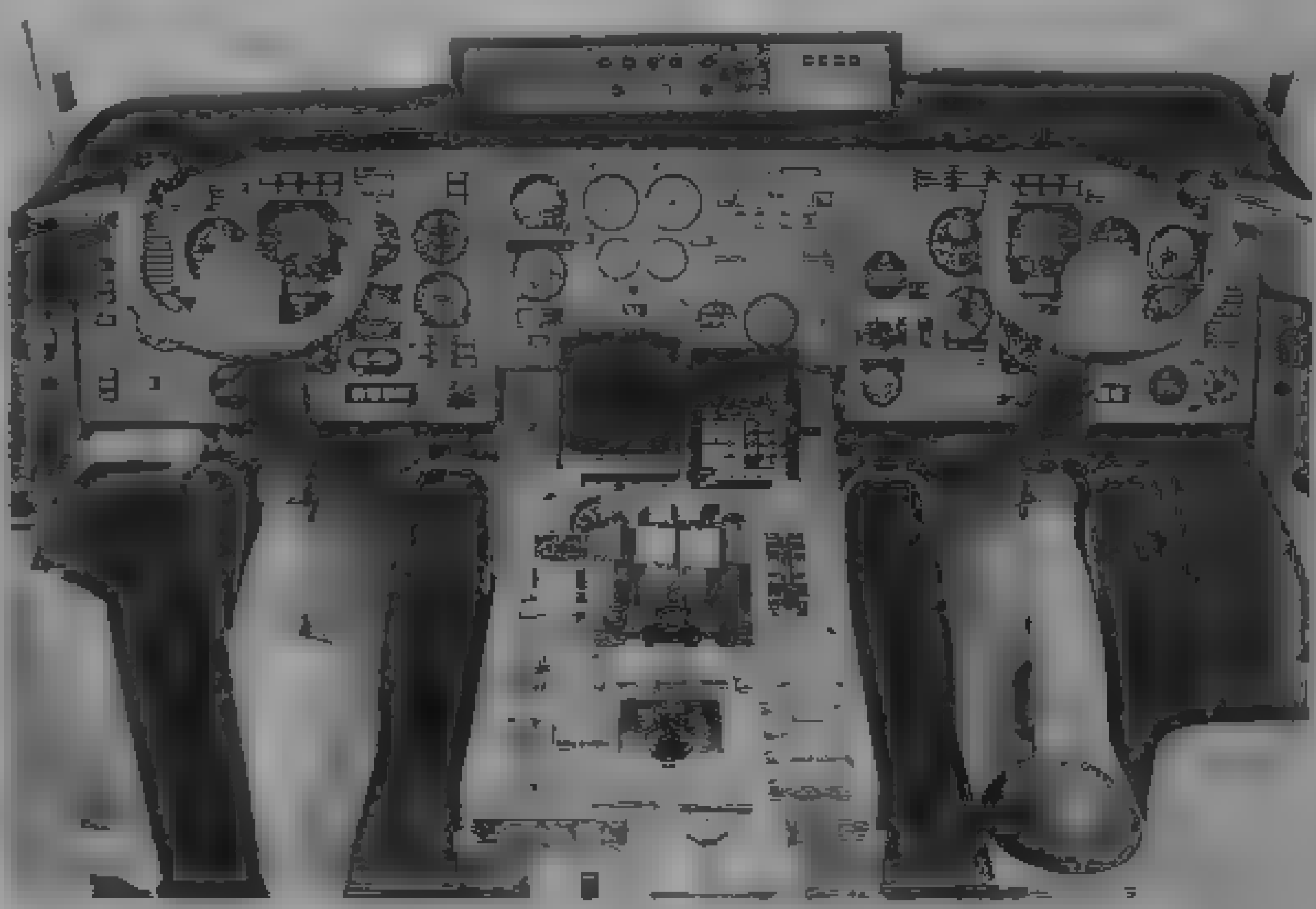
Re-engining with Western turbofans is also under consideration

CUSTOMERS: Manufactured at Kiev (GAZ 473) and (beginning with fifth production aircraft, SSSR-82005, in late 1985) Ulyanovsk (GAZ 977); by January 1995, 51 built, comprising 19 at Kiev (including one military) and 32 (including six military) at Ulyanovsk. Production continues at nominal five per year. First international commercial operator was Air Foyle of Luton, UK, which wet leases three An-124s from Antonov OKB, with option on two more; eight available to HeavyLift (UK)/VolgaDnepr (Russia) for charter operations. Other operators include Ajax, the freight subsidiary of ARIA (two + one on order); Rossiya division of Aeroflot (two for state missions + two), Antonov Airtrack (one + one), and Transcharter (one)

DESIGN FEATURES: World's largest production aircraft; configuration similar to Lockheed C-5 Galaxy, except for low-mounted tailplane, upward-hinged visor type nose and rear

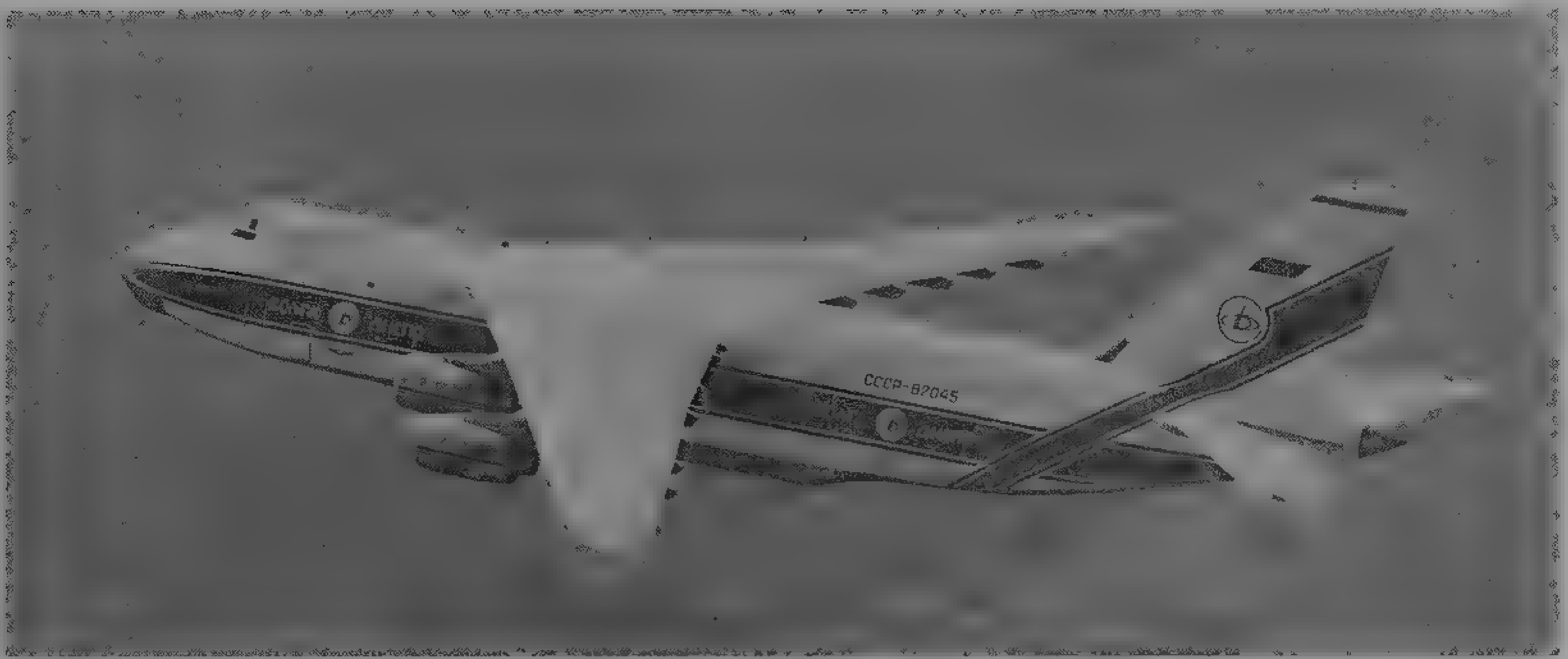
Antonov An-72P/An-76, with thrust reverser doors open and flaps extended (*Kenneth Munson*)

1994



Cockpit of An-72P/An-76 maritime patrol aircraft (*Peter J. Cooper*)

1993



Antonov An-124 heavy freight transport in the insignia of VolgaDnepr *(Paul R. Duffy)*

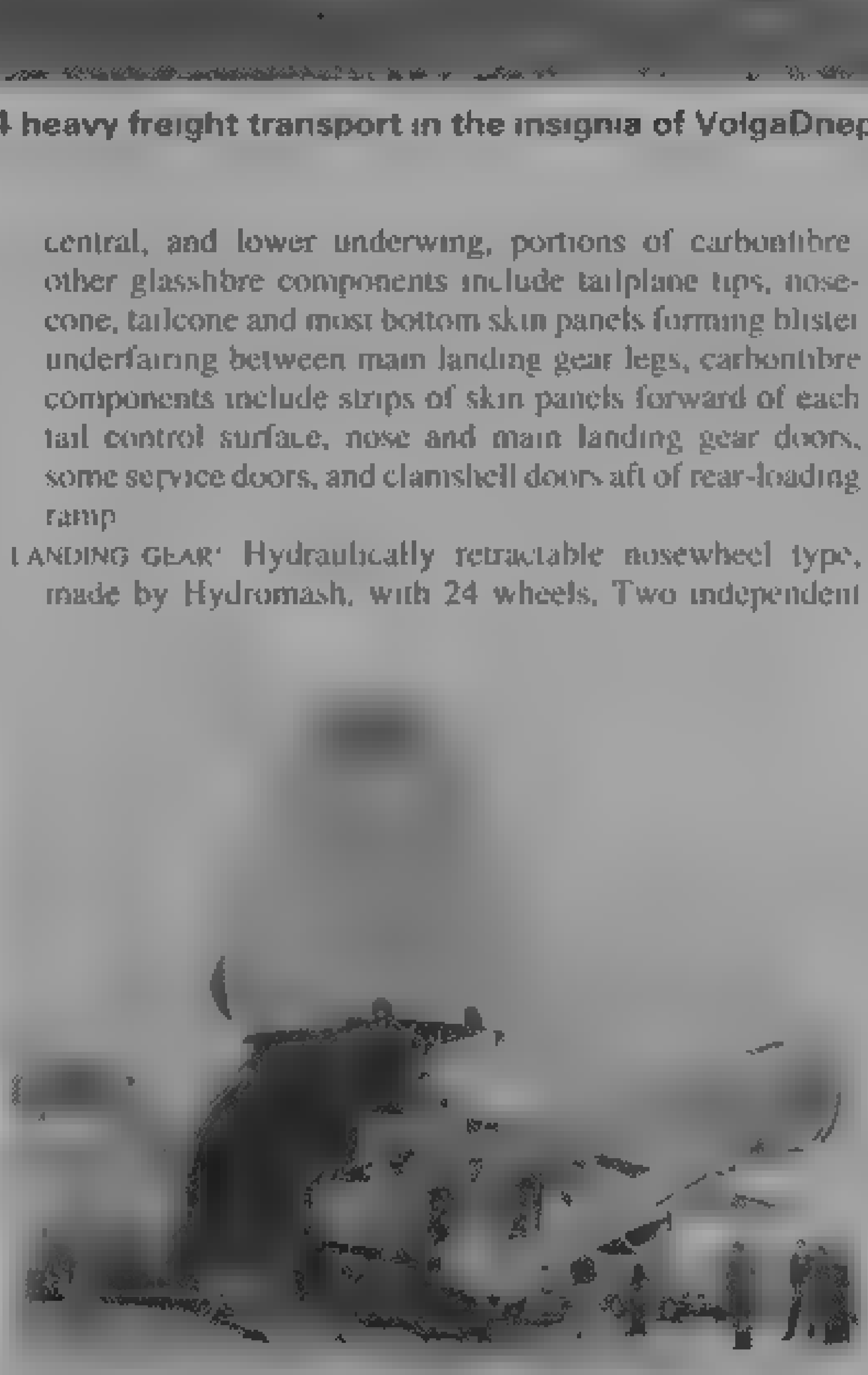
1994

fuselage ramp/door for simultaneous front and rear loading/unloading, 100 per cent fly-by-wire control system, titanium floor throughout constant-section main hold, which is lightly pressurised, with a fully pressurised cabin for passengers above, landing gear for operation from unprepared fields, hard packed snow and ice covered swampland, steerable nosewheels and mainwheels permit turns on 45 m (148 ft) wide runway. Supercritical wings, with anhedral, sweepback approximately 35° on inboard leading-edge, 32° outboard, all tail surfaces sweptback.

FLYING CONTROLS: Fly-by-wire, with all surfaces hydraulically actuated, two-section ailerons, three-section single-slotted Fowler flaps and six-section full-span leading-edge flaps on each wing, small slot in outer part of two inner flap sections each side to optimise aerodynamics; 12 spoilers on each wing, forward of trailing-edge flaps, no wing fences, vortex generators or tabs; hydraulic flutter dampers on ailerons, rudder and each elevator in two sections, without tabs but with hydraulic flutter dampers, fixed incidence tailplane, control runs (and other services) channelled along fuselage roof.

STRUCTURE: Basically conventional light alloy, but 5,500 kg (12,125 lb) of composites make up more than 1,500 m² (16,150 sq ft) of surface area, giving weight saving of more than 2,000 kg (4,410 lb), each wing has one-piece root-to-tip upper surface extruded skin panel, strip of carbonfibre skin panels on undersurface forward of control surfaces, and glassfibre tip, front and rear of each flap guide fairing of glassfibre, centre portion of carbonfibre, central frames of semi-monocoque fuselage each comprise four large forgings; fairings over intersection of fuselage double-bubble lobes in line with wing, from rear of flight deck to plane of fin leading-edge, primarily of glassfibre, with central, and lower underwing, portions of carbonfibre; other glassfibre components include tailplane tips, nosecone, tailcone and most bottom skin panels forming blister underfairing between main landing gear legs, carbonfibre components include strips of skin panels forward of each tail control surface, nose and main landing gear doors, some service doors, and clamshell doors aft of rear-loading ramp.

LANDING GEAR: Hydraulically retractable nosewheel type, made by Hydromash, with 24 wheels. Two independent forward-retracting and steerable twin-wheel nose units, side by side. Each main gear comprises five independent inward-retracting twin-wheel units, front two units on each side steerable. Each mainwheel bogie enclosed by separate upper and lower doors when retracted. Nosewheel doors and lower mainwheel doors close when gear extended. All wheel doors of carbonfibre. Main gear bogies retracted individually for repair or wheel change. Mainwheel tyres size 1,270 × 510 mm. Nosewheel tyres size 1,120 × 450 mm. Aircraft can 'kneel', by retracting nosewheels and settling on two extendable 'feet', giving floor of hold a 3.5° slope to assist loading and unloading. Rear of cargo hold lowered by compressing main gear oleos. Carbon brakes normally toe operated, via rudder pedals. For severe braking, pedals depressed by toes and heels.

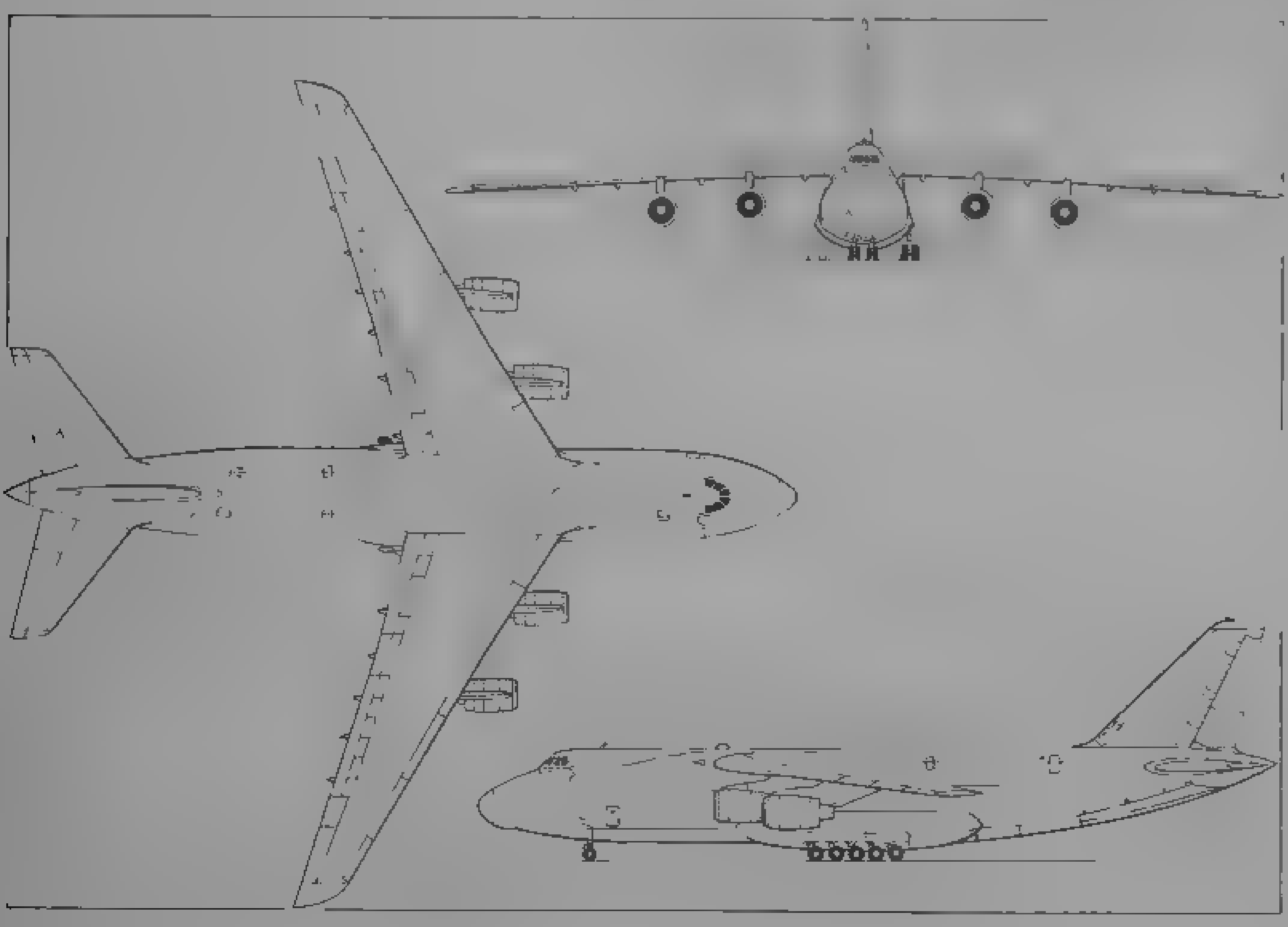


One of six 31.5 tonne excavators carried to Kuwait from Stansted Airport by Air Foyle Antonov An-124

1994

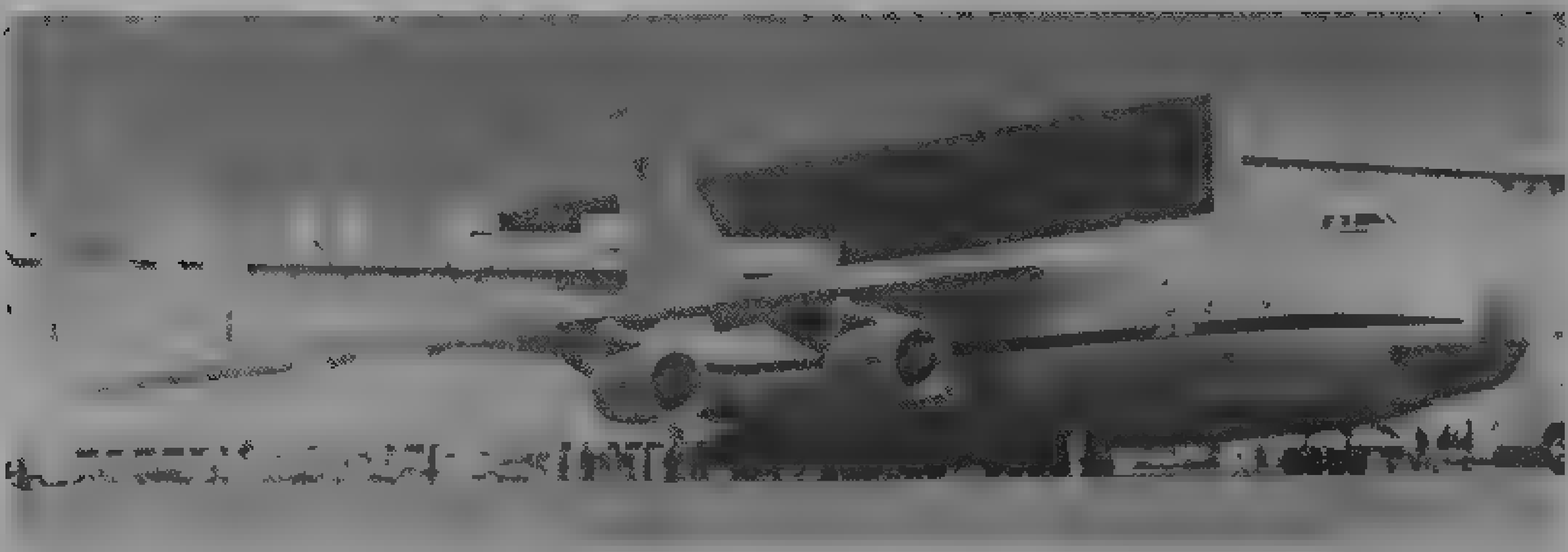
POWER PLANT: Four ZMKB Progress D-18T turbofans, each 229.5 kN (51,590 lb st), thrust reversers standard. Engine cowlings of glassfibre; pylons have carbonfibre skin at rear end. All fuel in 10 integral tanks in wings, total capacity 348,740 litres (92,128 US gallons, 76,714 Imp gallons).

ACCOMMODATION: Crew and passenger accommodation on upper deck, freight and/or vehicles on lower deck. Flight crew of six, in pairs, on flight deck, with place for loadmaster in lobby area (10 to 12 cargo handlers and servicing staff carried on commercial flights). Pilot and co-pilot on fully adjustable seats, which rotate for improved access. Two flight engineers, on wall-facing seats on starboard side, have complete control of master fuel cocks, detailed systems instruments, and digital integrated data system with CRT monitor. Behind pilot are navigator and communications specialist, on wall-facing seats. Between flight deck and wing carry-through structure, on port side, are toilets, washing facilities, galley, equipment compartment, and two cabins for up to six relief crew, with table and facing bench seats convertible into bunks. Aft of wing carry-through is passenger cabin for 88 persons. Hatches in upper deck provide access to wing and tail unit for maintenance when workstands not available. Flight deck and passenger cabin each accessible from cargo hold by hydraulically folding ladder, operated automatically with manual override. Rearward-sliding and jettisonable window each side of flight deck. Primary access to flight deck via airstair door, with ladder extension, forward of wing on port side. Smaller door forward of this and slightly higher. Door from main hold aft of wing on starboard side. Upper deck doors at rear of flight deck on starboard side and at rear of passenger cabin on each side. Emergency exit from upper deck aft of wing on each side. Hydraulically operated visor type upward-hinged nose takes 7 minutes to open fully, with simultaneous extension of folding nose loading ramp. When open, nose is steadied by reinforcing arms against wind gusts. No hydraulic, electrical or other system lines broken when nose is open. Radar wiring passes through hollow tube in hinge. Hydraulically operated rear loading doors take 3 minutes to open, with simultaneous extension of three-part folding ramp. This can be locked in intermediate position for direct loading from truck. Aft of ramp, centre panel of fuselage undersurface hinges upward, clamshell door to each side opens downward. Completely unobstructed lower deck freight hold has titanium floor, attached 'mobilely' to lower fuselage structure to accommodate changes of temperature, with rollgangs and retractable attachments for cargo tiedowns. Narrow catwalk along each sidewall facilitates access to, and mobility past, loaded freight. Payloads include largest CIS main battle tanks, complete missile systems, 12 standard ISO containers, oil well equipment and earth movers, HeavyLift/VolgaDnepr aircraft transport Airbus wings in Europe. No personnel carried normally on lower deck in



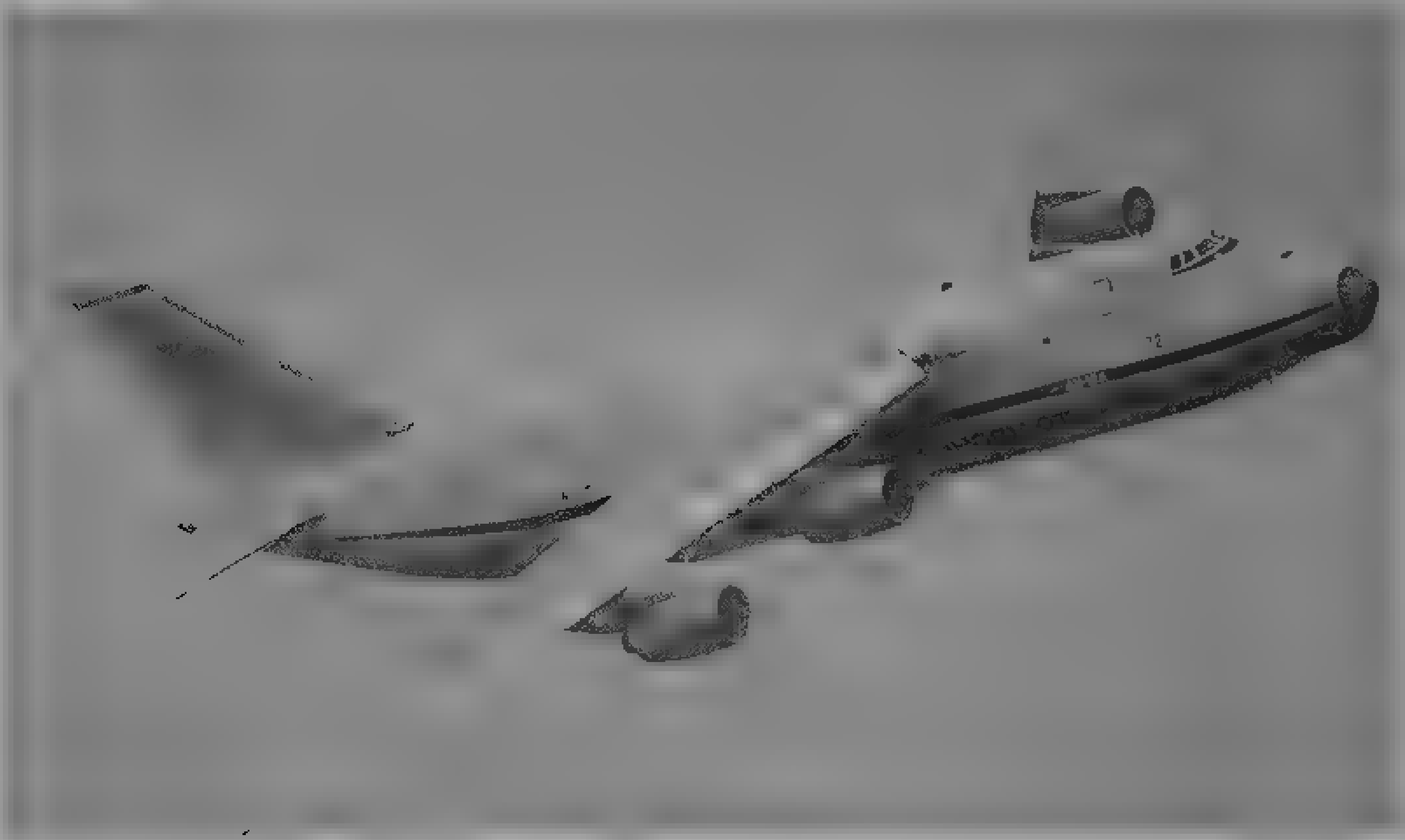
Antonov An-124 (four ZMKB Progress D-18T turbofans) *(Jane's/James Goulding)*

1995



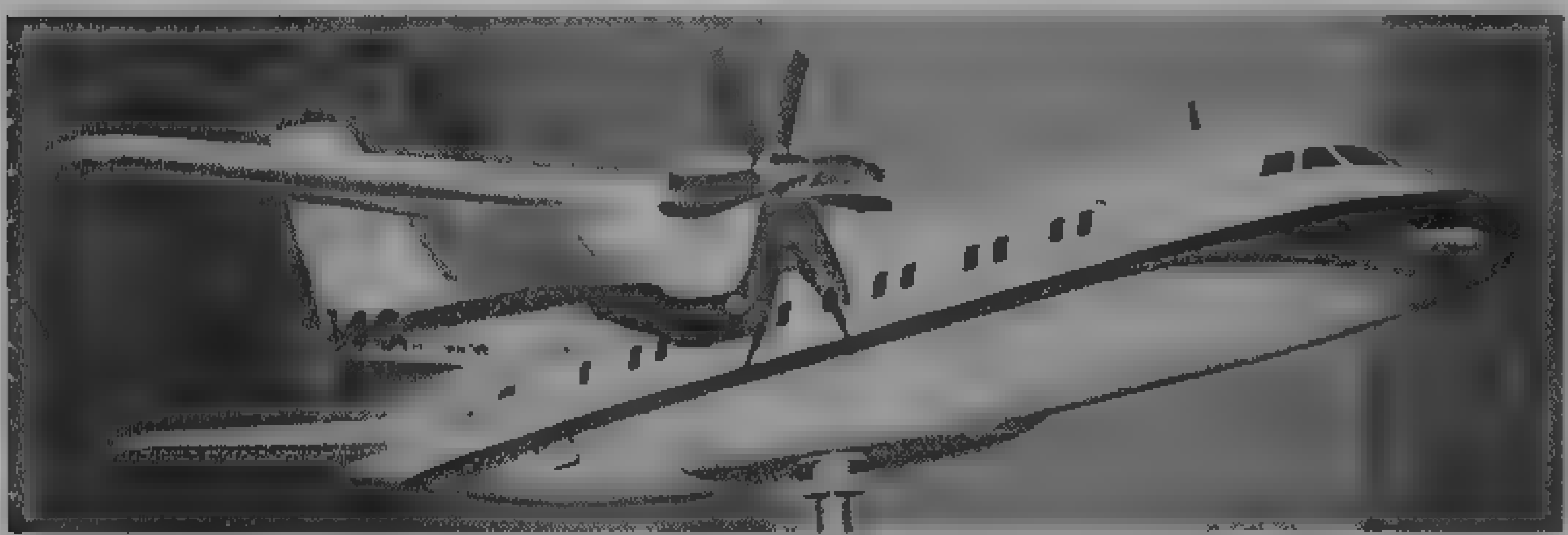
An-124 wet leased by Air Foyle of the UK from Antonov OKB

1994



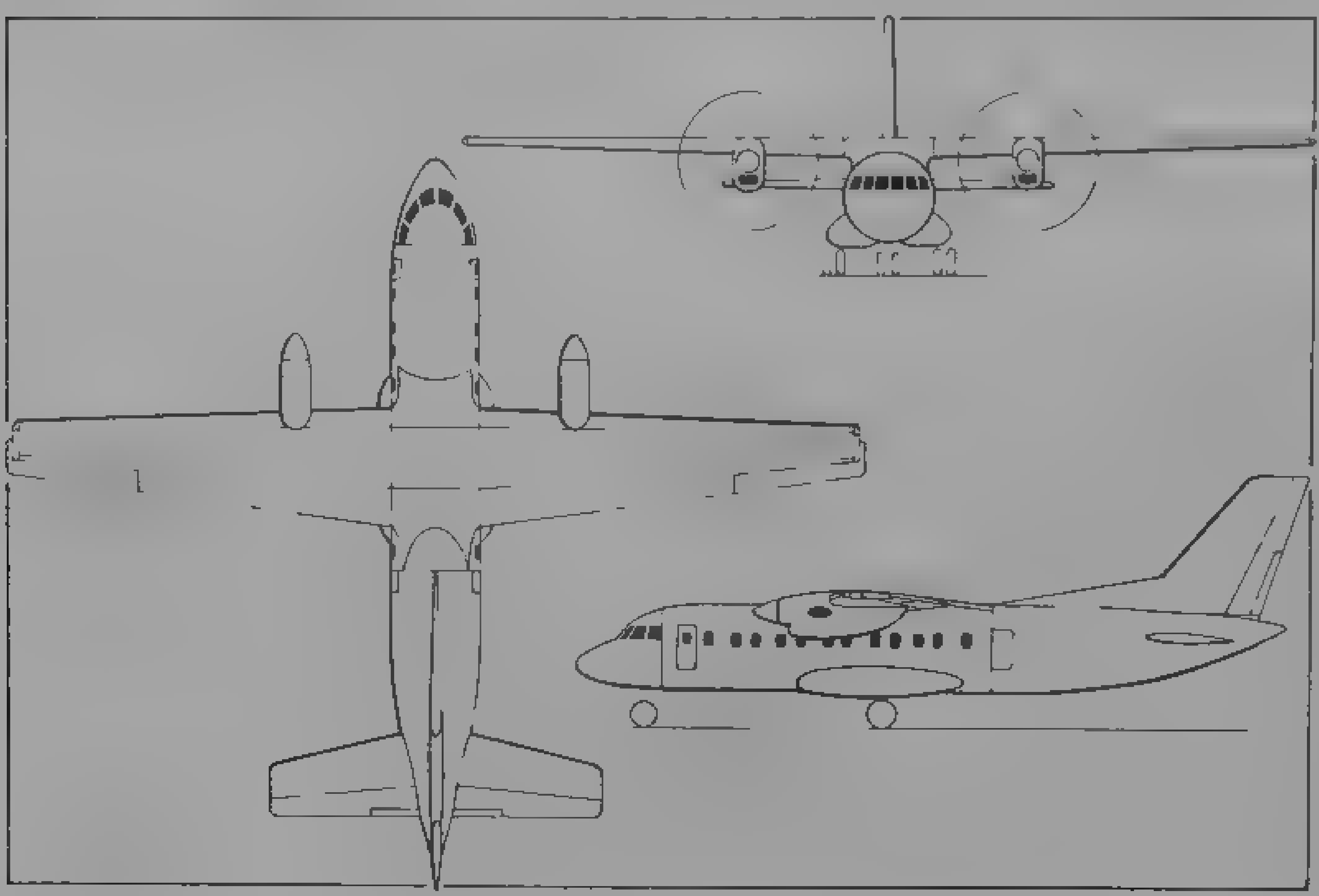
Second Ulyanovsk built Antonov An-124 in Aeroflot colours *(Paul Jackson)*

1995



Scale model of Antonov An-140 in current configuration *(Paul Jackson)*

1995



Provisional three-view drawing of Antonov An-140 *(Jane's/James Goulding)*

1995

flight, because of low pressurisation. Two electric travelling cranes in roof of hold, each with two lifting points, offer total lifting capacity of 20,000 kg (44,100 lb). Two winches each pull a 3,000 kg (6,614 lb) load.

SYSTEMS: Entire interior of aircraft is pressurised and air conditioned. Maximum pressure differential 0.55 bar (7.8 lb/sq in) on upper deck, 0.25 bar (3.55 lb/sq in) on lower deck. Four independent hydraulic systems. Quadruple redundant fly-by-wire flight control system, with mechanical emergency fifth channel to hydraulic control servos. Special secondary bus electrical system. Landing lights under nose and at front of each main landing gear fairing. APU in rear of each landing gear fairing for engine starting, can be operated in the air or on the ground to open loading doors for airdrop from rear or normal ground loading/unloading, as well as for supplying electrical, hydraulic and air conditioning systems. Bleed air anti-icing of wing leading edges. Electro-impulse de-icing of fin and tailplane leading edges.

AVIONICS: *Radar*: Two dielectric areas of nose visor enclose forward-looking weather radar and downward-looking ground mapping/nav radar.

Flight: Hemispherical dielectric fairing above centre-fuselage for satellite nav receiver, quadruple INS, Loran and Omega.

Instrumentation: Conventional flight deck equipment, including automatic flight control system panel at top of glareshield, weather radar screen and moving map display forward of throttle and thrust reverse levers on centre console. No electronic flight displays. Dual attitude indicator/flight director and HSIs, and vertical tape engine instruments.

EQUIPMENT: Small two-face mirror, of V form, enables pilots to adjust their seating position until their eyes are reflected in the appropriate mirror, which ensures optimum field of view from flight deck.

DIMENSIONS, EXTERNAL:

Wing span	73.30 m (240 ft 5¾ in)
Wing aspect ratio	8.55
Length overall	69.10 m (226 ft 8½ in)
Height overall	21.08 m (69 ft 2 in)
Wheel track	8.00 m (26 ft 3 in)
Wheelbase (centre row mainwheels)	22.90 m (75 ft 1½ in)

DIMENSIONS, INTERNAL:

Cargo hold: Length	36.0 m (118 ft 1¼ in)
Width at floor	6.40 m (21 ft 0 in)
Max width	6.68 m (21 ft 11 in)
Max height	4.4 m (14 ft 5¼ in)
Volume	1,000 m³ (35,315 cu ft)

AREAS:

Wings, gross	628.0 m² (6,760.0 sq ft)

WEIGHTS AND LOADINGS (A: basic An-124, B: An-124-100):

Operating weight empty: A	175,000 kg (385,800 lb)
Max payload: A	150,000 kg (330,700 lb)
B	120,000 kg (264,550 lb)
Max ramp weight: B	398,000 kg (877,425 lb)
Max T-O weight: A	405,000 kg (892,875 lb)
B	392,000 kg (864,200 lb)
Max landing weight: B	330,000 kg (727,513 lb)
Max zero-fuel weight: A	325,000 kg (716,500 lb)
Max wing loading: A	644.9 kg/m² (132.1 lb/sq ft)
Max power loading: A	441.2 kg/kN (4.32 lb/lb st)

PERFORMANCE (Basic An-124):

Max cruising speed	467 kts (865 km/h; 537 mph)
Normal cruising speed at 10,000-12,000 m (32,800-39,370 ft)	432-459 kts (800-850 km/h; 497-528 mph)
Approach speed	124-140 kts (230-260 km/h; 143-162 mph)
T-O balanced field length at max T-O weight	3,000 m (9,850 ft)
T-O run	2,520 m (8,270 ft)
Landing run at max landing weight	900 m (2,955 ft)
Range: with max payload	2,430 n miles (4,500 km; 2,795 miles)
with max fuel	8,900 n miles (16,500 km; 10,250 miles)

OPERATIONAL NOISE LEVELS:
Stated to meet ICAO requirements

UPDATED

ANTONOV An-140

TYPE: Twin-turboprop short range transport.

PROGRAMME: Announced 1993 as An-24 replacement; prototype with TV7-117S engines under construction, first flight scheduled 1995, certification to ICAO Cat II standards intended; series production for Russia and Ukraine under way at KhAPA aircraft manufacturing centre; version with PW120 series turboprops under development.

DESIGN FEATURES: Conventional high-wing monoplane (see accompanying illustration); engines mounted underwing; main landing gear retracts into fairings on sides of lower fuselage.

LANDING GEAR: Retractable tricycle type, twin wheels on each unit. Able to operate from gravel or unpaved fields.

POWER PLANT: Two 1,850 kW (2,480 shp) Klimov TV7-117S turboprops, driving Stupino six-blade propellers, or, optionally, two 1,864 kW (2,500 shp) Pratt & Whitney

Canada PW127A turboprops, driving Hamilton Standard 247F propellers

ACCOMMODATION: Crew of two plus cabin attendant, basic seating for 44 or 52 passengers, four-abreast with centre aisle, at 81 cm (32 in) or 75 cm (29.5 in) pitch respectively; seats and baggage compartment can be folded against cabin walls for freight carrying; door at rear of cabin on port side, with service door opposite, emergency exit each side at front of cabin, toilet at rear of cabin. Accommodation air conditioned and pressurised

DIMENSIONS, EXTERNAL:

Wing span	23.29 m (76 ft 5 in)
Length overall	20.90 m (68 ft 7 in)
Height overall	7.70 m (25 ft 3 in)

PERFORMANCE (estimated):

Max cruising speed at 7,600 m (25,000 ft) 310 kts (575 km/h, 357 mph)

Balanced runway length 1,300 m (4,265 ft)

Designed range at 280 kts (520 km/h, 323 mph) at 7,200 m (23,620 ft):

with max payload 960 n miles (1,780 km, 1,105 miles)

with max fuel 2,023 n miles (3,750 km, 2,330 miles)

UPDATED

ANTONOV An-180

TYPE: Twin-propfan medium-range passenger transport

PROGRAMME: Company funded programme; first details, and model, at 1991 Paris Air Show; configuration changed with engines on tailplane tips, 1992; studies and wind tunnel tests continuing

DESIGN FEATURES: Unique configuration, with propfans at tips of dihedral tailplane; low-mounted sweptback wings; circular-section fuselage and all-sweptback tail surfaces. Designed to equal, or exceed, highest Western standards, burning less fuel per passenger-km per engine than equivalent Western aircraft, equipped for automated navigation at all flight stages and for ICAO Cat. IIIa automatic landing. Airframe design life 60,000 flying hours

POWER PLANT: Two ZMKB Progress D-27 tractor propfans, each rated at 10,305 kW (13,820 shp), mounted on tips of tailplane

ACCOMMODATION: Two or three crew, single-class seating for 163 to 175 passengers or mixed class seating for 150 to 156, in pairs, six-abreast, with two aisles; seven LD3 containers underfloor; four seats for cabin attendants by passenger doors (port side) and service doors (starboard); one toilet at front, two at rear. Available in 180/200 passenger, mixed passenger/freight and all-freight versions with side-loading door. Emergency exit over each wing

DIMENSIONS, EXTERNAL:

Wing span	35.83 m (117 ft 6¾ in)
Length overall	40.90 m (134 ft 2¼ in)
Height overall	11.15 m (36 ft 7 in)

WEIGHTS AND LOADINGS:

Max payload	18,000 kg (39,680 lb)
Max T-O weight	67,500 kg (148,810 lb)

PERFORMANCE (estimated):

Nominal cruising speed 432 kt (800 km/h, 497 mph)

Nominal cruising height 9,100-10,100 m (29,850-33,135 ft)

Nominal field length 2,200-2,600 m (7,220-8,530 ft)

Range, with reserves:

from 2,200 m (7,220 ft) field:

with max payload 971 n miles (1,800 km; 1,118 miles)

with max fuel 4,155 n miles (7,700 km, 4,785 miles)

from 2,600 m (8,530 ft) field:

with max payload 1,780 n miles (3,300 km; 2,050 miles)

with max fuel 4,047 n miles (7,500 km, 4,660 miles)

UPDATED

ANTONOV An-218

TYPE: Twin-turbofan passenger transport

PROGRAMME: Announced at 1991 Paris Air Show; mockup constructed, first flight scheduled for 1996, but development now deferred

CURRENT VERSIONS: **An-218-100**: Basic version as *described in detail*.

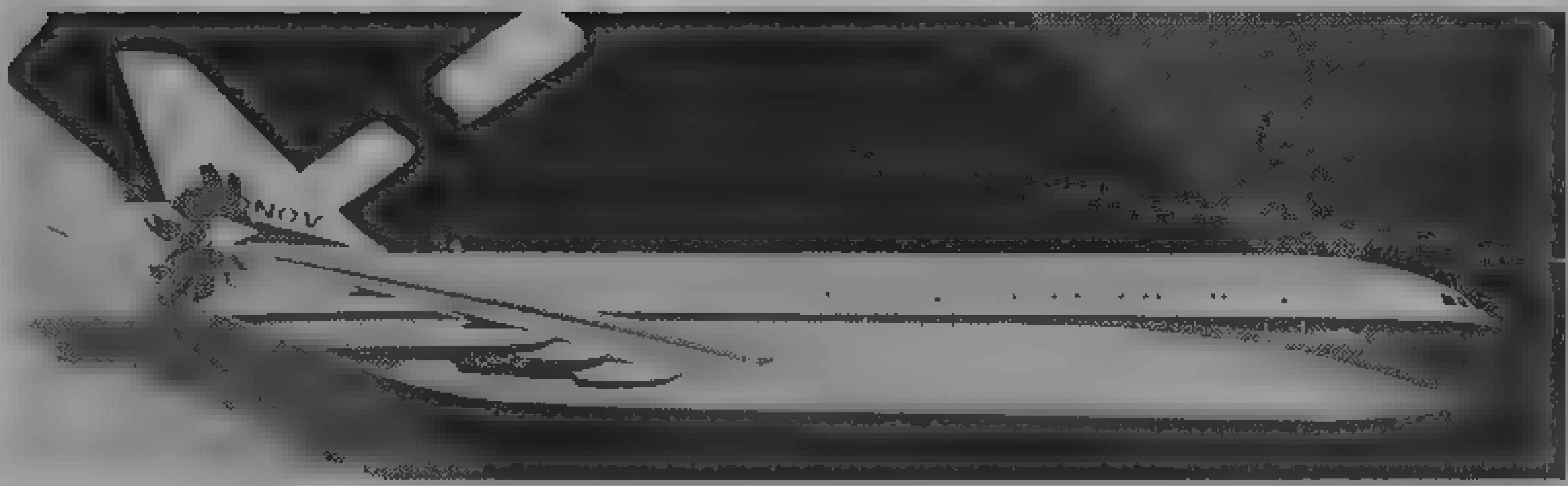
An-218-200: Extended range, two D-18TR (modified D-18TM), each 275 kN (61,820 lb st), or PW4060, CF6-80C2B6, or RB211-524H4 engines; additional fuel tanks in cargo compartments, enhanced cabin comfort for 220 passengers, range 5,720 n miles (10,600 km, 6,585 miles).

An-218-300: Long-range version; fuselage shortened by 11.50 m (37 ft 8¾ in) by removal of plugs; additional fuel in cargo compartments, 195 passengers, range 6,045 n miles (11,200 km, 6,960 miles).

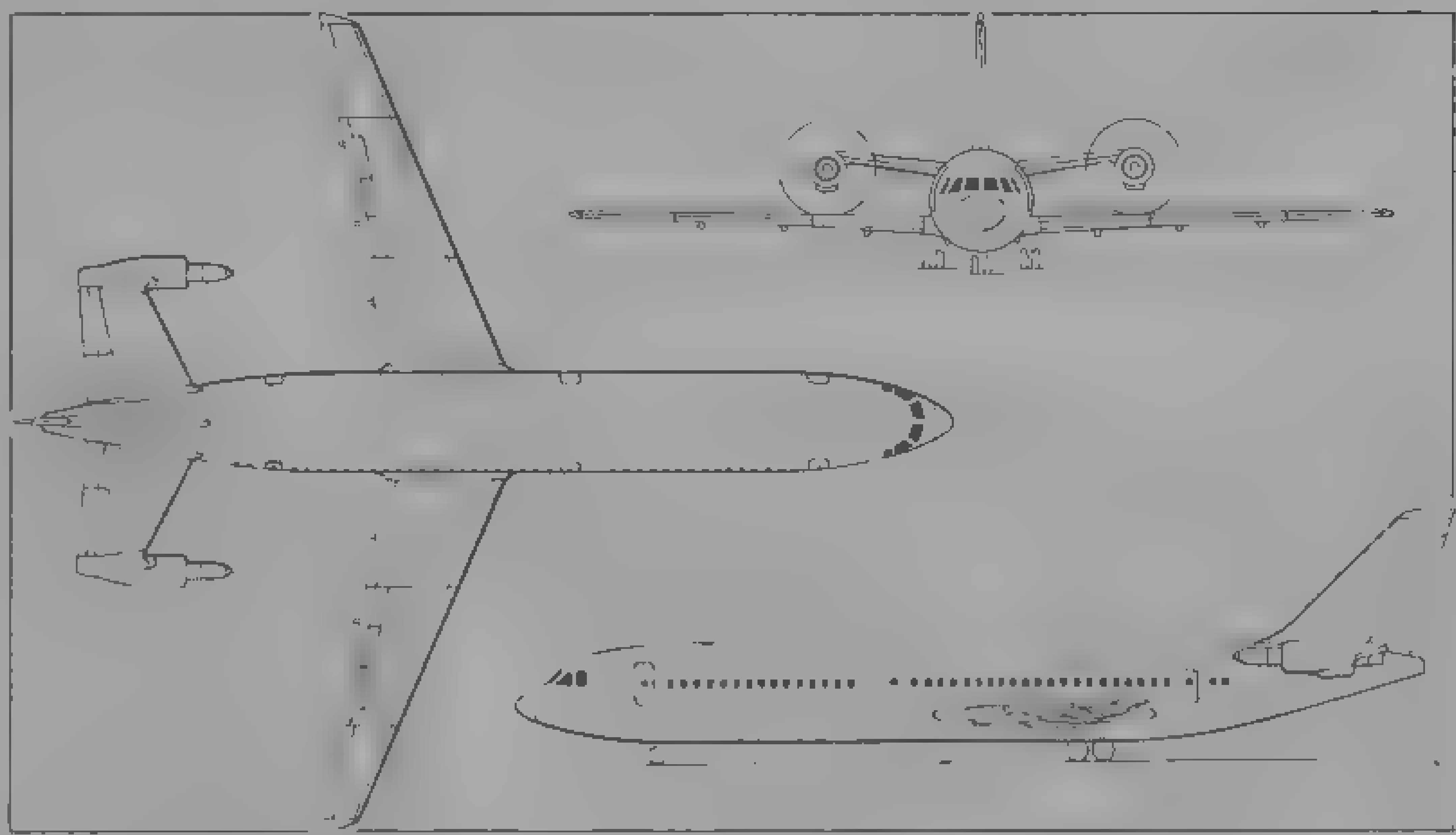
An-218-400: Under study; fuselage lengthened, 400 passengers, range 5,935 to 6,475 n miles (11,000 to 12,000 km; 6,835 to 7,455 miles)

DESIGN FEATURES: In general class of very similar Airbus A330, but slightly smaller and lighter in weight, with less fuel. Certification to ICAO Cat. IIIa standards intended

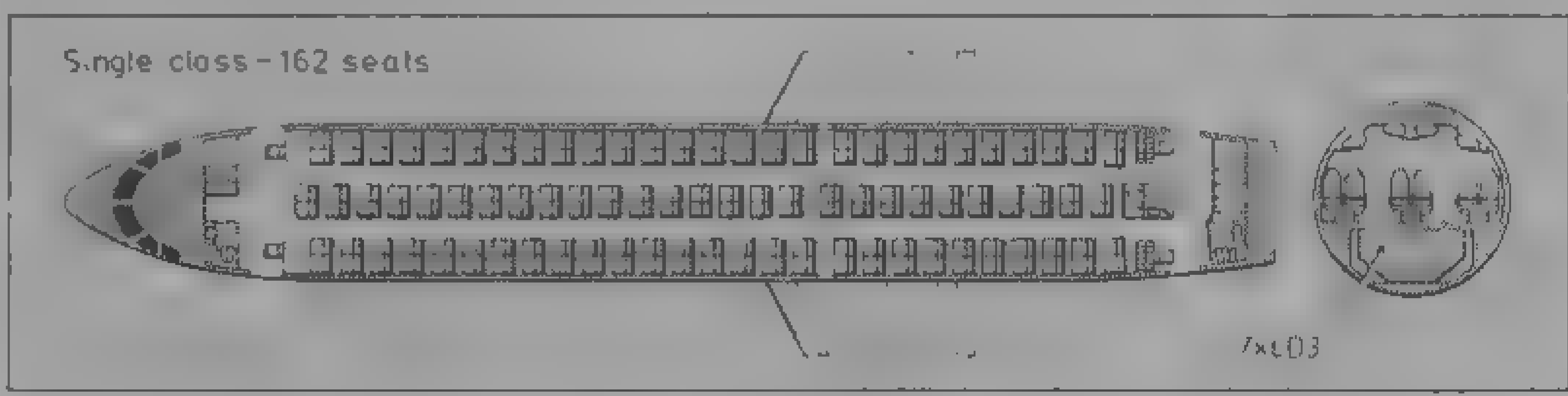
POWER PLANT: Two ZMKB Progress D-18TM turbofans, each 250-275 kN (56,200-61,820 lb st), in underwing pods



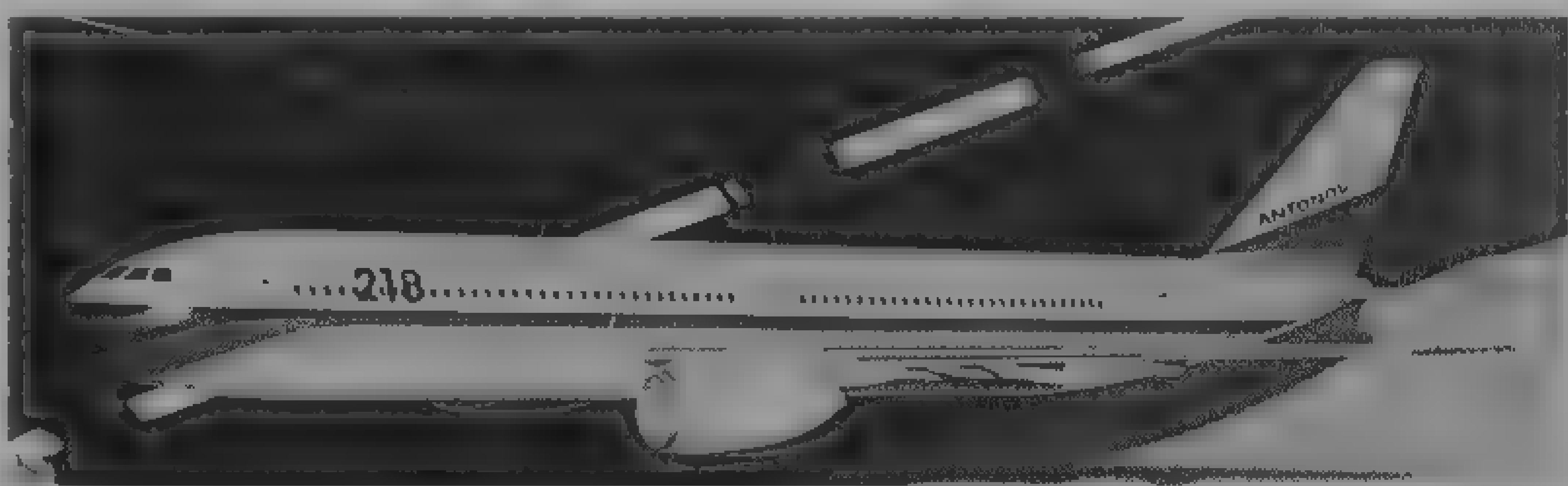
Model of Antonov An-180 propfan passenger transport *(Paul Jackson)* 1995



Latest configuration of Antonov An-180 twin-propfan airliner *(Jane's/Mike Keep)* 1994



Cabin layout of Antonov An-180 showing fore and aft galleys, four attendants' seats and three toilets *(Jane's/Mike Keep)* 1994



Model of Antonov An-218-100 transport *(Paul Jackson)* 1995

ACCOMMODATION: Two pilots on modern flight deck with electronic displays; three basic cabin configurations: (1) 292 passengers: 18 first class six-abreast at 102 cm (40 in) pitch, 64 business class at 87 cm (34.25 in) pitch and 210 econ class at 81 cm (32 in) pitch. (2) 350 passengers seven/eight abreast, all econ class. (3) 400 passengers seven/nine-abreast at 75 cm (29.5 in) pitch. 24 freight/baggage containers in underfloor compartments. Four cabin doors on port side; service doors opposite

DIMENSIONS, EXTERNAL:

Wing span	50.00 m (164 ft 0½ in)
Length overall	59.79 m (196 ft 2 in)
Height overall	15.70 m (51 ft 6 in)

DIMENSIONS, INTERNAL:

Cargo compartments:

Volume: front	81.0 m³ (2,860 cu ft)
rear	57.5 m³ (2,030 cu ft)

Baggage compartment volume for outsize cargoes 42.0 m³ (1,483 cu ft)

WEIGHTS AND LOADINGS:

Max payload	42,000 kg (92,600 lb)

PERFORMANCE (estimated):

Nominal cruising speed at 10,600-11,600 m (34,775-38,000 ft) 458-470 kts (850-870 km/h, 528-540 mph)

Required runway length, 30°C 2,900 m (9,500 ft)

Range, with reserves:

with 350 passengers 3,400-4,045 n miles (6,300-7,500 km; 3,915-4,660 miles)

with 292 passengers 3,885-4,585 n miles (7,200-8,500 km, 4,475-5,280 miles)

Fuel efficiency 18 g/passenger km

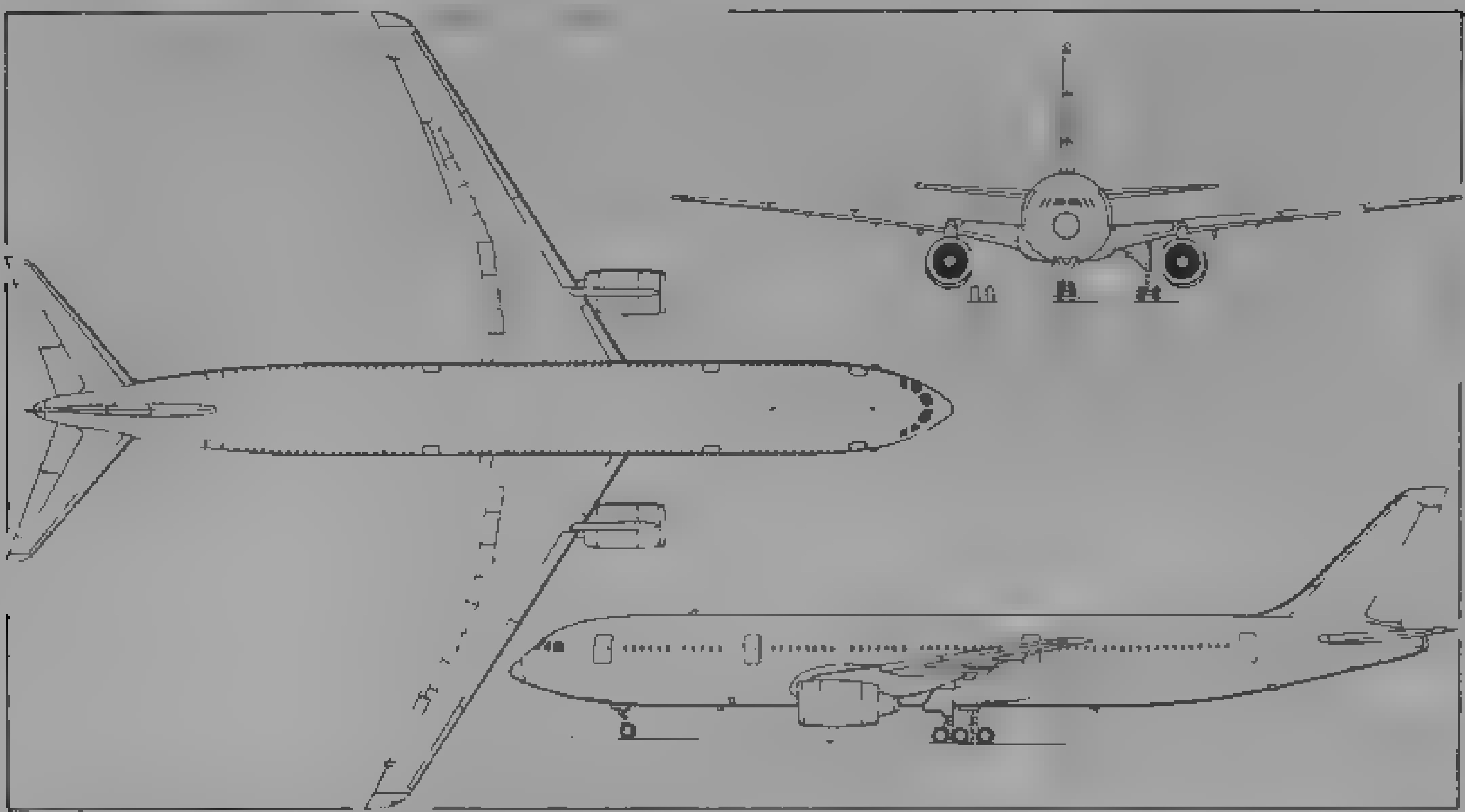
UPDATED

ANTONOV An-225 MRIYA (DREAM)

NATO reporting name: Cossack

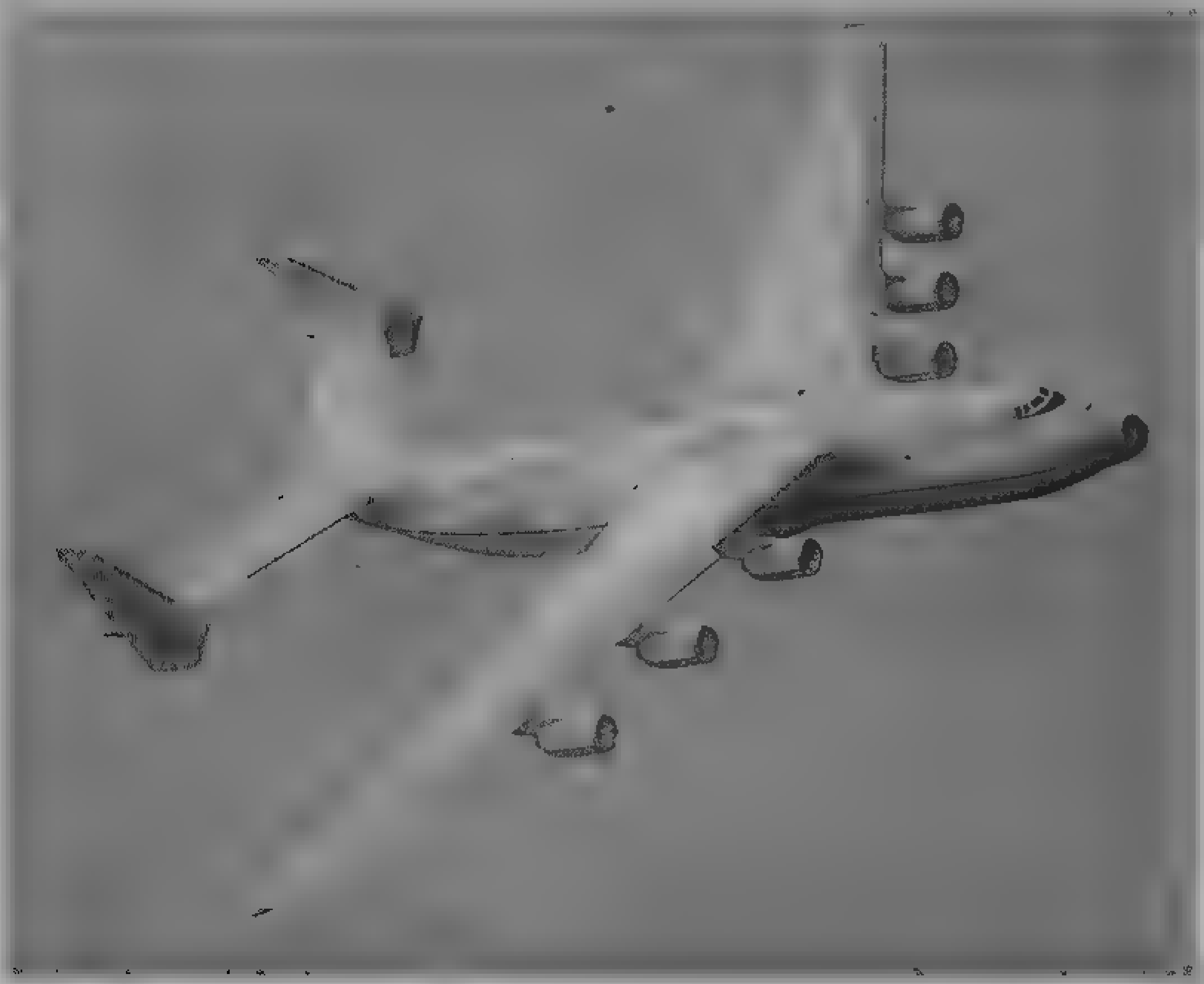
TYPE: Six-turbofan heavy transport for internal/external payloads

PROGRAMME: Design studies began mid-1985; prototype (SSSR 480182, now UR 82060) made 75 minutes first flight "from 1,000 m (3,280 ft) runway" on 21 December 1988, three weeks after unveiling at Kiev; total of 106



Antonov An-218-100 transport (two ZMKB Progress D-18TM turbofans) *(Jane's/Dennis Punnett)*

1994



World's largest aeroplane, the Antonov An-225 Mriya heavy transport *(Paul Jackson)*

1995

Antonov An-225 Mriya (NATO 'Cossack') six-turbofan heavy freight transport *(Jane's/Dennis Punnett)*

1989

records set on 22 March 1989 during 3½ hours flight taking off at 508,200 kg (1,120,370 lb), with 156,300 kg (344,576 lb) payload, flew 2,000 km closed circuit at 438.75 knots (813.09 km/h; 505.24 mph), with maximum altitude of 12,340 m (40,485 ft) en route; first flight carrying *Buran* orbiter on back made 13 May 1989 from Baikonur. No more An-225s completed by early 1995, but second aircraft being manufactured for experimental tasks involving aerospace technologies. Projected derivatives, capable of employment as subsonic carrier vehicles to launch into orbit payloads of up to 10 tonnes, include the following:

MAeSS. Under study by Russia and Ukraine, offered to European Space Agency (ESA).

Svityaz. Under study since 1993. Upgraded units of Zenit launcher, produced in Ukraine, offered as space launch vehicle payloads.

Raduga. Testbed for proving and demonstration of aerospace technologies. Documentation submitted to ESA by companies from UK, Russia and Ukraine.

DESIGN FEATURES: First aircraft built to fly at gross weight exceeding one million lb, designed to replace Myasishchev VM-T Atlant as external load-carrier for space orbiters, components of Energiya rocket launch vehicles and other outsize loads; based on An-124, with extended wings and lengthened fuselage to permit 50 per cent increase in maximum T-O weight and payload; basic cabin cross-section and visor type nose door unchanged; rear loading ramp/door deleted and rear fuselage reconfigured with twin fins and rudders on dihedral tailplane to avoid air flow problems when carrying piggyback loads; main landing gear uprated from five to seven pairs of wheels on each side; six engines instead of four, of same type; basically standard An-124 wings attached to new centre-section; anhedral on outer wings only; sweepback 35° on inboard half-span, 32° outboard; all tail surfaces swept back.

FLYING CONTROLS: Fly-by-wire, with all surfaces hydraulically actuated; each wing has two-section aileron, three-section single-slotted Fowler flaps on outer panels and single section on centre-section, and six-section leading-edge flaps on outer panels only; eight airbrakes (inboard) and eight spoilers (outboard) on each wing upper surface and centre-section forward of flaps; no wing fences, vortex generators or tabs; two-section rudder and three-section elevator on each side; control runs (and other services) channelled along fuselage roof.

STRUCTURE: Generally as for An-124.

LANDING GEAR: Hydraulically retractable nosewheel type, made by Hydromash. Two independent forward-retracting and steerable twin-wheel nose units, side by side. Each main gear comprises seven independent inward-retracting twin-wheel units, with tyres size 1,270 × 510 mm. Rear four pairs of wheels on each side steerable. Each mainwheel bogie enclosed by separate upper and lower doors when retracted. Nosewheel doors and lower mainwheel doors close when gear extended. Aircraft can 'kneel', by retracting nosewheels and settling on two extendable 'feet', giving floor a slope to assist loading and unloading. Minimum turning radius about nosewheels 60.0 m (197 ft).

POWER PLANT: Six ZMKB Progress D-18T turbofans, each 229.5 kN (51,590 lb st) and fitted with thrust reverser. Engine cowlings of glassfibre. All fuel in integral tanks in wings, including additional tanks in new centre-section. Maximum capacity estimated at well over 300,000 kg (661,375 lb).

ACCOMMODATION: Flight crew of six, in pairs, on flight deck, with place for loadmaster in lobby area. Pilot and co-pilot on fully adjustable seats that rotate for improved access. Two flight engineers, on wall-facing seats on starboard side. Navigator and communications specialist behind pilot, on wall-facing seats. Rest area for relief crew slightly larger than that of An-124. Cabin for 60 to 70 persons above hold aft of wing carry-through. Primary access to flight deck via airstair door, with ladder extension, forward of wing on port side. Door to main hold aft of wing on starboard side. Hydraulically operated visor type upward-hinged nose takes 7 minutes to open fully, with simultaneous extension of folding nose loading ramp. Completely unobstructed lower deck freight hold, 43.0 m (141 ft) long, has titanium floor, attached 'mobilely' to lower fuselage structure to accommodate changes of temperature, with rollgangs and retractable attachments for cargo tiedowns. Interior can be heated with warm air from perforated tube above floor on each side of hold. Internal loads can include 16 standard containers, up to 80 Lada type cars, Belaz, Kamatsu and Euclid heavy dump trucks, ground test and field maintenance equipment required by external loads. Two longitudinal mounting beams for external loads above wing centre-section. Small blister fairings forward of beams and forward of tailplane cover load attachments. Under consideration is a scheme to use an eight-engined version of the An-225 as a launcher for future space vehicles like the British Interim Hotol or space combat aircraft.

AVIONICS: Generally similar to An-124.

DIMENSIONS, EXTERNAL:

Wing span	88.40 m (290 ft 0 in)
Wing aspect ratio	8.64
Length overall	84.00 m (275 ft 7 in)
Height overall	18.20 m (59 ft 8½ in)
Tailplane span	32.65 m (107 ft 1½ in)

Antonov An-225 at Farnborough Air Show *(Paul Jackson)*

1995

Wheel track 8 84 m (29 ft 0 in)
Wheelbase, from main landing gear mid-point
29 10 m (95 ft 5¾ in)

DIMENSIONS, INTERNAL:
Cargo hold: Length of floor 43 0 m (141 ft 0 in)
Max width 6.4 m (21 ft 0 in)
Max height 4 4 m (14 ft 5¼ in)

AREAS:
Wings, gross 905 0 m² (9,741 sq ft)
Vertical tail surfaces, total 141 7 m² (1,525 sq ft)
Horizontal tail surfaces, total 265 5 m² (2,858 sq ft)

WEIGHTS AND LOADINGS:
Max payload, internal or external
250,000 kg (551,150 lb)
Max T-O weight 600,000 kg (1,322,750 lb)
Max wing loading 663 kg/m² (135 8 lb/sq ft)
Max power loading 435 7 kg/kN (4 27 lb/lb st)

PERFORMANCE:
Cruising speed
432-458 kts (800-850 km/h, 497-528 mph)
T-O balanced field length [illegible]

Range: with 200,000 kg (440,900 lb) internal payload
2,425 n miles (4,500 km, 2,795 miles)
with 100,000 kg (220 450 lb) internal payload
5,180 n miles (9,600 km; 5,965 miles
with max fuel 8,310 n miles (15,400 km, 9,570 miles)

UPDATED

KhAC

KHARKOV AVIATION CORPORATION

134 Sokolniki Street, 310023 Kharkov
Telephone: 38 (0572) 43 1985
Fax: 38 (0572) 47 8001

Established in 1926 as GAZ 135, Kharkov Aviation Corporation has built military, passenger and freight aircraft, including the Su-2, Yak-18, MiG-15, Tu-104 and Tu-134 It has exported its products since 1964

Current production is centred on the Antonov An-74 in various versions. It is preparing to manufacture the new An-140, described in Antonov entry

NEW ENTRY

UNITED KINGDOM

AMF

AMF AVIATION ENTERPRISES LTD

Membury Airfield, Lambourn, Berkshire RG16 7TJ
Telephone: 44 (1488) 72224
Fax: 44 (1488) 72224
MANAGING DIRECTOR: Angus M Fleming

Company founded to manufacture the Chevvron range of light aircraft. (Note the two letter Vs in Chevvron, used in order to avoid any confusion with the Chevron Oil company and others.)

VERIFIED

AMF Chevvron 2-32 C two-seat microlight and trainer *(Ian Strachan)*

1995

AMF CHEVVRON 2 32 C

TYPE: Side by side two-seat microlight/trainer; conforms to BCAR Section S certificated in Germany, Japan and UK

PROGRAMME: First flight 1983, production began 1987; deliveries have been in assembled form

CUSTOMERS: Total of 41 delivered by March 1995 to customers in Belgium, France, Ireland, Italy, Japan, Netherlands and UK

COSTS: Assembled from £18 900 (+ VAT) basic Kits introduced in 1992

DESIGN FEATURES: Wortmann wing section

STRUCTURE: Glassfibre/carbonfibre/Kevlar and foam

FLYING CONTROLS: Conventional primary surfaces, trailing-edge drag flaps/airbrakes

LANDING GEAR: Non-retractable tricycle type, with hydraulic disc brakes Optional floats.

POWER PLANT: One 24 kW (32 hp) König SD 570 four-cylinder radial engine; one float version powered by a 35 8 kW (48 hp) König engine. Standard fuel capacity 30 litres (7 9 US gallons, 6.6 Imp gallons) One auxiliary fuel tank optional, of either 30 litres or 20 litres (5 3 US gallons, 4.4 Imp gallons) capacity

DIMENSIONS, EXTERNAL:
Wing span 13 41 m (44 ft 0 in)
Wing aspect ratio 10.24
Length overall 7 01 m (23 ft 0 in)
Height overall 1 60 m (5 ft 3 in)
Propeller diameter 1 52 m (4 ft 11¾ in)

AREAS:
Wings, gross 17.56 m² (189 0 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 175 kg (386 lb)
Max T-O weight 382 kg (842 lb)
Max wing loading 21 75 kg/m² (4 45 lb/sq ft)
Max power loading (SD 570)
16.01 kg/kW (26.31 lb/hp)

PERFORMANCE:
Max level and max cruising speed
65 kts (120 km/h, 75 mph)
Econ cruising speed 55 kts (102 km/h, 63 mph)
Stalling speed 30 kts (56 km/h, 35 mph)
Max rate of climb at S/L 128 m (420 ft)/min
Service ceiling 3,050 m (10 000 ft)
T O run 91 m (300 ft)
Landing run 137 m (450 ft)
Range with standard fuel
200 n miles (370 km, 230 miles)
Endurance 3 h
g limits +4/-2

UPDATED

AMF CHEVVRON 2-45 CS

TYPE: Side by side two-seat microlight/trainer

DESIGN FEATURES: Slightly smaller span than 2-32 C, higher rate of roll; Limbach engine. *Description as for 2 32 C except the following*

POWER PLANT: One 33.6 kW (45 hp) Limbach L-550 flat four engine

DIMENSIONS, EXTERNAL:
Wing span 12.37 m (40 ft 7 in)
Wing aspect ratio 9 80
Length overall 6 86 m (22 ft 6 in)
Height overall 1.52 m (4 ft 11¾ in)

AREAS:
Wings, gross 15 61 m² (168 sq ft)

WEIGHTS AND LOADINGS:
Max T-O weight 390 kg (860 lb)
Max wing loading 25 0 kg/m² (5 1 lb/sq ft)
Max power loading 11 63 kg/kW (19 11 lb/hp)

PERFORMANCE, POWERED (at max T-O weight, ISA):
Never-exceed speed (VNE)
96 kts (177 km/h, 110 mph)
Max cruising speed 69 kts (128 km/h, 79 mph)
Stalling speed, power off, flaps down
31 kts (57 km/h, 36 mph)
Max rate of climb at S/L 167 m (550 ft)/min
Max rate of climb at S/L, single pilot 213 m (700 ft)/min
Max descent rate with airbrake 305 m (1 000 ft)/min
T O to 15 m (50 ft) 150 m (492 ft)
Landing from 15 m (50 ft) 250 m (820 ft)

PERFORMANCE, UNPOWERED:
Min rate of sink at 42 kts (78 km/h, 48 mph)
1 53 m (5 03 ft)/s
Best glide ratio 14

UPDATED

AVIATION SCOTLAND

Assembly of Aviation Scotland ARV-1 Super2 now transferred to Sweden, where aircraft known as ASL Opus 280 (which see). Production in kit form also planned by Highlander Aircraft of Minnesota, USA.

UPDATED

AVRO — *see under BAe Regional Aircraft*

BAe

BRITISH AEROSPACE plc

HEADQUARTERS: Warwick House, PO Box 87, Farnborough Aerospace Centre, Farnborough, Hampshire GU14 6YU
Telephone: 44 (1252) 373232
Fax: 44 (1252) 383000
CHAIRMAN: Robert Bauman
CHIEF EXECUTIVE: Richard Evans CBE
DIRECTOR COMMUNICATIONS: Locksley Ryan

British Aircraft Corporation (Holdings) Ltd, Hawker Siddeley Aviation Ltd, Hawker Siddeley Dynamics Ltd and Scottish Aviation Ltd nationalised and merged as British Aerospace 1977, became private sector public limited company January 1981; residual HM Government shareholding sold May 1985; responsibility for business operations devolved 1989 to divisions and subsidiaries, currently employing 48,000.

Principal wholly owned operating companies (aircraft and avionics only)

Avro International Aerospace Ltd (Division of British Aerospace Regional Aircraft Ltd)
British Aerospace Airbus Ltd (Airbus wings design/manufacture)
British Aerospace Australia Ltd (electronic systems, space equipment)
British Aerospace Defence Ltd (military aircraft, guided weapons systems, ordnance and support services)
British Aerospace Flying College Ltd (pilot training)
British Aerospace Inc (US holding company for BAe's North American assets)
British Aerospace Regional Aircraft Ltd (regional airliners)
British Aerospace (Sweden) AB (defence sales organisation)
British Aerospace (Systems & Equipment) Ltd (electronic systems and equipment for defence and civil applications)
Jetstream Aircraft Ltd (turboprop aircraft)
Jetstream Aircraft Inc (marketing and support of BAe turboprop aircraft in the West)

Subsidiary and associate organisations (aircraft and avionics only)

(BAe interest percentage)

Airbus Industrie (Airbus airliners; 20 per cent)
Australian Air Academy Pty Ltd (50 per cent)
Eurofighter Jagdflugzeug GmbH (Eurofighter 2000; 33 per cent)
Euroflag srl (new medium-lift military transport aircraft, 20 per cent)
Euromissile Dynamics Group (Trigat anti-tank guided weapon system, 33 per cent)
Liverpool Airport plc
Panavia Aircraft GmbH (Tornado multirole combat aircraft, 42.5 per cent)
Reflectone Inc (flight simulators, electronic training systems, 53 per cent)
SEPECAT SA (Jaguar combat aircraft, 50 per cent)
Singapore British Engineering Pte Ltd (marketing BAe defence products, 49 per cent)

UPDATED

BRITISH AEROSPACE AIRBUS LTD

CHAIRMAN: M J Turner
MANAGING DIRECTOR: C V Geoghegan
ENGINEERING DIRECTOR: J A Jupp
MANAGING DIRECTOR, BRITISH AEROSPACE AVIATION SERVICES: A C Duke
HEAD OF PUBLIC AFFAIRS: H Berry
FILTON: PO Box 77, New Filton House, Filton, Bristol BS99 7AR
Telephone: 44 (117) 969 3831
Fax: 44 (117) 936 2828
CHESTER: Broughton, near Chester, Clwyd CH4 0DR
Telephone: 44 (1244) 520444
Fax: 44 (1244) 535835

A wholly owned subsidiary of British Aerospace, BAe Airbus Ltd designs, manufactures and assembles primary structure of all wings for Airbus airliners; equips A320 and A321 wings, manufactures a fuselage section for A321 and supplies other Airbus components. Manufactures fuselage and wing for Hawker range of business aircraft for Raytheon Aircraft Company (Chester), and centre fuselage for all RJ aircraft for British Aerospace Regional Aircraft Ltd Avro International Aerospace Division (Filton). Has undertaken feasibility studies within European Supersonic Research Programme (ESRP) for new supersonic airliner to succeed Concorde and participated in international study group investigating feasibility of 600- to 800-seat Very Large Commercial Transport (VLCT).

BAe Airbus participated in Airbus Industrie-led study for A3XX very high-capacity aircraft, (study runs in parallel to VLCT), and in eight-nation Euroflag collaborative project to develop Future Large Aircraft (FLA) now under Airbus Industrie management.

Subsidiary company **British Aerospace Aviation Services** maintains Airbus and other large civil aircraft at Filton. Five VC10s converted to flight refuelling tankers for the Royal Air Force at Filton, completed in 1995; see *Jane's Aircraft Upgrades*.

UPDATED

BRITISH AEROSPACE DEFENCE LTD

BAe Defence formed 1 January 1992 with four divisions: Military Aircraft, Dynamics (see below), Systems and Services, and Royal Ordnance.
CHAIRMAN AND MANAGING DIRECTOR: J P Weston
TECHNICAL DIRECTOR: D Gardner
EXECUTIVE VICE-PRESIDENT MARKETING AND SALES: J M Wooding
DIRECTOR OF PUBLIC AFFAIRS: Ian Woodward

Military Aircraft Division

MANAGING DIRECTOR: K Smith
WARTON: Warton Aerodrome, Preston, Lancashire PR4 1AX
Telephone: 44 (1772) 633333
Fax: 44 (1772) 634724
PUBLIC RELATIONS: N Dean
SAMLESBURY: Samlesbury, Balderstone, Lancashire BB2 7LF
Telephone: 44 (125) 481 237
Fax: 44 (125) 481 3623
DUNSFOLD: Dunsfold Aerodrome, Godalming, Surrey GU8 4BS
Telephone: 44 (1483) 272121
Fax: 44 (1483) 200341
PUBLIC RELATIONS MANAGER: J S Godden
BROUGH: Brough, North Humberside HU15 1EQ
Telephone: 44 (1482) 667121
Fax: 44 (1482) 666625
PUBLIC RELATIONS MANAGER: N Dear

BAe Military Aircraft's main activities include development of Eurofighter 2000 (EFA) with Germany, Italy and Spain; design, development, production and support of Panavia Tornado, with Daimler-Benz Aerospace and Alenia; design, development, production and support of Harrier, Sea Harrier and, with McDonnell Douglas, AV-8B/GR. Mk 5/7 Harrier II and studies of JAST (see International section); design, development, production and support of Hawk and with McDonnell Douglas, T-45A Goshawk. Also provides product support for earlier aircraft still in use and contributes to BAe 146/Avro International RJ and Airbus programmes; offers defence support services and overseas and specialist training facilities, including technical and management courses.

Eurocopter and BAe Defence agreed on 27 February 1992 to study single-source supply of helicopters to UK MoD. First venture is Eurocopter Tiger (see International section) armed with Trigat missiles. Later possibilities include a UK Wessex/Puma replacement. Participates in development and

BAe Hawk T. Mk 1 in RAF's new high-visibility black colour scheme, relieved by aerobatic display markings *(Paul Jackson)*

1995

export marketing of JAS 39 Gripen multirole fighter under agreement signed with Saab Military Aircraft on 12 June 1995.

Dynamics Division

CHAIRMAN: J P Weston
MANAGING DIRECTOR: D A Laybourn
ENGINEERING DIRECTOR: N Wallwork
HEAD OF PUBLIC AFFAIRS: Charles Carr
PUBLIC RELATIONS MANAGER: Mark Ritson
STEVENAGE: Six Hills Way, Stevenage, Hertfordshire SG1 2DA
Telephone: 44 (1438) 312422
Fax: 44 (1438) 753377
LOSTOCK: Lostock Lane, Bolton, Lancashire BL6 4BR
Telephone: 44 (1204) 696555
Fax: 44 (1204) 693908

Derived from British Aerospace (Dynamics) Ltd, which was formed on 1 January 1989, incorporating former Air Weapons Division (Hatfield and Lostock), Army Weapons Division (Stevenage), and Naval and Electronic Systems Division (Bristol, Bracknell, Plymouth and Weymouth).

Details of missiles and other weapon systems can be found in *Jane's Air-Launched Weapons*.

UPDATED

BAe HAWK (TWO-SEAT VERSIONS)

RAF designations: Hawk T Mks 1 and 1A
US Navy designation: T-45A Goshawk

TYPE: Two-seat basic and advanced jet trainer, with air defence and ground attack roles.

PROGRAMME: Early history of HS P1182 Hawk in 1989-90 *Jane's*; first generation Hawk remains in production and marketed with advanced 100 Series and single-seat 200 Series (detailed separately) to meet customers' requirements. Hawk design leadership transferred from Kingston to Brough 1988, and final assembly and flight test from Dunsfold to Warton 1989.

Hawk 50 Series main exports made December 1980 to October 1985. Hawk 100 enhanced ground attack export model announced mid-1982; first flight of 100 Series aerodynamic prototype (G-HAWK/ZA101 converted as Mk

British Aerospace Hawk 100 Series demonstrator

1995

100 demonstrator) 21 October 1987, trials of wingtip Sidewinder rails started at Warton in April 1990. Warton assembly line officially opened 24 October 1991. RAF Hawk re-wing programme began 1989 initial 85 wings completed by BAe in 1993, delivery of second batch of 59 began November 1993 for completion in June 1995

CURRENT VERSIONS: **Hawk T. Mk 1**: Basic two-seater for RAF flying and weapon training. 23 13 kN (5,200 lb st) Adour 151-01 (-02 in Red Arrows aircraft) non-afterburning turbofan; two dry underwing hardpoints, underbelly 30 mm gun pack, three-position flaps, simple weapon sight in some aircraft of No. 4 FTS, unarmed versions at Central Flying School. Following basic Tucano stage, future RAF fast-jet pilots undertake 100 hours of advanced flying, weapons and tactical training with No. 4 FTS. Hawks introduced to navigator training syllabus at No. 6 FTS, Finningley, first delivery 10 September 1992. No. 100 Squadron received 15 Mks 1/1A from September 1991, replacing Canberras in target-towing role; seven (to increase to 15) Mk 1s loaned to Royal Navy's Fleet Requirements and Air Direction Unit at Yeovilton, first arriving on 6 April 1994

Hawk T. Mk 1A: Contract January 1983 to wire 89 Hawks (including Red Arrows) for AIM-9L Sidewinder on each inboard wing pylon and optional activation of previously unused outer wing hardpoints; last conversion redelivered 30 May 1986, 72 (reduced to 50 by 1993 defence cuts) NATO-declared, for point defence and participation in RAF's Mixed Fighter Force, to accompany radar equipped Tornado ADVs on medium-range air defence sorties

Hawk T Mk 1W: Following re-winging, a small number of RAF Hawk T Mk 1s have gained the ability to carry stores on two underwing pylons, although not the centreline gun pod. The alternative designation T Mk 1 FTS is also used for this modification

Hawk 50 Series: Initial export version with 23 13 kN (5,200 lb st) Adour 851 turbofan, maximum operating weight increased by 30 per cent, disposable load by 70 per cent, range by 30 per cent; revised tailcone shape to improve directional stability at high speed, larger nose equipment bay: four wing pylons, all configured for single or twin store carriage, each pylon cleared for 515 kg (1,135 lb) load, wet inboard pylons for 455 litre (122 US gallon, 100 Imp gallon) fuel tanks, improved cockpit, with angle of attack indication, fully aerobatic twin gyro AHRS and new weapon control panel; optional brake-chute, suitable for day VMC ground attack and armed reconnaissance with camera/sensor pod

T-45A Goshawk: US Navy version (see McDonnell Douglas/BAe in International section).

Hawk 60 Series: Development of 50 Series with 25 35 kN (5,700 lb st) Adour 861 turbofan, leading-edge devices and four position flaps to improve lift capability low-friction nose leg, strengthened wheels and tyres, and adaptive anti-skid system, 591 litre (156 US gallon, 130 Imp gallon) drop tanks provision for Sidewinder or Magic AAMs, maximum operating weight increased by further 17 per cent over 50 Series, disposable load by 33 per cent and range by 30 per cent. improved field performance, acceleration, rate of climb and turn rate. Recent orders comprise seven (designated Mk 51A) for Finland, 20 Mk 67s ('long-nosed' version with nosewheel steering) ordered by South Korea, five improved Mk 60As for Zimbabwe and four Mk 63Cs for Abu Dhabi. Last mentioned has upgraded 15 surviving Mk 63s to Mk 63A from 1991, incorporating Adour Mk 871 and new combat wing (four pylons and wingtip AAM rails); first two rebuilds at Brough; remainder at Al Dhafra. *Description applies to Hawk 60 Series, except where otherwise specified*

Hawk 100 Series: Enhanced ground attack development of 60 Series, announced mid-1982, to exploit Hawk's stores carrying capability, two-seater, with perhaps pilot only on combat missions; 26.0 kN (5,845 lb st) Adour Mk 871 turbofan; new combat wing incorporating fixed leading-edge droop for increased lift and manoeuvrability from Mach 0 3 to 0.7, full-width flap vanes, manually selected combat flaps; detail changes to wing dressing, structural provision for wingtip missile pylons; MIL-STD-1553B databus, advanced Smiths Industries HUD/WAC and new air data sensor package with optional laser ranging and FLIR in extended nose; improved weapons management system allowing preselection in flight and display of weapon status, manual or automatic weapon release, passive radar warning, HOTAS controls, full colour multipurpose CRT display in each cockpit, provision for ECM pod Demonstrator ZA101 (see Programme). Production prototype Mk 102D (ZJ100) flown 29 February 1992 Orders from Abu Dhabi (placed 1989), Indonesia (signed June 1993), Malaysia (signed 10 December 1990) and Oman (signed 30 July 1990). FLIR, laser ranger and Sky Guardian RWR in Omani aircraft

Hawk 200 Series: Single-seat multirole version (described separately)

CUSTOMERS: See table Total 42 Hawks (including Series 200s) delivered in 1994. Additional prospects under negotiation include: Australia, MoU with ASTA March 1991 for licence production if Hawk 100/200 chosen for 30 to 50 aircraft RAAF trainer requirement, Brunei, 16 Hawk 100s, India, provisional selection of Hawk 60, July 1992, comprising 94 for IAF and 11 for Navy, Indonesia, collaborative production agreement with IPTN June 1991, in anticipation of orders eventually totalling 144 Mks 100/200, of which initial contract to be 20; Korea, considering up to 100 Hawks, including lead-in trainers to F-16Cs; Kuwait, six attrition replacements, Malaysia, further 12 Mk 203s, Philippines, commitment announced August 1991 for 12 Hawks

DESIGN FEATURES: Fully aerobatic two-seat advanced jet trainer, adaptable for ground attack and air defence, design capable of other optional roles, with wing improvements on developed Series to enhance combat efficiency: single non afterburning engine, elevated rear cockpit to enhance forward view, underwing hardpoints; wingtip AAM rails (100 Series)

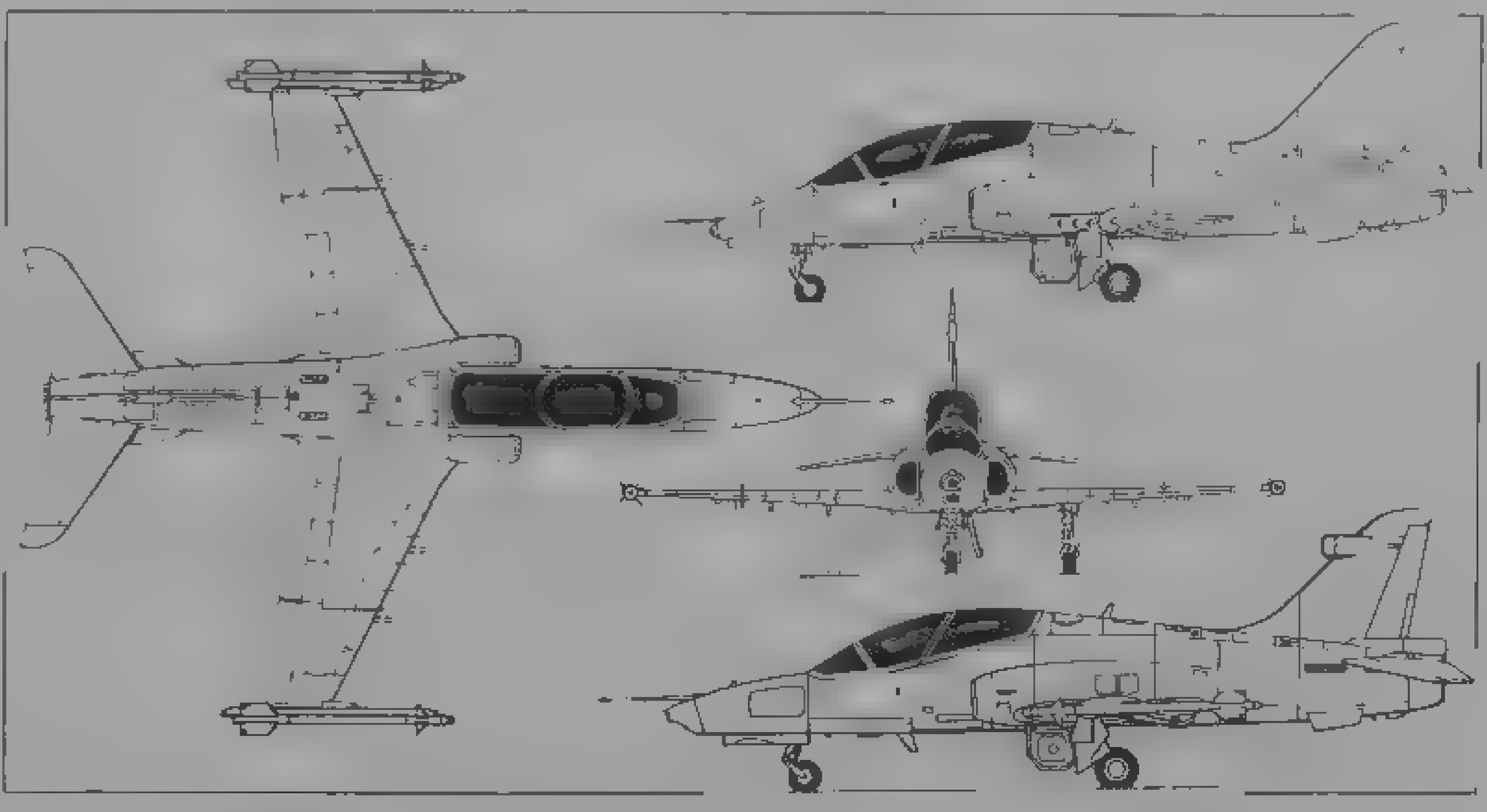
Wing thickness/chord ratio 10 9 per cent at root, 9 per cent at tip, dihedral 2°; sweepback 26° on leading-edge, 21° 30' at quarter chord. Anhedral tailplane

FLYING CONTROLS: Ailerons and one-piece all-moving tailplane actuated hydraulically by tandem actuators, rudder mechanically operated, with electrically actuated trim tab Hydraulically actuated double-slotted flaps, outboard 300 mm (12 in) of flap vanes normally deleted, small fence on each wing leading-edge, 100 and 200 Series use special combat wing with full width flap vanes (refer Hawk 200 entry); large airbrake under rear fuselage, aft of wings; two small ventral fins; smurfs (refer Hawk 200 entry) on 100 Series. Hydraulic yaw damper on 100 Series rudder

STRUCTURE: Aluminium alloy, one-piece wing, with machined torsion box of two main spars, auxiliary spar, ribs and skins with integral stringers, most of box forms integral fuel tank, honeycomb-filled ailerons; composites wing fences, frames and stringers fuselage, swept tail surfaces. Wing attached to fuselage by six bolts

LANDING GEAR: Wide track hydraulically retractable tricycle type, with single wheel on each unit. AP Precision Hydraulics oleos and jacks Main units retract inward into wing, ahead of front spar; castoring (optionally power-steered) nosewheel retracts forward Dunlop mainwheels, brakes and tyres size 6.50-10, pressure 9 86 bars (143 lb/sq in). Nosewheel and tyre size 4.4-16, pressure 8 27 bars (120 lb/sq in) Tail bumper fairing under rear fuselage. Anti-skid wheel brakes. Tail braking parachute, diameter 2 64 m (8 ft 8 in), on Mks 52/53 and all 60 and 100 Series aircraft

POWER PLANT: One Rolls-Royce Turbomeca Adour non-afterburning turbofan, as described under Current Versions. Adour Mk 861A for Switzerland assembled locally by Sulzer Bros. Air intake on each side of fuselage, forward of wing leading-edge Engine starting by Microturbo integral gas-turbine starter Fuel in one fuselage bag tank of 832 litres (220 US gallons, 183 Imp gallons) capacity and integral wing tank of 823 litres (217 US gallons 181 Imp gallons), total fuel capacity 1,655 litres (437 US gallons, 364 Imp gallons) Pressure refuelling point near front of port engine air intake trunk, gravity point on top of fuselage. Provision for carrying one 455 or 591 litre (120



British Aerospace Hawk 100 with wingtip Sidewinders and additional side view (top) of Hawk 60 Series *(Jane's/Dennis Punnett)*

1995

Malaysian Air Force Hawk Mk 108

1995

First Hawk Mk 103 for the Royal Air Force of Oman

1995

or 156 US gallon, 100 or 130 Imp gallon) drop tank on each inboard underwing pylon, according to Series.

ACCOMMODATION: Crew of two in tandem under one-piece fully transparent acrylic canopy, opening sideways to starboard. Fixed front windscreen able to withstand a 0.9 kg (1.98 lb) bird at 454 knots (841 km/h, 523 mph). Improved front windscreen fitted retrospectively to RAF Hawks, able to withstand a 1 kg (2.2 lb) bird at 528 knots (978 km/h 607 mph); this installed on all current export aircraft. Separate internal screen in front of rear cockpit. Rear seat elevated. Martin-Baker Mk 10LH zero/zero rocket-assisted ejection seats, with MDC (miniature detonating cord) system to break canopy before seats eject. MDC can also be operated from outside the cockpit for ground rescue. Dual controls standard. Entire accommodation pressurised, heated and air conditioned.

SYSTEMS: BAe cockpit air conditioning and pressurisation systems, using engine bleed air. Two hydraulic systems; flow rate: System 1, 36.4 litres (9.6 US gallons, 8 Imp gallons)/min, System 2, 22.7 litres (6 US gallons; 5 Imp gallons)/min. Systems pressure 207 bars (3,000 lb/sq in). System 1 for actuation of control jacks, flaps, airbrake, landing gear and anti-skid wheel brakes. Compressed nitrogen accumulators provide emergency power for flaps and landing gear at pressure of 2.75 to 5.5 bars (40 to 80 lb/sq in). System 2 dedicated to powering flying controls. Hydraulic accumulator for emergency operation of wheel brakes. Pop-up Dowty ram air turbine in upper rear fuselage provides emergency hydraulic power for flying controls in event of engine or No. 2 pump failure. No pneumatic system. DC electrical power from single 12 kW brushless generator, with two static inverters to provide AC power and two batteries for standby power. Gaseous oxygen system for crew.

AVIONICS: *Comms:* Mk 1/Srs 50 includes Sylvania UHF and VHF. Cossor 2720 Mk 10A IFF in Finnish aircraft. Srs 60 has Collins UHF and VHF, Magnavox UHF and Cossor IFF; Srs 100 has Collins AN/ARC-182 U/VHF, Magnavox AN/ARC-164 UHF and Cossor 4720 IFF.

Flight: Mk 1/Srs 50 with Cossor CAT 7000 Tacan. Cossor ILS having CILS 75/76 localiser/glide slope receiver and marker receiver. Collins VOR/ILS and ADF, Collins Tacan, Smiths-Newmark 6000-05 AHRS and Smiths radar altimeter in Srs 60; Srs 100 has BAe INS300 inertial platform, Collins AN/ARC 118 Tacan, Collins VIR-31A VOR/ILS and Smiths 0103 KTX 1 radar altimeter, all integrated via dual redundant MIL-STD-1553B databus.

Instrumentation: Smiths-Newmark compass, GEC-Marconi gyros and inverter, two Honeywell RAI 4 4 in (10 cm) remote altitude indicators and magnetic detector system in Mk 1/Srs 50, Smiths 1500 Series HUDWAC in Srs 100; GEC-Marconi F 195 weapon sight in approximately 90 RAF aircraft, GEC-Marconi ISIS 195 sight in Srs 50 and Srs 60, except Saab RGS2 in Finnish Mk 51.

Mission: GEC-Marconi camera and recorder in F 195-equipped RAF aircraft, Vinten camera and recorder in Srs 50 and Srs 60. Srs 100 has Smiths 3000 Series colour MFD, GEC data transfer system and Vinten colour video recording system, plus GEC-Marconi Type 105H laser rangefinder, optional FLIR.

Self-defence: (Series 100 only) Racal Prophet (or GEC-Marconi Sky Guardian as in Omani aircraft) RWR and chaff/flare dispenser at base of fin.

ARMAMENT: Underfuselage centreline-mounted 30 mm Aden Mk 4 cannon with 120 rounds (VKT 12.7 mm machine gun beneath Finnish aircraft), and two or four hardpoints underwing, according to Series. Provision for pylon in place of ventral gun pack. In RAF training roles, normal maximum external load is about 680 kg (1,500 lb), but the uprated Hawk 60 and 100 Series are cleared for an external load of 3,000 kg (6,614 lb), or 500 kg (1,102 lb) at 8 g. Typical weapon loadings on 60 Series include 30 mm or 12.7 mm centreline gun pod and four packs each containing eighteen 68 mm rockets, centreline reconnaissance pod and four packs each containing twelve 81 mm rockets, five 1,000 lb free-fall or retarded bombs, four launchers each containing four 100 mm rockets, nine 250 lb or 250 kg bombs; thirty-six 80 lb runway denial or tactical attack bombs; five 600 lb cluster bombs, four Sidewinder or two Magic air-to-air missiles, four CBLS 100/200 carriers each containing four practice bombs and four rockets, or two 591 litre (156 US gallon; 130 Imp gallon) drop tanks and two Maverick air-to-surface missiles. Vinten reconnaissance pod available for centre pylon. Similar options on 100 Series, plus wingtip air-to-air missiles.

DIMENSIONS, EXTERNAL:

Wing span: Mk 1, Srs 50, Srs 60	9.39 m (30 ft 9¾ in)
Srs 100	9.08 m (29 ft 9½ in)
Srs 100 with Sidewinders	9.94 m (32 ft 7⅜ in)
Wing chord: at root	2.65 m (8 ft 8¼ in)
at tip	0.90 m (2 ft 11½ in)
Wing aspect ratio: Mk 1, Srs 50, Srs 60	5.28
Srs 100	4.94
Length: fuselage (including jetpipe)	
Mk 1, Srs 50, Mks 60-66	10.775 m (35 ft 4¼ in)
Mk 67	11.375 m (37 ft 3¾ in)
Srs 100	11.40 m (37 ft 4¾ in)
fuselage and pitot	
Mk 1, Srs 50, Mks 60-66	11.455 m (37 ft 7 in)
Mk 67, Srs 100 (non combat)	12.035 m (39 ft 5¾ in)
Srs 100 (including chaff/flare dispenser)	12.095 m (39 ft 8 in)
overall	
Mk 1, Srs 50, Mks 60-66	11.845 m (38 ft 10¼ in)
Mk 67, Srs 100	12.425 m (40 ft 9¼ in)
Nose to pitot tip	
Mk 1, Srs 50, Mks 60-66	0.68 m (2 ft 2¾ in)
Mk 67	0.66 m (2 ft 2 in)
Srs 100	0.635 m (2 ft 1 in)
Tailplane overhang	0.39 m (1 ft 3½ in)
Height overall	3.981 m (13 ft 0¾ in)

BAe HAWK CUSTOMERS

Customer	Qty	Mark	First aircraft	Deliveries	Squadrons
Abu Dhabi	16[8]	63	1001	Oct 1984 - May 1985	FTS
	18*	102[1, 6, 10]	1051	Apr 1993 -	
	4*	63C	1017	Feb 1995 - Mar 1995	
Dubai	8	61	501	Mar 1983 - Sep 1983	Ftr Sqdn
	1	61	509	Jun 1988 -	Ftr Sqdn
Finland	50[2]	51	HW301	Dec 1980 - Oct 1985	11, 21, 31, Koul LLv, TLLv, Koelentue
	7*	51A	HW351	Nov 1993	
Indonesia	20	53	LL-5301	Sep 1980 - Mar 1984	103
	8*	100			On order
	16*	200			On order
Kenya	12	52	101	Apr 1980 - Feb 1982	
Korea, South	20*	67	67-496	Sep 1992 - Aug 1993	
Kuwait	12	64	140	Nov 1985 - 1987	12
Malaysia	10*	108[1, 6, 10]	M40-01	Jan 1994 - 1995	3 FTC
	18*	208[6, 9]	M40-21	Aug 1994 - Mar 1995	9
Oman	4*	103[1, 6, 10]	101	Dec 1993 - Feb 1995	
	12*	203[9]	121	Dec 1994 - Feb 1995	
Saudi Arabia	30	65	2110	Aug 1987 - Oct 1988	21, 37
	20	100	—	—	On order
Switzerland	20[3]	66	U-1251	Nov 1989 - Nov 1991	55, 255
UK	176[7]	T. Mk 1	XX154	Nov 1976 - Feb 1982	4 FTS (19, 74 & 208 Sqdns), Red Arrows, 100 Sqdn, FRADU[1]
USA	218[4]	T-45A	162787	Apr 1988 -	VT 21
Zimbabwe	8	60	600	Jul 1982 - Oct 1982	2
	5*	60A	608	Jun 1992 - Sep 1992	2
Demonstrator	2[5]	60/102D	G-HAWK		—
	3[5]	200/200/200RDA	ZG200		—
Total	**718**				

Notes

* Built at Brough, Hamble and Samlesbury and assembled at Warton unless stated otherwise; remainder built at Kingston, assembled at Dunsfold (290) and Bitteswell (1)

1 Laser nose

2 46 assembled by Valmet in Finland

3 19 assembled by F + W in Switzerland

4 Production by McDonnell Douglas in USA, 84 on firm order

5 One assembled at Warton

6 Wingtip Sidewinders

7 89 converted to T Mk 1A

8 15 converted to 63A

9 Fixed refuelling probe

10 Radar warning receiver

Tailplane span 4.39 m (14 ft 4¾ in)
Wheel track 3.47 m (11 ft 5 in)
Wheelbase 4.50 m (14 ft 9 in)

AREAS:
Wings, gross 16.69 m² (179.6 sq ft)
Ailerons (total):
Mk 1, 50 and 60 Series 1.05 m² (11.30 sq ft)
100 Series 0.97 m² (10.44 sq ft)
Trailing-edge flaps (total) 2.50 m² (26.91 sq ft)
Airbrake 0.53 m² (5.70 sq ft)
Fin, Mk 1, 50 and 60 Series 2.51 m² (27.02 sq ft)
100 Series 2.61 m² (28.10 sq ft)
Rudder, incl tab 0.58 m² (6.24 sq ft)
Tailplane 4.33 m² (46.61 sq ft)

WEIGHTS AND LOADINGS:
Weight empty: 60 Series 4,012 kg (8,845 lb)
100 Series 4,400 kg (9,700 lb)
Max weapon load (60, 100 Series) 3,000 kg (6,614 lb)
Max fuel weight:
internal (usable) 1,304 kg (2,875 lb)
external (usable) 932 kg (2,055 lb)
Max T-O weight: T Mk 1 5,700 kg (12,566 lb)
50 Series 7,350 kg (16,200 lb)
60, 100 Series 9,100 kg (20,061 lb)
Max landing weight: T Mk 1 4,649 kg (10,250 lb)
60 Series 7,650 kg (16,865 lb)
Max wing loading:
T Mk 1 341.5 kg/m² (69.97 lb/sq ft)
50 Series 440.4 kg/m² (90.2 lb/sq ft)
60,100 Series 545.2 kg/m² (111.7 lb/sq ft)
Max power loading:
T Mk 1 246.5 kg/kN (2.42 lb/lb st)
50 Series 318.18 kg/kN (3.12 lb/lb st)
60 Series 359.0 kg/kN (3.52 lb/lb st)
100 Series 350.0 kg/kN (3.43 lb/lb st)

PERFORMANCE:
Never-exceed speed (VNE), clean: at S/L
Mach 0.87 (575 kts, 1,065 km/h, 661 mph EAS)
at and above 5,180 m (17,000 ft)
Mach 1.2 (575 kts, 1,065 km/h, 661 mph EAS)
Max level speed at S/L:
50 Series 535 kts (990 km/h, 615 mph)
60 Series 545 kts (1,010 km/h; 627 mph)
100 Series 540 kts (1,001 km/h, 622 mph)
Max level flight Mach number 0.88
Stalling speed, flaps down 96 kts (177 km/h, 110 mph)
Max rate of climb at S/L 3,600 m (11,800 ft)/min
Time to 9,145 m (30,000 ft), clean: 60 Series 6 min 54 s
100 Series 7 min 30 s
Service ceiling: 60 Series 14,020 m (46,000 ft)
100 Series 13,565 m (44,500 ft)
T-O run (clean): 60 Series 710 m (2,330 ft)
100 Series 640 m (2,100 ft)
Landing run (10% fuel load): 60 Series 550 m (1,800 ft)
100 Series 605 m (1,980 ft)
Combat radius:
with 2,268 kg (5,000 lb) weapon load
538 n miles (998 km, 620 miles)
with 907 kg (2,000 lb) weapon load
781 n miles (1,448 km, 900 miles)
Ferry range:
60 Series, with two 591 litre (156 US gallon; 130 Imp gallon) drop tanks
1,575 n miles (2,917 km, 1,812 miles)
100 Series, as above
1,360 n miles (2,519 km; 1,565 miles)
Endurance, 100 n miles (185 km, 115 miles) from base:
60 Series approx 2 h 42 min
100 Series approx 2 h 6 min
g limits +8/–4

UPDATED

BAe HAWK 200 SERIES (SINGLE-SEAT VERSIONS)

TYPE: Single-seat multirole combat aircraft.

PROGRAMME: Intention to build demonstrator (ZG200) announced 20 June 1984, first flight 19 May 1986 but lost 2 July 1986 in g-induced loss of consciousness (GLOC) accident; replaced by first preproduction Hawk 200 (ZH200), first flown 24 April 1987; third demonstrator Series 200RDA (ZJ201) with full avionics and systems, including Westinghouse AN/APG-66H radar, flown 13 February 1992. First production Hawk Srs 200 (Oman 121) flew 11 September 1993, first for Malaysia (Mk 208 M40-21) flew 4 April 1994.

CURRENT VERSIONS: Missions can include:

Airspace denial: Four Sidewinders, gun and two 591 litre (156 US gallon, 130 Imp gallon) drop tanks enabling 2 hour loiter on station at 100 n miles (185 km; 115 miles) from base.

Close air support: Typically four 1,000 lb bombs precision-delivered up to 115 n miles (213 km, 132 miles) from base in lo-lo-lo-lo mission with gun and wingtip Sidewinder missiles also carried.

Battlefield interdiction: Typically 907 kg (2,000 lb) load on hi-lo-lo-hi mission over 290 n mile (537 km, 340 mile) radius with gun and wingtip Sidewinder missiles also carried.

BAe Hawk Mk 102 for Abu Dhabi

1995

British Aerospace Hawk 200 fitted with AN/APG-66H radar

1995

Long-range photo reconnaissance: 490 n mile (908 km, 564 mile) range with two external tanks, pod containing cameras and infra-red linescan and wingtip Sidewinder missiles for self-defence (rapid role change permits follow-on attack by the same aircraft).

Long-range deployment: 1,365 n mile (2,528 km, 1,571 miles) ferry range using two 591 litre (156 US gallon, 130 Imp gallon) external tanks, unrefuelled and with tanks retained (reserves allow 10 minutes over destination at 150 m, 495 ft).

Anti-shipping attack: Two rocket pods and two 591 litre (156 US gallon; 130 Imp gallon) external tanks plus wingtip Sidewinder missiles for self-defence, enabling ship attack and return with 10 per cent fuel reserves.

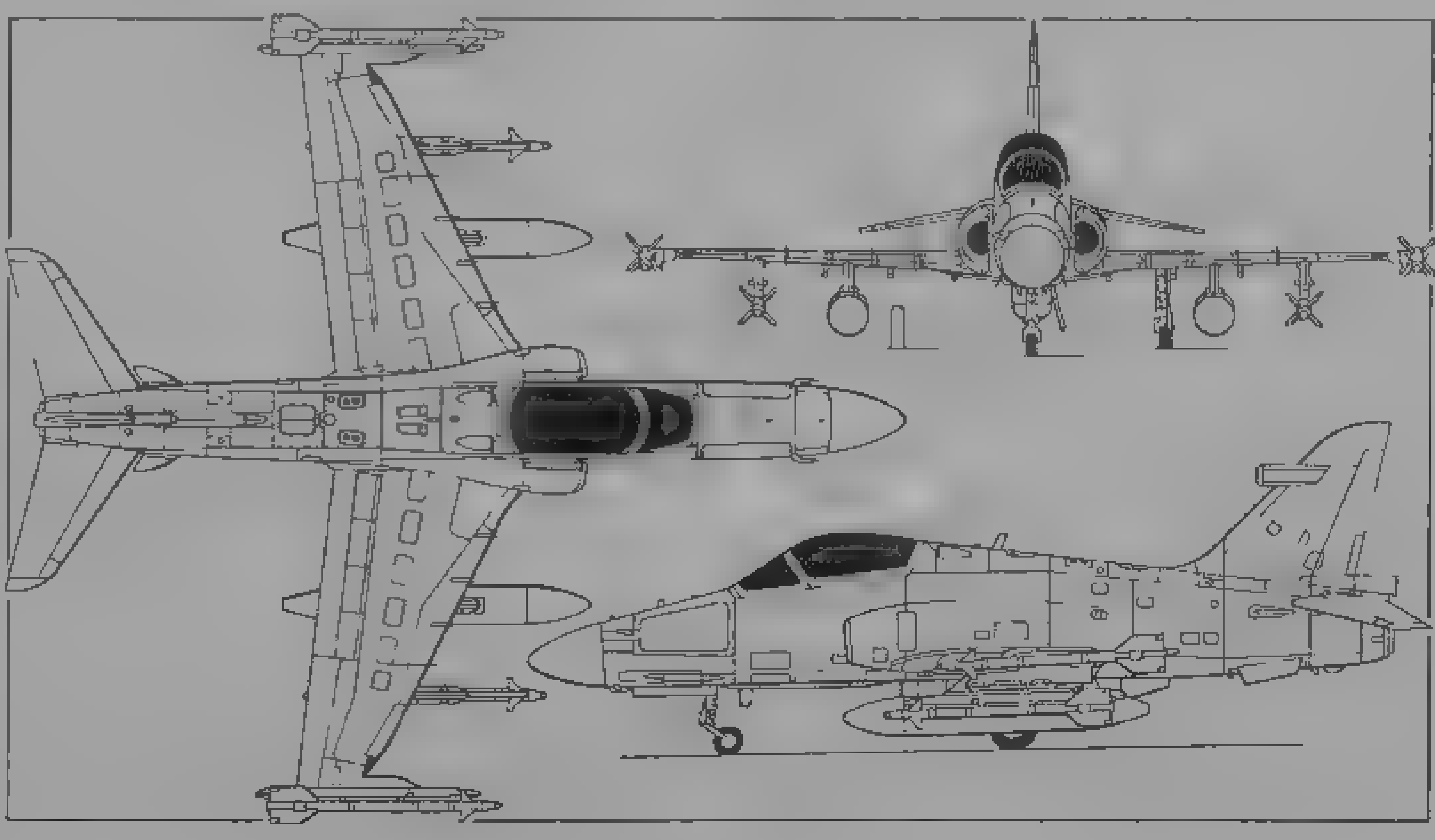
CUSTOMERS: See table. Oman (12 **Mk 203** ordered July 1990), Indonesia (12 ordered June 1993), Malaysia (18 **Mk 208** ordered December 1990, for delivery from July 1994.) Saudi Arabia signed MoU covering second batch of some 60 Hawks, substantial proportion **Mk 205** with APG-66H radar. All customers also ordered two-seat Hawks.

DESIGN FEATURES: Except for taller fin, fixed wing leading-edge droop to enhance lift and manoeuvrability at Mach 0.3 to 0.7, manually selected combat flaps (less than quarter flap setting) available below 350 knots (649 km/h, 403 mph) IAS to allow sustained 5 g+ at 300 knots (556 km/h, 345 mph) at sea level, full-width flap vanes reinstated and detail modifications to wing dressing, Hawk 200 virtually identical to current production Hawk two-seater aft of cockpit, giving 80 per cent airframe commonality. Intended to take advantage of new miniaturised low-cost avionics and intelligent weapons, Hawk 100 type avionics include INS, HUDWAC, IFF, RWR and optional HOTAS controls, Westinghouse AN/APG-66H advanced multimode radar for all-weather target acquisition and navigation fixes; proposed alternative FLIR/laser rangefinder nose no longer on offer, intended integral cannon also deleted, all four underwing pylons capable of 907 kg (2,000 lb) load, within maximum 3,493 kg (7,700 lb) external load, wingtip rails make possible four Sidewinders or similar AAMs (inboard pylons not cleared for these missiles).

FLYING CONTROLS: See Hawk two-seater; smurfs (strake ahead of each half of tailplane to restore control authority at high angles of attack).

LANDING GEAR: Mainwheel tyres size 559 × 165-279, pressure 16.2 bars (235 lb/sq in). Nosewheel tyre size 457 × 140-203, pressure 7.24 bars (105 lb/sq in).

POWER PLANT: One Rolls-Royce Turbomeca Adour Mk 871 non-afterburning turbofan, with uninstalled rating of 26.0 kN (5,845 lb st). Optional fixed refuelling probe on starboard side of windscreen.



The single-seat British Aerospace Hawk 200 Series with nose-mounted radar (*Jane's/Mike Keep*)

1992

First radar-equipped Hawk 200RDA carrying two Sidewinder AAMs plus telemetry pods

1995

ACCOMMODATION: Pilot only, on Martin-Baker Mk 10LH zero/zero ejection seat, under starboard-hinged canopy.

SYSTEMS: 25 kVA generator with DC transformer-rectifier. Fairey Hydraulics yaw control system added, comprising rudder actuator and servo control system, incorporating an autostabiliser computer. Lucas Aerospace artificial feel system. 12 kVA APU for engine starting, ground running and emergency power.

AVIONICS: Similar to Hawk 100.

Radar: Westinghouse AN/APG-66H multimode radar.

Flight: Smiths HUDWAC.

Instrumentation: GEC-Marconi multifunction display in cockpit, combined com/nav interface allows control of all functions from one panel. HOTAS controls optional.

Self-defence: GEC-Marconi Defence Systems Sky Guardian 200 RWR in aircraft for Oman and Abu Dhabi Mk 102s. Chaff/flare dispenser (Vinten Vicon 78 Srs 300 or equivalent) at base of fin.

ARMAMENT: None internally. All weapon pylons cleared for 8 g manoeuvres with 500 kg (1,102 lb) loads.

DIMENSIONS, EXTERNAL: As Hawk Series 100, except:

Span: 200RDA	9.39 m (30 ft 9¾ in)
Length: fuselage: 200	10.95 m (35 ft 11 in)
200 with chaff/flare dispenser	11.01 m (36 ft 1⅜ in)
200RDA	10.99 m (36 ft 0¾ in)
200RDA with chaff/flare dispenser	11.05 m (36 ft 3 in)
overall: 200	11.34 m (37 ft 2½ in)
200RDA	11.38 m (37 ft 4 in)
Height overall: 200	4.130 m (13 ft 6⅝ in)
200RDA	3.98 m (13 ft 0¾ in)
Wheelbase	3.56 m (11 ft 8 in)

WEIGHTS AND LOADINGS:

Basic weight empty	4,450 kg (9,810 lb)
Max fuel: internal (usable)	1,360 kg (3,000 lb)
external (usable)	932 kg (2,055 lb)
Max weapon load	3,000 kg (6,614 lb)
Max T-O weight	9,100 kg (20,061 lb)
Max wing loading	545.3 kg/m² (111.7 lb/sq ft)
Max power loading	350.04 kg/kN (3.43 lb/lb st)

PERFORMANCE (estimated, no external stores or role equipment unless stated):

Never-exceed speed (VNE): at S/L	Mach 0.87 (575 kts, 1,065 km/h, 661 mph EAS)
at and above 5,180 m (17,000 ft)	Mach 1.2 (575 kts, 1,065 km/h, 661 mph EAS)
Max level speed at S/L	540 kts (1,000 km/h, 621 mph)
Econ cruising speed at 12,500 m (41,000 ft)	430 kts (796 km/h, 495 mph)
Stalling speed, flaps down	96 kts (177 km/h, 110 mph) IAS
Max rate of climb at S/L	3,508 m (11,510 ft)/min
Time to 9,145 m (30,000 ft)	7 min 24 s
Service ceiling	13,720 m (45,000 ft)
Runway LCN: flexible pavement	15
rigid pavement	10
T-O run	630 m (2,070 ft)
Landing run	598 m (1,960 ft)
Ferry range (with two drop tanks)	1,365 n miles (2,528 km, 1,570 miles)
g limits	+8/-4

UPDATED

BAe HARRIER

Production of the first generation Harrier continues only as the Sea Harrier (see next entry); final RAF Harrier GR. Mk 3 retired May 1994, T. Mks 4/4A continued as RAF trainers, until late 1995 replacement by BAe/McDonnell Douglas Harrier T. Mk 10; Royal Navy T. Mks 4/4N being modified to T. Mk 8 for compatibility with Sea Harrier F/A. Mk 2, first flight (ZB605) 27 July 1994. Full details of Mk 3 Harrier last appeared in the 1988-89 *Jane's*, brief details of two-seat versions in 1993-94 edition.

UPDATED

BAe SEA HARRIER

Royal Navy designations: FRS. Mk 1 and F/A. Mk 2
Indian Navy designation: FRS. Mk 51

TYPE: V/STOL fighter, reconnaissance and strike aircraft.

PROGRAMME: Development of P1184 Sea Harrier announced by UK government 15 May 1975, first flight (XZ450) 20 August 1978, first delivery to Royal Navy (XZ451) 18 June 1979; first ship trials (HMS *Hermes*) November 1979.

Ski jump launching ramp (proposed by Lt Cmdr D. R. Taylor RN) take-off trials ashore 1977, and at sea from 30 October 1980: HMS *Invincible* and *Illustrious* first fitted with 7° ramps, HMS *Ark Royal* 12°; latter allows 1,135 kg (2,500 lb) increased load for same take-off run or 50 to 60 per cent shorter run at same weight; HMS *Invincible* recommissioned with 13° ramp 18 May 1989, HMS *Illustrious* received similar re-work, May 1991 to April 1994.

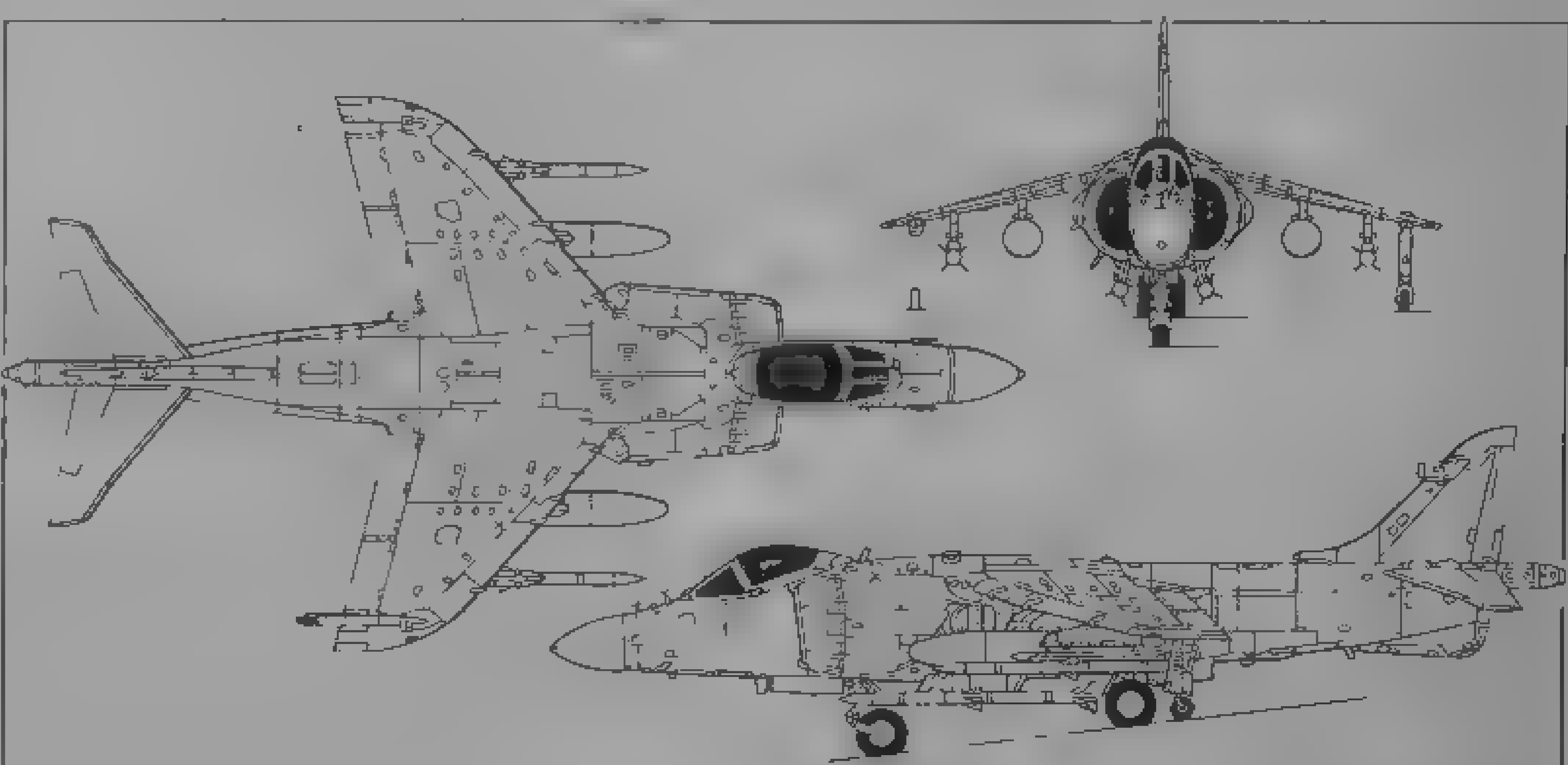
UK MoD gave BAe project definition contract January 1985 for mid-life update of RN Sea Harrier FRS. Mk 1s, upgraded aircraft redesignated FRS. Mk 2, aerodynamic development FRS. Mk 2 (redesignated F/A. Mk 2 in May 1994) converted at Dunsfold from Mk 1 ZA195, first flight 19 September 1988, first flight of second development aircraft (XZ439) 8 March 1989; contract for conversion of further 29 Mk 1s to Mk 2s signed by UK MoD 7 December 1988, modifications begun at Kingston October 1990, continuing at Dunsfold, Samlesbury and Brough, redelivery from 2 April 1993, for later augmentation by newly built Mk 2s, additional four conversions funded in 1994, representing all 35 Mk 1s and former Mk 1s extant by May 1994.

New F/A. Mk 2 AAM launch rail first tested by live AIM-9L (from Mk 1) 2 November 1988, AMRAAM trials began in USA (using XZ439) with first launch on 29 March 1993, flying from Eglin AFB, airborne testing of Blue Vixen radar began in RAE One-Eleven (ZF433), completing 114 hour/121 sortie programme November 1987; development work transferred to RAE BAe 125 (XW930), first flown with A-model radar version 26 August 1988; second 125-600B (ZF130) given full F/A. Mk 2 weapon system, including representative cockpit in co-pilot's position and Sidewinder acquisition round on underwing pylon (first flight at Woodford 20 May 1988, began development flying at Dunsfold December 1988, not fitted with B-model Blue Vixen radar until September 1989); first flight of B-model radar in Sea Harrier XZ439 24 May 1990. First Mk 2 deck landing, by ZA195 on HMS *Ark Royal*, 7 November 1990. First look-down firing of AIM-120 AMRAAM, 28 April 1993, series of 10 test firings completed May 1994. Operational Evaluation Unit for Mk 2 formed at Boscombe Down, 1 June 1993.

CURRENT VERSIONS: **FRS. Mk 1**: Initial Royal Navy version, Pegasus 104 engine; first used operationally during Falkland Islands campaign 1982, from HMS *Hermes* and *Invincible* (29 flew 2,376 sorties, destroying 22 enemy aircraft in air-to-air combat without loss, four lost in accidents and two to ground fire). *Following description applies to Sea Harrier FRS. Mk 1, except where indicated otherwise.*

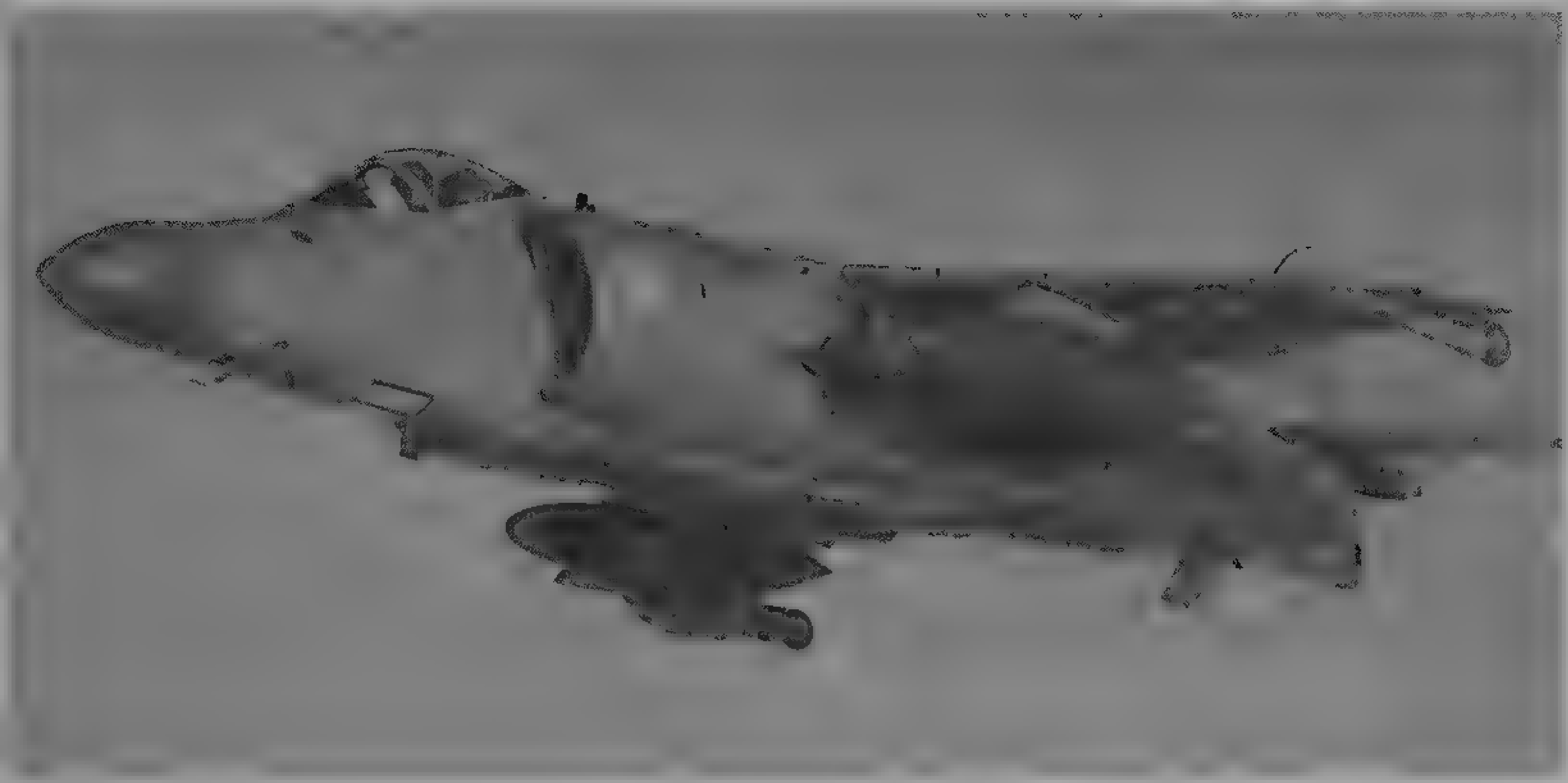
FRS. Mk 51: Similar to Mk 1, for Indian Navy. Upgrade for 22 remaining aircraft under discussion with BAe in 1994-95, retrofit with Blue Vixen radar possible.

F/A. Mk 2: Differs externally from Mk 1 by less pointed nose radome; longer rear fuselage, resulting from 35 cm (1 ft 1¾ in) plug aft of wing trailing-edge; revisions of



BAe Sea Harrier F/A. Mk 2 V/STOL fighter, reconnaissance and attack aircraft *(Jane's/Mike Keep)*

1993



BAe Sea Harrier F/A. Mk 2 fitted with strakes in place of cannon

1995

antennae and external stores Internal changes include GEC-Marconi Blue Vixen pulse Doppler radar, offering all-weather look-down/shoot-down capability, with inherent track-while-scan, multiple target engagement greatly increased missile launch range, enhanced surface target acquisition, and improved ECCM performance Current weapons plus AIM-120 AMRAAM on Airscrew Howden (Frazer-Nash) rail launchers and McDonnell Douglas LAU-106A eject launchers

Improved, integrated weapons built around MIL-STD-1553B databus, with dual redundant data highway, allowing computerised time-sharing of information processed in databus control and ...

Redesign of cockpit includes existing HUD and new dual multipurpose HDDs; proposed JTIDS terminal delayed following cancellation by US Navy of ... proposed equipment, JTIDS/Sea Harrier integration study (for retrofit) undertaken by BAe, 1992-... All ... weapon systems controls positioned on upfront control panel, or on throttle and stick (HOTAS)

Wingtip extensions of 20 cm (8 in) and 30 cm (1 ft 0 in) test-flown to enhance stability carrying AMRAAM, but proved unnecessary by 1990 trials

CUSTOMERS. Royal Navy ordered three development aircraft plus batches of 21, 10, 14 and nine by September 1984, all built as Mk 1s, last completed June 1988, intent to order at least 10 Mk 2s revealed March 1990, converted to firm order for 18 in January 1994 Naval Intensive Flying Trials Unit (No. 700A Squadron) commissioned at RNAS Yeovilton 18 September 1979 and became normally shore-based No. 899 HQ Squadron, April 1980; front-line units Nos. 800 and 801 Squadrons with eight aircraft each (previously five), non-radar T Mk 4N two-seat trainers (three) also received

First 'production' conversion to Mk 2 (XZ497) retained by BAe, second aircraft (ZE695) was first delivered 2 April 1993; nine delivered by end of 1993, 19 by January 1995; final Mk 1 (ZD581) withdrawn from 800 Squadron 17 March 1995 Operational Evaluation Unit formed at Boscombe Down 1 June 1993, 899 Squadron stood-down December 1993, in preparation for Mk 2 pilot training, initial loss sustained 5 January 1994, four Mk 2s of 899 Squadron/OEU to HMS *Invincible* 24 August 1994, operational 29 August for patrols over Bosnia 801 Squadron stood-down with Mk 1s August 1994, received first Mk 2s (ZA176 and XZ455) 5 October 1994; embarked HMS *Illustrious* 26 January 1995 for first full deployment of Mk 2

Six FRS Mk 51s (similar to FRS Mk 1) handed over to Indian Navy from January 1983, used by No. 300 (White Tiger) Squadron from INS *Vikrant*, two T Mk 60 two-seat trainers also received, 10 more FRS. Mk 51s and one T. Mk 60 ordered by Indian government November 1985 letter of intent for seven more FRS Mk 51s and ... T Mk 60 issued September 1986, to equip INS *Viraat* (former HMS *Hermes*). Total orders 98 (see table)

DESIGN FEATURES: Single-engined V/STOL system with four rotatable exhaust nozzles that can be set through 98.5° from fully aft position, short take-off made with nozzles initially fully aft, then turned partially downward for lift-off and continued forward acceleration, nozzles can be vectored at high speed to tighten turn radius or decelerate suddenly; control at less than wingborne airspeed automatically transferred to reaction control valves at wingtips, nose and tail also enhancing combat manoeuvres

Main differences from land based Harriers include elimination of magnesium components, introduction of raised cockpit, revised operational avionics, and installation of multimode GEC-Marconi radar with air-to-air intercept and air-to-surface modes in redesigned nose that folds to port. Pegasus 104 turbofan of Mk 1 incorporates additional anti-corrosion features and generates more electrical power than land-based Pegasus 103. See Current Versions for F/A Mk 2 features

Wing section BAe (HS) design, thickness/chord ratio 10 per cent at root, 5 per cent at tip, anhedral 12°, incidence 1° 45', and sweepback at quarter-chord 34°

FLYING CONTROLS. Plain ailerons irreversibly operated by tandem hydraulic jacks; one-piece variable incidence tailplane, with 15° anhedral, irreversibly operated by tandem hydraulic jacks, manually operated rudder with trim tab, flaps; jet reaction control valve built into front of each outrigger wheel fairing and in nose and tailcone; large air brake under fuselage; ventral fin under rear fuselage

STRUCTURE One-piece aluminium alloy three-spar safe-life wing with integrally machined skins (Brough built); entire wing unit removable to provide access to engine, revised inboard one-third of F/A. Mk 2 wing incorporates additional fence, kinked leading-edge, re-positioning of dog-tooth fillet closer to fuselage, and reduction of overwing vortex generators from 12 to 11, 67.3 cm (2 ft 2½ in) wing extensions available for ferrying, ailerons, flaps, rudder and tailplane trailing-edge of bonded aluminium alloy honeycomb construction safe-life fuselage of frames and stringers, mainly aluminium alloy but with titanium skins at rear and some titanium adjacent engine and other special areas, access to power plant through top of fuselage, ahead of wings, F/A Mk 2 has deepened and stiffened nose structure, plus extended rear fuselage, lengthened by 35 cm (1 ft 1¾ in), fin tip carries suppressed VHF aerial

LANDING GEAR Retractable bicycle type of Dowty Aerospace manufacture, permitting operation from rough unprepared surfaces of CBR as low as 3 to 5 per cent Hydraulic actuation, with nitrogen bottle for emergency extension of landing gear Single steerable nosewheel retracts forward, twin coupled mainwheels rearward, into fuselage. Small outrigger units retract rearward into fairings slightly inboard of wingtips. Nosewheel leg of levered suspension liquid spring type Dowty telescopic oleo-pneumatic main and outrigger gear Dunlop wheels and tyres, size 26.00 × 8.75-11 (nose unit), 27.00 × 7.74-13 (main units) and 13.5 × 6.4 (outriggers). Dunlop multidisc brakes and Dunlop-Hytrol adaptive anti-skid system

POWER PLANT One Rolls-Royce Pegasus Mk 104 or (retrofit option) Mk 106 vectored thrust turbofan (95.6 kN; 21,500 lb st), with four exhaust nozzles of the two-vane cascade type, rotatable through 98.5° from fully aft position Engine bleed air from HP compressor used for jet reaction control system and to power duplicated air motor for nozzle actuation. Low drag intake cowls each have eight automatic suction relief doors aft of leading-edge to improve intake efficiency by providing extra engine air at low forward or zero speeds. A 227 litre (60 US gallon, 50 Imp gallon) tank supplies demineralised water for thrust restoration in high ambient temperatures for STO, VTO and vertical landings Fuel in five integral tanks in fuselage and two in wings, with total capacity of approximately 2 865 litres (757 US gallons, 630 Imp gallons). This can be supplemented by two 455 litre (120 US gallon, 100 Imp gallon) jettisonable combat tanks, or two 864 litre (228 US gallon, 190 Imp gallon) tanks, or two 1,500 litre (396 US gallon; 330 Imp gallon) ferry tanks on the inboard wing pylons. Ground refuelling point in port rear nozzle fairing. Provision for fixed in-flight refuelling probe above the port intake cowl

ACCOMMODATION Pilot only, on Martin-Baker Mk 10H zero/zero rocket ejection seat which operates through the miniature detonating cord equipped canopy of the pressurised, heated and air conditioned cockpit Seat raised 28 cm (11 in) compared with Harrier GR. Mk 3 Manually operated rearward-sliding canopy Birdproof windscreen, with hydraulically actuated wiper Windscreen washing system

SYSTEMS. Three-axis limited authority autostabiliser for V/STOL flight Pressurisation system of BAe design, with Normalair-Garrett and Delaney Gallay major components, maximum pressure differential 0.24 bar (3.5 lb/sq in). Two hydraulic systems, flow rate: System 1, 36 litres (9.6 US gallons, 8 Imp gallons)/min System 2, 23 litres (6 US gallons, 5 Imp gallons)/min. Systems, pressure 207 bars (3,000 lb/sq in), actuate Fairey flying control and general

BAe SEA HARRIER CUSTOMERS

Customer	Qty	Mark	First aircraft	Deliveries
Royal Navy	3	1 (Devmt.)	XZ438	Dec 1978 - Jun 1979*
	21	1	XZ450	Jun 1979 - Aug 1981
	10	1	ZA174	Nov 1981 - Jan 1984†
	14	1	ZD578	Mar 1985 - Jun 1986
	9	1	ZE690	Nov 1987 Aug 1988
	18	2	ZH796	1995
Indian Navy	6	51	IN601	Jan 1983 - Oct 1984
	10	51	IN607	Dec 1989 - Sep 1991
	7	51	IN617	Sep 1991 Apr 1992
Total	**98**			

* First flights
† Ninth delivered April 1982

Landing approach by Sea Harrier F/A. Mk 2 of 899 Squadron ***(Paul Jackson)***

1995

services and a retractable ram air turbine inside top of rear fuselage, driving a small hydraulic pump for emergency power. Ram air turbine deleted from F/A. Mk 2. Hydraulic reservoirs nitrogen pressurised at 2.75 to 5.5 bars (40 to 80 lb/sq in). AC electrical system with transformer rectifiers to provide required DC supply. Two 15 kVA generators. Two 28 V 25 Ah batteries, one of which energises a 24 V motor to start Lucas Mk 2 gas-turbine starter/APU. This unit drives a 6 kVA auxiliary alternator for ground readiness servicing and standby. Bootstrap cooling unit for equipment bay, with intake at base of dorsal fin. Automatic flight control system consisting of two-axis autopilot (attitude and height hold) and three-axis autostabiliser. British Oxygen liquid oxygen system of 4.5 litres (1.2 US gallons, 1 Imp gallon) capacity in Royal Navy aircraft, Indian Navy has gaseous oxygen system.

AVIONICS: *Comms:* Plessey PTR 446 D-band IFF transponder and Thomson Thorn ARI 5983 I-band transponder. Radio com by multichannel Magnavox AN/ARC-164 UHF and GEC-Marconi AD 120 VHF with VHF standby via Dowty D 403M transceiver. Intended 1994 retrofit of Mk XII IFF.

Radar: Nose-mounted GEC-Marconi Blue Fox (Blue Vixen in F/A. Mk 2) multimode radar.

Flight: UHF homing, GEC-Marconi AD 2770 Tacan with offset facility, Thomson Thorn Microwave Airborne Digital Guidance Equipment (MADGE); radar altimeter, Racal Doppler 72, GEC-Marconi self-aligning attitude and heading reference platform and digital navigation computer, upfront control panel and multifunction display. Retrofit planned in 1997 of GPS.

Instrumentation: Radar and flight information overlaid on daylight-readable TV raster display; Smiths electronic HUD.

Mission: Vinten video recording system for HUD and HDD. Smiths digital weapon-aiming computer, bus control unit and missile control system. JTIDS installation planned in 1997. Optically flat panel in nose, on port side, for F 95 oblique camera, which is carried as standard. A cockpit voice recorder with in-flight playback facility supplements the reconnaissance cameras, and facilitates rapid debriefing and mission evaluation.

Self-defence: GEC-Marconi Defense Systems Sky Guardian 200 RWR.

ARMAMENT: No built-in armament. Combat load carried on four underwing and three underfuselage pylons. Wing and centre-fuselage pylons fitted with ML ejector release units, other underfuselage pylons with McDonnell Douglas LAU-106/A missile eject launchers for AIM-120 AMRAAM. Inboard wing points and fuselage centreline point stressed for loads up to 907 kg (2,000 lb) each, and outboard underwing pair for loads up to 295 kg (650 lb) each, two strake fairings under the fuselage can each be replaced by a 30 mm Aden gun pod and ammunition or, on F/A. Mk 2, by two missile pylons. Aircraft cleared for operations with maximum external load exceeding 2,270 kg (5,000 lb), and has flown with weapon load of 3,630 kg (8,000 lb). F/A. Mk 2 outboard pylons re-stressed to 454 kg (1,000 lb). Able to carry 30 mm guns, bombs, rockets and flares of UK and US designs. Alternative stores loads of RN Sea Harriers include free-fall (1,030 lb) and parachute-retarded (1,120 lb) bombs; Lepus flares; and ML CBLS 100 carriers for Portsmouth Aviation 3 kg and 14 kg practice bombs. Four AIM-9 Sidewinder missiles carried on the outboard underwing pylons (Matra Magic instead of Sidewinder on Indian Navy aircraft), two Sea Eagle missiles carried on inboard underwing pylons on BAe launchers. F/A. Mk 2 accommodates up to four AIM-120 AMRAAMs, or two AIM-120s and four AIM-9L/M Sidewinders, on McDonnell Douglas LAU-106 launchers (underfuselage AMRAAM), Airscrew Howden Common Rail Launchers (outboard wing AMRAAM) or Varo LAU-7 rail launchers (outboard Sidewinders). BAe ALARM anti-radiation missile may be integrated as alternative to AMRAAM. Missile control system by Smiths; guns and all other armament and ejector release units controlled by GEC-Marconi (Plessey) panel.

DIMENSIONS, EXTERNAL:
Wing span: normal 7.70 m (25 ft 3 in)
ferry 9.04 m (29 ft 8 in)
Length overall: FRS. Mk 1 14.50 m (47 ft 7 in)
F/A. Mk 2 14.17 m (46 ft 6 in)
Length overall, nose folded:
FRS. Mk 1 12.73 m (41 ft 9 in)
F/A. Mk 2 13.16 m (43 ft 2 in)
Height overall 3.71 m (12 ft 2 in)
Tailplane span 4.24 m (13 ft 11 in)
Outrigger wheel track 6.76 m (22 ft 2 in)
Wheelbase, nosewheel to mainwheels
approx 3.45 m (11 ft 4 in)

AREAS:
Wings, gross 18.68 m² (201.1 sq ft)
Rudder, incl tab 0.49 m² (5.3 sq ft)
Tailplane 4.41 m² (47.5 sq ft)

WEIGHTS AND LOADINGS (FRS. Mk 1):
Operating weight empty 6,374 kg (14,052 lb)
Max fuel: internal 2,295 kg (5,060 lb)
external 2,404 kg (5,300 lb)
Max weapon load: STO 3,630 kg (8,000 lb)
VTO 2,270 kg (5,000 lb)
Max T-O weight 11,880 kg (26,200 lb)
Max wing loading 636.0 kg/m² (130.3 lb/sq ft)
Max power loading 124.27 kg/kN (1.22 lb/lb st)

PERFORMANCE (FRS. Mk 1):
Max Mach number at high altitude 1.25
Max level speed at low altitude
above 640 kts (1,185 km/h; 736 mph) EAS
Typical cruising speed:
high-altitude, for well over 1 h on internal fuel
above Mach 0.8
low altitude
350-450 kts (650-833 km/h, 404-518 mph),
with rapid acceleration to
600 kts (1,110 km/h; 690 mph)
STO run at max T-O weight, without ski-jump
approx 305 m (1,000 ft)
Time from alarm to 30 n miles (55 km; 35 miles) combat area under 6 min
High-altitude intercept radius, with 3 min combat and reserves for VL 400 n miles (750 km, 460 miles)
Attack radius 250 n miles (463 km, 288 miles)
g limits +7.8/–4.2

COMBAT PROFILES (F/A. Mk 2, from carrier fitted with a 12° ski-jump ramp, at ISA + 15°C and with a 20 kt, 37 km/h, 23 mph wind over the deck):

Combat air patrol: Up to 1 hour 30 minutes on station at a radius of 100 n miles (185 km, 115 miles), carrying four AMRAAMs, or two AMRAAMs and two 30 mm guns, plus two 864 litre (228 US gallon, 190 Imp gallon) combat drop tanks.

Reconnaissance: Low level cover of 130,000 n miles² (446,465 km², 172,380 sq miles) at a radius of 525 n miles (970 km; 600 miles) from the carrier, with outward and return flights at medium/high level, carrying two 30 mm guns and two 864 litre (228 US gallon; 190 Imp gallon) combat drop tanks. Overall flight time 1 hour 45 minutes.

Surface attack (hi-lo-hi): Radius of action to missile launch 200 n miles (370 km; 230 miles), carrying two Sea Eagle missiles and two 30 mm guns.

Take-off deck run for the above missions is 137 m, 107 m and 92 m (450 ft, 350 ft and 300 ft) respectively, with vertical landing.

Interception. A typical deck-launched interception could be performed against a Mach 0.9 target at a radius of 116 n miles (215 km, 133 miles), or a Mach 1.3 target at 95 n miles (175 km, 109 miles), after initial radar detection of the approaching target at a range of 230 n miles (425 km, 265 miles), with the Sea Harrier at 2 minutes alert status, carrying two AMRAAM missiles.

UPDATED

V-22 OSPREY

BAe and Bell/Boeing concluded MoU in 1987 covering examination by British company of latter's V-22 tilt-rotor aircraft in both military and civilian applications within European NATO area. In 1989, Aeritalia (now Alenia) and Dornier (now DASA) reached agreement with BAe to pursue prospects of V-22 tilt-rotor aircraft within Europe on collaborative tri-national basis, with support of Bell/Boeing.

Potential applications for a tilt-rotor aircraft in UK military service are foreseen by BAe as shore-based anti-submarine warfare (four Sting Ray torpedoes), ship-based AEW, commando assault (24 troops), air mobility and special forces (12 troops and extra fuel). Civilian uses include resource development (carrying 30+ oil/gas rig workers) and commuter transport.

VERIFIED

BAe ADVANCED AIRCRAFT STUDIES

TYPE: Low-observables (LO) combat aircraft to replace Tornado GR. Mk 4.

PROGRAMME: £100 million spent in 1992-94 on stealth aircraft development, purpose-built research and development facility, including secure hangar, nearing completion at Warton plant in 1995. BAe urging government go-ahead for stealth demonstrator in 1997, production aircraft then to be available in 2013, international collaboration likely.

Note: US press reports, quoting Washington sources, allege UK already proceeding with LO aircraft programme optimised for frontal area stealthiness.

UK media allege LO aircraft (assumed to be American) destroyed in accident at Boscombe Down on night of 26 September 1994. No evidence available to substantiate either claim.

NEW ENTRY

OTHER AIRCRAFT

BAe involvement with **Eurofighter 2000** detailed in International section, conversion of **VC10** airliners to tankers for the RAF in *Jane's Aircraft Upgrades*.

NEW ENTRY

BRITISH AEROSPACE REGIONAL AIRCRAFT LTD

ASSET MANAGEMENT ORGANISATION (BAe RAL AMO)

2 Bishop Square, St Albans Road West, Hatfield, Hertfordshire AL10 9NE
Telephone: 44 (1707) 255547
Fax: 44 (1707) 255555
MANAGING DIRECTOR, AMO: Robin Southwell
MARKETING: Steve Pettigrew
PUBLIC RELATIONS: David Dorman, Dorway Public Relations, 18 Harpenden Lane, Redbourn, St Albans, Hertfordshire AL3 7PB
Telephone: 44 (1582) 794100
Fax: 44 (1582) 797999

BAe Regional Aircraft Limited (BAe RAL) Asset Management Organisation (AMO) deals with BAe 146 fleet leasing and sales, 60 aircraft were leased or purchased through AMO during 1994. BAe 146 now out of production but AMO holds portfolio of 112 aircraft. The design continues as the Avro Regional Jet series (see following entry) and is built at Woodford factory south of Manchester.

UPDATED

AVRO INTERNATIONAL AEROSPACE LTD

(Division of British Aerospace Regional Aircraft)

Woodford Aerodrome, Chester Road, Stockport, Cheshire SK7 1QR
Telephone: 44 (161) 439 5051
Fax: 44 (161) 955 4570
MANAGING DIRECTOR: Michael Donovan
SALES AND MARKETING: Jeffrey Marsh
PUBLIC RELATIONS: Howard Borrington

Avro International Aerospace assembles the RJ Avroliner family of aircraft at its headquarters in Woodford, Cheshire. 185 ha (459 acre) site includes over 93,000 m² (1,001,000 sq ft) of assembly hangars, not including flight test facilities. Workforce 2,000.

Agreement reached in January 1995 (and formally signed on 6 June 1995) for Avro to join Franco-Italian ATR (see International Section) and Jetstream Aircraft (this section) in single integrated organisation, eventually leading to development of new products. Resultant Aero International Regional (AIR) merges marketing, sales and customer support of ATR 42/72, Avro RJ and Jetstream 41 with HQ at Toulouse, France, logistics centre at Weybridge, UK, and training centre at Naples, Italy. Avro and Jetstream remain responsible for manufacture of existing products. New venture to become operational on 1 January 1996.

UPDATED

BAe RJ100 Avroliner of Turkish Airlines

1995

BAe RJ AVROLINER

TYPE: Four-turbofan short-range transport.

PROGRAMME: Developed from BAe 146 (1993-94 and earlier *Jane's*) with major changes including uprated engines and all-digital avionics; first development (RJ85) aircraft (G-ISEE) flown at Hatfield 23 March 1992 and first RJ100 (G-OIII) on 13 May 1992; formally announced June 1992; first production RJ (RJ85 for Crossair, G-CROS) made first flight at Woodford 27 November 1992, delivered 2 April 1993; CAA and FAA certification completed 1 October 1993 and 10 June 1994, respectively; final assembly of RJs is at Woodford. Customer support packages include an extended three-year warranty, guaranteed reliability and maintenance costs. Packages available include JetKey, a total fleet management package. Target weight saving of 680 kg (1,500 lb) announced September 1994, together with drag reduction improvements including fairing at fin/tailplane junction and deletion of tail bumper; drag modifications, standard from 1996, reduce fuel consumption by 2 per cent. Cabin pressure differential to be increased from 1996 to raise cruising altitude by 610 m (2,000 ft) to 10,065 m (33,000 ft).

CURRENT VERSIONS: **RJ70**: Shortest fuselage version, accommodating 70 to 94 passengers, choice of power plant between 31.14 kN (7,000 lb st) LF 507 or derated 27.27 kN (6,130 lb st) LF 507 engines. Three delivered in 1994, 8 further orders at March 1995.

RJ85: Lengthened version for 85 to 112 passengers. 31.14 kN (7,000 lb st) LF 507 engines. Seven delivered in 1994, 10 further orders at March 1995.

RJ100: Longest current model, for 100 to 128 passengers (100 at five-abreast seating), engines as for RJ85. Seven delivered in 1994, 16 further orders at March 1995.

RJ115: Same fuselage dimensions as RJ100 but featuring mid-cabin exits, increased capacity air conditioning packs and higher design weights and fuel capacity as standard, 116 to 128 passengers in six-abreast configuration, same engines as RJ100.

QT Quiet Trader: Freighter version.

RJ AVROLINER ORDERS
(June 1995)

Customer	Variant	Orders	Deliveries
Air Malta	RJ70	4	4
Business Express (USA)	RJ70	12	3
Crossair (Switzerland)	RJ85	4	4
	RJ100	12	0
Lufthansa	RJ85	10	6
Pelita Air Service (Indonesia)	RJ85	1	1
SAM (Colombia)	RJ100	8	8
Turkish Airlines	RJ100	10	8
Total		**61**	**34**

QC Quick Change: Versions configured for quick change from passenger to freight and vice versa.

Combi: Versions configured for carriage of both freight and passengers.

CUSTOMERS: Total of 61 orders (and 34 deliveries, including 17 in 1994) by June 1995, see table.

DESIGN FEATURES: Low operating noise levels; ability to operate from short or semi-prepared airstrips with minimal ground facilities; 'Spaceliner' interior; LF 507 FADEC controlled engines, digital flight deck with Cat. IIIa all-weather landing capability.

High lift aerofoil section, thickness/chord ratio 15.3 per cent at root, 12.2 per cent at tip; anhedral 3° at trailing edge; incidence 3° 6' at root, 0° at tip; sweepback 15° at quarter-chord.

FLYING CONTROLS: Mechanically actuated ailerons and elevators, with trim and servo tabs; powered rudder. Single section hydraulically actuated Fowler flaps, spanning 78 per cent of trailing edges, with Dowty actuators; 33° flap setting under development in 1995 for RJ100; hydraulically operated roll spoiler outboard of three automatically actuated lift dumpers on each wing; no leading-edge lift devices; petal airbrakes form tailcone when closed. Honeywell automatic flight control/flight guidance system.

STRUCTURE: All-metal, fail-safe wings with machined skins, integrally machined spars and ribs; fail-safe fuselage with chemically etched skins; strengthened centre-section developed initially for RJ100 (will be standard on all RJ70s); nose free of stringers, remainder of fuselage has top hat stringers bonded to skins above keel area, Z section stringers wet assembled with bonding agent and riveted to skin in keel area. T tail with chemically etched skins bonded to top hat section stringers; fixed incidence tailplane.

LANDING GEAR: Hydraulically retractable tricycle type of Dowty design, with twin Dunlop wheels on each unit. Main units retract inward into fairings on fuselage sides; steerable (±70°) nose unit retracts forward. Oleo-pneumatic shock-absorbers with wheels mounted on trailing axle. Simple telescopic nosewheel strut. Mainwheel tyres size 12.50-16 Type III, pressure (RJ70) 8.41 bars (122 lb/sq in). Nosewheel tyres size 7.50-10 Type III, pressure (RJ70) 7.79 bars (113 lb/sq in). Low-pressure tyres optional. Dunlop multidisc carbon brakes operated by duplicated hydraulic systems. Anti-skid units in both primary and secondary brake systems. Minimum ground turning radius about nosewheels: RJ70, 11.53 m (37 ft 10 in); RJ85, 12.55 m (41 ft 2 in); RJ100, 13.97 m (45 ft 10 in).

POWER PLANT: Four AlliedSignal LF 507 turbofans, each rated at 31.14 kN (7,000 lb st), installed in underwing pylon pods on RJ85, RJ100 and RJ115. RJ70 previously had derated LF 507 engines as standard, providing 27.27 kN (6,130 lb st); these now optional. No reverse thrust. Fuel in two integral wing tanks and integral centre-section tank (latter with vented and drained sealing diaphragm above passenger cabin), combined usable capacity 11,728 litres (3,098 US gallons, 2,580 Imp gallons). Optional auxiliary tanks in wingroot fairings, combined capacity 1,173 litres (310 US gallons, 258 Imp gallons), giving total capacity of 12,901 litres (3,408 US gallons, 2,838 Imp gallons). Single-point pressure refuelling, with coupling situated in starboard wing outboard of outer engine.

ACCOMMODATION: Crew of two pilots on flight deck, and two or three cabin staff. Standard observer's seat. RJ70 accommodates 70 passengers five-abreast and up to 94 six-abreast at 74 cm (29 in) pitch. RJ85 accommodates 85 passengers five-abreast, maximum 112 passengers six-abreast at 74 cm (29 in) pitch. RJ100 standard accommodation for 100 passengers five-abreast at 79 cm (31 in) pitch, and maximum 112 passengers. RJ115 accommodates 116 passengers six-abreast; maximum of 128. One outward-opening passenger door forward and one aft on port side of cabin. Built-in airstairs optional. Service doors, one forward and one aft on starboard side of cabin. Freight and baggage holds under cabin floor. All accommodation pressurised and air conditioned.

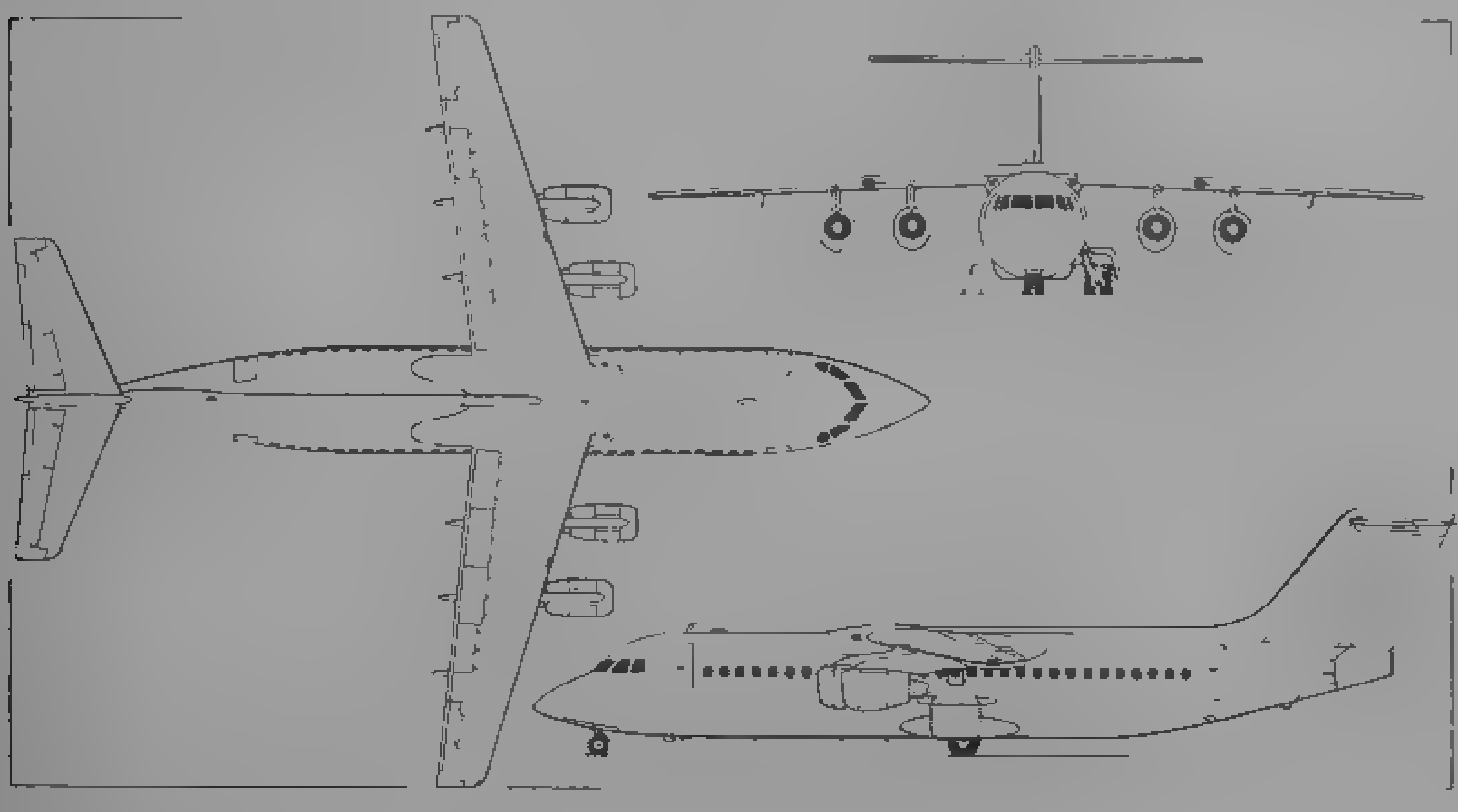
SYSTEMS: Normalair-Garrett cabin air conditioning and pressurisation system, using engine bleed air. Electropneumatic pressurisation control with discharge valves at front and rear of cabin. Maximum differential 0.47 bar (6.75 lb/sq in), giving 2,440 m (8,000 ft) equivalent altitude at 9,450 m (31,000 ft). Hydraulic system, duplicated for essential services, for landing gear, flaps, rudder, roll and lift spoilers, airbrakes, nosewheel steering, brakes and auxiliary fuel pumps, pressure 207 bars (3,000 lb/sq in). Electrical system powered by two 40 kVA integrated-drive alternators to feed 115/200 V three-phase 400 Hz primary systems. 28 V DC power supplied by transformer-rectifier in each channel. Hydraulically powered emergency electrical power unit. AlliedSignal GTCP 36-150 APU for ground and air usable air conditioning and electrical power generation, Sundstrand/APIC 1000 APU standard from 1994. Chemical oxygen system. Stall warning and identification system, comprising stick shaker (warning) and stick force (identification) elements, providing soft and hard corrective stick forces at the approach of stall conditions. Hot air de-icing of wing and tailplane leading-edges; windscreen electric anti-icing and demisting standard; rain repellent system.

AVIONICS: *Comms*: Dual VHF radios with ARINC 700 interface, Selcal, HF radios, PA system, CVR.

Radar: Choice of weather radars.

Flight: Honeywell digital flight guidance system incorporates fail-passive Cat. IIIa autopilot, autothrottle, yaw damper and windshear detection and protection. Marker beacon receiver, dual radio altimeters, ground proximity warning system, dual DME, dual ATC transponders, dual VHF nav and dual ADF.

Instrumentation: Full IFR.



Avroliner RJ115 with up to 128 seats (*Jane's/Dennis Punnett*)

1995

Lufthansa CityLine RJ85 D-AVRO departing from Avro's Woodford airfield on delivery 18 October 1994
1995

DIMENSIONS, EXTERNAL

* Wing span: all versions, excl static dischargers	26.21 m (86 ft 0 in)
Wing aspect ratio	8.97
Wing chord: at root	2.75 m (9 ft 0 in)
at tip	0.91 m (3 ft 0 in)
**Length overall: RJ70	26.20 m (85 ft 11½ in)
RJ85	28.60 m (93 ft 10 in)
RJ100, RJ115	30.99 m (101 ft 8¼ in)
Height overall: RJ70	8.61 m (28 ft 3 in)
RJ85	8.59 m (28 ft 2 in)
Fuselage: max diameter	3.56 m (11 ft 8 in)
Tailplane span	11.09 m (36 ft 5 in)
Wheel track	4.72 m (15 ft 6 in)
Wheelbase: RJ70	10.09 m (33 ft 1¼ in)
RJ85	11.20 m (36 ft 9 in)
RJ100, RJ115	12.52 m (41 ft 1 in)
Passenger doors (port, fwd and rear):	
Height	1.83 m (6 ft 0 in)
Width	0.85 m (2 ft 9½ in)
Height to sill: fwd	1.88 m (6 ft 2 in)
rear	1.98 m (6 ft 6 in)
Servicing doors (stbd, fwd and rear):	
Height	1.47 m (4 ft 10 in)
Width	0.85 m (2 ft 9½ in)
Height to sill: fwd	1.88 m (6 ft 2 in)
rear	1.98 m (6 ft 6 in)
Underfloor freight hold door (stbd, fwd):	
Height	1.09 m (3 ft 7 in)
Width	1.35 m (4 ft 5 in)
Height to sill	0.78 m (2 ft 7 in)
Underfloor freight hold door (stbd, rear):	
Height	1.04 m (3 ft 5 in)
Width	0.91 m (3 ft 0 in)
Height to sill	0.90 m (2 ft 11½ in)
Freight door (freighter versions):	
Height	1.93 m (6 ft 4 in)
Width	3.33 m (10 ft 11 in)
Height to sill	1.93 m (6 ft 4 in)

* *Static discharger extends 6.3 cm (2½ in) from each wingtip*
** *Static dischargers on elevator extend length of all series by 18.4 cm (7¼ in)*

DIMENSIONS, INTERNAL

Cabin (excl flight deck, incl galley and toilets):	
Length: RJ70	15.42 m (50 ft 7 in)
RJ85	17.81 m (58 ft 5 in)
RJ100, RJ115	20.20 m (66 ft 3¼ in)
Max width	3.42 m (11 ft 2½ in)
Max height	2.02 m (6 ft 7½ in)
Freight cabin (RJ85-QT):	
Cargo floor: Length	16.08 m (52 ft 9 in)
Width	3.23 m (10 ft 7 in)
Volume: Pallets/igloos	60.3 m³ (2,145 cu ft)
Baggage/freight holds, underfloor:	
RJ70	13.7 m³ (479 cu ft)
RJ85	18.3 m³ (645 cu ft)
RJ100, RJ115	22.99 m³ (812 cu ft)

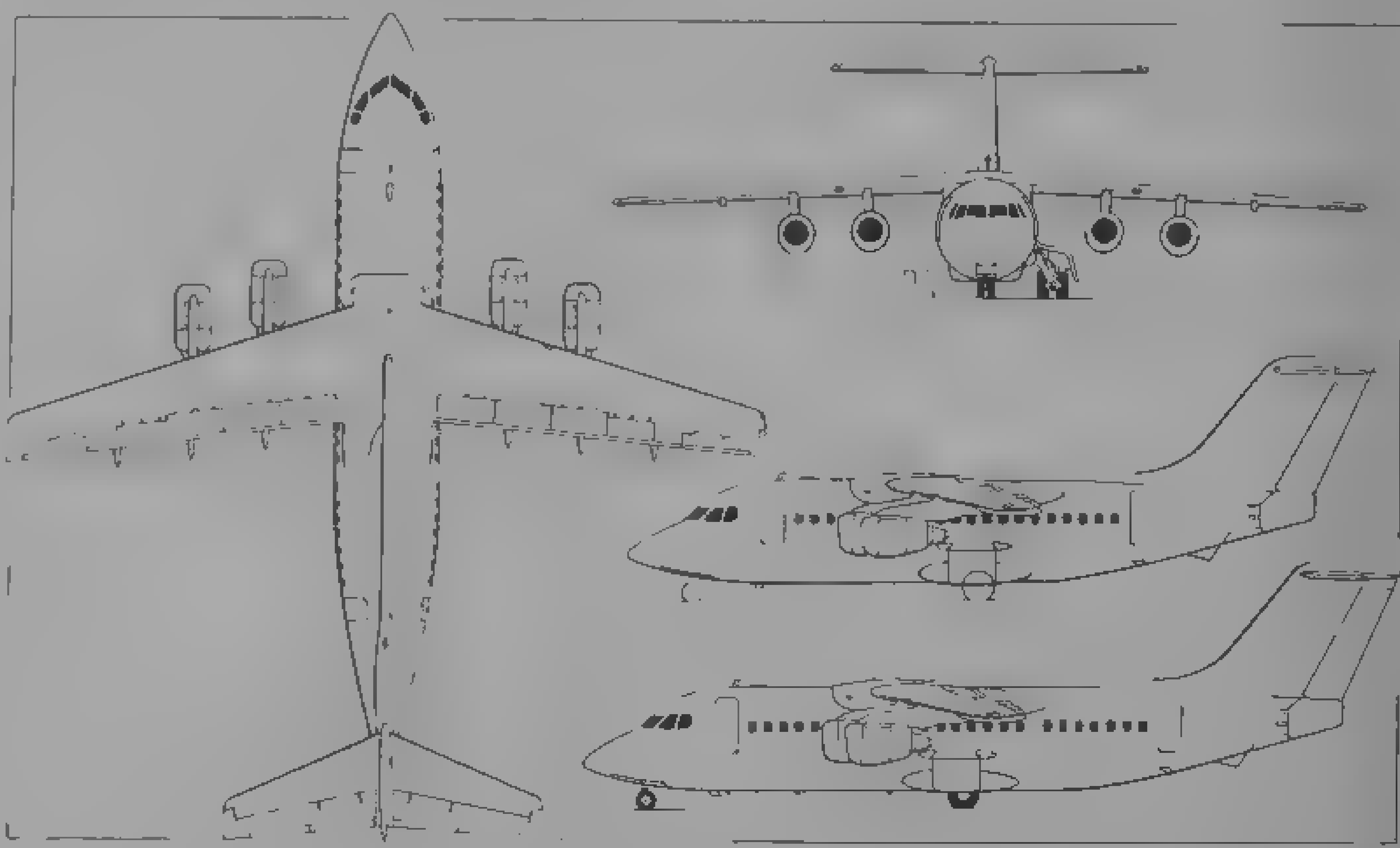
AREAS

Wings, gross: all versions	77.29 m² (832.0 sq ft)
Ailerons (total)	3.62 m² (39.0 sq ft)
Trailing-edge flaps (total)	19.51 m² (210.0 sq ft)
Spoilers (total)	10.03 m² (108.0 sq ft)
Fin	15.51 m² (167.0 sq ft)
Rudder	5.30 m² (57.0 sq ft)
Tailplane	15.61 m² (168.0 sq ft)
Elevators, incl tabs (total)	10.03 m² (108.0 sq ft)

WEIGHTS AND LOADINGS

Operating weight empty: RJ70	23,451 kg (51,700 lb)
RJ85	24,086 kg (53,100 lb)
RJ85 QT	22,906 kg (50,500 lb)
RJ100	24,993 kg (55,100 lb)
RJ100-QT	23,587 kg (52,000 lb)
RJ115	25,310 kg (55,800 lb)
Max payload: RJ70	10,070 kg (22,200 lb)
RJ85	11,340 kg (25,000 lb)
RJ85-QT	12,927 kg (28,500 lb)
RJ100	12,066 kg (26,600 lb)
RJ100-QT	13,835 kg (30,500 lb)
RJ115	11,793 kg (26,000 lb)
Max fuel weight: all series except RJ115	
standard	9,362 kg (20,640 lb)
optional	10,298 kg (22,704 lb)
RJ115	10,298 kg (22,704 lb)
Max T-O weight: RJ70	43,091 kg (95,000 lb)
RJ85	43,998 kg (97,000 lb)
RJ100 and RJ115	46,039 kg (101,500 lb)
Max ramp weight: RJ70	43,318 kg (95,500 lb)
RJ85	44,225 kg (97,500 lb)
RJ100 and RJ115	46,266 kg (102,000 lb)
Max zero-fuel weight: RJ70	33,793 kg (74,500 lb)
RJ85	35,834 kg (79,000 lb)
RJ100, RJ115	37,421 kg (82,500 lb)
Max landing weight: RJ70	37,875 kg (83,500 lb)
RJ85	38,555 kg (85,000 lb)
RJ100, RJ115	40,143 kg (88,500 lb)
Max wing loading: RJ70	557.5 kg/m² (114.2 lb/sq ft)
RJ85	569.2 kg/m² (116.6 lb/sq ft)
RJ100, RJ115	595.7 kg/m² (122.0 lb/sq ft)
Max power loading: RJ70*	345.98 kg/kN (3.39 lb/lb st)
RJ85	353.26 kg/kN (3.46 lb/lb st)
RJ100, RJ115	369.65 kg/kN (3.63 lb/lb st)

* *Fully rated engines*



RJ85 with additional side view (upper) of RJ70. Tail bumpers will be removed in 1996
(Jane's/Dennis Punnett) *1995*

PERFORMANCE (at ISA and max standard T-O weight, except where indicated):

Max operating Mach number (M_{MO}): all versions	0.73
Max operating speed (V_{MO}):	
RJ70, RJ85	300 kts (555 km/h; 345 mph) IAS
RJ100, RJ115	305 kts (565 km/h; 351 mph) IAS
Cruising speed at 9,455 m (31,000 ft):	
RJ70: high speed	432 kts (801 km/h; 498 mph)
long range	368 kts (681 km/h; 423 mph)
RJ85: high speed	432 kts (801 km/h; 498 mph)
long range	376 kts (696 km/h; 433 mph)
RJ100, RJ115:	
high speed	432 kts (801 km/h; 498 mph)
long range	384 kts (711 km/h; 442 mph)
Stalling speed, 30° flap:	
RJ70	97 kts (179 km/h; 111 mph) EAS
RJ85	101 kts (187 km/h; 116 mph) EAS
RJ100	104 kts (192 km/h; 119 mph) EAS
RJ115	106 kts (197 km/h; 122 mph) EAS
Stalling speed, 33° flap, at max landing weight:	
RJ70, RJ85	93 kts (172 km/h; 107 mph) EAS
RJ100, RJ115	95 kts (176 km/h; 109 mph) EAS
T-O to 10.7 m (35 ft), S/L, ISA: RJ70	1,192 m (3,910 ft)
RJ85	1,466 m (4,810 ft)
RJ100	1,655 m (5,430 ft)
RJ115	1,811 m (5,940 ft)
FAR landing distance from 15 m (50 ft), S/L, ISA, at max landing weight: RJ70	1,173 m (3,850 ft)
RJ85	1,189 m (3,900 ft)
RJ100, RJ115	1,268 m (4,160 ft)
Range with max fuel:	
RJ70	1,600 n miles (2,963 km; 1,841 miles)
RJ85	1,500 n miles (2,778 km; 1,726 miles)
RJ100	1,400 n miles (2,593 km; 1,611 miles)
RJ115	1,330 n miles (2,463 km; 1,530 miles)
Range with max payload:	
RJ70	1,230 n miles (2,278 km; 1,415 miles)
RJ85	960 n miles (1,778 km; 1,104 miles)
RJ100, RJ115	990 n miles (1,833 km; 1,139 miles)

OPERATIONAL NOISE LEVELS (FAR Pt 36-12):

T-O: RJ70	81.9 EPNdB
RJ85	83.0 EPNdB
RJ100	84.7 EPNdB
RJ115	86.1 EPNdB
Approach: RJ70	97.5 EPNdB
RJ85	97.3 EPNdB
RJ100, RJ115	97.6 EPNdB
Sideline: RJ70	87.2 EPNdB
RJ85	88.6 EPNdB
RJ100	88.2 EPNdB
RJ115	88.1 EPNdB

UPDATED

CFM

COOK FLYING MACHINES
(Trading as CFM Metal-Fax Ltd)

Unit 2D, Eastlands Industrial Estate, Leiston, Suffolk IP16 4LL
Telephone: 44 (1728) 832353/833076
Fax: 44 (1728) 832944
Telex: 9877703 CHACOM G
MANAGING DIRECTOR: David G Cook

While continuing to produce Shadow series of aircraft from its Suffolk works, CFM has licensed Laron Aviation Technologies of Portalis, New Mexico, to produce Shadow kits for North and South American and Canadian market, and has been negotiating for licensed production at a plant at Durban, Natal, for African, Australasian and Far Eastern markets.

VERIFIED

CFM SHADOW SERIES C and C-D

TYPE: Tandem two-seat microlight, conforms to FAI and UK CAA requirements (BCAR CAP 482 Section S).

PROGRAMME: Shadow first flew as prototype in 1983; in production since 1984, type approval to BCAR CAP 482 Section S gained May 1985. Current standard Shadow designated Series C, with C-D having dual controls, although Series B/B-D can still be bought. ULV cropspraying trials carrying 64 litre (16.8 US gallon; 14 Imp gallon)

chemical tank, multifunction surveillance fit for photography (Hasselblad survey camera), video recording, linescan or thermal imagery, or closed-circuit TV microwave transmission to a command vehicle/station also available.

COSTS (early 1995): Assembled: Series B, £15,410; Series B-D, £15,900; Series C, £16,370; Series C-D, £16,860. Kit: Series B, £9,625; Series B-D, £9,900; Series C, £10,425; Series C-D, £10,700. (All prices exclusive of VAT.)

CUSTOMERS: Total 14 new Shadows registered in UK during 1994, including two built under PFA auspices. Sales by early 1995 totalled 280.

DESIGN FEATURES: Design claimed to have no 'defined stall' and is spin-resistant. Options include agricultural spraygear and other specialised equipment.

STRUCTURE: Wings of aluminium alloy and wood, with foam/glassfibre ribs, plywood covering on forward section and polyester fabric aft. Fuselage pod of Fibrelam, aluminium tube tailboom.

LANDING GEAR: Non-retractable tricycle landing gear, with brakes. Options include floats.

POWER PLANT: One 38 kW (51 hp) Rotax 503 2V. Standard fuel capacity 23 litres (6 US gallons; 5 Imp gallons). Options include a 73 litre (19.2 US gallon, 16 Imp gallon) auxiliary fuel tank.

DIMENSIONS, EXTERNAL:

Wing span	10.03 m (32 ft 11 in)
Wing aspect ratio	6.69
Length overall	6.40 m (21 ft 0 in)
Height overall	1.75 m (5 ft 9 in)
Propeller diameter	1.30 m (4 ft 3 in)

AREAS:

Wings, gross	15.0 m² (162.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	158 kg (349 lb)
Pilot/passenger weight range:	
front cockpit	54.5-100 kg (120-220 lb)
rear cockpit	0-100 kg (0-220 lb)
Max T-O weight	348 kg (767 lb)
Max wing loading	23.09 kg/m² (4.73 lb/sq ft)
Max power loading	9.16 kg/kW (15.04 lb/hp)

PERFORMANCE (at max T-O weight, ISA):

Max level speed	89 kts (164 km/h; 102 mph)
Econ cruising speed	65 kts (121 km/h; 75 mph)
Min flying speed	22 kts (41 km/h; 25 mph)
Max rate of climb at S/L:	
pilot only	335-366 m (1,100-1,200 ft)/min
dual	213-244 m (700-800 ft)/min
Service ceiling	7,620 m (25,000 ft)
T-O run from metalled surface	90 m (295 ft)
Landing run, with brakes	75 m (246 ft)
Range, standard fuel	139 n miles (257 km; 160 miles)
Endurance, standard fuel	2 h
g limits	+6/-3 static, ultimate

UPDATED

CFM STREAK SHADOW

TYPE: Tandem two-seat ultralight/homebuilt, dual controls standard.

PROGRAMME: Construction of prototype started 1987 and this first flew June 1988; first flight of production aircraft October 1988; 75 kits delivered by January 1995.

COSTS (1995): Assembled: by application. Kits: Series S-A1, £11,750; Series S-A, £12,200. (All prices exclusive of VAT.)

CFM Starstreak (Hirth F30 engine)

1995

DESIGN FEATURES: Derivative version of Shadow, designated a microlight in Europe and Experimental homebuilt in USA. has new wing design, light airframe weight and more powerful engine; fuel capacity similar to latest C version of Shadow; no 'defined stall' and is spin-resistant.

FLYING CONTROLS: See Structure. Electric trim.

STRUCTURE: Similar to Shadow but with foam/glassfibre wings (CFM aerofoil section), and control surfaces with aluminium alloy ribs and polyester fabric covering (ailerons, flaps, rudder and elevators).

POWER PLANT: One 47.7 kW (64 hp) Rotax 582, or optional MWAE 622. Standard fuel capacity 54.6 litres (14.4 US gallons, 12 Imp gallons). Optional 73 litre (19.2 US gallon, 16 Imp gallon) auxiliary fuel tank.

DIMENSIONS, EXTERNAL:

Wing span	8.53 m (28 ft 0 in)
Wing aspect ratio	5.60
Length overall	6.40 m (21 ft 0 in)
Height overall	1.75 m (5 ft 9 in)
Propeller diameter	1.32 m (4 ft 4 in)

AREAS:

Wings, gross	13.01 m² (140.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	176 kg (388 lb)
Max T-O weight	408 kg (900 lb)
Max wing loading	31.39 kg/m² (6.43 lb/sq ft)
Max power loading	8.55 kg/kW (14.06 lb/hp)

PERFORMANCE (at ISA and max T-O weight):

Max level speed	105 kts (195 km/h; 121 mph)
Cruising speed:	
75% power	87 kts (161 km/h; 100 mph)
50% power	65 kts (121 km/h; 75 mph)
Min flying speed, engine idling	28 kts (52 km/h; 32 mph)
Max rate of climb at S/L:	
pilot only	549 m (1,800 ft)/min
dual	335-396 m (1,100-1,300 ft)/min
Service ceiling	9,150 m (30,000 ft)
Range	347 n miles (643 km; 400 miles)
Endurance, standard fuel	4 h 30 min
g limits	+6/-3 static, ultimate

UPDATED

CFM SHADOW II

This specialised single-seat version of Shadow is marketed by Mission Technologies Inc (Mi Tex) of Hondo, Texas, USA, as manned surveillance system aircraft for day and night use. Uses one 44.7 kW (64 hp) Rotax 532 engine, and has wing span of 8.53 m (28 ft 0 in).

VERIFIED

CFM STARSTREAK

As Streak Shadow but with 9.14 m (30 ft) span wing and Hirth F30 four-cylinder two-stroke engine of 70.8 kW (95 hp). Prototype flew in 1992, first deliveries February 1994. Cost of kit with engine £15,500.

VERIFIED

CMC

CHICHESTER MILES CONSULTANTS LTD

West House, Ayot St Lawrence, Welwyn, Hertfordshire AL6 9BT
Telephone: 44 (1438) 820341
Fax: 44 (1438) 820030
CHAIRMAN: Ian Chichester-Miles

Ian Chichester-Miles, formerly Chief Research Engineer of BAe Hatfield, established Chichester-Miles Consultants to develop Leopard high-performance light business jet.

UPDATED

CMC LEOPARD

TYPE: Four-seat light business aircraft.

PROGRAMME: Design began January 1981; mockup completed early 1982; detail design and construction of prototype by Designability Ltd of Dilton Marsh, Wiltshire, began July 1982 under CMC contract; first flight of unpressurised prototype (001/G-BKRL) 12 December 1988 at RAE Bedford; by December 1991 had made 50 flights investigating basic handling qualities at speeds up to 200 knots (371 km/h; 230 mph) IAS; new tailplane incorporating AS&T liquid anti-icing system on leading-edge subsequently installed on prototype prior to resumption of flight testing aimed at expanding airspeed, altitude and CG envelopes. Testing halted due to Noel Penny engine company going out of business; change of engine for second prototype.

Design of second (preproduction) aircraft, 002, began April 1989. Features strengthened structure, new landing gear, pressurised cabin, de-icing, reprofiled nose for EFIS avionics, substitution of oleo-pneumatic main landing gear legs for current rubber-in-compression units, and powered by Williams International FJX-1 turbofans. Second Leopard exhibited in incomplete condition at 1994 Farnborough Air Show.

DESIGN FEATURES: All composites airframe, sweptback supercritical wings, sweptback tail unit, twin low-cost turbofans, pressurised cabin, AS&T liquid anti-icing and decontamination system on wing and tailplane leading-edges of production aircraft (see Programme), warm air de-icing of engine intake leading-edges. First prototype has lower powered engines, lacks full pressurisation/air conditioning system, anti-icing, advanced avionics and instrumentation of second aircraft and planned production model.

ARA designed wing section and 3D profiles combining laminar flow and supercritical technology; thickness/chord ratio 14 per cent at root, 11 per cent at tip; wing sweepback at quarter-chord 25°.

FLYING CONTROLS: All-moving fin; two independent tailplane sections operated collectively for pitch control and differentially for roll control, no ailerons. Full span electrically actuated trailing-edge plain flaps, with ±45° deflections for high drag landing and airbraking/lift dumping; no spoilers.

STRUCTURE: Two spar wings, primarily of GFRP, with some carbonfibre reinforcement, carbonfibre flaps; fuselage built in three sections as unpressurised nose housing avionics and nosewheel gear, pressurised cabin (production aircraft), and unpressurised rear housing baggage bay, with fuel tanks below and equipment bays to rear; fuselage primarily GFRP with some carbonfibre reinforcement (fore and aft bulkheads, engine and tailplane axle frames moulded in), pressure cabin section divided approximately along aircraft horizontal datum, with upper section formed by electrically actuated upward-opening canopy hinged at windscreen leading-edge; bonded-in acrylic side windows carry pressurisation tension; nose opens for access to avionics; light alloy engine nacelles, with stainless steel firewalls; composites fin and tailplane; fin sternpost projects to bottom of rear fuselage; low set tailplane in two independent sections, each mounted on steel axle projecting from side of rear fuselage; carbonfibre tabs.

LANDING GEAR: Electrically retractable tricycle type, main units retracting inward into wingroot wells, nosewheels forward. Gravity extension assisted by bias springs and aerodynamic drag. Long stroke shock absorber in each unit, using synthetic elastomers in compression. CMC designed oleo-pneumatic main landing gear installed in 002 and for production aircraft. Main units, each with single Cleveland wheel, size 5.00-5, have tyres size 11 × 4, pressure 4.82 bars (70 lb/sq in) on prototype, 11.56 bars (170 lb/sq in) on production aircraft. Unpowered steerable twin-wheel nose unit has wheels size 4.00-3 and tyres size 8.5 × 2.5 in, pressure 2.75 bars (40 lb/sq in) on prototype, 3.8 bars (55 lb/sq in) on production aircraft. Hydraulic disc brakes. Parking brake.

POWER PLANT: Prototype 001 has two Noel Penny Turbines NPT 301-3A turbojets each of nominal 1.33 kN (300 lb st) rating. Aircraft 002 has two Williams FJX-1 turbofans each of 3.11 kN (700 lb st). Production aircraft will have two Williams International FJX-2 turbofans, each of 4.23 kN (950 lb st). Each engine in nacelle, mounted on crossbeam located in rear fuselage. Fuel tanks in fuselage, below baggage bay. First prototype has total fuel capacity of 455 litres (120 US gallons, 100 Imp gallons). Production aircraft will have maximum capacity of 673 litres (178 US gallons, 148 Imp gallons). Refuelling point on upper surface of fuselage.

ACCOMMODATION: Cabin seats four, in two pairs, on semi-reclining (35°) seats beneath upward opening jettisonable canopy. Options include dual controls, and accommodation for pilot, stretcher and attendant in medevac role. Unpressurised baggage bay aft of cabin, capacity 63 kg (140 lb), with external door in upper surface of fuselage.

SYSTEMS (production aircraft): Air conditioning and pressurisation (maximum differential 0.66 bar; 9.6 lb/sq in) by engine bleed air. Electrical system powered by dual

engine-driven 3 kVA starter/generators. Hydraulic system for brakes only. Anti-icing

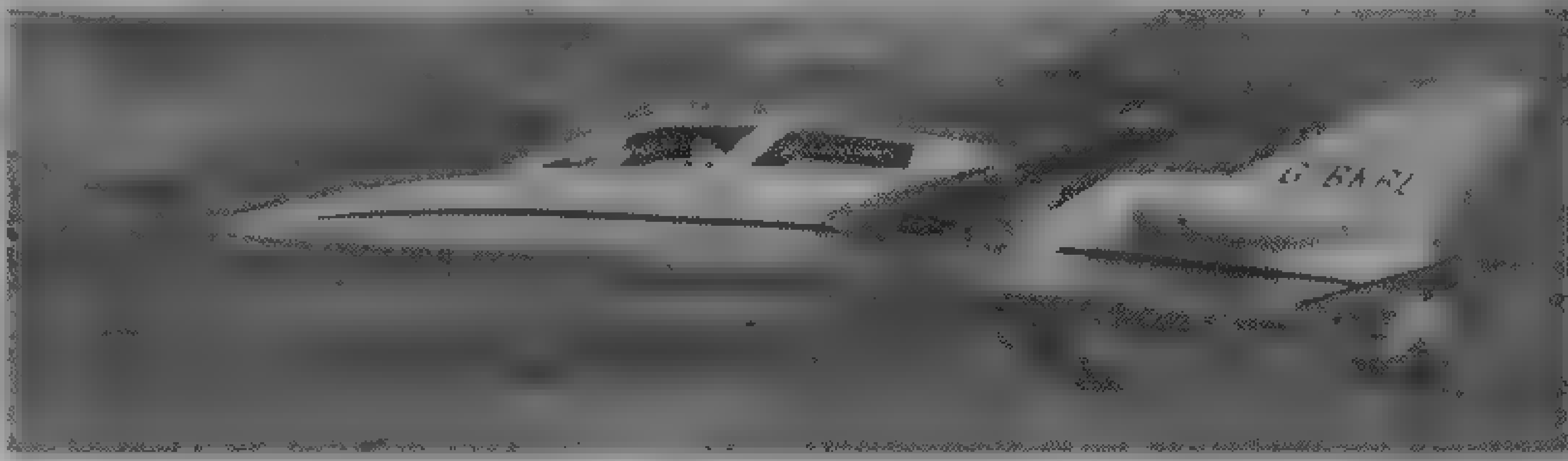
AVIONICS (production aircraft): Bendix/King avionics mounted in nose bay.

Radar: Weather radar.

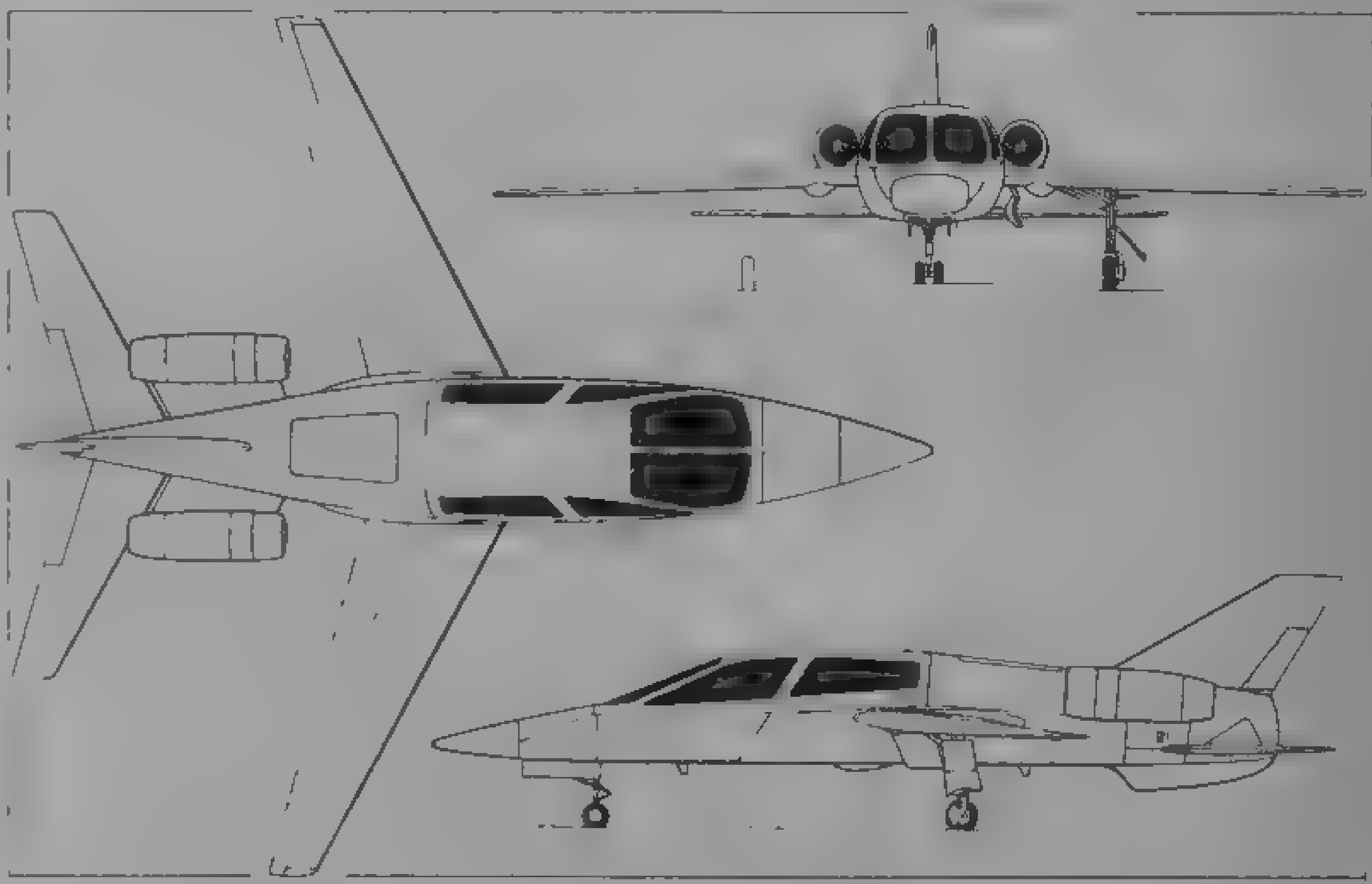
Instrumentation: Two CRTs in pilot's instrument panel. Electromechanical standby flight instruments.

DIMENSIONS, EXTERNAL:	
Wing span	7.16 m (23 ft 6 in)
Wing chord: at root	1.14 m (3 ft 9 in)
at tip	0.36 m (1 ft 2 in)
Wing aspect ratio	8.78
Length overall	7.54 m (24 ft 9 in)
Height overall	2.06 m (6 ft 9 in)
to canopy sill	0.76 m (2 ft 6 in)
Tailplane span	3.91 m (12 ft 10 in)
Wheel track	3.45 m (11 ft 4 in)
Wheelbase	3.20 m (10 ft 6 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	2.74 m (9 ft 0 in)
Max width	1.14 m (3 ft 9 in)
Max height	0.94 m (3 ft 1 in)
Baggage bay volume	0.40 m³ (14 cu ft)
AREAS:	
Wings, gross	5.85 m² (62.9 sq ft)
Trailing-edge flaps (total)	1.24 m² (13.3 sq ft)
Fin	0.86 m² (9.3 sq ft)
Tailplane (incl tabs)	2.14 m² (23.0 sq ft)
WEIGHTS AND LOADINGS (A: first prototype, B: production aircraft, estimated):	
Weight empty, equipped: A	862 kg (1,900 lb)
B	998 kg (2,200 lb)
Max fuel weight: A	367 kg (810 lb)
B	544 kg (1,200 lb)
Max T-O weight: A	1,156 kg (2,550 lb)
B	1,814 kg (4,000 lb)
Max zero-fuel weight: A	1,043 kg (2,300 lb)
B	1,361 kg (3,000 lb)
Max landing weight: A	1,156 kg (2,550 lb)
B	1,701 kg (3,750 lb)
Max wing loading: A	197.7 kg/m² (40.5 lb/sq ft)
B	310.3 kg/m² (63.6 lb/sq ft)
Max power loading: A	433.7 kg/kN (4.25 lb/lb st)
B	240.1 kg/kN (2.35 lb/lb st)
PERFORMANCE (production aircraft, estimated, ISA, max T-O weight):	
Never-exceed speed (VNE)	Mach 0.81 (300 kts, 556 km/h, 345 mph EAS)
Max level speed at 9,450 m (31,000 ft)	469 kts (869 km/h; 540 mph)
Max and econ cruising speed at 13,715 m (45,000 ft)	434 kts (804 km/h; 500 mph)
Stalling speed, full flap, at AUW of 1,497 kg (3,300 lb)	84 kts (156 km/h; 97 mph)
Max rate of climb at S/L	1,960 m (6,430 ft)/min
Rate of climb at S/L, OEI	631 m (2,070 ft)/min
Service ceiling	16,765 m (55,000 ft)
Service ceiling, OEI	9,145 m (30,000 ft)
T-O to 15 m (50 ft)	727 m (2,385 ft)
T-O balanced field length	838 m (2,750 ft)
Landing factored field length	854 m (2,800 ft)
Landing from 15 m (50 ft) at AUW of 1,497 kg (3,300 lb)	778 m (2,550 ft)
Range, max payload, with reserves	1,500 n miles (2,778 km; 1,726 miles)
max fuel and reduced payload	1,915 n miles (3,547 km; 2,204 miles)

UPDATED



First prototype of the CMC Leopard business jet *(B. J. Cunnington/CMC)* 1992



CMC Leopard production version (two Williams International FJX-2 turbofans) *(Jane's/Dennis Punnett)* 1995

EPA

EPA AIRCRAFT COMPANY LTD

Production of the NAC 6 Fieldmaster series is understood not to have taken place. See 1993-94 and earlier *Jane's* for description.

UPDATED

EUROPA

EUROPA AVIATION LTD

Unit 2A, Dove Way, Kirby Mills Industrial Estate, Kirkbymoorside, North Yorkshire YO6 6NR
Telephone: 44 (1751) 431773
Fax: 44 (1751) 431706
CHAIRMAN: Ivan Shaw

Formed to develop Europa light aircraft. Ivan Shaw previously built three Rutan canards before designing Europa for European environment including operating from grass strips. Don Dykins, formerly British Aerospace Chief Aerodynamicist, defined aerodynamics, Barry Meliers (Chief Designer of Slingsby Aviation Ltd) made structural calculations, and has much experience in use of composite materials in light aircraft design.

VERIFIED

EUROPA AVIATION EUROPA

TYPE: Two-seat light cabin monoplane.

PROGRAMME: Design started January 1990; prototype made first flight 12 September 1992 (G-YURO). PFA certification achieved May 1993; produced mainly in kit form under PFA auspices, but two assembled by Europa Aviation in 1994.

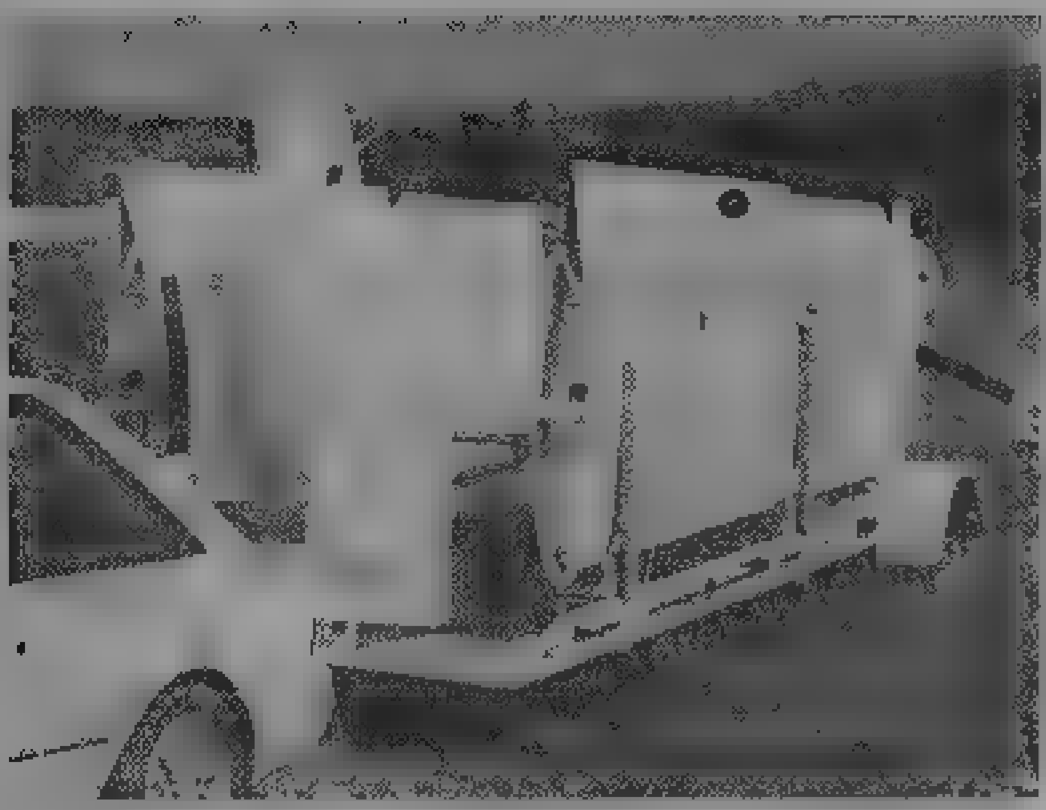
CURRENT VERSIONS: Options of Rotax 912 or 914 Turbo engines.

Company-assembled Europa G-KITS is test aircraft for tricycle landing gear *(Paul Jackson)* 1995

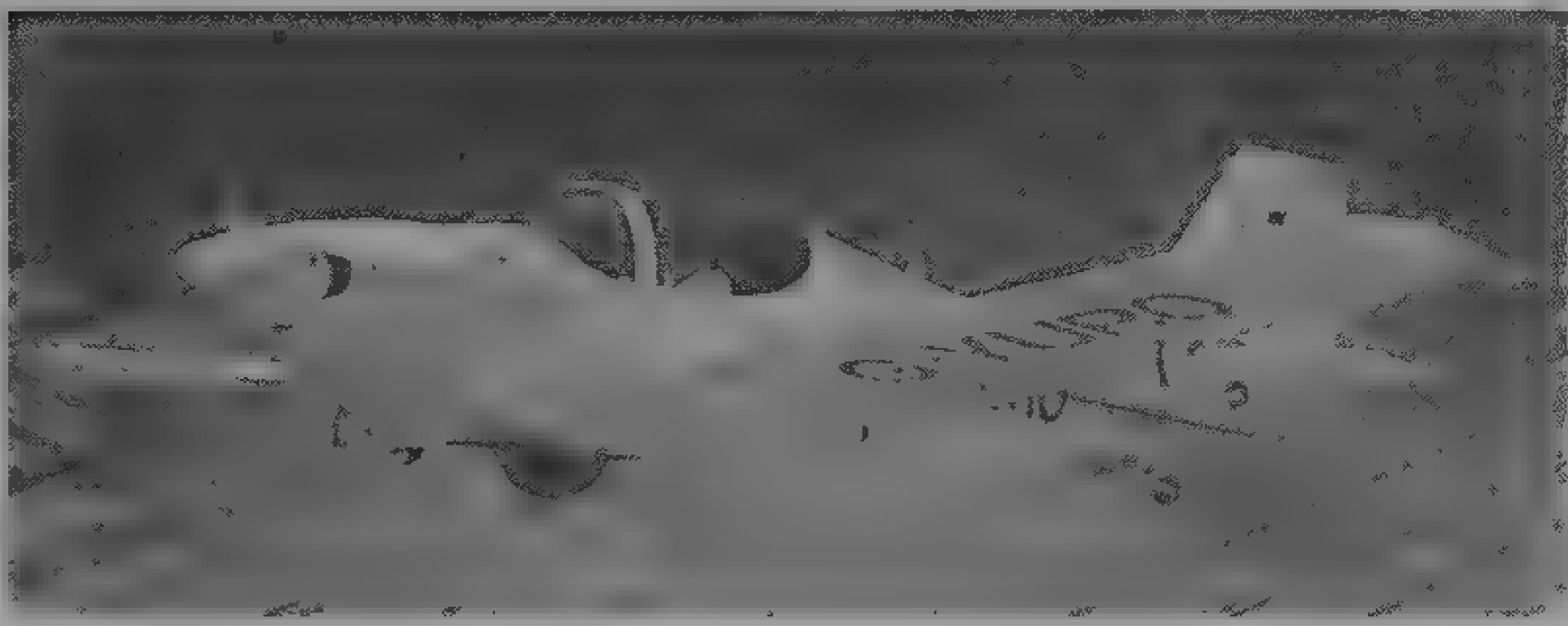
CUSTOMERS: Total of 164 kits sold by March 1995, including 27 added to UK register in 1994.

COSTS: Airframe kit £10,875 + VAT, Rotax 912 kit £7,200 + VAT; total £18,075 + VAT.

DESIGN FEATURES: Objectives included low-cost, economical cruise at IAS up to 120 knots (222 km/h; 138 mph) over 500 n miles (926 km; 575 miles), grass field capability, and ability to rig and de-rig quickly for storage in a trailer.



Europa de-rigged and loaded on its trailer in less than five minutes *1994*



Europa two-seat kitplane *1995*

similar to a shorter version of glider trailer. Rig/de-rig by six pip-pins, two for tail, two for each wing. Kit building time claimed to be 500 man-hours. Designed to JAR-VLA, stressed for maximum in-flight normal g of 4.3; proof factor of 2 used in design instead of the more usual 1.5, because of extensive use of composite materials in primary structure. Aerofoil, laminar flow Dykins design with 12 per cent thickness/chord ratio and 2° washout at tips. Wing dihedral 3°; no tail dihedral.

FLYING CONTROLS: Conventional ailerons and rudder; all-moving tailplane for pitch control with tab geared for balance, under pilot control for trim. Ground-adjustable tabs on ailerons and rudder. Two control columns, one centrally mounted at each seat; two pairs of rudder pedals. Central console between seats has throttle, gear and flap levers. Pitch trim switch next to throttle. Slotted flaps with settings of 0° and 25°.

STRUCTURE: General construction of GFRP with carbonfibre primary structure.

LANDING GEAR: Large single semi-retractable mainwheel and steerable tailwheel; outriggers at about half-span mounted on nylon stalks which retract with flaps. Mainwheel uses standard 6 in hub as in many light aircraft, and an 8.00-6 tundra tyre. Conventional fixed tricycle landing gear under evaluation since 1994.

POWER PLANT: One 59.7 kW (80 hp) Rotax 912 flat-four engine, directly driving a three-blade fixed-pitch propeller; propeller pitch is adjustable on ground to match operating environment (fine pitch for good take-off distances and rate of climb but higher noise and lower cruising speeds; reverse for coarse pitch). Alternative Subaru/NSI EA81 installation under test (G-NDOL) from mid-1995 in 73 kW (98 hp) and 88 kW (118 hp) form. Normal fuel capacity 73 litres (19.2 US gallons; 16 imp gallons).

ACCOMMODATION: Enclosed cabin seating two side by side under individual upward opening canopies, hinged on centreline. Baggage compartment at rear of cabin with maximum 36 kg (80 lb) capacity.

SYSTEMS: Hydraulics: mainwheel brake. Electrical: 12 V 30 Ah battery, alternator fit appropriate to engine.

AVIONICS: Customer choice.

DIMENSIONS, EXTERNAL:

Wing span	7.92 m (26 ft 0 in)
Width, wings removed	1.17 m (3 ft 10 in)
Wing aspect ratio	7.12
Length overall	5.85 m (19 ft 2½ in)
Height overall	1.32 m (4 ft 4 in)
Tailplane span	2.44 m (8 ft 0 in)
Propeller diameter	1.57 m (5 ft 2 in)
Propeller ground clearance	0.36 m (1 ft 2 in)

DIMENSIONS, INTERNAL:

Cabin: Length	1.42 m (4 ft 8 in)
Max width	1.12 m (3 ft 8 in)
Max height	0.97 m (3 ft 2 in)

AREAS:

Wings, gross	8.83 m² (95.0 sq ft)
Ailerons (total)	0.57 m² (6.1 sq ft)
Trailing-edge flaps (total)	1.37 m² (14.7 sq ft)
Fin	1.03 m² (11.1 sq ft)
Rudder	0.48 m² (5.2 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	308 kg (680 lb)
Max T-O and landing weight	590 kg (1,300 lb)
Payload with full fuel	229 kg (505 lb)
Max wing loading	66.8 kg/m² (13.7 lb/sq ft)
Max power loading	9.89 kg/kW (16.2 lb/hp)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (VNE)	160 kts (296 km/h; 184 mph)
Max level speed	135 kts (250 km/h; 155 mph)
Max cruising speed	130 kts (241 km/h; 150 mph)
Econ cruising speed, 75% power at 2,440 m (8,000 ft)	125 kts (232 km/h; 144 mph)
Stalling speed, power off: flaps up	48 kts (89 km/h; 55 mph)
flaps down	42 kts (78 km/h; 48 mph)
Rate of climb at S/L	244 m (800 ft)/min
T-O run	183 m (600 ft)
T-O to 15 m (50 ft)	274 m (900 ft)
Landing run	183 m (600 ft)
Range, normal fuel, 120 kts (222 km/h; 138 mph)	600 n miles (1,111 km; 690 miles)

UPDATED

FLS

FLS AEROSPACE (LIGHT AIRCRAFT) LTD

Bournemouth International Airport, Christchurch, Dorset BH23 6NW
Telephone: 44 (1202) 500200
Fax: 44 (1202) 580567
Telex: 41500, 41530

Wholly owned subsidiary of FLS Aerospace, division of F. L. Smidt Group, specialises in maintenance and overhaul of military and civil aircraft, particularly of BAC One-Eleven, Shorts 360 and Boeing 737. Acquired assets of Brooklands Aerospace Group 27 July 1990, including Optica observation aircraft originally developed by Edgley Aircraft Ltd. Responsibility transferred from Brooklands' Old Sarum factory to Lovaux at Bournemouth for further engineering and operational improvements prior to certification. Acquired SAH-1 from Orca Aircraft in October 1991, and renamed as Sprint.

FLS seeking buyer for Optica and Sprint programmes.

VERIFIED

FLS OPTICA OA7-300

1995

TYPE: Three-seat slow-flying observation and surveillance aircraft.

PROGRAMME: First flight 14 December 1979; production started 1983 but suspended after acquisition by FLS, aircraft redeveloped and prepared for FAA certification, which was awarded December 1991; intended production restart at Bournemouth in 1992 failed to materialise and programme offered for sale since 1994. Early history in 1990-91 *Jane's* under Brooklands Aviation, full description under FLS entry in 1994-95 edition.

UPDATED

FLS SPRINT

1995

TYPE: Two-seat aerobatic primary trainer.

PROGRAMME: Designed by Sydney A. Holloway as Trago Mills SAH-1, initiated October 1977, prototype (G-SAHI) flew 23 August 1983. UK certification obtained 12 December 1985. Orca Aircraft formed August 1988 to take over project but placed under administration in Summer 1989; design and manufacturing rights sold to FLS in October 1991. Production restarted with initial batch of five. FLS first production aircraft G-FLSI first flight 16 December 1993; three completed by March 1995, including first Club Sprint (G-BVNU) in May 1994. Programme then suspended and buyer sought. Full description in 1994-95 *Jane's*.

UPDATED

JETSTREAM

JETSTREAM AIRCRAFT LTD
(Subsidiary of British Aerospace plc)

Prestwick International Airport, Ayrshire KA9 2RW
Telephone: 44 (1292) 672842
Fax: 44 (1292) 671590
Telex: 77432

CHAIRMAN: M. J. (Mike) Turner
MANAGING DIRECTOR: Mike O'Callaghan
MARKETING DIRECTOR: Nick Godwin
SALES DIRECTOR: Jonathan Walton
DIRECTOR, PRODUCT ENGINEERING: William B. Black
DIRECTOR, TECHNICAL ENGINEERING: Gordon McConnell
PRODUCT PROMOTIONS MANAGER: Robert Gillies
PUBLIC AFFAIRS: Peter Black

Jetstream Aircraft Limited is responsible for design, manufacture, marketing, sales and customer support for Jetstream family of twin-turboprop aircraft. Production, marketing and customer support of the ATP was moved to Prestwick (from Woodford) following reorganisation of BAe's commercial aircraft business. Jetstream 61, a development of ATP with more powerful PW127D engines (for improved hot and high performance) and 70 seats at 78 cm (31 in) pitch, was to have been added to the range from third quarter of 1994.

In January 1995, however, Jetstream and Avro (to which refer for fuller details) committed by BAe to join ATR (International section) in single marketing organisation; as consequence, promotion of Jetstream 61 immediately terminated.

UPDATED

JETSTREAM SUPER 31

Final Jetstream 31, G-31-984, first flown 30 November 1993. Total 381 delivered by June 1994 (220 Jetstream 31s, 161 Super 31s); one unsold and two demonstrators, remains available to order. By mid-1995 had flown 3.9 million hours in 5 million sorties. See 1994-95 *Jane's*.

UPDATED

JETSTREAM 41

TYPE: Regional airliner.

PROGRAMME: Development announced 24 May 1989; full-scale cabin mockup displayed at 1989 Paris Air Show. Risk-sharing partners Field Aircraft Ltd of UK (electrical and avionics looms, interior furnishings) and Pilatus

Jetstream 41 twin-turboprop regional airliner in colours of Impulse Transportation

1995

Flugzeugwerke AG of Switzerland (manufacture of tail assemblies and ailerons), Gulfstream Aerospace Technologies of Oklahoma, USA to build 200 wing sets for 1990-2000 delivery, ML Slingsby Group to produce large composite components. Roll-out 27 March 1991, first flight (G-GCJL) 25 September 1991, second aircraft (G-PJRT) flew February 1992, third (G-OXLI) 27 March 1992 and fourth (G-JMAC) 8 July 1992. Total of 1,790 hours flown during four aircraft certification programme. JAA certification awarded 23 November 1992; first deliveries 25 November 1992 to Loganair and Manx Airlines. FAA certification (FAR Pt 25 to Amendment 71) April 1993. First delivery to USA (N301UE) to Atlantic Coast Airlines May 1993. Approval for Cat II operations granted May 1995. Production rate of 42 per year.

In April 1993, Jetstream Aircraft announced payload/range and performance increases for Jetstream 41s delivered from early 1994. In addition, flat rating of engines increases to 1,230 kW (1,650 shp), and flapless take-off capability is introduced.

CURRENT VERSIONS: **Passenger**: Standard version. *Detailed description applies to 1994 version. for weights and performances for 1993 and previously delivered aircraft see 1993-94 Jane's.*

Corporate: Range of seating configurations, from 10-seat VIP to 16-seat executive. First example (c/n 30) delivered to US completion centre May 1994.

QC/Combi: Combi may be offered with 18 airliner or 10 executive shuttle seats, three containers loaded through rear baggage door. Incorporation of large freight door in parallel section of rear fuselage being evaluated, sized to accommodate standard containers. QC seat-rail mounted guide rollers and ball mats for restrained rigid containers stressed to 9 g deceleration.

CUSTOMERS: Total 57 completed and 50 delivered by June 1995 from 109 firm orders and 35 options then placed by nine operators. See table.

JETSTREAM 41 ORDERS
(June 1995)

Customer	Orders	Options
Air Atlantic (Canada)	10	
Atlantic Coast Airlines (USA)	37	
Impulse Transportation (Australia)	10	
Manx Airlines (UK)	13	
SA Airlink (South Africa)	9	
Seoul Air (South Korea)	1	
Sun-Air (Denmark)	2	
Royal Thai Army	2	
Trans-States Airlines (USA)	25	35
Totals	**109**	**35**

DESIGN FEATURES: Adapted from Jetstream Super 31. Fuselage cabin section stretched 4.88 m (16 ft 0 in); large inward-opening rear baggage door to 4.81 m³ (170 cu ft) hold. wing mounted below fuselage for clear cabin aisle, ventral baggage hold 1.35 m³ (45.5 cu ft). Wing span increased, Super 31 wing extended inboard from nacelles; revised ailerons, improved flaps, increased single-point chord, increased fuel capacity in wing, with single-point pressure refuelling. Lift spoilers inboard of nacelles. New nacelles for TPE331-14GR/HR turboprops with contrarotating five-blade McCauley propellers with increased propeller/fuselage clearance, forward-retracting main landing gear with twin wheels, increased chord rudder, increased tailplane area. V windscreen, duplicated control runs, floor-mounted control columns, Honeywell avionics with four-tube EFIS, Smiths engine management system.

FLYING CONTROLS: Manual ailerons, elevators and rudder, split elevator and aileron control with manual disconnect. Each wing has single spar double-slotted flaps, electronic control and single hydraulic actuator on each flap. Floor-mounted control wheel column and inverted pendulum type rudder pedals. Automatic hydraulically operated ground spoilers. Stall warning system with audible stick shaker, stick pusher and visual warning for each pilot.

STRUCTURE: Aluminium alloy construction, fail-safe wing structure of front, main and rear spars, with chordwise ribs, wing skins chemically etched and reinforced with bonded spanwise stringers, semi-monocoque fail-safe fuselage, with chemically milled skin panels.

LANDING GEAR: Dunlop wheels and tyres, twin wheels on each main leg, size 22 × 6.75, tyre pressure 8.27 bars (120 lb/sq in); twin nosewheels, size 17.5 × 6.25, tyre pressure 2.9 bars (42 lb/sq in). Dunlop three-rotor steel brakes, anti-skid standard. Steerable nosewheels (±45°). Minimum ground turning radius, based on nosewheel, 10.35 m (33 ft 11 in).

POWER PLANT: Two 1,230 kW (1,650 shp) AlliedSignal TPE331-14GR/HR flat rated turboprops, handed, each driving a McCauley five-blade constant-speed feathering metal propeller. Usable fuel capacity 3,305 litres (873 US gallons; 727 Imp gallons).

ACCOMMODATION: Flight crew of two, one attendant seated centrally at rear of cabin, and up to 29 passengers seated in 10 double seats on right of cabin and nine singles on left at minimum seat pitch of 76.2 cm (30 in). Externally serviced toilet at rear on port side. Standard light galley at rear on port side. Passenger door with integral airstair at front of cabin on port side. Emergency exit over wing on each side and at rear of cabin on starboard side. Stowage for carry-on baggage in forward cabin on starboard side. Main baggage hold at rear of cabin, with external door, additional stowage in ventral wingroot fairing.

SYSTEMS: Normalair-Garrett air conditioning system with cabin pressurisation at maximum differential of 0.39 bar (5.7 lb/sq in), providing 2,440 m (8,000 ft) cabin altitude at 7,925 m (26,000 ft) or 2,225 m (7,300 ft) at US maximum operating altitude of 7,620 m (25,000 ft). GEC Marconi active noise suppression system selected in June 1995 for later incorporation. Hydraulic system, pressure 138 bars (2,000 lb/sq in), with variable delivery pump on each engine, one pump capable of supplying all services, system operates landing gear, nosewheel steering, flaps, spoilers and wheelbrakes. Emergency system operated by hand pump under flight deck floor for flaps and landing gear. Electrical power by dual channel 28 V DC system, provided by starter/generator on each engine, rated at 550 A continuous, and two 27 Ah batteries, 26 V 400 Hz AC system powered by two 1.25 kVA static inverters for left- and right-hand instrument and navigation systems, either inverter capable of supplying 115 V AC to flight data recorder. Electric de-icing for propellers, pneumatic boot de-icing for wing, tailplane and fin leading-edges. Electric anti-icing for windscreen, pitot/static heads, air flow sensors and elevator horns. Engine intake bleed air anti-icing. Two-bottle fire extinguishing system in nacelles.

AVIONICS: *Comms*: Honeywell Primus II digital radios and dual transponders.

Flight: Dual nav/com with VOR/ILS/markers, ADF, DME, flight director.

Radar: Primus 650 colour weather radar.

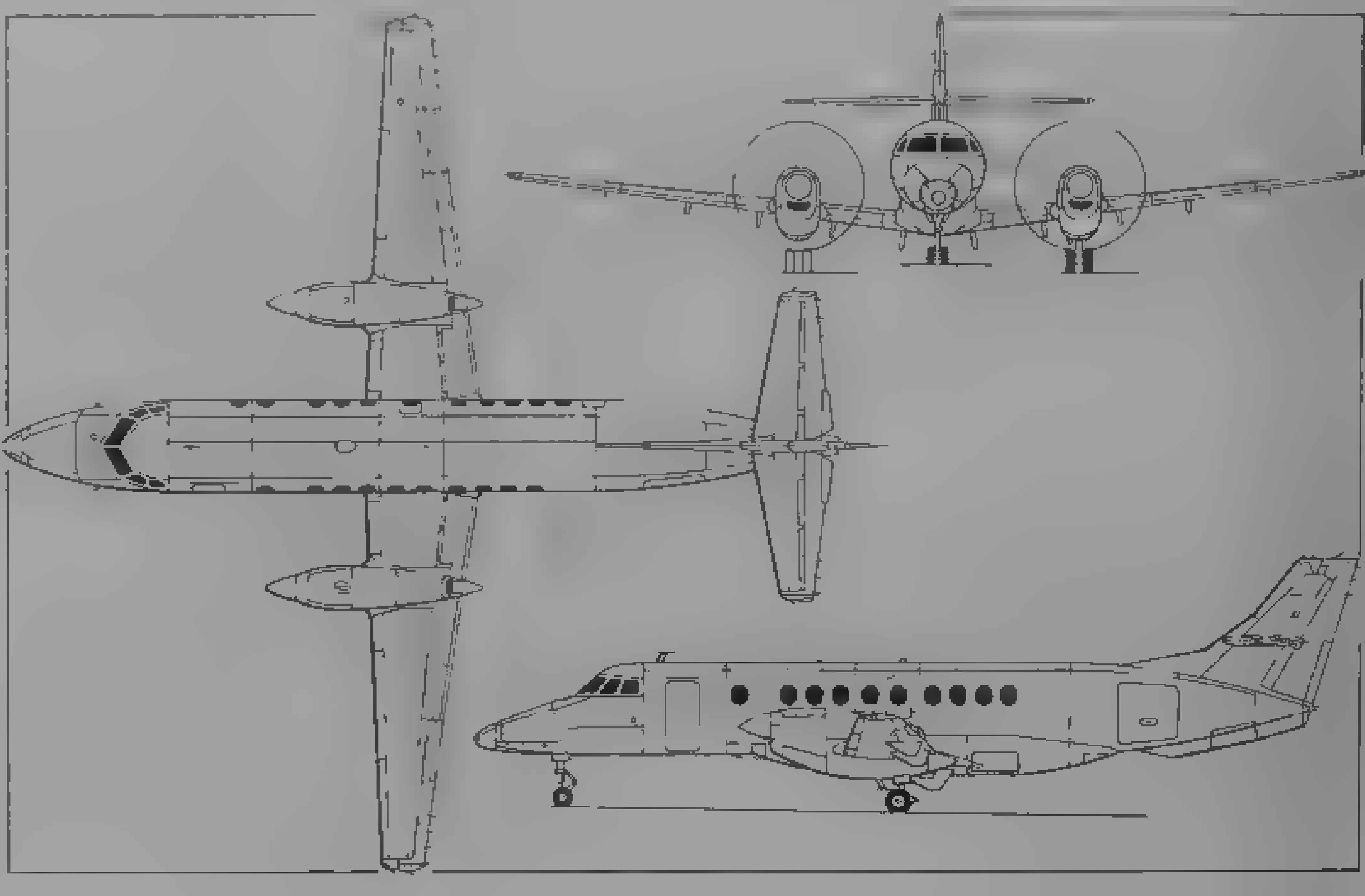
Instrumentation: Honeywell SPZ-4500 digital AFCS including AH-600 AHRS, AZ-810 air data computer and EDZ-805 four-tube EFIS, five-tube optional.

DIMENSIONS, EXTERNAL:

Wing span	18.29 m (60 ft 0 in)
Wing chord: at root	2.70 m (8 ft 10½ in)
at tip	0.89 m (2 ft 11 in)
Wing aspect ratio	10.26
Length overall	19.25 m (63 ft 2 in)
Height overall	5.74 m (18 ft 10 in)
Tailplane span	6.68 m (21 ft 11 in)
Wheel track	6.10 m (20 ft 0 in)
Wheelbase	7.32 m (24 ft 0 in)
Propeller diameter	2.90 m (9 ft 6 in)
Propeller ground clearance	0.43 m (1 ft 5 in)
Passenger door: Height	1.42 m (4 ft 8 in)
Width	0.74 m (2 ft 5 in)
Height to sill	1.24 m (4 ft 1 in)
Baggage door: Height	1.22 m (4 ft 0 in)
Width	1.35 m (4 ft 5 in)
Height to sill	1.68 m (5 ft 6 in)
Emergency exits, overwing: Height	0.99 m (3 ft 3 in)
Width	0.51 m (1 ft 8 in)
Emergency exit, rear: Height	1.22 m (4 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin: Length	9.55 m (31 ft 4 in)
Max width	1.85 m (6 ft 1 in)



The 29-passenger Jetstream 41 regional airliner *(Jane's/Mike Keep)*

1992

Jetstream 41 delivered to Trans States Airlines in USA

1995

Max height 1.78 m (5 ft 10 in)
Volume 29.45 m³ (1,040 cu ft)
Baggage compartment volume:
rear 4.81 m³ (170 cu ft)
ventral wingroot fairing 1.35 m³ (47.5 cu ft)

AREAS:
Wings, gross 32.59 m² (350.8 sq ft)
Ailerons (total) 1.94 m² (20.90 sq ft)
Trailing-edge flaps (total) 5.28 m² (56.80 sq ft)
Spoilers (total) 0.91 m² (9.78 sq ft)
Rudder, incl tab 2.03 m² (21.87 sq ft)
Tailplane 8.58 m² (92.35 sq ft)
Elevators, incl tabs 2.43 m² (26.18 sq ft)

WEIGHTS AND LOADINGS (1994 production onwards):
Weight empty 6,416 kg (14,144 lb)
Max fuel weight 2,703 kg (5,960 lb)
Max T-O weight 10,886 kg (24,000 lb)
Max ramp weight 10,932 kg (24,100 lb)
Max zero-fuel weight 9,707 kg (21,400 lb)
Max landing weight 10,569 kg (23,300 lb)
Max wing loading 334.03 kg/m² (68.42 lb/sq ft)
Max power loading 4.43 kg/kW (7.27 lb/shp)

PERFORMANCE (at max T-O weight, ISA, except where indicated, 1994 production onwards):
Never-exceed speed (VNE):
S/L to 5,300 m (17,400 ft) 315 kts (583 km/h; 362 mph) CAS
above 5,300 m (17,400 ft) Mach 0.65
Max level and max cruising speed at 6,100 m (20,000 ft) 295 kts (547 km/h; 340 mph)
Econ cruising speed at 6,100 m (20,000 ft) 260 kts (482 km/h; 299 mph)
Max rate of climb at S/L 670 m (2,200 ft)/min
Service ceiling 7,925 m (26,000 ft)
Service ceiling, OEI 4,575 m (15,000 ft)
T-O run 1,523 m (4,997 ft)
Landing run 1,280 m (4,200 ft)
Range with 29 passengers, IFR reserves 774 n miles (1,433 km; 891 miles)

UPDATED

JETSTREAM ATP

TYPE: Twin-turboprop regional airliner.

PROGRAMME: ATP (HL5228) handed over to Seoul Air International in late 1994 was 63rd and last of type. Aircraft remodelled as Jetstream 61 (which see). By June 1995, ATPs had flown 375,000 hours and made 492,000 landings.

UPDATED

JETSTREAM 61

TYPE: Twin-turboprop airliner.

PROGRAMME: Announced 26 April 1993, developed from Jetstream ATP with more powerful PW127D engines, increased design weights and new interior.

Prototype, G-JLXI, constructed from 64th ATP airframe, first flown 10 May 1994 at Prestwick, to where programme transferred from Woodford. (Uncompleted 65th ATP to Prestwick, January 1994.) Merger of BAe regional aircraft activities with ATR, announced 26 January 1995, involves abandonment of Jetstream 61 although certification continued (awarded by CAA 15 June 1995) and up to six additional aircraft may be completed from components already well advanced on assembly line.

DESIGN FEATURES: Pratt & Whitney Canada PW127D engines combined with increased design weights to offer payload/range improvements and better hot and high and T-O field length performance; passenger loads in hot and high conditions increased by up to 11 compared to ATP. Revised 70-seat standard layout, new-look spacious interior modelled on Jetstream 41; extra-wide seats (42.5 cm; 17.8 in) and large overhead bins (combined volume 3.54 m³; 125 cu ft) claimed as largest in this class of aircraft. Package of operating cost and maintainability improvements.

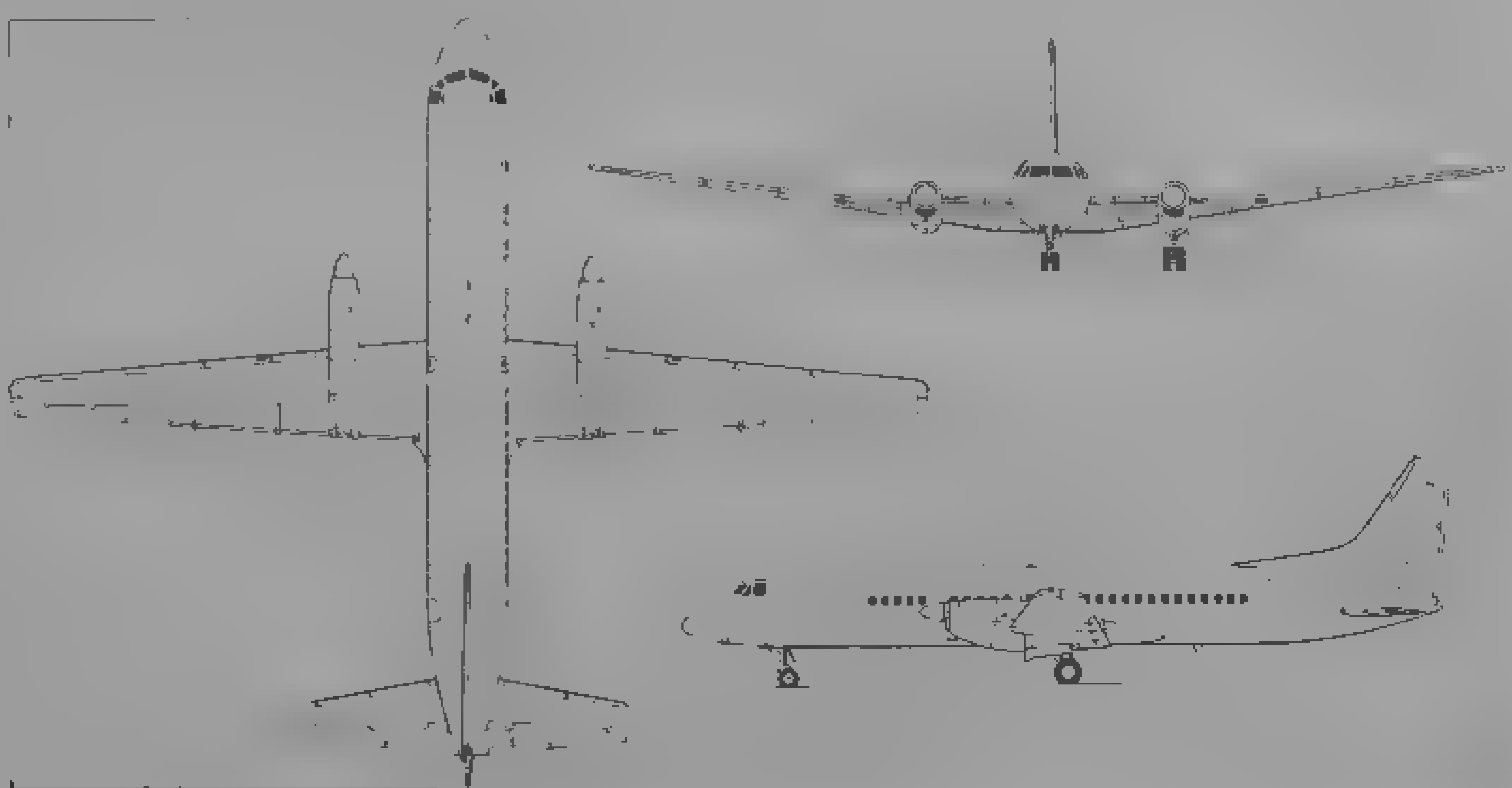
FLYING CONTROLS: Ailerons, elevators and rudder actuated mechanically; geared tab in each aileron, trim tab in each elevator, trim tab and spring tab in rudder. Fowler trailing-edge flaps. Dual AFCS.

STRUCTURE: All-metal. Two-spar fail-safe wings; spars do not intrude into passenger cabin. Circular section fail-safe fuselage. Slightly swept vertical and non-swept horizontal tail surfaces.

LANDING GEAR: Retractable tricycle type, of Dowty design with twin-wheel main units and twin-wheel steerable (±47°) nose unit. All units retract forward, main units into bottom of engine nacelles. Oleo-pneumatic shock absorbers. Mainwheels fitted with 34 × 12-14 tubeless tyres. Nosewheels fitted with 22 × 6.75-10 tubeless tyres. Mainwheels have fusible plugs operating at 199°C. All wheels have 'roll on rim' capability. Dunlop carbon brakes and Maxaret anti-skid units on mainwheels. Inner and outer brakes on each leg supplied from three independent hydraulic systems via engine-driven pump or standby DC pump. Minimum ground turning radius about nosewheel 9.75 m (32 ft 0 in).

POWER PLANT: Two Pratt & Whitney PW127D turboprops, each rated at 2,051 kW (2,750 shp). BAe Hamilton Standard slow-turning propellers, each having six blades of advanced aerodynamic profile and lightweight composite construction in a one-piece steel hub. Fuel in two integral wing tanks, with combined usable capacity of 6,364 litres (1,681 US gallons; 1,400 Imp gallons). Single pressure refuelling point under starboard outer wing.

ACCOMMODATION: Flight crew of two, plus two cabin attendants. Main cabin has standard pressurised accommodation for 70 passengers at a seat pitch of 79 cm (31 in), in four-abreast layout with central aisle. Cabin sidewalls contoured as continuous length armrest. Galley at rear of cabin on starboard side, toilet at rear on port side. Separate passenger doors, at front (with forward-stowing airstairs) and rear of cabin on port side. Compartments for carry-on baggage on starboard side, forward of front row of seats. Two baggage/freight compartments, one forward on starboard



Jetstream 61 twin-turboprop regional airliner *(Jane's/Dennis Punnett)*

1995

Jetstream 61 prototype in promotional livery for 1995 Farnborough Air Show

1995

side and one aft of main cabin, both with external access Overhead bins above passenger seats

SYSTEMS: Hamilton Standard ECS with twin packs offering sub-zero delivery temperature capability Automatic pressurisation system, giving altitude equivalent to 2,440 m (8,000 ft) at 7,620 m (25,000 ft) Pressure differential 0 38 bar (5 5 lb/sq in). Each engine drives an Abex variable delivery hydraulic pump providing hydraulic power at a regulated pressure of 169 bars (2,450 lb/sq in) for landing gear actuation, nosewheel steering, brakes and airstairs Auxiliary hydraulic power is supplied from a separate DC pump and reservoir for emergency operation of the landing gear and brakes The system also provides hydraulic pressure for servicing when the engines are not running. Main system has a flow rate of 41 litres (11 US gallons, 9 Imp gallons)/min controlled to 169 bars (2,450 lb/sq in), emergency system has a flow rate of 2.25 litres (0 6 US gallon, 0.5 Imp gallon)/min controlled to 172 4 bars (2,500 lb/sq in) Air/oil reservoirs pressurised to 1 25 bars (18 lb/sq in)

Electrical power provided by Lucas 200 V 30/45 kVA variable frequency alternator mounted on each engine 28 V DC subsystem from either two TRUs or two 36 Ah Ni/Cd batteries Second subsystem provides 1.5 kVA 200/115 V constant frequency power from two static inverters Optional Garrett GTCP36-150J APU for air conditioning on the ground, and electrical power for battery charging engine starting assist and other tasks. Pneumatic boot de-icing of wings (outboard of engine nacelles), fin and tailplane leading-edges

AVIONICS: Digital avionics system using ARINC 429 data transmission Bendix/King equipment

Comms. Twin VHF radios, transponder, CVR

Radar: RDS-86 colour weather radar, with checklist facility, can display weather on EFIS nav display Built-in test and recording facility

Flight: Twin VHF nav, scanning DME, R/Nav, ADF, FDR, digital GPWS Dual AFCS, each with Litton LTR 81-01 AHRS and Smiths digital DADS, for Cat. II ILS capability

Instrumentation: Smiths SDS 201 four-tube EFIS. Full IFR

DIMENSIONS, EXTERNAL:

Wing span	30.63 m (100 ft 6 in)
Wing aspect ratio	11 98
Length overall	26 00 m (85 ft 4 in)
Height overall	7 59 m (24 ft 11 in)
Wheel track	8 46 m (27 ft 9 in)
Wheelbase	9 70 m (31 ft 9¾ in)
Passenger doors (each): Height	1.73 m (5 ft 8 in)
Width	0.71 m (2 ft 4 in)
Height to sill: fwd door	1 96 m (6 ft 5 in)
rear door	1 71 m (5 ft 7½ in)

AREAS:

Wings, gross	78 32 m² (843 0 sq ft)

WEIGHTS AND LOADINGS:

Max payload	7,452 kg (16,430 lb)
Max T-O weight	23,678 kg (52,200 lb)
Max zero-fuel weight	21,772 kg (48,000 lb)
Max landing weight	23,133 kg (51,000 lb)

PERFORMANCE (estimated, with 70 passengers at 100 kg; 220 lb each IFR reserves):

Max cruising speed	270 kts (500 km/h, 311 mph)
T-O run at MTOW, ISA, S/L	1,329 m (4,360 ft)
Range: max	637 n miles (1,180 km, 733 miles)
sectors, two unrefuelled (each)	275 n miles (509 km, 316 miles)
from 1,220 m (4,000 ft) airfield, ISA + 20°C	200 n miles (370 km, 230 miles)

UPDATED

OTHER AIRCRAFT

BAe began market studies in June 1993 for Jetstream 61 developments designated **Jetstream 51** and **Jetstream 71**, carrying 52 and 72 passengers respectively. These last described in 1994-95 *Jane's* but then overtaken by merger of interests with ATR

NEW ENTRY

NASH

NASH AIRCRAFT LTD (Subsidiary of Kinetrol Ltd)

Trading Estate, Farnham, Surrey GU9 9NU
Telephone: 44 (1252) 733838
Fax: 44 (1252) 713042
Telex: 858567

DIRECTORS:
A R B Nash (Managing)
Roy G Procter
R C Nash

VERIFIED

NASH PETREL

TYPE: Two-seat light aircraft

PROGRAMME: First flight of prototype (G-AXSF) 8 November 1980 with O-320-D2A engine (replaced 1982 by 134 kW, 180 hp Textron Lycoming O-360-A3A), new high tailplane fitted 1983, upswept wingtips 1984 (further details in 1990-91 and earlier *Jane's*). Preproduction batch of five Petrels started in 1986, work towards certification proceeding, spinning trials needed. Second machine to be completed in 1995 Intention is to certificate in the Acrobatic category

DESIGN FEATURES: Optimised for club/touring use, especially ease of handling and for glider towing

FLYING CONTROLS: Manual operation of primary surfaces and NACA slotted flaps.

Prototype of the Nash Petrel two-seat light aircraft

1994

STRUCTURE: See 1990-91 *Jane's* for prototype, preproduction aircraft identical aerodynamically, but differ structurally

UPDATED

PILATUS BRITTEN-NORMAN

PILATUS BRITTEN-NORMAN LTD (Subsidiary of Oerlikon-Buhrle Holding Ltd)

Bembridge, Isle of Wight PO35 5PR
Telephone: 44 (1983) 872511
Fax: 44 (1983) 873246
Telex: 86277/86806

MANAGING DIRECTOR: Anthony Stansfeld
TECHNICAL DIRECTOR: Robert Wilson
HEAD OF MARKETING: Walter Stark
PUBLIC RELATIONS OFFICER: Sheila Dewart

Pilatus Aircraft Ltd of Switzerland acquired Britten-Norman (Bembridge) Ltd 1979, including Isle of Wight facilities and former Fairey SA Islander/Trislander production hardware at Gosselies, Belgium

Previous company history appeared in 1978-79 and earlier *Jane's*.

VERIFIED

PILATUS BRITTEN NORMAN BN2B ISLANDER

TYPE: Twin-engined feederline transport.

PROGRAMME: Prototype (G-ATCT) first flight 13 June 1965 with two 157 kW (210 hp) Rolls-Royce Continental IO-360-B engines and 13 72 m (45 ft) span wings, subsequently re-engined with Textron Lycoming O-540s and flown 17 December 1965, wing span also increased by 1 22 m (4 ft) to initial production standard; production prototype BN2 (G-ATWU) flown 20 August 1966; domestic C of A received 10 August 1967, FAA type certificate 19 December 1967, Romanian manufacture (see Romaero entry) began 1969

CURRENT VERSIONS: **BN2 Islander:** Initial piston-engined production model (see earlier *Jane's*).

BN2A Islander: Piston version built from 1 June 1969 (see 1977-78 *Jane's*).

BN2B Islander: Current standard piston-engined version, higher maximum landing weight; improved interior design; available with two engine choices and optional wingtip fuel tanks as **BN2B-26** with O-540s and **BN2B-20** with IO-540s (BN2B-27 and -21 no longer available). Features include range of passenger seats and

covers, more robust door locks, improved door seals and stainless steel sills, redesigned fresh air system to improve ventilation in hot and humid climates, smaller diameter propellers to decrease cabin noise, and redesigned flight deck and instrument panel. *Detailed description applies to this version.*

Series of modification kits available as standard or option for new production aircraft and can be fitted retrospectively to existing aircraft, extended nose, incorporating 0.62 m³ (22 cu ft) additional baggage space, introduced as option 1972. Jonas Aircraft developed Rajay turbocharging installation, optional for 194 kW (260 hp) engines as bolt-on unit.

BN2B Defender: Described separately (several versions).

BN2T Turbine Islander: Described separately.

BN2T-4R MSSA: Described separately.

BN2T-4S Defender 4000: Described separately.

CUSTOMERS: By January 1995 deliveries of Islanders and Defenders totalled 1,194 (see table). Recent customers include Scilly Skybus (UK), Frivia Luftverkehr (Germany), BA Express (UK), Air Moorea (Tahiti), Nogaraki Airways (Japan) and Falkland Islands Air Service.

COST: BN2B, about £470,000.

DESIGN FEATURES: STOL characteristics; three-blade propellers available on version of BN2B-26 giving quieter noise signature; NACA 23012 wing section, no dihedral, incidence 2°, no sweepback.

FLYING CONTROLS: Slotted ailerons, with starboard ground adjustable tab, operated by pushrods and cables; mass balanced elevator; rudder and elevator actuated by pushrods and cables; trim tabs in rudder and elevator; single-slotted flaps operated electrically; fixed incidence tailplane. Dual controls standard.

STRUCTURE: L72 aluminium-clad aluminium alloys; two-spar wing torsion box in one piece; flared-up wingtips; integral fuel tanks in wingtips optional; four-longeron fuselage of pressed frames and stringers; two-spar tail unit with pressed ribs.

LANDING GEAR: Non-retractable tricycle type, with twin wheels on each main unit and single steerable nosewheel. Cantilever main legs mounted aft of rear spar. All three legs fitted with oleo-pneumatic shock-absorbers. All five wheels and tyres size 16 x 7-7, supplied by Goodyear. Tyre pressure: main 2.41 bars (35 lb/sq in), nose 2.00 bars (29 lb/sq in). Foot operated air-cooled Cleveland hydraulic brakes on main units. Parking brake. Wheel/ski gear available optionally. Minimum ground turning radius 9.45 m (31 ft 0 in).

POWER PLANT: Two Textron Lycoming flat-six engines, each driving a Hartzell HC-C2YK-2B or -2C two-blade constant-speed feathering metal propeller; optional three-blade Hartzell HC-C3YR-2UF/FC8468-8R for O-540-E4C5 engines. Propeller synchronisers optional. Standard power plant 194 kW (260 hp) O-540-E4C5, but 224 kW (300 hp) IO-540-K1B5 fitted at customer's option. Optional Rajay turbocharging installation on 194 kW (260 hp) engines, to improve high-altitude performance. Integral fuel tank between spars in each wing, outboard of engine. Total fuel capacity (standard) 518 litres (137 US gallons; 114 Imp gallons). Usable fuel 492 litres (130 US gallons; 108 Imp gallons). With optional fuel tanks in wingtips, total capacity is increased to 855 litres (226 US gallons; 188 Imp gallons). Additional pylon-mounted underwing auxiliary tanks, each of 227 litres (60 US gallons; 50 Imp gallons) capacity, available optionally. Refuelling point in upper surface of wing above each internal tank. Total oil capacity 22.75 litres (6 US gallons; 5 Imp gallons).

ACCOMMODATION: Up to 10 persons, including pilot, on side by side front seats and four bench seats. No aisle. Seat backs fold forward. Access to all seats via three forward opening doors, forward of wing and at rear of cabin on port side and forward of wing on starboard side. Baggage compartment at rear of cabin, with port side loading door in standard versions. Exit in emergency by removing door windows. Special executive layouts available. Can be operated as freighter, carrying more than a ton of cargo; in this configuration passenger seats can be stored in rear baggage bay. In ambulance role, up to three stretchers and two attendants can be accommodated. Other layouts possible including photographic and geophysical survey, parachutist transport or trainer (with accommodation for up to eight parachutists and dispatcher), firefighting, environmental protection and cropspraying.

SYSTEMS: Southwind cabin heater standard. 45,000 BTU Stewart Warner combustion unit, with circulating fan, provides hot air for distribution at floor level outlets and at windscreen demisting slots. Fresh air, boosted by propeller slipstream, is ducted to each seating position for on-ground ventilation. Electrical DC power, for instruments, lighting and radio, from two engine-driven 24 V 50 A self-rectifying alternators and a controller to main busbar and circuit breaker assembly. Emergency busbar is supplied by a 24 V 17 Ah heavy-duty lead-acid battery in the event of a twin alternator failure. Ground power receptacle provided. Optional electric de-icing of propellers and windscreen and pneumatic de-icing of wing and tail unit leading-edges. Oxygen system available optionally for all versions.

AVIONICS: *Comms:* Intercom, including second headset, and passenger address system are standard.

Flight: Standard items include autopilot and wide range of VHF and HF communications and navigation equipment.

Instrumentation: IFR standard.

DIMENSIONS, EXTERNAL:

Wing span	14.94 m (49 ft 0 in)
Wing chord, constant	2.03 m (6 ft 8 in)
Wing aspect ratio	7.39
Length overall	10.86 m (35 ft 7¾ in)
Fuselage: Max width	1.21 m (3 ft 11½ in)
Max depth	1.46 m (4 ft 9½ in)
Height overall	4.18 m (13 ft 8¾ in)
Tailplane span	4.67 m (15 ft 4 in)
Wheel track (c/l of shock-absorbers)	3.61 m (11 ft 10 in)
Wheelbase	3.99 m (13 ft 1¼ in)
Propeller diameter	1.98 m (6 ft 6 in)
Cabin door (front, port):	
Height	1.10 m (3 ft 7¼ in)
Width: top	0.64 m (2 ft 1¼ in)
Height to sill	0.59 m (1 ft 11¼ in)
Cabin door (front, starboard):	
Height	1.10 m (3 ft 7¼ in)
Max width	0.86 m (2 ft 10 in)
Height to sill	0.57 m (1 ft 10½ in)
Cabin door (rear, port): Height	1.09 m (3 ft 7 in)
Width: top	0.635 m (2 ft 1 in)
bottom	1.19 m (3 ft 11 in)
Height to sill	0.52 m (1 ft 8½ in)
Baggage door (rear, port): Height	0.69 m (2 ft 3 in)

DIMENSIONS, INTERNAL:

Passenger cabin, aft of pilot's seat:	
Length	3.05 m (10 ft 0 in)
Max width	1.09 m (3 ft 7 in)
Max height	1.27 m (4 ft 2 in)
Floor area	2.97 m² (32 sq ft)
Volume	3.68 m³ (130 cu ft)
Baggage space aft of passenger cabin	1.39 m³ (49 cu ft)
Freight capacity:	
aft of pilot's seat, incl rear cabin baggage space	4.70 m³ (166 cu ft)
with four bench seats folded into rear cabin baggage space	3.68 m³ (130 cu ft)

AREAS:

Wings, gross	30.19 m² (325.0 sq ft)
Ailerons (total)	2.38 m² (25.6 sq ft)
Flaps (total)	3.62 m² (39.0 sq ft)
Fin	3.41 m² (36.64 sq ft)
Rudder, incl tab	1.60 m² (17.2 sq ft)
Tailplane	6.78 m² (73.0 sq ft)
Elevator, incl tabs	3.08 m² (33.16 sq ft)

WEIGHTS AND LOADINGS (A: 194 kW; 260 hp engines, B: 224 kW; 300 hp engines):

Weight empty, equipped (without avionics):	
A	1,866 kg (4,114 lb)
B	1,925 kg (4,244 lb)
Max payload: A	929 kg (2,048 lb)
B	870 kg (1,918 lb)
Payload with max fuel: A	692 kg (1,526 lb)
B	633 kg (1,396 lb)
Max fuel weight: standard: A, B	354 kg (780 lb)
with optional tanks in wingtips: A, B	585 kg (1,290 lb)
Max T-O and landing weight: A, B	2,993 kg (6,600 lb)
Max zero-fuel weight (BCAR): A, B	2,855 kg (6,300 lb)
Max wing loading: A, B	99.1 kg/m² (20.3 lb/sq ft)
Max floor loading, without cargo panels: A, B	586 kg/m² (120 lb/sq ft)
Max power loading: A	7.71 kg/kW (12.7 lb/hp)
B	6.68 kg/kW (11.0 lb/hp)

PERFORMANCE (at max T-O weight; A and B as above):

Never-exceed speed (VNE): A, B	183 kts (339 km/h; 211 mph) IAS
Max level speed at S/L:	
A	148 kts (274 km/h; 170 mph)
B	151 kts (280 km/h; 173 mph)
Max cruising speed (75% power) at 2,135 m (7,000 ft):	
A	139 kts (257 km/h; 160 mph)
B	142 kts (264 km/h; 164 mph)
Cruising speed (67% power) at 2,750 m (9,000 ft):	
A	134 kts (248 km/h; 154 mph)
B	137 kts (254 km/h; 158 mph)
Cruising speed (59% power) at 3,660 m (12,000 ft):	
A	130 kts (241 km/h; 150 mph)
B	132 kts (245 km/h; 152 mph)
Stalling speed:	
flaps up: A, B	50 kts (92 km/h; 57 mph) IAS
flaps down: A, B	40 kts (74 km/h; 46 mph) IAS
Max rate of climb at S/L: A	262 m (860 ft)/min
B	344 m (1,130 ft)/min
Rate of climb at S/L, OEI: A	44 m (145 ft)/min
B	60 m (198 ft)/min
Absolute ceiling: A	4,145 m (13,600 ft)
B	6,005 m (19,700 ft)

Pilatus Britten-Norman BN2B-26 Islander operating in rugged country in the South Island of New Zealand

Service ceiling: A 3,445 m (11,300 ft)
B 5,240 m (17,200 ft)
Service ceiling, OEI: A 1,525 m (5,000 ft)
B 1,980 m (6,500 ft)
T-O run at S/L, zero wind, hard runway
A 278 m (913 ft)
B 264 m (866 ft)
T-O run at 1,525 m (5,000 ft): A 396 m (1,299 ft)
B 372 m (1,221 ft)
T-O to 15 m (50 ft) at S/L, zero wind, hard runway
A 371 m (1,218 ft)
B 352 m (1,155 ft)
T-O to 15 m (50 ft) at 1,525 m (5,000 ft),
A 528 m (1,732 ft)
B 496 m (1,628 ft)
Landing from 15 m (50 ft) at S/L, zero wind, hard runway
A, B 299 m (980 ft)
Landing from 15 m (50 ft) at 1,525 m (5,000 ft)
A, B 357 m (1,170 ft)
Landing run at 1,525 m (5,000 ft): A, B 171 m (560 ft)
Landing run at S/L, zero wind, hard runway
A, B 140 m (460 ft)
Range at 75% power at 2,135 m (7,000 ft)
A, standard fuel 622 n miles (1,152 km; 716 miles)
A, with optional tanks
1,023 n miles (1,895 km; 1,177 miles)
B, standard fuel 555 n miles (1,028 km, 639 miles)
B, with optional tanks
920 n miles (1,704 km, 1,059 miles)
Range at 67% power at 2,750 m (9,000 ft)
A, standard fuel 713 n miles (1,320 km, 821 miles)
A, with optional tanks
1,159 n miles (2,146 km, 1,334 miles)
B, standard fuel 577 n miles (1,069 km, 664 miles)
B, with optional tanks
975 n miles (1,806 km, 1,122 miles)
Range at 59% power at 3,660 m (12,000 ft)
A, standard fuel 755 n miles (1,398 km, 869 miles)
A, with optional tanks
1,216 n miles (2,252 km, 1,399 miles)
B, standard fuel 613 n miles (1,135 km, 705 miles)
B, with optional tanks
1,061 n miles (1,965 km, 1,221 miles)

UPDATED

PILATUS BRITTEN-NORMAN BN2T TURBINE ISLANDER

Army Air Corps designation: Islander AL. Mk 1

TYPE: Twin-turboprop development of piston-engined Islander.

PROGRAMME: First flight of prototype (G-BPBN) 2 August 1980 with two Allison 250-B17C turboprops; British CAA certification received end of May 1981; first production aircraft delivered December 1981; FAR Pt 23 US type approval 15 July 1982; full icing clearance to FAR Pt 25 gained 23 July 1984.

CUSTOMERS: Total 62 aircraft delivered by March 1995, mainly of the Defender variant.

DESIGN FEATURES: Turboprops enable use of available low-cost jet fuel, low operating noise level; available for same range of applications as Islander, including military versions (described separately).

Description of BN2B Islander applies also to BN2T, except as follows:

POWER PLANT: Two 298 kW (400 shp) Allison 250-B17C turboprops, flat rated at 238.5 kW (320 shp), and each driving a Hartzell three-blade constant-speed fully feathering metal propeller. Usable fuel 814 litres (215 US gallons; 179 Imp gallons). Pylon-mounted underwing tanks, each of 227 litre (60 US gallon; 50 Imp gallon) capacity, are available optionally for special purposes. Total oil capacity 5.7 litres (1.5 US gallons; 1.25 Imp gallons).

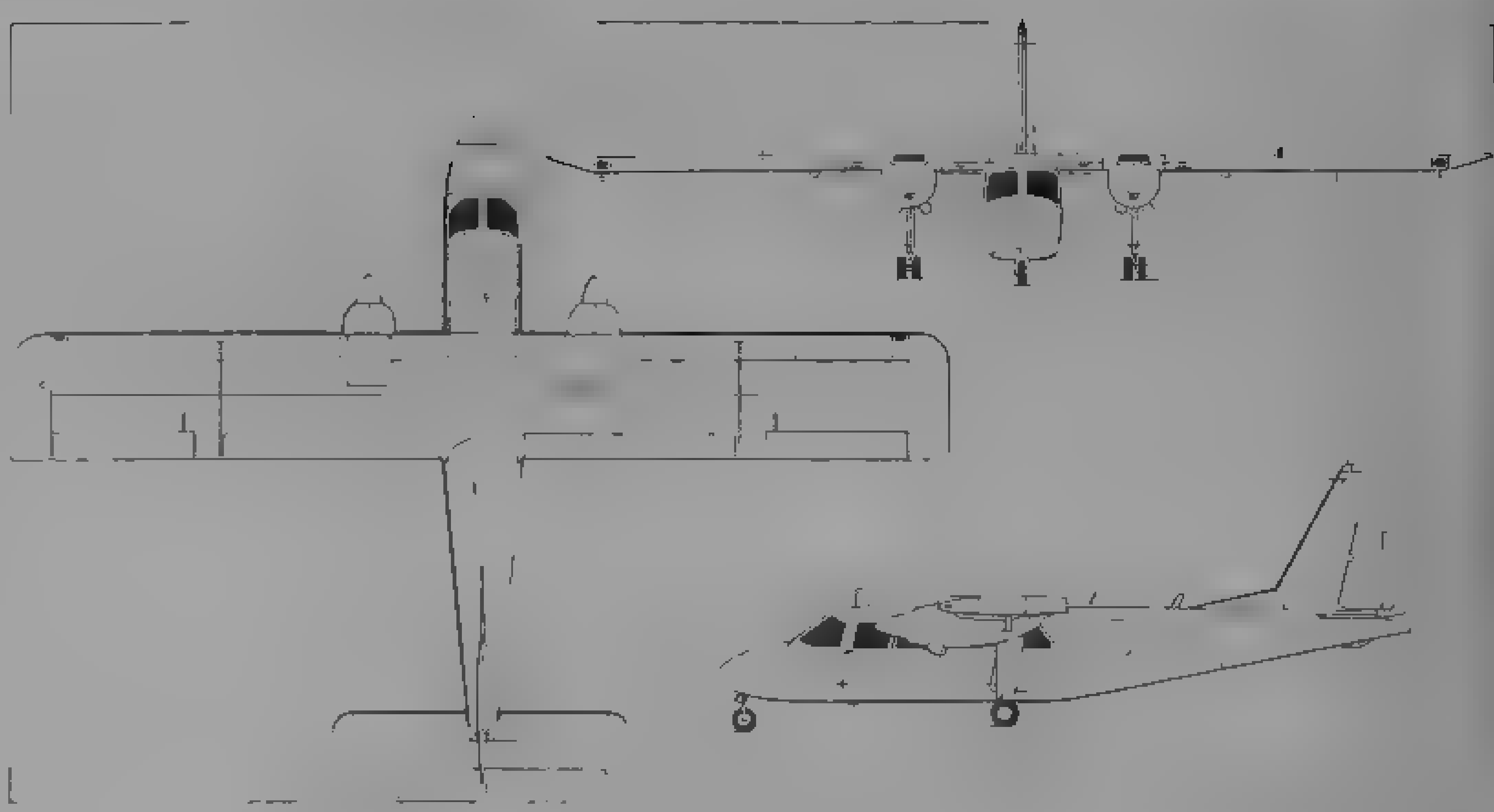
ACCOMMODATION: Generally as for BN2B. In ambulance role can accommodate, in addition to pilot, a single stretcher, one medical attendant and five seated occupants, or two stretchers, one attendant and three passengers, or three stretchers, two attendants and one passenger. Other possible layouts include photographic and geophysical survey, parachutist transport or trainer (with accommodation for up to eight parachutists and a dispatcher), and pest control or other agricultural spraying. Maritime Turbine Islander/Defender versions available for fishery protection, coastguard patrol, pollution survey, search and rescue, and similar applications. In-flight sliding parachute door optional.

AVIONICS: *Comms:* Optional maritime band and VHF transceivers.

Flight: VLF/Omega nav system, radar altimeter.

Self-defence: (Military versions) Army Air Corps Islander AL. Mk 1s have provision for AN/ALQ-144 IR jammer under fuselage.

EQUIPMENT: According to mission, can include fixed tail sting or towed bird magnetometer, spectrometer, or electromagnetic detection/analysis equipment (geophysical survey); one or two cameras, navigation sights and appropriate avionics (photographic survey); 188.7 litre (50 US gallon; 41.5 Imp gallon) Micronair underwing spraypods complete with pump and rotary atomiser (pest control/agricultural spraying versions); dinghies, survival equipment and special crew accommodation (maritime versions).



Pilatus Britten-Norman BN2T Turbine Islander *(Jane's/Dennis Punnett)*

1993

Pilatus Britten-Norman BN2T Islander AL. Mk 1 of British Army fitted with underfuselage AN/ALQ-144 IR jammer *(Paul Jackson)*

1995

DIMENSIONS, EXTERNAL: As for BN2B, except:
Length overall: standard nose 10.86 m (35 ft 7¼ in)
weather radar nose 11.07 m (36 ft 3¾ in)
Propeller diameter 2.03 m (6 ft 8 in)

WEIGHTS AND LOADINGS:
Weight empty, equipped 1,832 kg (4,040 lb)
Payload with max fuel 608 kg (1,340 lb)
Max T-O weight 3,175 kg (7,000 lb)
Max landing weight 3,084 kg (6,800 lb)
Max zero-fuel weight 2,994 kg (6,600 lb)
Max wing loading 105.17 kg/m² (21.54 lb/sq ft)
Max power loading 5.33 kg/kW (8.75 lb/shp)

PERFORMANCE (standard Turbine Islander/Defender, at max T-O weight, ISA, except where indicated):
Max cruising speed
at 3,050 m (10,000 ft) 170 kts (315 km/h, 196 mph)
at S/L 154 kts (285 km/h, 177 mph)
Cruising speed, 72% power
at 3,050 m (10,000 ft) 150 kts (278 km/h, 173 mph)
at 1,525 m (5,000 ft) 143 kts (265 km/h, 165 mph)
Stalling speed, power off:
flaps up 52 kts (97 km/h; 60 mph) IAS
flaps down 45 kts (84 km/h, 52 mph) IAS
Max rate of climb at S/L 320 m (1,050 ft)/min
Rate of climb at S/L, OEI 66 m (215 ft)/min
Service ceiling over 7,620 m (25,000 ft)
Absolute ceiling, OEI over 3,050 m (10,000 ft)
T-O run 255 m (837 ft)
T-O to 15 m (50 ft) 381 m (1,250 ft)
Landing from 15 m (50 ft) 339 m (1,110 ft)
Landing run 231 m (757 ft)
Range (IFR) with max fuel, reserves for 45 min hold plus 10% 590 n miles (1,093 km; 679 miles)
Range (VFR) with max fuel, no reserves
728 n miles (1,348 km, 838 miles)

UPDATED

PILATUS BRITTEN-NORMAN DEFENDER

TYPE: Variants of the civil BN2B and BN2T specially developed for military and paramilitary roles.

CUSTOMERS: For piston (BN2B) version, customers include Indian Navy, Belgian Army, Botswana Defence Forces and Jamaican Defence Force.

For turbine (BN2T) version, customers include Moroccan Ministry of Fisheries, Pakistan Maritime Security Agency, Belgian Gendarmerie, Dutch Police, UK Army Aviation and Mauritius Coastguard.

COSTS: BN2B (Piston) Defender, about £580,000; BN2T (Turbine) Defender, about £1,200,000. Exact cost dependent on fit, particularly sensors.

Pilatus Britten-Norman BN2T Defender of the Pakistan Maritime Security Agency

1995

DESIGN FEATURES: Similar to those of civil Islander, but with four underwing hardpoints for standard NATO pylons to attach fuel tanks, weapons and other stores; number of additional airframe options, including sliding door on rear port side which can be opened in flight are also offered. Concept of Defender is to provide a low-cost airframe which can be fitted with best available sensors to meet operational needs of customers.

UPDATED

PILATUS BRITTEN-NORMAN BN2T-4S DEFENDER 4000

TYPE: Twin-turboprop multirole surveillance and patrol aircraft.

PROGRAMME: Marketing experience with BN2T Defenders revealed that many military and government agencies expressed need for greater payload; announced 1994, prototype (G-SURV) made first flight 17 August 1994, public launch at Farnborough Air Show September 1994.

DESIGN FEATURES: Enlarged wing, based on that of Trislander, plus proportionately enlarged horizontal tail; fuselage stretched to seat up to 16, more powerful engines for greater sortie time and payload capacity, fuselage and landing gear strengthened, flight deck windows deepened for enhanced field of view, redesigned nose and tail unit, rear sliding door with blister window.

POWER PLANT: Two Allison 250-B17F turboprops, each flat rated at 298 kW (400 shp) and driving a three-blade propeller.

ACCOMMODATION: Flight crew of two on airline-type seats; sliding seat rails permit seat and equipment positioning anywhere within fuselage. Space for two or more consoles and operators in tandem along one side of cabin. Up to 16 troops/passengers in tactical transport role.

SYSTEMS: Electrical system includes two 200 A engine-driven generators.

AVIONICS: *Comms:* Full range of open or secure voice com radios from UHF, VHF, HF and VHF-FM.

Radar: Modified nose can accommodate 68.5 cm (27 in), 360° rotating antenna for maritime, simple search or weather radar (GEC-Marconi Seaspray 2000 in prototype Defender 4000).

Flight: Fully integrated autopilot. GPS nav system, integrated with Omega or INS.

Mission: Sensors can include thermal imagers and/or hand-held or podded video or film cameras. Prototype on debut fitted with Agema FLIR under fuselage on starboard side; alternatives could include GMAv pod or FLIR 2000. Appropriate radars could include GMAv Seaspray, Thomson Thorn Super Searcher, Thomson-CSF Ocean Master, Telephonics 143 or Litton 504(V)5.

ARMAMENT: Two hardpoints under each wing, inboard pair stressed for loads of up to 340 kg (750 lb) and outboard pair for up to 159 kg (350 lb) each. Typical weapons on inboard stations can include Sting Ray torpedo or Sea Skua anti-ship missile.

DIMENSIONS, EXTERNAL:
- Wing span: 16.15 m (53 ft 0 in)

AREAS:
- Wings, gross: 35.17 m² (378.6 sq ft)

WEIGHTS AND LOADINGS:
- Max usable internal fuel: 908 kg (2,002 lb)
- Payload with max fuel: 721 kg (1,590 lb)
- Max T-O and landing weight: 3,855 kg (8,500 lb)
- Max zero-fuel weight: 3,765 kg (8,300 lb)
- Max wing loading: 109.6 kg/m² (22.45 lb/sq ft)
- Max power loading: 6.46 kg/kW (10.63 lb/shp)

PERFORMANCE:
- Max cruising speed: 176 kts (326 km/h, 202 mph)
- Transit speed from base to patrol area: 160 kts (296 km/h, 184 mph)
- Econ cruising speed: 150 kts (278 km/h, 173 mph)
- Stalling speed, power off:
  - flaps up: 55 kts (102 km/h, 64 mph) IAS
  - flaps down: 44 kts (82 km/h, 51 mph) IAS
- Max rate of climb at S/L: 369 m (1,210 ft)/min
- Rate of climb at S/L, OEI: 68 m (223 ft)/min
- Absolute ceiling: 7,620 m (25,000 ft)
- Absolute ceiling, OEI: 3,050 m (10,000 ft)
- T-O run: 336 m (1,100 ft)
- T-O to 15 m (50 ft): 458 m (1,500 ft)
- Landing from 15 m (50 ft): 458 m (1,500 ft)
- Landing run: 305 m (1,000 ft)
- Max range on internal fuel:
  - with IFR reserves: 850 n miles (1,574 km, 978 miles)
  - with VFR reserves: 993 n miles (1,839 km, 1,143 miles)
- Max endurance on internal fuel: 8 h 20 min

UPDATED

PILATUS BRITTEN-NORMAN MSSA

TYPE: 'MultiSensor surveillance aircraft'.

PROGRAMME: Developed (as BN2T-4R) with Westinghouse Electric Corporation as low-cost, off-the-shelf system for surveillance, border and fisheries patrol, drug interdiction and special operations/low-intensity conflict applications. Demonstrator (G-MSSA, conversion of AEW Defender G-TEMI) rolled out at Baltimore on 10 September 1991.

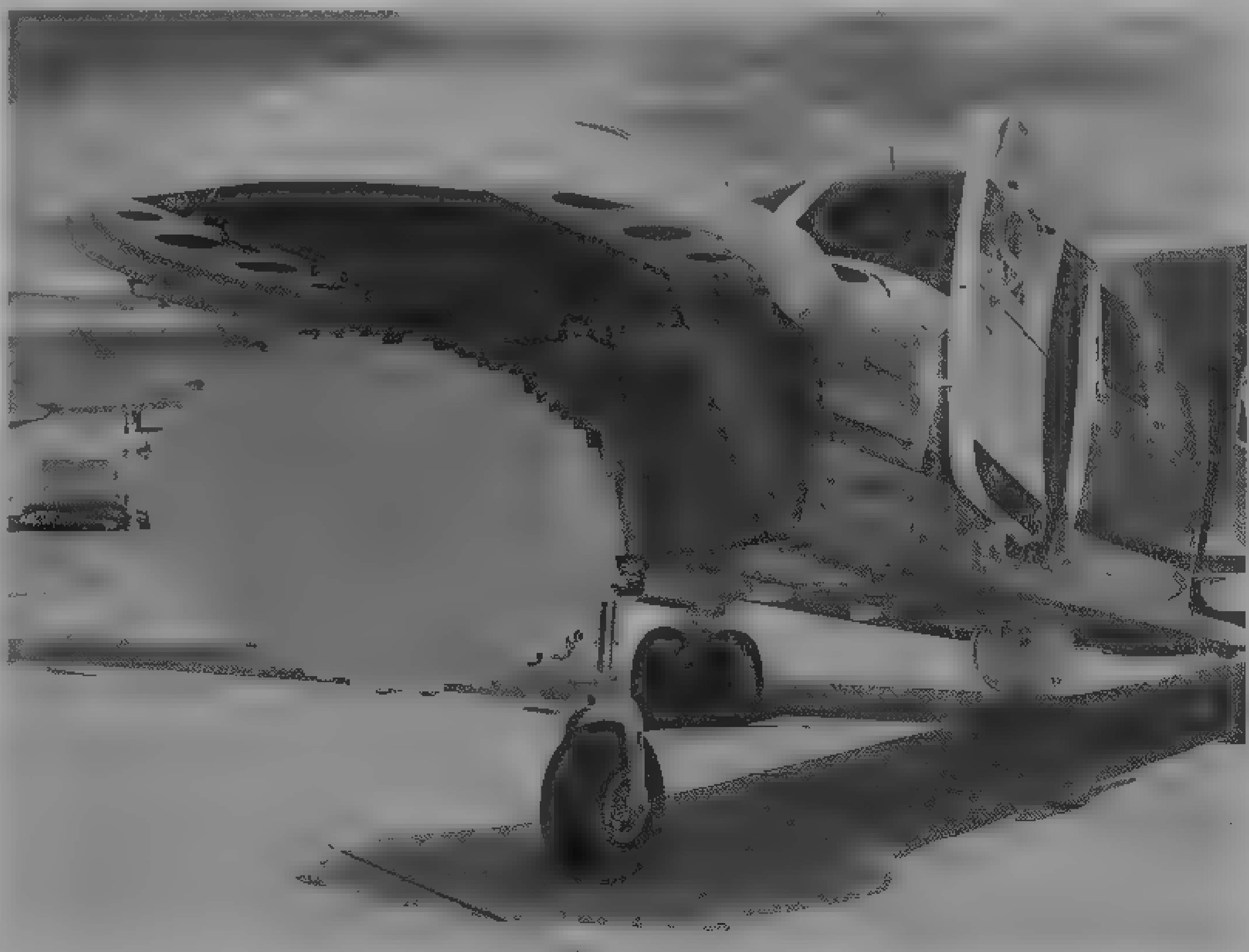
Pilatus Britten-Norman BN2T-4S Defender 4000 prototype G-SURV on flight trials

1995

BN2 DELIVERY SUMMARY

Year	BN2	BN2A	BN2B	BN2T	MSSA	Trislander	Total	Cum Total
1967	7	2					9	9
1968	16	14					30	39
1969		79					79	118
1970		88					88	206
1971		117				4	121	327
1972		34				4	38	365
1973		80				4	84	449
1974		77				10	87	536
1975		85				15	100	636
1976		74				11	85	721
1977		68				6	74	795
1978		43				4	47	842
1979		35	6			8	49	891
1980		32	13			2	47	938
1981		40	11	2		1	54	992
1982		2	11	3		4	20	1,012
1983			11	4		3	18	1,030
1984			9	8		5	22	1,052
1985		3	9	2			14	1,066
1986		4	6	3			13	1,079
1987		8	9	2			19	1,098
1988		2	8	3			13	1,111
1989		2	8	7			17	1,128
1990			10	9			19	1,147
1991			8	7			15	1,162
1992			9	2	1		12	1,174
1993			5	6			11	1,185
1994			5	4			9	1,194
Totals	**23**	**889**	**138**	**62**	**1**	**81**	**1,194**	

Notes. Totals reflect number of new aircraft delivered to customers, and do not take into account second-hand aircraft including one converted as second MSSA.



MSSA nose showing Westinghouse AN/APG-66 radar

1995

DESIGN FEATURES: Based on BN2T Defender

AVIONICS: *Comms*: Dual UHF/VHF radios

Radar: AN/APG-66 radar with 360° rotating antenna.

Flight: LTN-92 RLG INS and GPS

Mission: WF 360 FLIR; real time video datalink, high resolution multifunction displays.

CUSTOMERS: Two aircraft delivered to Westinghouse (January 1995)

BN2 STATUS

	Number delivered	Approx number in service: number	% of delivered
BN2	23	3	13
BN2A	889	645	73
BN2B	138	133	96
BN2T	62	60	97
MSSA	1	1	100
Trislander	81	55	68
Totals	**1,194**	**897**	**75**

Notes: 11 BN-2s converted to BN2As five still extant Light Belg an Army BN2A 21s converted to BN2B-21s One BN2B converted to BN2T (US Army).

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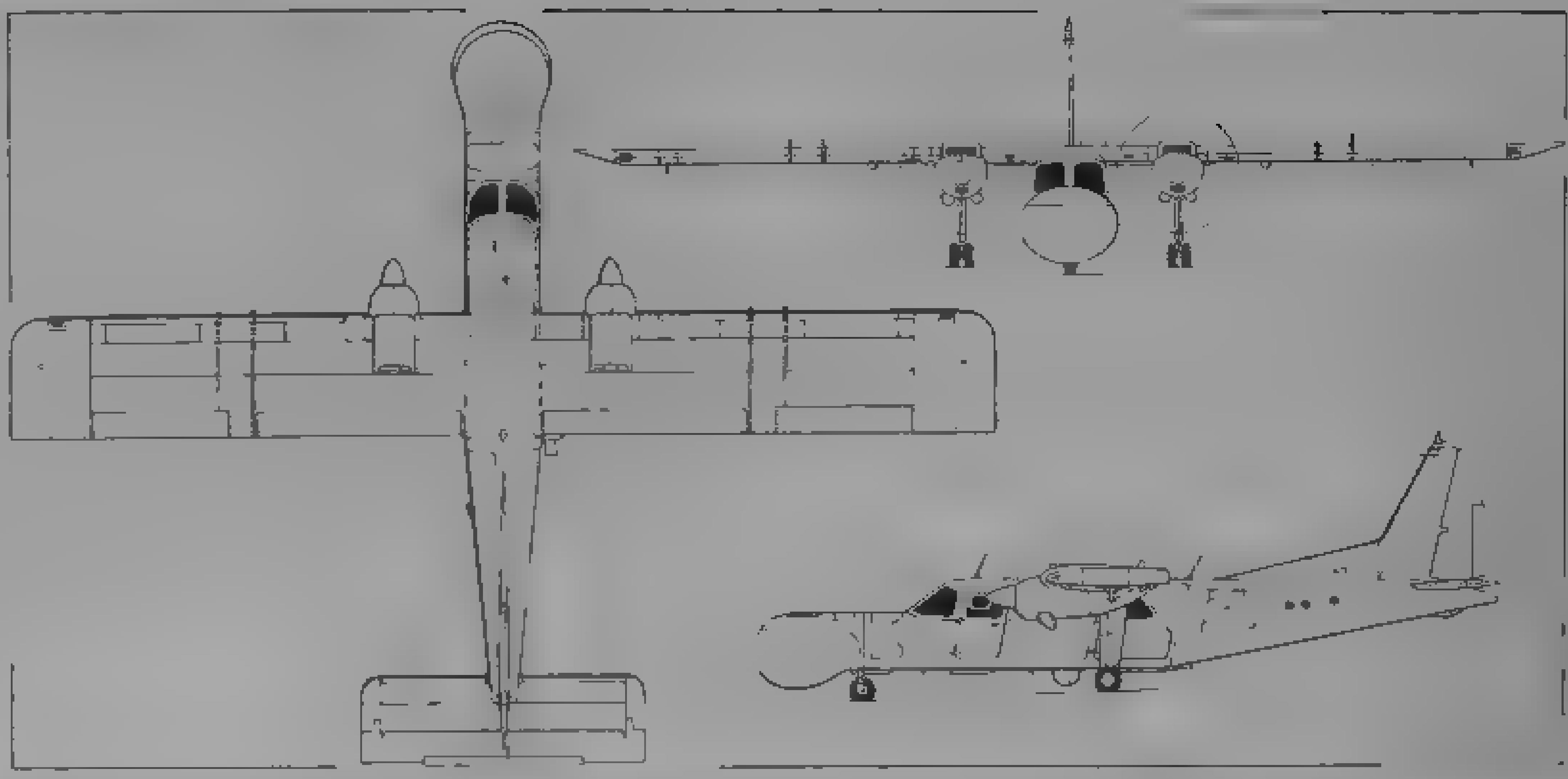


Pilatus Britten-Norman MSSA with Westinghouse Electric nose-mounted radar *(Jane's/Dennis Punnett)*
1987

Pilatus Britten-Norman MultiSensor Surveillance Aircraft (MSSA)
1995

RAYTHEON

RAYTHEON AIRCRAFT COMPANY

HQ, N. AMERICAN MARKETING, CUSTOMER SUPPORT, COMPLETION OF CORPORATE HAWKER 800s, MAINTENANCE

2400 David Grundfest Drive, Adams Field, Little Rock Arkansas 72206 USA

Telephone: 1 (501) 372 1501

Fax: 1 (501) 371 0403

DESIGN, ENGINEERING, INTERNATIONAL MARKETING AND CUSTOMER SUPPORT

3 Bishop Square, St Albans Road West, Hatfield, Hertfordshire AL10 9NE, UK

Telephone: 44 (1707) 251125

Fax: 44 (1707) 253807

PRODUCTION, COMPLETION OF MAIN VARIANTS, MAINTENANCE

Hawarden Airport, Broughton, North Wales CH4 0BA, UK

Telephone: 44 (1244) 520444

Fax: 44 (1244) 523004

PRESIDENT AND CEO: Roy H Norris III

CHAIRMAN: Arthur E. Wegner

SENIOR VICE PRESIDENT SALES: Raynor Reavis

VICE PRESIDENT OPERATIONS (USA): John Dicker

MANAGING DIRECTOR UK OPERATIONS: Tom Nicholson

VICE-PRESIDENT MARKETING: David A Pishko

COMMUNICATIONS USA: Pat Zerbe

Telephone: 1 (316) 676 7603

Fax: 1 (316) 676 8867

COMMUNICATIONS UK: Mike Brown

Telephone: 44 (1707) 253806

Fax: 44 (1707) 253807

VICE-PRESIDENT PRODUCT SUPPORT: A John Diebold

VICE-PRESIDENT ENGINEERING: C. A. Parlier

Raytheon company purchased BAe Corporate Jets on 6 August 1993 for $372 million, adding the Hawker 800 and 1000 types to the company's aircraft products offered by what was then its Beech aircraft unit. The Hawker variants were developed from the BAe 125 series, of which a total of 859 of all versions had been sold to 44 countries by early 1994. Production of the Hawker 800 and 1000 currently in UK, but intention announced 1994 to transfer production to new 17,190 m² (185,000 sq ft) assembly shop at Wichita, USA, beginning November 1995, for completion by 1997. Name changed January 1995 from Raytheon Corporate Jets Inc to Raytheon Aircraft. Raytheon Aircraft (which see in US section) includes the former Beech Aircraft Corporation, and is a subsidiary of the Raytheon Company which has its HQ at Lexington, Massachusetts.

UPDATED

RAYTHEON HAWKER 800

TYPE: Twin-turbofan business transport

PROGRAMME: First flight of prototype (G-BKTF) 26 May 1983 (maximum operating altitude achieved during the 3 hours 8 minute flight), type certificate gained 4 May 1984 and Public Transport Category C of A on 30 May 1984, FAA certification 7 June 1984, Russian certification May 1993.

CURRENT VERSIONS: **800**: Standard business transport; *detailed description applies to this version*.

800XP: Announced March 1995, when prototype G-BVYW completed, available from Autumn 1995. 'Extended Performance' version with 20.00 kN (4,496 lb st) AlliedSignal TFE731-5BR engines, giving enhanced performance, including 14 knot (26 km/h; 16 mph) increase in cruising speed at 11,800 kg (26,015 lb) at 10,790 m (39,000 ft), 225 kg (496 lb) payload increase with eight passengers; and 15 to 23 per cent reduction in time to cruising altitude.

800FI, MP, RA and SIG: Special missions versions, described separately.

CUSTOMERS: By January 1995, over 250 Series 800s sold and 273 built. Further 21 to be produced in 1995.

COSTS: $9.9 million (1995) for standard 800 and 800XP.

DESIGN FEATURES: Improvements compared with earlier 700 variant include curved windscreen, sequenced nosewheel doors, extended fin leading-edge, larger ventral fuel tank and increased wing span which reduces induced drag, improves aerodynamic efficiency and carries extra fuel; outboard 3.05 m (10 ft) of each wing redesigned. TFE731-5R-1H turbofans improve airfield/climb performance and increase maximum speed and range; redesigned interior, with increased headroom by relocating oxygen dropout units to sidewall panels, and 12.2 cm (4.8 in) extra width at shoulder level by sculpturing sidewall panels around fuselage frames; flight deck incorporates five-tube Collins EFIS-86, with centrally mounted multifunction display showing flight plans and checklists.

Wing thickness/chord ratio 14 per cent at root, 8.35 per cent at tip; dihedral 2°, incidence 2° 5′ 42″ at root, −3° 5′ 49″ at tip; sweepback 20° at quarter-chord; small fairings on tailplane undersurface eliminate turbulence around elevator hinge cutouts.

FLYING CONTROLS: Manually operated ailerons, elevators and rudder, each with geared tab; port aileron tab trimmed manually via screwjack. Hydraulically actuated four-position double-slotted flaps, mechanically operated hydraulic cutout prevents asymmetric flap operation; upper and lower airbrakes, with interconnected controls to prevent asymmetric operation, form part of flap shrouds and provide lift dumping for landing. Fixed incidence tailplane.

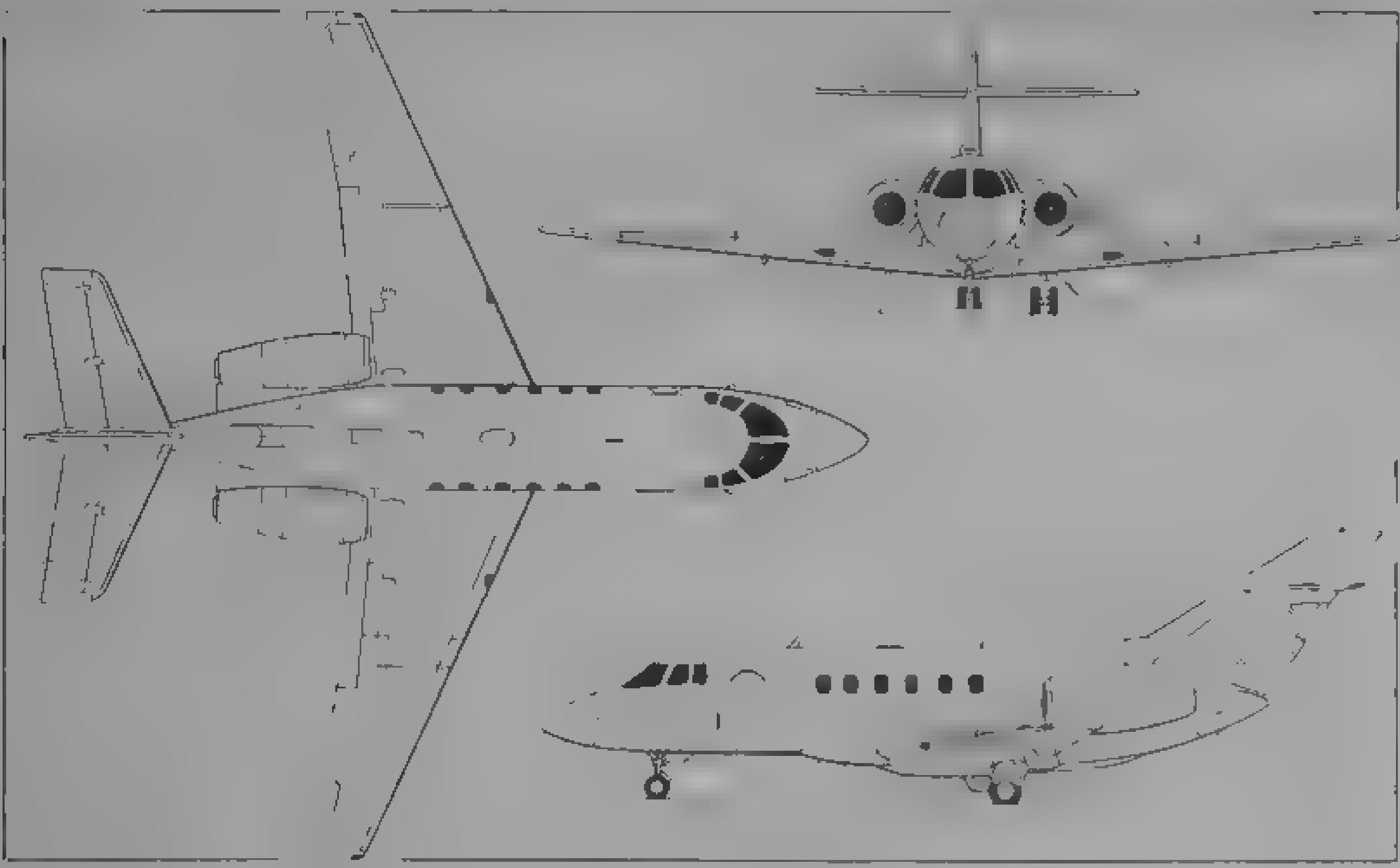
STRUCTURE: All-metal. One-piece wings, dished to pass under fuselage and attached by four vertical links, side link and drag spigot; two-spar fail-safe wings, with partial centre spar of approximately two-thirds span, to form integral fuel tankage; single-piece skins on each upper and lower wing semi-spans; detachable leading-edges; fail-safe fuselage structure of mainly circular cross-section, incorporating Redux bonding.

LANDING GEAR: Retractable tricycle type, with twin wheels on each unit. Hydraulic retraction, nosewheels forward, mainwheels inward into wings. Oleo-pneumatic shock-absorbers. Fully castoring nose unit, steerable ±45°. Dunlop mainwheels and 12 ply tubeless tyres, size 23 × 7-12. Dunlop nosewheels and 6 ply tubeless tyres, size 18 × 4.25-10. Dunlop triple-disc hydraulic brakes with Maxaret anti-skid units on all mainwheels. Minimum ground turning radius about nosewheel 9.14 m (30 ft 0 in).

POWER PLANT: Two 19.13 kN (4,300 lb st) AlliedSignal TFE731-5R-1H turbofans, mounted on sides of rear fuselage in pods designed and manufactured by Northrop Grumman. Thrust reversers developed by Dee Howard fitted as standard. Integral fuel tanks in wings, with combined capacity of 4,820 litres (1,273 US gallons; 1,060 Imp

Raytheon Hawker 800 *(Ian Strachan)*

1995



Raytheon Hawker 800 (two AlliedSignal TFE731-5R-1H turbofans) *(Jane's/Dennis Punnett)*

1993

gallons). Rear underfuselage tank of 854 litres (226 US gallons, 188 Imp gallons) capacity, giving total capacity of 5,674 litres (1,499 US gallons; 1,248 Imp gallons). Single pressure refuelling point at rear of ventral tank. Overwing refuelling point near each wingtip.

ACCOMMODATION: Flight deck crew of two. Dual controls standard. Seat for third crew member. Executive layout has forward baggage compartment, forward galley comprising heated Prepco units, and miscellaneous storage. Seats swivel through 360°. Seating for eight passengers, with club four seating at the front of the cabin, three-place settee on the right side rear cabin and single seat opposite. Airliner style toilet at rear with external servicing as standard. Maximum seating for 14. Interior options include different seating layouts, microwave oven, entertainment system including CD player and video LCD screen.

SYSTEMS: AiResearch air conditioning and pressurisation system. Maximum cabin differential 0.59 bar (8.55 lb/sq in). Oxygen system standard, with dropout masks for passengers. Hydraulic system, pressure 186 to 207 bars (2,700 to 3,000 lb/sq in), for operation of landing gear, mainwheel doors, flaps, spoilers, nosewheel steering, mainwheel brakes and anti-skid units. Two accumulators, pressurised by engine bleed air, one for main system pressure, other providing emergency hydraulic power for wheel brakes in case of main system failure. Independent auxiliary system for lowering landing gear and flaps in event of main system failure. DC electrical system utilises two 30 V 12 kW engine-driven starter/generators and two 24 V 23 Ah Ni/Cd batteries. A 24 V 4 Ah battery provides separate power for standby instruments. AC electrical system includes two 1.25 kVA static inverters, providing 115 V 400 Hz single-phase supplies, one 250 VA standby static inverter for avionics, and two engine-driven 208 V 7.4 kVA frequency-wild alternators for windscreen anti-icing. Ground power receptacle on starboard side at rear of fuselage for 28 V external DC supply. Turbomach T-62T-40C8D-1 APU. TKS liquid system de-icing/anti-icing on leading-edges of wings and tailplane. Engine ice protection system supplied by engine bleed air. Graviner triple FD Firewire fire warning system and two BCF engine fire extinguishers. Stall warning and stick pusher system fitted.

AVIONICS: Standard Honeywell SPZ 800; Collins fit as option.

Comms: Dual RCZ-850 integrated communication system, Motorola N1335B Selcal. Fairchild A110A CVR.

Radar: Primus 870 weather radar.

Flight: Dual DFZ-800 AFCS, dual Omega.

Instrumentation: Dual EDZ-818 EFIS, dual ADZ-810 air data system, dual AHZ-600 AHRS, AA-300 radio altimeter; Safeflight AoA system.

DIMENSIONS, EXTERNAL:

Wing span	15.66 m (51 ft 4½ in)
Wing chord (mean)	2.29 m (7 ft 6 in)
Wing aspect ratio	7.06
Length overall	15.60 m (51 ft 2 in)
Height overall	5.36 m (17 ft 7 in)
Fuselage: Max diameter	1.93 m (6 ft 4 in)
Tailplane span	6.10 m (20 ft 0 in)
Wheel track (c/l of shock absorbers)	2.79 m (9 ft 2 in)
Wheelbase	6.41 m (21 ft 0½ in)
Passenger door (fwd, port): Height	1.30 m (4 ft 3 in)
Width	0.69 m (2 ft 3 in)
Height to sill	1.07 m (3 ft 6 in)
Emergency exit (overwing, stbd):	
Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin (excl flight deck): Length	6.50 m (21 ft 4 in)
Max width	1.83 m (6 ft 0 in)
Max height	1.75 m (5 ft 9 in)
Floor area	5.11 m² (55.0 sq ft)
Volume	17.10 m³ (604.0 cu ft)
Baggage compartments:	
forward	0.74 m³ (26.0 cu ft)
rear	0.74 m³ (26.0 cu ft)
pannier (optional)	0.79 m³ (28.0 cu ft)

AREAS:

Wings, gross	34.75 m² (374.0 sq ft)
Ailerons (total)	2.05 m² (22.1 sq ft)
Airbrakes: upper (total)	0.74 m² (8.0 sq ft)
lower (total)	0.46 m² (5.0 sq ft)
Trailing-edge flaps (total)	4.83 m² (52.0 sq ft)
Fin (excl dorsal fin)	6.43 m² (69.2 sq ft)
Rudder	1.32 m² (14.2 sq ft)
Horizontal tail surfaces (total)	9.29 m² (100.0 sq ft)

WEIGHTS AND LOADINGS:

Basic weight empty	7,076 kg (15,600 lb)
Typical operating weight empty	7,257 kg (16,000 lb)
Max payload	907 kg (2,000 lb)
Max ramp weight	12,483 kg (27,520 lb)
Max T-O weight	12,428 kg (27,400 lb)
Max zero-fuel weight	8,165 kg (18,000 lb)
Max landing weight	10,591 kg (23,350 lb)
Max wing loading	357.69 kg/m² (73.26 lb/sq ft)
Max power loading	325.1 kg/kN (3.19 lb/lb st)

PERFORMANCE (at ISA, max T-O weight):

Max limiting Mach number	0.87
Max level speed and max cruising speed at 8,840 m (29,000 ft)	456 kts (845 km/h; 525 mph)
Econ cruising speed at 11,900-13,100 m (39,000-43,000 ft)	400 kts (741 km/h; 461 mph)
Stalling speed in landing configuration at typical landing weight	92 kts (170 km/h; 106 mph)
Max rate of climb at S/L	945 m (3,100 ft)/min
Time to 10,670 m (35,000 ft)	19 min
Service ceiling	13,100 m (43,000 ft)
T-O balanced field length at max T-O weight	1,713 m (5,620 ft)
Landing from 15 m (50 ft) at typical landing weight (six passengers and baggage)	1,372 m (4,500 ft)
Range:	
with max payload	2,580 n miles (4,778 km; 2,969 miles)
with max fuel, NBAA VFR reserves	2,825 n miles (5,232 km; 3,251 miles)

UPDATED

RAYTHEON HAWKER 800FI

US Air Force designation: C-29A

JASDF designation: U-125

TYPE: Twin-turbofan flight inspection aircraft.

CURRENT VERSIONS: **C-29A:** Development of Hawker 800 for US Air Force, fitted with fully automatic flight inspection system (FIS). First of six C-29As for USAF delivered on 24 April 1990, equipped with LTV (Sierra Technologies Inc) inspection system for combat flight inspection and navigation (C-FIN) mission, replacing CT-39A and C-140A calibration fleet with 1866th FCS at Scott AFB, Illinois. In September 1991 control of the six C-29As transferred to FAA Headquarters in Oklahoma City. They are currently deployed on a worldwide basis in support of FAA flight inspection operations.

U-125: Selected by Japan Air Self-Defence Force (JASDF) for its FC-X flight inspection requirement. First of three U-125s handed over 18 December 1992; delivery of second U-125 to JASDF took place 16 December 1993, third delivered 22 September 1994. See also KAC under Japan.

DESIGN FEATURES: Version of Hawker 800 with Collins EFIS-86 B2 avionics suite, and integrated inertial/GPS system for precision navigation in addition to dual VOR/DME/ADF. Maximum ramp weight up from 12,483 kg (27,520 lb) of standard Hawker 800 to 12,746 kg (28,100 lb); maximum take-off weight up from 12,428 kg (27,400 lb) to 12,701 kg (28,000 lb).

UPDATED

RAYTHEON HAWKER 800MP

JASDF designation: U-125A

TYPE: Twin-turbofan search and rescue maritime patrol aircraft.

CURRENT VERSIONS: **U-125A:** Selected by JASDF for its H-X search and rescue requirement (see KAC entry under Japan for photograph). JASDF requirement is for total of 27 aircraft for delivery beginning early 1995 through to 2004. First three ordered in FY92, one each in FY93 and 94, two in FY95. First aircraft (52-3001) flew 19 July 1994, 350 hours of development flying in UK, first delivery (52-3003) 11 December 1994 to Japan for completion by KAC; handover to JASDF March 1995.

DESIGN FEATURES: Hawker 800 fitted with two large observation windows in cabin, a 360° scan surveillance radar and retractable, steerable FLIR sensor. Capable of dropping marker flares and liferafts. Rear ventral fuselage fuel tank replaced by avionics pannier. Maximum zero-fuel weight increased from 8,165 kg (18,000 lb) of Hawker 800FI to 8,369 kg (18,450 lb).

UPDATED

RAYTHEON HAWKER 800RA and 800SIG

TYPE: Surveillance and sigint versions, currently under development.

CURRENT VERSIONS: **800RA:** Surveillance version of Hawker 800, to be equipped with synthetic aperture radar, defensive aids subsystem and military communications equipment, capable of high altitude (up to 13,100 m; 43,000 ft) and long endurance (6.5 h). Maximum take-off weight 12,701 kg (28,000 lb), maximum zero-fuel weight 8,369 kg (18,450 lb).

800SIG: Signals intelligence version to collect communications intelligence and electronic intelligence for airborne analysis or datalink to ground station for near real-time assessment or, with recording systems for onboard storage, for post-flight analysis, estimated performance as 800RA.

UPDATED

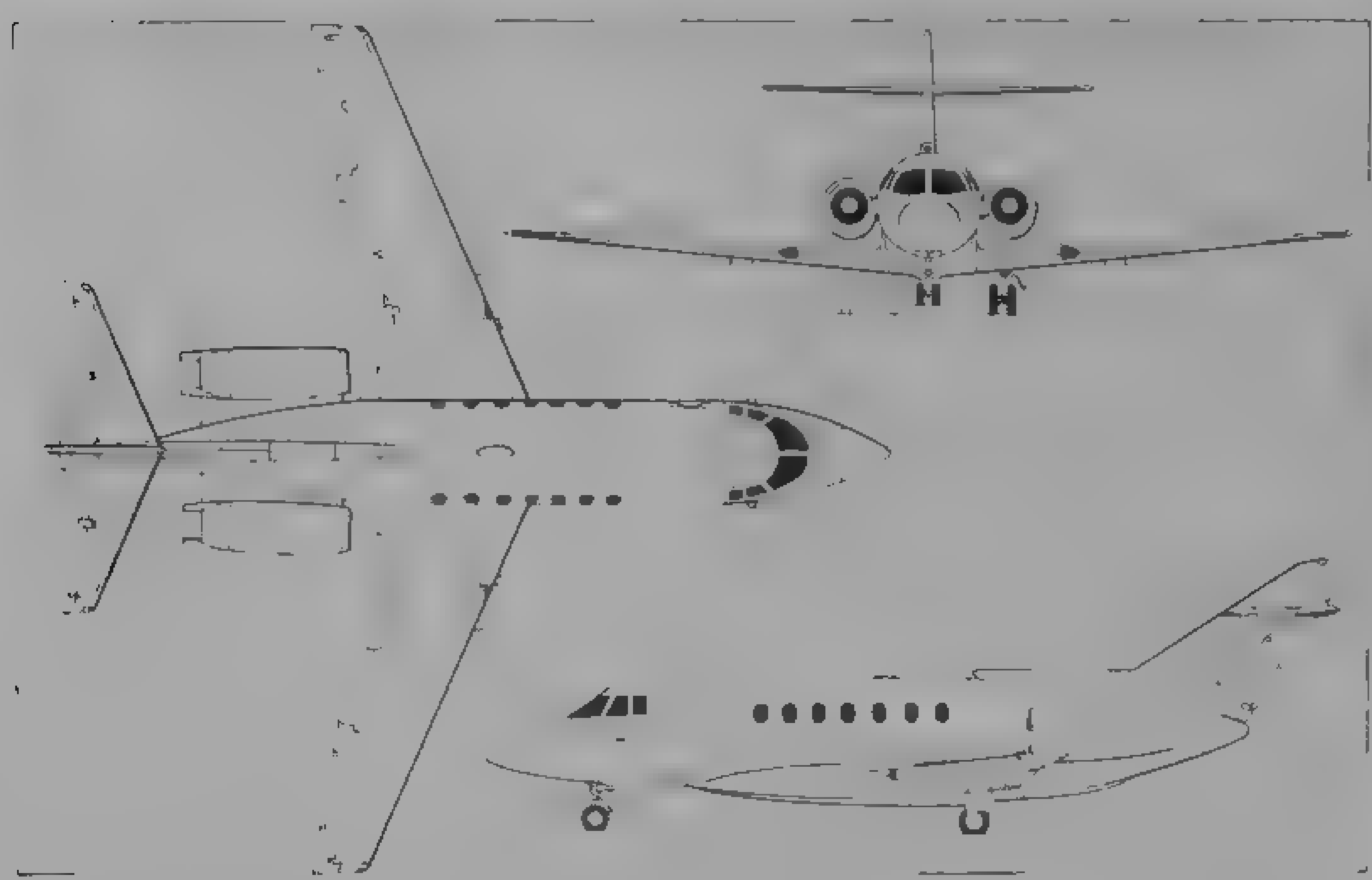
RAYTHEON HAWKER 1000

TYPE: Twin-turbofan business transport.

PROGRAMME: Development initiated 1988 as BAe 125 Series 1000, with larger cabin and increased range, substantial

Raytheon Hawker 1000 twin-turbofan business transport

1995



Raytheon Hawker 1000 (two P&WC PW305B turbofans) (*Jane's/Dennis Punnett*)

1990

structural and systems changes, and modifications to meet latest FAR and JAR certification requirements, launched as BAe 1000 October 1989; first flight (G-EXLR) 16 June 1990 and of second aircraft 26 November 1990. 800 hours flight development programme with three aircraft achieved certification on 21 October 1991, followed by FAA certification on 31 October and initial customer deliveries in December same year.

CUSTOMERS: Launch customers were J. C. Bamford Excavators Ltd (two) and The Yeates Group (one) in UK, United Technologies in USA (three, plus one for subsidiary Pratt & Whitney Canada), Aravco Ltd in UK ordered two for business jet charter; orders totalled 45 by March 1995, 47 built by January 1995; further three to be produced during 1995. Largest corporate operator is Executive Jet Aviation of Columbus, Ohio, which has ordered 1, with options on a further nine.

DESIGN FEATURES: Intercontinental development of Hawker 800 to offer increase in range and improvement in field performance particularly for hot and high airfields; 0.84 m (2 ft 9 in) fuselage stretch via plugs forward and aft of wings, additional cabin windows, PW305B turbofans with thrust reversers standard, fuel tank in extended forward wing fairing capacity 623 litres (164 US gallons; 137 Imp gallons); ventral fuel tank capacity increased by 150 litres (39.6 US gallons, 33 Imp gallons); restyled cabin interior; improved modular galley facilities; external baggage hatch; Honeywell SPZ8000 digital avionics, underwing vortillons.

BAe wing sections. Wing thickness/chord ratio 14 per cent at root, 8.35 per cent at tip; dihedral 2°; incidence 2° 5′ 42″ at root, −3° 5′ 49″ at tip; sweepback 20° at quarter-chord.

FLYING CONTROLS: Similar to Hawker 800. Split elevator circuit with normally locked break-out struts which split automatically in event of control jam.

STRUCTURE: Similar to Hawker 800 but with upper fence on each wing replaced by underwing vortillon, intermediate fuselage frames fitted to meet latest FAR/JAR requirement; secondary rear pressure bulkhead forms forward bulkhead of rear baggage area (with baggage access door) allowing altitude certification to 13,100 m (43,000 ft) in USA: push-in/slide-up plug type exterior baggage access door (63.5 × 35.5 cm; 25 × 14 in) on port side, interlocked to prevent engine start up if open.

LANDING GEAR: Retractable tricycle type, with twin wheels on each unit. Hydraulic retraction, nosewheels forward, mainwheels inward into wings. Oleo-pneumatic shock absorbers. Fully castoring nose unit, steerable ±45°. Dunlop mainwheels and 12 ply tubeless tyres, size 23 × 7-12. Dunlop nosewheels and 6 ply tubeless tyres, size 18 × 4.25-10. Dunlop triple-disc hydraulic brakes with Maxaret anti-skid units on mainwheels.

POWER PLANT: Two 23.13 kN (5,200 lb st) Pratt & Whitney Canada PW305B turbofans on sides of rear fuselage, in Rohr Aerospace pods. Rohr target-type thrust reversers standard. Integral fuel tanks in wings, with combined capacity of 4,819 litres (1,273 US gallons, 1,060 Imp gallons). Rear underfuselage ventral tank of 1,023 litres (270 US gallons, 225 Imp gallons) capacity and forward underfuselage ventral tank forming wingroot fairing, capacity 623 litres (164 US gallons, 137 Imp gallons), giving total capacity of 6,465 litres (1,707 US gallons, 1,422 Imp gallons). Single pressure refuelling point at rear of aft ventral tank. Overwing refuelling point near each wingtip.

ACCOMMODATION: As described for Hawker 800 but with maximum of 15 seats in executive layout.

SYSTEMS: Hydraulic system also operates thrust reversers. Three accumulators, pressurised by engine bleed air, are for emergency hydraulic power for wheel brakes in case of main system failure. DC electrical system utilises two 30 V 12 kW (restricted to 9 kW) engine-driven starter/generators and two 26 V 43 Ah Ni/Cd batteries. A 24 V 5 Ah battery provides separate power for standby instruments. The AC system is deleted on the 1000 version, those instruments requiring AC having their own dedicated inverter. Two engine-driven 208 V 7.4 kVA frequency-wild alternators for windscreen anti-icing can also provide DC power through a standby transformer-rectifier unit in emergency. Otherwise as described for Hawker 800.

AVIONICS: Standard Honeywell SPZ8000 avionics fit, as Hawker 800 with addition of dual Laseref III inertial reference system; DG1086 GPS, LSZ-850 lightning detection system, FMZ 900 FMS with colour displays.

DIMENSIONS, EXTERNAL: As for Hawker 800 except:

Length overall	16.42 m (53 ft 10½ in)
Height overall	5.21 m (17 ft 1 in)
Wheelbase	6.91 m (22 ft 8 in)
Baggage door: Height	0.64 m (2 ft 1 in)
Width	0.36 m (1 ft 2 in)

DIMENSIONS, INTERNAL: As for Hawker 800 except:

Cabin (excl flight deck): Length	7.44 m (24 ft 5 in)
Floor area	5.85 m² (62.95 sq ft)
Volume	approx 19.26 m³ (680.0 cu ft)
Baggage compartments, volume:	
rear (main)	1.33 m³ (47.0 cu ft)
forward (wardrobe)	0.28 m³ (10.0 cu ft)
optional (wardrobe extension)	0.28 m³ (10.0 cu ft)

AREAS: As for Hawker 800

WEIGHTS AND LOADINGS:

Weight empty	7,811 kg (17,220 lb)
Typical operating weight empty	8,165 kg (18,000 lb)
Max payload	1,043 kg (2,300 lb)
Max T-O weight	14,060 kg (31,000 lb)
Max ramp weight	14,105 kg (31,100 lb)
Max zero-fuel weight	9,208 kg (20,300 lb)
Max landing weight	11,340 kg (25,000 lb)
Max wing loading	404.7 kg/m² (82.89 lb/sq ft)
Max power loading	304.1 kg/kN (2.98 lb/lb st)

PERFORMANCE (at max T-O weight, ISA, except where indicated):

Max limiting Mach number	0.87
Max level and max cruising speed at 8,840 m (29,000 ft)	468 kts (867 km/h, 539 mph)
Econ cruising speed at 11,890-13,100 m (39,000-43,000 ft)	402 kts (745 km/h, 463 mph)
Stalling speed in landing configuration at typical landing weight	89 kts (165 km/h, 103 mph)
Time to 10,670 m (35,000 ft)	22 min
Service ceiling	13,100 m (43,000 ft)
T-O balanced field length	1,798 m (5,900 ft)
Landing from 15 m (50 ft) at typical landing weight (six passengers and baggage)	1,280 m (4,200 ft)
Range:	
with max payload	3,105 n miles (5,750 km; 3,573 miles)
with max fuel, NBAA VFR reserves	3,350 n miles (6,204 km; 3,855 miles)

UPDATED

SHORTS

SHORT BROTHERS PLC
(Subsidiary of Bombardier Inc)

PO Box 241, Airport Road, Belfast BT3 9DZ, Northern Ireland
Telephone: 44 (1232) 458444
Fax: 44 (1232) 732974
Telex: 74688

OTHER WORKS: Newtownards, Castlereagh, Belfast (3), Dunmurry, Newtownabbey, and (in England) Bournemouth
LONDON OFFICE: 14 Queen Anne's Gate, London SW1 9AA
Telephone: 44 (171) 222 4555
Fax: 44 (171) 976 8565
PRESIDENT: R. W. R. McNulty, CBE
EXECUTIVE VICE-PRESIDENT: A. F. C. Roberts, OBE
DIRECTOR, COMMUNICATIONS & PUBLIC AFFAIRS:
Alec McRitchie

Shorts acquired in October 1989 by Bombardier of Canada is European Group of Bombardier Aerospace, which also comprises North American Group (see Canadian section); operates from headquarters in Belfast, Northern Ireland, with subsidiary offices in London, Washington, Kuala Lumpur and Bahrain, currently employs over 9,000 personnel worldwide.

Major new investment by Shorts in plant, facilities and machinery carried out since 1989; now has modern

First Learjet 45 fuselage designed and built at Belfast being loaded on 18 October 1994 for delivery to USA inside an earlier Shorts aircraft, the Belfast

1995

equipment, extended capacity, new systems, and updated working practices. Production of Shorts 330 and 330-UTT (total 136 built) ended in September 1992, manufacturer of S312 (Embraer licence) Tucano completed early 1993

Two manufacturing centres, Newtownabbey and Dunmurry, cater for advanced composites programme; over 27,871 m² (300,000 sq ft) production floor area allocated to manufacture of components for Boeing, Rolls-Royce International Aero Engines, Fokker and British Aerospace Shorts has major partnership role in Canadair Regional Jet responsible for designing and manufacturing 9.75 m (32 ft) long centre section of fuselage, including forward and aft fuselage extension plugs, as well as wing flaps, ailerons, spoilers and spoilerons, vanes and nacelles. In September 1992 it was announced that Shorts would build complete fuselage and tail unit for new Learjet 45 mid size business jet in Belfast, first fuselage delivered October 1994

Shorts designed, developed and now produces Fokker 70 and 100 wing as risk sharing partner with Fokker of Netherlands and Daimler-Benz Aerospace Airbus of Germany Shorts also currently supplies components for Boeing 737, 747, 757 and 777. Announced 28 March 1994 that Shorts will undertake 10 per cent of BAe work-share in European Future Large Aircraft (see under Euroflag in International section)

Company is teamed with Westland to produce Apache attack helicopters for the UK MoD, and also owns Airwork Ltd, the international aviation support company with HQ at Bournemouth UK

Nacelle Systems Division specialises in design and manufacture of engine nacelle and turbofan components and makes a significant contribution to many Rolls Royce power plant programmes

UPDATED

OTHER AIRCRAFT

Details of the US Army's **C-23B+** programme now appear in *Jane's Aircraft Upgrades*. Shorts **S312 Tucano** in the 1994-95 and previous editions of this book. (Brazilian built Tucano information given under Embraer, which see) Delayed delivery of Kuwaiti Tucanos was effected in April May 1995

NEW ENTRY

SLINGSBY

SLINGSBY AVIATION LIMITED (Subsidiary of ML Holdings plc)

Ings Lane, Kirkbymoorside. York YO6 6EZ
Telephone 44 (1751) 432 474
Fax 44 (1751) 431 173
Telex 57597 SLINAV G
MANAGING DIRECTOR Russell Haworth
CHIEF DESIGNER Barry Mellers, MSc
MARKETING DIRECTOR John C Dignan, MBIM
CUSTOMER SERVICE MANAGER Malcolm Drinkel

Specialises in application of composite materials, formerly manufacturer of sailplanes but now concentrating on development and production of T67 Firefly series of military training aircraft, currently producing 113 T67M260 (T-3A) for US Air Force, all to be delivered by November 1995

Other activities include design and manufacture of hovercraft in composite materials, and design, development and manufacture of high-performance composite structures for marine and aerospace industries. Supplier to Jetstream 41 programme, supplying ventral fairing assembly and baggage bay, oil cooler ducts, wingtip fairings and other composites components

Work for UK MoD includes technical support for RAF Air Cadet gliders and operation and management of full scale dynamic fatigue test of RAF Grob Viking glider

Airship activities sold to Westinghouse in 1993

VERIFIED

SLINGSBY T67 FIREFLY

TYPE: Two-seat aerobatic training and sporting aircraft

PROGRAMME: Current composites constructed Firefly developed from wooden Slingsby T67A (licence built version of French Fournier RF6B — see 1982-83 *Jane's*). T67B gained CAA certification 18 September 1984; T67C was CAA certificated 15 December 1987

CURRENT VERSIONS: **T67B.** Basic version, 86.5 kW (116 hp) Textron Lycoming O-235-N2A engine and two-blade fixed-pitch propeller, no longer produced

T67C: Similar to T67B, but 119 kW (160 hp) Textron Lycoming O-320-D2A engine, metal fixed-pitch propeller, 24 V 70 A engine-driven alternator and 24 V 15 Ah battery Subvariants **T67C1** with normal fuselage fuel tank and one-piece canopy, **T67C2** with fuselage tank and two-piece canopy, **T67C3** with wing fuel tanks and two-piece canopy. *Detailed description applies to T67C*

T67M. Military variants, described separately

CUSTOMERS: Over 160 civil/military T67s delivered to customers in 13 countries by early 1995. Nine T67C3s purchased by Netherlands government Civil Aviation Flying School for KLM and Royal Netherlands Navy pilot training; 12 T67C3s for Canadian Department of National Defence for military primary flying training, plus other T67C variants for UK schools, including CSE and Bristow Helicopters

DESIGN FEATURES: Wing section NACA 23015 at root, 23013 at tip, dihedral 3° 30', incidence 3

FLYING CONTROLS: Manually operated mass balanced Frise type ailerons, without tabs, mass balanced elevators with manually operated port trim tab (electric trim optional), rudder, trailing edge fixed hinge flaps, spin strakes forward of tailplane roots

STRUCTURE: GFRP, single-spar wings with double skin (corrugated inner skin bonded to plain outer skin) and conventional ribs in heavy load positions, conventional frame and top-hat stringer fuselage; stainless steel firewall between cockpit and engine; fixed incidence tailplane of similar construction to wings (built-in VOR antenna); fin incorporates VHF antenna

LANDING GEAR: Non-retractable tricycle type. Oleo-pneumatic shock-absorber in each unit. Steerable nosewheel. Main wheel tyres size 6.00-6, pressure 1.4 bars (20 lb/sq in) Nosewheel tyre size 5.00-5, pressure 2.5 bars (37 lb/sq in) Hydraulic disc brakes. Parking brake

POWER PLANT: One flat-four engine as described under Current Versions. Fuselage fuel tank, immediately aft of firewall, in T67C1 and T67C2, capacity 114 litres (30 US gallons; 25 Imp gallons). Refuelling point on fuselage upper surface, forward of windscreen. T67C3, wing fuel tanks as T67M. Oil capacity 4 litres (1.06 US gallons, 0.88 Imp gallon). Oil system permits short periods of inverted flight

ACCOMMODATION: Two seats side by side, originally (T67C1) under one-piece transparent canopy, which swings upward and rearward for access to cockpit. T67C2/C3 have fixed windscreen and rearward-hinged upward-opening rear section. Dual controls standard. Adjustable rudder pedals Cockpit heated and ventilated. Baggage space aft of seats

SYSTEMS: Hydraulic system for brakes only. Vacuum system for blind flying instrumentation. Electrical power supplied by 28 V 70 A engine-driven alternator and 24 V 15 Ah battery

AVIONICS: Optional avionics, available to customer requirements, include equipment by Becker, Bendix/King and Narco, up to full IFR standard

Instrumentation: Standard avionics include artificial horizon and directional gyro, with vacuum system and vacuum gauge, electric turn and slip indicator, rate of climb indicator, recording tachometer, stall warning system, clock, outside air temperature gauge, accelerometer

EQUIPMENT: Includes tiedown rings and towbar; cabin fire extinguisher, crash axe, heated pitot, instrument, landing, navigation and strobe lights. Optional equipment includes T67M type blue tinted canopy, external power socket, and wingtip-mounted smoke system

DIMENSIONS, EXTERNAL:

Wing span	10.59 m (34 ft 9 in)
Wing chord: at root	1.53 m (5 ft 0¼ in)
at tip	0.83 m (2 ft 8¾ in)
Wing aspect ratio	8.88
Length overall	7.32 m (24 ft 0¼ in)
Height overall	2.36 m (7 ft 9 in)
Tailplane span	3.40 m (11 ft 1¾ in)
Wheel track	2.44 m (8 ft 0 in)
Wheelbase	1.50 m (4 ft 11 in)
Propeller diameter	1.88 m (6 ft 2 in)

DIMENSIONS, INTERNAL:

Cockpit: Length	2.05 m (6 ft 8¾ in)
Max width	1.08 m (3 ft 6½ in)
Max height	1.08 m (3 ft 6½ in)

AREAS:

Wings, gross	12.63 m² (136.0 sq ft)
Ailerons (total)	1.24 m² (13.35 sq ft)
Trailing-edge flaps (total)	1.74 m² (18.73 sq ft)
Fin	0.80 m² (8.61 sq ft)
Rudder	0.82 m² (8.8 sq ft)
Tailplane	1.65 m² (17.76 sq ft)
Elevators (incl tab)	0.99 m² (10.66 sq ft)

WEIGHTS AND LOADINGS:

Weight empty (basic): T67C2	649 kg (1,430 lb)
T67C3	685 kg (1,510 lb)
Max fuel: T67C1/C2	82 kg (181 lb)
T67C3	114 kg (252 lb)
Max baggage: T67C	30 kg (66 lb)
Max T-O, landing and aerobatic weights	
T67C2	907 kg (2,000 lb)
T67C3	975 kg (2,150 lb)
Max wing loading: T67C2	71.82 kg/m² (14.71 lb/sq ft)
T67C3	77.18 kg/m² (15.81 lb/sq ft)
Max power loading: T67C2	7.62 kg/kW (12.50 lb/hp)
T67C3	8.18 kg/kW (13.44 lb/hp)

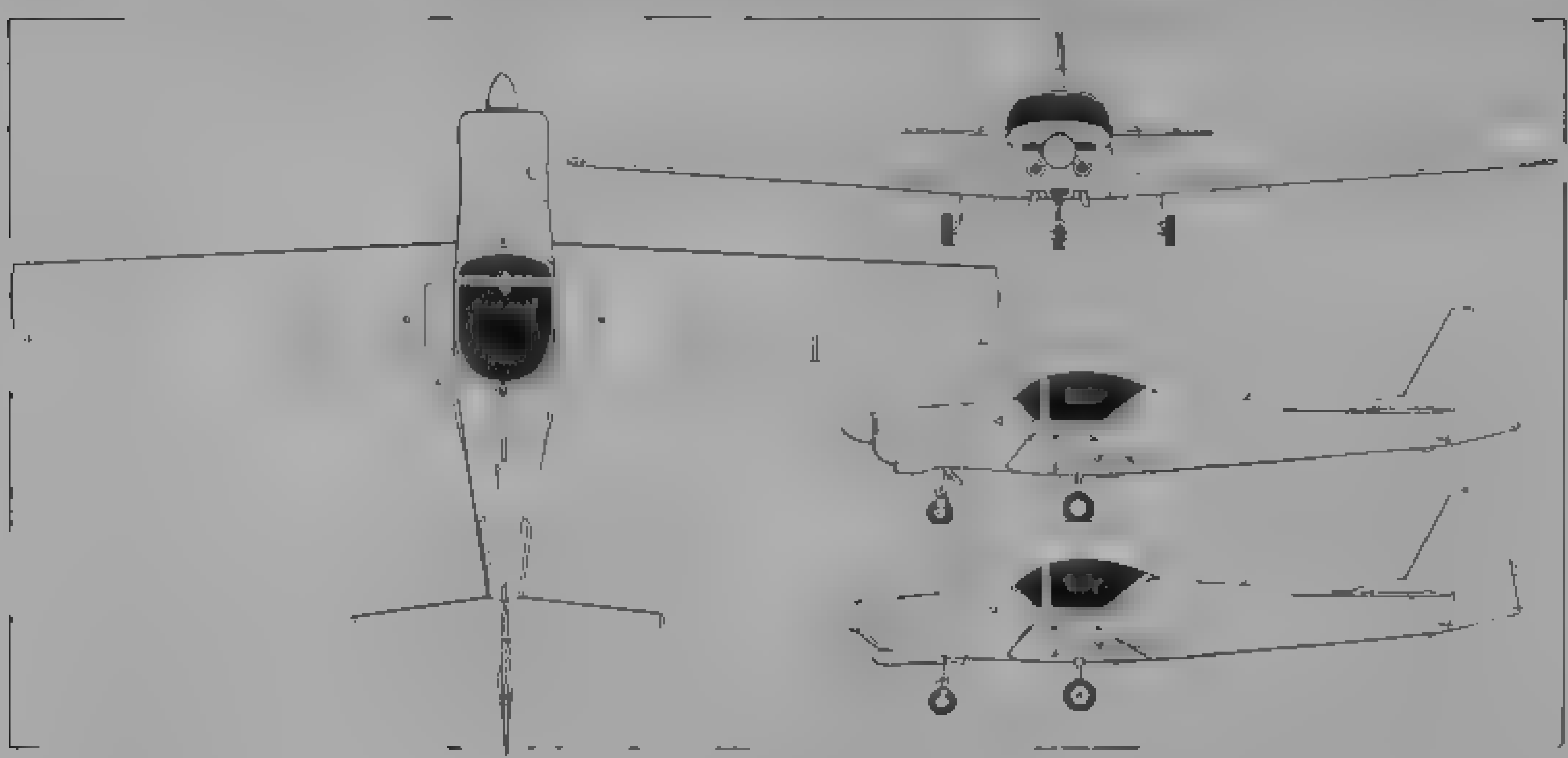
PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (V_{NE})	180 kts (334 km/h, 207 mph)
Max level speed at S/L	127 kts (235 km/h, 146 mph)
Max cruising speed (75% power) at 2,440 m (8,000 ft)	116 kts (215 km/h, 134 mph)
Stalling speed, power off, flaps up: T67C2	52 kts (97 km/h, 60 mph)
T67C3	53 kts (99 km/h, 61 mph)
Stalling speed, power off, flaps down	49 kts (91 km/h, 57 mph)
Max crosswind	25 kts (46 km/h, 29 mph)
Max rate of climb at S/L: T67C2	274 m (900 ft)/min
Service ceiling	3,660 m (12,000 ft)
T-O run: T67C3	335 m (1,100 ft)
T-O to 15 m (50 ft): T67C3	550 m (1,805 ft)
Landing from 15 m (50 ft): T67C3	565 m (1,854 ft)
Landing run: T67C3	348 m (1,142 ft)
Range with max fuel (65% power at 2,440 m, 8,000 ft), allowances for T-O and climb, 30 min reserves at 45% power: T67C2	360 n miles (666 km, 414 miles)
T67C3	554 n miles (1,026 km, 638 miles)
Endurance at best econ setting to 20 min fuel remaining: T67C2	4 h 10 min
T67C3	7 h 0 min
g limits	+6/−3

UPDATED

Slingsby T67M Fireflies in formation (*John Dignan*)

1995



Slingsby T67M Mk II Firefly (Textron Lycoming AEIO-320-D1B engine) with additional side view (bottom) of T67M260 (*Jane's/Dennis Punnett*)

1992

SLINGSBY T67M Mk II FIREFLY

TYPE: Two-seat military basic trainer

PROGRAMME: First flight of T67M Firefly 160 (G-BKAM) 5 December 1982, CAA certification 20 September 1983, designation changed to T67M Mk II as two-piece canopy introduced

CUSTOMERS: Sold to Holland for military grading, Japan and UK for airline training, and Switzerland for aerobatic and general flying training. Used by RAF and RN for elementary flying training, Joint Elementary FTS formed at Topcliffe, July 1993 with first of 17 Fireflies operated under contract by Hunting Aircraft Ltd, transferred to Barkston Heath in April 1995

DESIGN FEATURES: T67M based on T67C, except as detailed

STRUCTURE: Generally as T67C

LANDING GEAR: Generally as T67C

POWER PLANT: One 119 kW (160 hp) Textron Lycoming AEIO-320-D1B flat-four engine, driving a Hoffmann HO-V72 two-blade constant speed composite propeller. Fuel and oil systems suitable for inverted flight. Fuel tanks in leading-edge of wings, capacity 159 litres (42 US gallons, 35 Imp gallons). Refuelling point in upper wing surface. Oil capacity 7.7 litres (2.0 US gallons, 1.675 Imp gallons)

ACCOMMODATION: As for T67C, except that current aircraft have blue tinted canopy with fixed windscreen and upward-hinged, rearward-opening rear section. Inertia reel lockable shoulder harness standard, air conditioning optional

AVIONICS: Avionics to customer requirements. Blind-flying instrumentation standard

DIMENSIONS, EXTERNAL: As for T67C

AREAS: As for T67C

WEIGHTS AND LOADINGS:

Weight empty, equipped	685 kg (1,510 lb)
Max fuel weight	114 kg (252 lb)
Max T-O, aerobatic and landing weight	975 kg (2,150 lb)
Max wing loading	77.18 kg/m² (15.81 lb/sq ft)
Max power loading	8.18 kg/kW (13.44 lb/hp)

PERFORMANCE (at max T-O weight except where indicated):

Never-exceed speed (VNE)	180 kts (334 km/h; 207 mph)
Max level speed at S/L	130 kts (241 km/h; 150 mph)
Max cruising speed, 75% power at 2,440 m (8,000 ft)	121 kts (224 km/h; 139 mph)
Stalling speed, power off, flaps down	49 kts (91 km/h, 57 mph)
Max crosswind for T-O and landing	25 kts (46 km/h, 29 mph)
Max rate of climb at S/L	305 m (1,000 ft)/min
Service ceiling	4,575 m (15,000 ft)
T-O run	218 m (718 ft)
T-O to 15 m (50 ft)	444 m (1,458 ft)
Landing from 15 m (50 ft)	546 m (1,794 ft)
Landing run	258 m (847 ft)
Range with max fuel at 65% power, at 2,440 m (8,000 ft), allowances for T-O, climb and 30 min reserves at 45% power	486 n miles (901 km; 631 miles)
Endurance, at best econ setting to 20 min fuel remaining	6 h 30 min
g limits at 884 kg (1,950 lb) AUW	+6/−3

UPDATED

SLINGSBY T67M200 FIREFLY

TYPE: Two-seat military basic trainer

PROGRAMME: First flight 16 May 1985, CAA certification 13 October 1985, representative airframe underwent long term fatigue test to simulate 75,000 flying hours.

CUSTOMERS: 29 used in five countries by January 1992, first customer Turkish Aviation Institute, Ankara (16 delivered from 1985), Dutch operator King Air (three T67M200s, plus one T67M Mk II) as screening trainers for prospective RNethAF pilots, Royal Hong Kong Auxiliary Air Force (now Government Flying Service) (four), Norwegian government's Flying Academy (six)

DESIGN FEATURES: Development of T67M; 149 kW (200 hp) Textron Lycoming AEIO-360-A1E engine, Hoffman HO-V123 three-blade variable-pitch composite propeller; fuel/oil systems for inverted flight

DIMENSIONS, EXTERNAL: As for T67C/M except

Propeller diameter	1.80 m (5 ft 10¾ in)

WEIGHTS AND LOADINGS:

Weight empty	700 kg (1,543 lb)
Max fuel	114 kg (252 lb)
Max baggage	30 kg (66 lb)
Max T-O weight: Utility	1,020 kg (2,250 lb)
Aerobatic	975 kg (2,150 lb)
Max landing weight	975 kg (2,150 lb)
Max wing loading	80.75 kg/m² (16.54 lb/sq ft)
Max power loading	6.85 kg/kW (11.25 lb/hp)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (VNE)	180 kts (334 km/h, 207 mph)
Max level speed at S/L	135 kts (250 km/h, 155 mph)
Max cruising speed (75% power at 2,440 m, 8,000 ft)	125 kts (232 km/h, 144 mph)
Stalling speed, power off, flaps down	49 kts (91 km/h, 57 mph)
Max crosswind for T-O and landing	25 kts (46 km/h, 29 mph)
Max rate of climb at S/L	333 m (1,091 ft)/min
T-O run	295 m (967 ft)
T-O to 15 m (50 ft)	467 m (1,531 ft)
Landing from 15 m (50 ft)	575 m (1,888 ft)
Landing run	329 m (1,078 ft)
Range with max fuel (65% power at 2,440 m; 8,000 ft), allowances for T-O and climb, 30 min reserves at 45% power	469 n miles (869 km, 540 miles)
Endurance at best econ setting, 20 min fuel remaining	6 h 0 min
g limits	+6/−3

UPDATED

SLINGSBY T67M260 FIREFLY

US Air Force designation: T-3A Firefly

TYPE: Two-seat military basic trainer

PROGRAMME: Selected by USAF to meet Enhanced Flight Screener (EFS) requirement. Slingsby prime contractor for both acquisition contract and seven year contractor logistic support (CLS) contract. Northrop Grumman is subcontractor for final assembly at Hondo, Texas, and for operation of CLS activities at Hondo and USAF Academy at Colorado Springs. Prototype (G-BLUX) flown May 1991, evaluated at Wright-Patterson AFB, hot and high trials at USAF Academy in Summer 1991. Preproduction aircraft (G-EFSM) flown September 1992. First flight of first USAF aircraft (92-0625/N7020D) 4 July 1993. T-3A type certificate awarded by CAA and FAA December 1993. Official USAF acceptance 25 February 1994; student pilot training at 1st Flight Screening Squadron of 12th Flying Training Wing, Hondo, began March 1994.

CUSTOMERS: US Air Force, 113 aircraft in three lots (38, 42 and 33) to replace Cessna T-41. USAF pilot conversion completed September 1993. Deliveries January 1994 to November 1995. 50 aircraft in service by beginning of 1995. Second and final operating unit (with 57 aircraft) is 557th FTS of USAF Academy at Colorado Springs, deliveries to this unit from August 1994, operational January 1995. All T-3As wear dual military/civilian identities

Slingsby T-3A Firefly military basic trainer (*John Dignan*)

1995

COSTS: Initial programme costs (including CLS) $54.8 million plus extra options for air conditioning and UHF radios
DESIGN FEATURES: Development of T67M, higher powered Lycoming engine; cabin air conditioning system added, higher maximum T-O and aerobatic weights, to allow 227 kg (500 lb) for two pilots and equipment plus full fuel load
POWER PLANT: One 194 kW (260 hp) Textron Lycoming AEIO-540-D4A5 flat-six engine, driving a Hoffmann HO-V123K X/180 DT three-blade constant-speed composite propeller. Fuel capacity 159 litres (42 US gallons, 35 Imp gallons)
Data as for T67C/M except:

DIMENSIONS, EXTERNAL:
Length overall 7.57 m (24 ft 10 in)
WEIGHTS AND LOADINGS (with air conditioning installed):
Weight empty 807 kg (1,780 lb)
Max fuel 114 kg (252 lb)
Max T-O weight, Utility/Aerobatic 1,145 kg (2,525 lb)
Max wing loading 90.8 kg/m² (18.6 lb/sq ft)
Max power loading 5.89 kg/kW (9.69 lb/hp)
PERFORMANCE (at max T-O weight, ISA):
Never-exceed speed (VNE) 195 kts (361 km/h, 224 mph)
Max level speed at S/L 152 kts (281 km/h, 175 mph)
Max cruising speed (75% power at 2,590 m; 8,500 ft) 140 kts (259 km/h, 173 mph)
Stalling speed, power off 52 kts (98 km/h, 68 mph)
Max rate of climb at S/L 480 m (1,380 ft)/min
T-O run, 18° flap 278 m (913 ft)
T-O to 15 m (50 ft), 18° flap 476 m (1,562 ft)
Landing from 15 m (50 ft), full flap 877 m (2,877 ft)
Landing run, full flap 374 m (1,226 ft)
Range with max fuel, 65% power at 2,440 m (8,000 ft), allowances for T-O, climb and 30 min reserves 408 n miles (755 km, 469 miles)
Endurance at best econ setting, 20 min fuel remaining 5 h 20 min

UPDATED

SPEEDTWIN

SPEEDTWIN DEVELOPMENTS LTD

Upper Cae Garw Farm, Trellech, Monmouth, Gwent
Telephone: (44) 1600 860165
Fax: (44) 1600 860813
CHAIRMAN: Peter J C Phillips

The company was formed to market the Speedtwin twin-engined aerobatic light sporting aircraft designed by Peter Phillips, a former demonstration pilot with Britten-Norman and test pilot with the Norman Aeroplane Company.

NEW ENTRY

Speedtwin aerobatic sporting aircraft designed by Peter Phillips *(Paul Jackson)* *1995*

SPEEDTWIN E2E SPEEDTWIN

TYPE: Twin-engined, tandem-seat sporting aircraft.
PROGRAMME: Design started 1981, prototype first flew 1992, production rate about six kits per year after certification. Construction requirements arranged to meet the '51 per cent rule'.
CURRENT VERSIONS: **Mk I** with Continental engines. **Mk II** with Lycoming engines.
COSTS: Kit, £38,000, information pack £15, demonstration flight £300.
DESIGN FEATURES: Designed to meet FAR Pt 23 and BCAR 23 standards for sporting flying and aerobatics. World's only aerobatic light twin. Low-wing twin-engined monoplane with fixed tailwheel undercarriage. VMCA of Mk I version claimed to be at or below the stall.
FLYING CONTROLS: Conventional mechanical ailerons, elevator and rudder. Elevator tab for pitch trim. Fixed tabs on ailerons and rudder for adjustments before flight.
STRUCTURE: General construction of metal, flush riveted and butt jointed. Carbonfibre control surfaces.
LANDING GEAR: Tailwheel type, spats on mainwheels.
POWER PLANT: Mk I Speedtwin, two 74.6 kW (100 hp) Continental O-200 or, Mk 2 Speedtwin, two 119.3 kW (160 hp) Textron Lycoming IO-320. Dynafocal engine mounts. Fuel capacity 363 litres (96.0 US gallons, 79.9 Imp gallons).
ACCOMMODATION: Two in tandem.
SYSTEMS: Electrical system, 12 V 30 Ah battery, alternator fit appropriate to engine.
AVIONICS: Customer specified.
DIMENSIONS, EXTERNAL:
Wing span 7.92 m (26 ft 0 in)
Wing aspect ratio 5.63
Length overall 6.96 m (22 ft 10 in)
Width, wing outer panels removed for stowage 4.88 m (16 ft 0 in)
Height overall 2.08 m (6 ft 10 in)
DIMENSIONS, INTERNAL:
Cabin:
Min width 0.63 m (2 ft 1 in)
AREAS:
Wings, gross 11.15 m² (120.0 sq ft)
WEIGHTS AND LOADINGS:
Weight empty: Mk I 640 kg (1,410 lb)
Mk II 680 kg (1,500 lb)
Max T-O weight: US FAA rules 1,111 kg (2,450 lb)
UK CAA rules 1,020 kg (2,250 lb)
Max weight for aerobatics 907 kg (2,000 lb)
Max wing loading at aerobatic weight 81.4 kg/m² (16.7 lb/sq ft)
Max power loading at aerobatic weight:
Mk I 6.09 kg/kW (10.00 lb/hp)
Mk II 3.80 kg/kW (6.25 lb/hp)
PERFORMANCE (at max UK T-O weight, ISA):
Never-exceed speed (VNE) 214 kts (397 km/h, 247 mph)
Max level speed at S/L:
Mk I 155 kts (286 km/h, 178 mph)
Mk II 187 kts (346 km/h, 215 mph)
Economical cruising speed at 75% power:
Mk I 139 kts (257 km/h, 160 mph)
Mk II 174 kts (322 km/h, 200 mph)
Stalling speed, power off:
flaps up 59 kts (110 km/h, 68 mph)
flaps down 53 kts (97 km/h, 60 mph)
Max rate of climb at S/L, aerobatic weight:
Mk I 365 m (1,200 ft)/min
Mk II 929 m (3,050 ft)/min
Service ceiling, OEI, aerobatic weight:
Mk I 915 m (3,000 ft)
Mk II 3,505 m (11,500 ft)
T-O run, aerobatic weight: Mk I 165 m (540 ft)
Mk II 101 m (330 ft)
Landing run, aerobatic weight 156 m (510 ft)
Landing crosswind limit 30 kts (55 km/h, 34 mph)
Range with max internal fuel, 61% power:
Mk I 1,129 n miles (2,092 km, 1,300 miles)
Mk II 955 n miles (1,770 km, 1,100 miles)
g limits: aerobatic weight +6/−3
max T-O weight +3.8/−1.5

NEW ENTRY

WESTLAND

WESTLAND GROUP PLC

Yeovil, Somerset BA20 2YB
Telephone: 44 (1935) 75222
Fax: 44 (1935) 702131
Telex: 46277 WHL YEO G
LONDON OFFICE: 4 Carlton Gardens, Pall Mall, SW1Y 5AB
Telephone: 44 (171) 839 4061
CHAIRMAN: Sir Leslie Fletcher, DSC, FCA
DEPUTY CHAIRMAN: Alec Daly
CHIEF EXECUTIVE: Alan Jones, MA, FEng, FIProdE, FRAeS
PUBLIC RELATIONS DIRECTOR: Christopher Loney

Westland Aircraft Ltd (now Westland Group plc) formed July 1935, taking over aircraft branch of Petters Ltd (known previously as Westland Aircraft Works) that had designed/built aircraft since 1915, entered helicopter industry having acquired licence to build US Sikorsky S-51 as Dragonfly 1947; developed own Widgeon from Dragonfly, technical association with Sikorsky Division of United Technologies continued after decision to concentrate on helicopter design, development and construction.

Acquisition of Saunders-Roe Ltd 1959, Helicopter Division of Bristol Aircraft Ltd and Fairey Aviation Ltd 1960, and British Hovercraft Corporation's Aerospace Division 1983, plus subsequent restructuring into Divisions, detailed in 1989-90 *Jane's*.

Financial reconstruction package approved February 1986, with United Technologies (USA) and Fiat (Italy) acquiring minority shareholdings. Fiat withdrew 1988. GKN acquired 22 per cent holding in Westland, later increasing to 45 per cent with buy-out of United Technologies' holding and eventually gaining overall control on 18 April 1994. Westland Group then placed in newly formed GKN Aerospace and Defence division.

Westland Group has five principal subsidiary companies: Westland Aerospace, specialising in composites and metallic structures; Westland Engineering, producing transmission systems and rotor blades; Westland Helicopters (see below); Westland Industries, producing a wide range of components and subassemblies; and Westland Technologies, which includes Normalair-Garrett, a supplier of control systems. Westland Group employs 8,700 persons.

Current programmes include construction of composite engine cowlings for Lockheed C-130J Hercules (Allison AE 2100 installation, including cowling design), Saab 340, de Havilland Dash 8, Jetstream 41 and Dornier 328, composite structures for Airbus, Boeing and McDonnell Douglas aircraft, Learjet 45 fuselage frames (subcontract to Short Brothers), and Saab 2000 rear fuselage structure and engine nacelles.

EH Industries Ltd (see EHI in International section) is joint Westland/Agusta (Italy) management company developing EH 101 helicopter; collaboration with Agusta extended to include design, manufacture and marketing across joint product range. EHI Inc (USA) and EHI Canada are subsidiaries of EHI Ltd. Westland Group activities in USA and Central America represented by wholly owned subsidiary, Westland Inc.

UPDATED

WESTLAND HELICOPTERS LIMITED

Yeovil, Somerset BA20 2YB
Telephone: 44 (1935) 75222
Fax: 44 (1935) 704201
Telex: 46277 WHL YEO G
MANAGING DIRECTOR: Richard I Case
MARKETING DIRECTOR: P Burton
HEAD OF HM GOVERNMENT BUSINESS: G N Cole
COMMUNICATIONS MANAGER: Julie A Pilbeam

Sea King and Lynx in production. Westland and Agusta of Italy collaborate on EH 101 development and manufacture (see EHI in International section); agreement with United Technologies permits Sikorsky Black Hawk production as WS 70.

Under June 1989 agreement, Westland obtained co-production rights for McDonnell Douglas AH-64 Apache; this selected for British Army Air Corps July 1995, Westland to be prime contractor to UK MoD.

Pending full production of EH 101, Westland continues low-rate production of existing products; delivered four helicopters in 1993, none in 1994.

UPDATED

WESTLAND APACHE

TYPE: Day/night twin-engined attack helicopter.
PROGRAMME: Westland selected 13 July 1995, to build McDonnell Douglas AH-64D Apache for Army Air Corps,

First Mk 3A version of Sea King for the RAF undertaking its maiden flight

1995

total 67 to be ordered, although original requirement was for 91, programme involves some 180 UK companies. Apache description in US section, UK version similar, including Longbow radar.

NEW ENTRY

WESTLAND SEA KING

TYPE: Anti-submarine, search and rescue and airborne early warning helicopter.

PROGRAMME: Licence to develop/manufacture Sikorsky S-61 obtained 1959; developed initially for Royal Navy as advanced ASW helicopter with prolonged endurance, SAR, tactical troop transport, casualty evacuation, cargo carrying, long-range self-ferry secondary roles; ordered for RN 1967, first flight of production HAS Mk 1 (XV642) 7 May 1969. Westland built Sea King airborne time reached 1 million hours in 1993.

CURRENT VERSIONS: **Sea King AEW. Mk 2A**: Ten conversions of HAS Mk 2A with externally mounted radar; 849 Squadron, Culdrose. See also AEW Mk 5. Planned late 1990s upgrade with new IFF, enhanced communications and radar video recorder.

Sea King HAR Mk 3/3A: SAR version for RAF; first flight (Mk 3) 6 September 1977; 16 HAR Mk 3s delivered by 1979, plus three in 1985; intention to order additional six officially announced 19 February 1992 and effected in October 1992; first flight (ZH540) 9 February 1995 (deliveries, two in 1995 and four in 1996). Designated HAR Mk 3A, these latter have Racal RNAV2 computer, Racal Doppler 91, BAe CM9 compass, Smiths-Newmark SN500 flight control system, Collins HF9000 HF radio, Cossor STR2000 series GPS, Motorola MX 1000(R) mountain rescue radio, Thomson Thorn ARI5955/2 search radar, Rockwell Collins AN/ARC-182 VHF/UHF, Bendix/King VOR/ILS and Bendix/King DME/ADI.

Operated by No. 202 Squadron at Boulmer (HQ) and detachments at Boulmer, Lossiemouth and Leconfield; No 22 Squadron with detachments at Chivenor (from July 1994), Valley (from mid-1996) and Wattisham (from 18 July 1994); and Sea King OCU at St Mawgan (from April 1993). Further two aircraft with No 78 Squadron on Falkland Islands. Accommodation comprises two flight crew, air electronics/winch operator and loadmaster/winchman; up to six stretchers, or two stretchers and 11 seated survivors, or 19 persons; nav system of initial production Mk 3 includes Decca TANS F computer, accepting Mk 19 Decca nav receiver and Type 71 Doppler inputs. Thomson Thorn ARI5955 radar. No. 78 Squadron helicopters fitted with RWR and chaff/flare dispensers. UK-based flights converted to night vision goggles, 1992-93.

Sea King HAS Mk 5: Updated ASW/SAR version for Royal Navy; 30 new aircraft handed over 2 October 1980 to July 1986; one HAS Mk 1, 20 HAS Mk 2s and 35 HAS Mk 2As brought to same standard by 1987 at Fleet Air Arm workshops; four became HAR Mk 5s and others HAS Mk 6s and AEW Mk 5s (which see); nav/attack system utilises TANS G coupled to Decca 71 Doppler and Sea Searcher radar (in larger radome), Racal MIR 2 Orange Crop ESM, passive sonobuoy dropping equipment, and associated GEC Marconi LAPADS acoustics processing and display equipment; four crew, with sonar operator also monitoring LAPADS as additional crew station; cabin enlarged by moving rear bulkhead 1.72 m (5 ft 7¾ in) aft; max T-O weight 9,525 kg (21,000 lb).

Equipment allows pinpoint of enemy submarine at greater range and attack with torpedoes; can monitor signals from own sonobuoys and those dropped by RAF Nimrod in joint search.

Sea King HAR Mk 5: Four HAS Mk 5s with ASW equipment removed for SAR; 771 Squadron, Culdrose.

Sea King AEW. Mk 5: Three aircraft converted from HAS Mk 5 in 1995, generally as HAS Mk 2A, with external Thomson Thorn Searchwater radar.

Sea King HAS Mk 6: Uprated RN ASW version; large blade aerial under starboard side of nose; five new aircraft ordered from October 1987 and delivered January-August 1990; 25 HAS Mk 5s being retrofitted to standard at RN Fleetlands workshop using Westland-supplied kits; further batch of 44 kits followed; first flight of conversion (Mk 5 XZ581) 15 December 1987; first flight of new Mk 6 (ZG816) 7 December 1989; entered service (ZA136) with Intensive Flight Trials Unit within No. 824 Squadron (detached from Culdrose to Prestwick) 15 April 1988; squadron later disbanding; issued to 819 Squadron, Prestwick, April 1989; and Culdrose squadrons 810 (November 1989), 820 (January 1990), 826 (February 1990; disbanded 30 July 1993), 814 (October 1990) and 706 (June 1991). Mk 6 Operational Evaluation Unit at Boscombe Down is detachment of 810 Squadron. By early 1995, 810, 814, 819 and 820 Squadrons wholly Mk 6; training unit, 706 Squadron reverted to Mk 5s.

AQS-902G-DS enhanced sonar system (31 ordered from GEC-Marconi under 1987 contract, plus upgrade to standard of 112 previous AQS-902C sonobuoy processing systems), replacing Mk 5's analog computing element of Plessey 195 dipping sonar with digital processor (changing designation to GEC-Marconi 2069; 44 ordered initially in June 1989 and delivered from August 1991), and presenting integrated information from sonobuoys and dipping sonar on single CRT display; sonar dunking depth increased from 75 m (245 ft) to about 213 m (700 ft); GEC-Plessey PTR 446 improved IFF; upgraded ESM to Orange Reaper standard; two GEC-Marconi AD3400 VHF/UHF secure speech radios; CAE Electronics internal AIMS (advanced integrated magnetic anomaly detection system) retrofit contract awarded to Westland December 1991 for 73 conversion kits (clearance trials completed 1989); 227 to 363 kg (500 to 800 lb) weight-saving offers improved performance (equivalent to 30 minutes extra fuel).

Sea King AEW. Mk 7: Proposed upgrade of AEW Mk 2 with new radar (Searchwater 2000 competing against GEC-Marconi Blue Vixen variant), JTIDS datalink and new central tactical system with colour displays. Tenders submitted May 1995; service entry in 2000.

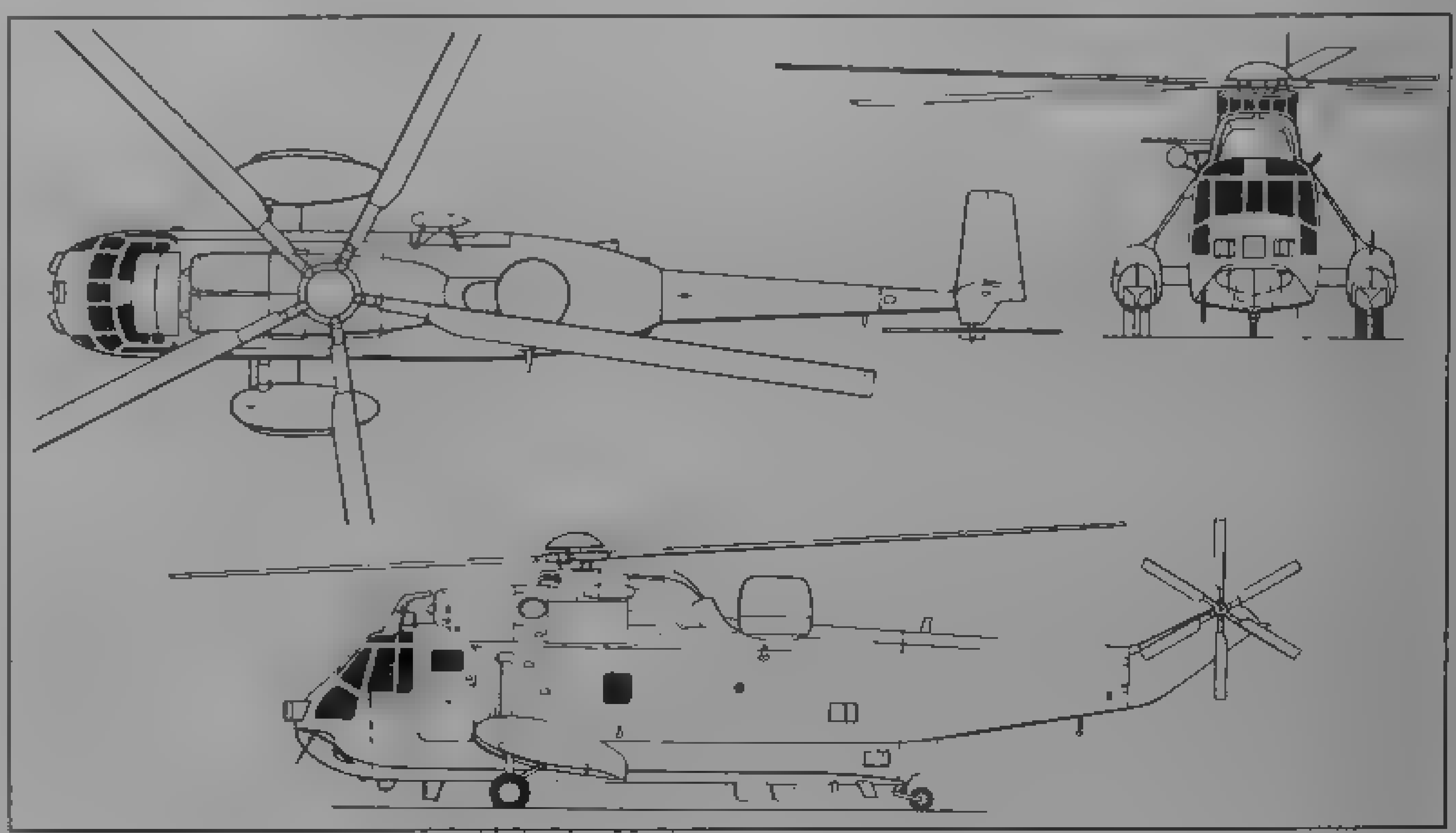
Advanced Sea King: 1,092 kW (1,465 shp) Rolls-Royce Gnome H 1400-1T engines; uprated main gearbox with emergency lubrication and strengthened main lift frames; composite main and tail rotor blades, improved search radar; maximum AUW 9,752 kg (21,500 lb), for improved payload/range; through-life costs reduced. *Following details apply to Advanced Sea King and, in airframe and power train features, to new production of earlier versions.*

Sea King Mk 43B: Norwegian Air Force SAR helicopter; one (322, temporarily ZH566) delivered 28 July 1992, supplementing 11 Mk 43s received 1972-78. Bendix King RDR-1500 spine radar. Nine survivors being upgraded to Mk 43B standard with additional Bendix/King RDR 1300C nose radar, Racal Doppler 91, RNAV2 and Mk 32 Decca, plus FLIR Systems Inc 2000F FLIR; redelivery began, also on 28 July 1992, with 071. Further two Mk 43Bs ordered November 1993 for 1995 delivery from new production.

Sea King Mk 48: Contract of January 1994 to Westland for update of all five Belgian Sea Kings with Bendix/King RDR-1500B radar in spine position, FLIR Systems FLIR 2000F, and Racal RNS252 navigation.

Westland Sea King HAR. Mk 5 of 771 Squadron, Royal Navy *(Paul Jackson)*

1995



Westland Sea King HAS. Mk 6 anti-submarine helicopter *(Jane's/Dennis Punnett)*

1995

Westland Sea King HAS Mk 6 conversion from Mk 5 *(Paul Jackson)*

1995

Sea King Mk 50 £27 6 million contract in July 1994 for Westland to update avionics and airframes of seven remaining Australian Navy Sea Kings by 1996

CUSTOMERS: Royal Navy 56 HAS Mk 1s, 21 HAS Mk 2s, 30 HAS Mk 5s and five HAS Mk 6s delivered, but progressively modified; fleet in January 1995 comprised 10 AEW Mk 2As, 13 HAS Mk 5s, five HAR Mk 5s, three AEW Mk 5s (under conversion) and 55 HAS Mk 6s Royal Air Force 25 HAR Mk 3/3As, of which six being delivered See table for exports and for further 89 built as Commandos (which see) including 49 officially designated 'Sea King', plus two lost on trials prior to delivery

Total Sea King/Commando planned production 328 of which 321 built by March 1995 (Royal Navy also received four Sikorsky S-61Ds for development 1966-67; one remains) Further details of previous variants in earlier editions of *Jane's*; details of upgrades in *Jane's Aircraft Upgrades*.

COSTS: £15 million for two SAR Sea Kings, 1993, Norway

DESIGN FEATURES: Based on Sikorsky S-61/SH-3 airframe and rotor system; Rolls-Royce Gnome turboshaft engines, specialised equipment to UK requirements; composite rotor blades, new six-blade tail rotor for increased capability in side wind, unbraced tail stabiliser; increased fuel capacity Automatic main rotor blade folding and spreading is standard for shipboard operation the tail pylon can also be folded

FLYING CONTROLS: Mk 31 AFCS provides radio altitude displays for both pilots artificial horizon displays three-axis stabilisation in pilot controlled manoeuvres, attitude hold heading hold and height hold in cruising flight, controlled transition manoeuvres to and from the hover, automatic height control and plan position control in the hover, and an auxiliary trim facility

POWER PLANT: Two 1,238 kW (1 660 shp) (maximum contingency rating) Rolls-Royce Gnome H 1400-1T turboshafts, mounted side by side above cabin Transmission rating 2,013 kW (2 700 shp). Fuel in six underfloor bag tanks, total capacity 3,714 litres (981 US gallons, 817 Imp gallons). Internal auxiliary tank, capacity 863 litres (228 US gallons, 190 Imp gallons), may be fitted for long range ferry purposes. Pressure refuelling point on starboard side, two gravity points on port side Flat plate debris guard for engine air intakes Optional Centrisep air cleaner unit

ACCOMMODATION: Crew of four in ASW role accommodation for up to 22 survivors - or 18 if radar fitted - in SAR role, and up to 28 troops in utility role Alternative layouts for nine stretchers and two attendants, or 15 VIPs Two-section airstair door at front on port side, cargo door at rear on starboard side Entire accommodation heated and ventilated. Cockpit doors and windows, and two windows each side of cabin, can be jettisoned in an emergency

SYSTEMS: Three main hydraulic systems. Primary and auxiliary systems operate main rotor control System pressure 103 5 bars (1,500 lb/sq in), flow rate 22 7 litres/min at 87 9 bars (6 US gallons, 5 Imp gallons/min at 1,275 lb/sq in) Unpressurised reservoir. Utility system for main landing gear, sonar and rescue winches, blade folding and rotor brake. System pressure 207 bars (3,000 lb/sq in), flow rate 41 litres/min at 186.2 bars (10 8 US gallons, 9 Imp gallons/min at 2,700 lb/sq in). Unpressurised reservoir Electrical system includes two 20 kVA 200 V three-phase 400 Hz engine-driven generators, 26 V single phase AC supply fed from aircraft's 40 Ah Ni/Cd battery through an inverter, and DC power provided as secondary system from two 200 A transformer-rectifier units.

AVIONICS (ASW models): Fully integrated all-weather hunter/killer weapon system, capable of operating independently of surface vessels.

Comms. Radio equipment in HAS Mk 6 comprises GEC-Marconi AD 3400 UHF/VHF, AD 13304 UHF homer, Chelton 700 VHF homer, Ultra D 403M standby UHF, Collins 618T 3 HF radio, Racal B693 intercom,

Westland Sea King Mk 43B of the Royal Norwegian Air Force

1997

Telebrief system and Pilkington ARI 5954/2 I-band transponder GEC Plessey PTR 446 D-band transponder

Radar: Thomson Thorn Super Searcher radar in dorsal radome of Mk 6

Flight: Racal Doppler 71 navigation, Honeywell AN/APN-171 radar altimeter, BAe GM9B Gyrosyn compass system, Smiths-Newmark Mk 31 AFCS GPS installation due in 1997

Mission: Sea King HAS Mk 6 has GEC Marconi 2069 dipping sonar and associated AQS 902 processor (both of which being updated under July 1994 contract), GEC Plessey Type 195, Bendix/King AN/AQS-13B or Alcatel HS 312 optional on other versions Observer/navigator has GEC Marconi AQS-902G acoustic processing and display system on which sonar contacts are integrated with search radar and navigational information Racal Orange Reaper ESM CAE Electronics AN/ASQ-504(V) internal MAD ordered for RN Sea Kings in 1987 and fitted from 1988 onwards. Ericsson Radar Electronics AN/ALQ-167 Yellow Veil modular jamming equipment installed internally in Mk 5 from about 1986, retained in Mk 6

AVIONICS (non ASW models): Wide range of radio and navigation equipment installed, including VHF/UHF communications, VHF/UHF homing, radio compass, Doppler navigation system, radio altimeter VOR/ILS, radar and transponder, of Collins, GEC-Plessey, Honeywell and GEC Marconi manufacture

Radar: Thomson Thorn ARI5955 spine radar in most SAR versions (Bendix/King RDR 1500 optional) plus Bendix/King RDR-1300C nose radar for Norwegian Mk 43B

Flight: Honeywell compass system and Smiths-Newmark AFCS

EQUIPMENT: Two No. 4 marine markers, four No 2 Mk 2 smoke floats, Ultra Electronics mini-sonobuoys, in ASW versions Sea Kings equipped for search and rescue have Breeze BL 10300 variable speed hydraulic rescue hoist of 272 kg (600 lb) capacity mounted above starboard side cargo door Second electric hoist optional

ARMAMENT: Up to four Mk 46, Whitehead A244S or Sting Ray homing torpedoes, or four Mk 11 depth charges or one Clevite simulator, two BAe Sea Eagle or Aerospatiale Exocet anti-ship missiles For secondary role a mounting is provided on the rear frame of the starboard door for a general purpose machine gun

DIMENSIONS, EXTERNAL	
Main rotor diameter	18 90 m (62 ft 0 in)
Tail rotor diameter	3 16 m (10 ft 4 in)
Distance between rotor centres	11 10 m (36 ft 5 in)
Main rotor blade chord	0 46 m (1 ft 6¼ in)
Length	
overall, rotors turning	22 15 m (72 ft 8 in)
main rotor folded	17.42 m (57 ft 2 in)
rotors and tail folded	14 40 m (47 ft 3 in)
Height overall, rotors turning	5 13 m (16 ft 10 in)
rotors spread and stationary	4 85 m (15 ft 11 in)
to top of rotor head	4 72 m (15 ft 6 in)
Fuselage Length	17 02 m (55 ft 10 in)
Max width	2 16 m (7 ft 1 in)
Width overall, rotors folded	
with flotation bags	4 98 m (16 ft 4 in)
without flotation bags	4 77 m (15 ft 8 in)
Wheel track (c/l of shock absorbers)	3.96 m (13 ft 0 in)
Wheelbase	7 14 m (23 ft 5 in)
Cabin door (port) Height	1 68 m (5 ft 6 in)
Width	0 91 m (3 ft 0 in)
Cargo door (stbd) Height	1 52 m (5 ft 0 in)
Width	1 73 m (5 ft 8 in)
Height to sill	1 14 m (3 ft 9 in)
DIMENSIONS, INTERNAL	
Cabin Length	7 59 m (24 ft 11 in)
Max width	1 98 m (6 ft 6 in)
Max height	1 92 m (6 ft 3½ in)
Floor area (incl area occupied by radar, sonar and so on)	13 94 m² (150 sq ft)
Volume	28 03 m³ (990 cu ft)
AREAS	
Main rotor disc	280 6 m² (3,020 3 sq ft)
Tail rotor disc	7 8 m² (83 9 sq ft)

WEIGHTS AND LOADINGS (A anti-submarine, B, anti-surface vessel, C airborne early warning, D: SAR, E. troop transport, F external cargo, G VIP)

Basic weight with sponsons	5,447 kg (12,009 lb)
without sponsons	5 426 kg (11,963 lb)
Weight empty, equipped (typical): A	7,331 kg (16,163 lb)
B	7,625 kg (16 810 lb)
C	7 418 kg (16,353 lb)
D	6,082 kg (13,409 lb)
E, F	5,582 kg (12,308 lb)
G	6,998 kg (15,429 lb)
Max underslung or internal load	3 628 kg (8,000 lb)
Max T-O weight	9,752 kg (21,500 lb)
Max disc loading	34.75 kg/m² (7 12 lb/sq ft)
Max power loading	4 44 kg/kW (7 29 lb/shp)

PERFORMANCE (at max T-O weight, ISA)

Never exceed speed (V_{NE}, British practice) at S/L	122 kts (226 km/h 140 mph)
Cruising speed at S/L	110 kts (204 km/h, 126 mph)
Max rate of climb at S/L	564 m (1,850 ft)/min
Max vertical rate of climb at S/L	246 m (808 ft)/min

SEA KING/COMMANDO PRODUCTION

Variant	Customer	Qty	First aircraft	First flights	Operators
HAS Mk 1	Fleet Air Arm	56	XV642	7 May 1969 - May 1972	Converted to Mk 2
HAS Mk 2	Fleet Air Arm	21	XZ570	18 Jun 1976 - 13 Jul 1977 (13)	Converted to Mk 5
			XZ915	7 Feb 1979 - 24 Aug 1979 (8)	Converted to Mk 5
AEW Mk 2A	Fleet Air Arm	-	-	Conversions	849 Sqdn
HAR Mk 3	Royal Air Force	19	XZ585	6 Sep 1977 - 1 Dec 1978 (15)	22, 202 Sqdns
			ZA105	14 Aug 1980 (1)	
			ZE368	22 May 1985 - 21 Aug 1985 (3)	
HAR Mk 3A	Royal Air Force	6	ZH540	9 Feb 1995 -	
HC. Mk 4*	Fleet Air Arm	40	ZA290	26 Sep 1979 - 20 Sep 1982 (15)	772, 845, 846, 848 Sqdns
			ZD476	8 Dec 1983 - 9 Aug 1984 (8)	
			ZE425	10 Sep 1985 - 10 Dec 1985 (14)	
			ZG820	2 Jun 1990 - 18 Sep 1990 (3)	
Mk 4*	MoD(PE)	1	ZG829	10 Apr 1989	ETPS
Mk 4X*	MoD(PE)	2	ZB507	19 Jan 1982 - 19 Nov 1982	DRA
HAS Mk 5	Fleet Air Arm	30	ZA126	26 Aug 1980 - 2 Sep 1982 (17)	See text
			ZD630	9 Aug 1984 - 23 Apr 1985 (8)	
			ZE418	Jan 1986 - Jul 1986 (5)	
HAR. Mk 5	Fleet Air Arm	-	-	Conversions	771 Sqdn
AEW. Mk 5	Fleet Air Arm	-		Conversions	849 Sqdn
HAS Mk 6	Fleet Air Arm	5	ZG816	7 Dec 1989 - 27 Jun 1990	See text
Mk 41	German Navy	22	8950	6 Mar 1972 - 21 Aug 1974 (21)	1/MFG 5
				Jul 1975 (1)	1/MFG 5
Mk 42	Indian Navy	12	IN501	1971 - 23 Jul 1971 (6)	INAS 330, 336
			IN507	17 Jul 1973 - 4 May 1974 (6)	INAS 330, 336
Mk 42A	Indian Navy	3	IN551	23 Nov 1979 - 12 Feb 1980	INAS 330, 336
Mk 42B	Indian Navy	20	IN513	17 May 1985 - 11 Apr 1990	INAS 339
Mk 42C*	Indian Navy	6	IN555	25 Sep 1986 - 5 Jan 1988	INAS 330, 336
Mk 43	Norwegian Air Force	10	060	19 May 1972 - 30 Sep 1972	Skv 330
Mk 43A	Norwegian Air Force	1	189	6 Jul 1978	Skv 330
Mk 43B	Norwegian Air Force	3	322	28 Jul 1992 - 1995	Skv 330
Mk 45	Pakistani Navy	6	4510	30 Aug 1974 - 10 Dec 1974	111 Sqdn
Mk 45A	Pakistani Navy	-	-	Conversion	111 Sqdn
Mk 47	Egyptian Navy	6		11 Jul 1975 - 5 Nov 1975	(Alexandria)
Mk 48	Belgian Air Force	5	RS-01	19 Dec 1975 - 1976	40 Sqdn
Mk 50	Australian Navy	10	N6-098	30 Jun 1974 - Apr 1975	HS 817
Mk 50A	Australian Navy	2	N6-238	7 Dec 1982 - 9 Feb 1983	HS 817
Mk 1*	Egyptian Air Force	5		12 Sep 1973 - 29 Sep 1973	
Mk 2*	Egyptian Air Force	17	1	16 Jan 1975 - 27 Jan 1976	
Mk 2A*	Qatari Air Force	3	QA-20	9 Aug 1975 - 16 Mar 1976	8 Sqdn
Mk 2B*	Egyptian Air Force	2	725	13 Mar 1975 - 25 Jul 1975	
Mk 2C*	Qatari Air Force	1	QA-21	9 Oct 1975	8 Sqdn
Mk 2E*	Egyptian Air Force	4	SU-BBJ	1 Sep 1978 - 4 Dec 1978	
Mk 3*	Qatari Air Force	8	QA-30	14 Jun 1982 - 5 Oct 1983	9 Sqdn
Mk 41/42B	Destroyed predelivery	2			
Total		**328**			

* Commando variant

Service ceiling, OEI 1,220 m (4,000 ft)
Max contingency ceiling (1 h rating)
1,067 m (3,500 ft)
Hovering ceiling: IGE 1,705 m (5,600 ft)
OGE 1,065 m (3,500 ft)
Radius of action:
A (2 h on station, incl three torpedoes)
125 n miles (231 km; 144 miles)
B (2 h on station, incl two Sea Eagles)
110 n miles (204 km; 126 miles)
C (2 h 24 min on station)
100 n miles (185 km; 115 miles)
D (picking up 20 survivors)
220 n miles (407 km; 253 miles)
E (28 troops) range 300 n miles (556 km; 345 miles)
F (1,814 kg, 4,000 lb external load)
225 n miles (417 km; 259 miles)
G 580 n miles (1,075 km; 668 miles)
Range with max standard fuel, at 1,830 m (6,000 ft)
800 n miles (1,482 km; 921 miles)
Ferry range with max standard and auxiliary fuel, at 1,830 m (6,000 ft)
940 n miles (1,742 km; 1,082 miles)

PERFORMANCE (at typical mid-mission weight):
Never-exceed speed (VNE, British practice) at S/L
146 kts (272 km/h; 169 mph)
Cruising speed at S/L 132 kts (245 km/h; 152 mph)

UPDATED

WESTLAND LYNX

TYPE: Twin-engined multipurpose helicopter

PROGRAMME: Developed within Anglo-French helicopter agreement confirmed 2 April 1968, Westland given design leadership; first flight of first of 13 prototypes (XW835) 21 March 1971, first flight of fourth prototype (XW838) 9 March 1972, featuring production type monobloc rotor head; first flights of British Army Lynx prototype (XX153) 12 April 1972, French Navy prototype (XX904) 6 July 1973, production Lynx (RN HAS Mk 2 XZ229) 20 February 1976; first RN operational unit (No. 702 Squadron) formed on completion of intensive flight trials December 1977; AH. Mk 5 first flew (ZE375) 23 February 1985; other development details and records in 1975-76 and subsequent *Jane's*. Production shared 70 per cent Westland, 30 per cent Aerospatiale; for details of G-LYNX's 1986 world helicopter absolute speed record, and Lynx AH. Mk 7 XZ170's 1989 agility trials, see 1990-91 *Jane's*.

CURRENT VERSIONS: **Lynx AH Mk 1:** British Army general purpose and utility version, 113 built and most converted to Mk 7 (see below). Described in 1986-87 and earlier *Jane's*.

Lynx HAS. Mk 3: Second Royal Navy version for advanced shipborne anti-submarine and other duties, similar to Mk 2, with GEC-Marconi Seaspray search and tracking radar in modified nose, capable of anti-submarine classification and strike, air to surface vessel search and strike, SAR, reconnaissance, troop transport, fire support, communications and fleet liaison, and vertrep; can carry Sea Skua. Mk 2's Gem 2 engines replaced by two 835 kW (1,120 shp) Gem 41-1 engines; 23 delivered March 1982 to April 1985; seven more in **HAS. Mk 3S** configuration (first flight, ZF557, 12 October 1987) delivered November 1987 to November 1988; this version has two GEC-Marconi AD3400 UHF radios with secure speech facility; additionally, ZD560 built in approximately Mk 7 configuration, delivered to Empire Test Pilots' School April 1988, further 53 obtained through modification of all existing HAS Mk 2s by 1989. **Lynx HAS Mk 3ICE** is Mk 3 lacking some operational equipment for general duties aboard Antarctic survey vessel, HMS *Endurance*; two converted.

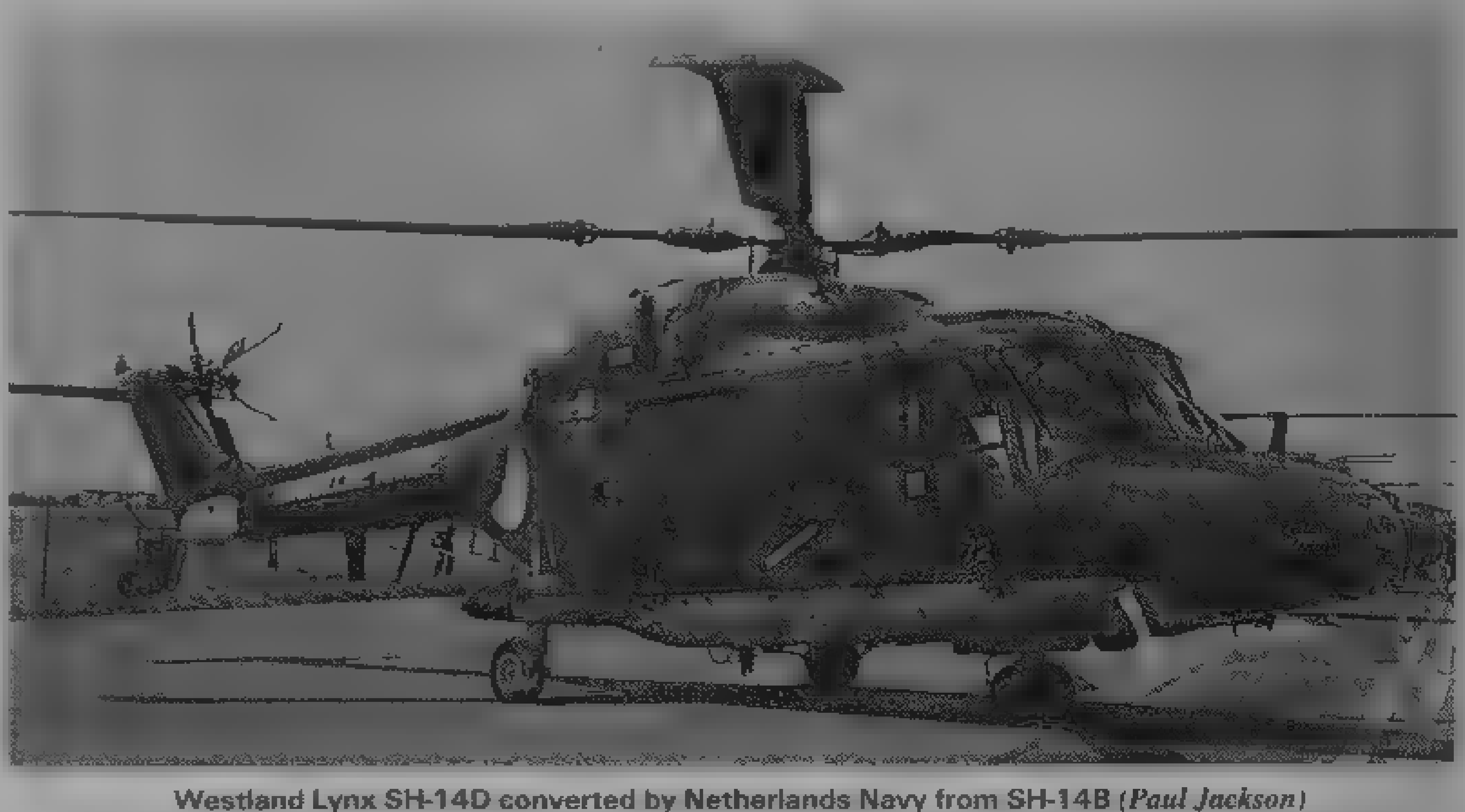
Main RN operators, Nos 815 and 829 Squadrons, combined on 26 March 1993 as No. 815 Squadron. Those used by Armilla Patrol in Arabian Gulf modified to **HAS Mk 3GM** (Gulf Mod), with better cooling, or **HAS Mk 3S/GM**, also with Mk 3S modifications (to which standard all 3GMs being converted). Augmenting new-build Mk 3Ss, 36 modified by RN Aircraft Yard at Fleetlands from April 1989; Mk 3S is Phase 1 of Mk 8 conversion programme, involving GEC-Marconi AD 3400 secure speech radios (blade aerial beneath mid point of tail boom) and upgraded ESM; programme continues, including Mk 3S/GM. Phase 2 is Lynx **HAS. Mk 3CTS**, adding RAMS 4000 central tactical system; prototype (XZ236 ex Mk 3) flew 25 January 1989; further six for RN trials (one ex-Mk 3, five ex Mk 3S), deliveries to Operational Flight Trials Unit, Portland, from April 1989; unit became No. 700L Squadron 6 July 1990 with three Lynx; remaining three deployed to destroyers and frigates at sea from 3 December 1990 (HMS *Newcastle*); CTS service clearance granted August 1991; Mk 3CTS has flotation bag each side of nose. RN Lynx status January 1995: nine Mk 3, three Mk 3GM, 36 Mk 3S, seven Mk 3CTS, 14 Mk 3S/GM, two Mk 3ICE and seven Mk 8. (Excludes two Mk 3S sold to Portugal as Mk 95s in 1993 and two Mk 3s sold to Pakistan in August 1994, with one more to follow in 1995.)

Lynx AH Mk 7: Uprated British Army version, meeting GSR 3947, with improved systems, reversed-direction tail rotor with improved composite blades to reduce noise and enhance extended period hover at high weights, 4,876 kg (10,750 lb) AUW; 13 ordered, eight from Mk 5 contract (two cancelled); first flight (ZE376) 7 November 1985, 11th delivered July 1987.

RN workshops at Fleetlands converted Mk 1s to Mk 7s, first (XZ641) redelivered 30 March 1988; box-type exhaust diffusers added from early 1989; last conversion mid-1994; 104 ex-Mk 1s in service at January 1995. Interim version was Lynx **AH. Mk 1GT** with uprated engines and rotors, but lacking Mk 7's improved electronic systems; first conversion (XZ195) 1991. GEC-Marconi AWARE-3 radar warning receiver selected 1989 for retrofit, designated ARI23491 Rewarder; Mk 1 XZ668 to Westland for trial installation 22 November 1991. (GEC-Marconi Sky Guardian Mk 13 installed in some Lynx AH Mk 7s for Gulf War, 1990-91, later uprated to Mk 15.) BERP (extended tip chord) blades retrofitted to Mk 7 from 1993.

Lynx HAS. Mk 8: For RN, equivalent to export **Super Lynx** (see separate entry); passive identification system, engines uprated to Gem 42 Srs 200 (686 kW; 920 shp), 5,125 kg (11,300 lb) maximum T-O weight (although increase planned to 5,334 kg; 11,760 lb), improved (reversed-direction) tail rotor control, BERP composite main rotor blades, Racal RAMS 4000 central tactical system (CTS eases crew's workload by centrally processing sensor data and presents mission information on multifunction CRT display; 15 systems ordered 1987, 106 September 1989), original Seaspray Mk 1 radar repositioned in new chin radome, GEC-Marconi Sea Owl thermal imager (×5 or ×30 magnifying system on gimballed mount, with elevation +20 to −30° and azimuth +120 to −120°, ordered October 1989) in former radar position, MIR-2 ESM updated; three Mk 3s used in development programme as tactical system (XZ236), dummy Sea Owl/chin radome (ZD267) and avionics (ZD266) testbeds; see Lynx Mk 3 for Phases 1 and 2 of Lynx Mk 8 programme.

Definitive Mk 8 (Phase 3) conversions begun 1992 with addition of Sea Owl, further radar and navigation



Westland Lynx SH-14D converted by Netherlands Navy from SH-14B *(Paul Jackson)*

1995

LYNX PRODUCTION

Variant	Customer	Qty	First aircraft	First flights	Operators
AH Mk 1	Army Air Corps	113*	XZ170	11 Feb 1977 - 24 Jan 1984	Note A
HAS Mk 2	Fleet Air Arm	60	XZ227	20 Feb 1976 - 26 May 1981	Converted to Mk 3
HAS. Mk 2(FN)	French Navy	26	260	4 May 1977 - 5 Sep 1979	31F, 34F, 20S
HAS Mk 3	Fleet Air Arm	31	ZD249	4 Jan 1982 - 21 Oct 1988	815, 702 Sqdns
HAS Mk 4(FN)	French Navy	14	801	1 Apr 1982 - 26 Aug 1983	31F, 34F, 20S
Mk 5	MoD(PE)	3*	ZD285	21 Nov 1984 - 23 Feb 1985	DRA
AH Mk 6	Royal Marines			None built	-
AH Mk 7	Army Air Corps	11*	ZE376	23 Apr 1985 - 5 Jun 1987	Note A
HAS. Mk 8	Fleet Air Arm			Conversions	
AH. Mk 9	Army Air Corps	16*†	ZG884	20 Jul 1990 - 21 Jun 1992	653, 669 Sqdns
Mk 21	Brazilian Navy	9	N3020	30 Sep 1977 - 14 Apr 1978	1° EHA, six for upgrade
Mk 21A	Brazilian Navy	9†		1996	On order
Mk 22	Egyptian Navy			None built	-
Mk 23	Argentine Navy	2	0734	17 May 1978 - 23 Jun 1978	Withdrawn from service
Mk 24	Iraqi Army			None built	
Mk 25	Netherlands Navy	6	260	23 Aug 1976 - 16 Sep 1977	7 Sqdn
Mk 26	Iraqi Army (armed)			None built	
Mk 27[2]	Netherlands Navy	10	266	6 Oct 1978 - 12 Nov 1979	860 Sqdn
Mk 28	Qatari Police	3*	QP 31	2 Dec 1977 - 12 Apr 1978	Withdrawn from service
Mk 80	Danish Navy	8	S-134	3 Feb 1980 - 15 Sep 1981	Søvårnets Flyvetjåneste
Mk 81[3]	Netherlands Navy	8	276	9 Jul 1980 - 24 Mar 1981	860 Sqdn
Mk 82	Egyptian Army			None built	
Mk 83	Saudi Army			None built	
Mk 84	Qatari Army			None built	
Mk 85	UAE Army			None built	-
Mk 86	Norwegian Coast Guard	6	207	23 Jan 1981 - 11 Sep 1981	Skv 337
Mk 87	Argentine Navy			Embargoed	
Mk 88	German Navy	19	8301	26 May 1981 - 10 Dec 1988	3/MFG 3
Mk 89	Nigerian Navy	3	01-F89	29 Sep 1983 - 14 Mar 1984	101 Sqdn
Mk 90[4]	Danish Navy	1	S-256	19 Apr 1988[6]	Søvårnets Flyvetjåneste
Mk 95[5]	Portuguese Navy	3†	9203	1993-1993	EHM[8]
Mk 99	South Korean Navy	12†	90-0701	16 Nov 1989 - 14 May 1991	627 Sqdn
Subtotal		**373**			
Lynx 3		1	ZE477	14 Jun 1984	
Demonstrator		2	G-LYNX	18 May 1979 - 29 Mar 1982	
Prototypes		13	XW835	21 Mar 1971 - 5 Mar 1975	
Total		**389**			

Notes

Note A: Army Air Corps 651, 652, 654, 655, 656, 657, 659, 661, 662, 663, 664, 665, 667 and 671 Squadrons; 847 Squadron (Royal Marine Commando)

[1] Netherlands designation UH-14A, all to SH-14D

[2] Netherlands designation SH-14B, all to SH-14D

[3] Netherlands designation SH-14C, all to SH-14D

[4] Plus one conversion from demonstrator, others from Mk 80

[5] Plus two conversions from Mk 3

[6] Completion and first flight at Vaerløse, Denmark

[7] Sold

[8] Esquadrilha de Helicopteros de Marinha

* Army version

† Super/Battlefield Lynx

upgrades, (including Racal RNS252 'Super TANS' with associated TNL8000 GPS), composites BERP main rotor blades and reversed direction tail rotor (internal MAD not adopted for economy reasons).

Conversion planned of 45 Mks 3/3S/3CTS to Mk 8, contract award to Westland, May 1992 for first seven conversions; initial delivery (XZ732) in July 1994 to Operational Evaluation Unit within 815 Squadron at Portland, four received by January 1995. Others for conversion by RN at Fleetlands, first Westland-produced conversion kit for RN delivered in early 1995, initial contract covers 18 kits, conversions to be completed by 2001.

Lynx AH. Mk 9: UK Army Air Corps equivalent of export **Battlefield Lynx** (see separate entry); tricycle wheel landing gear; maximum T-O weight 5,125 kg (11,300 lb); advanced technology composites main rotor blades, exhaust diffusers, no TOW capability, first flight of prototype (converted company demonstrator XZ170) 29 November 1989; 16 new aircraft (beginning ZG884, flown 20 July 1990) ordered for delivery from 1991, plus eight Mk 7 conversions (contract awarded November 1991), for support of 24th Airmobile Brigade, five outfitted as advanced command posts (with two secure radios and Tacan), remainder for tactical transport role. Deliveries to A&AEE Boscombe Down from 22 May 1991 (ZG884), to No. 672 Squadron from 19 December 1991 (ZG889), No. 664 Squadron from June 1992; final aircraft (ZG923) flown 30 June 1992; first 'production' conversion (ZF538) to Westland for modifications 3 February 1992, all Mk 9s reassigned to 653 and 659 Squadrons in late 1993.

Other versions and operators where orders completed, see 1990-91 *Jane's*.

CUSTOMERS: Production totalled 367 by January 1994 (including two demonstrators but not 13 prototypes); no deliveries in 1994, further nine ordered by Brazil late 1993, together with six upgrades of Mk 21s, (first for upgrade, N3027, arrived at Yeovil on 1 February 1995) these and any further orders to be Super Lynx/Battlefield Lynx standard; production details in table.

COSTS: £3.5 million (1991) to upgrade eight Mk 7s to Mk 9s. £20 million (1992) to convert seven Mk 3s to Mk 8s, £150 million for nine new Lynx and five upgrades, 1993 (Brazil).

Following description applies to military general purpose and naval versions with Gem 2 engines, except where indicated:

DESIGN FEATURES: Compact design suited to hunter-killer ASW and missile-armed anti-ship naval roles from frigates or larger ships (superseding ship-guided helicopters), armed/unarmed land roles with cabin large enough for squad, or other tasks, manually folding tail pylon on naval versions, single four-blade semi-rigid main rotor (foldable), each blade attached to main rotor hub by titanium root plates and flexible arm, rotor drives taken from front of engines into main gearbox mounted above cabin ahead of engines; in flight, accessory gears (at front of main gearbox) driven by one of two through shafts from first stage reduction gears; four-blade tail rotor, drive taken from main ring gear, single large window in each main cabin sliding door, provision for internally mounted armament, and for exterior universal flange mounting each side for other weapons/stores.

FLYING CONTROLS: Rotor head controls actuated by three identical tandem servojacks and powered by two independent hydraulic systems, control system incorporates simple stability augmentation system; each engine embodies independent control system providing full authority rotor speed governing, pilot control being limited to selection of desired rotor speed range; in event of one engine failure system restores power up to single-engine maximum contingency rating, main rotor can provide negative thrust to increase stability on deck after touchdown on naval versions, hydraulically operated rotor brake mounted on main gearbox, sweptback fin/tail rotor pylon, with starboard half-tailplane.

STRUCTURE: Conventional semi-monocoque pod and boom, mainly light alloy; glassfibre access panels, doors, fairings, pylon leading/trailing-edges, and bullet fairing over tail rotor gearbox, composites main rotor blades, main rotor hub and inboard flexible arm portions built as complete unit, as titanium monobloc forging, tail rotor blades have light alloy spar, stainless steel leading-edge sheath and rear section as for main blades.

LANDING GEAR (general purpose military version): Non-retractable tubular skid type. Provision for a pair of adjustable ground handling wheels on each skid. Flotation gear optional.

LANDING GEAR (naval versions): Non-retractable oleo-pneumatic tricycle type. Single-wheel main units, carried on sponsons, fixed at 27° toe-out for deck landing; can be manually turned into line and locked fore and aft for movement of aircraft into and out of ship's hangar. Twin-wheel nose unit steered hydraulically through 90° by the pilot to facilitate independent take-off into wind. Sprag brakes (wheel locks) fitted to each wheel prevent rotation on landing or inadvertent deck roll. These locks disengaged hydraulically and re-engage automatically in event of hydraulic failure. Maximum vertical descent 2.29 m (7½ ft)/s, with lateral drift 0.91 m (3 ft)/s for deck landing. Flotation gear, and hydraulically actuated harpoon deck lock securing system, optional.

POWER PLANT: Two Rolls-Royce Gem 2 turboshafts, each with maximum contingency rating of 671 kW (900 shp) in Lynx AH. 1, HAS. 2 and early export variants. Later versions have Gem 41-1, 41-2, or 42-1 engines, all with maximum contingency rating of 835 kW (1,120 shp). Transmission rating 1,372 kW (1,840 shp). Engines of British and French Lynx in service converted to Mk 42 standard during regular overhauls from 1987 onwards. Danish, Netherlands and Norwegian Lynx similarly retrofitted. Fuel in five internal tanks; usable capacity 957 litres (253 US gallons; 210 Imp gallons) when gravity-refuelled, 985 litres (260 US gallons, 217 Imp gallons) when pressure-refuelled. For ferrying, two tanks each of 441 litres (116 US gallons, 97 Imp gallons) in cabin, replacing bench tank. Maximum usable fuel 1 867 litres (493 US gallons, 411 Imp gallons). Engine oil tank capacity 6.8 litres (1.8 US gallons, 1.5 Imp gallons). Main rotor gearbox oil capacity 28 litres (7.4 US gallons, 6.2 Imp gallons).

ACCOMMODATION: Pilot and co-pilot or observer on side by side seats. Dual controls optional. Individual forward-hinged cockpit door and large rearward-sliding cabin door on each side; cockpit doors jettisonable, windows of cabin doors also jettisonable. Cockpit accessible from cabin area. Maximum high density layout (military version) for one pilot and 10 armed troops or paratroops, on lightweight bench seats in soundproofed cabin. Alternative VIP layouts for four to seven passengers, with additional cabin soundproofing. Seats can be removed quickly to permit

Westland Lynx HAS. Mk 8 with Sea Owl thermal imager and chin radome

664 Squadron Westland Lynx AH Mk 7 conversion from Mk 1 after further modification with BERP main rotors *(Paul Jackson)*

1994

carriage of up to 907 kg (2,000 lb) of freight internally. Tiedown rings provided. In casualty evacuation role, with a crew of two, Lynx can accommodate up to six Alphin stretchers and a medical attendant. Both basic versions have secondary capability for search and rescue (up to nine survivors) and other roles.

SYSTEMS: Two independent hydraulic systems, pressure 141 bars (2,050 lb/sq in). Third hydraulic system provided in naval version when sonar equipment, MAD or hydraulic winch system installed. No pneumatic system. 28 V DC electrical power supplied by two 6 kW engine-driven starter generators and an alternator. External power sockets. 24 V 23 Ah (optionally 40 Ah) Ni/Cd battery fitted for essential services and emergency engine starting. 200 V three-phase AC power available at 400 Hz from two 15 kVA transmission driven alternators. Cabin heating and ventilation system. Optional supplementary cockpit heating system. Electric anti-icing and demisting of windscreen, and electrically operated windscreen wipers standard; windscreen washing system.

AVIONICS (general): Avionics common to all roles (general purpose and naval versions):

Comms: Collins VOR/ILS, DME, Collins AN/ARN-118 Tacan, I-band transponder (naval version only). GEC-Plessey PTR 446, Collins APX 72, Siemens STR 700/375 or Italtel APX 77 IFF.

Flight: GEC-Marconi duplex three-axis automatic stabilisation equipment, BAe GM9 Gyrosyn compass system, Decca tactical air navigation system (TANS), Decca 71 Doppler. E2C standby compass. GEC-Marconi Mk 34 AFCS. Additional units fitted in naval version when sonar is installed, to provide automatic transition to hover and automatic Doppler hold in hover.

AVIONICS (Army): *Mission:* British Army Lynx equipped with TOW missiles have roof-mounted Hughes sight manufactured under licence by British Aerospace. Roof sight upgraded with night vision capability in far infra-red waveband; first test firing of TOW with added GEC Marconi thermal imager took place in October 1988. Optional equipment, according to role, can include lightweight sighting system with alternative target magnification, vertical and/or oblique cameras, flares for night operation, low-light level TV, infra-red linescan, searchlight, and specialised communications equipment. Some have infra-red formation flying lights and provision for crew's NVGs. For surveillance, some AAC Lynx carry Chancellor Heli-tele in external (port) ball housing, complete with datalink.

Self-defence: Sanders AN/ALQ-144 infra-red jammer installed beneath tailboom of some British Army Lynx from 1987, later augmented by exhaust diffusers. Requirement for RWR satisfied by 1989 selection of GEC Marconi AWARE-3 (ARI23491) system. GEC Marconi Sky Guardian Mk 13 (later Mk 15) on some aircraft from 1990.

AVIONICS (Navy): *Comms:* RN helicopters have two GEC Marconi AD 3400 VHF/UHF transceivers, Dowty D403M standby UHF radio, Collins 718U-5 HF transceiver, Plessey PTR446 D-band transponder and Pilkington ARI 5983 I-band transponder.

Radar: GEC-Marconi ARI5979 Seaspray Mk 1 lightweight search and tracking radar, for detecting small surface targets in low visibility/high sea conditions.

Flight: GPS on Royal Navy Lynx from 1991.

Mission: Detection of submarines by dipping sonars or magnetic anomaly detector. Dipping sonars operated by hydraulically powered winch and cable hover mode facilities within the AFCS. Racal MIR-2 Orange Crop passive radar detection system in RN Lynx; similar Racal Kestrel retrofitted to Danish Mk 90. CAE Electronics AN/ASQ-504(V) internal MAD ordered for RN Lynx in 1990. Matra AF 530 or APX 334 stabilised sight in French naval Lynx. Optional GEC Sandpiper FLIR on RN Lynx. FLIR Systems 2000HP specified for Netherlands SH-14D upgrade; FLIR Systems Safire optional for Danish Lynx.

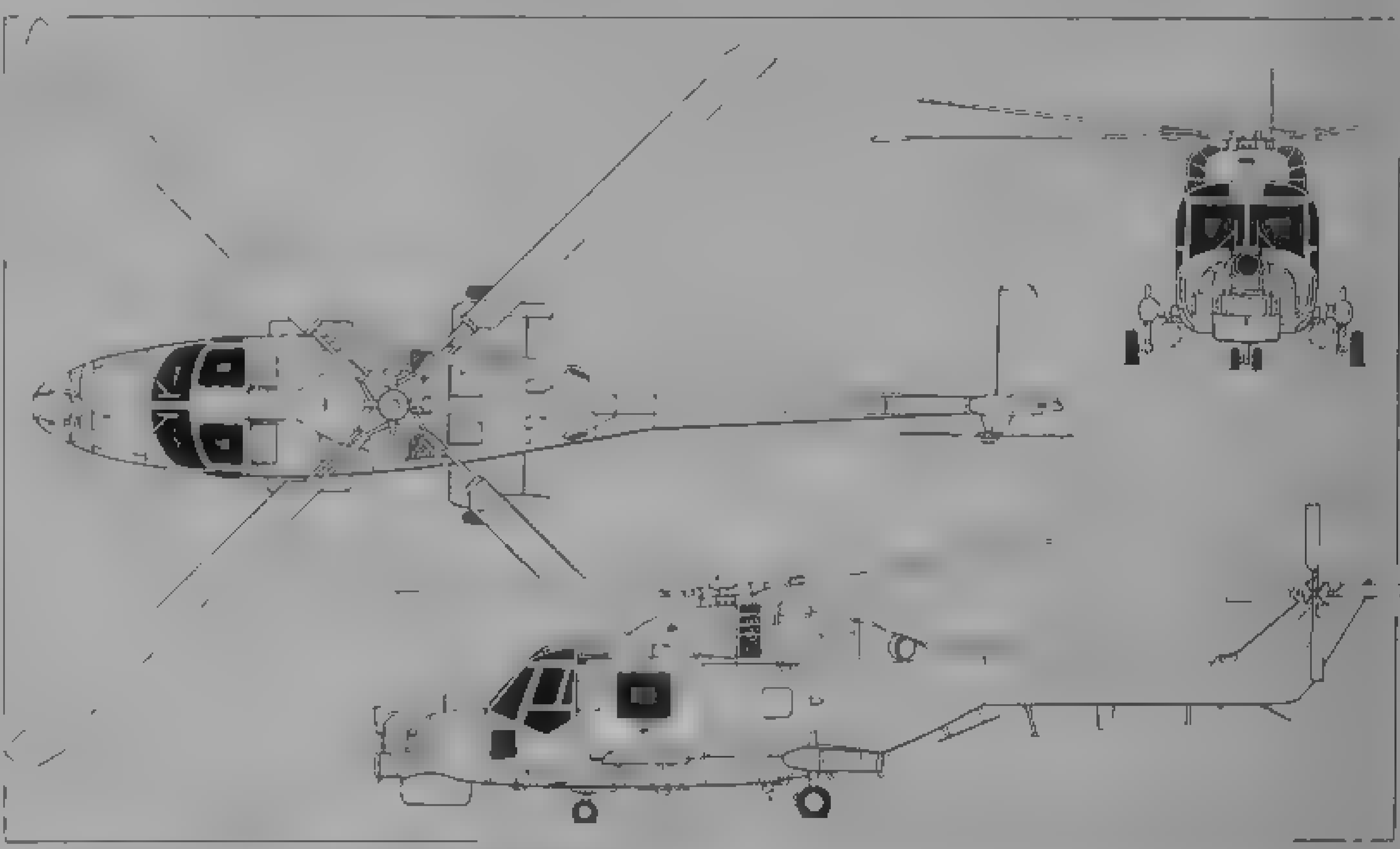
Self-defence: Tracor M-130 chaff/flare dispensers and Ericsson Radar Electronics AN/ALQ-167(V) D- to J-band anti-ship missile jamming pods installed on RN Lynx patrolling Arabian Gulf 1987. Two Loral Challenger IR jammers above cockpit of RN Lynx during 1991 Gulf War.

EQUIPMENT: All versions equipped as standard with navigation, cabin and cockpit lights, adjustable landing light under nose and anti-collision beacon. For search and rescue, with three crew, both versions can have a waterproof floor and a 272 kg (600 lb) capacity clip-on hydraulic hoist on starboard side of cabin. Cable length 30 m (98 ft).

ARMAMENT: For armed escort, anti-tank or air-to-surface strike missions, army version can be equipped with two 20 mm cannon mounted externally so as to permit carriage also of anti-tank missiles or pintle-mounted 7.62 mm machine gun inside cabin. External pylon can be fitted on each side of cabin for variety of stores, including two Minigun or other self-contained gun pods; two rocket pods, or up to eight HOT, Hellfire, TOW, or similar air-to-surface missiles. Additional six or eight missiles carried in cabin. For ASW role, armament includes two Mk 44, Mk 46, A244S or Sting Ray homing torpedoes, one each on an external pylon on each side of fuselage, and six marine markers, or two Mk 11 depth charges. Alternatively, up to four Sea Skua semi-active homing missiles; on French Navy Lynx, four AS 12 or similar wire-guided missiles. Self-protection FN HMP 0.50 in machine gun pod optional on RN Lynx.

DIMENSIONS, EXTERNAL (A: military version, N: naval version):

Main rotor diameter (A, N)	12.80 m (42 ft 0 in)
Tail rotor diameter (A, N)	2.21 m (7 ft 3 in)
Length overall:	
A, N, both rotors turning	15.165 m (49 ft 9 in)
N, main rotor blades and tail folded	10.62 m (34 ft 10 in)



Westland Lynx HAS Mk 8, based on the Super Lynx advanced export version *(Jane's/Dennis Punnett)*

1987

Westland Lynx AH Mk 9s of the Army Air Corps

1995

Westland Lynx HAS. Mk 3CTS (rear) with BERP blades and HAS Mk 3GM of Royal Navy *(Paul Jackson)*
1995

Width overall, main rotor blades folded
  A 3.75 m (12 ft 3⅝ in)
  N 2.94 m (9 ft 7¾ in)
Height overall, both rotors stopped
  A 3.505 m (11 ft 6 in)
  N 3.48 m (11 ft 5 in)
 main rotor blades and tail folded
  N 3.20 m (10 ft 6 in)
Tailplane half-span 1.78 m (5 ft 10 in)
Skid track: A 2.032 m (6 ft 8 in)
Wheel track: N 2.78 m (9 ft 1½ in)
Wheelbase: N 2.94 m (9 ft 7¾ in)
DIMENSIONS, INTERNAL:
Cabin, from back of pilots' seats
  Min length 2.057 m (6 ft 9 in)
  Max width 1.778 m (5 ft 10 in)
  Max height 1.42 m (4 ft 8 in)
  Floor area 3.72 m² (40.04 sq ft)
  Volume 5.21 m³ (184 cu ft)
 Cabin doorway: Width 1.37 m (4 ft 6 in)
  Height 1.19 m (3 ft 11 in)
AREAS:
 Main rotor disc 128.7 m² (1,385.4 sq ft)
 Tail rotor disc 3.84 m² (41.28 sq ft)
WEIGHTS AND LOADINGS (A and N as above):
 Manufacturer's empty weight: A 2,578 kg (5,683 lb)
  N 2,740 kg (6,040 lb)
 Manufacturer's basic weight: A 2,658 kg (5,860 lb)
  N 3,030 kg (6,680 lb)
 Operating weight empty, equipped
  A, troop transport (pilot and 10 troops)
   2,787 kg (6,144 lb)
  A, anti-tank strike (incl weapon pylons, firing equipment and sight) 3,072 kg (6,772 lb)
  A, search and rescue (crew of three)
   2,963 kg (6,532 lb)
  N, anti-submarine strike 3,343 kg (7,370 lb)
  N, reconnaissance (crew of two) 3,277 kg (7,224 lb)
  N, anti-submarine classification and strike
   3,472 kg (7,654 lb)
  N, air to surface vessel search and strike (crew of two and four Sea Skuas) 3,414 kg (7,526 lb)
  N, search and rescue (crew of three)
   3,416 kg (7,531 lb)
  N, dunking sonar search and strike
   3,650 kg (8,047 lb)
 Max T-O weight: A 4,535 kg (10,000 lb)
  N (Gem Mk 41) 4,763 kg (10,500 lb)
  N (Gem Mk 42) 4,876 kg (10,750 lb)
 Max disc loading: A 35.24 kg/m² (7.22 lb/sq ft)
  N (Gem Mk 41) 37.00 kg/m² (7.58 lb/sq ft)
  N (Gem Mk 42) 37.88 kg/m² (7.76 lb/sq ft)
 Max power loading: A 3.31 kg/kW (5.43 lb/shp)
  N (Gem Mk 41) 3.47 kg/kW (5.71 lb/shp)
  N (Gem Mk 42) 3.55 kg/kW (5.84 lb/shp)
PERFORMANCE (at normal max T-O weight at S/L, ISA, except where indicated, A and N as above):
 Max continuous cruising speed
  A 140 kts (259 km/h, 161 mph)
  N 125 kts (232 km/h; 144 mph)
  A (ISA + 20°C) 130 kts (241 km/h, 150 mph)
  N (ISA + 20°C) 114 kts (211 km/h, 131 mph)
 Speed for max endurance
  A, N (ISA and ISA + 20°C)
   70 kts (130 km/h, 81 mph)
 Max forward rate of climb: A 756 m (2,480 ft)/min
  N 661 m (2,170 ft)/min
  A (ISA + 20°C) 536 m (1,760 ft)/min
  N (ISA + 20°C) 469 m (1,540 ft)/min
 Max vertical rate of climb
  A 472 m (1,550 ft)/min
  N 351 m (1,150 ft)/min
  A (ISA + 20°C) 390 m (1,280 ft)/min
  N (ISA + 20°C) 244 m (800 ft)/min
 Hovering ceiling OGE: A 3,230 m (10,600 ft)
  N 2,575 m (8,450 ft)
 Typical range, with reserves
  A, troop transport 292 n miles (540 km, 336 miles)
 Radius of action, out and back at max sustained speed, allowances for T-O and landing, 30 min loiter in search area, 3 min hover for each survivor, and 10% fuel reserves at end of mission
  N, search and rescue (crew of three and two survivors)
   115 n miles (212 km, 132 miles)
  N, search and rescue (crew of three and seven survivors)
   96 n miles (178 km, 111 miles)
 Time on station at 50 n miles (93 km, 58 miles) radius, out and back at max sustained speed, with two torpedoes, smoke floats and marine markers, allowances for T-O and landing and 10% fuel reserves at end of mission
  N, anti-submarine classification and strike, loiter speed on station 2 h
  N, anti-submarine strike, loiter on station 2 h 29 min
  N, dunking sonar search and strike, 50% loiter speed and 50% hover on station 1 h 5 min
 Time on station at 50 n miles (93 km, 58 miles) radius, out and back at max sustained speed, with crew of two and four Sea Skuas, allowances and reserves as above:
  N, air-to-surface vessel strike, en route radar search and loiter speed on station 1 h 36 min
 Max range: A 340 n miles (630 km, 392 miles)
  N 320 n miles (593 km, 368 miles)
 Max endurance: A 2 h 57 min
  N (ISA + 20°C) 2 h 50 min
 Max ferry range with auxiliary cabin tanks
  A 724 n miles (1,342 km, 834 miles)
  N 565 n miles (1,046 km, 650 miles)

UPDATED

AN/ALQ-144 IR jammer 'lantern' and dome antenna for AWARE 3 RWR on Lynx AH. Mk 7 *(Paul Jackson)*
1994

Army Air Corps Westland Lynx: three AH. Mk 7s and four AH. Mk 9s, plus two Gazelles *(Paul Jackson)*
1995

WESTLAND SUPER LYNX and BATTLEFIELD LYNX

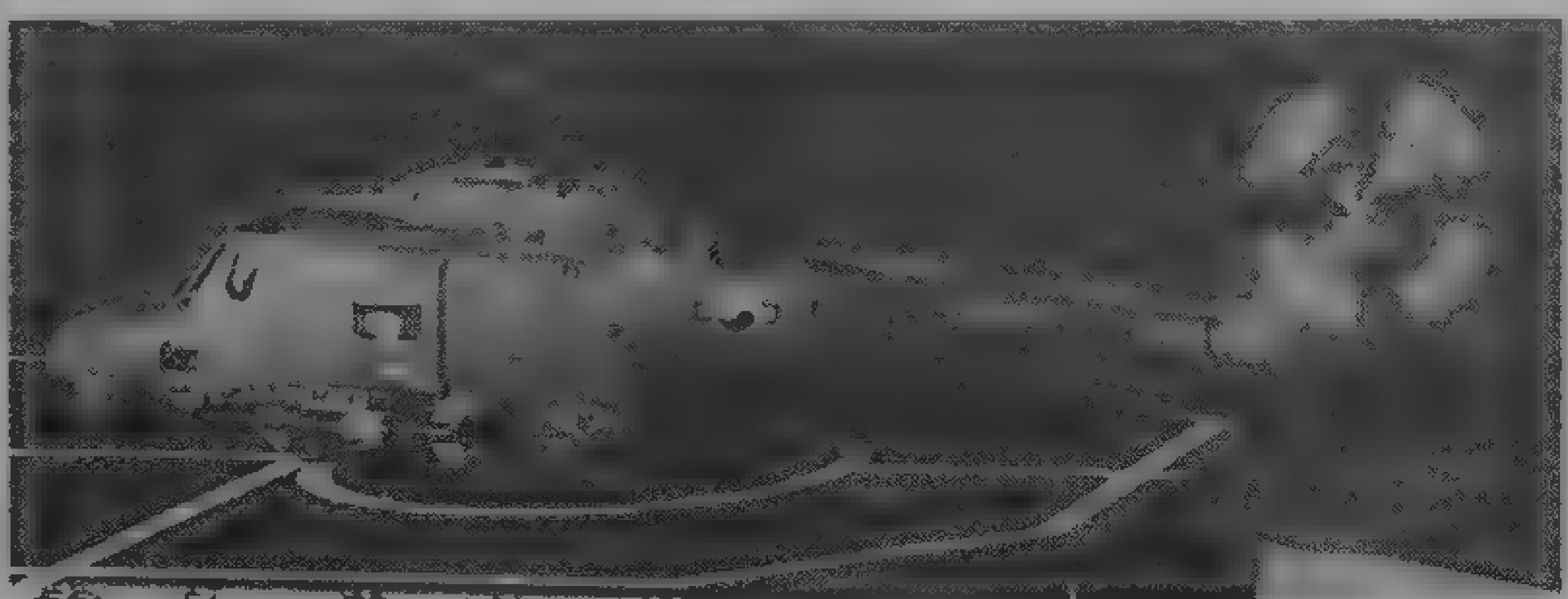
TYPE: Twin-engined multipurpose export helicopters.

PROGRAMME: Battlefield Lynx mockup displayed at 1988 Farnborough Air Show (converted demonstrator G-LYNX), featuring wheeled landing gear, exhaust air diffusers and provision for anti-helicopter missiles each side of fuselage; first flight of wheeled prototype (converted trials AH. Mk 7 XZ170) 29 November 1989; first flight of South Korean Super Lynx (90-0701, temporarily ZH219) 16 November 1989 (also first Lynx with Seaspray Mk 3); first flight of Portuguese Lynx (9201, temporarily ZH580, ex-RN ZF559) 27 March 1992.

CURRENT VERSIONS: **Super Lynx**: Upgraded export naval Lynx, approximately equivalent to Lynx HAS. Mk 8 (see previous entry).

Battlefield Lynx: Upgraded export army Lynx, approximately equivalent to Lynx AH. Mk 9 (see previous entry). Demonstrator G-LYNX fitted with two 1,007 kW (1,350 shp) LHTEC T800 turboshafts as **Battlefield Lynx 800** private venture (LHTEC funding power plants and gearboxes, Westland providing airframe for full flight demonstration programme); first flight 25 September 1991, programme terminated early 1992 after 17 hours.

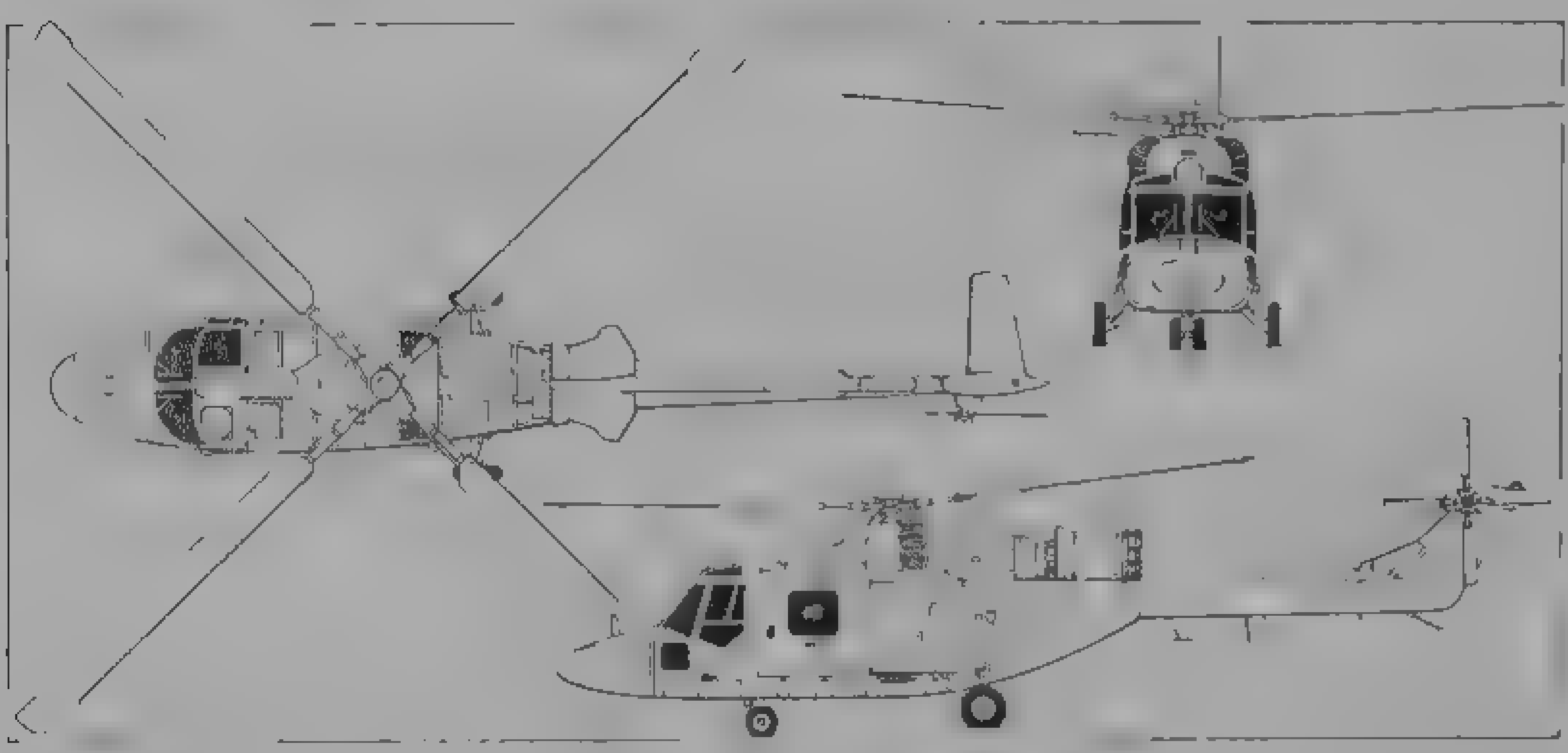
CUSTOMERS: Super Lynx ordered by South Korea 1988 (12 **Mk 99** with Racal Avionics Doppler 71/TANS N nav system, Seaspray Mk 3 360° radar, AN/AQS-18 dipping sonar and Sea Skua), handed over between 26 July 1990 and May 1991 for 'Sumner' and 'Gearing' class destroyers. Portugal ordered five (first two ex-Royal Navy modified airframes) Super Lynx **Mk 95** 1990 (plus three options) with Racal RNS252 GPS-aided INS and Doppler 91 navigation systems and some US equipment including AN/AQS-18 sonar and Bendix/King RDR 1500 radar; first two handed over 29 July 1993 for 'Vasco da Gama' class (MEKO 200) frigates; final two delivered 16 November 1993. Brazil ordered nine **Mk 21As** plus six conversions from Mk 21 for delivery from 1996. Mk 21A avionics include 360°



Westland Super Lynx Mk 99 in service with South Korean Navy
1995

Westland Super Lynx Mk 95 of Portuguese Navy

1995



Westland Battlefield Lynx for export, equivalent to the British Army's Lynx AH. Mk 9
(Jane's/Dennis Punnett)

1990

Seaspray 3000 radar, RNS252 INS and Doppler 71, armament includes Sea Skua missiles

DESIGN FEATURES: Upgraded export Lynx, maximum T-O weight 5,125 kg (11 300 lb); all-weather day/night capability, extended payload/range, advanced technology swept-tip (BERP) composite main rotor blades offering improved speed and aerodynamic efficiency and reduced vibration, Mk 7's dynamic improvements (reversed direction tail rotor for improved control, and so on); non-retractable wheeled landing gear

STRUCTURE: Composite main and tail rotor blades

LANDING GEAR: Non-retractable tricycle type. Twin nosewheels, single mainwheels. Oleo-pneumatic struts capable of absorbing 1 83 m (6 ft)/s descent rate.

POWER PLANT: Two Rolls-Royce Gem 42-1 turboshafts, each rated at 835 kW (1,120 shp) Transmission rating 1,372 kW (1,840 shp). Exhaust diffusers for infra-red suppression optional on Battlefield Lynx

AVIONICS (Naval): *Radar:* Super Lynx has Seaspray Mk 3000 or Bendix/King RDR 1500 360° scan radar in chin fairing. (UK Mk 8 has original Seaspray Mk 1 upgraded to Mk 3000 under 1994 contract and re-packaged below fuselage, leaving space for GEC Marconi Sea Owl thermal imaging equipment above nose.)

Mission: Vinten Vipa 1 reconnaissance pod, or Agiflite reconnaissance camera system. Optional Bendix/King AN/AQS-18 or Thomson Sintra HS-312 sonars

AVIONICS (Army): *Comms:* Secure speech radio.

Flight: Decca Doppler 91 and RNS252 navigation Honeywell/Smiths AN/APN 198 radar altimeter; Collins 206A ADF, Collins VIR 31A VOR/ILS

Mission: Sextant 250 sight for fixed armament

ARMAMENT: Super Lynx as standard naval Lynx, including four Sea Skua or two Penguin anti-ship missiles. Battlefield Lynx may carry two Giat 20 mm cannon pods, two FN Herstal pods with two 7 62 mm machine guns each, or two M 159C pods containing nineteen 2 75 in rockets each

DIMENSIONS, EXTERNAL (A: Battlefield Lynx, N: Super Lynx)

Tail rotor diameter	2 36 m (7 ft 9 in)
Length overall	
A, N, both rotors turning	15 24 m (50 ft 0 in)
A, rotors folded	13 24 m (43 ft 5¼ in)
N, main rotor blades and tail folded	10 85 m (35 ft 7¼ in)
Width overall, main rotor blades folded	
A	3 02 m (9 ft 10⅞ in)
N	2 94 m (9 ft 7¾ in)
Height overall, tail rotor turning	
A	3.73 m (12 ft 3 in)
N	3 67 m (12 ft 0½ in)
main rotor blades and tail folded	
N	3 25 m (10 ft 8 in)
Tailplane half span: A, N	1 32 m (4 ft 4 in)
Wheel track: A, N	2.80 m (9 ft 2¼ in)
Wheelbase: A, N	3.02 m (9 ft 10⅞ in)

AREAS

Tail rotor disc	4 37 m² (47.04 sq ft)

WEIGHTS AND LOADINGS

Basic weight empty: A	3,178 kg (7,006 lb)
N	3,291 kg (7,255 lb)
Operating weight empty (including crew and appropriate armament)	
A, anti-tank (eight TOW)	3,949 kg (8,707 lb)
A, reconnaissance	3,444 kg (7,592 lb)
A, transport (unladen)	3,496 kg (7,707 lb)
N, ASW (two torpedoes)	4,618 kg (10,181 lb)
N, ASV (four Sea Skuas)	4,373 kg (9,641 lb)
N, surveillance and targeting	3,708 kg (8,174 lb)
N, search and rescue	3,778 kg (8,329 lb)
Max underslung load	1,361 kg (3 000 lb)
Max T-O weight	5 125 kg (11,300 lb)
Max disc loading	39 82 kg/m² (8 16 lb/sq ft)
Max power loading	3 74 kg/kW (6 14 lb/shp

PERFORMANCE

Never-exceed speed (VNE), Mk 9,	
clean	156 kts (289 km/h; 180 mph)
IR exhaust diffusers fitted	145 kts (269 km/h; 167 mph)
Max continuous cruising speed	
A	138 kts (256 km/h, 159 mph)
Radius of action	
A, anti-tank, 2 h on station with four TOWs	25 n miles (46 km, 29 miles)
N, anti-submarine, 2 h on station, dipping sonar and one torpedo	20 n miles (37 km, 23 miles)
N, point attack with four Sea Skuas	125 n miles (232 km, 143 miles)
N, surveillance, 3 h 50 min on station	75 n miles (139 km, 86 miles
Range	
A, tactical transport	370 n miles (685 km, 426 miles)

UPDATED

WESTLAND WS 70L

TYPE: Combat assault squad transport helicopter

PROGRAMME: After full partnership agreement with United Technologies (USA), Westland received US State Department approval to produce Sikorsky Black Hawk as WS 70, demonstrator (ZG468) assembled from Sikorsky kit to US Army UH-60A battlefield transport standards, first flight 1 April 1987 (used for training and market support). Remains operational (1995)

CURRENT VERSIONS: **WS 70L**. Equivalent to US UH-60L (see Sikorsky entry in US section), except as detailed below

CUSTOMERS: Saudi Arabia signed provisional agreement for 88 WS 70Ls July 1988 (part of larger equipment deal with UK government), firm contract failed to materialise.

COSTS: Westland board assigned £3 million for demonstrator (ZG468).

POWER PLANT: Two 1,224 kW (1,641 shp) General Electric T700-GE-701C turboshafts

AVIONICS (recommended): Communications equipment includes UHF and V/UHF and VHF/FM homing. Navigation equipment includes AN/ASN 43 compass, Doppler, plus customer specified equipment.

WEIGHTS AND LOADINGS

Weight empty	4,964 kg (10,943 lb)
Max T-O weight	9,979 kg (22,000 lb)

PERFORMANCE

Range with 1,814 kg (4 000 lb) payload	300 n miles (556 km, 345 miles)
Ferry range	1,145 n miles (2,122 km, 1,318 miles)

UPDATED

OTHER AIRCRAFT

Westland **Commando** is similar to Sea King (which see for production details) but detailed description appears in *Jane's Aircraft Upgrades*. **EH 101** programme, in which Westland partners Agusta, will be found in International section

NEW ENTRY

UNITED STATES OF AMERICA

AAC

AEROSTAR AIRCRAFT CORPORATION

Aerostar's most recent activities are now detailed in *Jane's Aircraft Upgrades*.

UPDATED

AASI

ADVANCED AERODYNAMICS AND STRUCTURES INC

10703 Vanowen Street, North Hollywood, California 91605
Telephone: 1 (818) 753 1888
Fax: 1 (818) 753 8554
CHAIRMAN: Song Gen Yeh
PRESIDENT: Dr Carl C. Chen
CEO AND GENERAL MANAGER: Darius Sharifzadeh
EXECUTIVE VICE-PRESIDENT: Bill Leeds
VICE-PRESIDENT, MANUFACTURING: David Tracy
VICE-PRESIDENT, MARKETING: Gene Comfort

AASI succeeded Aerodynamics and Structures Inc (ASI), formed by former airline pilot Darius Sharifzadeh to develop Jetcruzer. Factory being extended to 18,580 m² (200,000 sq ft) in readiness for production at rate of 15 aircraft per year. Workforce 300.

UPDATED

AASI JETCRUZER 450 and 500P

TYPE: Six-seat turboprop business and utility transport.

PROGRAMME: Design began March 1983, aerodynamic design undertaken in UK 1984-85 by 'Sandy' Burns, layout prepared by Ladislao Pazmany, structural design by David Kent of Light Transport Design in UK, wind tunnel tests by University of San Diego, prototype construction started June 1988, first exhibited at NBAA show October 1988 with 313 kW (420 shp) Allison 250-C20S engine; first flight 11 January 1989 (N5369M); preproduction prototype (N102JC) made first flight April 1991 and first flight in production form 13 September 1992; certification to FAR Pt 23 on 14 June 1994, intending single-engine FAA Pt 135 public transport IFR certification. Final assembly of aircraft for customers in the Asia-Pacific region may be undertaken in Taiwan.

CURRENT VERSIONS: **Jetcruzer 450**: Unpressurised model, *as detailed below*. Freight and air ambulance configurations available.

Jetcruzer 500P: Pressurised model with smaller windows and 634 kW (850 shp) PT6A-42 engine.

Jetcruzer ML-1: Unmanned military model.

Jetcruzer ML-2: Piloted military model.

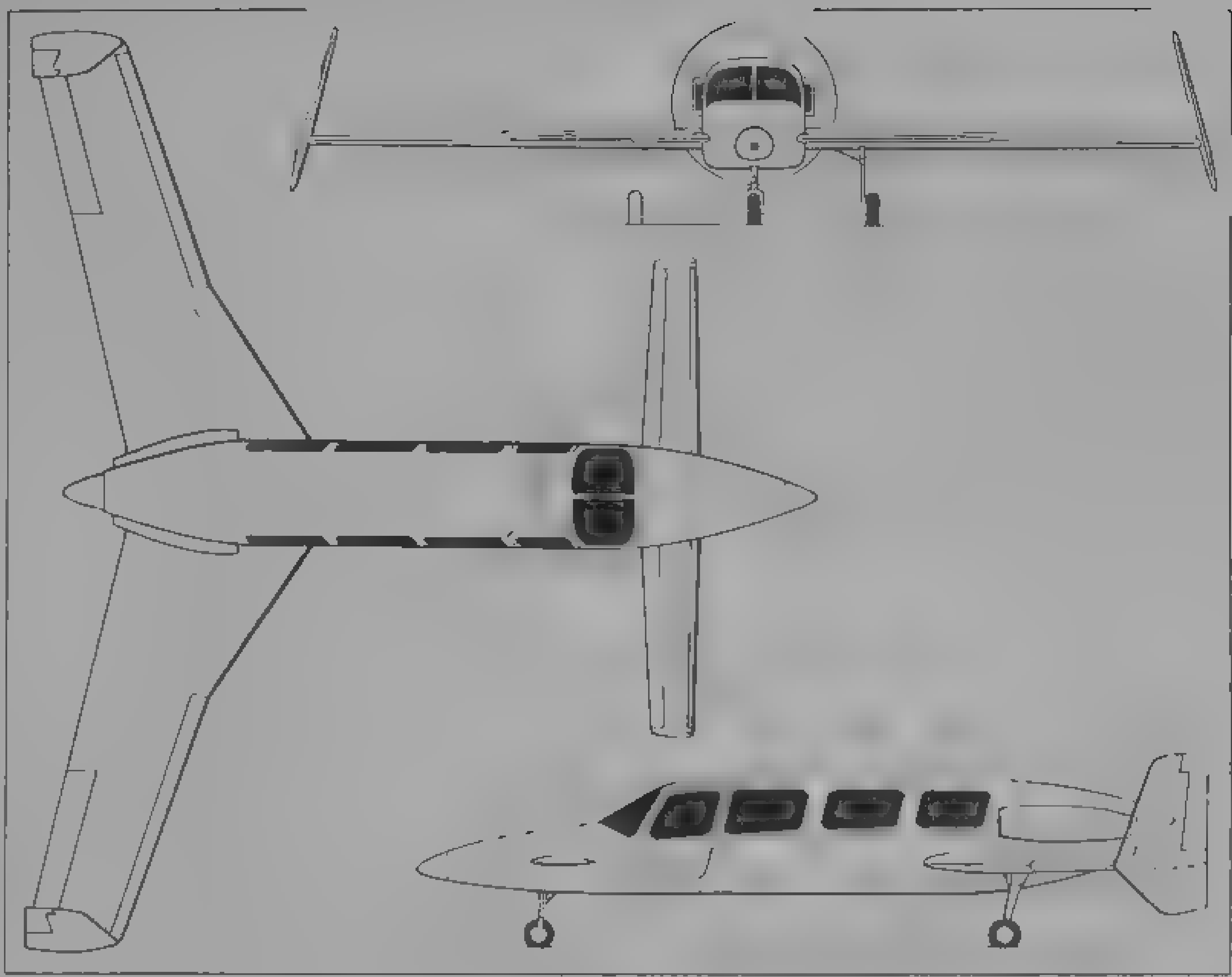
CUSTOMERS: Total of 26 firm orders and 27 options for Jetcruzer 450 by late 1994.

COSTS: $995,000 for 450.

DESIGN FEATURES: Canard layout; spin-resistant design, high speed, short field T-O/landing performance, all-CAD, rear-mounted main wing using NACA 2412 aerofoil, with 20° sweepback at quarter-chord and 4° dihedral, tip-mounted fins, unswept foreplane using NASA LS 0417 (Mod) section. Compared to prototype, production Jetcruzer 500P has 25 cm (10 in) fuselage stretch, addition of fuel carrying strakes at wingroots with 34° sweepback, 43 cm (17 in) nose extension to allow forward retraction of nosewheel, and vertical tail surfaces canted 5° inboard to improve aileron control.

FLYING CONTROLS: Pushrod actuated; ailerons in main wing, elevators on foreplane, rudders in tip-mounted fins.

STRUCTURE: Aluminium alloy wings, foreplane and vertical tail surfaces, monocoque fuselage of graphite composite/Nomex honeycomb sandwich with embedded aluminium mesh.



AASI Jetcruzer 650 commuter and utility transport (P&WC PT6A-135A turboprop engine) *(Jane's/Dennis Punnett)*

1993

LANDING GEAR: Retractable tricycle oleo-pneumatic type with steerable nosewheel.

POWER PLANT: One 507 kW (680 shp) Pratt & Whitney Canada PT6A-27 turboprop, driving a Hartzell three-blade constant-speed pusher propeller at 2,200 rpm (with reverse and autofeathering). Fuel capacity 946 litres (250 US gallons; 208 Imp gallons).

ACCOMMODATION: Standard and club seating for six, including pilot, stressed to new FAA 26 g load limit. Three cabin windows on each side. Airstep gullwing door on each side.

SYSTEMS: Pressurisation (500P), air conditioning, de-icing and anti-icing.

AVIONICS: *Comms:* Standard Bendix/King suite includes KX 165 VHF com, KT 70 transponder and KMA 24H audio-control console.

Radar: Bendix/King RDS-82UP colour weather radar or Collins weather radar optional. 3M Stormscope optional.

Flight: Bendix/King KX 165 nav, KR 87 ADF and KN 63 DME standard, KLN Loran and GPS optional. Bendix/King KI 256 flight director (ADI) and ED 461 HSI standard; Bendix/King KC 192 or Collins autopilot optional.

Instrumentation: EFIS standard.

DIMENSIONS, EXTERNAL:	
Wing span	12.85 m (42 ft 2 in)
Wing aspect ratio	9.23
Foreplane span	5.77 m (18 ft 11 in)
Length overall	7.52 m (24 ft 8 in)
Fuselage length	7.49 m (24 ft 7 in)
Height overall	2.62 m (8 ft 7 in)
Propeller diameter	2.03 m (6 ft 8 in)
Propeller ground clearance	0.71 m (2 ft 4 in)
Cabin doors (each): Height	1.09 m (3 ft 7 in)
Width	0.97 m (3 ft 2 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	3.40 m (11 ft 2 in)
Volume	4.15 m³ (146.5 cu ft)
AREAS:	
Wings, gross	17.89 m² (192.6 sq ft)
Ailerons (total)	0.81 m² (8.75 sq ft)
Foreplane, incl elevators	3.71 m² (39.90 sq ft)
Elevators (total, incl tabs)	0.42 m² (4.53 sq ft)
Fins (total)	0.81 m² (8.75 sq ft)
Rudders (total)	0.33 m² (3.60 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,111 kg (2,450 lb)
Max T-O weight	2,496 kg (5,500 lb)
Max wing loading	139.4 kg/m² (28.56 lb/sq ft)
Max power loading	4.92 kg/kW (8.09 lb/shp)
PERFORMANCE (at max T-O weight, ISA):	
Max operating speed (VMO) and max cruising speed at 6,700 m (22,000 ft)	262 kts (486 km/h; 302 mph)
Stalling speed	59 kts (109 km/h; 68 mph)
Service ceiling	7,620 m (25,000 ft)
T-O to 15 m (50 ft)	436 m (1,430 ft)
Landing from 15 m (50 ft)	594 m (1,950 ft)
Max range at 3,050 m (10,000 ft)	1,344 n miles (2,490 km; 1,547 miles)

UPDATED

AASI Jetcruzer 450 six-seat business and utility aircraft (preproduction prototype)

1994

AASI JETCRUZER 650

TYPE: 10/13-seat turboprop commuter and utility transport.

PROGRAMME: Construction of prototype and first production aircraft began December 1992; no further information available.

CURRENT VERSIONS: **Jetcruzer 650**: *As detailed below*, for commuter, freight carrying and air ambulance uses.

ML-4: Military version.

CUSTOMERS: Seven ordered by mid-1994.
COSTS: $1.1 million (1994).
DESIGN FEATURES: Enlarged version of Jetcruzer 450/500P, with greatly increased accommodation; 260 knot (483 km/h; 300 mph) cruising speed and short field performance, economical operation, low maintenance costs, low noise.
FLYING CONTROLS: As for Jetcruzer 450/500P.
STRUCTURE: As for Jetcruzer 450/500P.
POWER PLANT: One 691 ekW (927 ehp) Pratt & Whitney Canada PT6A-135A turboprop, driving a Hartzell three-blade pusher propeller. Fuel capacity 757 litres (200 US gallons; 166.5 Imp gallons) in wing tanks.
ACCOMMODATION: Thirteen persons (including one or two pilots) in international models or 10 for US market, on standard or club seats. Two airstep gullwing doors. Air conditioning and optionally pressurised.
SYSTEMS: Optional pressurisation, air conditioning, de-icing and anti-icing.
AVIONICS: IFR dual nav/com, EFIS, radar, GPS and Loran.
DIMENSIONS, EXTERNAL:

Wing span	11.33 m (37 ft 2 in)
Foreplane span	5.49 m (18 ft 0 in)
Fuselage: Length	10.36 m (34 ft 0 in)
Max depth	1.55 m (5 ft 1 in)
Max width	1.52 m (5 ft 0 in)
Height overall	2.44 m (8 ft 0 in)
Wheel track	3.66 m (12 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin: Length	5.49 m (18 ft 0 in)
Max width	1.50 m (4 ft 11 in)
Max height	1.52 m (5 ft 0 in)

WEIGHTS AND LOADINGS:

Weight empty	1,588 kg (3,500 lb)
Max T-O weight	2,948 kg (6,500 lb)
Max power loading *	4.27 kg/ekW (7.01 lb/ehp)

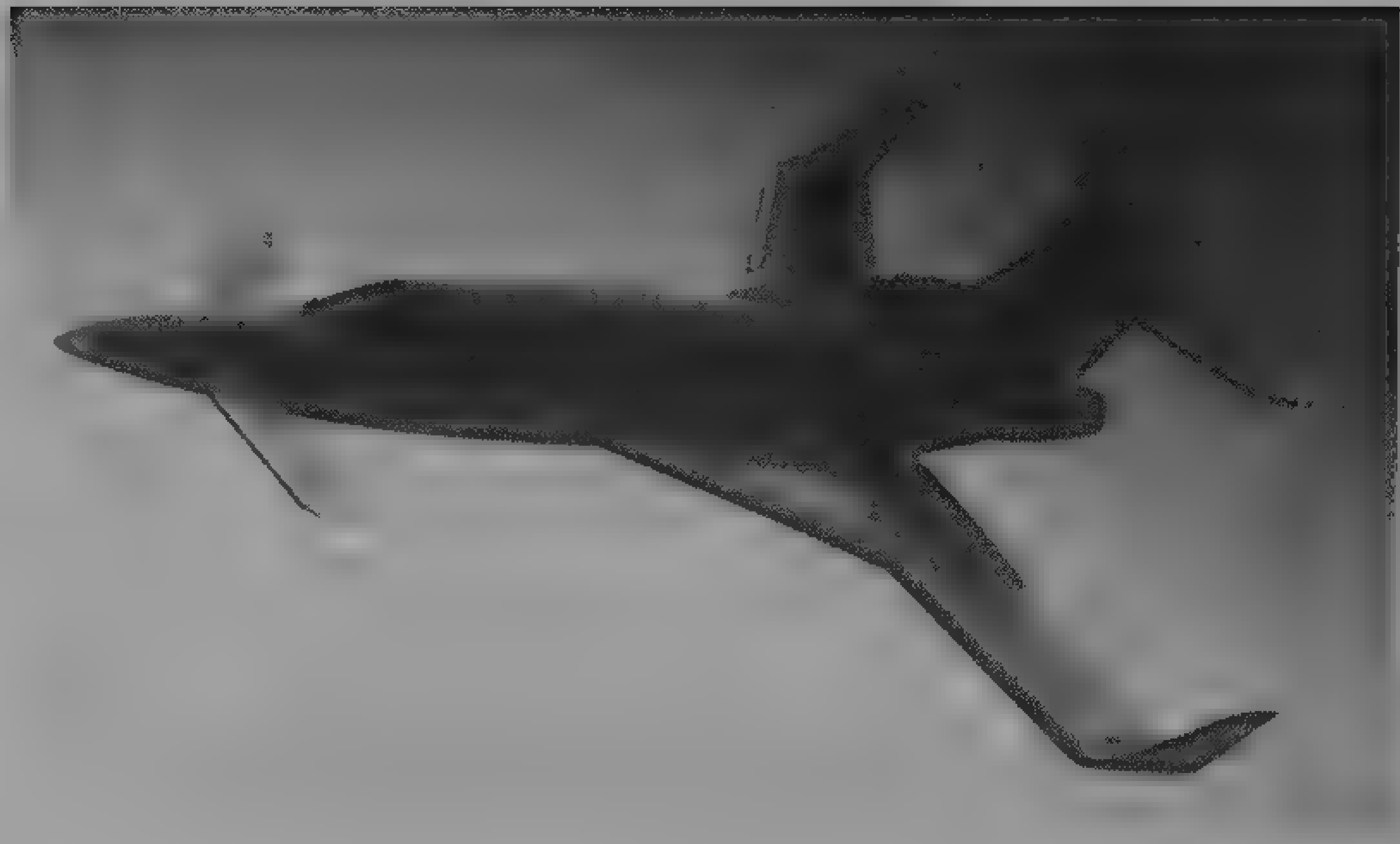
PERFORMANCE (estimated):

Max cruising speed at 6,700 m (22,000 ft)	260 kts (483 km/h; 300 mph)
Stalling speed, flaps down, power off	69 kts (128 km/h; 79 mph)
Max rate of climb at S/L	716 m (2,350 ft)/min
Service ceiling	9,150 m (30,000 ft)
T-O run	391 m (1,280 ft)
Landing run	412 m (1,352 ft)
Range	1,000 n miles (1,852 km; 1,151 miles)

UPDATED

AASI STRATOCRUZER 1250-ER

TYPE: 10/13-seat pressurised twin-turbofan transport.
PROGRAMME: Design started September 1991.
CURRENT VERSIONS: **Stratocruzer 1250-ER**: Intercontinental civil version, *as detailed below*. Can be used for commercial operations, corporate transportation, freight carrying, medevac and other roles.
ML-5: Military version; envisaged SAR layout has two pilots plus three other crew and two radar scanner consoles.
COSTS: $3.2 million.



Artist's impression of the AASI Stratocruzer 1250-ER long-range transport (two Williams-Rolls FJ44 turbofans) *1993*

DESIGN FEATURES: Intercontinental range, high speed, low cost and maintenance. Design based on Jetcruzer general configuration, but with pressurisation for high altitude flight, swept foreplanes, extended inboard wing leading-edges, winglets, fin with high-mounted swept tailplane, and twin turbofans pod-mounted on pylons at fin root.
FLYING CONTROLS: All pushrod actuated, ailerons on main wings with trim tabs, elevators on tailplane, and rudder; foreplane elevator trim, wing leading-edge flaps, dual yaw dampers, mechanical trim system, autopilot.
STRUCTURE: As for Jetcruzer.
LANDING GEAR: Similar arrangement to Jetcruzer, but with twin wheels on each unit, hydraulically actuated, nosewheel steering, mainwheel disc brakes, anti-skid brake system, parking brake, emergency brake system and speed brake system.
POWER PLANT: Two 8.45 kN (1,900 lb st) Williams Rolls FJ44 turbofans; AASI requested 10 to 15 per cent thrust increase to improve engine-out performance. Four fuel tanks in fuselage and wings; fuel jettison system.
ACCOMMODATION: Thirteen persons (including one or two pilots) on international models or 10 for US market. Alternative layouts are for two pilots and four executives plus rest room, two pilots plus two stretcher patients and three attendants for medevac role; or single pilot plus freight. Galley, toilet, standard or club seating are among customer options. Two doors.
SYSTEMS: Cabin pressurisation, air conditioning and heating, ram air ventilation, and oxygen with crew masks and passenger drop-down masks, electrical power from two starter generators, dual 24 V batteries and solid-state voltage regulators, de-icing and anti-icing, including wing and foreplane leading-edges, fin, winglets, engine inlets and windscreen, heated static ports and pitot tubes.
DIMENSIONS, EXTERNAL:

Wing span	14.02 m (46 ft 0 in)
Length overall	10.97 m (36 ft 0 in)
Fuselage length	10.36 m (34 ft 0 in)
Diameter of fuselage	1.55 m (5 ft 1 in)
Height overall	4.04 m (13 ft 3 in)

WEIGHTS AND LOADINGS:

Weight empty	2,654 kg (5,850 lb)
Fuel weight	2,585 kg (5,700 lb)
Max T-O weight	5,670 kg (12,500 lb)
Max power loading	335.5 kg/kN (3.29 lb/lb st)

PERFORMANCE (estimated, ISA):

Max cruising speed at 11,275 m (37,000 ft)	422 kts (781 km/h; 485 mph)
Stalling speed, flaps down	81 kts (150 km/h; 94 mph)
Max rate of climb at S/L	1,115 m (3,650 ft)/min
Max cruising altitude	13,715 m (45,000 ft)
T-O run	1,250 m (4,100 ft)
Landing run	1,115 m (3,650 ft)
Range, with 20 min VFR reserves	3,240 n miles (6,000 km; 3,728 miles)

UPDATED

ADI

AERO DESIGNS INC

11910 Radium Street, San Antonio, Texas 78216
Telephone: 1 (210) 308 9332
Fax: 1 (210) 308 9329
CHAIRMAN: Mark Brown

Aero Designs is designer and manufacturer of Pulsar range of light aircraft manufactured in kit form for homebuilding. All parts are oven-cured composites.

UPDATED

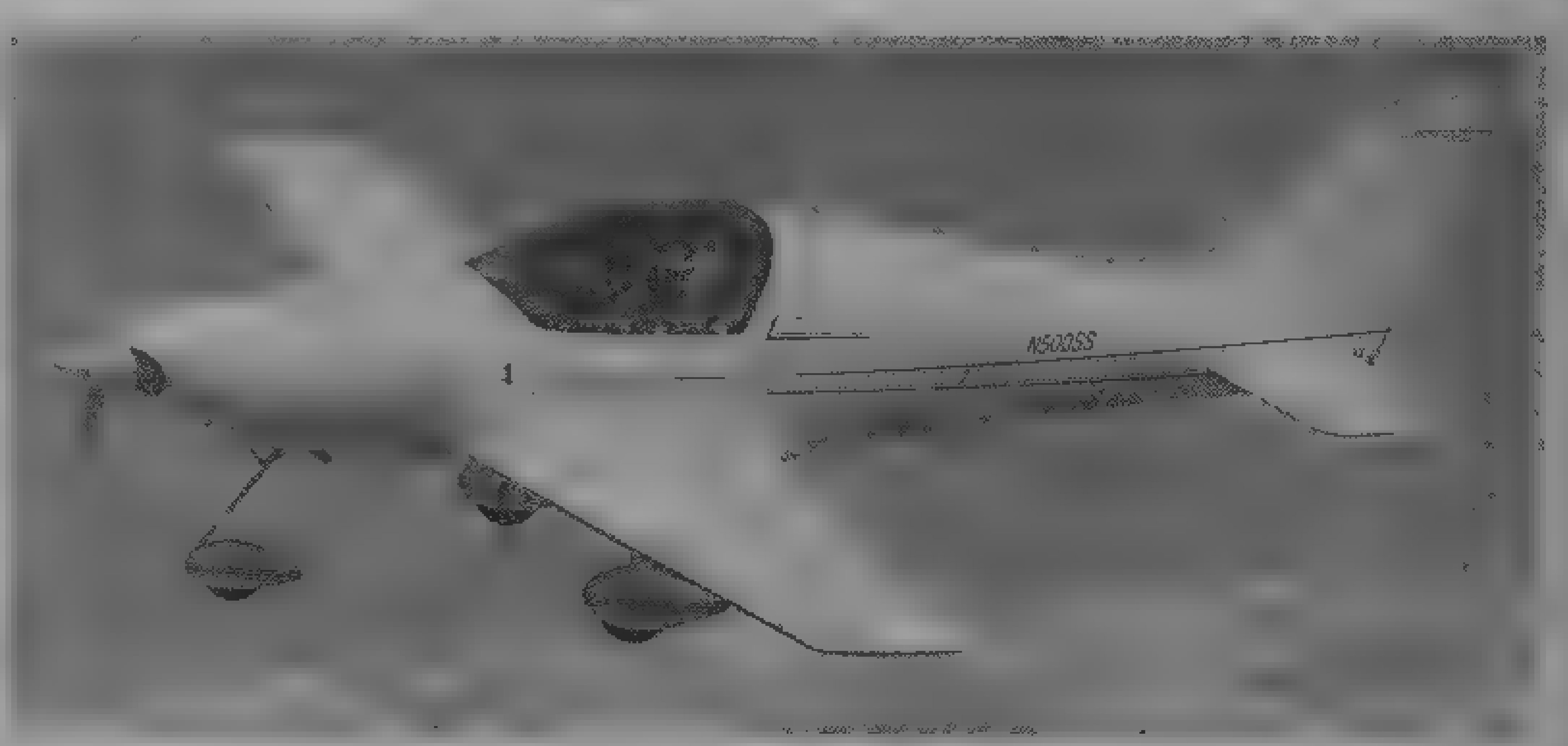
AERO DESIGNS PULSAR

TYPE: Two-seat light cabin monoplane.
CURRENT VERSIONS: Both nosewheel and tailwheel versions available; original version fitted with 49 kW (66 hp) Rotax 582 engine.

Pulsar with wings folded on trailer ready to move *(Alan Gill)* *1994*

Pulsar XP: With 59.7 (80 hp) Rotax 912 engine. *Details apply to this version unless signified otherwise.*
CUSTOMERS: Total of 73 flying by Spring 1995, 60 in USA, eight in UK, two in France, one each in Denmark, Germany and Holland.
COSTS: Kit complete with airframe, engine and basic instruments: $21,500 for basic version, $27,500 for Pulsar XP.
DESIGN FEATURES: Designed for ease of home construction with premoulded components where possible. Wings removable in about 15 minutes for mounting on trailer.
FLYING CONTROLS: Conventional controls operated by rods and cables.

Tailwheel version of Pulsar XP *(Paul Jackson)* *1995*



ADI Pulsar (Rotax 582 engine) *1995*

STRUCTURE: General construction of GFRP with carbonfibre structure and foam cores. Wing skins are composite.
LANDING GEAR: Tricycle or tailwheel options available.
POWER PLANT: One 49 kW (66 hp) Rotax 582 engine in basic Pulsar, directly driving a two-blade fixed-pitch propeller. Rotax 912 engine (59.7 kW, 80 hp) with optional variable-pitch propeller in Pulsar XP. Maximum fuel capacity (XP) 72 litres (19 US gallons, 15.8 Imp gallons).
ACCOMMODATION: Enclosed cabin seating two side by side beneath forward-sliding, one-piece canopy; baggage compartment at rear of cabin.
SYSTEMS: Hydraulics for mainwheel brakes only. Electrical: 12 V battery, 14 V alternator fit appropriate to engine.
AVIONICS: Customer choice.

DIMENSIONS, EXTERNAL:	
Wing span	7.62 m (25 ft 0 in)
Wing aspect ratio	7.81
Length overall	5.94 m (19 ft 6 in)
Height overall	1.93 m (6 ft 4 in)
Propeller diameter	1.52 m (5 ft 0 in)
AREAS:	
Wings, gross	7.43 m² (80.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	231 kg (510 lb)
Max payload	249 kg (550 lb)
Max T-O and landing weight	481 kg (1,060 lb)
Max wing loading	64.69 kg/m² (13.25 lb/sq ft)
Max power loading	8.06 kg/kW (13.25 lb/hp)

PERFORMANCE (at max T-O weight, ISA):

Never exceed speed (VNE)	139 kts (257 km/h; 160 mph)
Max cruising speed (75% power):	
fixed-pitch propeller	122 kts (225 km/h; 140 mph)
variable-pitch propeller	130 kts (241 km/h; 150 mph)
Stalling speed, power off	40 kts (74 km/h; 46 mph)
Max rate of climb at S/L	366 m (1,200 ft)/min
Service ceiling	4,575 m (15,000 ft)
T-O and landing run	244 m (800 ft)
Range with max fuel at 120 kts (222 km/h; 138 mph)	521 n miles (965 km; 600 miles)

UPDATED

AFI

AVIATION FRANCHISING INTERNATIONAL

San Antonio, Texas
CHAIRMAN: Tom Prescott

AFI established to produce the Prescott Pusher in kit form under the new name of Prescott II.

PRESCOTT II

TYPE: Four-seat kitbuilt.
PROGRAMME: Prototype Prescott Pusher (N41PP) first flew 9 July 1985; second prototype (N42PP) represented definitive design, offered in kit form only as a complete airframe with retractable landing gear, including the hydraulic system and components for the landing gear and flaps; first kit-built Pusher flew on 8 April 1988. Marketing transferred to ASI and aircraft renamed Prescott II. Two further development aircraft under construction in 1995; certification to FAA Primary Category anticipated by 1996.
DESIGN FEATURES: Wings, ailerons and flaps of aluminium alloy construction; cambered glassfibre wingtips. Wing section NLF (1)-0215.
STRUCTURE: Fuselage of welded square-section steel tubing covered by non-structural glassfibre shells in two parts plus a nose section. T tail of aluminium alloy construction.
LANDING GEAR: Retractable tricycle type, with tailskid to protect propeller in tail-down attitude.
POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-A2A, driving a pusher propeller. Fuel capacity 214 litres (56.5 US gallons, 47 Imp gallons).

DIMENSIONS, EXTERNAL:	
Wing span	8.94 m (29 ft 4 in)
Length overall	6.18 m (20 ft 3½ in)
Height overall	2.67 m (8 ft 9 in)
Propeller diameter (max)	1.57 m (5 ft 2 in)
AREA:	
Wings, gross	10.29 m² (110.8 sq ft)
WEIGHTS:	
Weight empty	703 kg (1,550 lb)
Baggage capacity	45 kg (100 lb)
Max T-O weight	1,088 kg (2,400 lb)
PERFORMANCE (O-360 engine):	
Max level speed at S/L	184 kts (340 km/h; 212 mph)
Max cruising speed at S/L	174 kts (322 km/h; 200 mph)
Stalling speed: flaps up	63 kts (116 km/h; 72 mph)
flaps down	58 kts (106 km/h; 66 mph)
Max rate of climb at S/L	290 m (950 ft)/min
Service ceiling	5,485 m (18,000 ft)
T-O to 15 m (50 ft)	526 m (1,725 ft)

Second prototype of the Prescott Pusher
1995

Landing from 15 m (50 ft)	473 m (1,550 ft)
Range: with max fuel	869 n miles (1,609 km; 1,000 miles)
with max payload	738 n miles (1,368 km; 850 miles)

NEW ENTRY

AG-CAT

AG-CAT CORPORATION

Malden Industrial Park, Building 167, Malden, Missouri 63863
Telephone: 1 (314) 276 5770
Fax: 1 (314) 276 5776
PRESIDENT AND CEO: Jim Krepps
VICE-PRESIDENT, SALES AND MARKETING: Joe Kosier

Following 1995 decision by Schweizer to sell Ag Cat manufacturing rights, overhaul and modification centre Malden Ag-Craft formed new company to build this agricultural biplane, Schweizer to provide support during transition phase. Full Ag-Cat description, photograph and general arrangement drawing under EAL in Ethiopian section, photograph under Schweizer in this section.

NEW ENTRY

AIR & SPACE

AIR & SPACE AMERICA INC

4460 Shemwell Lane, Paducah, Kentucky 42003
Telephone: 1 (502) 898 2403
Fax: 1 (502) 898 8691
PRESIDENT: Don Farrington
VICE-PRESIDENT SALES: John Potter
VICE-PRESIDENT ENGINEERING: Tom Davey

Manufacturing and marketing subsidiary of Farrington Aircraft Corporation.

UPDATED

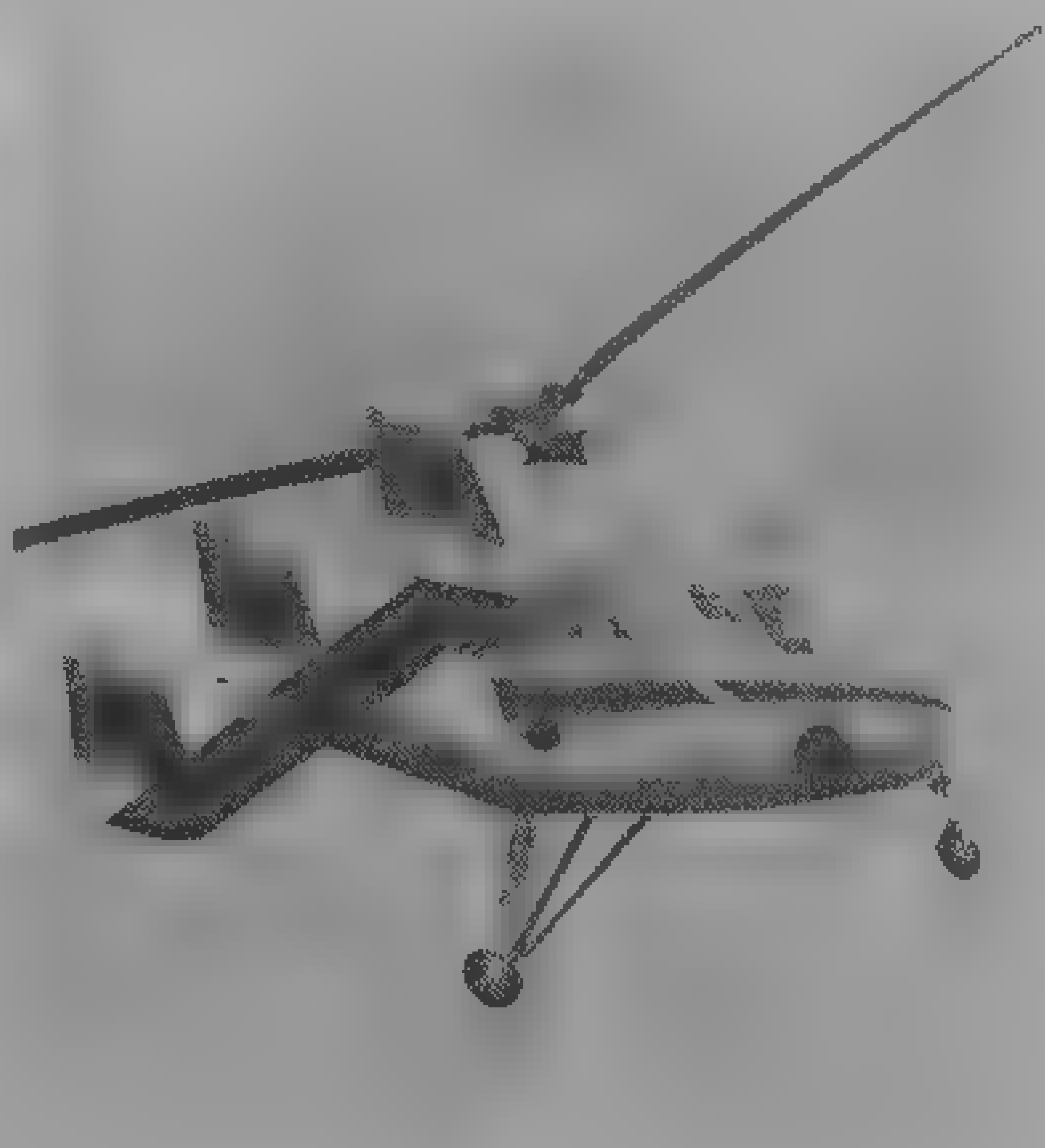
AIR & SPACE 18A

TYPE: Two-seat autogyro.
PROGRAMME: Original aircraft (68 built) produced in mid-1960s (certificated 1965) until Air & Space Manufacturing Inc declared bankrupt in 1966. Farrington Aircraft announced in June 1990 that 30 of these had been modernised under seven STCs and that it intended to restart production in this improved form; first new production aircraft (N902AS) granted Standard Airworthiness Certificate 2 April 1991 and sold; prototype flown with 149 kW (200 hp) IO-360, to be offered as optional engine; to be followed by maximum T-O weight increase to 907 kg (2,000 lb), which provides empty weight of 601 kg (1,325 lb), an anticipated useful load of 306 kg (675 lb), and possibility of three-seat interior. Proposed applications for 18A include patrol/surveillance, environmental monitoring, law enforcement, pipeline inspection and broadcasting as well as private flying.
CUSTOMERS: Four (three and one) sold to two South African customers in 1993, three sold in 1994.
COSTS: Standard VFR equipped $119,995 in March 1995.
DESIGN FEATURES: Three-blade rotor, fully enclosed tandem-seat cabin, non-retractable tricycle landing gear, three-fin tail unit (all-moving central and two fixed outer). Original aircraft described in 1967-68 *Jane's*. Farrington improvements include trimmable two-position collective pitch control, improved engine cowling, noise-reduced exhaust and strengthened nosewheel leg.

Line-up of Air & Space 18A autogyros
1995

POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360 flat four engine with Hartzell two-blade pusher propeller. Fuel capacity 113.5 litres (30 US gallons; 25 Imp gallons).

DIMENSIONS, EXTERNAL:	
Rotor diameter	10.67 m (35 ft 0 in)
Length, without rotor	6.06 m (19 ft 10¾ in)
Height overall	2.95 m (9 ft 8 in)
DIMENSIONS, INTERNAL:	
Cabin length	2.78 m (9 ft 1½ in)
AREAS:	
Rotor disc	89.38 m² (962.1 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	596 kg (1,315 lb)
Max baggage weight	45 kg (100 lb)



Air & Space 18A two-seat autogyro
1992

Max T-O weight	816.5 kg (1,800 lb)
Max disc loading	9.13 kg/m² (1.87 lb/sq ft)
PERFORMANCE (ISA):	
Never-exceed speed (VNE)	95 kts (177 km/h; 110 mph)
Cruising speed (75% power) at 2,135 m (7,000 ft)	80 kts (148 km/h; 92 mph)
Min level flight speed	24 kts (44 km/h; 27 mph)
Range with reserves	173 n miles (322 km; 200 miles)
Endurance with 30 min reserves	2 h 30 min

UPDATED

AIR TRACTOR

AIR TRACTOR INC

PO Box 485, Municipal Airport, Olney, Texas 76374
Telephone: 1 (817) 564 5616
Fax: 1 (817) 564 2348
PRESIDENT: Leland Snow
VICE PRESIDENT FINANCE: David Ickert

Air Tractor agricultural aircraft based on 41 year experience of Leland Snow, who produced Snow S-2 series, which later became Rockwell S-2R (see earlier *Jane's*). 1,267 aircraft delivered by early 1995, seven models available powered by various P&W PT6A and R-1340 engines

UPDATED

AIR TRACTOR AT-401B AIR TRACTOR

TYPE: Single-seat agricultural aircraft

PROGRAMME: AT-401 developed 1986 from AT-301 (see *Jane's Aircraft Upgrades*), with increased wing span and larger hopper, total of 85 built in 1994. AT-401A version with Polish PZL-3S radial engine has been abandoned with just one aircraft produced (see 1992-93 *Jane's*). AT-401B version replaces the 401 and has Hoerner wingtips and increased wing span

CUSTOMERS: By early 1995, 200 AT-401s delivered to Argentina, Australia, Brazil, Canada, Colombia, Mexico, Spain and USA

COSTS: Standard AT-401 $190,500, with customer supplied engine $158,000

DESIGN FEATURES: Wing aerofoil NACA 4415, dihedral 3° 30', incidence 2°

FLYING CONTROLS: Ailerons, elevators and rudders with balance tabs, ailerons droop 10° when electrically operated Fowler flaps deflected to their maximum of 26°

STRUCTURE: Two-spar wing structure of 2024-T3 light alloy, with alloy steel lower spar cap, bonded doubler inside wing leading edge to resist impact damage, glassfibre wingroot fairings and skin overlaps sealed against chemical ingress, wing ribs and skins zinc chromated before assembly, flaps and ailerons of light alloy. Fuselage of 4130N steel tube, oven stress relieved and oiled internally, with skin panels of 2024-T3 light alloy attached by Camloc fasteners for quick removal; rear fuselage lightly pressurised to prevent chemical ingress; cantilever fin and strut-braced tailplane of light alloy, metal-skinned and sealed against chemical ingress

LANDING GEAR: Non-retractable tailwheel type. Cantilever heavy-duty E-4340 spring steel main gear, thickness 28.6 mm (1.125 in), flat spring suspension for castoring and lockable tailwheel. Cleveland mainwheels with tyre size 8.50-10 (8 ply), pressure 2.83 bars (41 lb/sq in). Tailwheel tyre size 5.00-5. Cleveland four-piston brakes with heavy-duty discs. Optional 29.00-11 Cleveland mainwheels with six piston brakes

POWER PLANT: One remanufactured 447 kW (600 hp) Pratt & Whitney R-1340 air-cooled radial engine with speed ring cowling, driving a Hamilton Standard 12D40/6101A-12 propeller, optional propellers include a Pacific Propeller 22D40/AG200-2 Hydromatic two-blade constant-speed metal and Hydromatic 23D40 three-blade propeller. Air Tractor has designed and is producing new FAA approved replacement crankshaft for R-1340; other new replacement parts available include main and thrust bearings, master rod bearings and blower (impeller) bearings. Over 175 replacement crankshafts delivered by early 1995

ACCOMMODATION: Single seat with nylon mesh cover in enclosed cabin which is sealed to prevent chemical ingress. Downward-hinged window/door on each side. 'Line of sight' instrument layout, with swing-down lower instrument panel for ease of access for instrument maintenance. Baggage compartment in bottom of fuselage, aft of cabin, with door on port side. Cabin ventilation by 0.10 m (4 in) diameter air scoop

SYSTEMS: 24 V electrical system, supplied by 35 A engine-driven alternator, 60 A alternator optional.

AVIONICS: Optional avionics include Bendix/King KX 155 nav/com and Narco ELT-10 emergency locator transmitter

EQUIPMENT: Agricultural dispersal system comprises a 1,514 litre (400 US gallon, 333 Imp gallon) Derakane vinylester resin/glassfibre hopper mounted in forward fuselage with hopper window and instrument panel-mounted hopper quantity gauge; 0.97 m (3 ft 2 in) wide Transland gatebox, Transland 5 cm (2 in) bottom loading valve; Agrinautics 6.4 cm (2½ in) spraypump with Transland on/off valve and either two-blade wooden or five-blade variable-pitch plastics fan, and 41-nozzle stainless steel spray system with streamlined booms. Ground start receptacle and three-colour polyurethane paint finish standard

Optional equipment includes night flying package comprising strobe and navigation lights, night working lights, retractable 600 W landing light in port wingtip, and ferry fuel system. Alternative agricultural equipment includes Transland 22358 extra high volume spreader, Transland 54401 NorCal Swathmaster, and 40 extra spray nozzles for high volume spraying. Hopper rinse system also available

DIMENSIONS, EXTERNAL:
Wing span: 15.57 m (51 ft 1¼ in)
Wing chord, constant: 1.83 m (6 ft 0 in)
Wing aspect ratio: 8.53
Length overall: 8.23 m (27 ft 0 in)
Height overall: 2.59 m (8 ft 6 in)
Propeller diameter: standard: 2.77 m (9 ft 1 in)
optional: 2.59 m (8 ft 6 in)

AREAS:
Wings, gross: 28.43 m² (306.0 sq ft)
Ailerons (total): 3.55 m² (38.2 sq ft)
Trailing-edge flaps (total): 3.75 m² (40.4 sq ft)
Fin: 0.90 m² (9.7 sq ft)
Rudder: 1.30 m² (14.0 sq ft)
Tailplane: 2.42 m² (26.0 sq ft)
Elevators, incl tabs: 2.36 m² (25.4 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, spray equipped: 1,905 kg (4,200 lb)
Max T-O weight: 3,565 kg (7,860 lb)
Max landing weight: 2,721 kg (6,000 lb)
Max wing loading: 125.4 kg/m² (25.69 lb/sq ft)
Max power loading: 7.97 kg/kW (13.1 lb/hp)

PERFORMANCE (at max T-O weight, ISA, except where indicated):
Max cruising speed at S/L, hopper empty: 135 kts (251 km/h, 156 mph)
Cruising speed at 1,220 m (4,000 ft): 124 kts (230 km/h, 143 mph)
Typical working speed: 104-122 kts (193-225 km/h, 120-140 mph)
Stalling speed at 2,721 kg (6,000 lb):
flaps up: 64 kts (118 km/h, 73 mph)
flaps down: 53 kts (99 km/h, 61 mph)
Stalling speed as usually landed: 47 kts (87 km/h, 54 mph)
Max rate of climb at S/L:
at max landing weight: 335 m (1,100 ft)/min
at max T-O weight: 158 m (520 ft)/min
T-O run: 402 m (1,318 ft)
Range, econ cruising speed at 2,440 m (8,000 ft), no reserves: 547 n miles (1,014 km, 630 miles)

UPDATED

AT-402B TURBO AIR TRACTOR

TYPE: Turboprop agricultural aircraft

PROGRAMME: Following on from AT-400. AT-402 first flight August 1988, certificated November 1988, first delivery late 1988. Current model 402B has Hoerner wingtips and increased span

CURRENT VERSIONS: **AT-402B:** Combines fuselage, tail surfaces and landing gear of AT-400 with turboprop engine and wing of AT-401B

CUSTOMERS: Total of 86 AT-400s (earlier shorter-span model), 82 AT-402s and two 402Bs delivered by early 1995

COSTS: Standard AT-402 $431,900; or $194,500 with customer supplied PT6A-15AG, -27, -28, -34AG engine

DESIGN FEATURES: All models have steel alloy lower wing spar caps for unlimited fatigue life and reinforced leading edges to prevent bird strike damage. Size 29-11 high-flotation tyres and wheels as standard. 250 A starter/generator and two 24 V 21 Ah batteries

POWER PLANT: One 507 kW (680 shp) P&WC PT6A-15AG, -27 or -28, either new or customer-furnished, driving a Hartzell three-blade constant-speed reversible-pitch propeller. Standard fuel capacity 644 litres (170 US gallons, 142 Imp gallons), optional fuel tankage 818 litres (216 US gallons; 180 Imp gallons) or 886 litres (234 US gallons, 195 Imp gallons).

EQUIPMENT: Hopper and gatebox size as for AT-401, optional equipment includes Transland extra high volume dispersal system

DIMENSIONS, EXTERNAL:
Wing span: 15.57 m (51 ft 1¼ in)

WEIGHTS AND LOADINGS:
Weight empty, spray equipped: 1,733 kg (3,820 lb)
Certificated gross weight (FAR 23): 2,721 kg (6,000 lb)
Typical operating weight (CAM 8): 3,565 kg (7,860 lb)
Max wing loading: 125.4 kg/m² (25.69 lb/sq ft)
Max power loading: 7.04 kg/kW (11.56 lb/shp)

PERFORMANCE (at max T-O weight except where indicated):
Max level speed at S/L:
clean: 174 kts (322 km/h, 200 mph)
with dispersal equipment: 160 kts (298 km/h, 185 mph)
Cruising speed at 283 kW (380 shp) at 2,440 m (8,000 ft): 142 kts (264 km/h; 164 mph)
Typical working speed: 113-126 kts (209-233 km/h, 130-145 mph)
Stalling speed at 2,721 kg (6,000 lb) AUW:
flaps up: 64 kts (118 km/h, 73 mph)
flaps down: 53 kts (99 km/h, 61 mph)
Stalling speed at 2,041 kg (4,500 lb) typical landing weight: 46 kts (86 km/h; 53 mph)
Max rate of climb at S/L, dispersal equipment installed:
AUW of 2,721 kg (6,000 lb): 495 m (1,625 ft)/min
AUW of 3,565 kg (7,860 lb): 305 m (1,000 ft)/min
T-O run at AUW of 3,565 kg (7,860 lb): 247 m (810 ft)
Landing run at 2,041 kg (4,500 lb): 122 m (400 ft)

UPDATED

AIR TRACTOR AT-502B

TYPE: Turboprop agricultural aircraft

PROGRAMME: First flight April 1987; certificated 23 June 1987. 43 sold in 1994

CURRENT VERSIONS: **AT-502:** Original version. *Described below*

AT-502A: Similar to AT-502B but with 820 kW (1,100 shp) PT6A-45R, slow turning (1,425 rpm) five-blade Hartzell propeller, enlarged vertical tail surfaces. For operation in mountainous terrain. Prototype first flight February 1992, certificated April 1992, 15 delivered in 1994.

AT-502B: Thicker wing with 0.61 m (2 ft) longer span and Hoerner wingtips, which claimed to increase width of spray pattern by 0.91 m (3 ft)

CUSTOMERS: 267 AT-502s delivered by January 1995

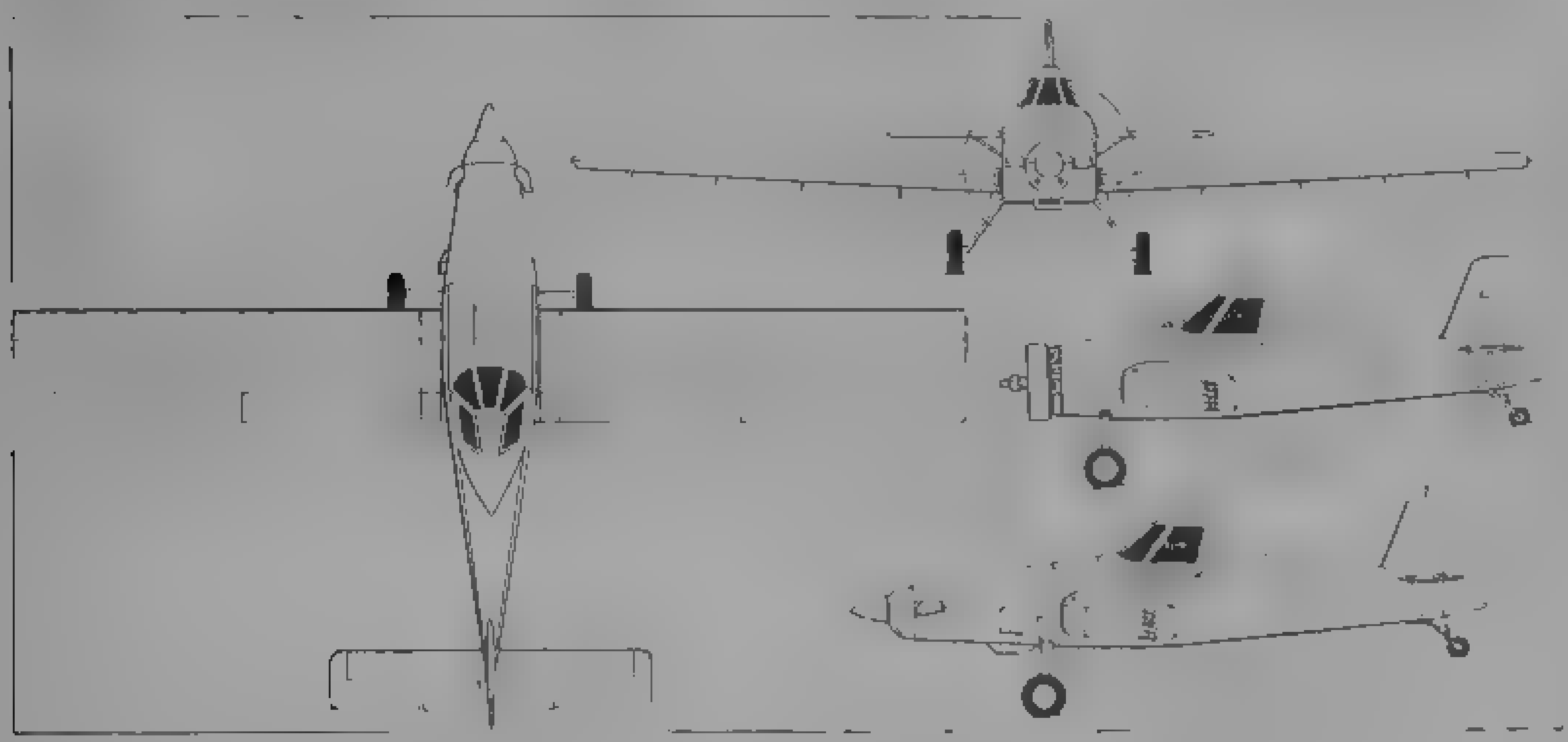
COSTS: Standard AT-502 $441,000, or $204,900 with customer supplied PT6A-15AG, -27, -28, -34AG

DESIGN FEATURES: Larger chemical hopper than AT-400 to handle low-density nitrogen based fertilisers such as urea, safety glass centre windscreen with wiper. Differences

Air Tractor AT-402B (P&WC PT6A turboprop)

Air Tractor AT-502 showing the spraybars under the wings and the windmill generator under the fuselage

1995



Air Tractor AT-502 agricultural aircraft, with extra side view (top) of AT-401 *(Jane's/Dennis Punnett)*

1993

from AT-400 include approximately 1.52 m (5 ft 0 in) increase in wing span, alloy steel lower spar cap and bonded doubler on inside of wing leading-edge for increased resistance to impact damage, and glassfibre wingroot fairings, fuselage length increased by 0.56 m (1 ft 10 in), width increased by 0.25 m (10 in), and larger diameter tubular frame members used to cater for increased maximum T-O weight.

LANDING GEAR: Non-retractable tailwheel type. Heavy-duty E-4340 spring steel main gear, thickness 37.2 mm (1.31 in), flat spring for castoring and lockable tailwheel. Cleveland mainwheels, tyre size 29.00-11, pressure 3.45 bars (50 lb/sq in); tailwheel tyre size 5.00-5. Cleveland six-piston brakes with heavy-duty discs.

POWER PLANT: One 507 kW (680 shp) Pratt & Whitney Canada PT6A-15AG, PT6A-27 or PT6A-28, or 559 kW (750 shp) PT6A-34 or PT6A-34AG turboprop, driving a Hartzell HC-B3TN-3D/T10282+4 three-blade metal propeller. Standard fuel capacity 644 litres (170 US gallons; 142 Imp gallons). Optional capacities 818 litres (216 US gallons; 180 Imp gallons) and 886 litres (234 US gallons; 195 Imp gallons).

ACCOMMODATION: As for AT-400, but with new quick detachable instrument panel and removable fuselage skin panels for ease of maintenance.

SYSTEMS: Two 24 V 42 Ah batteries and 250 A starter/generator.

AVIONICS: *Comms:* Optional avionics include Bendix/King KX 155 nav/com and KR 87 ADF, KY 196 com radio, KT 76A transponder and Narco ELT-10 emergency locator transmitter.

EQUIPMENT: Agricultural dispersal system comprises a 1,900 litre (502 US gallon, 418 Imp gallon) hopper mounted in forward fuselage with hopper window and instrument panel-mounted hopper quantity gauge; 0.97 m (3 ft 2 in) wide Transland gatebox; Transland 6.4 cm (2½ in) bottom loading valve, Agrinautics 6.4 cm (2½ in) spraypump with Transland on/off valve and five-blade variable-pitch plastics fan and 40-nozzle stainless steel spray system with streamlined booms. Optional dispersal equipment includes 7.6 cm (3 in) spray system with 119 spray nozzles, and automatic flagman. Standard equipment includes safety glass centre windscreen panel, ground start receptacle, three-colour polyurethane paint finish, strobe and navigation lights, windscreen washer and wiper; and twin nose-mounted landing/taxi lights. Optional equipment includes night flying package, comprising night working lights, retractable 600 W landing light in port wingtip; fuel flowmeter, fuel totaliser and ferry fuel system. Alternative agricultural equipment includes Transland 22356 extra high volume spreader, Transland 54401 NorCal Swathmaster, 41 extra spray nozzles for high-volume spraying and eight- or 10-unit Micronair Mini Atomiser unit; an optional hopper rinse tank can be fitted.

DIMENSIONS, EXTERNAL:

Wing span: AT-502A/502B	15.85 m (52 ft 0 in)
Wing chord, constant	1.83 m (6 ft 0 in)
Wing aspect ratio	8.67
Length overall	9.91 m (32 ft 6 in)
Height overall	2.99 m (9 ft 9½ in)
Wheel track	3.11 m (10 ft 2½ in)
Wheelbase	6.64 m (21 ft 9½ in)
Propeller diameter	2.69 m (8 ft 10 in)

AREAS:

Wings, gross: AT-502A/502B	28.99 m² (312.0 sq ft)
Ailerons (total)	3.53 m² (38.0 sq ft)
Trailing-edge flaps (total)	3.75 m² (40.4 sq ft)
Fin	0.90 m² (9.7 sq ft)
Rudder	1.30 m² (14.0 sq ft)
Tailplane	2.41 m² (26.0 sq ft)
Elevators (total, incl tab)	2.44 m² (26.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, spray equipped	1,950 kg (4,300 lb)
Max T-O weight	4,309 kg (9,500 lb)
Max landing weight	3,629 kg (8,000 lb)
Max wing loading: AT-502A/502B	148.66 kg/m² (30.45 lb/sq ft)
Max power loading: 502A	5.26 kg/kW (8.64 lb/shp)
502B (PT6A-34AG)	7.71 kg/kW (12.67 lb/shp)
502B (PT6A-15AG)	8.50 kg/kW (13.97 lb/shp)

PERFORMANCE (AT-502B at max T-O weight, ISA, except where indicated, with spray equipment installed):

Never-exceed speed (VNE) and max level speed at S/L, hopper empty: 156 kts (290 km/h, 180 mph)

Cruising speed at 2,440 m (8,000 ft), 283 kW (380 shp): 136 kts (253 km/h, 157 mph)

Typical working speed: 104-126 kts (193-233 km/h, 120-145 mph)

Stalling speed at 3,629 kg (8,000 lb):

flaps up	72 kts (134 km/h, 83 mph)
flaps down	60 kts (111 km/h, 69 mph)

Stalling speed at 1,978 kg (4,360 lb), typical landing weight: 46 kts (86 km/h, 53 mph)

Max rate of climb at S/L, AUW of 3,629 kg (8,000 lb):

with PT6A-15AG	311 m (1,020 ft)/min
with PT6A-34AG	360 m (1,180 ft)/min

Max rate of climb at S/L, AUW of 4,309 kg (9,500 lb):

with PT6A-15AG	232 m (760 ft)/min
with PT6A-34AG	282 m (925 ft)/min

T-O run at AUW of 3,629 kg (8,000 lb):

with PT6A-15AG	244 m (800 ft)
with PT6A-34AG	222 m (730 ft)

T-O run at AUW of 4,309 kg (9,500 lb):

with PT6A-15AG	356 m (1,170 ft)
with PT6A-34AG	302 m (990 ft)

Range with max fuel: 435 n miles (805 km, 500 miles)

UPDATED

AIR TRACTOR AT-802

TYPE: Two-seat agricultural and firefighting aircraft.

PROGRAMME: Design started July 1989; first flight of prototype (N802LS) 30 October 1990; second aircraft flew November 1991, with PT6A-45R and configured as agricultural model with spraybooms, pump and Transland gatebox. Production deliveries started second quarter 1993.

CUSTOMERS: 15 delivered by early 1995 to Argentina. Production of 10 aircraft planned in 1995.

CURRENT VERSIONS: **AT-802**: Two-seater powered by P&WC PT6A-45R, certificated for gross weight of 6,804 kg (15,000 lb) 27 April 1993. PT6A-65R and -67R versions certificated April 1993 at maximum T-O weight of 7,257 kg (16,000 lb).

AT-802A: Single-seat version, third production aircraft in this configuration, can be powered by used PT6A-45R, PT6A-65B or PT6A-65AG engine. First flight 6 July 1992. FAA certification gained 17 December 1992, certificated for gross weight of 6,804 kg (15,000 lb) with PT6A-45R on 27 April 1993. PT6A-65R and -67R versions certificated March 1993 at maximum T-O weight of 7,257 kg (16,000 lb).

AT-802AF: Single-seat firefighting version, PT6A-67AF engine. FAA certification at 5,670 kg (12,500 lb) maximum T-O weight 17 December 1992, certificated at 7,257 kg (16,000 lb) on 27 April 1993, giving useful load of 4,232 kg (9,330 lb). *Data apply to this version except where indicated.*

COSTS: Standard AT-802A $795,000 with factory refurbished PT6A-67AG, with customer supplied PT6A-45R, -65AG or -67R $331,000. Standard AT-802AF $905,000.

DESIGN FEATURES: Largest model built by company to date, full dual controls for training, also designed for firefighting; programmable logic computer with cockpit control panel and digital display enables pilot to select coverage level and opens hydraulically operated 'bomb bay' drop doors to prescribed width, closing them when selected amount of retardant released. Drop doors adjust automatically for changing IAS and aircraft acceleration to provide a constant flow rate and even ground coverage. Wing aerofoil section NACA 4415; dihedral 3° 30'; incidence 2°.

FLYING CONTROLS: Manually operated ailerons, elevators and rudder with balance tabs; electrically operated Fowler trailing-edge flaps deflect to maximum 30°.

STRUCTURE: Two-spar wing of 2024-T3 light alloy with alloy steel upper and lower spar caps and bonded doubler on inside of leading-edge for impact damage resistance; ribs and skins zinc chromated before assembly; glassfibre wingroot fairing and skin overlaps sealed against chemical ingress; flaps and ailerons of light alloy. Fuselage of welded 4130N steel tube, oven stress relieved and oiled internally, with skin panels of 2024-T3 light alloy attached by Camloc fasteners for quick removal; rear fuselage lightly pressurised to prevent chemical ingress. Cantilever fin and strut braced tailplane of light alloy, metal skinned and sealed against chemical ingress.

LANDING GEAR: Non-retractable tailwheel type. Cantilever heavy duty E-4340 spring steel main legs, thickness 39.6 mm (1.56 in); flat spring suspension for castoring and lockable tailwheel. Cleveland mainwheels with tyre size 11.00-12 (10 ply), pressure 4.14 bars (60 lb/sq in). Tailwheel tyre size 6.00-6. Cleveland eight piston brakes with heavy-duty discs.

POWER PLANT: One Pratt & Whitney Canada PT6A-67AG or -67AF turboprop, rated at 1,007 kW (1,350 shp) at 37°C driving a Hartzell five-blade feathering and reversible-pitch constant speed metal propeller. (Used engine options for AT-802A: see Current Versions.) Fuel in two integral wing tanks, total usable capacity 946 litres (250 US gallons, 208 Imp gallons); optional tanks to increase capacity to 1,438 litres (380 US gallons, 317 Imp gallons). Engine air is filtered through two large pleated paper industrial truck filters.

ACCOMMODATION: Two seats in tandem in enclosed cabin which is sealed to prevent chemical ingress and protected with overturn structure. Four downward hinged doors, two on each side. Windscreen is safety-plate auto glass, with washer and wiper. Air conditioning system standard.

Air Tractor AT-802 two-seat agricultural and firefighting aircraft

1994

SYSTEMS: Hydraulic system, pressure 207 bars (3,000 lb/sq in)
AVIONICS: Advanced nav/com, including Loran
EQUIPMENT: Two removable Derakane vinylester hoppers forward of cockpit and 227 litre (60 US gallon; 50 Imp gallon) gate tank in ventral bulge, for agricultural chemical, fire retardant or water; total capacity 3,066 litres (810 US gallons; 674 Imp gallons)
DIMENSIONS, EXTERNAL:

Wing span	17.68 m (58 ft 0 in)
Wing chord constant	2.07 m (6 ft 9½ in)
Wing aspect ratio	8.60
Length overall	11.07 m (36 ft 4 in)
Height overall	3.35 m (11 ft 0 in)
Wheel track	3.11 m (10 ft 2½ in)
Wheelbase	7.25 m (23 ft 9½ in)
Propeller diameter	2.92 m (9 ft 7 in)

AREAS:

Wings, gross	36.33 m² (391.0 sq ft)
Ailerons (total)	4.61 m² (49.6 sq ft)
Trailing-edge flaps (total)	5.54 m² (59.6 sq ft)
Fin	1.24 m² (13.4 sq ft)
Rudder	1.57 m² (16.9 sq ft)
Tailplane	3.44 m² (37.0 sq ft)
Elevators (total, incl tab)	3.00 m² (32.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped: sprayer	2,858 kg (6,300 lb)
firefighter	3,025 kg (6,670 lb)
Max T-O and landing weight	7,257 kg (16,000 lb)
Max wing loading	199.8 kg/m² (40.92 lb/sq ft)
Max power loading	6.83 kg/kW (11.24 lb/shp)

PERFORMANCE (at max T-O weight, ISA, except where indicated):

Max level speed at S/L	182 kts (338 km/h, 210 mph)
Max cruising speed at 1,675 m (5,500 ft)	169 kts (314 km/h, 195 mph)
Stalling speed, power off, flaps down, at max landing weight	79 kts (147 km/h, 91 mph)
Max rate of climb at S/L	244 m (800 ft)/min
Service ceiling	3,960 m (13,000 ft)
T-O run	549 m (1,800 ft)
Range with max fuel	434 n miles (804 km; 500 miles)

UPDATED

OTHER AIRCRAFT

Last of three **AT-503s** delivered in 1991, no further production, details in 1994-95 *Jane's*.

NEW ENTRY

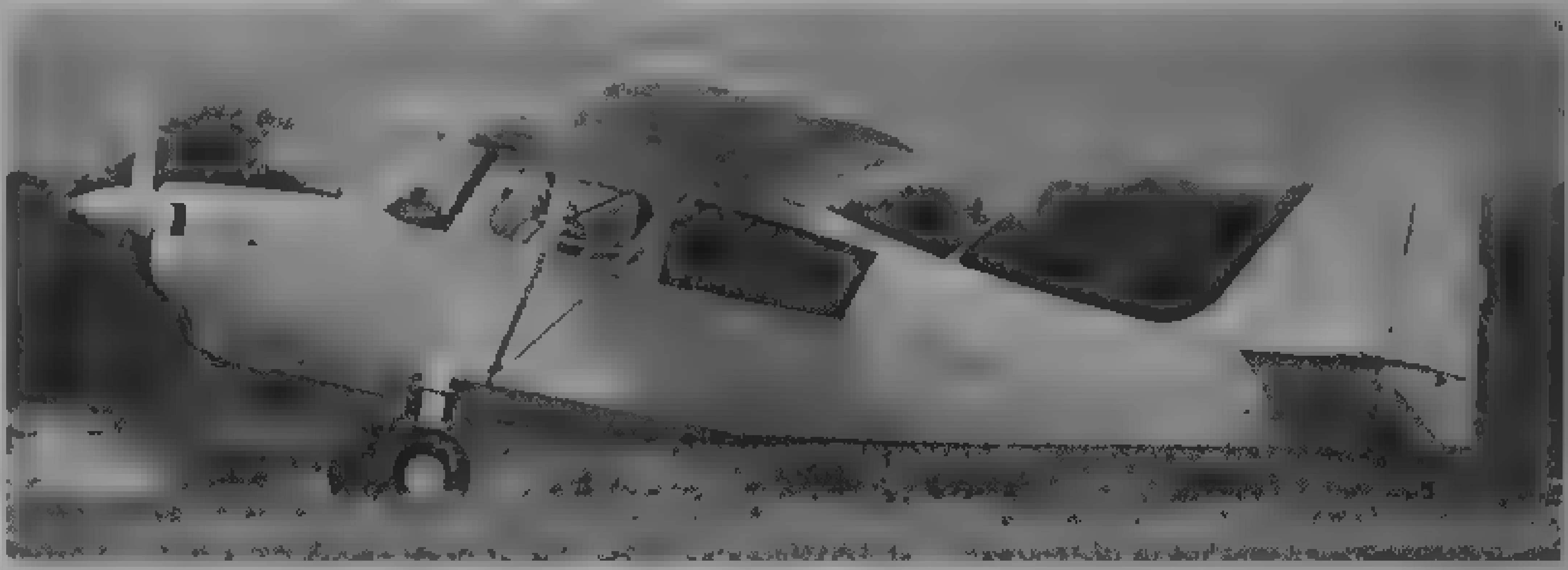
AMERICAN CHAMPION

AMERICAN CHAMPION AIRCRAFT CORPORATION

PO Box 37, 32032 Washington Avenue, Highway D, Rochester, Wisconsin 53167
Telephone: 1 (414) 534 6315
Fax: 1 (414) 534 2395
PRESIDENT AND CEO: Jerry K. Mehlhaff
GENERAL MANAGER: Dale Gauger

ACAC offers new-build Citabria (now called Explorer), Super Decathlon and Scout, formerly marketed by Bellanca Aircraft Corporation (see 1979-80 *Jane's*) and then Champion Aircraft Company (see 1985-86 *Jane's*). Reinstated production in 1990-91. In addition, ACAC offers its new metal spar wing for retrofit to existing 8GCBC aircraft. Total of 20 aircraft produced in 1994.

UPDATED



American Champion 7GCBC, originally built as Citabria 150S *(Paul Jackson)*
1995

AMERICAN CHAMPION 7GCBC EXPLORER

TYPE: Two-seat light cabin monoplane, suitable for training and touring. Formerly Citabria 150S (7GCBC).
PROGRAMME: Certified late 1993.
CUSTOMERS: Two aircraft added to US civil register in 1994.
COSTS: Standard aircraft $60,000.
DESIGN FEATURES: Include modified instrument panel, new window and door, and improved ventilation and heating system. Options include streamline wheel fairings and voltage regulator. Braced high-wing monoplane with NACA 4412 aerofoil section. Dihedral 2°, incidence 1°.
FLYING CONTROLS: Ailerons, elevators and rudder conventional mechanical, elevator trim tab, fixed incidence tailplane. Trailing-edge flaps.
STRUCTURE: Fuselage and wire-braced tail unit are welded chromoly steel tube with Dacron covering, two-spar wing has Sitka spruce spars, aluminium ribs, Dacron covering. GFRP tips and steel tube V struts.
LANDING GEAR: Non-retractable tricycle type. Cantilever spring steel main gear with 6.00-6 wheels and 4 ply tyres as standard. Steerable tailwheel. Disc brakes and parking brake.
POWER PLANT: One 112 kW (150 hp) Textron Lycoming O-320 series flat-four engine, McCauley 1C172AGM two-blade fixed-pitch metal propeller. Fuel in two wing tanks, combined capacity 136 litres (36 US gallons, 30 Imp gallons), overwing refuelling point for each tank. Oil capacity 7.5 litres (2 US gallons, 1.7 Imp gallons).
ACCOMMODATION: Two seats in tandem in fully enclosed cabin. Dual controls. Space for 45 kg (100 lb) of baggage. Door on starboard side.
SYSTEMS: Hydraulic for mainwheel brakes only. Electrical system (12 V DC) powered by engine-driven alternator and battery.
AVIONICS: To customer's choice.
DIMENSIONS, EXTERNAL:

Wing span	10.49 m (34 ft 5 in)
Wing chord, constant	1.52 m (5 ft 0 in)
Wing aspect ratio	6.97
Length overall	6.92 m (22 ft 8½ in)
Height overall	2.35 m (7 ft 8½ in)
Wheel track	1.93 m (6 ft 4 in)
Wheelbase	4.90 m (16 ft 1 in)

AREAS:

Wings, gross	15.79 m² (170.0 sq ft)
Ailerons (total)	1.53 m² (16.50 sq ft)
Fin	0.65 m² (7.02 sq ft)
Rudder	0.63 m² (6.83 sq ft)
Tailplane	1.14 m² (12.25 sq ft)
Elevators (total, incl tab)	1.35 m² (14.58 sq ft)

WEIGHTS AND LOADINGS (7GCBC, Explorer similar):

Weight empty, equipped	522 kg (1,150 lb)
Max T-O and landing weight	748 kg (1,650 lb)
Max wing loading	47.3 kg/m² (9.7 lb/sq ft)
Max power loading	6.68 kg/kW (11.0 lb/hp)

PERFORMANCE (7GCBC at max T-O weight; Explorer similar):

Never-exceed speed (V_{NE})	140 kts (261 km/h, 162 mph)
Max level speed at S/L	113 kts (209 km/h, 130 mph)
Max cruising speed (75% power) at optimum height	111 kts (206 km/h, 128 mph)
Cruising speed (65% power)	107 kts (198 km/h, 123 mph)
Stalling speed, flaps down	39 kts (72 km/h, 45 mph)
Max rate of climb at S/L	349 m (1,145 ft)/min
Service ceiling	5,180 m (17,000 ft)
T-O run	93 m (305 ft)
T-O to 15 m (50 ft)	173 m (567 ft)
Landing from 15 m (50 ft)	210 m (690 ft)
Landing run	95 m (310 ft)
Range with max fuel, allowance for start, taxi, S/L T-O, climb and descent, no reserves: at 75% power	431 n miles (799 km, 496 miles)
at 55% power	521 n miles (966 km, 600 miles)
g limits	+5/−2

UPDATED

AMERICAN CHAMPION 8KCAB SUPER DECATHLON

TYPE: Two-seat light cabin monoplane and aerobatic competition aircraft.
PROGRAMME: FAA certification under FAR Pt 23, for both Normal and Aerobatic categories, granted 1970.
CURRENT VERSIONS: **Super Decathlon**: Constant-speed propeller.

Super Decathlon Fixed Pitch: Fixed-pitch propeller, new paint scheme, offers economy of Explorer with all aerobatic manoeuvres of Super Decathlon.
COSTS: Standard price $69,900.
CUSTOMERS: Approximately 25 built in 1993 and 14 in 1994, total 95 built 1990-94.
DESIGN FEATURES: Higher rated engine than Decathlon, cleared for limited inverted flight, choice of constant-speed or fixed-pitch propeller. Wing section NACA 1412 (modified), dihedral 1°, incidence 1° 30'.
FLYING CONTROLS: Ailerons, elevators with port trim tab, and rudder.
STRUCTURE: Wing has wooden spars and aluminium alloy ribs, Dacron covered, GFRP wingtips, Dacron covered ailerons, aluminium alloy (front) and steel tube (aft) bracing struts. Fuselage and tail unit are welded steel tube structures, Dacron covered.
LANDING GEAR: Non-retractable tailwheel type; cantilever spring steel main legs; mainwheel tyres size 17 × 6.6, pressure 1.66 bars (24 lb/sq in); tailwheel tyre size 8.30 × 2.50-2.80, pressure 2.07 bars (30 lb/sq in); Cleveland disc brakes, optional wheel fairings.
POWER PLANT: One 134 kW (180 hp) Textron Lycoming AEIO-360-H1A flat-four engine, driving a Hartzell constant-speed or fixed-pitch propeller. Fuel capacity 151.4 litres (40 US gallons, 33.3 Imp gallons). Oil capacity 7.5 litres (2 US gallons, 1.7 Imp gallons).
ACCOMMODATION: Tandem seats in enclosed cabin.
DIMENSIONS, EXTERNAL:

Wing span	9.75 m (32 ft 0 in)
Wing chord, constant	1.63 m (5 ft 4 in)
Wing aspect ratio	6.06
Length overall	6.98 m (22 ft 10¾ in)
Height overall	2.36 m (7 ft 9 in)
Tailplane span	3.10 m (10 ft 2¼ in)

AREAS:

Wings, gross	15.71 m² (169.1 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	596 kg (1,315 lb)
Max T-O weight	816 kg (1,800 lb)
Max wing loading	51.75 kg/m² (10.6 lb/sq ft)
Max power loading	6.08 kg/kW (10.0 lb/hp)

PERFORMANCE:

Max level speed at 2,315 m (7,000 ft)	137 kts (254 km/h, 158 mph)
Cruising speed at 75% power	130 kts (241 km/h, 150 mph)
Stalling speed	47 kts (87 km/h, 54 mph)
Max rate of climb at S/L	375 m (1,230 ft)/min
Service ceiling	4,875 m (16,000 ft)
Range, no reserves: at 75% power	509 n miles (944 km, 587 miles)
at 55% power	542 n miles (1,006 km, 625 miles)
g limits	+6/−5

UPDATED

AMERICAN CHAMPION 8GCBC SCOUT

TYPE: Two-seat light utility aircraft.
PROGRAMME: Original 8GCBC version with 134 kW (180 hp) engine received type approval 1974.
CUSTOMERS: Five built in 1993 and one in 1994, total 39 built 1991-94.
COSTS: $65,900 with 134 kW (180 hp) Textron Lycoming O-360-C2A engine and McCauley 1A200HFA8041 fixed-pitch propeller; $67,900 with O-360-C1A engine and Hartzell HC-C2YR 1BF/F7666A O constant-speed propeller. Retrofit metal spar wing for existing 8GCBC, $13,800 with 136 litre (36 US gallon; 30 Imp gallon) wing tank (usable capacity), $14,800 with optional 265 litre (70 US gallon, 58 Imp gallon) tank (usable).
DESIGN FEATURES: Upgraded version of Bellanca/Champion Scout, with new lighter and stronger metal spar wing with 300 per cent less deflection than previous wooden wings, circuit breakers; modern avionics, revised interior; and high gloss weather resistant exterior finish. Can operate from short fields while towing glider or banner, low speed assists pipeline, border patrol, forestry and wildlife management roles. Options include wheel fairings, cropduster package, long-range fuel tank, glider tow assembly, and new voltage regulator.

Wing section NACA 4412, dihedral 1°, incidence 1°. Hoerner wingtips.
FLYING CONTROLS: Ailerons, elevators and rudder; 27° droop trailing-edge flaps.
STRUCTURE: All-metal, with Dacron covering.
LANDING GEAR: Non-retractable tailwheel type. Cantilever spring steel main gear with wheels and tyres size 8.50 × 6 (4 ply), heavy-duty tailwheel, optional floats, skis or tundra tyres. Dual toe brakes, parking brake.
POWER PLANT: See Costs. Oil capacity 7.5 litres (2 US gallons; 1.7 Imp gallons).
ACCOMMODATION: Tandem seating for two, dual controls.

SYSTEMS: Heating and ventilation, vacuum pump system, electrical with starter, 60 A alternator, ammeter, 12 V Gel Cell battery, voltage regulator with overvolt protector, control panel with circuit breakers.

AVIONICS: Terra, Narco and Bendix/King suites available; include communications, intercom, emergency locator transmitter, and gyro panel groups; other instruments at customer's request.

DIMENSIONS, EXTERNAL (A: fixed-pitch propeller, B: constant-speed propeller):

Wing span	11.02 m (36 ft 2 in)
Wing chord, constant	1.52 m (5 ft 0 in)
Wing aspect ratio	7.27
Length overall: A	6.93 m (22 ft 9 in)
B	7.01 m (23 ft 0 in)
Height overall	2.64 m (8 ft 8 in)
Tailplane span	3.10 m (10 ft 2¼ in)
Propeller diameter: B	1.93 m (6 ft 4 in)

AREAS:

Wings, gross	16.70 m² (180.0 sq ft)

WEIGHTS AND LOADINGS (A and B as above):

Weight empty: A	597 kg (1,315 lb)
B	603 kg (1,330 lb)
Max T-O weight: A and B, Normal	975 kg (2,150 lb)
A, Restricted	1,179 kg (2,600 lb)
Max wing loading: Normal	58.3 kg/m² (11.94 lb/sq ft)
B, Restricted	70.5 kg/m² (14.4 lb/sq ft)
Max power loading: Normal	7.28 kg/kW (11.94 lb/hp)
B, Restricted	8.80 kg/kW (14.44 lb/hp)

PERFORMANCE (A and B as above):

Max level speed at S/L:	
A, B	117 kts (217 km/h, 135 mph)
Cruising speed, 75% power:	
A	106 kts (196 km/h, 122 mph)
B	113 kts (209 km/h, 130 mph)
Stalling speed, flaps down:	
A, B	45 kts (84 km/h, 52 mph)
Max rate of climb at S/L: A	329 m (1,080 ft)/min
B	311 m (1,020 ft)/min
T-O run: A, B	156 m (510 ft)
Range, no reserves:	
A, at 75% power	333 n miles (618 km; 384 miles)
A, at 75% power, optional fuel	680 n miles (1,260 km; 783 miles)
A, at 55% power, optional fuel	779 n miles (1,444 km; 897 miles)
B, at 75% power	343 n miles (636 km; 395 miles)
B, at 75% power, optional fuel	700 n miles (1,297 km; 806 miles)
B, at 55% power, optional fuel	802 n miles (1,487 km; 924 miles)

UPDATED

AMERICAN GENERAL

AMERICAN GENERAL AIRCRAFT CORPORATION

Production of the AG-5B Tiger has been terminated, final two aircraft (Nos 174 and 175) delivered to German owners in February 1994; details in 1994-95 *Jane's*. GA 7 Cougar built under licence by SOCATA of France (see Addenda).

UPDATED

ARCTIC

ARCTIC AIRCRAFT COMPANY

PO Box 190141, Anchorage International Airport, Alaska 99519
Telephone: 1 (907) 243 1580
Fax: 1 (907) 562 2549
PRESIDENT: William A. Diehl

VERIFIED

ARCTIC AIRCRAFT INTERSTATE S1B2 ARCTIC TERN

TYPE: Tandem two-seat sporting and general utility aircraft.

PROGRAMME: Updated and much improved version of Interstate S1A, first flown 1940. Built to CAR 04a (aerobatic) standard; certificated for operation on optional Edo floats 20 January 1981; production in response to individual orders. Full description in 1994-95 and earlier *Jane's*.

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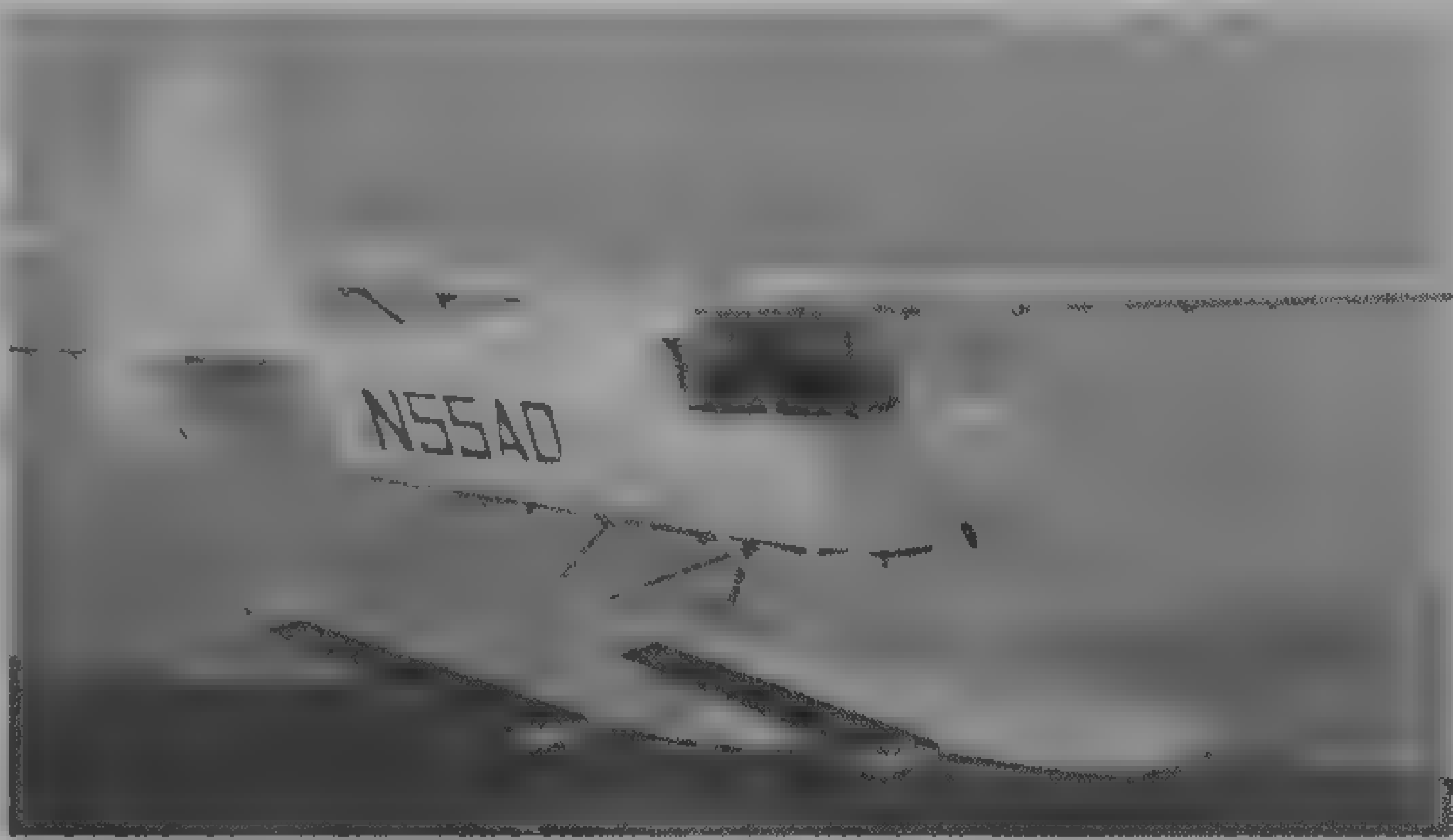


Arctic Aircraft Interstate S1B2 Arctic Tern

1993

ARCTIC AIRCRAFT INTERSTATE S-4 PRIVATEER

TYPE: Four-seat utility aircraft.

PROGRAMME: Certificated in 1994.

COSTS: Assembled $72,300.

CUSTOMERS: Four assembled aircraft and eight kits sold.

DESIGN FEATURES: Longer span version of Arctic Tern, with increased fuselage width to allow for four persons.

POWER PLANT: One 119 kW (160 hp) Textron Lycoming O-320-B2B flat-four engine. Fuel capacity 151 litres (40 US gallons; 33.3 Imp gallons). Optional underbelly auxiliary fuel tank.

DIMENSIONS, EXTERNAL:

Wing span	11.48 m (37 ft 8 in)
Wing aspect ratio	7.51
Length overall	7.01 m (23 ft 0 in)
Height overall	2.13 m (7 ft 0 in)

AREAS:

Wings, gross	17.56 m² (189.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	521 kg (1,148 lb)
Baggage capacity	45 kg (100 lb)
Max T-O weight	1,021 kg (2,250 lb)
Max wing loading	58.1 kg/m² (11.9 lb/sq ft)
Max power loading	8.58 kg/kW (14.06 lb/hp)

PERFORMANCE (at max T-O weight, ISA):

Cruising speed:	
75% power at 1,065 m (3,500 ft)	107 kts (198 km/h, 123 mph)
65% power at 1,065 m (3,500 ft)	103 kts (191 km/h, 119 mph)

Arctic Aircraft Interstate S-4 Privateer

1993

Stalling speed, flaps down	33 kts (61 km/h, 38 mph)
Max rate of climb at S/L	317 m (1,040 ft)/min
Service ceiling	4,575 m (15,000 ft)
T-O to, and landing from, 15 m (50 ft)	153 m (500 ft)
Range at 75% power at 915 m (3,000 ft), 45 min reserves	600 n miles (1,112 km; 691 miles)
at 65% power, reserves as above	650 n miles (1,204 km; 748 miles)

UPDATED

ASI

AMERICAN SPORTSCOPTER INC

875 Middle Ground Boulevard, Newport News, Virginia 23606
Telephone: 1 (804) 873 4914
Fax: 1 (804) 873 3711

VERIFIED

AMERICAN SPORTSCOPTER ULTRASPORT

TYPE: Single/two-seat ultralight/microlight helicopter.

PROGRAMME: Prototype (254 version) first flight 24 July 1993. Two prototypes built and tested. Supplied as five module kit taking 60 man-hours to assemble.

CURRENT VERSIONS: **Ultrasport 254**: Single-seat, ultralight category. Designation is empty weight in pounds.

Ultrasport 331: Microlight category FAR Pt 21.191(g); one or two seats, in design.

CUSTOMERS: Three 331s ordered by Georgia Tech Research Corporation for delivery in kit form in May/June 1995 for participation in US Army's Autonomous Scout Rotorcraft Testbed programme.

COSTS: 254 version between $25,000 and $35,000, depending on customer fit.

DESIGN FEATURES: Design objective of 254 was basic weight not to exceed 115 kg (254 lb) in order to comply with FAR Pt 103. Two-blade main rotor; shielded two-blade tail rotor; tailplane with fins at tip; tail rotor drive carried in narrow streamline tailboom.

FLYING CONTROLS: Conventional collective, cyclic and yaw pedals. Cyclic stick is top-mounted in cockpit.

STRUCTURE: Composites.

LANDING GEAR: Fixed skids or optional floats.

POWER PLANT: One 41 kW (55 hp) Gobler Hirth 2703 two-stroke engine with electric starter. Normal fuel capacity 38 litres (10 US gallons, 8.3 Imp gallons) in 254, 87.5 litres (23.1 US gallons, 19.2 Imp gallons) in 331.

ACCOMMODATION: Single open seat (254 version), side by side seating optional in 331 version.

SYSTEMS: Electrical: 12 V battery, 14 V alternator fit appropriate to engine.

AVIONICS: Customer choice.

DIMENSIONS, EXTERNAL:

Main rotor diameter	6.40 m (21 ft 0 in)
Main rotor blade chord	0.17 m (6¾ in)
Tail rotor diameter	0.76 m (2 ft 6 in)
Tail rotor blade chord	0.05 m (2 in)
Fuselage length (main rotor folded)	5.08 m (16 ft 8 in)
Height overall	2.29 m (7 ft 6 in)
Skid track	2.43 m (8 ft 0 in)

WEIGHTS AND LOADINGS:

Weight empty: 254	115 kg (254 lb)
331	150 kg (331 lb)
Payload (incl fuel): 254	113 kg (250 lb)
331	159 kg (350 lb)
Max T-O and landing weight: 254	236 kg (520 lb)
331	308 kg (680 lb)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (VNE)	135 kts (250 km/h; 155 mph)
Max level speed: 254	55 kts (102 km/h; 63 mph)
331	90 kts (167 km/h; 104 mph)
Max cruising speed: 331	55 kts (102 km/h; 63 mph)
Rate of climb at S/L	305 m (1,000 ft)/min
Service ceiling	3,660 m (12,000 ft)
Hovering ceiling, 331: IGE	3,290 m (10,800 ft)
OGE	2,135 m (7,000 ft)
Range: normal fuel, 55 kts	130 n miles (241 km; 150 miles)
Endurance: 331	2 h 30 min

UPDATED

ASI Ultrasport 254 single-seat ultralight helicopter

1995

AVIAT

AVIAT INC

Airport Box 1149, South Washington Street, Afton, Wyoming 83110
Telephone: 1 (307) 886 3151
Fax: 1 (307) 886 9674
CHAIRMAN: Malcolm T. White
PRESIDENT: Robert Merritt
VICE-PRESIDENT MARKETING: Verdean G. Heiner

Pitts Aerobatics company plus manufacturing and marketing rights of Pitts Special aircraft acquired by Christen Industries November 1983. Pitts Aerobatics factory at Afton, Wyoming, became headquarters of Christen Industries, which in turn was acquired April 1991 by Aviat Inc of Delaware (wholly owned subsidiary of White International Ltd, Guernsey, Channel Islands). Aviat now owns production and type certificates for Christen range. Total 30 aircraft produced in 1994.

UPDATED

AVIAT A-1 HUSKY

TYPE: Two-seat light utility aircraft.

PROGRAMME: First flight (N6070H) 1986. FAA certification 1987, including Edo 2000 floats and skis, glider/banner towing hook approved.

CUSTOMERS: Total 286 delivered by early 1995, including two to US Department of Interior and four to US Department of Agriculture; also operated by US police agencies and in Kenya for wildlife protection patrols. Eight new Huskys added to US civil register in 1994.

COSTS: $74,995 basic; $86,500 typically equipped.

DESIGN FEATURES: Missions include bush flying, border patrol, fish and wildlife protection and pipeline inspection. Wing has modified Clark Y US 35B section, drooped Plane Booster wingtips.

FLYING CONTROLS: Symmetrical section ailerons with spade type mass balance, trim tabs in elevators, slotted flaps. Fixed tailplane, trim by adjustable bungee.

STRUCTURE: Wing has two aluminium spars, metal ribs and metal leading edge, Dacron covering overall. Twin bracing struts each side of wings and wire and strut-braced tail unit. Light alloy flaps and ailerons, with Dacron covering. Fuselage and tail have chrome molybdenum steel tube frames, covered in Dacron except for metal skin to rear fuselage.

LANDING GEAR: Non-retractable tailwheel type. Two faired side Vs and half-axles hinged to bottom of fuselage, with internal (under front seat) bungee cord shock-absorption. Cleveland mainwheels, tyres size 8.00-6 as standard; 6.00-6 or 8.50-6 tyres or 24 × 10-6 tundra tyres optional. Cleveland mainwheel brakes. Steerable leaf spring tailwheel. Wheel-replacement or wheel-retract skis and floats optional.

POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-C1G flat four engine, driving a Hartzell two-blade constant-speed metal propeller. Fuel in two metal tanks, one in each wing, total capacity 208 litres (52 US gallons, 45.75 Imp gallons), of which 189 litres (50 US gallons, 41.6 Imp gallons) are usable. Fuel filler point in upper surface of each wing, near root.

Aviat A-1 Husky two-seat utility aircraft on floats

1995

ACCOMMODATION: Enclosed cabin seating two in tandem, with dual controls. Downward-hinged door on starboard side, with upward-hinged window above. Skylight window in roof.

SYSTEMS: Electrical system includes lights and 60 A alternator.

DIMENSIONS, EXTERNAL:

Wing span	10.73 m (35 ft 2½ in)
Wing aspect ratio	6.89
Length overall	6.88 m (22 ft 7 in)
Height overall	2.01 m (6 ft 7 in)
Propeller diameter	1.93 m (6 ft 4 in)

AREAS:

Wings, gross	16.72 m² (180.0 sq ft)
Ailerons (total)	1.43 m² (15.4 sq ft)
Trailing-edge flaps (total)	2.09 m² (22.5 sq ft)
Fin	0.43 m² (4.66 sq ft)
Rudder	0.62 m² (6.76 sq ft)
Tailplane	1.48 m² (15.9 sq ft)
Elevators, incl tabs	1.31 m² (14.1 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	540 kg (1,190 lb)
Max T-O weight	816 kg (1,800 lb)
Max baggage weight	22.7 kg (50 lb)
Max wing loading	48.8 kg/m² (10.0 lb/sq ft)
Max power loading	7.45 kg/kW (10.0 lb/hp)

PERFORMANCE:

Never-exceed speed (VNE)	132 kts (245 km/h; 152 mph)
Cruising speed: 75% power at 1,220 m (4,000 ft)	122 kts (226 km/h; 140 mph)
55% power	115 kts (212 km/h; 132 mph)
Stalling speed: flaps up	48 kts (80 km/h; 49 mph)
flaps down	37 kts (68 km/h; 42 mph)
Max rate of climb at S/L	457 m (1,500 ft)/min
Service ceiling	6,100 m (20,000 ft)
T-O run	46 m (150 ft)
T-O to 15 m (50 ft)	229 m (750 ft)
Landing from 15 m (50 ft)	427 m (1,400 ft)
Landing run, full flap	107 m (350 ft)
Range with max fuel, 75% power, 45 min reserves	550 n miles (1,019 km; 633 miles)

UPDATED

AVIAT ACRO-HUSKY

Shorter wing span with NACA 23012 section; 134 kW (180 hp) Textron Lycoming engine with full inverted-flight oil/fuel systems, symmetrical ailerons with spade type balance, no flaps, *g* limits +6/−3. In development, to fly during 1995.

UPDATED

PITTS S-1T SPECIAL

TYPE: Single-seat aerobatic biplane.

PROGRAMME: Original single-seat Pitts Special built and flown 1944, early factory built S-1S last described in 1987-88 *Jane's*. Production of current S-1T factory version started early 1981, FAA certification Autumn 1982.

CUSTOMERS: Total 63 delivered by early 1995, including three built in 1994. Available to order only.

COSTS: $97,845

DESIGN FEATURES: New features include more powerful engine and wings moved forward 11.5 cm (4.5 in) to compensate; symmetrical wing and aileron sections. Wing section M6, thickness/chord ratio 12 per cent, dihedral upper wings 0°, lower wings 3°, incidence upper wing 1° 30′, lower wings 0°; sweepback 6° 40′ upper wing only.

FLYING CONTROLS: Symmetrical ailerons on upper and lower wings, lower with spade-type aerodynamic balance; trim tab on each elevator, fixed tailplane, no flaps.

STRUCTURE: Fabric covered wooden wing and ailerons, single interplane strut and duplicated flying and landing wires, fabric covered steel tube fuselage with wooden stringers and aluminium top decking and side panels, remainder fabric covered, tail surfaces fabric covered steel tube. Cockpit floor is clear Plexiglas for improved vision when inverted.

LANDING GEAR: Non-retractable tailwheel type. Rubber cord shock-absorption. Cleveland mainwheels with 6 ply tyres, size 5.00-5, pressure 2.07 bars (30 lb/sq in). Cleveland hydraulic disc brakes. Steerable tailwheel. Glassfibre fairing on mainwheels.

POWER PLANT: One 149 kW (200 hp) Textron Lycoming AEIO-360-A1E flat-four engine, driving a Hartzell two-blade constant-speed propeller. Fuel tank aft of firewall, capacity 75 litres (20 US gallons; 16.6 Imp gallons). Refuelling point on upper surface of fuselage, forward of windscreen. Oil capacity 7.5 litres (2 US gallons; 1.7 Imp gallons). Inverted fuel and oil systems standard.

ACCOMMODATION: Single seat. Sliding cockpit canopy standard.

DIMENSIONS, EXTERNAL:

Wing span, upper	5.28 m (17 ft 4 in)
Wing chord (constant, both)	0.91 m (3 ft 0 in)
Wing aspect ratio	5.8
Length overall	4.72 m (15 ft 6 in)
Height overall	1.91 m (6 ft 3 in)
Tailplane span	1.98 m (6 ft 6 in)
Propeller diameter	1.93 m (6 ft 4 in)

AREAS:

Wings, gross	9.15 m² (98.5 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	376 kg (830 lb)
Max T-O weight	521 kg (1,150 lb)
Max wing loading	57.05 kg/m² (11.68 lb/sq ft)
Max power loading	3.50 kg/kW (5.75 lb/hp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (VNE)	176 kts (326 km/h, 203 mph)
Max level speed at S/L	161 kts (298 km/h, 185 mph)
Max cruising speed at S/L	152 kts (282 km/h, 175 mph)
Stalling speed	56 kts (103 km/h, 64 mph)
Max rate of climb at S/L	853 m (2,800 ft)/min
Range with max fuel, 55% power, 30 min reserves	268 n miles (497 km, 309 miles)
g limits	+6/−3.5

UPDATED

Aviat Pitts S-2B two-seat aerobatic aircraft

1995

PITTS S-2B

TYPE: Two-seat aerobatic biplane, successor to S-2A.

PROGRAMME: Prototype completed September 1982; certificated in FAR Pt 23 Aerobatic category Spring 1983; won first place Advanced Category of 1982 US Nationals with two occupants.

CUSTOMERS: 315 delivered up to early 1995, including approximately 20 in 1994.

COSTS: $119,265

DESIGN FEATURES: 194 kW (260 hp) engine and wings moved 15 cm (6 in) forward to compensate; more front cockpit space. Wing sections NACA 6400 series on upper wing, 00 series on lower wings. See 1987-88 and earlier *Jane's*.

FLYING CONTROLS: Ailerons on upper and lower wings with aerodynamic spade-type balances on lower ailerons, trim tab on each elevator, fixed tailplane; no flaps.

STRUCTURE: Wings generally as S-1T, fuselage 4130 steel tube with wooden stringers, aluminium top decking and side panels; remainder Dacron covered. Steel tube, metal skinned fixed tail surfaces. Dacron covered control surfaces.

LANDING GEAR: Non-retractable tailwheel type. Rubber cord shock absorption. Steerable tailwheel. Streamline fairings on mainwheels.

POWER PLANT: One 194 kW (260 hp) Textron Lycoming AEIO-540-D4A5 flat-six engine, driving a Hartzell two-blade constant-speed metal propeller. Fuel tank in fuselage, immediately aft of firewall, capacity 110 litres (29 US gallons; 24 Imp gallons). Refuelling point on fuselage upper surface forward of windscreen. Oil capacity 11.35 litres (3 US gallons; 2.5 Imp gallons). Inverted fuel and oil systems standard.

ACCOMMODATION: Two seats in tandem cockpits, with dual controls. Sideways opening one-piece canopy covers both cockpits. Space for 9.1 kg (20 lb) baggage aft of rear seat when flown in non-aerobatic category.

SYSTEMS: Electrical system powered by 12 V 40 A alternator and non-spill 12 V battery.

DIMENSIONS, EXTERNAL:

Wing span, upper	6.10 m (20 ft 0 in)
lower	5.79 m (19 ft 0 in)
Wing chord (constant, both)	1.02 m (3 ft 4 in)
Length overall	5.71 m (18 ft 9 in)
Height overall	2.02 m (6 ft 7½ in)

AREAS:

Wings, gross	11.6 m² (125.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	521 kg (1,150 lb)
Max T-O weight	737 kg (1,625 lb)
Max wing loading	63.55 kg/m² (13.0 lb/sq ft)
Max power loading	3.80 kg/kW (6.25 lb/hp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (VNE)	182 kts (338 km/h, 210 mph)
Max cruising speed	152 kts (282 km/h, 175 mph)
Stalling speed	52 kts (97 km/h, 60 mph)
Max rate of climb at S/L	823 m (2,700 ft)/min
Service ceiling	6,400 m (21,000 ft)
Range with max fuel, 55% power, 30 min reserves	277 n miles (513 km, 319 miles)

UPDATED

PITTS S-2S

TYPE: Single-seat version of S-2B aerobatic biplane.

PROGRAMME: First flight of prototype 9 December 1977, production began late 1978, full certification June 1981.

CUSTOMERS: Total 36 delivered by early 1995, including two in 1994. Available to order only.

COSTS: $112,575

DESIGN FEATURES: Forward fuselage shortened by 0.36 m (14 in) to accommodate 194 kW (260 hp) Textron Lycoming AEIO-540-D4A5 flat-six engine, driving Hartzell two-blade constant-speed metal propeller, fuel capacity increased to 132.5 litres (35 US gallons; 29.1 Imp gallons); oil capacity as for S-2B.

FLYING CONTROLS: Generally as for S-2B.

STRUCTURE: Generally as for S-2B.

DIMENSIONS, EXTERNAL: As for S-2B except:

Length overall	5.28 m (17 ft 4 in)

WEIGHTS AND LOADINGS:

Weight empty	499 kg (1,100 lb)
Max T-O weight	680 kg (1,500 lb)
Max wing loading	58.6 kg/m² (12.0 lb/sq ft)
Max power loading	3.51 kg/kW (5.77 lb/hp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (VNE)	176 kts (326 km/h, 203 mph)
Max level speed at S/L	162 kts (301 km/h, 187 mph)
Max cruising speed at S/L	152 kts (282 km/h, 175 mph)
Stalling speed	51 kts (94 km/h, 58 mph)
Max rate of climb at S/L	853 m (2,800 ft)/min
g limits	+6/[illegible]

UPDATED

PITTS SUPER STINKER

Curtis Pitts produced a longer fuselage biplane design which flew in March 1994, 186 kW (250 hp) Textron Lycoming engine driving Hartzell constant-speed propeller. Weight 485 kg (1,069 lb), power loading 2.60 kg/kW (4.28 lb/hp), stalling speed 57 knots (106 km/h [illegible]) maximum speed 177 knots [illegible] be able to recover from a six-turn spin in one [illegible]. The 5.49 m (18 ft) long fuselage gives more stability and is also said to enable aerobatic judges assess manoeuvres more accurately. No plans for immediate manufacture because of US liability laws.

UPDATED

AVID

AVID AIRCRAFT INC

PO Box 728, 4823 Aviation Way, Caldwell, Idaho 83606
Telephone: 1 (208) 454 2600
Fax: 1 (208) 454 8608
GENERAL MANAGER: Jim Metzger
MANAGER SALES: Robert Stone

Avid Aircraft currently markets Avid Flyer Mark IV and Magnum.

UPDATED

AVID AIRCRAFT AVID FLYER MARK IV

TYPE: Two-seat, dual-control homebuilt.

PROGRAMME: First flown 1983; takes from 200 to 400 working hours to assemble; available as single kit, or six separate kits to spread cost of purchase. Strongly influenced design of Indaer Peru Chuspi light aircraft (see under Peru in 1992-93 *Jane's*), and the SkyStar series of kit built aircraft.

CUSTOMERS: More than 1,600 kits delivered.

COSTS: Kit $17,995

DESIGN FEATURES: Strut-braced wings, two forms available (interchangeable), as original **High Gross STOL** with unique near full span auxiliary aerofoil flaperons, and shorter span **Aerobatic Speedwing** using new wing section, cruising and stalling speeds raised with Aerobatic Speedwing fitted. Wings fold for storage. Baggage compartment with external door. Cabin heating.

FLYING CONTROLS: Flaperons (see Design Features), elevators with adjustable trim tab, and rudder.

STRUCTURE: Aluminium wing spars and plywood ribs, covered with heat shrunk Dacron. Welded steel tube fuselage, rudder, tailplane and elevators, Dacron covered except for fuselage nose which has premoulded GFRP cowlings. Fin integral with fuselage.

LANDING GEAR: Non-retractable tricycle or tailwheel landing gear, with tundra tyres and brakes. Optional Aqua 1500 floats, skis and wheel skis.

POWER PLANT: One 48.5 kW (65 hp) Rotax 582 two-stroke engine, driving a two- or three-blade propeller; fixed-pitch propeller for STOL, three-blade ground adjustable for Speedwing. Fuel capacity 53 litres (14 US gallons; 11.7 Imp gallons) for High Gross STOL and 68 litres (18 US gallons; 15 Imp gallons) for Aerobatic Speedwing. Similar capacity [illegible] may be added in port wing.

ACCOMMODATION: Two seats side by side, upward opening doors each side.

AVIONICS: *Instrumentation:* Altimeter, airspeed indicator, compass, slip indicator, tachometer, water temperature gauge and dual EGT.

Avid Aircraft Avid Flyer Speedwing Mark IV *(Paul Jackson)* 1995

Tricycle version of Avid Flyer Speedwing with enlarged, rectangular rudder *(Paul Jackson)* 1995

DIMENSIONS, EXTERNAL (A: STOL, B: Aerobatic Speedwing)

Wing span: A	9.11 m (29 ft 10½ in)
B	7.30 m (23 ft 11½ in)
Wing chord	
A, B without flaperons	1.07 m (3 ft 6 in)
A, B with flaperons	1.30 m (4 ft 3 in)
Wing aspect ratio: A	7.03
B	5.50
Length overall	5.46 m (17 ft 11 in)
Height overall	1.80 m (5 ft 10¾ in)
Propeller diameter: A	1.88 m (6 ft 2 in)
B	1.73 m (5 ft 8 in)

AREAS (A and B as above)

Wings, gross: A	11.38 m² (122.46 sq ft)
B	9.04 m² (97.31 sq ft)

WEIGHTS AND LOADINGS (A and B as above)

Weight empty: A	200-231 kg (440-510 lb)
B	231 kg (510 lb)
Baggage capacity	16 kg (35 lb)
Max T-O weight: A	522 kg (1,150 lb)
B	476 kg (1,050 lb)
Max wing loading: A	45.85 kg/m² (9.39 lb/sq ft)
B	52.68 kg/m² (10.79 lb/sq ft)
Max power loading: A	10.76 kg/kW (17.69 lb/hp)
B	9.8 kg/kW (16.15 lb/hp)

PERFORMANCE (at max T-O weight, ISA, A and B as above)

Never-exceed speed (V_{NE})	
A	117 kts (217 km/h; 135 mph)
B	130 kts (241 km/h; 150 mph)
Max level speed at 1 525 m (5,000 ft)	
A	91 kts (169 km/h; 105 mph)
Max cruising speed: A	78 kts (145 km/h; 90 mph)
B	104 kts (193 km/h; 120 mph)
Stalling speed: A, flaps down, engine idling	
	32 kts (58 km/h; 36 mph)
B	40 kts (74 km/h; 46 mph)
Max rate of climb at S/L: A	305 m (1,000 ft)/min
B	259 m (850 ft)/min
Service ceiling: A, B	more than 3 810 m (12,500 ft)
T-O run: A	43 m (140 ft)
B	92 m (300 ft)
T-O to 15 m (50 ft): A	61 m (200 ft)
B	183 m (600 ft)
Landing run: A	61 m (200 ft)
B	183 m (600 ft)
Range, no reserves: A	295 n miles (547 km; 340 miles)
B	491 n miles (910 km; 566 miles)
g limits	+6/−3

UPDATED

AVID AIRCRAFT MAGNUM

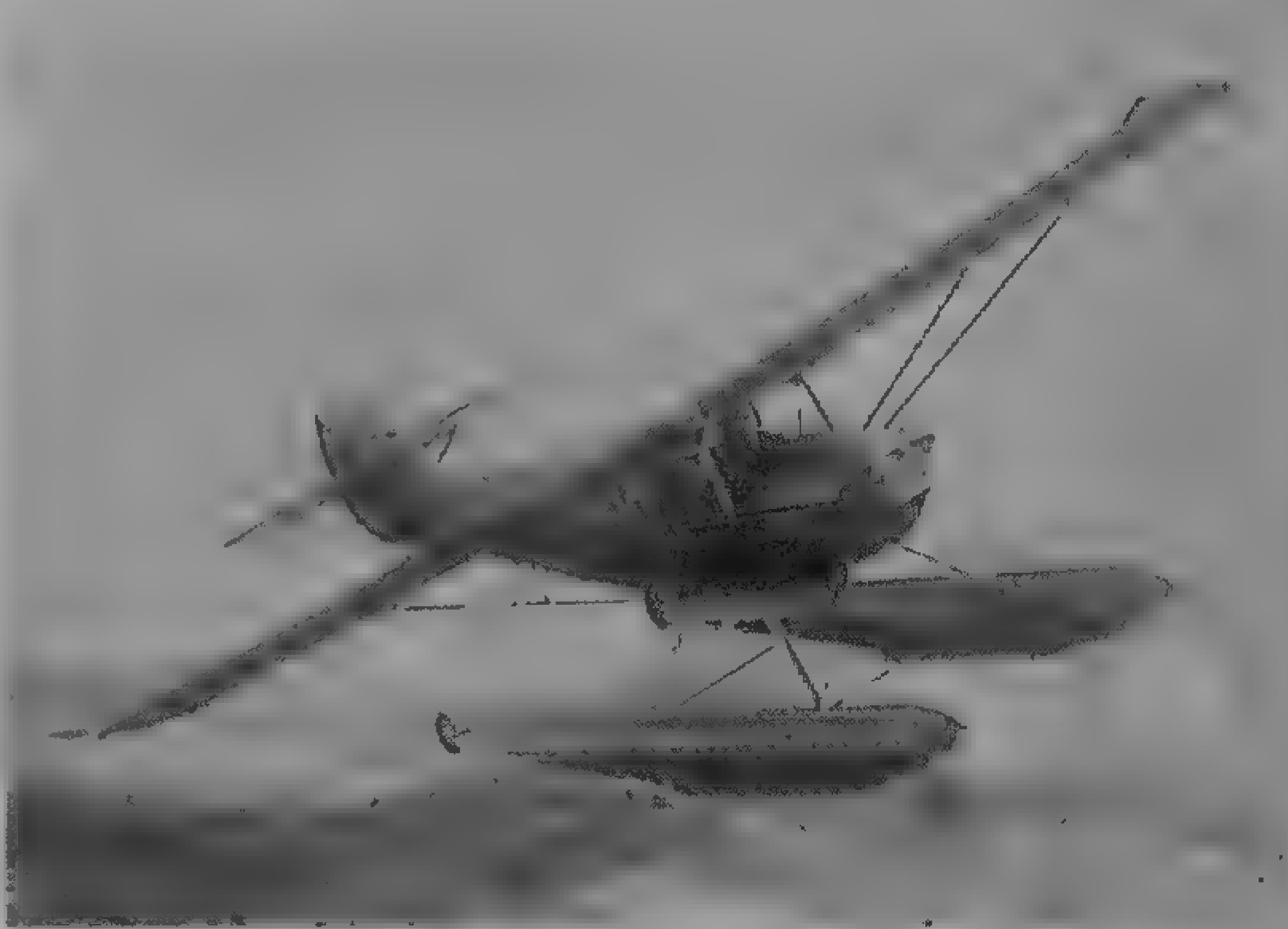
TYPE: Side by side two-seat homebuilt with dual control.

CUSTOMERS: About 800 flying.

COSTS: Kit $18,995 without engine.

DESIGN FEATURES: Similar layout to Avid Flyer but using Textron Lycoming engine and having baggage area large enough to fit optional jump seat for small adult or two children.

FLYING CONTROLS: Similar to Avid Flyer.



Avid Aircraft Magnum with floats 1995

STRUCTURE: Similar to Avid Flyer, but with Ceconite covering.

LANDING GEAR: Non-retractable tailwheel type, with Cleveland wheels and brakes, wheel fairings.

POWER PLANT: One Textron Lycoming engine in 85.75 to 134 kW (115 to 180 hp) range, including O-235, O-320 and O-360. Fuel capacity 106 litres (28 US gallons; 23.3 Imp gallons). Optional 38 litre (10 US gallon; 8.3 Imp gallon) wingtip tanks available.

ACCOMMODATION: Two seats side by side, plus optional jump seat for small adult or two children in 0.81 m³ (28.5 cu ft) baggage area.

DIMENSIONS, EXTERNAL

Wing span	10.06 m (33 ft 0 in)
Wing chord, constant	1.30 m (4 ft 3 in)
Wing aspect ratio	7.76
Length overall	6.40 m (21 ft 0 in)
Height overall	1.86 m (6 ft 1¼ in)

DIMENSIONS, INTERNAL

Cabin: Width	1.12 m (3 ft 8 in)

AREAS

Wings, gross	13.03 m² (140.25 sq ft)

WEIGHTS AND LOADINGS

Weight empty	465 kg (1,025 lb)
Baggage capacity	68 kg (150 lb)
Max T-O weight	794 kg (1,750 lb)
Max wing loading	57.44 kg/m² (11.76 lb/sq ft)
Power loading (119 kW, 160 hp)	
	6.29 kg/kW (10.31 lb/hp)

PERFORMANCE (at max T-O weight, ISA, 119 kW, 160 hp O-320 engine)

Never-exceed speed (V_{NE})	130 kts (241 km/h; 150 mph)
Cruising speed	113 kts (209 km/h; 130 mph)
Stalling speed	32 kts (58 km/h; 36 mph)
Max rate of climb at S/L	457 m (1,500 ft)/min
Service ceiling	more than 5 335 m (17,500 ft)
T-O run	approx 77 m (250 ft)
T-O to 15 m (50 ft)	99 m (325 ft)
Landing run	77 m (250 ft)

UPDATED

OTHER AIRCRAFT

Avid Catalina amphibian remains available to order (see 1992-93 *Jane's* Private Aircraft section). **Avid Bandit** under development.

NEW ENTRY

AVTEK

AVTEK CORPORATION

4680 Calle Carga, Camarillo, California 93010

Telephone: 1 (805) 482 2700

Fax: 1 (805) 987 0068

PRESIDENT: Robert F. Adickes

SENIOR VICE-PRESIDENT, ENGINEERING: Niels Andersen

VICE-PRESIDENT, MARKETING: Robert D. Honeycutt

Company founded 1982 to develop Avtek 400A; investors include Valmet Aviation (Finland), Air Rotor GmbH (Germany), Nomura Securities (Japan) and Dow Chemical (USA).

UPDATED

AVTEK 400A

TYPE: Six/10-seat all-composite turboprop twin.

PROGRAMME: Design started March 1981; proof of concept aircraft N400AV (see 1985-86 *Jane's*) flew 17 September 1984; N400AV then fitted with P&WC PT6A-135M engines (PT6A-35s with counterrotating gearboxes from PT6A-66); extensive changes made Spring 1985, including fuselage stretch 20 cm (8 in) forward and 76 cm (2 ft 6 in) aft of front pressure bulkhead, widened cabin, new outer wing and enlarged fuel tanks in forward-swept root extensions, foreplane with greater span and reduced chord, ventral strakes (known as delta fins), relocated main landing gear legs, and specially developed P&WC PT6A-3x mounted closer to wings. Preproduction second prototype expected to fly 1995, FAA certification planned for late 1996.

CURRENT VERSIONS: **400A**: Basic version, *as detailed below*.

Explorer: Valmet purchased option on 20 March 1985 to build Explorer derivative of Avtek 400A for maritime surveillance, liaison, coastal patrol, aerial survey, search and reconnaissance and ESM, tailored to individual customer requirements. Fuel capacity increased by 208 litres (55 US gallons; 45.8 Imp gallons) and maximum T-O weight raised to 3,402 kg (7,500 lb).

419 Express: 19-passenger commuter version, PT6A-45 engines, to be certificated after FAR 23 gained by 400A. Length increased to 16.62 m (54 ft 5 in) and maximum T-O weight raised to 5 669 kg (12,499 lb).

CUSTOMERS: 80 on order

COSTS: Standard 400A $1.75 million, Explorer $2 million plus sensors and systems, 419 Express $4.2 million.

DESIGN FEATURES: Twin-engine pusher configuration with foreplane. Initial design by Al W. Mooney, founder of Mooney Aircraft, refined by Niels Andersen, Ford Johnston and Irvin Culver; computer analysis of configuration and wind tunnel testing by NASA; materials research by Dow Chemical and Dr Leo Windecker. Dow Chemical basic patents on Windecker Eagle (first all-composites aircraft to receive civil certification) licensed to Avtek. Avtek 12 aerofoil section; anhedral 2° 30′ from roots, sweepback 50° inboard, 15° 30′ outboard; foreplane dihedral 1°; fuselage pressurised.

FLYING CONTROLS: Actuation by pushrods and cranks throughout; mass balanced elevators on foreplane; mass balanced rudder without trim tab; two-section ailerons, with inboard sections also electrically actuated as pitch-axis trim surfaces; no flaps.

STRUCTURE: All-composite structure, 72 per cent Kevlar and Nomex, 16 per cent graphite/carbonfibre, smaller quantities of R-glass, S-glass, aluminium and nickel fibres; wire mesh incorporated to protect against lightning.

LANDING GEAR: Hydraulically retractable tricycle type, main units retracting inward and nosewheel forward. Emergency extension system. Oleo-pneumatic shock-absorber in each unit. Single wheel on each unit; mainwheels size 6.00-6 with Goodyear tyres size 17.5 6.25 × 7.5, pressure 7.0 bars (102 lb/sq in). Steerable nosewheel unit with wheel size 5.00-5 and Goodyear tyre size 14.2-5.5 × 6.5, pressure 5.0 bars (73 lb/sq in). Cleveland hydraulic disc brakes.

POWER PLANT: Two Pratt & Whitney Canada PT6A-3L/R turboprops derived from PT6A-135 and each flat rated at 507 kW (680 shp), one mounted within nacelle above each wing. Hartzell four-blade constant speed fully feathering reversible-pitch pusher propellers (metal blades on prototype, Kevlar on production version). Propellers are opposite rotating, with automatic synchrophasing, full Beta control, reversing and autofeathering. In-flight start capability. Integral fuel tank in each wingroot leading-edge. Total fuel capacity 1,003 litres (265 US gallons, 221 Imp gallons), of which 984 litres (260 US gallons, 216.5 Imp gallons) are usable. Refuelling point in upper surface of each wing.

ACCOMMODATION: Pilot and five to nine passengers according to interior layout. Optional configurations include eight-passenger Pullman or Salon, eight-passenger Lounge, six-passenger Conference, Ambulance with stretcher, medical equipment and seats for three ambulatory patients or medical attendants, and Cargo with seats for pilot and one passenger. Two-section door on port side of cabin, with step incorporated in lower half. Emergency exit on starboard side opposite cabin door. Baggage compartment at rear of cabin with internal access. Unpressurised baggage compartment in nose with external door on port side. Accommodation pressurised, air conditioned, heated and ventilated.

SYSTEMS: AiResearch bleed air pressurisation system with maximum differential of 0.52 bar (7.6 lb/sq in), and air cycle air conditioning system. Electrically driven hydraulic pump provides pressure of 138 bars (2,000 lb/sq in) for landing gear actuation. Electrical system includes dual 28 V 300 A engine-driven generators, dual 29 Ah storage batteries and external power socket. Oxygen system of 1.39 m³ (49 cu ft) capacity, pressure 128 bars (1,850 lb/sq in), provides constant flow for passengers and demand flow for pilot. Anti-icing of windscreen by electrical system, of propellers by engine efflux; electrically heated pitot. Engine fire extinguishing system optional. Choice of wing and foreplane pneumatic, alcohol, electric or engine bleed de-icing. Dual anti-icing inlets for each engine.

AVIONICS: Wide range of optional avionics by Bendix/King, Collins and Honeywell, including EFIS and EICAS, and Honeywell colour weather radar. Full IFR instrumentation optional.

DIMENSIONS, EXTERNAL:

Wing span	10.67 m (35 ft 0 in)
Wing aspect ratio	8.50
Foreplane span	6.92 m (22 ft 8½ in)
Length: overall	11.99 m (39 ft 4 in)
fuselage	10.41 m (34 ft 2 in)
Height overall	3.47 m (11 ft 4¾ in)
Propeller diameter	1.93 m (6 ft 4 in)
Passenger door (port): Height	1.17 m (3 ft 10 in)
Width	0.76 m (2 ft 6 in)
Height to sill	0.76 m (2 ft 6 in)
Baggage door (port, nose): Height	0.51 m (1 ft 8 in)
Width	0.56 m (1 ft 10 in)
Height to sill	0.79 m (2 ft 7 in)
Emergency exit (stbd): Height	0.51 m (1 ft 8 in)
Width	0.67 m (2 ft 2½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	3.14 m (10 ft 3½ in)
Max width	1.40 m (4 ft 7 in)
Max height	1.37 m (4 ft 6 in)
Baggage hold volume: nose	0.62 m³ (22.0 cu ft)
cabin	1.24 m³ (44.0 cu ft)

AREAS:

Wings, gross	13.40 m² (144.2 sq ft)
Foreplane, gross	4.52 m² (48.7 sq ft)
Elevators (total)	0.92 m² (9.9 sq ft)
Ailerons (total)	0.60 m² (6.5 sq ft)
Fin	1.16 m² (12.5 sq ft)
Rudder	0.90 m² (9.7 sq ft)

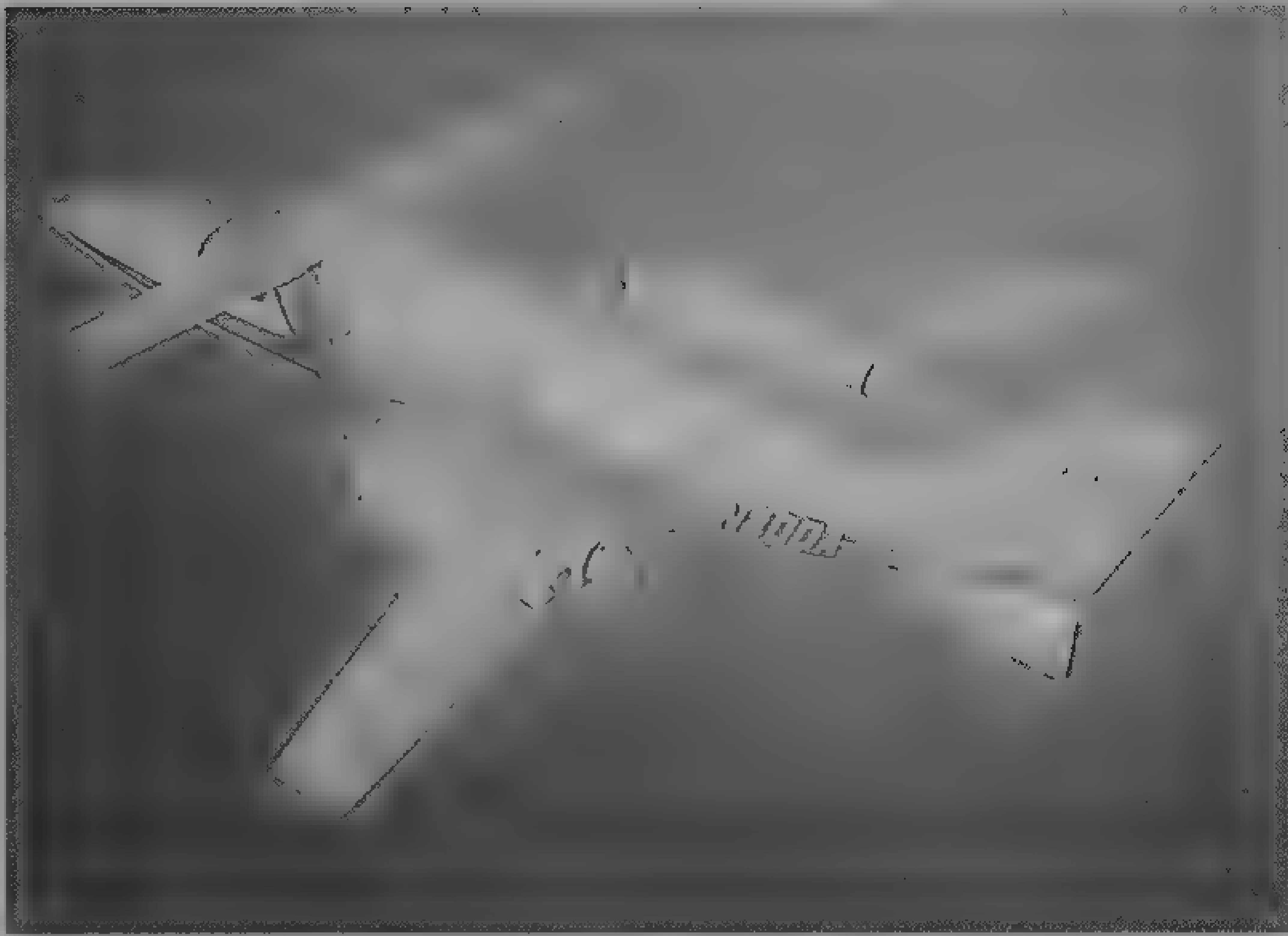
WEIGHTS AND LOADINGS:

Weight empty, equipped	1,714 kg (3,779 lb)
Max ramp weight	2,976 kg (6,560 lb)
Max T-O and landing weight	2,948 kg (6,500 lb)
Max wing loading	220.1 kg/m² (45.08 lb/sq ft)
Max power loading	2.91 kg/kW (4.78 lb/shp)

PERFORMANCE (estimated, at max T-O weight, ISA):

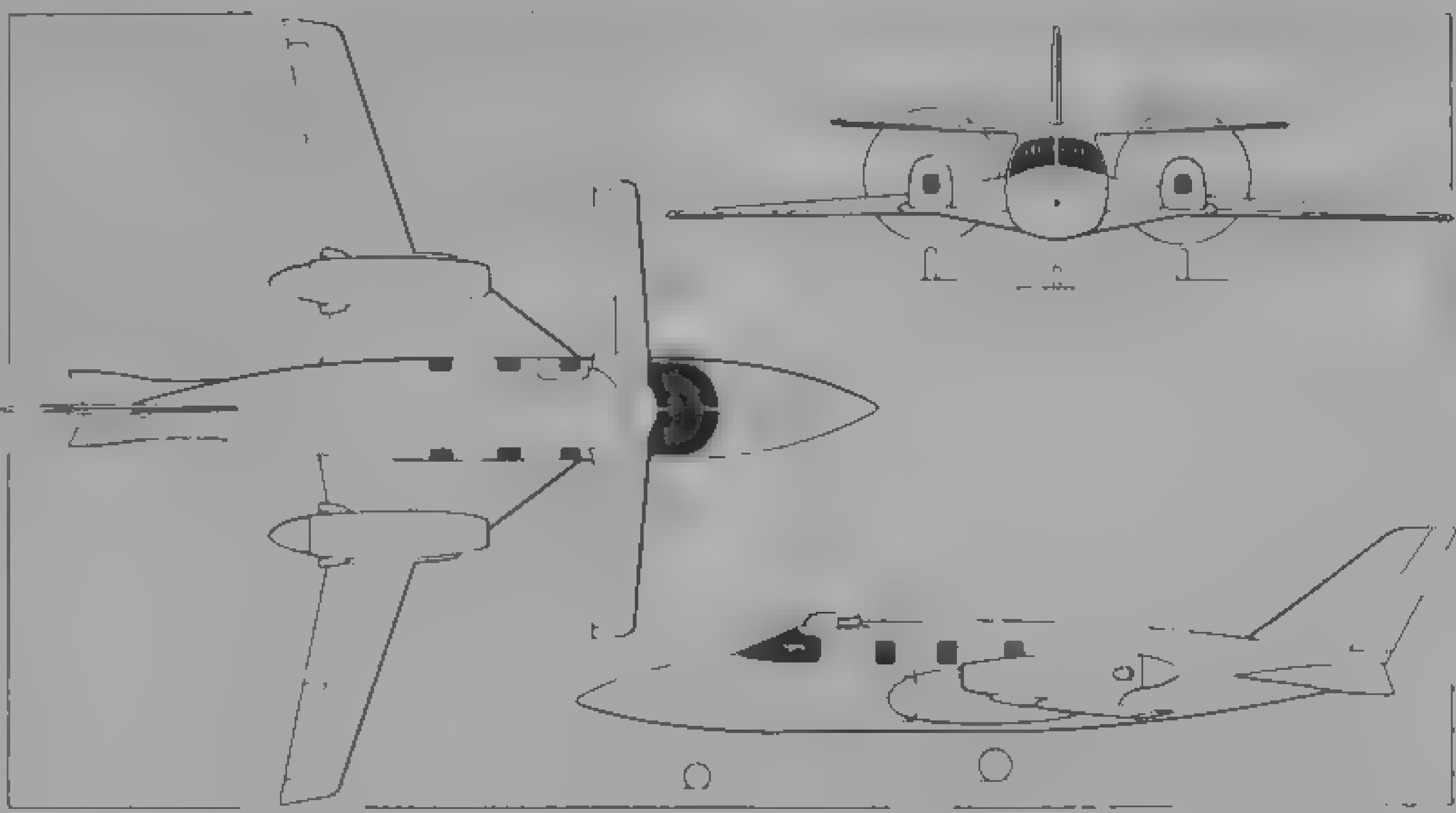
Max level speed at S/L	255 kts (473 km/h, 294 mph)
Max cruising speed: at 3,050 m (10,000 ft)	297 kts (550 km/h, 342 mph)
at 6,700 m (22,000 ft)	364 kts (675 km/h, 419 mph)
at 12,500 m (41,000 ft)	338 kts (626 km/h, 389 mph)
Stalling speed	83 kts (154 km/h, 96 mph)
Max rate of climb at S/L	1,411 m (4,630 ft)/min
Rate of climb at S/L, OEI	578 m (1,897 ft)/min
Service ceiling	12,950 m (42,500 ft)
Service ceiling, OEI	10,060 m (33,000 ft)
T-O to 15 m (50 ft)	463 m (1,520 ft)
Landing from 15 m (50 ft)	390 m (1,280 ft)
Range with max fuel: no reserves	2,276 n miles (4,218 km, 2,621 miles)
NBAA IFR reserves	1,922 n miles (3,562 km, 2,213 miles)

UPDATED



Artist's impression of Avtek 400A all-composite multirole twin

1995



Avtek 400A six/10-seat twin-turboprop aircraft *(Jane's/Dennis Punnett)*

1989

AYRES

AYRES CORPORATION

PO Box 3090, 1 Rockwell Avenue, Albany, Georgia 31708-5201
Telephone: 1 (912) 883 1440
Fax: 1 (912) 439 9790
Telex: 547629 AYRESPORT ABN

VICE-PRESIDENT, SALES: Daniel Lewis

Ayres Corporation bought manufacturing and world marketing rights to Thrush Commander-600 and -800 from Rockwell International General Aviation Division in November 1977. In 1995, looking for partners for assembly and manufacture in Asia and Pacific Rim.

UPDATED

AYRES THRUSH S2R-R1340

TYPE: Single/two-seat agricultural aircraft.

PROGRAMME: In production.

CURRENT VERSIONS: **Thrush S2R-R1340**: Basic version, powered by Pratt & Whitney R-1340 Wasp air-cooled radial engine and with one or two seats. *Description applies to this version.*

Ayres Thrush S2R-R1340 (600 hp Pratt & Whitney R-1340 Wasp engine)

1993

Thrush S2R-R1820: Powered by Wright R-1820 air-cooled radial (described separately).

Turbo-Thrush S2R: Basic S2R powered by Pratt & Whitney Canada PT6A-11, -15, -34 or -65AG, described separately.

CUSTOMERS: Operating in 70 countries. In small-scale production, approximately five 1340/1820s built during 1994.

COSTS: About $300,000, depending on engine and customer fit.

DESIGN FEATURES: Cantilever wing with 3° 30′ dihedral, wingroots sealed against chemical entry, wing extensions adding 2.79 m² (30 sq ft) standard, deflector cable from cockpit to tip of fin.

FLYING CONTROLS: Plain ailerons, servo tab in each elevator, electrically actuated flaps.

STRUCTURE: Two-spar light alloy wing with 4130 chrome molybdenum steel spar caps, welded chrome molybdenum steel tube fuselage structure covered with quickly removable light alloy skin panels, underfuselage skin of stainless steel; all-metal tail surfaces with strut-braced tailplane, metal ailerons and flaps.

LANDING GEAR: Non-retractable tailwheel type. Main units have rubber in compression shock absorption and 29 × 11.00-10 wheels with 10 ply tyres. Hydraulically operated disc brakes. Parking brakes. Wire cutters on main gear. Steerable, locking tailwheel, size 12.5 × 4.5 in.

POWER PLANT: One 447 kW (600 hp) Pratt & Whitney R-1340 Wasp nine-cylinder air-cooled radial engine, driving a Hamilton Standard 12D40/EAC AG-100-2 two-blade constant-speed metal propeller. Fuel contained in wing tanks with combined capacity of 401 litres (106 US gallons, 88.3 Imp gallons).

ACCOMMODATION: Single adjustable mesh seat in 'safety pod' sealed cockpit enclosure, with steel tube overturn structure. Tandem seating optional, with forward-facing second seat. Dual controls optional with forward-facing rear seat, for pilot training. Adjustable rudder pedals. Downward-hinged door on each side. Tempered safety glass windscreen. Cockpit wire cutter. Dual inertia reel safety harness with optional second seat. Baggage compartment standard on single-seat aircraft. Windscreen wiper and washer.

SYSTEM: Electrical system powered by a 24 V 50 A alternator. Lightweight 24 V 35 Ah battery.

AVIONICS: To customer's requirements.

EQUIPMENT: GFRP hopper forward of cockpit can hold 1,514 litres (400 US gallons, 333 Imp gallons) of liquid or 1,487 kg (3,280 lb) of dry chemical. Hopper has a 0.33 m² (3.56 sq ft) lid, openable by two handles, and cockpit viewing window. Standard equipment includes Universal spray system with external 50 mm (2 in) stainless steel plumbing, 50 mm pump with wooden fan, Transland gate, 50 mm valve, quick disconnect pump mount and strainer. Streamlined spraybooms with outlets for 68 nozzles. Micro-adjust valve control (spray) and calibrator (dry). A 63 mm (2.5 in) side-loading system is installed on the port side. Stainless steel rudder cables. Navigation lights, instrument lights and two strobe lights. Optional equipment includes a rear cockpit to accommodate forward-facing seat for passenger, or flying instructor if optional dual controls installed, space can be used alternatively for cargo. Other optional items are a Transland high-volume spreader, agitator installation, 10-unit AU 5000 Micronair installation in lieu of standard booms and nozzles, Transland gatebox with stiffener casting, quick disconnect flange and kit, night working lights including landing light and wingtip turn lights, cockpit fire extinguisher, and water bomber configuration.

DIMENSIONS, EXTERNAL:

Wing span	14.48 m (47 ft 6 in)
Wing aspect ratio	6.33
Length overall (tail up)	8.95 m (29 ft 4.5 in)
Height overall	2.79 m (9 ft 2 in)
Tailplane span	5.18 m (17 ft 0 in)
Wheel track	2.72 m (8 ft 11 in)
Propeller diameter	2.74 m (9 ft 0 in)

DIMENSIONS, INTERNAL:

Hopper volume	1.50 m³ (53.0 cu ft)

AREAS:

Wings, gross	33.13 m² (356.6 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	1,678 kg (3,700 lb)
Max T-O weight: CAR 3	2,721 kg (6,000 lb)
CAM 8	3,130 kg (6,900 lb)
Max wing loading	103.0 kg/m² (21.1 lb/sq ft)
Max power loading	7.0 kg/kW (11.5 lb/hp)

PERFORMANCE (with spray equipment installed and at CAR 3 max T-O weight, except where indicated):

Max level speed	122 kts (225 km/h, 140 mph)
Max cruising speed, 70% power	108 kts (200 km/h; 124 mph)
Working speed, 70% power	91-100 kts (169-185 km/h, 105-115 mph)
Stalling speed: flaps up	58 kts (108 km/h, 67 mph)
flaps down	55 kts (101 km/h, 63 mph)
Stalling speed at normal landing weight: flaps up	47 kts (87 km/h, 54 mph)
flaps down	45 kts (84 km/h, 52 mph)
Max rate of climb at S/L	317 m (1,040 ft)/min
Service ceiling	4,575 m (15,000 ft)
T-O run	215 m (705 ft)
Landing run	139 m (455 ft)
Ferry range with max fuel at 70% power	350 n miles (648 km; 403 miles)

UPDATED

AYRES THRUSH S2R-R1820/510

TYPE: Single/two-seat agricultural aircraft.

DESIGN FEATURES: As S2R-R1340 except for bigger hopper and more powerful engine.

CUSTOMERS: In small scale production during 1994.

Details as for S2R-R1340 except as follows:

POWER PLANT: One 895 kW (1,200 hp) Wright R-1820 Cyclone nine-cylinder air-cooled radial engine, driving a Hamilton Standard three-blade constant-speed metal propeller. Fuel system as for S2R-R1340, but total usable fuel capacity 863 litres (228 US gallons, 190 Imp gallons).

EQUIPMENT: Generally as for S2R-R1340, except that chemical hopper is of 1,930 litres (510 US gallons, 425 Imp gallons) capacity.

DIMENSIONS, EXTERNAL: As for S2R-R1340, except:

Wing span	13.54 m (44 ft 5 in)
Wing aspect ratio	6.04
Length overall	9.60 m (31 ft 6 in)
Height overall	2.92 m (9 ft 7 in)
Wheel track	2.74 m (9 ft 0 in)

DIMENSIONS, INTERNAL:

Hopper volume	1.93 m³ (68.2 cu ft)

AREAS:

Wings, gross	30.34 m² (326.6 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	2,263 kg (4,990 lb)
Typical operating weight (CAM 8)	4,536 kg (10,000 lb)
Max wing loading	149.5 kg/m² (30.62 lb/sq ft)
Max power loading	5.07 kg/kW (8.33 lb/hp)

PERFORMANCE (with spray equipment, at CAM 8 T-O weight, except where indicated):

Max level speed	138 kts (256 km/h, 159 mph)
Cruising speed, 50% power	135 kts (249 km/h; 155 mph)
Working speed, 30-50% power	87-130 kts (161-241 km/h, 100-150 mph)
Stalling speed: flaps up	61 kts (113 km/h, 70 mph)
flaps down	58 kts (107 km/h, 66 mph)
Stalling speed at normal landing weight: flaps up	52 kts (95 km/h, 59 mph)
flaps down	50 kts (92 km/h; 57 mph)
Max rate of climb at S/L	620 m (2,033 ft)/min
Service ceiling	8,535 m (28,000 ft)
T-O run	168 m (550 ft)
Landing run at normal landing weight	290 m (950 ft)
Ferry range at 40% power	582 n miles (1,078 km, 670 miles)

UPDATED

AYRES TURBO-THRUSH S2R

TYPE: Single/two-seat turboprop agricultural and multirole aircraft.

CURRENT VERSIONS: **S2R-T11:** 373 kW (500 shp) PT6A-11AG turboprop, standard 1,514 litre (400 US gallon, 333 Imp gallon) chemical hopper.

S2R-T15: 507 kW (680 shp) P&WC PT6A-15AG turboprop; standard or optional 1,930 litre (510 US gallon, 425 Imp gallon) hopper.

S2R-T34: 559 kW (750 shp) P&WC PT6A-34AG turboprop; standard or optional hoppers.

S2R-T65 NEDS: Narcotics Eradication Delivery System; 1,026 kW (1,376 shp) P&WC PT6A-65AG turboprop and 2.82 m (9 ft 3 in) five-blade propeller; 19 delivered to US State Department (see Customers). NEDS equipment includes Bendix/King VLF/Omega 660, ADF, VOR, HF and VHF avionics.

S2R-G6: Introduced 1992, 559 kW (750 shp) TPE331-6 turboprop; standard or optional hopper.

S2R-G10: First flown November 1992, CAM 8 certification, 701 kW (940 shp) TPE331-10 turboprop, two 435 litre (115 US gallon, 95.75 Imp gallon) fuel tanks, with 863 litres (228 US gallons, 190 Imp gallons) usable, hopper capacity 1,930 litres (510 US gallons, 425 Imp gallons); pilot, with dual cockpit option.

Vigilante: Surveillance and close air support version; TPE331 turboprop as in S2R-G6 and S2R-G10 versions. Still carries hopper, has five-blade propeller for quiet operation; can be fitted with range of equipment including loudspeaker systems for policing duties.

CUSTOMERS: US State Department ordered 19 S2R-T65 NEDS during 1983-88 for use by International Narcotics Matters Bureau. Vigilante sales (early 1994) worth $30.5 million, for use in Africa for game and poacher surveillance. Total 17 production T65s built by early 1995; five G6s built in 1994 along with six T34s and two each of sub-variants identified as G5 and G10.

COSTS: About $600,000, depending on engine and customer fit.

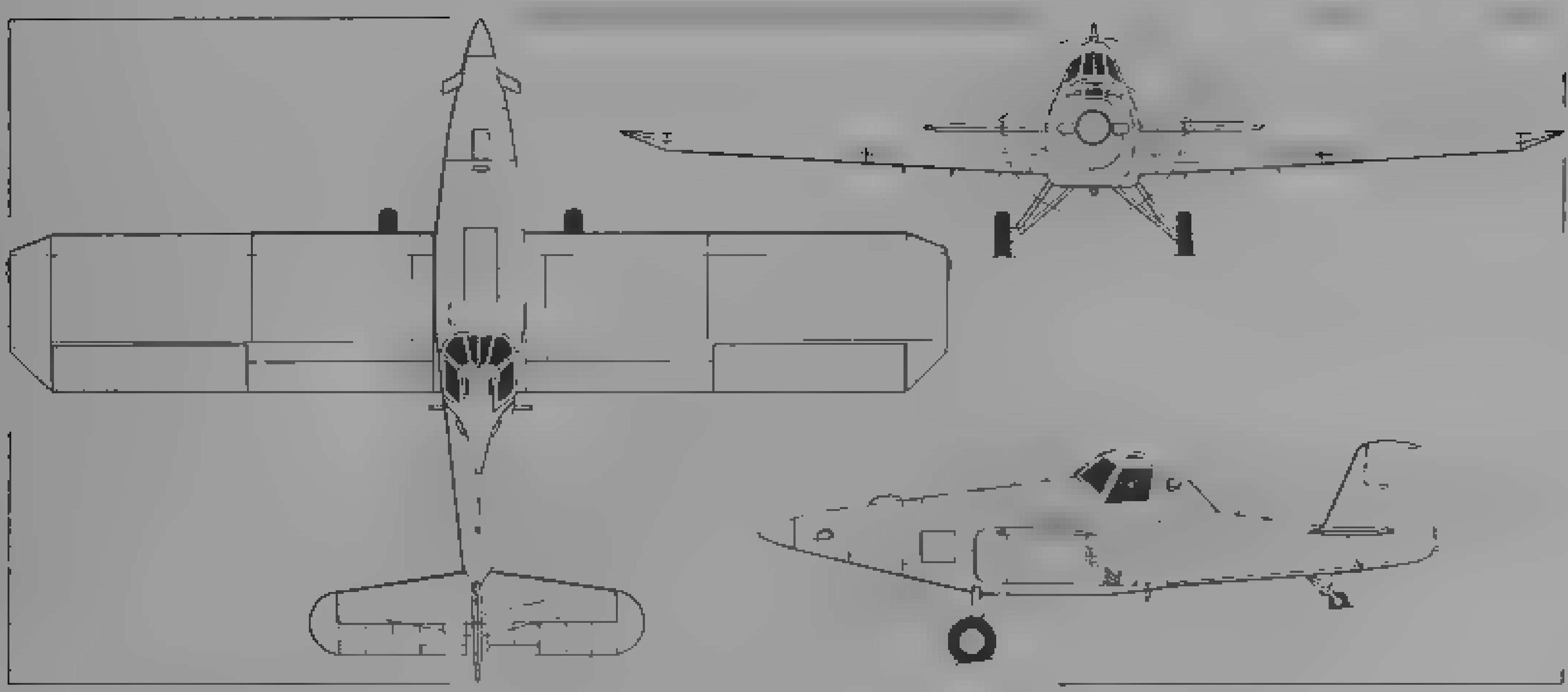
DESIGN FEATURES: All but NEDS variant have Hartzell three-blade, constant-speed, feathering and reversing propellers; usable fuel capacity 863 litres (228 US gallons; 190 Imp gallons); claimed advantages include much improved take-off and climb, 454 kg (1,000 lb) higher payload because of lower engine weight, operation on aviation turbine fuel or diesel, 3,500 hour TBO, quieter operation and ability to feather propeller without stopping engine while refuelling and reloading. Wing extensions (see S2R-R1340) optional on Turbo-Thrush.

DIMENSIONS, EXTERNAL: As for S2R-R1820 except:

Length overall	10.06 m (33 ft 0 in)
Height overall	2.79 m (9 ft 2 in)

Ayres Turbo-Thrush S2R-T34 with optional dual cockpit

1992



Ayres Turbo-Thrush S2R-T34 with optional 1,930 litre (510 US gallon, 425 Imp gallon) hopper *(Jane's/Dennis Punnett)* *1993*

Ayres Turbo-Thrush S2R-G10 (AlliedSignal TPE331-10 turboprop) *1993*

AREAS: As for S2R-R1820

WEIGHTS AND LOADINGS (A: standard hopper and PT6A, B: optional hopper and PT6A, C: with TPE331-6, D: with TPE331-10):

Weight empty: A 1,633 kg (3,600 lb)
B 1,769 kg (3,900 lb)
C 1,905 kg (4,200 lb)
D 2,041 kg (4,500 lb)
Max T-O weight (CAR 3): A, B 2,721 kg (6,000 lb)
Typical operating weight (CAM 8):
A 3,719 kg (8,200 lb)
B 3,856 kg (8,500 lb)
C 4,400 kg (9,700 lb)
D 4,082 kg (9,000 lb)
CAM 8 wing loading: A 122.6 kg/m² (25.11 lb/sq ft)
B 127.1 kg/m² (26.03 lb/sq ft)
C 145.0 kg/m² (26.70 lb/sq ft)
D 134.5 kg/m² (27.56 lb/sq ft)

PERFORMANCE (A and B with PT6A-34AG engine at max T-O weight except where indicated, C with TPE331-6, D with TPE331-10):

Never exceed speed (VNE):
D 138 kts (256 km/h, 159 mph)
Max level speed with spray equipment:
A, B, D 138 kts (256 km/h, 159 mph)
Cruising speed:
A and B, 50% power 130 kts (241 km/h, 150 mph)
C, 55% power 130 kts (241 km/h, 150 mph)
Working speed, 30-50% power
82-130 kts (153-241 km/h, 95-150 mph)
Stalling speed: flaps up 61 kts (113 km/h, 70 mph)
flaps down 57 kts (106 km/h, 66 mph)
Stalling speed at normal landing weight:
flaps up 51 kts (95 km/h, 59 mph)
flaps down 50 kts (92 km/h, 57 mph)
Max rate of climb at S/L: A, B, C 530 m (1,740 ft)/min
D 762 m (2,500 ft)/min
Service ceiling: A, B, C 7,620 m (25,000 ft)
D 3,660 m (12,000 ft)
T-O run: A, B, D 183 m (600 ft)
C at 4,400 kg (9,700 lb) 366 m (1,200 ft)
Landing from 15 m (50 ft) 366 m (1,200 ft)
Landing run: A, B, C 152 m (500 ft)
D 244 m (800 ft)
Landing run with propeller reversal:
A, B, C 91 m (300 ft)
Range: D 500 n miles (926 km, 575 miles)
Ferry range at 40% power
664 n miles (1,231 km; 765 miles)

UPDATED

AYRES LOADMASTER

A future project, intending to use Vigilante wings and a new box-section fuselage, for carrying freight. Powered by a single AlliedSignal TPE331-14 giving powers between 746 and 1,462 kW (1,000-1,960 shp) depending on the variant chosen. Possibility of passenger seating also being studied. Intended for operations from short and/or rough strips.

VERIFIED

BASLER

BASLER TURBO CONVERSIONS INC

Turboprop conversions of Douglas DC-3 and Cessna 337 are now covered by *Jane's Aircraft Upgrades*.

UPDATED

BEDE

BEDE JET CORPORATION

8421 Edison Avenue, Spirit of St Louis Airport, Chesterfield, Missouri 63005
Telephone: 1 (314) 537 2333
Fax: 1 (314) 536 2822
PRESIDENT: James R. Bede

Bede Jet Corporation specialises in design of high-performance jet aircraft for private ownership, civilian version of most recent product, BD-10, is built and marketed by Peregrine International (which see) as the Falcon; Bede retains rights for military versions of BD-10.

UPDATED

BEECH

BEECH AIRCRAFT CORPORATION

Current versions of Beechcraft will be found under the Raytheon Aircraft Company heading in this section.

UPDATED

BELL

BELL HELICOPTER TEXTRON INC
(Subsidiary of Textron Inc)

PO Box 482, Fort Worth, Texas 76101
Telephone: 1 (817) 280 8415
Fax: 1 (817) 280 8221
PRESIDENT: Webb F. Joiner
EXECUTIVE VICE-PRESIDENT: Lloyd Shoppa
SENIOR VICE-PRESIDENT, MARKETING: Peter H. Parsinen
SENIOR VICE-PRESIDENT, PRODUCT SUPPORT AND US GOVERNMENT BUSINESS: John R. Murphey
VICE-PRESIDENT, RESEARCH AND ENGINEERING:
Troy M. Gaffey
DIRECTOR, PUBLIC AFFAIRS AND ADVERTISING:
Carl L. Harris

From 1970-81, Bell Helicopter Textron was unincorporated division of Textron Inc, became wholly owned subsidiary of Textron Inc from 3 January 1982. Bell Helicopter Canada (see Canada) formed at Montreal/Mirabel under contract with Canadian government October 1983, transfer to Mirabel completed January 1987 of Bell 206B JetRanger and 206L LongRanger production to make room for V-22 Osprey. Production of Bell 212/412 transferred mid-1988 and early 1989 respectively; Bell 230, 430, 407 and 442 programmes also undertaken in Canada. Bell TH-206 JetRanger variant selected March 1993 (as TH-67 Creek) for US Army NTH requirement, further details under Bell in Canadian section.

More than 32,000 Bell helicopters manufactured worldwide, including over 9,000 commercial models.

Bell helicopters built in USA detailed here. Those currently built in Canada listed under Canada; other models built under licence by IPTN in Indonesia, Agusta in Italy and Fuji in Japan (which see); Bell Helicopter Korea (BHK) is planning to co-produce helicopters with Bell Helicopter Textron

in Republic of Korea. Bell Helicopter de Venezuela CA, joint venture with Maquinarias Mendoza CA and Aerotecnica SA established early 1984 in Caracas for marketing and support. Bell Helicopter Asia (Pte) Ltd is wholly owned Singapore-based company for marketing and support in Southeast Asia.

UPDATED

BELL 209 HUEYCOBRA (MODERNISED VERSIONS)

US Army designations: AH-1E, AH-1F, TAH-1F, AH-1P, AH-1S and TH-1S

US production of the single-engined HueyCobra completed on execution of South Korean contract last described fully in 1993-94 *Jane's*. Remains in production by Fuji of Japan, which see for technical data

VERIFIED

BELL 209 and SUPERCOBRA

US Navy/Marine Corps designation: AH-1W

TYPE: Two-seat, twin-engined close support and attack helicopter

CURRENT VERSIONS: All surviving US Marine Corps AH-1J SeaCobras withdrawn and 42 AH-1T Improved SeaCobras converted to AH-1W to augment new production

AH-1W SuperCobra: Bell flew AH-1T powered by two GE T700-GE-700; first flight of proposed improved AH-1T+ including GE T700-GE-401 engines, 16 November 1983. Production for USMC and export; former also received one composite maintenance trainer

AH-1W IWS: Integrated Weapon System. Proposed Marine Corps retrofit for 225 AH-1Ws launched 1993 for redelivery from 1999 at cost of $2-3 million per upgrade. Phase I is Night Targeting System (NTS - see Design Features) plus GPS/INS/RLG navigation system; Phase II is Integrated Weapon System (IWS) in form of 'glass cockpit' with advanced mission computer, digital map, multi-purpose colour displays, new stores management system, onboard systems monitoring, mission data loader and HOTCC (hands on throttle, collective and cyclic) controls and new EW suite including AN/APR-39A(XE2) RWR and AN/AAR-47 MAWS. Phase III to involve four-blade rotor (70 per cent vibration reduction) and extension of wings to carry six universal weapon pylons for (130 per cent) increase in ordnance carrying. RFP for IWS issued 9 August 1994, but IWS abandoned, July 1995

Venom: See separate entry

CUSTOMERS: US Marine Corps (see under Current Versions), target procurement of 190 (including two Gulf War attrition replacements) reduced to 154 by 1994 defence review. Deliveries began 27 March 1986 to Camp Pendleton, California, for HML/A-169, -267, -367 and -369, plus HMT-303 for training; further aircraft issued to USMC Reserve, beginning with HMA-775 at Camp Pendleton from June 1992, followed by HMA-773 at Atlanta, Georgia; total of 36 for Reserves. Surviving 42 AH-1Ts upgraded to AH-1W for HML/A 167 and 269 at New River, North Carolina, last seven completed 1992. 100th new/converted AH-1W delivered 8 August 1991, over 180 in service by mid 1995

Turkish Land Forces received five AH-1Ws in 1990 and five in 1993, all diverted from USMC contracts. Taiwan signed letter of offer and acceptance February 1992, for 18 (of which nine taken up in April 1993 and eight in FY95) plus 24 options, deliveries began 1993 for training with USMC; first aircraft 501 (ex Bu Aer 164913)

COSTS: $10.7 million (1992) projected unit cost

DESIGN FEATURES: Two-blade main rotor similar to that of Bell 214 with strengthened rotor head incorporating Lord Kinematics Lastoflex elastomeric and Teflon faced bearings. Blade aerofoil Wortmann FX-083 (modified), normal 311 rpm. Tail rotor also similar to that of Bell 214 with greater diameter and blade chord, normal 1,460 rpm. Rotor brake standard. Stub-wings, NACA 0030 section at root, NACA 0024 at tip; incidence 14°; sweepback 14.7

Missions of AH-1W include anti-armour, escort, multiple-weapon fire support, including air-to-air with Sidewinder, armed reconnaissance, search and target acquisition. US AH-1Ws being fitted with Israeli Tamam laser night targeting system (NTS) for dual TOW/Hellfire day and night capability, prototype conversion authorised December 1991, initial 25 sets built by Tamam and delivered from January 1993, further production jointly with Kollsman approved May 1994; total of 250 required by USMC, additional 12 sets for Turkey and 53 for Taiwan ordered 1994. Testing of enhanced electronic warfare system began August 1989. Hughes AGM-65D Maverick ASM test fired in August 1990, up to 12 Maverick-capable SuperCobras required

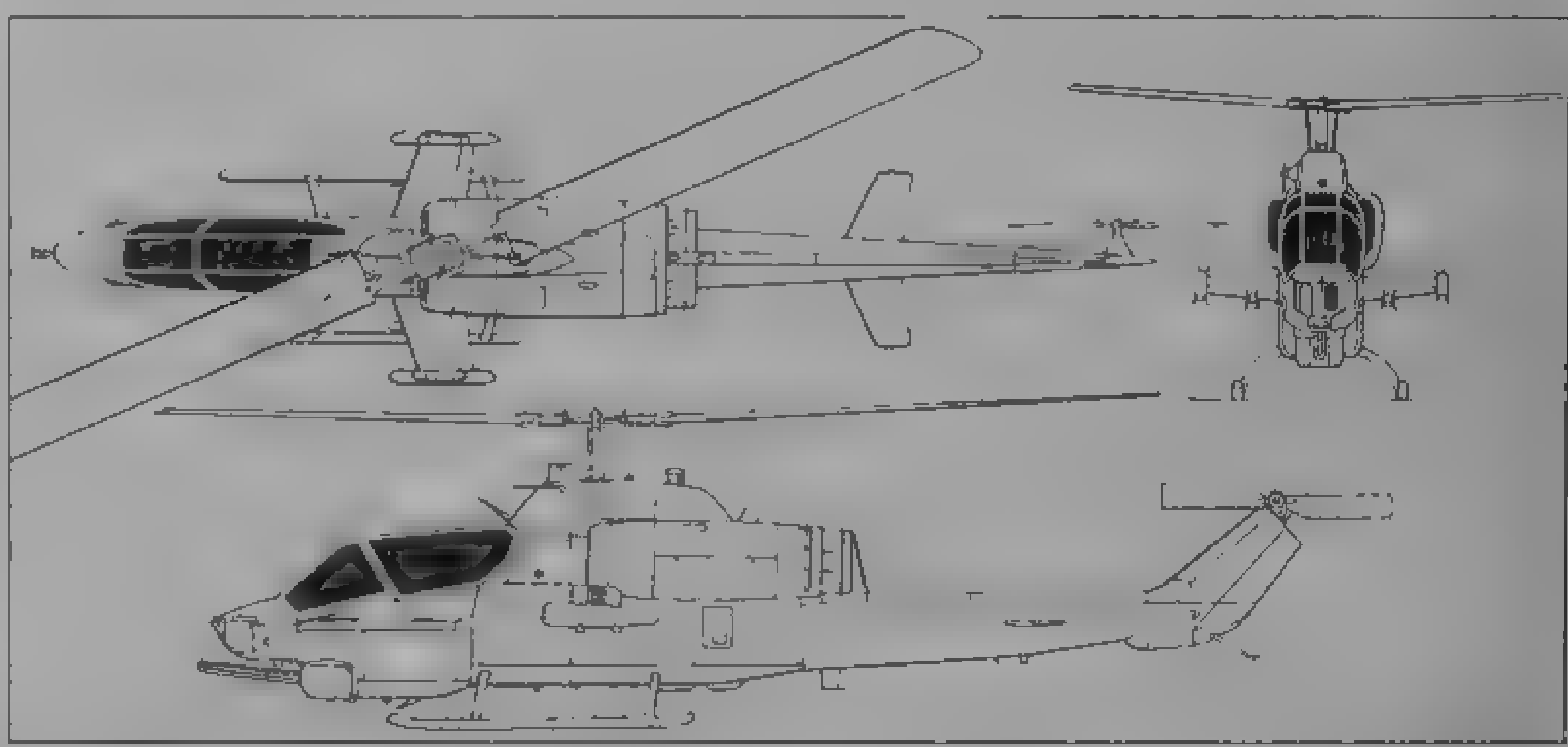
STRUCTURE: Main rotor blades have aluminium spar and aluminium faced honeycomb aft of spar, tail rotor has aluminium honeycomb with stainless steel skin and leading-edge. Airframe conventional all-metal semi-monocoque

New-build Bell AH-1W SuperCobra in standard USMC grey camouflage *(Paul Jackson)*

1995

USMC NEW BUILD AH-1W FUNDING

FY	Qty
85	22
86	22
88	30
90	14
92	12
93	12
94	12
95	12
Sub-total	**136**
Planned	
96	9
97	9
Total	**154**

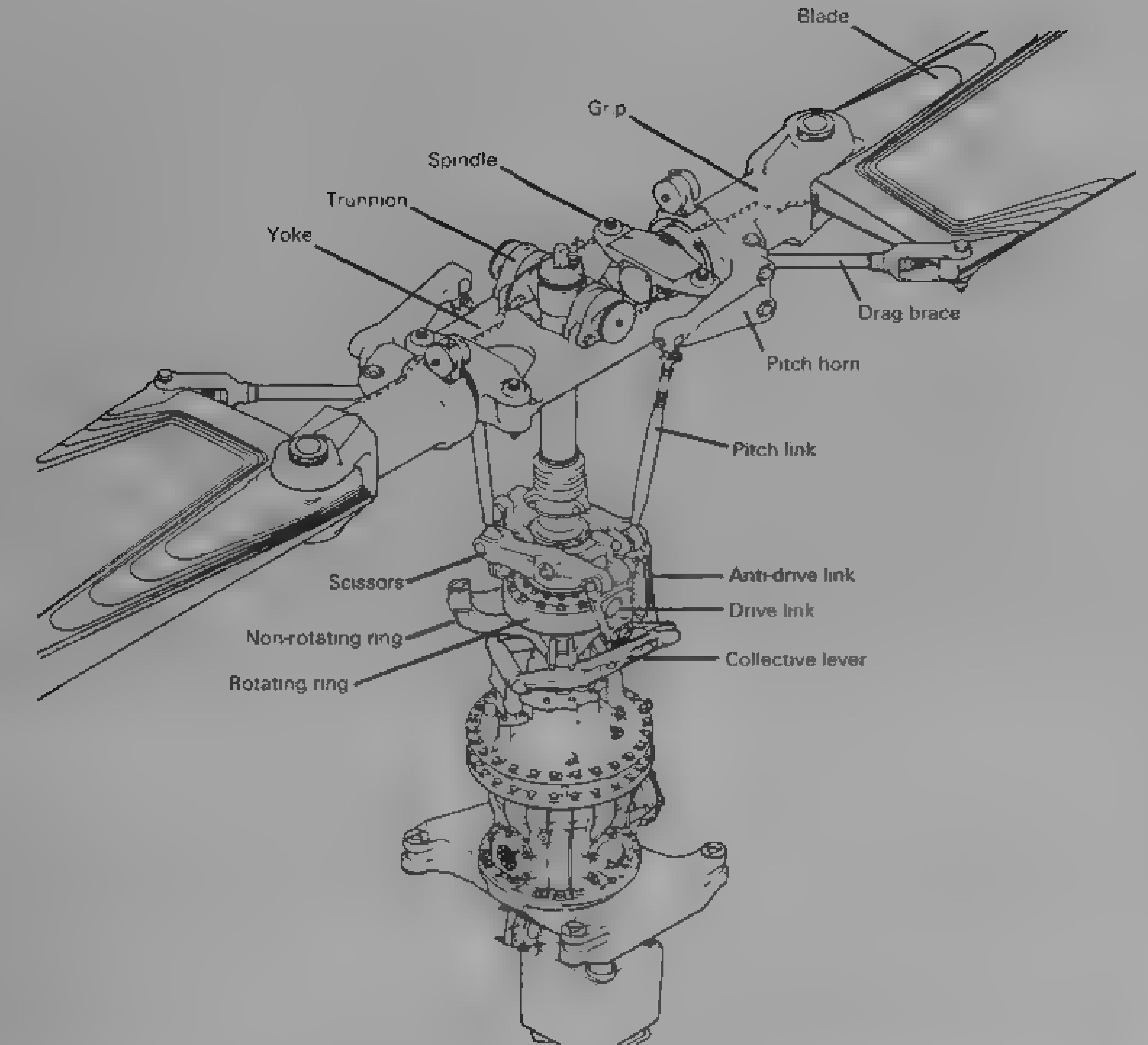


Bell AH-1W SuperCobra *(Jane's/Dennis Punnett)*

1995

US Marine Corps Bell AH-1W SuperCobra attack helicopter

1995

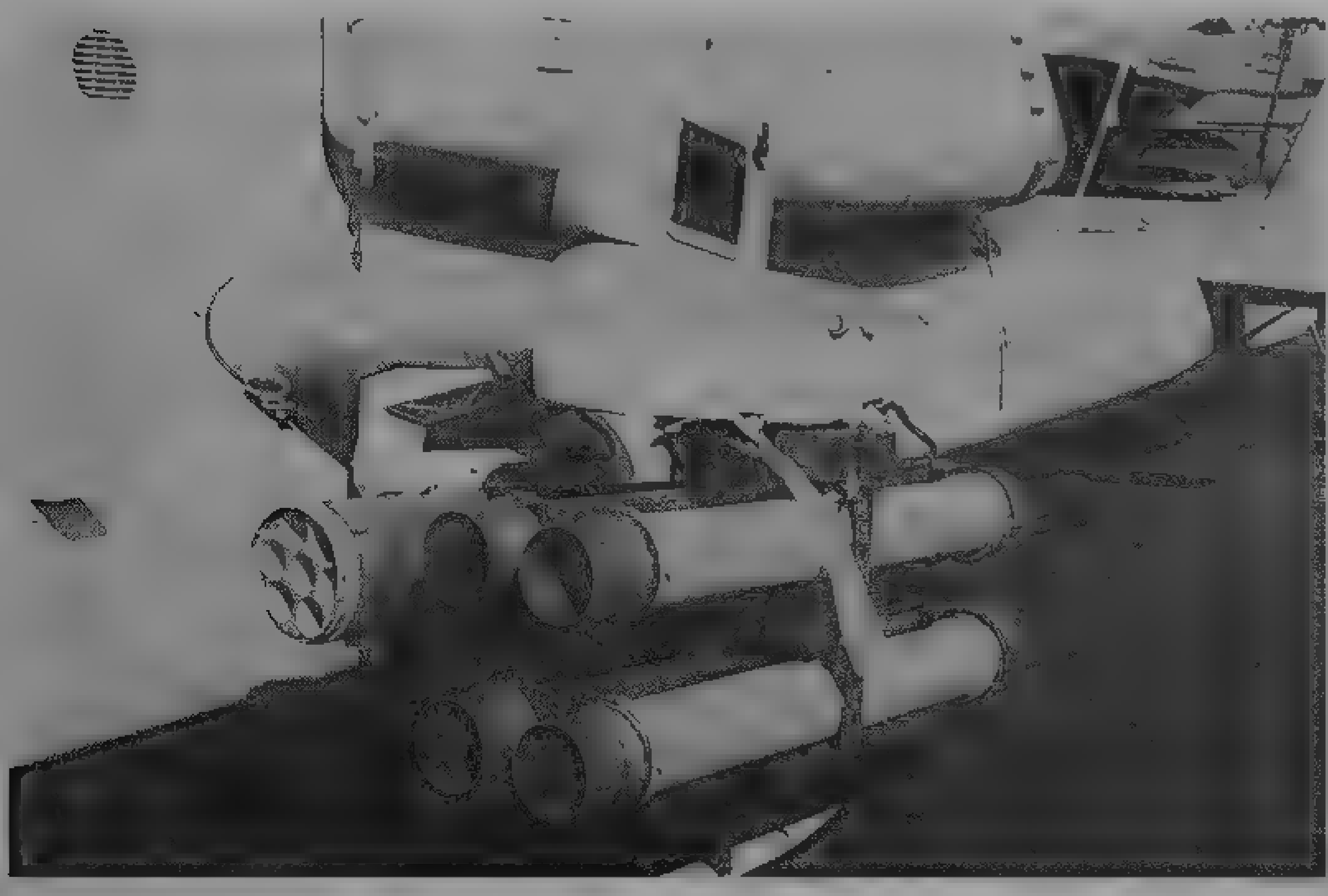


Bell AH-1W main rotor system

1994

US Marine Corps Bell AH-1W SuperCobra converted from AH-1T ***(Paul Jackson)***

1995



Four TOW launch tubes, Hydra 70 rocket pod and flare dispenser on Bell AH-1W stub wing ***(Paul Jackson)***

1995

LANDING GEAR: Non-retractable tubular skid type. Ground handling wheels optional.

POWER PLANT: Two General Electric T700-GE-401 turboshafts, each rated at 1,285 kW (1,723 shp). Transmission rating 1,515 kW (2,032 shp) for take-off, 1,286 kW (1,725 shp) continuous. Fuel (JP5) contained in two interconnected self-sealing rubber fuel cells in fuselage, with protection from damage by 0.50 in ballistic ammunition, total usable capacity 1,162 litres (306.8 US gallons, 255.7 Imp gallons). Gravity refuelling point in forward fuselage, pressure refuelling point in rear fuselage. Provision for carriage on underwing stores stations of two or four external fuel tanks each of 291 litres (77 US gallons, 64 Imp gallons) capacity, or two 378 litre (100 US gallon, 83 Imp gallon) tanks, or two 100 and two 77 US gallon tanks, larger tanks on outboard pylons only. Oil capacity 19 litres (5 US gallons, 4.2 Imp gallons).

ACCOMMODATION: Crew of two in tandem, with co-pilot/gunner in front seat and pilot at rear. Cockpit is heated, ventilated and air conditioned. Dual controls; lighting compatible with night vision goggles, and armour protection standard. Forward crew door on port side and rear crew door on starboard side, both upward-opening.

SYSTEMS: Three independent hydraulic systems, pressure 207 bars (3,000 lb/sq in), for flight controls and other services. Electrical system comprises two 28 V 400 A DC generators, two 24 V 34.5 Ah batteries and three inverters: main 115 V AC, 1 kVA, single-phase at 400 Hz, standby 115 V AC, 750 VA, three-phase at 400 Hz and a dedicated 115 V AC 365 VA single-phase for AIM-9 missile system. AiResearch environmental control unit.

AVIONICS: *Comms:* Two AN/ARC-182(V) radios, KY-58 TSEC secure voice set, AN/APX-100(V) IFF.

Flight: AN/ASN-75B compass set, AN/ARN-89B ADF, AN/ARN-118 Tacan, AN/APN-154(V) radar beacon set, and AN/APN-194 radar altimeter. From January 1991, new-build AH-1Ws have Teledyne AN/APN-217 Doppler-based navigation system with Collins CDU-800 control/display unit and dual Collins RCU-800 processors.

Instrumentation: Kaiser HUD compatible with PNVS-5 and ANVIS-6 night vision goggles.

Mission: Tamam/Kollsman Night Targeting System (NTSF-65) comprising FLIR, laser rangefinder/designator, TV camera, day/night video tracker and full in-flight boresighting, being retrofitted (within M-65 sighting system for TOW missiles) from 1993 (see Design Features); first re-delivery in June 1994; alternative McDonnell Douglas Electronic Systems NightHawk system also offered for export SuperCobras, following 1992-93 flight testing.

Self-defence: AN/APR-39(V) pulse radar signal detecting set, AN/APR-44(V) CW radar warning system, and AN/ALQ-144(V) IR countermeasures set. Dual AN/ALE-39 chaff system with one MX-7721 dispenser mounted on top of each stub-wing. Improved countermeasures suite in USMC AH-1Ws will replace AN/APR-39 and AN/APR-44 by AN/APR-39(XE2) radar warning and adds AN/AVR-2 laser warner and AN/AAR-47 plume detecting set.

ARMAMENT: Electrically operated General Electric undernose A/A49E-7(V4) turret housing an M197 three-barrel 20 mm gun. A 750-round ammunition container is located in the fuselage directly aft of the turret; firing rate is 650 rds/min; a 16-round burst limiter is incorporated in the firing switch. Gun can be tracked 110° to each side, 18° upward, and 50° downward, but barrel length of 1.52 m (5 ft 0 in) makes it imperative that the M197 is centralised before wing stores are fired. Underwing attachments for up to four LAU-61A (19-tube), LAU-68A, LAU-68A/A, LAU-68B/A or LAU-69A (seven-tube) 2.75 in Hydra 70 rocket launcher pods, two CBU-55B fuel-air explosive weapons, four SUU-44/A flare dispensers, two M118 grenade dispensers, Mk 45 parachute flares, or two GPU-2A or SUU-11A/A Minigun pods. Provision for carrying totals of up to eight TOW missiles, eight AGM-114 Hellfire missiles, two AIM-9L Sidewinder or AGM-122A Sidearm missiles, on outboard underwing stores stations. Canadian Marconi TOW/Hellfire control system enables AH-1W to fire both TOW and Hellfire missiles on same mission. Hughes AGM-65D Maverick capability demonstrated 1990; under consideration for USMC. Addition planned of further two pylons (total six) with proportional increase in weapons capability.

DIMENSIONS, EXTERNAL:

Main rotor diameter	14.63 m (48 ft 0 in)
Main rotor blade chord	0.84 m (2 ft 9 in)
Tail rotor diameter	2.97 m (9 ft 9 in)
Tail rotor blade chord	0.305 m (1 ft 0 in)
Distance between rotor centres	8.89 m (29 ft 2 in)
Wing span	3.28 m (10 ft 9 in)
Wing aspect ratio	3.74
Length: overall, rotors turning	17.68 m (58 ft 0 in)
fuselage	13.87 m (45 ft 6 in)
Width overall	3.28 m (10 ft 9 in)
Height: to top of rotor head	4.11 m (13 ft 6 in)
overall	4.44 m (14 ft 7 in)
Ground clearance, main rotor, turning	2.74 m (9 ft 0 in)
Elevator span	2.11 m (6 ft 11 in)
Width over skids	2.24 m (7 ft 4 in)

AREAS:

Main rotor blades (each)	6.13 m² (66.0 sq ft)
Tail rotor blades (each)	0.45 m² (4.835 sq ft)

Main rotor disc	168 11 m² (1,809 56 sq ft)
Tail rotor disc	6 94 m² (74.70 sq ft)
Vertical fin	2.01 m² (21.70 sq ft)
Horizontal tail surfaces	1 41 m² (15 20 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	4,634 kg (10,216 lb)
Mission fuel load (usable)	946 kg (2,086 lb)
Max useful load (fuel and disposable ordnance)	2,065 kg (4,552 lb)
Max T-O and landing weight	6,690 kg (14,750 lb)
Max disc loading	39 80 kg/m² (8.15 lb/sq ft)
Max power loading	4.42 kg/kW (7 26 lb/shp)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (VNE)	190 kts (352 km/h, 219 mph)
Max level speed at S/L	152 kts (282 km/h, 175 mph)
Max cruising speed	150 kts (278 km/h, 173 mph)
Rate of climb at S/L, OEI	244 m (800 ft)/min
Service ceiling	more than 4,270 m (14,000 ft)
Service ceiling, OEI	more than 3,660 m (12,000 ft)
Hovering ceiling: IGE	4,495 m (14,750 ft)
OGE	915 m (3,000 ft)
Range at S/L with standard fuel, no reserves	317 n miles (587 km, 365 miles)

UPDATED

BELL AH-1W VENOM

Venom was version of AH-1W offered by Bell Helicopter with GEC-Marconi as prime contractor for British Army attack helicopter requirement, completion of 'green' airframes would have been at Rochester, UK. Avionics borrowed from proposed AH-1W IWS (refer above) and included night vision and new sensors for day/night all-weather operation, autonomous navigation (GPS, possibly augmented by Doppler) and linked defensive aids, colour multifunction flat panel displays, integrated night vision helmets with night trackers and combined situation and digital map displays. Systems included APU. Bid submitted to UK MoD 2 November 1993, rejected in favour of McDonnell Douglas AH-64 Apache, 13 July 1995

UPDATED

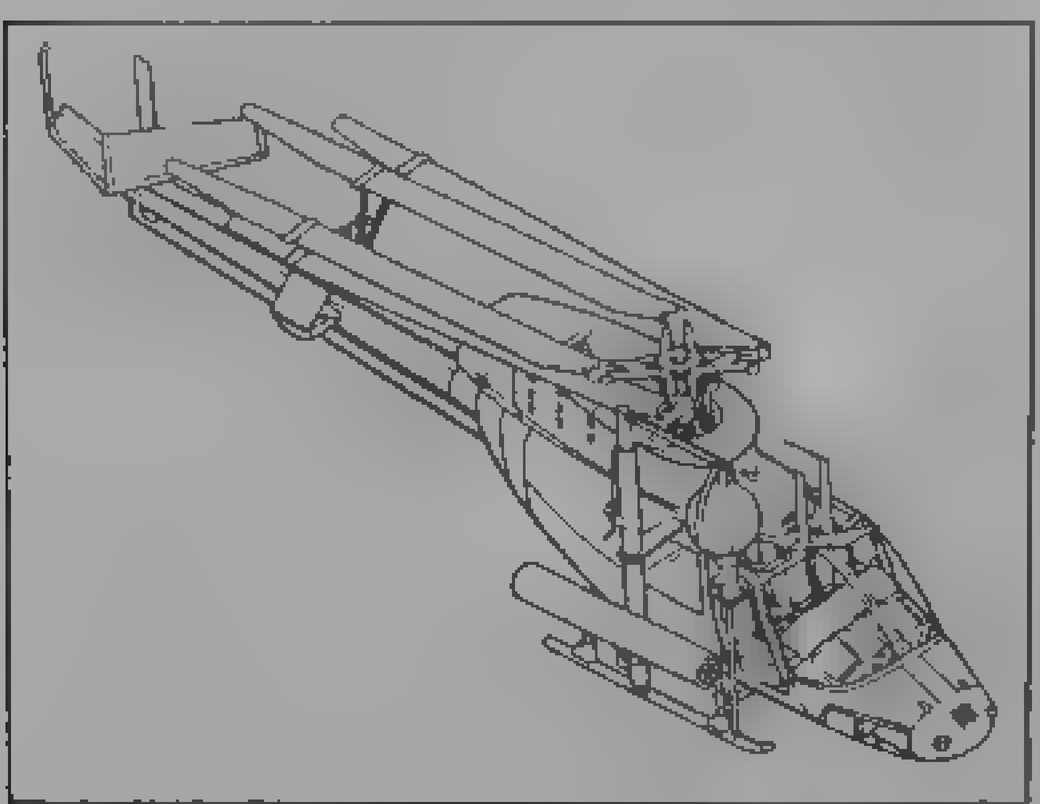
BELL 406 (AHIP)

US Army designations: OH-58D Kiowa and Kiowa Warrior

TYPE: Two-seat scout and attack helicopter

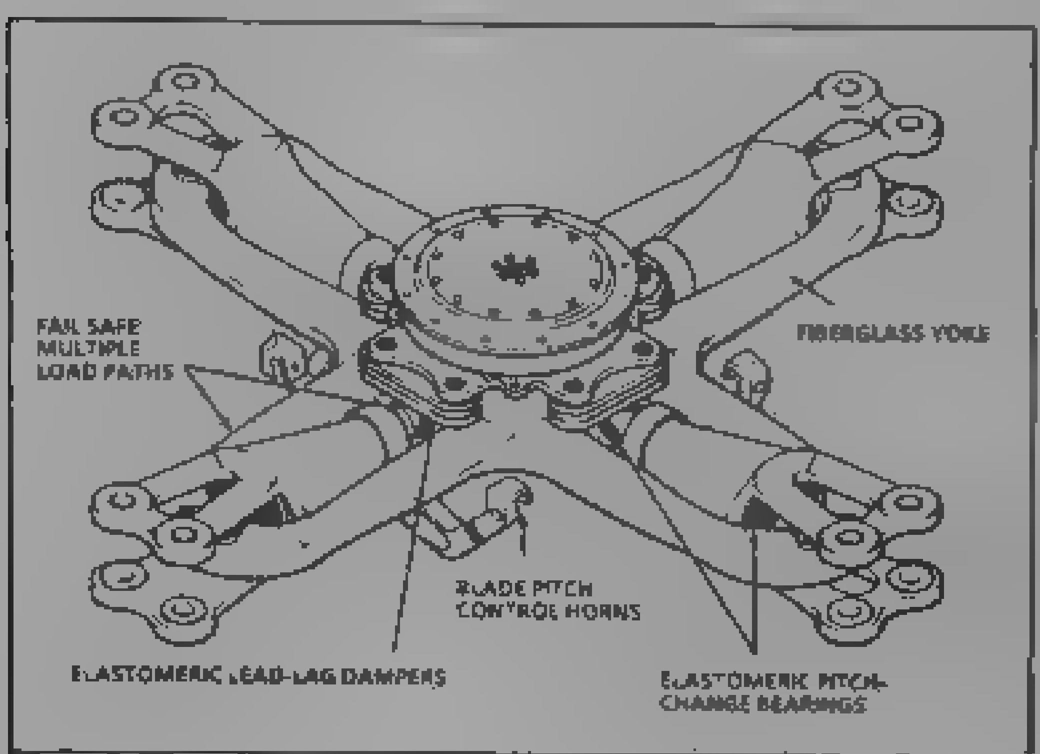
PROGRAMME: Bell won US Army Helicopter Improvement Program (AHIP) 21 September 1981, first flight of OH-58D 6 October 1983, deliveries started December 1985, first based in Europe June 1987. Production running at minimum economic rate of three a month, compared with capacity for 12.

CURRENT VERSIONS: **Prime Chance:** Fifteen special armed OH-58Ds (86-8908 to -8922) modified from September 1987 under Operation Prime Chance for use against Iranian high-speed boats in Gulf; delivery started after 98 days, in December 1987, firing clearance for Stinger, Hellfire, 0.50 in gun and seven-tube rocket pods completed in seven days. Further conversion (85-24716) for development trials. All currently operated by 4-17th Cavalry at Fort Bragg, North Carolina



Quick folding system for OH-58D MultiPurpose Light Helicopter

1995



Bell OH-58D rotor head

1995

Detail of OH-58D Kiowa Warrior armed with Stinger AAMs *(Paul Jackson)*

1995

Kiowa Warrior: Armed version, to which all planned OH-58Ds are being modified, integrated weapons pylons, uprated transmission and engine, lateral CG limits increased, raised gross weight, EMV protection of avionics bays, localised strengthening, RWR, IR jammer, video recorder, SINCGARS radios, laser warning receiver and tilted vertical fin, armament same as Prime Chance, integrated avionics and lightened structure. See illustration for stealth kit modification (details of kit in 1992-93 *Jane's*), converted aircraft (of which 89-0090 was first) reportedly have since reverted to standard, but low-observable OH-58Ds of 1-17th Cavalry at Fort Bragg, North Carolina, operating with undisclosed modifications by 1993; changes include coated rotor blades, new windscreen material and modified rotor sail, rotor cuffs and hubs for substantial reduction in frontal radar signature

Further modifications for Warrior, currently under consideration, include undernose FLIR turret (tested late 1993), 227 litre (60 US gallon, 50 Imp gallon) conformal fuel tanks on flanks of rear cabin, radio frequency interferometer RWR; INS/GPS, digital map display, integrated helmet display, and 19 5 per cent power plant uprating for OGE hover at 1,220 m (4,000 ft) at 35°C (95°F) with four Hellfire ATMs

MultiPurpose Light Helicopter (MPLH): Further modification of Kiowa Warrior; features include squatting landing gear, quick folding rotor blades, horizontal stabiliser and tilting fin to allow helicopter to be transported in cargo aircraft and flown to cover 10 minutes after unloading from C-130. Later additions include cargo hook for up to 907 kg (2,000 lb) slung load and fittings for external carriage of six outward facing troop seats or four stretchers.

OH-58X Light Utility Variant: Contender for anticipated US Army requirement, fourth development OH-58D (69-16322) modified in 1992 with partial stealth features (including chisel nose); chin-mounted McDonnell Douglas Electronic Systems turret for night piloting system, Kodak FLIR with 30° field of view, 907 kg (2,000 lb) capacity cargo hook, Allison T703-AD-700 power plant with 429 kW (575 shp) transmission, and Honeywell avionics including ring laser INS with GPS, colour map and integrated helmet display system. Avionics relocated to nose, freeing two passenger seats, third seat available if mast sight avionics removed, target empty weight 1,400 kg (3,085 lb). Cockpit doors have full length transparencies, bulged for extra elbow room

CUSTOMERS: US Army: initial plan to modify 592 OH-58A to OH-58D reduced to 477, again reduced to 207, but Congressionally mandated re-orders increased total to 376 (excluding five prototypes) by 1995 from new goal of 507, as under

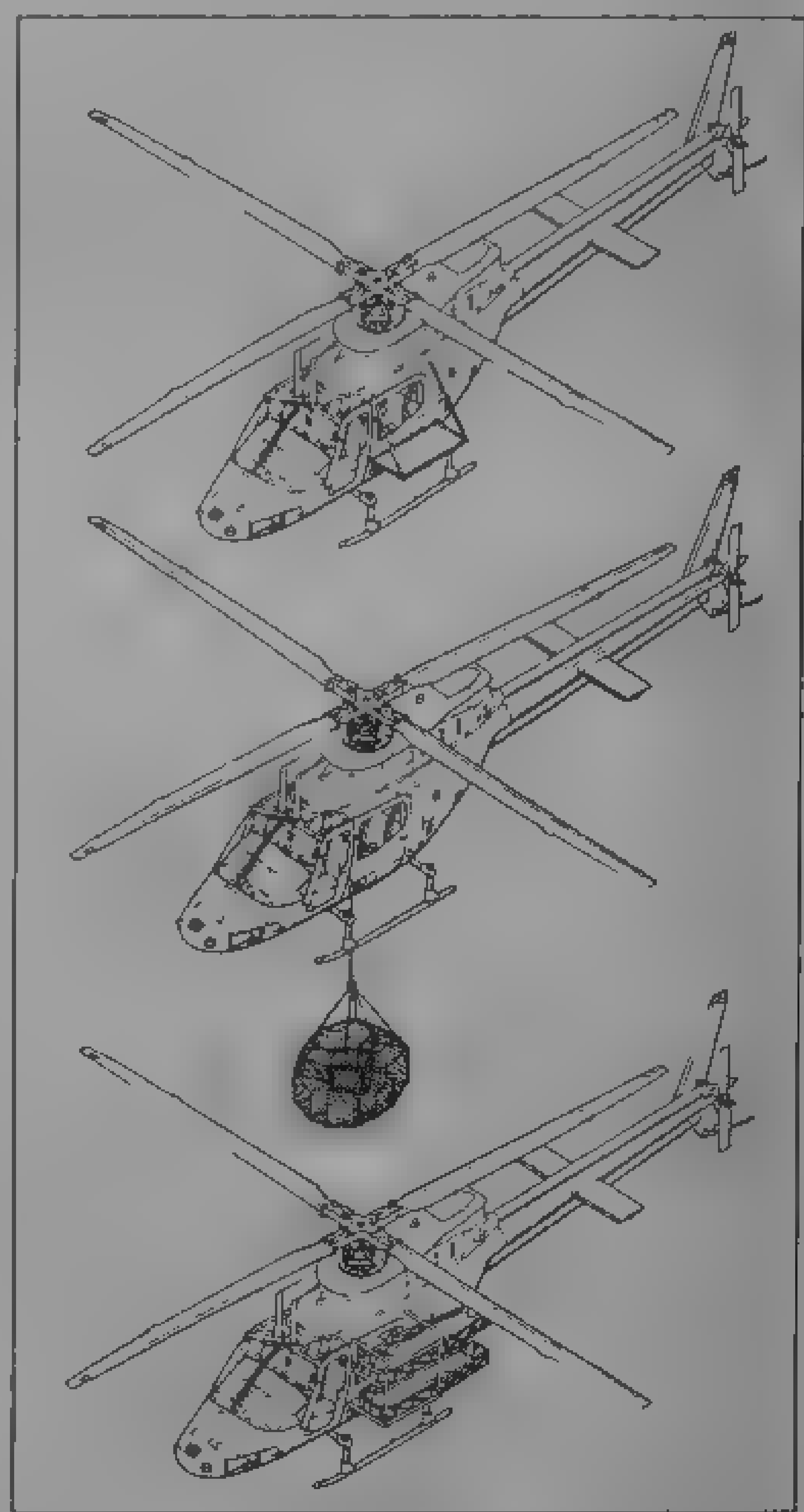
FY	Lot	Qty	First aircraft
83	1	16	83-24129
85	2	44	85-24690
86	3	39	86-8901
87	4	36	87-0725
88	5	36	88-0285
89	6	36	89-0082
90	7	36	90-0346
91	8	36	91-0536
92	9	36	
92	10	12*	
93	11	15	
94	12	18	
95	13	16	
Total		**376†**	

*Gulf War attrition replacements
†Plus five prototypes

First 117 conversions at Amarillo, from 87-0743 at Fort Worth, produced as Kiowa Warrior from 202nd aircraft (89-0112), May 1991; initially to 'C' and 'D' Troops of 4-17 Aviation, Fort Bragg. First Warrior retrofit contract (28 helicopters) to Bell January 1992, further 75 in FY93 budget and 38 in FY95. Taiwan ordered 12 OH-58Ds plus maintenance trainer in February 1992 and reserved 14 options, deliveries from July 1993 (s/n 601). Taiwanese helicopters are new-build, US Army aircraft are ex-OH-58As with new serial numbers. Main effort now is provision for armament and accompanying upgrades in new aircraft and retrofitting existing OH-58D to armed Kiowa Warrior configuration, 81 Kiowa Warriors to be raised to ultimate MultiPurpose Light Helicopter (MPLH) standard for use by US Army quick reaction forces of XVIII (32 aircraft) and 82nd (49 aircraft) Airborne Divisions.

COSTS: $9 42 million (1990) programme unit cost. Flyaway $4 9 million (Kiowa) or $6.7 million (Kiowa Warrior). Retrofit to Warrior configuration $1 34 million (1992-93 average)

DESIGN FEATURES: Four-blade Bell soft in plane rotor with carbon composites yoke, elastomeric bearings and composites blades. Main rotor rpm 395, tail rotor rpm 2,381



Bell OH-58D potential configurations. (top) six external troops, one internal with equipment; (centre) 907 kg (2,000 lb) underslung load, (bottom) four casualties and one internal medical attendant

1995

Bell OH-58D Kiowa Warrior with weapons and mast-mounted sight

1993

Stealth Kiowa Warrior (89-0090) with chisel nose, blade root cuffs, composites side door, tail rotor hub cover, modified engine fairing and radar-absorbent coatings

1993

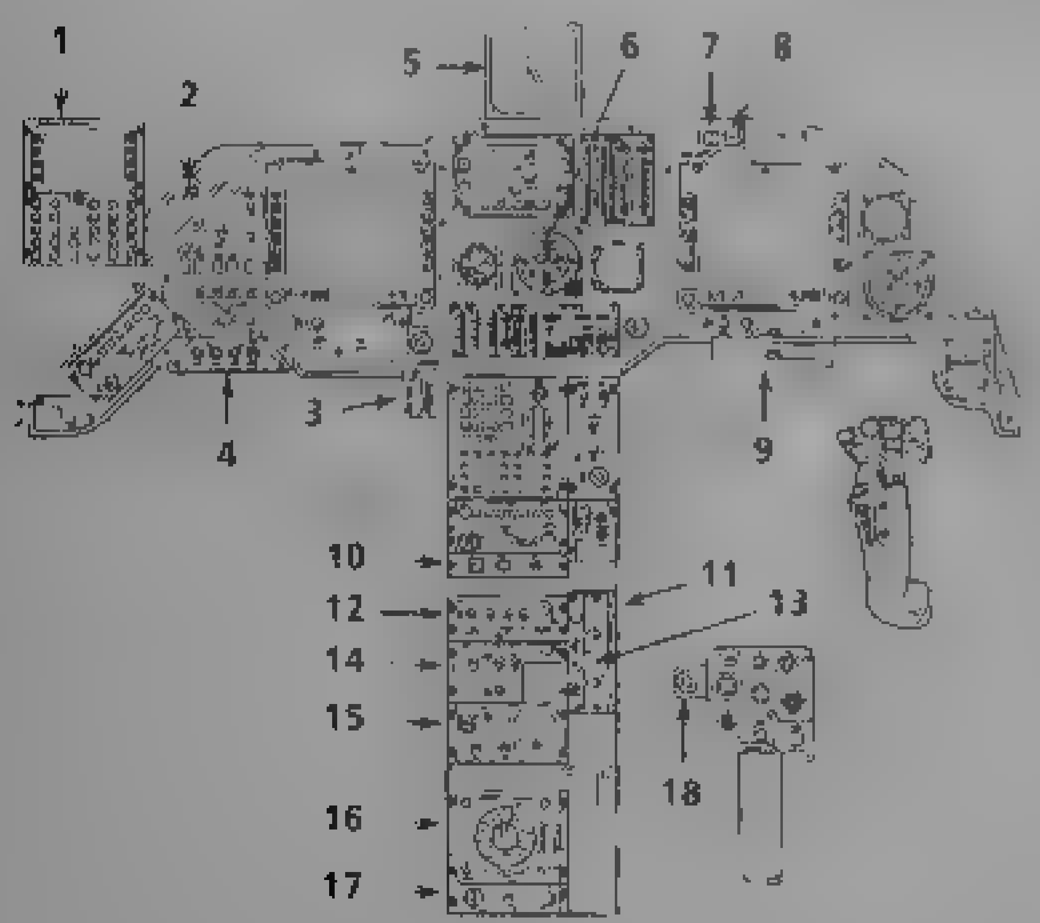
McDonnell Douglas/Northrop Grumman mast-mounted sight containing TV and IR optics and laser designator/ranger. Honeywell integrated control of mission functions, navigation, communications, systems and maintenance functions based on large electronic primary displays for pilot and observer/gunner, hands-on cyclic and collective controls for all combat functions; automatic target hand-off system in some OH-58Ds operates air-to-air as well as air-to-ground using digital frequency hopping, system indicates location and armament state of other helicopters, some OH-58Ds have real-time video downlink capable of relaying to US Army Guardrail aircraft, to headquarters 22 n miles (40 km; 25 miles) away or, via satellite, to remote locations.

Stage 1 of MultiStage Improvement Program (MSIP) includes fitting GPS receiver, improved Doppler, digital data loader and MIL-STD-1750 processors.

FLYING CONTROLS: Fully powered controls, including tail rotor, with four-way trim and trim release; stability and control augmentation system (SCAS) using AHRS gyro signals; automatic bob-up and return to hover mode, Doppler blind hover guidance mode, co-pilot/observer's cyclic stick can be disconnected from controls and locked centrally.

STRUCTURE: Basic OH-58 structure reinforced, armament cross-tube fixed above rear cabin floor; avionics occupy rear cabin area, baggage area and nose compartment.

LANDING GEAR: Light alloy tubular skids bolted to extruded cross-tubes.



Bell OH-58D instrument panel

1 Hellfire control display unit (CDU)
2 Weight on gear switch interrupt
3 Jettison switches
4 Video recorder control panel
5 Bearing distance heading indicator (BDHI)
6 Attitude deviation indicator (ADI)
7 AN/APR-44 radar indicator
8 AN/ALQ-144 IR jammer annunciator
9 Pilot steering indicator (PSI)
10 AN/APR-44 radar control panel
11 AN/ALQ-144 IR jammer control panel
12 Hellfire control panel
13 AN/APR-39 radar warning control panel
14 ATAS control panel
15 Armament control panel (ACP)
16 Armament management system (AMS) control panel
17 Gyromagnetic compass control panel
18 Hellfire fire switch

1994

POWER PLANT: One Allison 250-C30R (T703-AD-700) turboshaft (C30R/3 in Kiowa Warrior), with an intermediate power rating of 485 kW (650 shp) at S/L ISA. Transmission rating: Kiowa 339 kW (455 shp) continuous; Kiowa Warrior 410 kW (550 shp) continuous. One self-sealing crash resistant fuel cell, capacity 424 litres (112 US gallons, 93 Imp gallons), located aft of cabin area. Refuelling point on starboard side of fuselage. Oil capacity 5.7 litres (1.5 US gallons; 1.2 Imp gallons).

ACCOMMODATION: Pilot and co-pilot/observer seated side by side. Door on each side of fuselage. Accommodation is heated and ventilated.

SYSTEMS: Dual hydraulic system with three-axis SCAS, pressure 69 bars (1,000 lb/sq in), for main and tail rotor controls. Maximum flow rate 11.36 litres (3 US gallons, 2.5 Imp gallons)/min. Open-type reservoir. Primary electrical power provided by 10 kVA 400 Hz three-phase 120/208 V AC alternator with 200 A 28 V DC transformer rectifier unit for secondary DC power. Back-up power provided by 500 VA 400 Hz single-phase 115 V AC solid-state inverter and 200 A 28 V DC starter/generator.

AVIONICS: *Comms*: Five com transceivers, datalink and secure voice equipment. Phase 1 additions, introduced on production line in 1990 in preparation for Kiowa Warrior, include AN/ARC-201 SINCGARS secure voice/data radio and Have Quick II radio.

Flight: Plessey (PESC) AN/ASN-157 Doppler strapdown INS.

Instrumentation: Equipped for day/night VFR. Multifunction displays for vertical and horizontal situation indication, mast-mounted sight day/night viewing and communications control, with selection via control column handgrip switches.

Mission: Mast-mounted sight houses 12× magnification TV camera, autofocusing IR thermal imaging sensor and laser rangefinder/designator, with automatic target tracking and in-flight automatic boresighting; turret may be trained 190° port and 190° starboard in azimuth, ±30° in elevation. Night vision goggles, AHRS, and airborne target handoff subsystem (ATHS). Germany-based OH-58Ds have real-time video downlink which can be relayed via Guardrail-capable aircraft. Phase 1 additions include doubled computer capacity to 88 kbits, added weapons selection/aiming and multitarget acquisition/track displays, video recorder, data transfer system, ANVIS display and symbology system and EMV hardening.

Self-defence: AN/APR-39(V)1 or -39A(V)1 RWR. Phase 1 adds AN/ALQ-144 IR jammer, second RWR (AN/APR-44(V)3) and AN/AVR-2 laser detection system.

EQUIPMENT: M-43 NBC mask in Phase 1 and Warrior aircraft.

ARMAMENT: Four Stinger air-to-air or Hellfire air-to-surface missiles, or two seven-round 2.75 in rocket pods, or one Global Helicopter Technology CFD-5000 pod for 7.62 mm and 0.50 in machine guns, mounted on outriggers on cabin sides (port side only for gun). IR jammer standard on armed version.

DIMENSIONS, EXTERNAL:

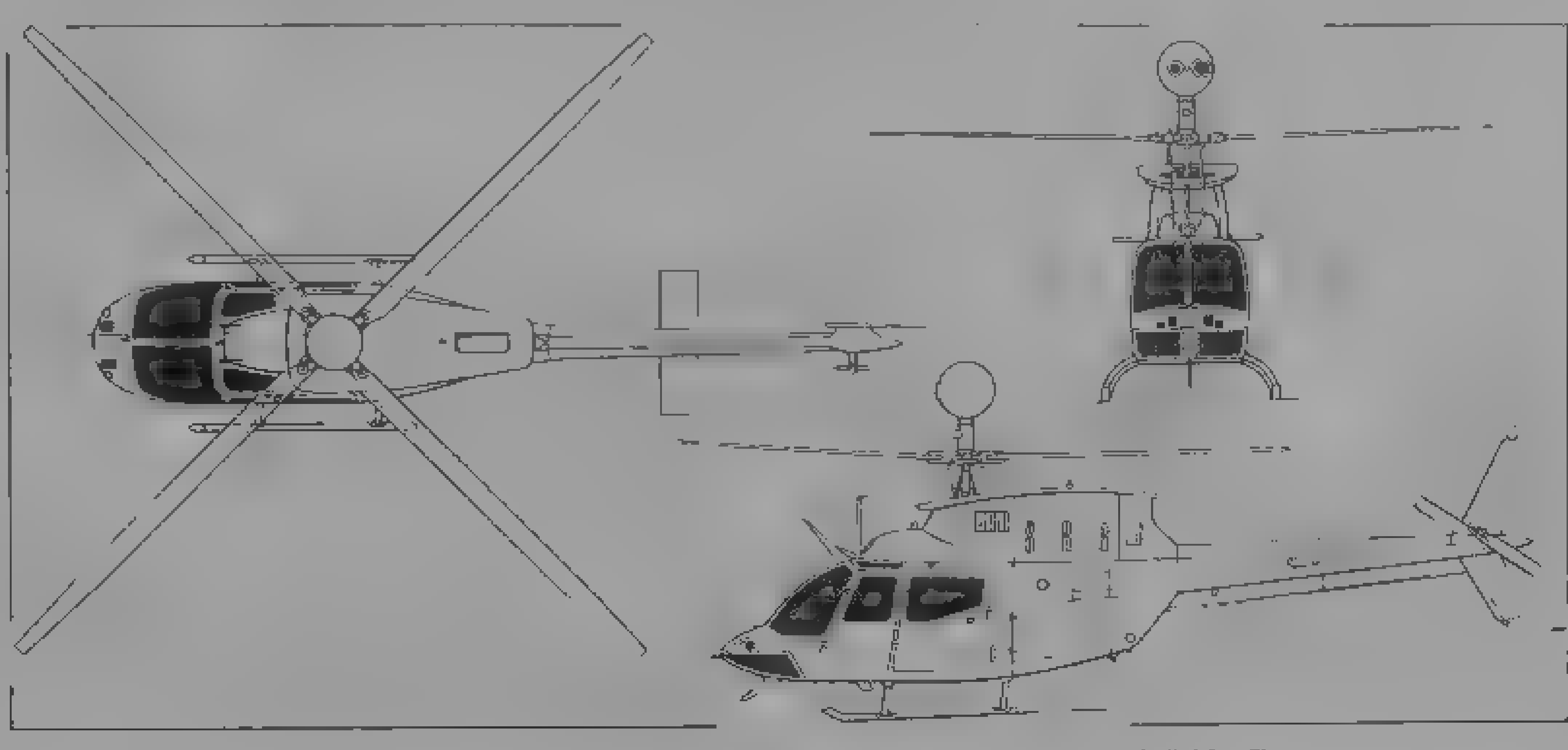
Main rotor diameter	10.67 m (35 ft 0 in)
Main rotor blade chord (mean)	0.24 m (9½ in)
Tail rotor diameter	1.65 m (5 ft 5 in)
Length: overall, rotors turning	12.85 m (42 ft 2 in)
fuselage (pitot to skid)	10.48 m (34 ft 4¾ in)
fin tilted for air transport	10.29 m (33 ft 9¼ in)
Width: rotors folded, clean	1.97 m (6 ft 5½ in)
armament fitted, pylons folded for air transport (MPLH)	2.39 m (7 ft 10 in)
Height: overall	3.93 m (12 ft 10⅝ in)
squatting and folded for air transport (MPLH)	2.73 m (8 ft 11⅝ in)
Horizontal stabiliser span	2.29 m (7 ft 6 in)
Skid track	1.88 m (6 ft 2 in)
Cabin doors (port and stbd, each):	
Height	1.04 m (3 ft 5 in)
Width	0.91 m (3 ft 0 in)
Height to sill	0.66 m (2 ft 2 in)

AREAS:

Main rotor blades (each)	1.38 m² (14.83 sq ft)
Tail rotor blades (each)	0.13 m² (1.43 sq ft)
Main rotor disc	89.37 m² (962.0 sq ft)
Tail rotor disc	2.14 m² (23.04 sq ft)
Horizontal stabiliser	1.11 m² (11.92 sq ft)
Fin	0.87 m² (9.33 sq ft)

WEIGHTS AND LOADINGS (K: OH-58D Kiowa, KW: armed Kiowa Warrior):

Weight empty: K	1,381 kg (3,045 lb)
KW	1,492 kg (3,289 lb)



Bell OH-58D Kiowa Warrior scout and attack helicopter (*Jane's/Mike Keep*)

1994

OH-58X prototype receives adjustments to night piloting system turret *(Kenneth Munson)*

1994

Max external load: KW 907 kg (2,000 lb)
Max fuel weight: K, KW 341 kg (752 lb)
Mission weight: KW 2,359 kg (5,200 lb)
Max T-O and landing weight: K 2,041 kg (4,500 lb)
KW 2,495 kg (5,500 lb)
Max disc loading: K 22.84 kg/m² (4.68 lb/sq ft)
KW 27.91 kg/m² (5.72 lb/sq ft)
Max power loading: K 6.02 kg/kW (9.89 lb/shp)
KW 5.82 kg/kW (9.56 lb/shp)

PERFORMANCE (at max T-O weight, clean, K, or at mission weight, KW):
Never-exceed speed (VNE) 130 kts (241 km/h; 149 mph)
Max level speed at 1,220 m (4,000 ft) 128 kts (237 km/h; 147 mph)
Max cruising speed: K 118 kts (219 km/h; 136 mph)
KW 114 kts (211 km/h; 131 mph)
Econ cruising speed at 1,220 m (4,000 ft) 110 kts (204 km/h; 127 mph)
Max rate of climb: at S/L, ISA 469 m (1,540 ft)/min
at 1,220 m (4,000 ft), 35°C (95°F) over 366 m (1,200 ft)/min
Vertical rate of climb:
at S/L, ISA: K 232 m (760 ft)/min
KW 4,875 m (1,600 ft)/min
at 1,220 m (4,000 ft), 35°C (95°F):
K over 152 m (500 ft)/min
Service ceiling: KW 4,575 m (15,000 ft)
Hovering ceiling:
IGE, ISA: K over 3,660 m (12,000 ft)
KW 3,050 m (10,000 ft)
OGE, ISA: K 3,415 m (11,200 ft)
KW 2,105 m (6,900 ft)
OGE, 35°C (95°F): K 1,735 m (5,700 ft)
KW* 1,220 m (4,000 ft)
Range: K 250 n miles (463 km; 288 miles)
KW 223 n miles (413 km; 257 miles)
Endurance: K and KW 2 h 24 min
*at 2,176 kg (4,798 lb)

UPDATED

OTHER AIRCRAFT

Bell **TH-67 Creek** and **civilian helicopters** appear under Bell Helicopter Textron Canada in that country's section.

NEW ENTRY

BELL/BOEING

BELL HELICOPTER TEXTRON and BOEING HELICOPTERS

PROGRAMME MANAGERS: Colonel Bob Garner, USMC (customer)
Stuart D. Dodge (manufacturer)

UPDATED

BELL/BOEING V-22 OSPREY

TYPE: Twin-engined tilt-rotor multimission aircraft.

PROGRAMME: Based on Bell/NASA XV-15 tilt-rotor; initiated as US Department of Defense Joint Services Advanced Vertical Lift Aircraft (JVX), run by US Army; FY82, programme transferred to US Navy January 1983; 24 month US Navy preliminary design contract 26 April 1983; aircraft named V-22 Osprey January 1985; seven year full-scale development (FSD) began 2 May 1986 with order for six prototypes (Nos. 1, 3 and 6 by Bell at Arlington, Texas; Nos. 2, 4 and 5 by Boeing at Wilmington, Delaware) plus static test airframes.

No. 1/Bu Aer No. 163911: Rolled out at Arlington 23 May 1988; first flight 19 March 1989; flight envelope expansion and flight loads examination; achieved first transition from helicopter to aeroplane mode 14 September 1989; grounded July 1992 and not returned to flying duties.

No. 2/163912: First flight at Arlington 9 September 1989; to Wilmington 6 May 1990; fly-by-wire development; grounded July 1992, modified and resumed flying at Wilmington, November 1993; hot/cold weather trials early 1994; to Patuxent River, where initial operational flight testing by USMC and USAF undertaken July 1994 (20 hours 15 minutes in 27 days); flight-ready storage from October 1994; painted grey overall and flight demonstrated at Paris Air Show, June 1995 (first V-22 to fly outside USA).

No. 3/163913: First flight at Arlington 9 May 1990; flight loads, vibration and sea trials, USS *Wasp* 4-7 December 1990; grounded July 1992, modified and resumed flying at Arlington 17 June 1993; to Patuxent River: aerodynamic trials, external loads, sea trials 1994; trials of anti-buffet forebody strake from September 1994; flight testing continuing in 1995.

No. 4/163914: First flight at Wilmington 21 December 1989; first with full avionics and ejection seats; shipboard compatibility and propulsion trials: USS *Wasp* 4-7 December 1990; four months of weather testing (–54 to +49°C, –65 to +120°F) completed 7 June 1992; lost on 94th sortie (103 hours) 21 July 1992 due to engine nacelle fire.

No. 5/163915: First flight at Wilmington ended with crash due to avionics mis-wiring, 11 June 1991.

No. 6/163916: Construction abandoned, became mockup for EMD configuration, cabin evacuation trials 1993.

Initial government trials, April 1990, involved 15 hours' flying by three military test pilots in No. 2. Sea trials aboard USS *Wasp*, 4 to 7 December 1990, involved No. 3 in landing and take-off tests and No. 4 in fit and function tests. By end 1990, trials included transition landings and take-offs, wing stall tests, single-engine tests and flights up to 349 knots (647 km/h; 402 mph). V-22 awarded National Aeronautic Association's Collier Trophy in 1990 for greatest achievement in aeronautics in past year. Aimed to meet or exceed 32 multiservice mission requirements. Trials programme is 4,000 hours, of which 763 hours flown in 643 sorties up to July 1992 temporary grounding. Flying resumed in 1993 with Nos. 2 and 3, these having been modified with improved firewalls, nacelle drains and pylon driveshaft heatshields as consequence of No. 4's crash. Nos. 2 and 3 assigned to envelope expansion and concept demonstration until 1996; both based at Patuxent River NAS, instead of contractors' two airfields.

Original schedule called for delivery to US Marines late 1991/early 1992, US Air Force 1993 and US Navy 1995. Production funding cut FY90, but development contract maintained, some long-lead items for production aircraft funded FY91; 12 serial numbers (164389-164400) reserved, then cancelled. Congress appropriated FY92 funding for three of additional six 'production representative' engineering and manufacturing development (EMD) aircraft (164939-164944), second three planned for FY93 funding; however, programme revised in late 1992, and six to comprise four new and two rebuilt prototypes; operational testing deferred until these new aircraft available.

Osprey passed critical design review 13 December 1994 with minor provisions, including addition of forebody strake to eliminate buffeting and provision for nose-mounted gun; simultaneous defence review authorised V-22 production for both Marines and special forces.

EMD Ospreys, to begin flying in 1997, have significant changes from earlier aircraft, including 1,000 kg (2,205 lb) reduction in empty weight to approximately 15,100 kg (33,290 lb); aluminium cockpit cage, replacing titanium, but with smaller windows to preserve structural strength; upgraded flight controls, enhanced engine and drive system, improved tail unit construction (built by Bell in place of Northrop Grumman) including fibre placement aft fuselage, redesigned rotor system, absence of fin tuning weights, improved wing constructional techniques, redesigned wiring, and pyrotechnic escape hatches. Four EMD aircraft are:

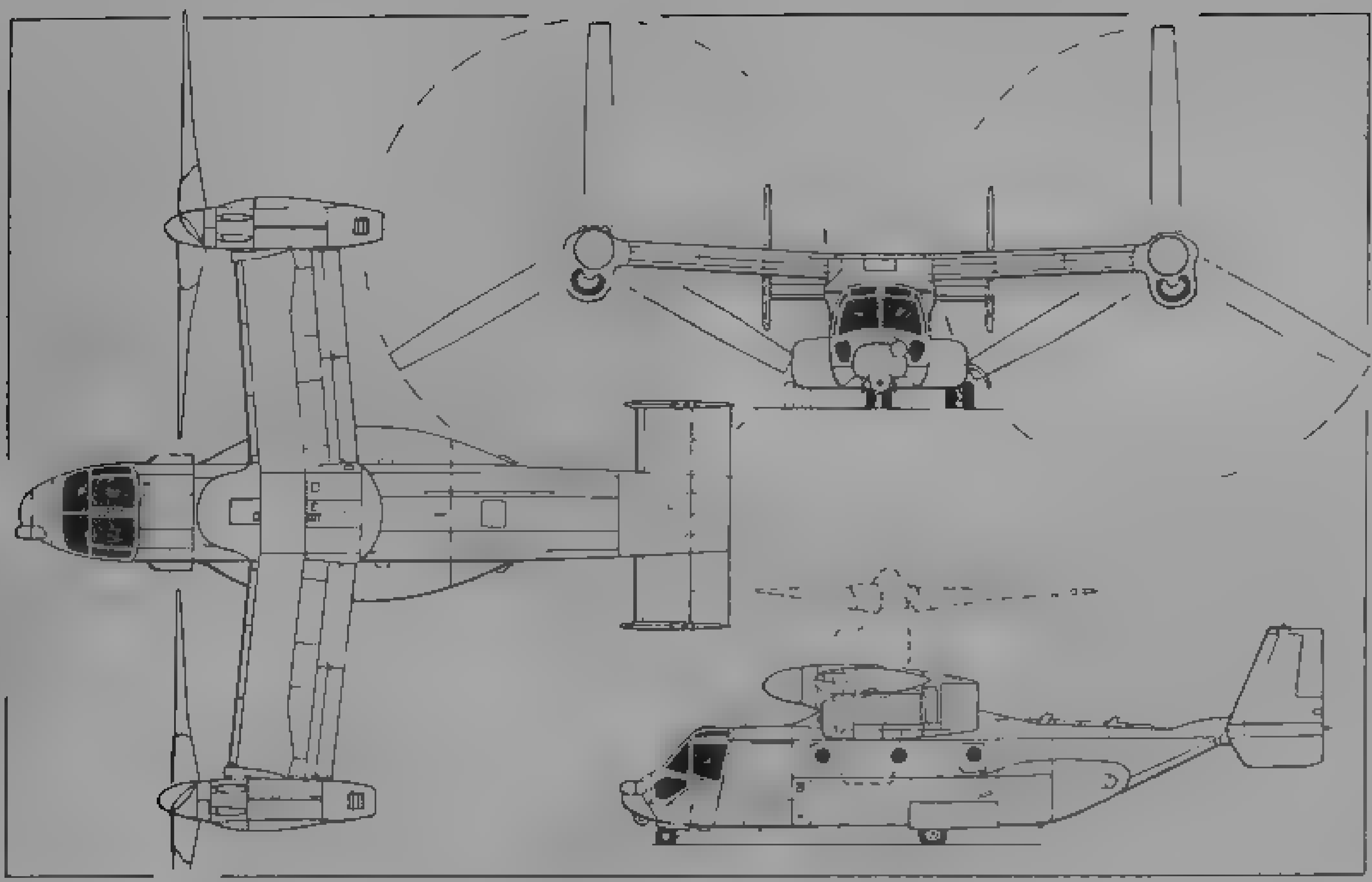
No. 7: First flight December 1996; structural, load and vibration testing to be completed by April 1998.

No. 8: First flight February 1997; propulsion and systems testing and high AoA trials.

No. 9: First flight May 1997; government technical

Third prototype Bell/Boeing V-22 Osprey in helicopter mode

1995



Bell/Boeing V-22 Osprey tilt-rotor multimission aircraft *(Jane's/Dennis Punnett)*

1995

Bell/Boeing V 22 prototype No. 2, repainted tactical grey, transitioning to forward flight at Paris Air Show 1995 *(Paul Jackson)*

1995

evaluation, USMC evaluation August 1998 to January 1999

No. 10: First flight April 1997 (sic), rough sea trials USMC evaluation August 1998 to January 1999

Marine Corps downgraded requirements for CH-46 replacement, 1992, making conventional helicopter solution possible, production decision, due December 1993 postponed to November 1994 for new assessment of post Cold War requirements for assault transports; MV-22A IOC remains unchanged at 1999

CURRENT VERSIONS **MV-22A** Basic US Marine Corps transport, original requirement for 552 (now 425) to replace CH-46 Sea Knight and CH-53 Sea Stallion. Three-man crew and 24 combat-equipped troops or cargo carried at 250 knots (463 km/h, 288 mph) over radius of 200 n miles (370 km, 230 miles), with ability to hover mid-way at 915 m (3,000 ft) OGE at 33°C (91 4°F)

HV-22A: US Navy combat search and rescue (CSAR), special warfare and fleet logistics model to replace HH-3s Requirement for 48 (originally 50) IOC 2006

CV-22A. US Air Force long-range special missions aircraft. Original requirement for 80 reduced to 55, then 50, should carry 12 troops or 1,306 kg (2,880 lb) internal cargo over 520 n mile (964 km; 599 mile) radius at 250 knots (463 km/h, 288 mph), with ability to hover OGE at 1,220 m (4,000 ft) at 35°C (95°F)

SV 22A. Tentative US Navy ASW version to replace S-3 Viking Original requirement for up to 300 Required to deposit and pick up recoverable large ASW sensors and operate them from high altitude

US Army: Original requirement for 231 V-22s, based on USMC transport, withdrawn Documented requirement remains for V-22 in medevac, special operations and combat assault support roles

CUSTOMERS. See above First four production aircraft to be funded in FY97 Also European marketing co-operation with British Aerospace (which see), Dornier and Alenia Japan Maritime Self-Defence Force provisional commitment to fund four SAR Ospreys

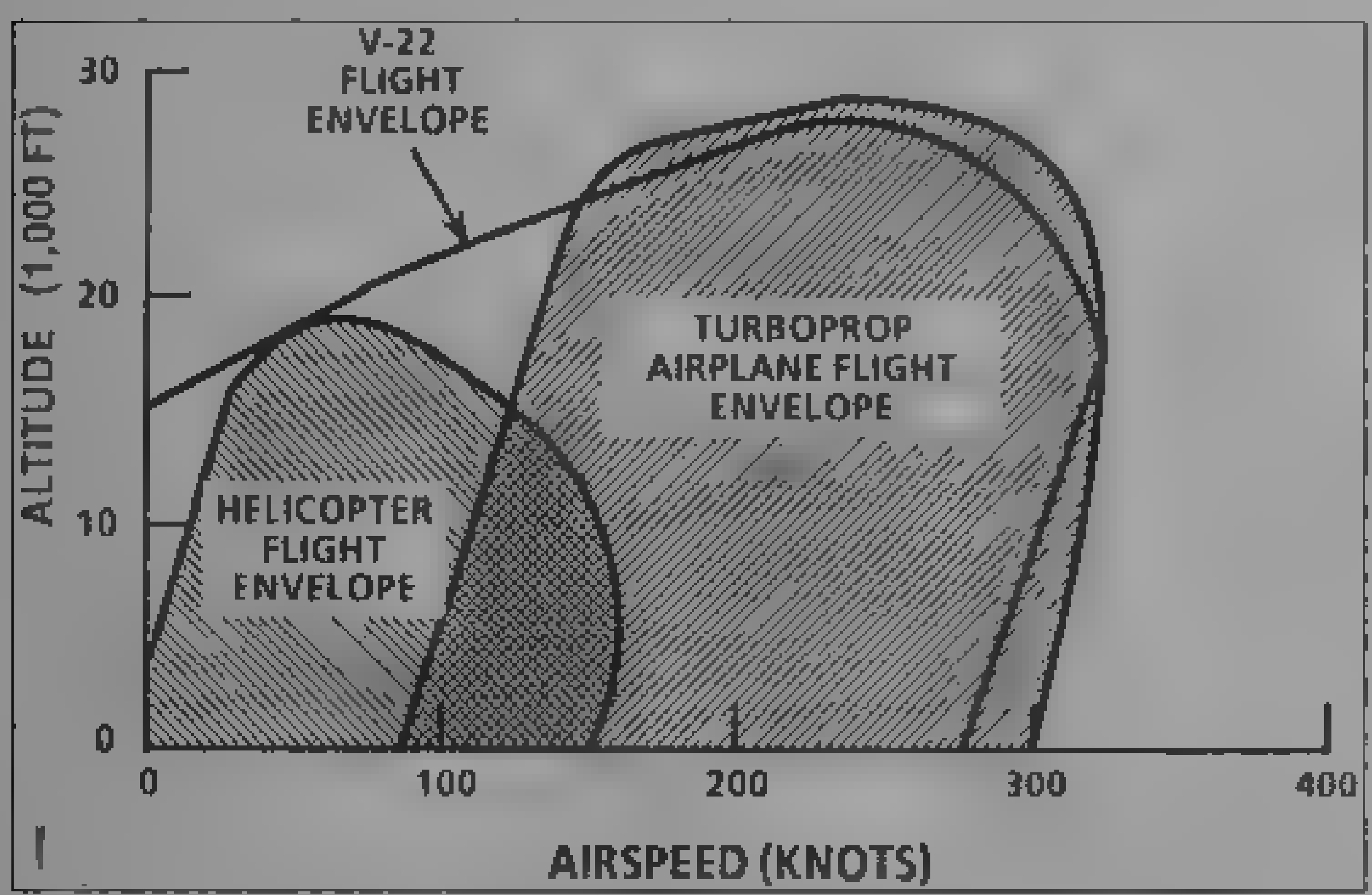
COSTS. FSD contract awarded 2 May 1986, valued at $1 810 million over seven years, terminated 22 October 1993 and replaced same day by EMD contract, initially funded at $550 million but expected to total $2 000 million, of which $1 540 million appropriated in FY92-93, no request in FY94 as sufficient remained from previous years. Production launch planned in FY96 with $50 million, followed by $700 million in FY97 $800 million in FY98 and $1 000 million in FY99 towards Marines' requirement for 425 Estimated cost (1991) to complete full-scale development $2 100 million Unit cost $33 4 million (December 1994. target is $29 million (1993) over total production of 612. FY97 budget draft includes $640 million for four V 22s

DESIGN FEATURES Engines, transmission and proprotors tilt through 97° 30' between forward flight and steepest approach gradient or tail-down hover; cross-shaft keeps both proprotors turning after engine loss Three-blade, graphite/fibreglass, contrarotating proprotors have special high-twist tapered format blades with elastomeric bearings and powered folding mechanisms, separate swashplates produce respectively yaw and fore-and-aft translation in hover and sideways flight in level attitude Rotation speed 333 rpm; tip speed 201 75 m (662 ft)/s Wing-fold sequence from helicopter mode involves power-folding of blades parallel to wing leading edge. tilting engine nacelles down to horizontal and rotating entire wing engine/proprotor group clockwise on stainless steel carousel to lie over fuselage

FLYING CONTROLS Three line fly-by-wire (Moog actuators) with automatic stabilisation, full autopilot and formation flying modes Automatic control of configuration change during transition and of transfer of control from aerodynamic surfaces to rotor-blade pitch changing, flaperons and ailerons droop during hover to reduce negative lift of wing

Rotors have separate cyclic control swashplates for sideways flight and fore-and-aft control (symmetrical for forward and rearward flight and differential for yaw) in hover Lateral attitude controlled in hover by differential rotor thrust, but lateral swashplate allows sideways flight in level attitude controlled by button on control column Integrated electronic cockpit with six electronic display screens, helicopter-style control columns rather than aileron wheels, but left-handed power levers move forward to full power in opposite sense to helicopter collective lever

STRUCTURE Approximately 59 per cent of airframe is composites and just 454 kg (1,000 lb) of empty weight is metal, main composites are Hercules IM-6 graphite/epoxy in wing and AS4 in fuselage and tail, nacelle cowlings and



Advantages of tilt-rotor include flight envelope combining those of turboprop aeroplane and helicopter

1995

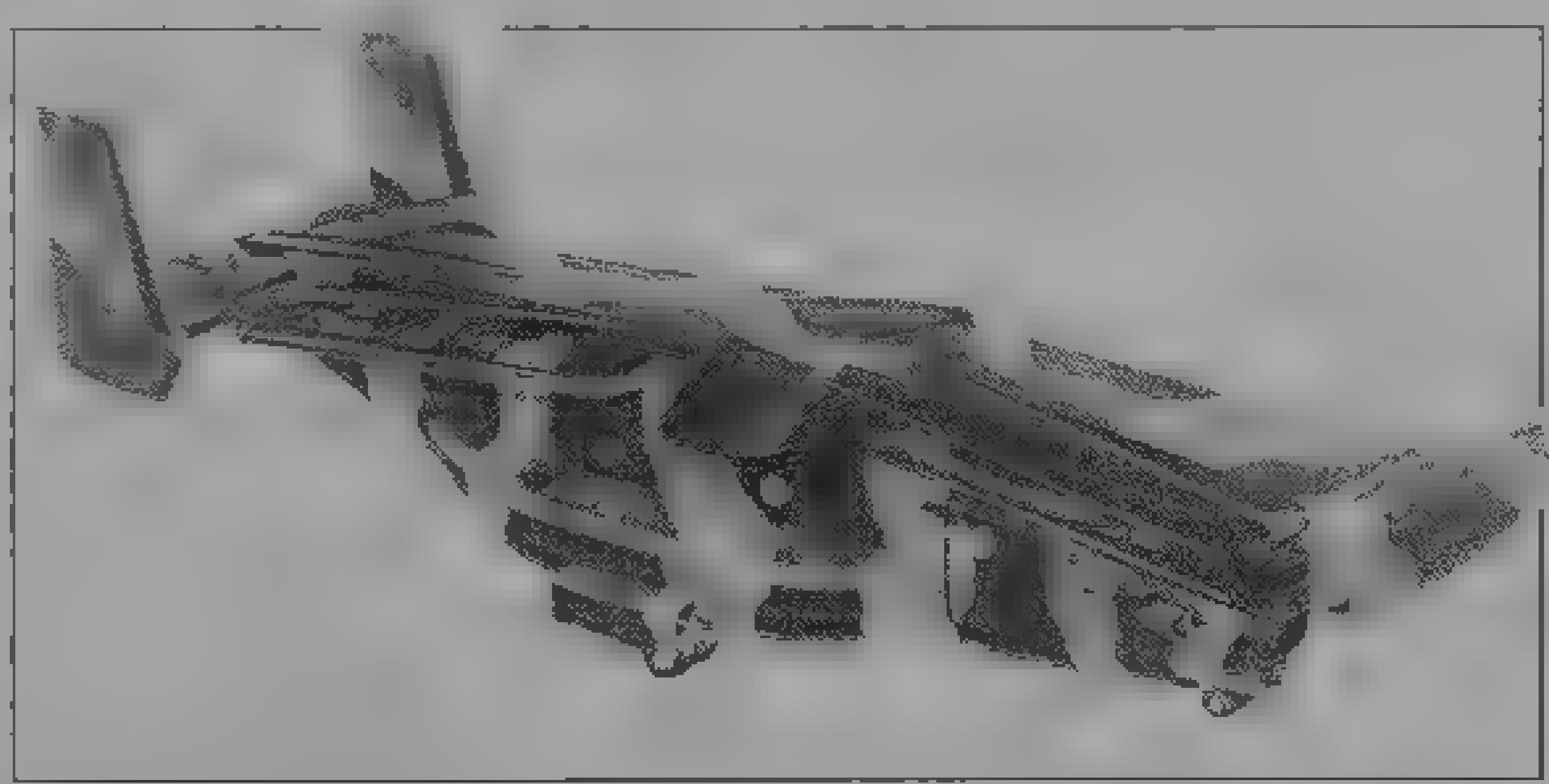
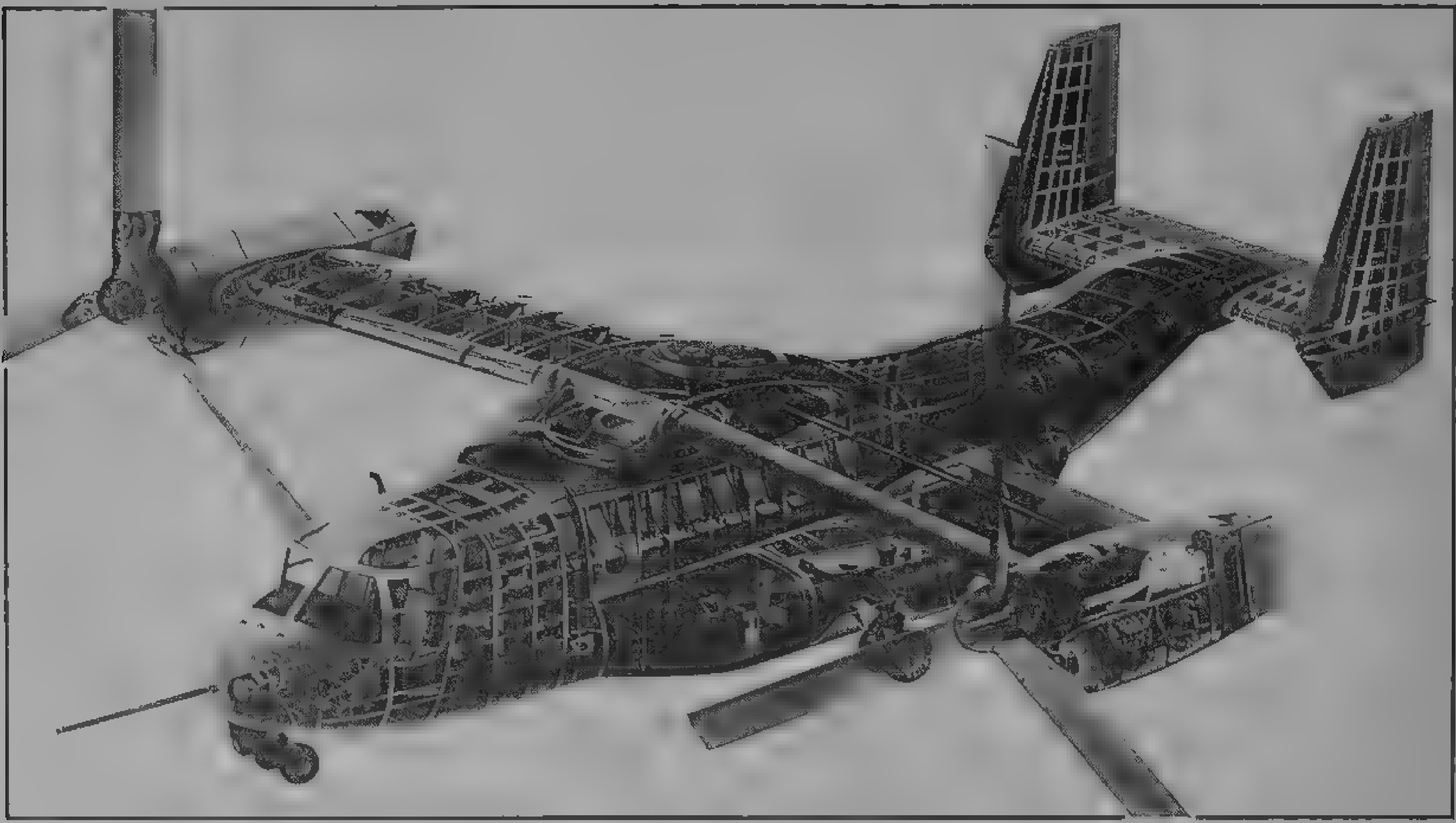


Diagram illustrating the V-22 with wing and rotor blades in the stowed position

1993



Construction details of Bell/Boeing V-22 Osprey

1995

pylon supports are of GFRP. Fuselage mainly 'black aluminium' consisting of conventional stringers, frames and preformed skin, all in composites, assembled with metal fasteners. Main cabin has composites floor panels and titanium window frames. Crew seats of boron carbide/polyethylene laminate.

Wing box is high-strength, very stiff torsion box made up from one-piece upper and lower skins with moulded ribs and bonded stringers, two-segment graphite single slotted flaperons with titanium fittings, three-segment detachable leading-edge of aluminium alloy with Nomex honeycomb core. Wing locking and unlocking with Lucas Aerospace actuators, fuselage sponsons contain landing gear, air conditioning unit and fuel, tail unit of Hercules AS4 graphite/epoxy built by Bell from No. 7 onwards. Bell also contributes wing, nacelles, proprotor and transmission systems and integrates engines. Boeing responsible for fuselage, landing gear and fairings and integrates avionics.

LANDING GEAR: Dowty hydraulically actuated retractable tricycle type, with twin wheels and oleo-pneumatic shock absorbers on each unit. Menasco Canada steerable nose unit. Dowty Toronto two-stage shock-absorption in main gear is designed for landing impacts of up to 3.66 m (12 ft)/s normal, 4.48 m (14.7 ft)/s maximum, and has been drop tested to 7.32 m (24 ft)/s. All units retract rearward, main gear into sponsons on lower sides of centre-fuselage. Manual and nitrogen pressurised standby systems for emergency extension. Parker Bertea wheels and multidisc hydraulic carbon brakes.

POWER PLANT: Two Allison T406-AD-400 (501-M80C) turboshafts, each with T-O and intermediate rating of 4,586 kW (6,150 shp) and maximum continuous rating of 4,392 kW (5,890 shp), installed in Bell built tilting nacelles at wingtips and driving a three-blade proprotor.

Transmission rating 3,706 kW (4,970 shp) USN/USAF T-O, 3,408 kW (4,570 shp) USMC T-O, emergency (OEI) rating (all) 4,415 kW (5,920 shp). Each nacelle has a AiResearch infra-red emission suppressor at rear. Air particle separator and Lucas inlet/spinner ice protection system for each engine. Lucas Aerospace FADEC for each engine, with analog electronic back-up control. Pratt & Whitney originally named as second production source for engines, starting with production lot 5. Internal fuel (JP-5) in up to 13 crash-resistant self sealing (nitrogen pressurised) ILC Dover cells: one 1,115 litre (295 US gallon; 245 Imp gallon) forward cell in each sponson, a 2,417 litre (638.5 US gallon; 532 Imp gallon) cell in rear of starboard sponson, four 319 litre (84.2 US gallon, 70.2 Imp gallon) auxiliary cells in each wing leading-edge, and a 428 litre (113 US gallon; 94 Imp gallon) engine feed cell outboard of the auxiliary tanks in each wing. Total capacity 7,627 litres (2,015 US gallons, 1,678 Imp gallons). (Not all versions have all tanks.) Pressure refuelling point in starboard sponson leading-edge; gravity point in upper surface of each wing. Simmonds fuel management system. Provision for a further 9,221 litres (2,436 US gallons, 2,028 Imp gallons) of fuel to be carried in four additional joint services auxiliary fuel tanks, each 2,305 litres (609 US gallons, 507 Imp gallons), in main cabin for self-deployment mission. In-flight refuelling probe in lower starboard side of forward fuselage.

ACCOMMODATION: Normal crew complement of pilot (in starboard seat), co-pilot and crew chief in USMC variant. Flight crew accommodated on Simula Inc crashworthy armoured seats capable of withstanding strikes from 0.30 in armour piercing ammunition, 30 *g* forward and 14.5 *g* vertical decelerations. Flight deck has overhead and knee-level side transparencies in addition to large windscreen and main side windows, plus an overhead rearview mirror.

Main cabin can accommodate up to 24 combat-equipped troops, on inward-facing crashworthy foldaway seats, plus two gunners, up to 12 litters plus medical attendants, or an equivalent cargo load with energy absorbing tiedowns. Cargo handling provisions include a 907 kg (2,000 lb) capacity cargo winch and pulley system and removable roller rails. Main cabin door at front on starboard side, top portion of which opens upward and inward, lower portion (with built-in steps) downward and outward. Full width rear-loading ramp/door in underside of rear fuselage, operated by Parker Bertea hydraulic actuators. Emergency exit windows on port side; escape hatch in fuselage roof aft of wing.

SYSTEMS: Environmental control system, utilising engine bleed air; control unit in rear of port main landing gear sponson. Three hydraulic systems (two independent main systems and one standby), all at operating pressure of 345 bars (5,000 lb/sq in), with Parker Bertea reservoirs.

Electrical power supplied by two 40 kVA constant frequency AC generators, two 50/80 kVA variable frequency DC generators (one driven by APU), rectifiers, and a 15 Ah battery.

GE Aerospace triple redundant digital fly-by-wire flight control system, incorporating triple primary FCS (PFCS) and triple automatic FCS (AFCS) processors, and triple flight control computers (FCC) each linked to a MIL-STD-1553B databus; two PFCSs and one AFCS are fail operational. FBW system signals hydraulic actuation of flaperons, elevator and rudders, controls aircraft transition between helicopter and aeroplane modes, and can be programmed for automatic management of airspeed, nacelle tilting and angle of attack. FCCs provide interfaces for swashplate conversion actuator, flaperon, elevator, rudder and pylon primary actuators, flight deck central drive, force feel, and nosewheel steering. Dual 1750A processors for PFCS and single 1750A for AFCS incorporated in each FCC. Non-redundant standby analog computer (in development aircraft only) provides control of aircraft, including FADEC and pylon actuation, in the event of FBW system failure.

Sundstrand Turbomach 261 kW (350 shp) APU, in rear portion of wing centre-section, provides power for mid wing gearbox which, in turn, drives two electrical generators and an air compressor. Anti-icing of windscreens and engine air intakes, de-icing of proprotors and spinners. Clifton Precision combined oxygen (OBOGS) and nitrogen (OBIGGS) generating systems for cabin and fuel tank pressurisation respectively. Systron Donner pneumatic fire protection systems for engines, APU and wing dry bays.

AVIONICS: VHF/AM-FM, HF/SSB and (USAF only) UHF secure voice com. IFF.

Radar: (USAF and USN only) Texas Instruments AN/APQ-174 terrain-following multifunction radar in offset (to port) nose thimble.

Flight: Tacan, VOR/ILS, AHRS, radar altimeter and digital map displays. Jet Inc ADI-350W standby attitude indicator; Aydin Vector data acquisition and storage system. Two Control Data AN/AYK-14 mission computers, with Boeing/IBM software.

Instrumentation: Pilots' night vision system and Honeywell integrated helmet display system. Radar-equipped aircraft have two Bendix/King IP-1555 full colour multifunction displays.

Mission: Variant of Hughes Aircraft AN/AAQ-16 FLIR in undernose fairing.

Self-defence: Honeywell AN/AAR-47 missile warning system; radar/infra-red warning system; chaff/flare dispensers.

EQUIPMENT: Provision for rescue hoist over forward (starboard) cabin door.

ARMAMENT: Provision stipulated in December 1994 for nose [redacted]

DIMENSIONS, EXTERNAL:

Rotor diameter, each	11.58 m (38 ft 0 in)
Rotor blade chord: at root	0.90 m (2 ft 11½ in)
at tip	0.56 m (1 ft 10 in)
Wing span: excl nacelles	14.02 m (46 ft 0 in)
incl nacelles	15.52 m (50 ft 11 in)
Width: rotors turning	25.55 m (83 ft 10 in)
stowed	5.61 m (18 ft 5 in)
Wing chord, constant	2.54 m (8 ft 4 in)
Distance between proprotor centres	14.25 m (46 ft 9 in)
Width: overall, rotors turning	25.78 m (84 ft 7 in)
folded	5.61 m (18 ft 5 in)
Length: fuselage, excl probe	17.47 m (57 ft 4 in)
overall, wings stowed/blades folded	19.09 m (62 ft 7½ in)
Height: over tailfins	5.38 m (17 ft 7¾ in)
wings stowed/blades folded	5.51 m (18 ft 1 in)
overall, nacelles vertical	6.63 m (21 ft 9 in)
Tail span, over fins	5.61 m (18 ft 5 in)
Wheel track (c/l of outer mainwheels)	4.62 m (15 ft 2 in)
Wheelbase	6.59 m (21 ft 7½ in)
Nacelle ground clearance, nacelles vertical	1.31 m (4 ft 3¾ in)
Proprotor ground clearance, nacelles vertical	6.35 m (20 ft 10 in)
Dorsal escape hatch: Length	1.02 m (3 ft 4 in)
Width	0.74 m (2 ft 5 in)

DIMENSIONS, INTERNAL:

Cabin: Length	7.37 m (24 ft 2 in)
Max width	1.80 m (5 ft 10¾ in)
Max height	1.83 m (6 ft 0 in)
Usable volume	24.3 m³ (858 cu ft)

AREAS:

Rotor discs, each	105.4 m² (1,134 sq ft)

Rotor blades (each) 12.15 m² (130.76 sq ft)
Wing, total incl flaperons and fuselage centre-section 35.49 m² (382.0 sq ft)
Flaperons, total 8.25 m² (88.8 sq ft)
Tailplane 8.22 m² (88.5 sq ft)
Elevators, total 4.79 m² (51.54 sq ft)
Fins (each) 10.81 m² (116.4 sq ft)
Rudders (each) 1.64 m² (17.6 sq ft)

WEIGHTS AND LOADINGS (provisional):
Weight empty 15,032 kg (33,140 lb)
Max fuel weight: standard 6,215 kg (13,700 lb)
with self-ferry cabin tanks 13,641 kg (30,074 lb)
Max internal payload (cargo) 9,072 kg (20,000 lb)
Cargo hook capacity: single 4,536 kg (10,000 lb)
two hooks (combined weight) 6,804 kg (15,000 lb)
Rescue hoist capacity 272 kg (600 lb)
Normal mission T-O weight: VTO 21,545 kg (47,500 lb)
STO 24,947 kg (55,000 lb)
Max STO weight for self-ferry 27,442 kg (60,500 lb)
Max floor loading (cargo) 1,464 kg/m² (300 lb/sq ft)
Max power loading 8.06 kg/kW (13.23 lb/shp)

PERFORMANCE (estimated):
Max cruising speed
at S/L, helicopter mode 100 kts (185 km/h; 115 mph)
at S/L, aeroplane mode 275 kts (509 km/h; 316 mph)
at optimum altitude, aeroplane mode 314 kts (582 km/h; 361 mph)
Max forward speed with max slung load 130 kts (241 km/h; 150 mph)
Max rate of climb at S/L: vertical 332 m (1,090 ft)/min
inclined 707 m (2,320 ft)/min
Service ceiling 7,925 m (26,000 ft)
Service ceiling, OEI 3,441 m (11,300 ft)
Hovering ceiling OGE 4,331 m (14,200 ft)
T-O run at normal mission STO weight less than 152 m (500 ft)
Range
Amphibious assault 515 n miles (935 km; 592 miles)
VTO at 21,146 kg (46,619 lb) gross weight, incl 5,443 kg (12,000 lb) payload 1,200 n miles (2,224 km; 1,382 miles)
STO at 24,947 kg (55,000 lb) gross weight, incl 9,072 kg (20,000 lb) payload 1,800 n miles (3,336 km; 2,073 miles)
STO at 27,442 kg (60,500 lb) self-ferry gross weight, no payload 2,100 n miles (3,892 km; 2,418 miles)

UPDATED

BOEING

THE BOEING COMPANY

PO Box 3707, Seattle, Washington 98124
Telephone: 1 (206) 655 2121
Fax: 1 (206) 655 1171
CHAIRMAN AND CEO: Frank A. Shrontz
PRESIDENT: Philip M. Condit
VICE-PRESIDENT, CORPORATE PUBLIC RELATIONS AND ADVERTISING: Harold Carr

Company founded July 1916. On 2 January 1990, Boeing Defense & Space Group formed to co-ordinate Aerospace & Electronics, Helicopters, Military Airplanes and Advanced Systems divisions of The Boeing Company. Simultaneously, former Military Airplanes division at Wichita reduced in size by transfer of some activities to Boeing Commercial Airplane Group.

Operating components of The Boeing Company include:

BOEING COMMERCIAL AIRPLANE GROUP
Follows this entry

BOEING DEFENSE & SPACE GROUP
Electronic Systems Division
Follows Commercial Airplane Group
Helicopters Division
Follows Electronic Systems Division
Military Airplanes Division
Follows Helicopters Division
Product Support Division
Boeing Computer Services

UPDATED

BOEING COMMERCIAL AIRPLANE GROUP

PO Box 3707, Seattle, Washington 98124-2207
Telephone: 1 (206) 237 2121
Fax: 1 (206) 237 1706
Telex: 0650 329430 BOEING CO C
PRESIDENT: Ronald B. Woodard*
EXECUTIVE VICE-PRESIDENTS:
Richard R. Albrecht
Robert L. Dryden (Manufacturing)
Bruce Gissing (Operations)
VICE-PRESIDENT, GENERAL MANAGER BOEING 777 DIVISION: Alan R. Mulally
VICE-PRESIDENT, NEW SMALL AIRPLANE STUDY: Richard L. James
VICE-PRESIDENT, ENGINEERING: Robert A. Davis
SENIOR VICE-PRESIDENT, GOVERNMENT AND INTERNATIONAL AFFAIRS: L. W. Clarkson
VICE-PRESIDENT, COMMUNICATIONS: Gerald A. Hendin
**Also corporate Senior Vice-President, The Boeing Company*

Boeing Commercial Airplane Group, headquarters at Renton, near Seattle, reorganised into three divisions in 1983. Renton Division produced 707 (until 1991) and produces 737 and 757; Everett Division produces 747, 767 and 777. Fabrication Division provides manufacturing for other divisions. Materiel Division, created 1984, covers purchasing, quality control and vendor supplies.

Output in 1994 (1993 figures in parentheses) was 1 (0) 707 (deferred delivery, production ended in 1991), 121 (152) 737s, 40 (56) 747s, 69 (71) 757s and 40 (51) 767s. New orders covered 70 (110) 737s, 16 (2) 747s, 12 (40) 757s and 22 (66) 767s. Slowdown in airliner deliveries and reduction in defence orders caused Boeing to reduce its total workforce by 28,000 by mid-1994, of which about 19,000 in Seattle airliner production area and by a further 7,000 in 1995, monthly airliner production declining from 23 to 21 in early 1994, to 19½ in November, 18½ in January 1995 and 17 in November 1995.

UPDATED

BOEING COMMERCIAL AIRPLANE GROUP ORDERS, DELIVERIES AND BACKLOG
(at 20 June 1995)

	Orders 1995 to 20 June	Orders Total	Deliveries 1995 to 20 June	Deliveries Total	Backlog Announced
707	0	1,010	0	1,010	0
Total	**0**	**1,010**	**0**	**1,010**	**0**
727	0	1,831	0	1,831	0
Total	**0**	**1,831**	**0**	**1,831**	**0**
737 TBD[1]	0	11	0	0	11[2]
737-100	0	30	0	30	0
737-200	0	1,114	0	1,114	0
737-300	10	1,054	27	905	149
737-400	8	431	8	383	48
737-500	4	357	10	288	69
737-600	35	35	0	0	35
737-700	16	85	0	0	85
737-800	0	22	0	0	22
Total	**73**	**3,139**	**45**	**2,720**	**419**
747-100	0	248	0	248	0
747-100F	0	2	0	2	0
747-200	0	322	0	322	0
747-200F	0	71	0	71	0
747-300	0	81	0	81	0
747-400	8	425	11	327	98
747-400F	0	16	1	7	9
Total	**8**	**1,165**	**12**	**1,058**	**107**
757-200	5	761	18	615	146
757-200ER	0	2	0	2	0
757-200F	0	70	3	55	15
Total	**5**	**833**	**21**	**672**	**161**
767	0	1	0	0	1
767 TBD	0	8	0	0	8
767-200	0	158	0	156	2
767-200ER	0	69	0	68	1
767-300	3	133	3	88	45
767-300ER	6	327	10	260	67
Total	**9**	**696**	**13**	**572**	**124**
777-200	3	144	1	1	143[3]
Total	**3**	**144**	**1**	**1**	**143**
Grand Totals	**98**	**8,818**	**92**	**7,864**	**954**

Notes:
[1]Variant to be decided later
[2]No decision yet taken, so aircraft remain in backlog
[3]Adjusted following June 1995 launch of Series 300 (which see)

UPDATED

NEW SMALL AIRPLANE (NSA)

Announced in May 1994 when Richard L. James was appointed Boeing vice-president New Small Airplane study. Boeing working with Japan Aircraft Development Corporation representatives and observers from China's CATIC to determine market requirement and potential configuration of a new twin-engined airliner, smaller than the 737, for service entry in 2002. Boeing expects retirement of noisier Stage 2 airliners in the 70- to 170-passenger category to lead to purchase of up to 3,000 new smaller airliners during next 20 years. Engine candidates announced in June 1995 are BMW Rolls-Royce BR 715, CFM International CFM56 Lite and Pratt & Whitney/MTU Thrust (MTFE).

UPDATED

BOEING 737-100 and 737-200

USAF designation: T-43A

First flight of 737-100, 9 April 1967; FAA certification 15 December 1967; 30 built. Superseded by 737-200; first flight 8 August 1967, added to 737-100 type certificate 21 December 1967; first delivery to United Air Lines 29 December 1967. Last of 1,114 Boeing 737-200s (and 30 737-100s) delivered August 1988: total includes 19 **T-43A** navigation trainers for US Air Force and three **Surveillers** for Indonesian Air Force. Details of early versions and developments in 1974-75 *Jane's*; 737-200 last described in *Jane's* 1990-91.

VERIFIED

BOEING 737-300

TYPE: First of three 737 variants in current production.

PROGRAMME: Production go-ahead March 1981, first flight 24 February 1984, certificated 14 November 1984, first delivery (to USAir) 28 November 1984. 737-300 for Ansett Worldwide (and subsequent lease to British Midland Airways) rolled out at Renton 19 February 1990 (as 1,833rd 737); 737 orders passed 3,000 when Southwest Airlines ordered 34 in third quarter 1992. Approval for 120 minute ETOPS given November 1986, but withdrawn July 1989 due to concerns related to operation in heavy rain and hail; approval restored 14 September 1990. Commonwealth of Independent States Interstate Aviation Committee certificated Boeing 737 family with P&W or CFM engines 18 January 1993, first delivery for CIS registration (737-300 to National State Aviacompany Turkmenistan) 12 November 1992. Production rate for 737 series reduced from 21 to 14 a month in October 1992, to 10 in February 1994 to 8½ in October 1994 and to seven in November 1995. 2,500th 737 rolled out 16 June 1993; 1,500th current-generation 737 delivered 8 September 1994.

CURRENT VERSIONS: **737-300**: Basic airliner, *as detailed below.*

Executive: Typically for about 20 passengers, with conference room, bedroom, bathroom and full dining facilities. Three sold by 29 February 1992, including one to Royal Thai Air Force.

CUSTOMERS: See table for orders/deliveries.

DESIGN FEATURES: Fuselage stretched 2.64 m (8 ft 8 in) compared with 737-200 by means of 1.12 m (3 ft 8 in) plug forward of wing box and 1.52 m (5 ft 0 in) aft; underfloor freight volume increased by 5.47 m³ (193 cu ft); wing aerofoil modified by 4.4 per cent extension of leading-edge outboard of engines, new slats, new flap sections and track fairings aft of engines, additional lateral control spoilers outboard; each wingtip extended by 28 cm (11 in); increased dorsal fin area and tailplane span.

FLYING CONTROLS: All surfaces powered by two independent hydraulic systems with manual reversion for ailerons and elevator; elevator servo tabs unlock on manual reversion; rudder has standby hydraulic actuator and system. Three outboard powered overwing spoiler panels on each wing assist lateral control and also act as airbrakes. Variable incidence tailplane has two electric motors and manual standby.

Leading-edge Krueger flaps inboard and three sections of slats outboard of engines; two airbrake/lift dumper panels on each wing, inboard and outboard of engines; triple-slotted trailing-edge flaps inboard and outboard of engines.

FAA Cat. II landing minima system standard using SP-300 dual digital integrated flight director/autopilot; Cat. IIIa capability optional. Common pilot type ratings for 737-200, -300, -400 and -500.

STRUCTURE: Aluminium alloy dual-path fail-safe two-spar wing structure. Aluminium alloy two-spar tailplane. Graphite composite ailerons, elevators and rudder, latter built by Short Brothers (UK). Aluminium honeycomb spoiler/airbrake panels and trailing-edges of slats and flaps. Fuselage structure fail safe aluminium. Some fins made by Xian Aircraft Co in China. Elevators, rudder and aileron contain graphite/Kevlar and CFRP, other unstressed components in GFRP and CFRP.

LANDING GEAR: Hydraulically retractable tricycle type, with Boeing oleo-pneumatic shock absorbers; inward-retracting main units have no doors, wheels forming wheel well seal, nose unit retracts forward, free-fall emergency extension. Compared with 737-200, nose unit is repositioned downwards by 13 cm (5 in) and modified to ensure adequate ground clearance for larger engine nacelles. Twin nosewheels have tyres size 27 × 7.75. Main units have twin wheels, H40 × 14.5-19 heavy-duty tyres, and Bendix or Goodrich heavy-duty wheel brakes as standard. Mainwheel tyre pressure 13.45 to 14.00 bars (195 to 203 lb/sq in). Nosewheel tyre pressure 11.45 to 11.85 bars (166 to 172 lb/sq in).

POWER PLANT: Basic aircraft has two CFM International CFM56-3C-1 turbofans rated at either 88.97 kN (20,000 lb st) or 97.86 kN (22,000 lb st), introduced 1988. Engines pylon-mounted forward of wings, and higher than those of 737-200; each has external strake on inboard side. Standard fuel capacity up to 20,104 litres (5,311 US gallons; 4,422 Imp gallons) with integral fuel cells in wing centre-section and integral wing tanks. Fuel options up to 23,830 litres (6,295 US gallons; 5,242 Imp gallons) with Rogerson tanks in underfloor cargo bays (from 1989). Single-point pressure refuelling under leading-edge of starboard wing.

ACCOMMODATION: Crew of two side by side on flight deck. Alternative cabin layouts seat from 128 to 149 passengers. Typical arrangements offer eight first class seats four-abreast at 96.5 cm (38 in) pitch and 120 tourist class seats six-abreast at 81 cm (32 in) in mixed class, and 141 or 149 all tourist class at seat pitches of 81 cm (32 in) or 76 cm (30 in) respectively. One plug type door at each corner of cabin, with passenger doors on port side and service doors on starboard side. Airstair for forward cabin door optional. Overwing emergency exit on each side. One or two galleys and one lavatory forward, and one or two galleys and lavatories aft, depending on configuration. New lightweight interior, using advanced crushed core materials, providing total overhead baggage capacity of 6.80 m³ (240 cu ft), equivalent to 0.048 m³ (1.7 cu ft) per passenger. Underfloor freight holds forward and aft of wing, with doors on starboard side.

SYSTEMS: AiResearch bleed air control system for thermal anti-icing, air conditioning and pressurisation systems; maximum differential 0.52 bar (7.5 lb/sq in); two functionally independent hydraulic systems with a third standby system, using fire resistant hydraulic fluid, for flying controls, flaps, slats, landing gear, nosewheel steering and brakes, pressure 207 bars (3,000 lb/sq in). No pneumatic system. Electrical supply since 1991 from two 50 kVA variable-speed constant-frequency generators. AlliedSignal GTCP-5-129(C) APU (GTCP36-280 from 1988 and APS 2000 from 1991) for air supply and electrical power in flight and on ground as well as engine starting.

AVIONICS: Avionics fit is common to 737-300, -400 and -500.

Radar: Digital colour weather radar.

Flight: Flight management computer provides lateral, vertical and time navigation using pilot-set waypoints; dual digital flight management computers introduced 1993; dual ring laser gyro inertial system.

Instrumentation: EFIS screens show map, flight plan, full or partial compass rose, weather and, optionally, integrated airspeed scale; electronic engine instrument system has coloured LED dials, with secondary panel; secondary engine and hydraulics indications; windshear alerting with recovery guidance in attitude indicator; full flight regime autothrottle.

DIMENSIONS, EXTERNAL:

Wing span	28.88 m (94 ft 9 in)
Wing chord at root	4.71 m (15 ft 5.6 in)
Wing aspect ratio	7.91
Length overall	33.40 m (109 ft 7 in)
Height overall	11.13 m (36 ft 6 in)
Tailplane span	12.70 m (41 ft 8 in)
Wheel track	5.23 m (17 ft 2 in)
Wheelbase	12.45 m (40 ft 10 in)
Main passenger door (port, fwd):	
Height	1.83 m (6 ft 0 in)
Width	0.86 m (2 ft 10 in)
Height to sill	2.62 m (8 ft 7 in)
Passenger door (port, rear): Height	1.83 m (6 ft 0 in)
Width	0.76 m (2 ft 6 in)
Width with airstair	0.86 m (2 ft 10 in)
Height to sill	2.74 m (9 ft 0 in)
Emergency exits (overwing, port and stbd, each):	
Height	0.97 m (3 ft 2 in)
Width	0.51 m (1 ft 8 in)
Galley service door (stbd, fwd):	
Height	1.65 m (5 ft 5 in)
Width	0.76 m (2 ft 6 in)
Height to sill	2.62 m (8 ft 7 in)
Service door (stbd, rear): Height	1.65 m (5 ft 5 in)
Width	0.76 m (2 ft 6 in)
Height to sill	2.74 m (9 ft 0 in)
Freight hold door (stbd, fwd):	
Height	1.22 m (4 ft 0 in)
Width	1.30 m (4 ft 3 in)
Height to sill	1.30 m (4 ft 3 in)
Freight hold door (stbd, rear):	
Height	1.22 m (4 ft 0 in)
Width	1.22 m (4 ft 0 in)
Height to sill	1.55 m (5 ft 1 in)

DIMENSIONS, INTERNAL:

Cabin, incl galley and toilet:	
Length	23.52 m (77 ft 2 in)
Max width	3.45 m (11 ft 4 in)
Max height	2.13 m (7 ft 0 in)
Freight hold volume: basic	30.2 m³ (1,068 cu ft)
with max optional fuel	22.4 m³ (792 cu ft)

AREAS:

Wings, gross	105.4 m² (1,135.0 sq ft)
Ailerons (total)	2.49 m² (26.8 sq ft)
Trailing-edge flaps (total)	16.87 m² (181.6 sq ft)
Slats (total)	7.23 m² (77.8 sq ft)
Ground spoilers (total)	5.00 m² (53.8 sq ft)
Flight spoilers (total)	2.64 m² (28.4 sq ft)
Fin	23.13 m² (249.0 sq ft)
Rudder	5.22 m² (56.2 sq ft)
Tailplane	31.31 m² (337.0 sq ft)
Elevators, incl tabs (total)	6.55 m² (70.5 sq ft)

Boeing 737-300 of Romanian airline, Tarom *(Peter J. Cooper)*

1994

WEIGHTS AND LOADINGS (A: basic aircraft, B: long-range option):

Operating weight empty: A	31,895 kg (70,320 lb)
B	up to 32,459 kg (71,560 lb)
Max T-O weight: A	56,470 kg (124,500 lb)
B	up to 62,820 kg (138,500 lb)
Max ramp weight: A	56,700 kg (125,000 lb)
B	up to 63,050 kg (139,000 lb)
optional, with controlled CG	63,500 kg (140,000 lb)
Max zero-fuel weight: A	47,625 kg (105,000 lb)
B	up to 49,715 kg (109,600 lb)
Max landing weight: A	51,720 kg (114,000 lb)
B	up to 52,890 kg (116,600 lb)
Max wing loading: A	535.6 kg/m² (109.7 lb/sq ft)
B	595.8 kg/m² (122.0 lb/sq ft)

PERFORMANCE (A: at brake release weight of 56,472 kg, 124,500 lb; B: at optional brake release weight of 62,822 kg, 138,500 lb):

T-O field length, S/L, at 29°C (84°F):	
A	2,027 m (6,650 ft)
B	2,749 m (9,020 ft)
Wet landing field length, 40° flap, at max landing weight:	
A, B	1,603 m (5,260 ft)
Still air range with 140 passengers, T-O at S/L:	
A	1,600 n miles (2,963 km; 1,841 miles)
B	2,600 n miles (4,815 km; 2,992 miles)

OPERATIONAL NOISE LEVELS: 737-300, -400 and -500 only exceed FAR Pt 36, Stage 3/ICAO Annex 16 Chapter 3 noise in approach with 40° flap setting.

UPDATED

BOEING 737-400

TYPE: Stretched version of 737-300.

PROGRAMME: Announced June 1986, rolled-out 26 January 1988, first flight 19 February 1988, certificated for up to 188 passengers 2 September 1988, first delivery (to Piedmont Airlines) 15 September 1988. High gross weight structure variant rolled-out 23 December 1988, certificated by FAA and delivered to first customer 21 March 1989. ETOPS approval granted 14 September 1990. CIS certification with CFM engines 18 January 1993, as for 737-300. See production rates under 737-300.

CURRENT VERSIONS: **Basic and long-range**: *As described.*

High gross weight structure: Optional strengthened centre-fuselage, wing and landing gear, slats and Kruegers, increased fuel capacity by means of Rogerson tanks in aft cargo bay.

CUSTOMERS: See table for orders/deliveries.

DESIGN FEATURES: Incorporates all the new technology of 737-300. Fuselage has 1.83 m (6 ft 0 in) plug forward of wing and 1.22 m (4 ft 0 in) aft, totalling 3.05 m (10 ft); outer wings and landing gear strengthened for maximum landing weights from 54,885 to 56,245 kg (121,000 to 124,000 lb). Tail bumper standard on all 737-400s. At gross weights above 63,049 kg (139,000 lb) loading must be controlled to preserve CG. Avionics and systems as for 737-300 except for modified avionics software and improved environmental control system.

POWER PLANT: Two CFM56-3C-1 turbofans, each rated at 97.86 kN (22,000 lb st) or 104.5 kN (23,500 lb st). Basic fuel capacity 20,104 litres (5,311 US gallons; 4,422 Imp gallons); maximum long-range option fuel capacity 23,830 litres (6,295 US gallons; 5,242 Imp gallons).

DIMENSIONS, EXTERNAL: As for 737-300 except:

Length overall	36.45 m (119 ft 7 in)

DIMENSIONS, INTERNAL: As for 737-300 except:

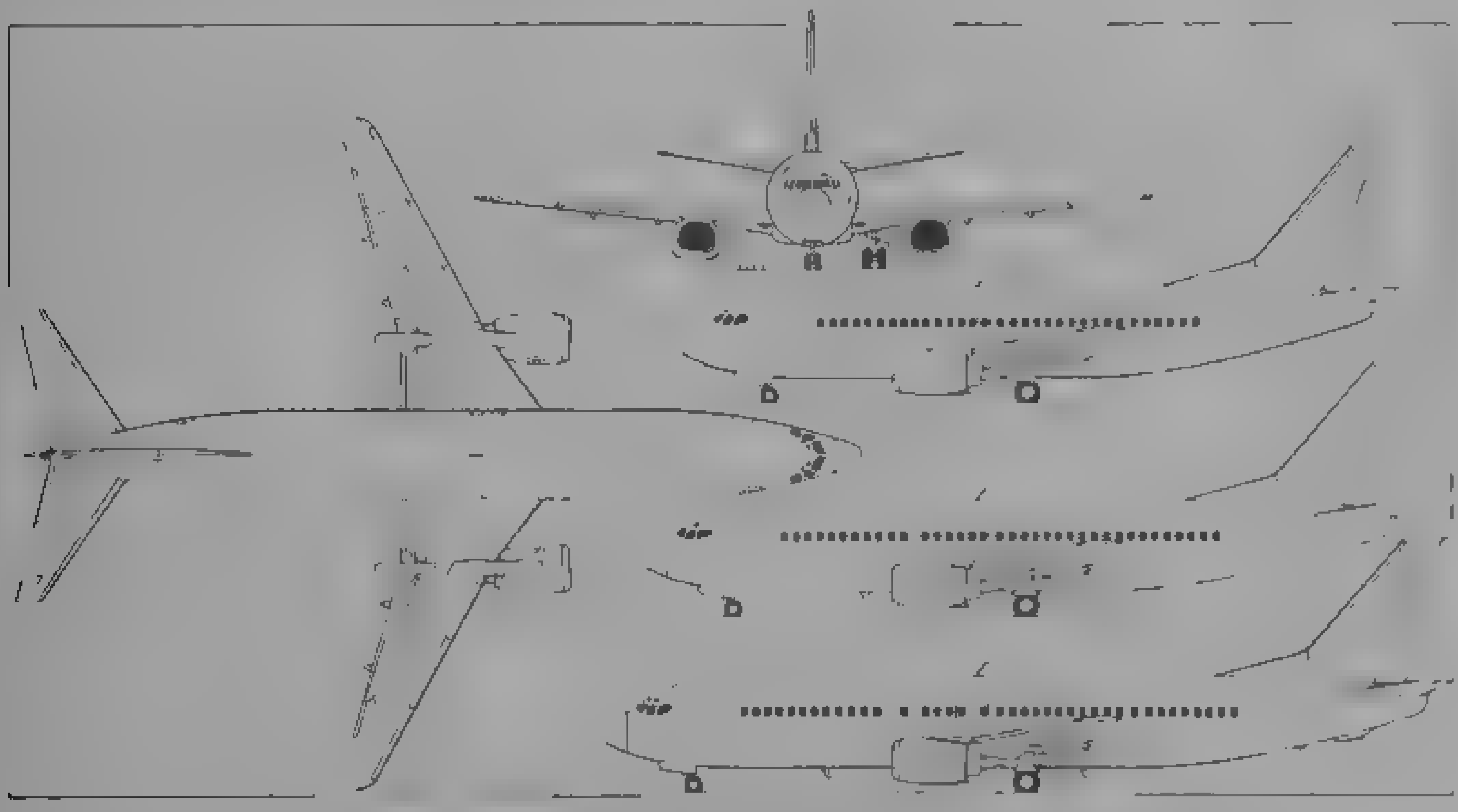
Cabin, incl galley and toilet:	
Length	27.18 m (89 ft 2 in)

WEIGHTS AND LOADINGS (A: basic aircraft, B: long-range option):

Operating weight empty: A	33,435 kg (73,710 lb)
B	34,270 kg (75,555 lb)
Max T-O weight: A	62,820 kg (138,500 lb)
B	68,040 kg (150,000 lb)
Max ramp weight: A	63,050 kg (139,000 lb)
B	68,265 kg (150,500 lb)
Max zero-fuel weight: A	51,255 kg (113,000 lb)
B	53,070 kg (117,000 lb)
Max landing weight: A	54,885 kg (121,000 lb)
B	56,245 kg (124,000 lb)

Boeing 737 500 of Denmark's Maersk Air *(Peter J Cooper)*

1994



Three-view drawing of Boeing 737-400, with additional side views of 737-500 (top) and 737-300 (centre) *(Jane's/Dennis Punnett)*

1988

Max wing loading A	595 8 kg/m² (122.0 lb/sq ft)
B	645.2 kg/m² (132.2 lb/sq ft)

PERFORMANCE (A at T-O weight of 62,822 kg, 138,500 lb, B at optional T-O weight of 68,039 kg, 150,000 lb)

T-O field length, S/L, at 30°C: A	2,315 m (7,600 ft)
B, with optional higher thrust engines	2,500 m (8,200 ft)
Wet landing field length, 40° flap	
A at 54,885 kg (121,000 lb) landing weight	1,725 m (5,650 ft)
B at 56,245 kg (124,000 lb) landing weight	1,850 m (6,070 ft)
Range with 146 passengers T-O at S/L	
A	2,200 n miles (4,074 km, 2,531 miles)
B	2,700 n miles (5,000 km, 3,107 miles)

UPDATED

BOEING 737-500

TYPE: Short-body version of 737-300, replacing 737-200

PROGRAMME: Initially known as 737-1000, announced as 737-500 on 20 May 1987; first flight 20 June 1989, certificated 12 February 1990 after 375 hour test programme, first delivery (to Southwest Airlines) 28 February 1990; ETOPS approval 14 September 1990. CIS certification with CFM engines 18 January 1993, as for 737-300 and -400. See 737-300 entry for production rates

CURRENT VERSIONS: Maximum T-O weights ranging from 52,390-60,554 kg (115,500-133,500 lb)

CUSTOMERS: Launch customers were Braathens SAFE of Norway (25 firm) and Southwest Airlines (20 firm and 20 optioned), see table for orders and deliveries

DESIGN FEATURES: Incorporates advanced technology of 737-300 and -400, but fuselage shortened. Engine thrust and fuel capacity options detailed below. New nosewheel tyres. Systems and avionics as for 737-300 with minor variations

POWER PLANT: Two CFM International CFM56-3C-1 turbofans each rated at 88.97 kN (20,000 lb st) or derated to 82.29 kN (18,500 lb st) according to gross weight. Electronic power control allows fixed-throttle climb and limits fan speed and EGT overshoots. Basic fuel capacity 20,104 litres (5,311 US gallons, 4,422 Imp gallons); long range option fuel capacity 23,830 litres (6,295 US gallons, 5,242 Imp gallons)

DIMENSIONS, EXTERNAL: As for 737-300 except

Length overall	31.01 m (101 ft 9 in)

WEIGHTS AND LOADINGS (A: basic aircraft, B: long range option)

Operating weight empty: A	30,955 kg (68,240 lb)
B	31,515 kg (69,480 lb)
Max T-O weight: A	52,390 kg (115,500 lb)
B	60,555 kg (133,500 lb)
Max ramp weight: A	52,615 kg (116,000 lb)
B	60,780 kg (134,000 lb)
Max zero-fuel weight: A	46,495 kg (102,500 lb)
B	46,720 kg (103,000 lb)
Max landing weight: A, B	49,895 kg (110,000 lb)
Max wing loading: A	496.8 kg/m² (101.8 lb/sq ft)
B	574.3 kg/m² (117.6 lb/sq ft)

PERFORMANCE

Range with 108 passengers	
A	1,700 n miles (3,148 km, 1,956 miles)
B	2,420 n miles (4,482 km, 2,785 miles)

UPDATED

BOEING 737-600, -700 and -800

TYPE: Developments of 737 family, originally called 737X; regarded as 'Next-Generation' 737s

PROGRAMME: Boeing asked more than 30 airlines to help define 737X in 1991; company board authorised offer for sale June 1993. Southwest Airlines ordered 63 737-700s (32 converted from options for 737-300s) plus 63 new options 18 November 1993; roll-out planned for December 1996; first deliveries in 1997, last of 63 Southwest aircraft delivered in 2001. 737-300/-400/-500 remain in production

CURRENT VERSIONS: Note: Unlike earlier 737s, the X series is numbered in ascending order of size; the smallest is designated 737-600

Computer-generated image of Next-Generation Boeing 737 800, launched September 1994

1995

737 600 Known as 737 500X until officially launched, smallest of family, seating 108 two-class passengers

737 700. First to be ordered and manufactured, mid-size version of family, equivalent to current 737-300, seating 128 two-class passengers

737 800 Known as 737 400X Stretch until launched in September 1994, largest variant, seating 164 to 189 passengers, first deliveries 1998

CUSTOMERS Lead customer for 737 700 is Southwest Airlines, which ordered 63 in November 1993, Maersk Air ordered six, Bavaria Fluggesellschaft ordered four Germania ordered 12 Orders for more than 40 737 800s held at time of launch, announced customers include Hapag Lloyd (16) and Air Berlin (six). Scandinavian Airline System is launch customer for 737-600, with 35 orders and 35 options announced March 1995, first deliveries scheduled for second half of 1998. By end of March 1995 total orders for Next-Generation 737s stood at 142

COSTS Price quoted as $36 to 40 million depending on configuration

DESIGN FEATURES: Greater range and speed than previous 737s, with less noise and fewer emissions, wing area increased by some 25 per cent by means of approximately 0.46 m (1 ft 6 in) increase in wing chord and about 4.88 m (16 ft 0 in) increase in wing span, larger tail surfaces increased tankage gives US transcontinental range, new aircraft can use same runways, taxiways, ramps and gates as preceding variants, new variant of CFM56 turbofan derated from nominal thrust to suit smaller versions of the family. Noise on ground reduced by new diffuser duct and cooling vent silencer on APU, new ECS fan and duct and new electrical/electronics cooling fan

FLYING CONTROLS As earlier 737s

POWER PLANT Two CFM International CFM56-7 (formerly CFM56-3XS), each rated at 116.54 kN (26,200 lb st) for the 737-800, 106.76 kN (24,000 lb st) for the 737-700 and 97.86 kN (22,000 lb st) for the 737 600 CFM56-7 combines core of CFM56-5 with improved low-pressure compressor of CFM56-3 and 1.55 m (61 in) fan

AVIONICS: Honeywell Air Transport Systems Common Display System (CDS) with flat-panel liquid crystal display (LCD) technology, will enable Next-Generation 737 operators to emulate 737 electromechanical 737/757/767 electronic flight instrument system (EFIS) and 747-400/777 primary flight display-navigation display (PFD-ND) flight deck formats. LCDs will be identical to those on 777. Honeywell autopilot will be standard on all models

DIMENSIONS, EXTERNAL

Wing span: all versions	34.31 m (112 ft 7 in)
Length 737-600	31.24 m (102 ft 6 in)
737-700	33.63 m (110 ft 4 in)
737-800	39.47 m (129 ft 6 in)

WEIGHTS AND LOADINGS

Max T-O weight 600	63,505 kg (140,000 lb)
700	67,585 kg (149,000 lb)
800	76,430 kg (168,500 lb)
Max power loading: 600	324.7 kg/kN (3.18 lb/lb st)
700	316.7 kg/kN (3.10 lb/lb st)
800	328.1 kg/kN (3.21 lb/lb st)

PERFORMANCE

Cruising speed	Mach 0.78-0.80
Max cruising altitude	12,500 m (41,000 ft)
Range	3,000 n miles (5,556 km, 3,452 miles)

UPDATED

BOEING 747-400

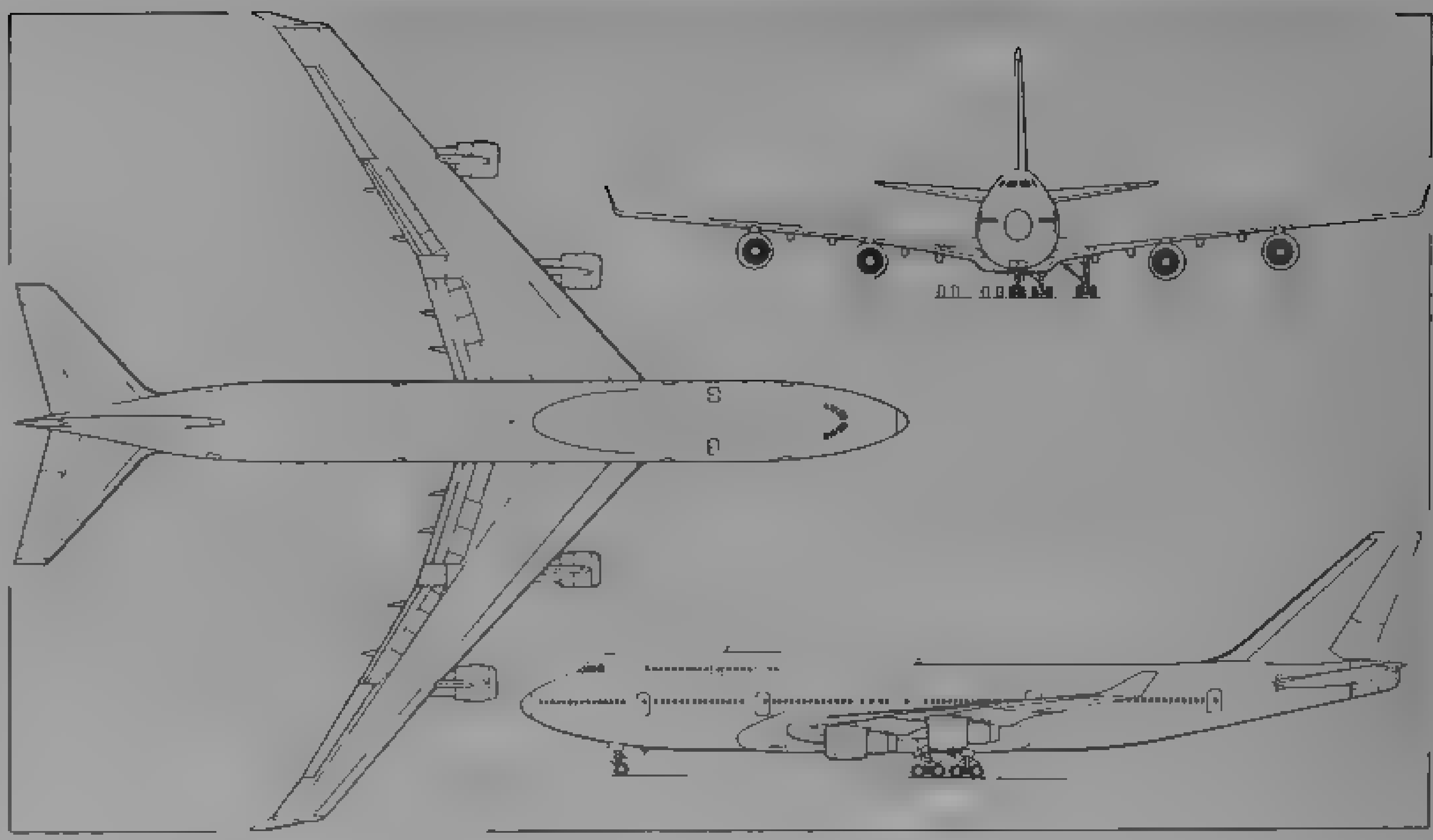
TYPE Wide-bodied airliner

PROGRAMME (original). Announced 13 April 1966 (first ever wide-body jet airliner), with Pan American order for 25 official programme launch 25 July 1966; first flight 9 February 1969; FAA certification 30 December 1969, first delivery (to Pan Am) 12 December 1969, first route service New York-London flown 22 January 1970. In May 1990 Boeing decided to market only the -400, last -200 (a -200F Freighter for Nippon Cargo Air Lines) delivered 19 November 1991

For all variants prior to 747-400, see *Jane's Aircraft Upgrades*. Production variants, listed in table on earlier page, totalled 724 (205 -100, 45 SP, 393 -200 and 81 -300). Nineteen Pan American 747s modified as passenger/cargo **C-19As** by Boeing Military Airplanes for Civil Reserve Air Fleet (see 1990-91 edition)

PROGRAMME (current). Series 400 announced May 1985 as 747 development with extended capacity and range; design go-ahead July 1985, roll-out 26 January 1988, first flight 29 April 1988 certificated with P&W PW4056 on 10 January 1989, certificated with GE CF6-80C2B1F on 8 May 1989; R-R RB211-524G on 8 June 1989; R-R RB211-524H on 11 May 1990 Since May 1990, -400 is the only 747 marketed. Thousandth 747 rolled out 10 September 1993 and delivered to Singapore Airlines 12 October Production reduced from five to three per month in February 1994 and two in January 1995 but to rise to three per month in second half of 1996

CURRENT VERSIONS: **747 400**: Basic passenger version, standard and three optional gross weights (see below) *Detailed description applies to this version, except where indicated*



Boeing 747-400 advanced long-range airliner (General Electric CF6-80C2 engines) *(Jane's/Dennis Punnett)* *1986*

747-400 Combi: Passenger/freight version, certificated 1 September 1989, maximum 266 three-class passengers with freight, 413 without; port-side rear freight door; main deck limit is seven pallets at 27,215 kg (60,000 lb); underfloor and fuel capacities as for passenger 747, 39 delivered by 31 December 1993. For all gross weights, maximum landing weight 285,763 kg (630,000 lb) and maximum zero-fuel weight 256,280 kg (565,000 lb). All three engine options available

747-400F: All-freight version. See separate entry

747-400 Domestic: Special high-density two-class 568-passenger version, certificated 10 October 1991, ordered by Japan Air Lines (six), All Nippon (six) and Japan Air System (one). Maximum T-O weight 272,155 kg (600,000 lb) but can be certificated to 394,625 kg (870,000 lb). Structurally reinforced, no winglets; lower engine thrust; five more upper deck windows; revised avionics software and cabin pressure schedule, brake cooling fans; five pallets, 14 LD-1 containers and bulk cargo under floor; GE or P&W engines

747-400 Performance Improvement Package (PIP): Announced April 1993, but implementation depends on customer demands, first stage includes gross weight increase of 907 kg (2,000 lb) or more, longer chord dorsal fin made of CFRP, slower transfer of fuel from tailplane trim tank to prolong trim drag alleviation, and wing spoilers held down more tightly to reduce profile drag and leakage; this stage to be applied to production aircraft as soon as ready and to be retrofittable; first-stage PIP flight tested in leased United Airlines 747 400 May 1993 Second PIP stage, potentially available by mid-1996, would increase gross weight to 421,840 kg (930,000 lb) and range to 8,000 nm (14 816 km, 9,206 miles). See also Boeing 747X

CUSTOMERS Northwest Orient Airlines ordered 10 -400s with PW4000s and 420-passenger interior October 1985; first delivery 26 January 1989

DESIGN FEATURES. Wing has Boeing aerofoil and 3.66 m (12 ft 0 in) greater span than 747-300; sweepback at quarter-chord 37° 30′, thickness/chord ratio 13.44 per cent inboard, 7.8 per cent at mid-span, 8 per cent outboard, dihedral at rest 7°; incidence 2°; winglets, canted 22° outward and swept 60°, increase range by three per cent; upper deck extended rearward by 7.11 m (23 ft 4 in)

FLYING CONTROLS: *Elevators*: four elevator sections mechanically linked with breakable shear devices and controlled mechanically from the control columns, each elevator has dual hydraulic powered control units, control feel and three individual autopilot input servos mounted on central elevator quadrant, all surfaces have position transmitters; feel computer operated by pitot pressure and tailplane angle

Rudder, upper rudder surface operated by three hydraulic actuators served by two hydraulic systems, lower surface by two actuators fed by remaining two hydraulic systems; each rudder has separate yaw damper module, left and right digital air data computers provide signals for controlling rudder ratio changer on each rudder surface according to air data and tailplane angle, combined feel actuator, rudder centring and trim actuator in rear servo area, mechanical cable linkage between rudder pedals and aft actuator area rudder trim control switches on centre console

Tailplane: Tailplane angle set by hydraulic motor-driven shaft and ball screw with primary and secondary

Singapore Airlines' Boeing 747-400 9V-SMU, the 1,000th 747 built *1995*

'Everything down' view of Boeing 747-400

1995

hydraulic brakes, flight control unit and air data computer signals sent to tailplane through dual stabiliser, trim and rudder ratio modules, which automatically apply Mach trim, and by dual stabiliser control modules; tailplane trim limits computed according to flap positions

Lateral control: Pilot and co-pilot aileron linkage can be physically separated if necessary, all four ailerons operate at low speeds; outboard ailerons are locked out at cruising speed, the inboard spoiler panel on each wing used on ground only; remainder have variable ratio response and spoiler mixer units; there are trim, centring and feel units

Leading-edge and trailing-edge devices: Krueger flaps inboard of engines; variable camber slats between and outboard of engines lie flat when retracted and adopt camber curvature when extended. Two flap assemblies on each wing, one inboard of engines and the other between engines, three sections, fore flap, mid-flap and aft flap, move rearwards as single flat panel up to 5° deflection, thereafter, three sections separate progressively to form three slots and camber angles relative to each other increase progressively

Automatic flight control system: combines autopilot, flight director and automatic tailplane trim and sends commands through triple independent flight control computers, system automates all flight phases except take-off, dual digital air data computers, pilots' primary flight and navigation displays are large-size cathode-ray tubes; two engine indicating and crew alerting screens, one on main panels, one on console; three multifunction control and display panels control flight management system, navigation and communications; flight control computers (autopilot) and inertial reference units are triplicated, new features include full time autothrottle and dual thrust management system included in flight management computer integrated radio control panels and automatic start and shutdown of APU

STRUCTURE: Wing and tail surfaces are aluminium alloy dual-path fail-safe structures, advanced aluminium alloys in wing torsion box save 2,721 kg (6,000 lb), advanced aluminium honeycomb spoiler panels, CFRP winglets and main deck floor panels, advanced graphite/phenolic and Kevlar/graphite in cabin fittings and engine nacelles, frame/stringer/stressed skin fuselage with some bonding Improved corrosion protection and further coverage with compound introduced from 1993

LANDING GEAR: Twin-wheel nose unit retracts forward, main gear consists of four four-wheel bogies; two mounted side by side under fuselage at wing trailing edge, retract forward; two, mounted under wings, retract inward, nosewheel steerable up to 70° left or right from tillers, full rudder pedal travel gives up to 7° for use at high speed, two centre main legs steer up to 13° when nosewheels are steered more than 20° and speed is less than 20 knots (37 km/h, 23 mph), carbon disc brakes on all mainwheels, with individually controlled digital anti-skid units; one of three brake pressure supplies automatically selected; mainwheel diameter increased to 56 cm (22 in), 125 cm (49 in) diameter low-profile tyres; new wheels save 816 kg (1,800 lb) weight. Minimum ground turning radius, with body gear steering, is 48.46 m (159 ft 0 in) at wingtip and 27.73 m (91 ft 0 in) at nosewheels

POWER PLANT: Four 252.4 kN (56,750 lb st) Pratt & Whitney PW4056, 258 kN (57,900 lb st) General Electric CF6-80C2B1F, 258 kN (58,000 lb st) Rolls-Royce RB211-524G or 270 kN (60,600 lb st) Rolls-Royce RB211-524H turbofans.

Further optional engines are 266.9 kN (60,000 lb st) PW4060, 275.8 kN (62,000 lb st) PW4062, 273.6 kN (61,500 lb st) CF6-80C2B1F1 or CF6-80C2B7F

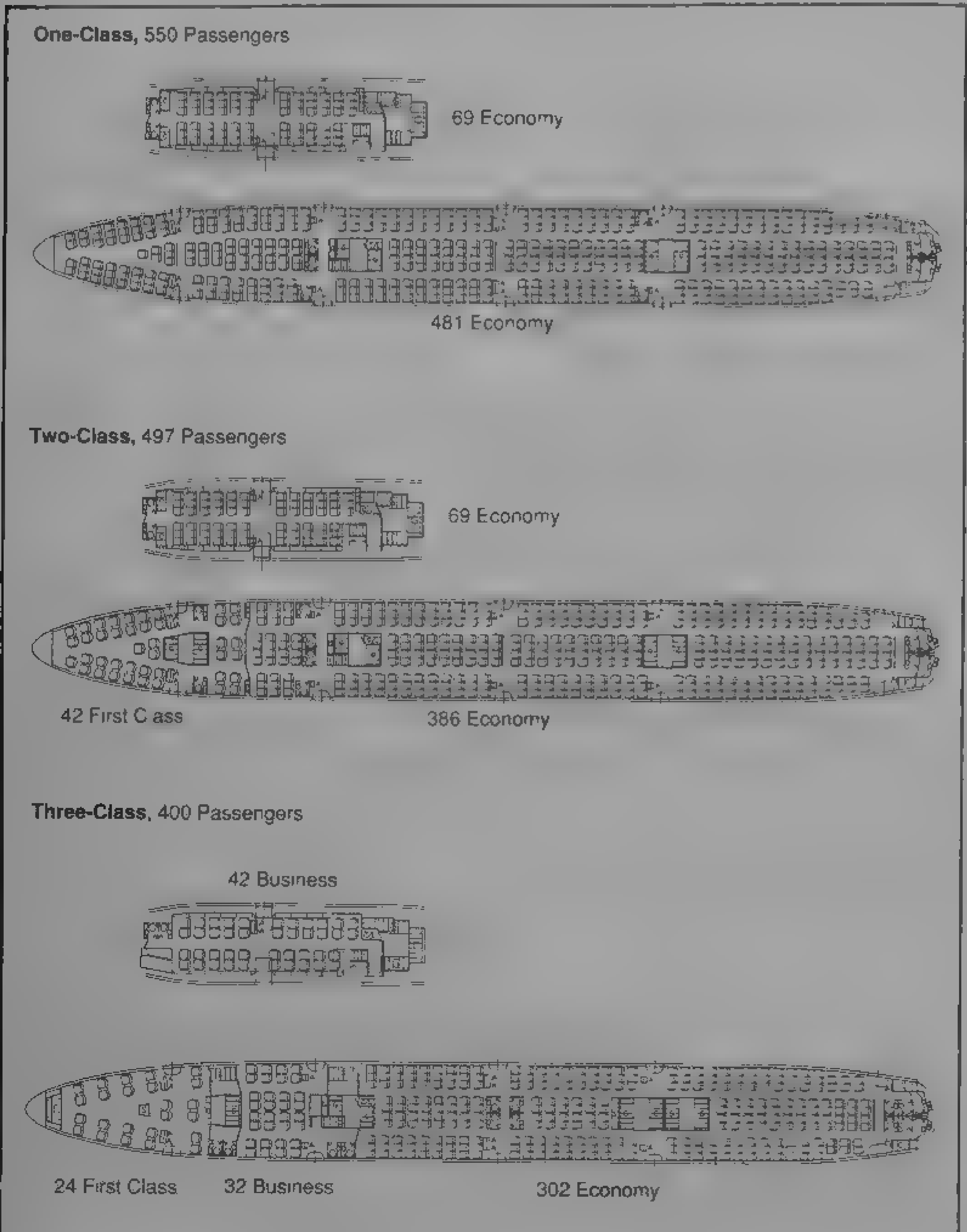
Fuel in four main tanks in wings can feed to any engine, in addition there is a centre-wing tank and reserve tanks in outer wing, optional tailplane tank, vent and surge tanks in outer wings and starboard tailplane, jettison pumps in inner main tanks; APU fed from port inner tank; automatic refuelling through two receptacles under each wing leading-edge between engines, automatic condensate scavenging and flame arresters in vent outlets

Fuel capacity 204,355 litres (53,985 US gallons, 44,952 Imp gallons) with P&W and R R engines; 203,523 litres (53,765 US gallons, 44,769 Imp gallons) with GE engines, at 377,842 kg (833,000 lb) and 394,625 kg (870,000 lb) T-O weights, fuel capacity including tailplane tank is 216,846 litres (57,285 US gallons; 47,700 Imp gallons) with P&W and R R engines and 216,013 litres (57,065 US gallons; 47,516 Imp gallons) with GE engines; optional tailplane tank holds 12,492 litres (3,300 US gallons, 2,748 Imp gallons) transferable fuel (must be full for take-off at 394,625 kg, 870,000 lb gross weight)

ACCOMMODATION: Two-crew flight deck, with seats for two observers, two-bunk crew rest cabin accessible from flight deck. Optional overhead cabin crew rest compartments above rear of main deck cabin (four bunks, four seats, eight bunks, two seats, two bunks, two seats, five sleeper seats) Typical 421-seat three-class configuration accommodates 42 business class on upper deck, 24 first class in front cabin, 29 business class in middle cabin and 326 economy class in rear cabin on main deck. Maximum upper deck capacity 69 economy class. Centre overhead stowage bins 0.16 m³ (5.7 cu ft) volume per 1.02 m (40 in) long bin, outboard bins 0.45 m³ (15.9 cu ft) volume per 1.52 m (60 in) long bin, 0.083 m³ (2.95 cu ft) bin volume per passenger (three-class). Two modular upper deck toilets, 14 on main deck, relocatable and vacuum-drained into four waste tanks. Basic galley configuration one on upper deck, seven centreline and two sidewall on main deck, toilets and galleys can be quickly relocated if required fittings are installed, advanced integrated audio/video/announcement system

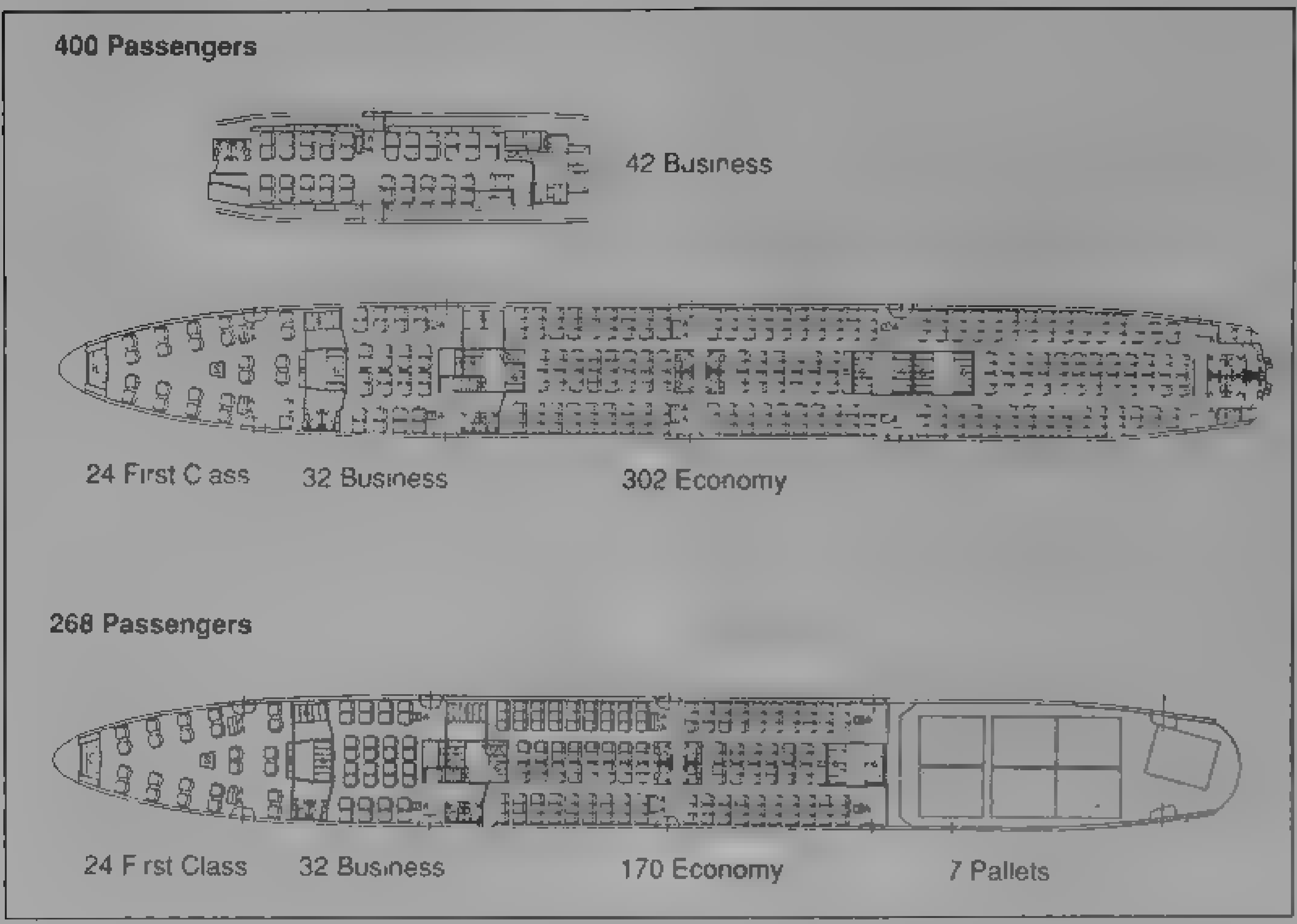
Underfloor freight: forward compartment, five 2.44 m (96 in) × 3.18 m (125 in) pallets or 16 LD-1 containers, aft compartment, 14 LD-1 containers and 23.6 m³ (835 cu ft) bulk cargo or 16 LD-1 and 13.9 m³ (490 cu ft) bulk cargo pallets and LD-1s can be interlined with Boeing 767

SYSTEMS: Each engine drives a hydraulic pump feeding an independent system, services are connected to supplies in such a way that loss of one supply cannot disable one system, two hydraulic systems also have air-driven pumps to maintain pressure and two have electric pumps, one electric pump can be run to provide braking when the aircraft is



Representative Boeing 747 interior configurations for single- or multiple-class travel

1995



Boeing 747 Combi interiors, showing all-passenger and passenger/freight arrangements

1995

being towed on the ground, all four hydraulic reservoirs can be filled from a single location in the port main landing gear bay

Hot air bled from the low-pressure and high-pressure compressors of all four engines is precooled by fan exit air and fed into a manifold to the cabin pressurisation and air conditioning, de-icing of wing leading-edge and engine nose cowling and to pressurise hydraulic tanks. Three conditioning packs in wing/fuselage fairing provide cabin air

Each engine drives an integrated drive generator supplying 90 kVA power to respective AC buses, three generators are a dispatch item, but one will supply essential loads; APU drives two further generators; automatic start-up, load transfers and load shedding reduce crew workload, power systems may be isolated from each other for triple-channel Cat. III autoland

Completely self contained P&WC PW901A APU, mounted clear of all flight-critical structure and flight controls in the extreme tail, drives two 90 kVA generators that can supply electrical power for whole aircraft also supplies compressed air to operate pneumatic components; can run at up to 6,100 m (20 000 ft) and supply compressed air below 4,575 m (15,000 ft)

Forward underfloor cargo compartment heated to 5°C by hot air exhausted from flight deck cooling equipment and avionics in main equipment centre, boosted as necessary by two electrical heaters; rear underfloor hold heated to minimum 5°C or 18°C (selected by crew) by engine bleed

Overheat detection and automatic extinguishing provided in all toilets, APU automatically shut down and fire extinguisher bottles initiated on detection of fire; each engine has three dual fire detectors in series and a fourth detector for overheating. Underfloor freight compartments and upper deck hold of Combi have smoke detectors and extinguisher systems, wheel wells have overheat detectors

AVIONICS Boeing launched development of new Flight Management Computer software in January 1993 to match existing aircraft to International Future Air Navigation System (FANS) during 1995. Standard avionics fit as follows.

Comms Dual VHF and HF transceivers with Selcal dual transponders, flight intercom with air to ground facility, connectible also to satcom system, cabin entertainment and passenger address and service units

Radar: Colour weather radar transmitting in X and C bands

Flight: Dual VOR, triple ILS receivers with single marker beacon receiver; dual ADF; dual DME, all nav radios automatically tuned by flight management computer system (FMCS). Automatic flight control system (AFCS) integrates autopilot, flight director and automatic stabiliser trim functions, dual digital air data computers with dual selectable pressure sensors, angle of attack sensors and total air temperature probes; flight management computer system (FMCS) allows crew to preselect flight plan using standard air traffic control language; FMCS incorporates database, updated every 28 days, which includes data on waypoints, airports, standard instrument departures (SIDs), standard terminal arrival routes (STARs), airline routes and information on specific geographic areas, triple ring laser gyro inertial reference units provide navigation input on EFIS, flight management displays or radio magnetic indicators, other systems include ground proximity warning, triple low-range radio altimeters and TCAS

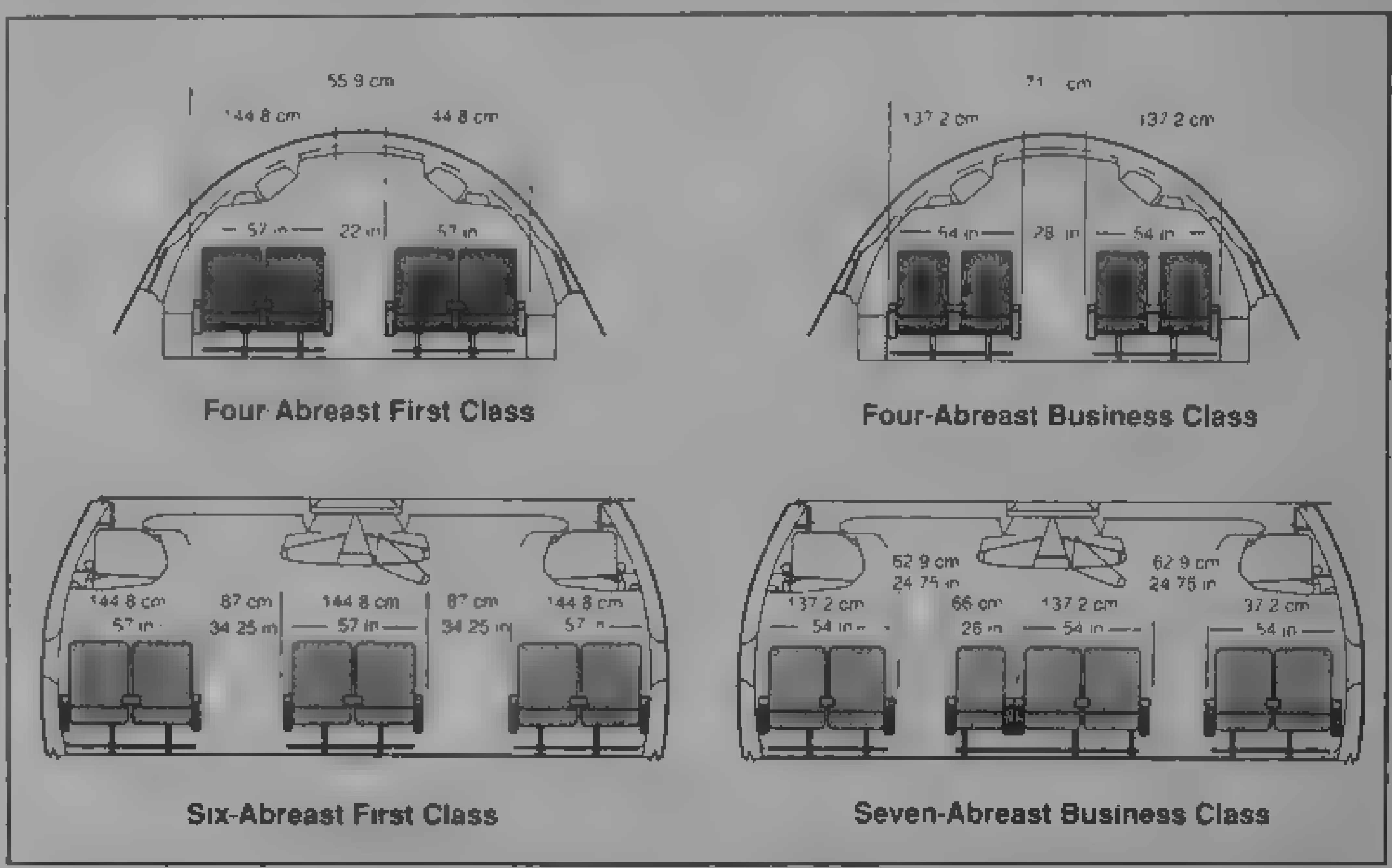
Instrumentation Electronic flight instrument system (EFIS) comprising six (left/right inboard/outboard and central upper/lower) 20.3 x 20.3 cm (8 x 8 in) integrated display units (IDU), two each for primary flight display (PFD), navigation display (ND) and engine indicating and crew alerting (EICAS) functions, all IDUs receive data from all three EFIS/EICAS interface units (EIU), updated via software data loader; PFD and EICAS primary formats automatically switch to inboard and lower IDUs respectively, with facility for manual selection of formats on different IDUs as required

Central maintenance computer monitors electrical and electromechanical systems, performs tests and centralises maintenance data, failures are indicated in EICAS displays and stored for future reference for in-flight use or line or hangar maintenance

DIMENSIONS, EXTERNAL

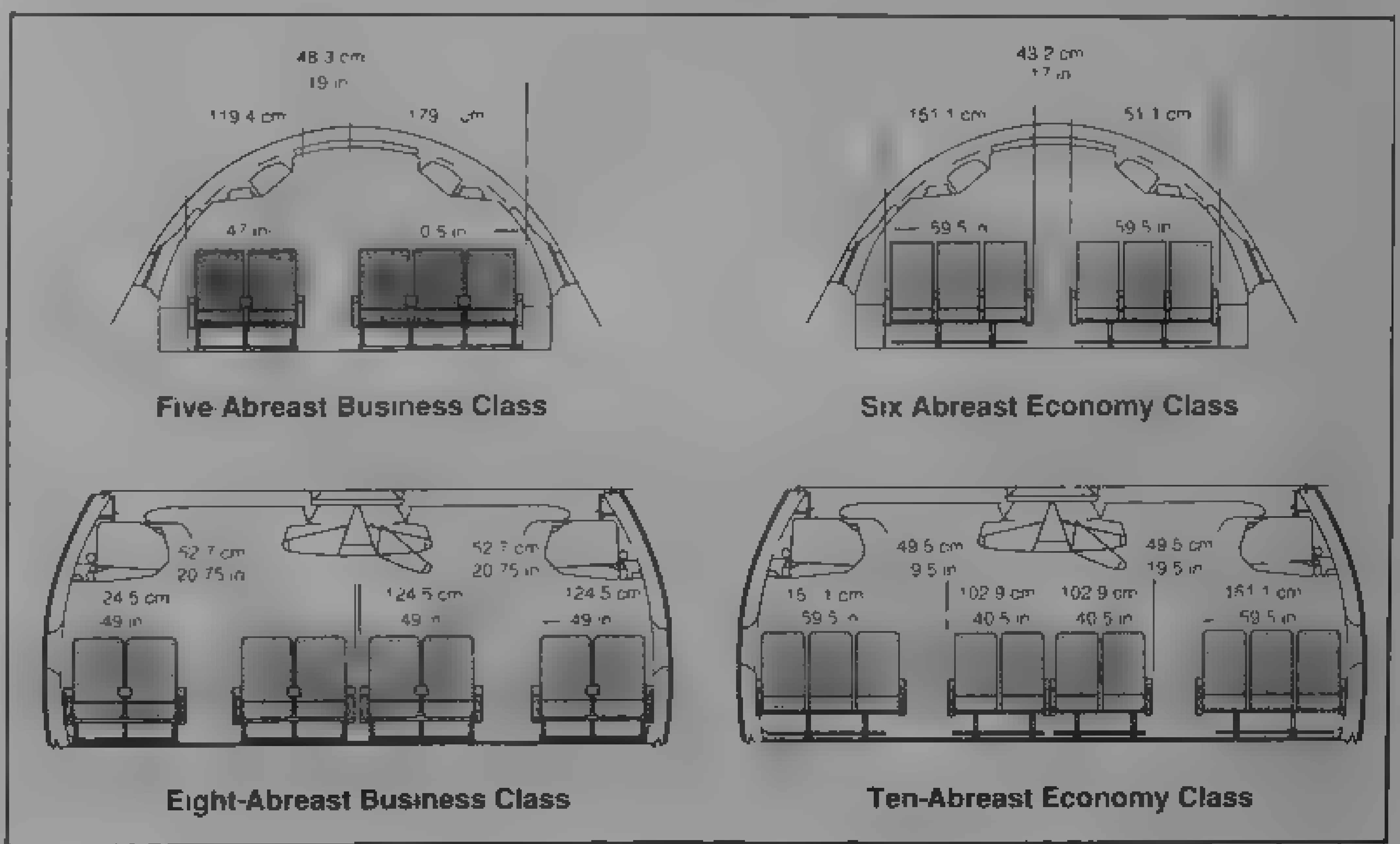
Wing span	64.44 m (211 ft 5 in)
Wing span, fully fuelled	64 92 m (213 ft 0 in)
Length: overall	70.66 m (231 ft 10 in)
fuselage	68 63 m (225 ft 2 in)
Height overall	19 41 m (63 ft 8 in)
Tailplane span	22.17 m (72 ft 9 in)
Wheel track	11 00 m (36 ft 1 in)
Wheelbase	25 60 m (84 ft 0 in)
Passenger doors (10, each): Height	1.93 m (6 ft 4 in)
Width	1.07 m (3 ft 6 in)
Height to sill	approx 4 88 m (16 ft 0 in)
Baggage door (front hold). Height	1.68 m (5 ft 6 in)
Width	2.64 m (8 ft 8 in)
Height to sill	approx 2.64 m (8 ft 8 in)
Baggage door (forward door, rear hold).	
Height	1.68 m (5 ft 6 in)
Width	2.64 m (8 ft 8 in)
Height to sill	approx 2 69 m (8 ft 10 in)
Bulk loading door (rear door, rear hold)	
Height	1 19 m (3 ft [illegible] in)
Width	1 12 m (3 ft 8 in)
Height to sill	approx 2.90 m (9 ft 6 in)
Freighter cargo door (port): Height	3 05 m (10 ft 0 in
Width	3 40 m (11 ft 2 in)
Height to sill	4 87 m (16 ft 0 in)

WEIGHTS AND LOADINGS (letters denote engine installations as follows P PW 4056 [illegible] CF6-80C2B1 [illegible] R RB211-524G/H)



Cross-section of Boeing 747 showing low- and medium-density seating

1995

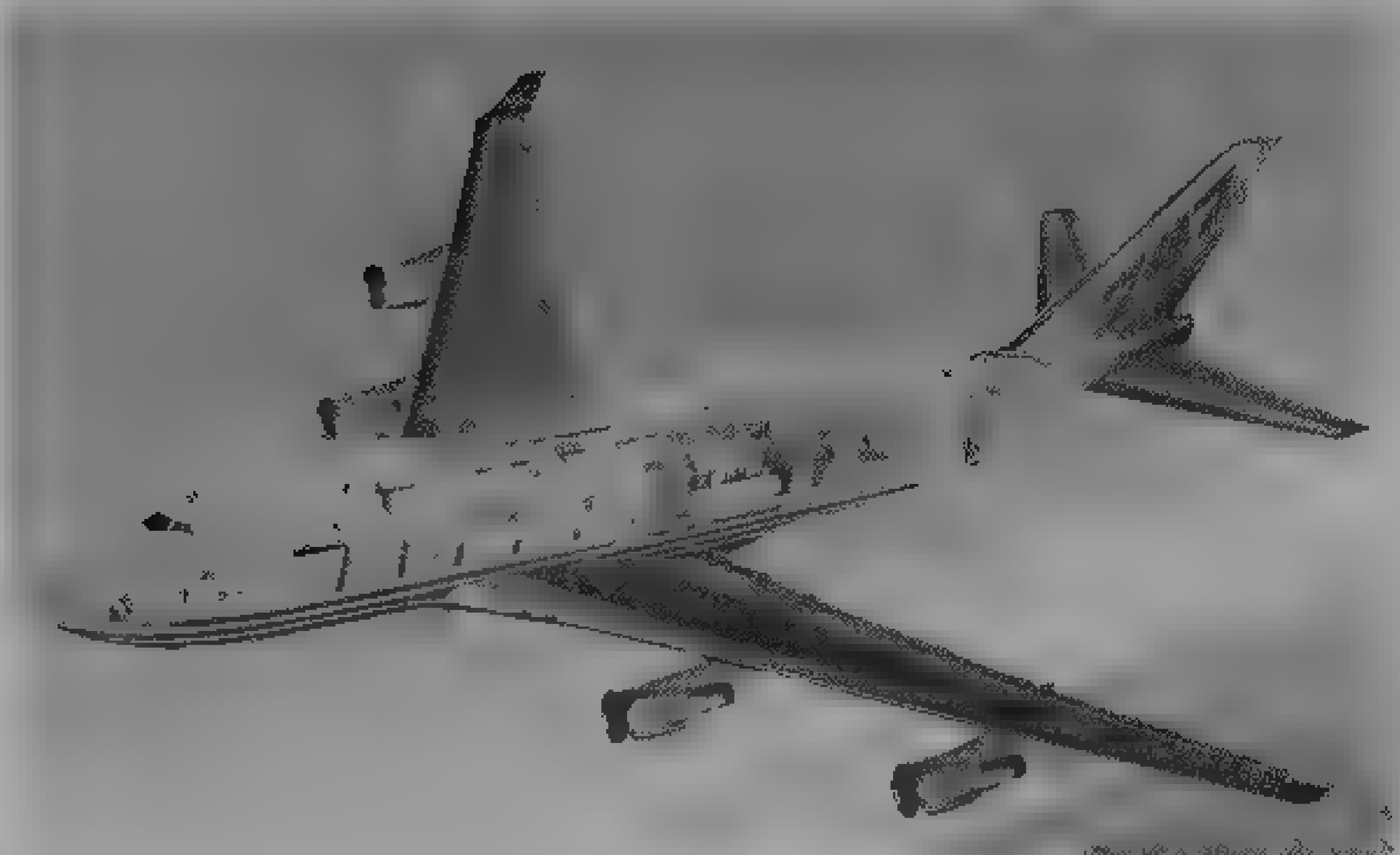


Boeing 747 medium- and high-density seating

1995

Internal arrangement of Boeing 747-400 Combi with 266 passengers in three classes and seven freight pallets in the rear cargo hold Standard underfloor cargo capacity is retained

1993



Boeing 747 400F freighter showing short upper deck, nose loading door and optional rear port side freight door

1993

Operating weight empty: P 180,985 kg (399,000 lb)
P at max optional T-O weight 181,485 kg (400,100 lb)
C 181,030 kg (399,100 lb)
C at max optional T-O weight 181,530 kg (400,200 lb)
R 182,255 kg (401,800 lb)
R at max optional T-O weight 182,755 kg (402,900 lb)
Max T-O weight: P, C, R 362,875 kg (800,000 lb)
or 385,555 kg (850,000 lb)
or 394,625 kg (870,000 lb)
Max ramp weight: P, C, R 364,235 kg (803,000 lb)
or 386,915 kg (853,000 lb)
or 395,985 kg (873,000 lb)
Max zero-fuel weight: P, C, R 242,670 kg (535,000 lb)
Max landing weight: at standard max T-O weight
P, C, R 260,360 kg (574,000 lb)
at alternative max T-O weights
P, C, R 285,765 kg (630,000 lb)

PERFORMANCE (engines as designated under Weights and Loadings):
Approach speed at basic landing weight
P, C, R 146 kts (270 km/h; 168 mph)
Approach speed at highest optional landing weight
P, C, R 153 kts (284 km/h; 176 mph)
Initial cruise altitude at highest optional T-O weight
P, C, R 10,030 m (32,900 ft)
FAR T-O field length at S/L, ISA, at highest optional T-O weight: P, C 3,322 m (10,900 ft)
R 3,352 m (11,000 ft)
FAR landing field length at max landing weight of 285,765 kg (630,000 lb): P, C, R 2,072 m (6,800 ft)
Design range, typical international rules, 420 three-class passengers, at highest optional T-O weight
P 7,165 n miles (13,269 km; 8,245 miles)
C 7,230 n miles (13,390 km; 8,320 miles)
R 7,100 n miles (13,149 km; 8,170 miles)

UPDATED

BOEING 747-400F

TYPE: All-freight version of 747-400

PROGRAMME: First flight (N6005C) 7 May 1993, FAA certification October 1993, JAR certification followed

CURRENT VERSIONS: **747-400F**: *As described*

Military freighter: Offered to USAF to meet [redacted] developmental airlift aircraft (NDAA) requirement for possible alternative to McDonnell Douglas C-17A, Pratt & Whitney PW4056 power plant chosen early 1995, USAF decision due November 1995, military 747 400F available 18 months from go-ahead

CUSTOMERS: Seven customers (Air France, Asiana, Cargolux, Cathay Pacific, KLM, Korean Airlines and Singapore Airlines) ordered 20 aircraft by December 1994: first 747-400F delivered to Cargolux November 1993

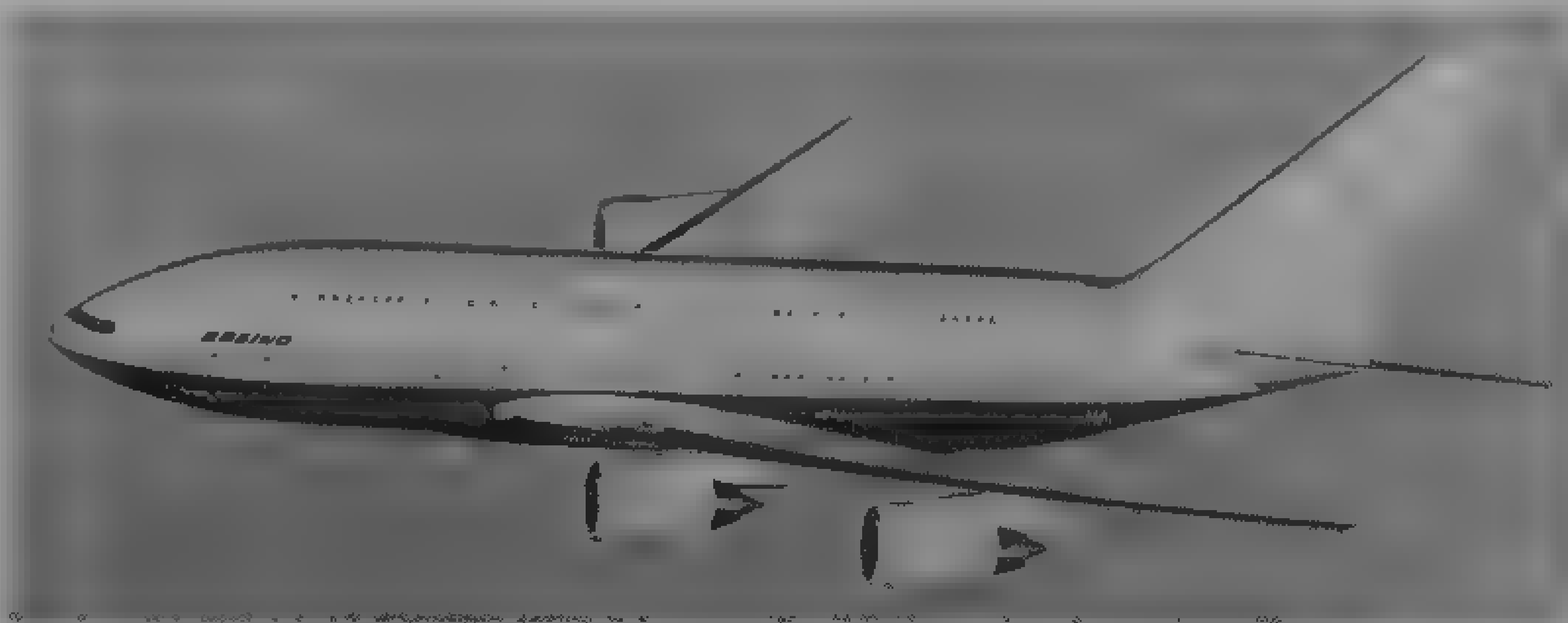
DESIGN FEATURES: 747-200F fuselage (short upper deck) with additional changes combined with stronger and larger 747-400 wing, strengthened floor of short upper deck, as offered for -200F, also integrated into 747-400F; further developed freight handling system, total cargo volume increased by 41.7 m³ (1,473 cu ft), empty weight saving of 2,000 kg (4,409 lb) has raised maximum revenue freight load to about 113,000 kg (249,122 lb), at which range is 4,400 n miles (8,149 km; 5,063 miles), fuel consumption is 14.2 per cent lower than 747-200F. Same gross weights as passenger 747-400; maximum landing weight at optional T-O weight, 302,090 kg (666,000 lb); maximum zero-fuel weight 276,690 kg (610,000 lb), can be increased on condition T-O weight is decreased

ACCOMMODATION: Two-pilot crew, as 747-400. Upward opening nose cargo door and optional port-side rear cargo door; underfloor cargo doors fore and aft of wing and bulk cargo door aft of rear underfloor door; two crew doors to port. Capacity for 30 pallets on main deck and 32 LD-1 containers plus bulk cargo under floor

UPDATED

BOEING 747X

Apart from the studies directed towards the UHCA/VLCT New Large Airplane (see under UHCA/VLCT in International section), Boeing also making preliminary design studies of stretched 747-400, sometimes known as 747X. Studies of several alternative extrapolations of 747 continued into 1993, but Boeing statements during first quarter of 1994 suggested that a new wing combined with a fuselage stretched to accommodate 80 more passengers could be an interim approach to NLA. Cost of development might prevent company from funding development of NLA until further into the next century. A 747 development would not become a multicompany project. Simultaneously, Boeing pursuing NLA studies with the four Airbus Industrie partner companies and Airbus Industrie itself



Artist's impression of hypothetical two-deck Boeing 747X

1994

Boeing 747 400F freighter takes off for first time from Paine Field, Washington, on 7 May 1993

1993

New wing would probably follow design approach of the 777, with more moderate sweep to afford good field performance and climb; cruising Mach number around 0.84, and fuel capacity of about 208,197 litres (55,000 US gallons, 45,797 Imp gallons). Seating for 500 or more passengers would be afforded by fuselage plugs forward and aft of wing, with forward plug extending both upper and main decks. Boeing says customers will determine any capacity or range stretch of 747-400.

UPDATED

BOEING 757

TYPE: Medium-range twin-turbofan airliner.

PROGRAMME: New technology family designated 757/767/777 announced early 1978, 757 has 707/727/737 fuselage cross-section and two large turbofans. Eastern Air Lines and British Airways ordered 21 firm and 24 optioned and 19+18 respectively 13 August 1978, first flight (N757A) 19 February 1982 powered by 166.4 kN (37,400 lb st) Rolls-Royce RB535Cs and designated 757-200, first Boeing airliner launched with foreign engine; FAA certification 21 December 1982. CAA certification 14 January 1983, revenue services began 1 January 1983 (EAL) and 9 February 1983 (BA). First flight of 757 powered by P&W PW2037s, 14 March 1984, certificated October 1984 and delivered to Delta, first 757 with RB535E4s delivered to EAL 10 October 1984, first extended-range model delivered to Royal Brunei Airlines May 1986; 757 with RB535E4 engines approved FAA ETOPS December 1986 (extended to 180 minutes July 1990); 757 with PW2037/2040 ETOPS approved April 1990 (180 minutes for PW2037 April 1992), Boeing windshear guidance and detection system approved by FAA January 1987. Certificated for operation in Russia and CIS September 1993.

First 757 kept by Boeing for flight test support, used as avionics testbed for Lockheed YF-22 (see below) and Boeing 777. Production rate of 757 reduced from 8½ per month to seven in June 1993 (instead of September) and then to five in October 1993 (instead of November), steady at four during 1995. Discussions in 1993 for possible assembly of 757 in China, leading towards full production, no decision announced.

CURRENT VERSIONS: **757-200:** Initial production passenger airliner, extended range available. *Main description applies to this version except where indicated.*

757-200PF Package Freighter: Developed for United Parcel Service. Large freight door forward, single crew door and no windows, up to 15 standard 2.24 × 3.18 m (88 × 125 in) cargo pallets on main deck, same higher operating weights as Freighters. UPS ordered 20 in 1985, total 65 ordered by December 1993 plus 36 on option, 52 delivered by February 1995.

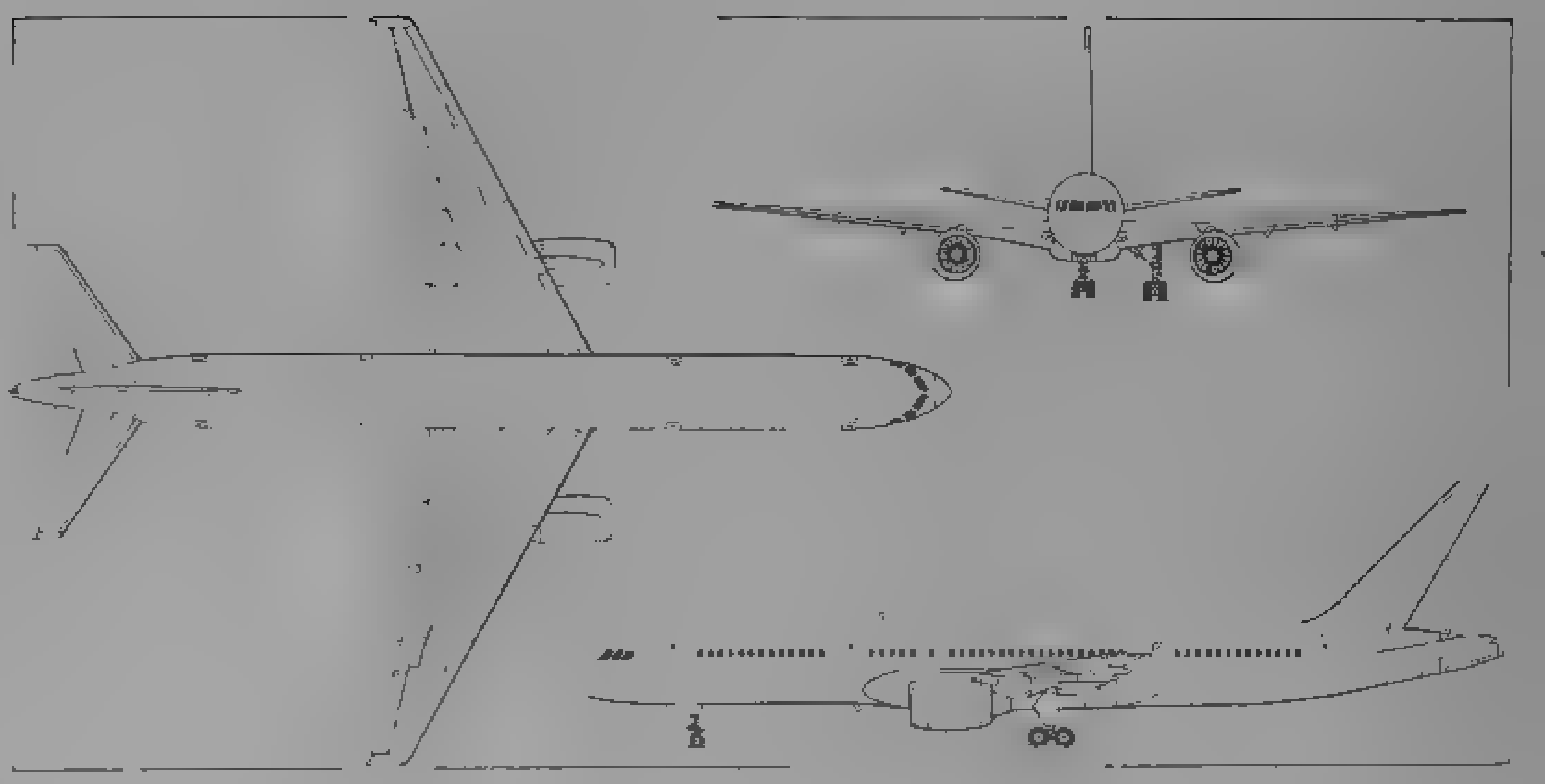
757-200M Combi: Boeing's mixed cargo/passenger configuration with windows, upward-opening cargo door to port (forward) 3.40 × 2.18 m (134 × 86 in), carries up to three 2.24 × 2.74 m (88 × 108 in) cargo containers and 150 passengers, one delivered to Royal Nepal Airlines.

757-200 Freighter: Developed by Pemco Aeroplex in 1992 as conversions of existing 757s, all freight, combi and quick-change versions available, same weights as Boeing 757-200PF Package Freighter (see data below), choice of more powerful engines, large freight door forward on port side.

757-200 'Catfish': Boeing's own 757-200 (N757A) being fitted with radar nose in F-22 profile and representative F-22 swept wing section above flight deck containing conformal radar antennae for advanced radar trials, first flight expected 1997. See also Lockheed Martin entry.

CUSTOMERS: See table at start of Boeing Commercial entry for orders/deliveries.

COSTS: Price of four 757s ordered by Shorouk in November 1992 reported as $240 million.



Boeing 757-200 twin-turbofan short/medium-range transport *(Jane's/Dennis Punnett)*

1983

DESIGN FEATURES: Boeing aerofoils; sweepback at quarter chord 25°; dihedral 5°; incidence 3° 12'.

FLYING CONTROLS: All-speed fully powered outboard ailerons assisted by five flight spoilers on each wing also acting variously as airbrakes and ground spoilers; one additional ground spoiler inboard on each wing, elevators and rudder; double-slotted trailing-edge flaps; full-span leading-edge slats, five sections each wing, variable incidence tailplane.

STRUCTURE: Aluminium alloy two-spar fail-safe wing box; centre-section continuous through fuselage, ailerons, flaps and spoilers extensively of honeycomb, graphite composites and laminates; tailplane has full-span light alloy torque boxes, fin has three-spar dual cell light alloy torque box, elevators and rudder have graphite/epoxy honeycomb skins supported by honeycomb and laminated spar and rib assemblies; CFRP wing/fuselage and flap track fairings. All landing gear doors of CFRP/Kevlar.

Subcontractors include Hawker de Havilland (wing inspar ribs), Shorts (inboard flaps), CASA (outboard flaps), Boeing Renton (leading-edge slats, main cabin sections), Boeing Helicopters (fixed leading-edges), Boeing Military Airplanes (flight deck), Northrop Grumman (overwing spoiler panels), Heath Tecna (wing/fuselage and flap track fairings), Schweizer (wingtips), Vought Aircraft (fin and tailplane, extreme rear fuselage), Rohr Industries (engine support struts), IAI (dorsal fin), Fleet Industries (APU access doors).

LANDING GEAR: Retractable tricycle type, with main and nose units manufactured by Menasco. Each main unit carries a four-wheel bogie, fitted with Dunlop or Goodrich wheels, carbon brakes and tyres. Twin-wheel nose unit, also with Dunlop or Goodrich tyres. Minimum ground turning radius 21.64 m (71 ft) at nosewheels, 29.87 m (98 ft) at wingtip.

POWER PLANT: Two 166.4 kN (37,400 lb st) Rolls-Royce 535C, 170 kN (38,200 lb st) Pratt & Whitney PW2037, 178.4 kN (40,100 lb st) Rolls-Royce 535E4/E4-B, or 185.5 kN (41,700 lb st) Pratt & Whitney PW2040 turbofans, mounted in underwing pods. Rolls-Royce 535C not offered for Freighters. Fuel capacity 42,597 litres (11,253 US gallons, 9,370 Imp gallons); fuel capacity of Freighters 42,684 litres (11,276 US gallons, 9,389 Imp gallons).

ACCOMMODATION: Crew of two on flight deck, with provision for an observer. Five to seven cabin attendants. Nine standard interior arrangements for 178 (16 first class/162 tourist), 186 (16 first class/170 tourist), 202 (12 first class/190 tourist), 208 (12 first class/196 tourist) mixed class passengers, or 214, 220, 223, 224 or 239 all tourist passengers. First class seats are four-abreast, at 96.5 cm (38 in) pitch; tourist seat pitch is 81 or 86 cm (32 or 34 in), mainly six-abreast, in mixed class arrangements. Large overhead bins of Kevlar provide approximately 0.054 m³ (1.9 cu ft) of stowage per passenger. Choice of two cabin door configurations, with either three passenger doors and two overwing emergency exits on each side (used with 186-, 208-, 220- and 224-seat interiors), or four doors on each side (used with 178-, 202-, 214-, 223- and 239-seat interiors). All versions have a galley at front on starboard side and another at rear (two on 178- and 186-passenger versions and three on 239 version plus one amidships), toilet at front on port side and three more at rear (186, 202, 208, 220, 224 passengers) or two at rear (239) or amidships (178, 214, 223 passengers). Coat closet at front of first class cabins and 214/220-passenger interiors. Baggage/cargo hold doors on starboard side.

SYSTEMS: AiResearch ECS, General Electric engine thrust management system; Honeywell-Vickers engine-driven hydraulic pumps, four Abex electric hydraulic pumps. Hydraulic system maximum flow rate 140 litres (37 US gallons; 30.8 Imp gallons)/min at T-O power on engine-driven pumps; 25.4 to 34.8 litres (6.7 to 9.2 US gallons; 5.6 to 7.7 Imp gallons)/min on electric motor pumps; 42.8 litres (11.3 US gallons; 9.4 Imp gallons)/min on ram air turbine. Independent reservoirs, pressurised by air from pneumatic system, maximum pressure 207 bars (3,000 lb/sq in) on primary pumps. Sundstrand electrical power generating system and ram air turbine. AlliedSignal GTCP331-200 APU. Wing thermally anti-iced.

AVIONICS: *Flight:* Honeywell inertial reference system (IRS) (first commercial application of laser gyros); IRS provides position, velocity and attitude information to flight deck displays, and the flight management computer system (FMCS) and digital air data computer (DADC) supplied by Honeywell. FMCS provides automatic en route and terminal navigation capability, and also computes and commands both lateral and vertical flight profiles for optimum fuel efficiency, maximised by electronic linkage of the FMCS with automatic flight control and thrust management systems; Boeing windshear detection and guidance system is optional.

Instrumentation: Collins EFIS-700 with engine indication and crew alerting system (EICAS), Collins FCS-700 autopilot flight director system (AFDS).

Boeing 757-200 for Iberia takes off from the Boeing airfield at Renton, Washington

1994

Boeing 757 twin-turbofan airliner

1995

DIMENSIONS, EXTERNAL:
Wing span 38.05 m (124 ft 10 in)
Wing chord: at root 8.20 m (26 ft 11 in)
at tip 1.73 m (5 ft 8 in)
Wing aspect ratio 7.82
Length: overall 47.32 m (155 ft 3 in)
fuselage 46.96 m (154 ft 10 in)
Height overall 13.56 m (44 ft 6 in)
Tailplane span 15.21 m (49 ft 11 in)
Wheel track 7.32 m (24 ft 0 in)
Wheelbase 18.29 m (60 ft 0 in)
Passenger doors (two, fwd, port):
Height 1.83 m (6 ft 0 in)
Width 0.84 m (2 ft 9 in)
Passenger door (rear, port): Height 1.83 m (6 ft 0 in)
Width 0.76 m (2 ft 6 in)
Service door (fwd, stbd): Height 1.65 m (5 ft 5 in)
Width 0.76 m (2 ft 6 in)
Service door (stbd, opposite second passenger door):
Height 1.83 m (6 ft 0 in)
Width 0.84 m (2 ft 9 in)
Service door (rear, stbd): Height 1.83 m (6 ft 0 in)
Width 0.76 m (2 ft 6 in)
Emergency exits (four, overwing):
Height 0.97 m (3 ft 2 in)
Width 0.51 m (1 ft 8 in)
Emergency exits, optional (two, aft of wings):
Height 1.32 m (4 ft 4 in)
Width 0.61 m (2 ft 0 in)

DIMENSIONS, INTERNAL:
Cabin (aft of flight deck to rear pressure bulkhead):
Length 36.09 m (118 ft 5 in)
Max width 3.53 m (11 ft 7 in)
Max height 2.13 m (7 ft 0 in)
Floor area 116.04 m² (1,249 sq ft)
Passenger section volume 230.50 m³ (8,140 cu ft)
Underfloor cargo volume (bulk loading):
fwd 19.82 m³ (700 cu ft)
rear 30.87 m³ (1,090 cu ft)

AREAS:
Wings, gross 185.25 m² (1,994.0 sq ft)
Ailerons (total) 4.46 m² (48.0 sq ft)
Trailing-edge flaps (total) 30.38 m² (327.0 sq ft)
Leading-edge slats (total) 18.39 m² (198.0 sq ft)
Flight spoilers (total) 10.96 m² (118.0 sq ft)
Ground spoilers (total) 12.82 m² (138.0 sq ft)
Fin 34.37 m² (370.0 sq ft)
Rudder 11.61 m² (125.0 sq ft)
Tailplane 50.35 m² (542.0 sq ft)
Elevators (total) 12.54 m² (135.0 sq ft)

WEIGHTS AND LOADINGS (with 186 passengers. A: 535E4 engines, B: PW2037s, C: PW2040s, F1: Freighter with P&W engines, F2: Freighter with RR engines):
Operating weight empty: A 57,180 kg (126,060 lb)
B, C 57,040 kg (125,750 lb)
F1 50,960 kg (112,350 lb)
F2 51,165 kg (112,800 lb)
Freighter revenue payload, volume limited:
F1, F2 32,755 kg (72,210 lb)
Zero-fuel weight limited, containers:
F1 36,220 kg (79,850 lb)
F2 36,015 kg (79,400 lb)
Zero-fuel weight limited, pallets:
F1 38,260 kg (84,350 lb)
F2 38,055 kg (83,900 lb)
Max basic T-O weight: A, B, C 99,790 kg (220,000 lb)
Max T-O weight (medium-range):
A, B, C 104,325 kg (230,000 lb)
F1, F2 113,400 kg (250,000 lb)
Max T-O weight (long-range):
A, B, C 113,400 kg (250,000 lb)
F1, F2 115,665 kg (255,000 lb)
Max landing weight: A, B, C 89,810 kg (198,000 lb)
F1, F2 95,255 kg (210,000 lb)
Max zero-fuel weight: A, B, C 83,460 kg (184,000 lb)
F1, F2 90,720 kg (200,000 lb)
Max wing loading: A, B, C at max basic T-O weight
538.5 kg/m² (110.3 lb/sq ft)
A, B, C at long-range max T-O weight
587.8 kg/m² (120.4 lb/sq ft)
F1, F2 at long-range max T-O weight
624.3 kg/m² (127.8 lb/sq ft)
Max power loading:
at max basic T-O weight:
A 279.68 kg/kN (2.74 lb/lb st)
B 293.5 kg/kN (2.88 lb/lb st)
C 268.97 kg/kN (2.64 lb/lb st)
at long-range max T-O weight:
A 317.81 kg/kN (3.12 lb/lb st)
B 333.51 kg/kN (3.27 lb/lb st)
C 305.1 kg/kN (3.00 lb/lb st)
F1 311.8 kg/kN (3.05 lb/lb st)
F2 324.1 kg/kN (3.18 lb/lb st)

PERFORMANCE (with 186 passengers, at max basic T-O weight except where indicated):
Max operating speed: A, B, C Mach 0.86
Cruising speed: A, B, C Mach 0.80
Approach speed at S/L, flaps down, max landing weight:
A, B, C 132 kts (245 km/h; 152 mph) EAS
Initial cruising height: A 11,880 m (38,970 ft)
B, C 11,675 m (38,300 ft)
Runway LCN at ramp weight of 100,244 kg (221,000 lb), optimum tyre pressure and subgrade C flexible pavement, H40 × 14.5-19.0 tyres 36
T-O field length (S/L, 29°C):
at max basic T-O weight: A 1,646 m (5,400 ft)
B 1,791 m (5,875 ft)
C 1,637 m (5,370 ft)
at long range max T-O weight: A 2,134 m (7,000 ft)
B 2,792 m (9,160 ft)
C 2,118 m (6,950 ft)
Landing field length at max landing weight:
A 1,411 m (4,630 ft)
B, C 1,460 m (4,790 ft)
Range with 186 passengers:
at max basic T-O weight:
A 2,820 n miles (5,222 km; 3,245 miles)
B, C 2,980 n miles (5,519 km; 3,429 miles)
at long-range max T-O weight:
A 3,820 n miles (7,074 km; 4,396 miles)
B, C 4,000 n miles (7,408 km; 4,603 miles)
757-200PF, max long-range T-O weight, 22,680 kg (50,000 lb) payload:
A 3,700 n miles (6,852 km; 4,258 miles)
B, C 3,885 n miles (7,195 km; 4,471 miles)

OPERATIONAL NOISE LEVELS (FAR Pt 36 Stage 3):
T-O, at max basic T-O weight, cutback power:
A [illegible] EPNdB
B 86.2 EPNdB
C (estimated) 84.7 EPNdB
Approach at max landing weight, 30° flap:
A 95.[illegible] EPNdB
B, C 97.7 EPNdB
Sideline: A 93.3 EPNdB
B 94.0 EPNdB
C (estimated) 94.6 EPNdB

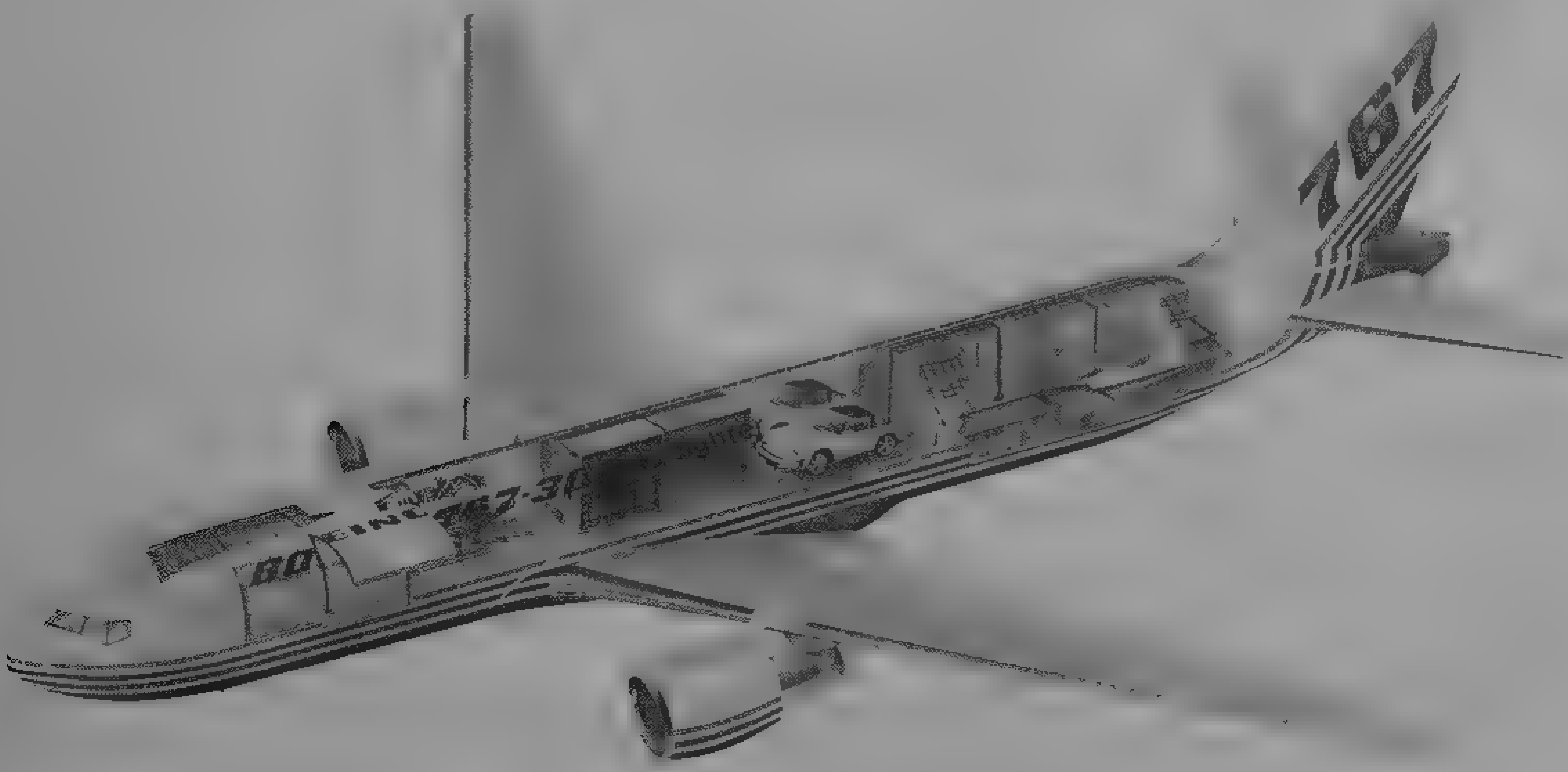
UPDATED

BOEING 767

TYPE: Medium/long-range twin-turbofan airliner.

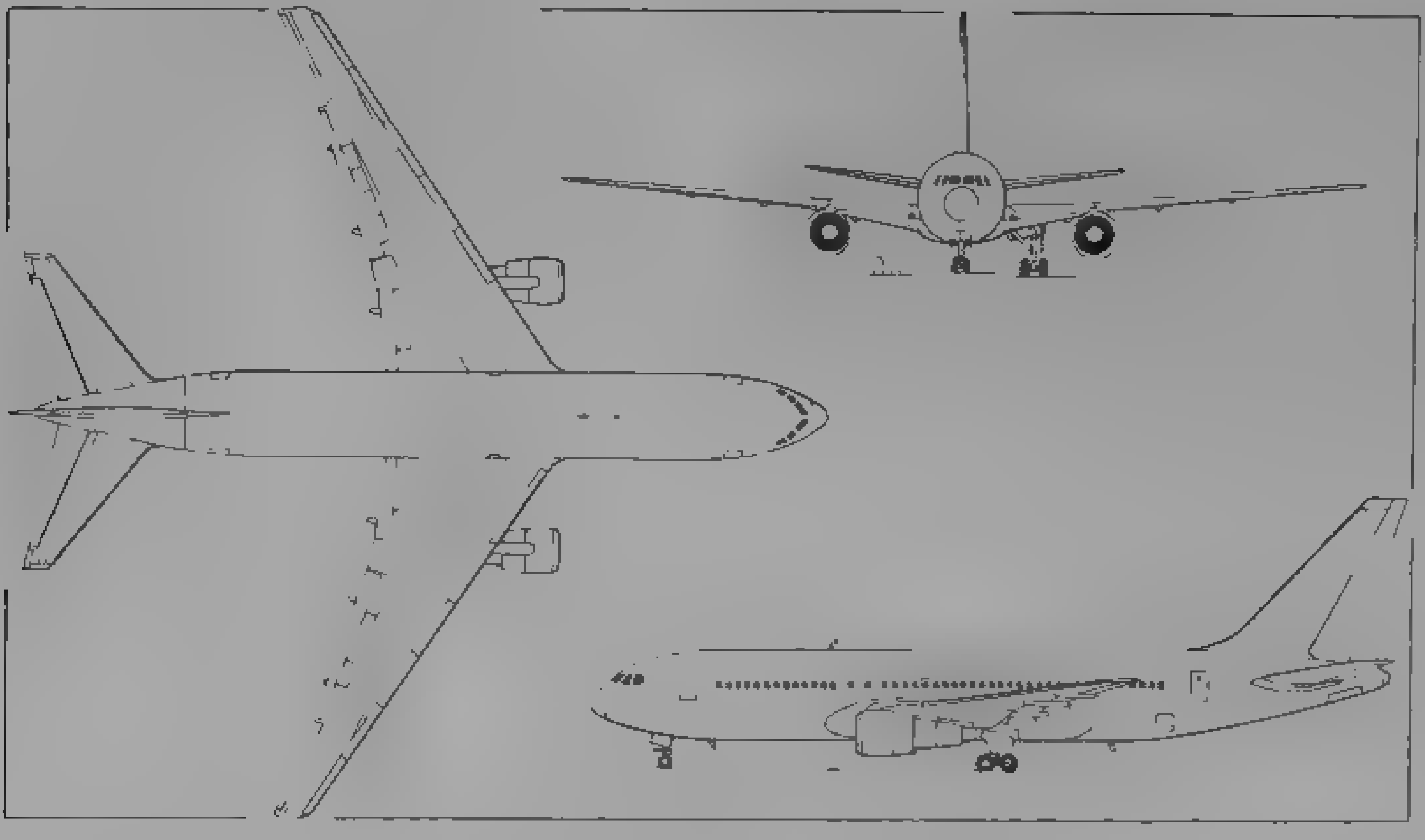
PROGRAMME: Launched on receipt of United Air Lines order for 30 on 14 July 1978; construction of basic 220-passenger 767-200 began 6 July 1979; first flight (N767BA) 26 September 1981 with P&W JT9D turbofans, first flight fifth aircraft with GE CF6-80A 19 February 1982; 767 with JT9D-7R4D certificated 30 July 1982, with CF6-80A 30 September 1982.

First delivery with JT9D (United Air Lines) 19 August 1982, first delivery with CF6 (Delta) 25 October 1982. ETOPS approval for 767-200 with JT9D-7R4 or CF6-80A or -80A2 granted January 1987, ETOPS approval for 767-200 and -300 with PW4000 obtained April 1990; 180 min ETOPS approval with PW4000 engines obtained August 1993. Boeing windshear detection and guidance system FAA approved for 767-200 and -300 February 1987; production reduced from five per month to three in October 1993 (instead of four in November), rising to four in April 1995, then reducing to 3½ in December 1995.



Interior layout of Boeing 767 300 Freighter

1994



Boeing 767 200 wide-bodied airliner (*Jane's/Dennis Punnett*)

1995

CURRENT VERSIONS: **767 200:** Basic model Medium-range variant has reduced fuel, higher gross weight variant certificated June 1983. *Description applies to basic 767 200, except where indicated.*

767-200ER: Extended range version, first flight 6 March 1984, basic -200ER with centre-section tankage and gross weight increased to 156,490 kg (345,000 lb) first delivered to Ethiopian Airlines 23 May 1984, optional higher gross weights are 159,211 kg (351,000 lb), 172,365 kg (380,000 lb) and 175,540 kg (387,000 lb)

767-300: Stretched 269-passenger version with 3 07 m (10 ft 1 in) plug forward of wing and 3 35 m (11 ft) plug aft, and same gross weight as 767-200, strengthened landing gear and thicker metal in parts of fuselage and underwing skin, same flight deck and systems as other 767s, same engine options as 767-200ER, first ordered 29 September 1983. First flight with JT9D-7R4D engines 30 January 1986, certificated with JT9D-7R4D and CF6-80A2 22 September 1986, British Airways ordered 11 in August 1987, later increased to total 25, with Rolls-Royce RB211-524H, for delivery from November 1989

767 300ER: Extended range, higher gross weight version, development began January 1985, optional gross weights 172,365 kg (380,000 lb), 175 540 kg (387,000 lb) and 181,437 kg (400,000 lb), further increased centre-section tankage. Engine choice CF6-80C2, PW4000, RB211-524H, structural reinforcement, certificated late 1987 Launch customer American Airlines (15), delivered from February 1988

767ERX/ERY: Possible long-range versions of 767 300. Boeing's initial 767ERX study of 1992 extended tail plane tankage to give additional 550 n mile (1,019 km, 633 mile) range, 767ERY would have wing area and tankage volume extended by increased wing chord, modified front spar, extended span and winglets, fuselage section 48, pressure bulkhead and landing gear would be reinforced, GE, P&W and RR studying 278 0 kN (62,500 lb st) engines. 767ERY could have payload improved by 5,987 kg (13,200 lb), range extended to more than 7,000 n miles (12,964 km; 8 055 miles), hot and high take-off performance improved and cruising speed pushed towards Mach 0 84. Boeing could produce 767-300ERX in two years and 767-300ERY in about three years from order

767-300 Freighter: See separate entry

767 AWACS. See Boeing 767 AWACS under Boeing Electronic Systems Division. Also under consideration are a tanker version for boom and hose-reel systems and a carrier for Joint STARS radar, see Boeing Military Airplanes entry

CUSTOMERS. See table on earlier page for orders/deliveries Original prototype became 767 Airborne Surveillance Testbed (formerly AOA) for US Army (see 1991-92 *Jane's*). One reconfigured by E Systems as medevac aircraft for Civil Reserve Air Fleet

COSTS: Two 767-300ER ordered by Airtours in August 1993 for delivery in Spring 1994, cost about $200 million including spares and support

DESIGN FEATURES Boeing aerofoils, quarter chord sweepback 31° 30′; thickness/chord ratio 15 1 per cent at root, 10 3 per cent at tip dihedral 6°; incidence 4° 15′

FLYING CONTROLS Inboard all-speed and outboard low-speed ailerons supplemented by flight spoilers also acting as airbrakes and lift dumpers, single-slotted, linkage supported outboard trailing edge flaps, double-slotted inboard, track-mounted leading-edge slats, variable incidence tailplane; no trim tabs, all control surfaces hydraulically powered, roll and yaw trim through spring feel system; triple digital flight control computers and EFIS. Boeing windshear detection and guidance system optional

STRUCTURE. Fail-safe structure; CFRP wing spoilers, tailplane and fin contain aluminium honeycomb. Subcontractors include Boeing Helicopters (wing fixed leading edges), Northrop Grumman (wing centre section and adjacent lower fuselage section, fuselage bulkheads), Vought Aircraft (horizontal tail); Canadair (rear fuselage), Alenia (wing control surfaces, flaps and leading-edge slats, wingtips, elevators, fin and rudder, nose radome). Fuji (wing fairings and main landing gear doors), Kawasaki (centre fuselage body panels, exit hatches; wing in-spar ribs), Mitsubishi (rear fuselage body panels, stringers, passenger and cargo doors, dorsal fin)

LANDING GEAR: Hydraulically retractable tricycle type, Menasco twin wheel nose unit retracts forward. Cleveland Pneumatic main gear, with two four-wheel bogies, retracts inward, oleo-pneumatic shock-absorbers, Bendix wheels and brakes, mainwheel tyres size 45 × 17-20, pressure 12 6 bars (183 lb/sq in); nosewheel tyres size 37 × 14-15, pressure 10.0 bars (145 lb/sq in), steel disc brakes on all mainwheels, electronically controlled anti-skid units

POWER PLANT: Two high bypass turbofans in pods, pylon-mounted on the wing leading-edges. Alternative engines available for all models are General Electric CF6-80A and Pratt & Whitney JT9D-7R4D, both rated at 213 5 kN (48,000 lb st), and CF6-80A2, JT9D-7R4E and JT9D-7R4E4, rated at 222 4 kN (50 000 lb st). Additionally, 767-200, 767-200ER and 767-300 are available with Pratt & Whitney PW4050 rated at 222 4 kN (50,000 lb st), PW4052 rated at 231 3 kN (52,000 lb st) and General Electric CF6-80C2B2 rated at 233.5 kN (52,500 lb st). General Electric CF6-80C2B4, rated at 257 5 kN (57,900 lb st), available on 767 200ER, 767 300 and 767-300ER Pratt & Whitney PW4056, rated at 252 4 kN (56,750 lb st), and PW4060 and General Electric CF6-80C2B6 rated at 266 9 kN (60,000 lb st), available only on extended range versions. Rolls Royce RB211 524G, rated at 269 6 kN (60,600 lb st), available on 767s since early 1990. Fuel in one integral tank in each wing, and in centre tank, with total capacity of 63,216 litres (16,700 US gallons, 13,905 Imp gallons) in 200/300, 767 200ER has additional 14,195 litres (3,750 US gallons; 3,122 Imp gallons) in second centre-section tank, raising total capacity to 77,412 litres (20,450 US gallons; 17,028 Imp gallons). 767 300ER has further expanded wing centre-section tank (optional on -200ER), bringing total capacity to 91,039 litres (24,050 US gallons, 20,026 Imp gallons). Refuelling point in port outer wing

ACCOMMODATION Normal operating crew of two on flight deck, with third position optional Basic accommodation in 200 models for 216 passengers, made up of 18 first class passengers forward in six abreast seating at 96.5 cm (38 in) pitch, and 198 tourist class in mainly seven-abreast seating at 87 cm (34 in) pitch. Type A inward-opening plug doors provided at both front and rear of cabin on each side of fuselage, with Type III emergency exit over wing on each side. Total of five toilets installed, two centrally in main cabin, two aft in main cabin, and one forward in first class section. Galleys situated at forward and aft ends of cabin. Alternative single class layouts provide for 230 tourist passengers, seven abreast at 86 cm (34 in) pitch, 242 passengers seven abreast at 81 cm (32 in) pitch, 255 passengers mainly seven-abreast (two-three-two) at 76 cm (30 in) pitch, or eight abreast (two-four-two) at 81 cm (32 in) pitch. Maximum seating capacity in -200 models (requiring additional overwing emergency exit) 290 passengers, mainly eight abreast, at 76 cm (30 in) pitch, capacity in -300 is 290 passengers seven-abreast.

Underfloor cargo holds of 200 versions can accommodate, typically, up to 22 LD2 or 11 LD1 containers, 767 300 underfloor cargo holds can accommodate 30 LD2 or 15 LD1 containers. Starboard side forward and rear cargo doors of equal size standard on 767-200 and 767-300 but larger port-side forward cargo door standard on 767-200ER and 767-300ER and optional on 767-200 and 767-300, to permit loading of Type 2 pallets, three such pallets being accommodated in -200/200ER and four in -300/300ER Bulk cargo door at rear on port side. Overhead stowage for carry-on baggage. Cabin air conditioned, cargo holds heated

SYSTEMS AiResearch dual air cycle air conditioning system Pressure differential 0 59 bar (8 6 lb/sq in). Electrical supply from two engine-driven 90 kVA three-phase 400 Hz constant frequency AC generators, 115/200 V output. 90 kVA generator mounted on APU for ground operation or for emergency use in flight. Three hydraulic systems at 207 bars (3,000 lb/sq in), for flight control and utility functions, supplied from engine-driven pumps and an AlliedSignal bleed air powered hydraulic pump or from APU Maximum generating capacity of port and starboard systems is 163 litres (43 US gallons, 35.8 Imp gallons)/min, centre system 185 5 litres (49 US gallons, 40 8 Imp gallons)/min, at 196 5 bars (2,850 lb/sq in). Reservoirs pressurised by engine bleed air via pressure regulation module, Reservoir relief valve pressure nominally 4 48 bars (65 lb/sq in). Additional hydraulic motor-driven generator, to provide essential functions for extended range operations, standard on 767-200ER and 767-300ER and optional on 767-200 and 767-300 Nitrogen chlorate oxygen generators in passenger cabin, plus gaseous oxygen for flight crew APU in tailcone to provide ground and in-flight electrical power and pressurisation. Anti-icing for outboard wing leading-edges (none on tail surfaces), engine air inlets, air data sensors and windscreen

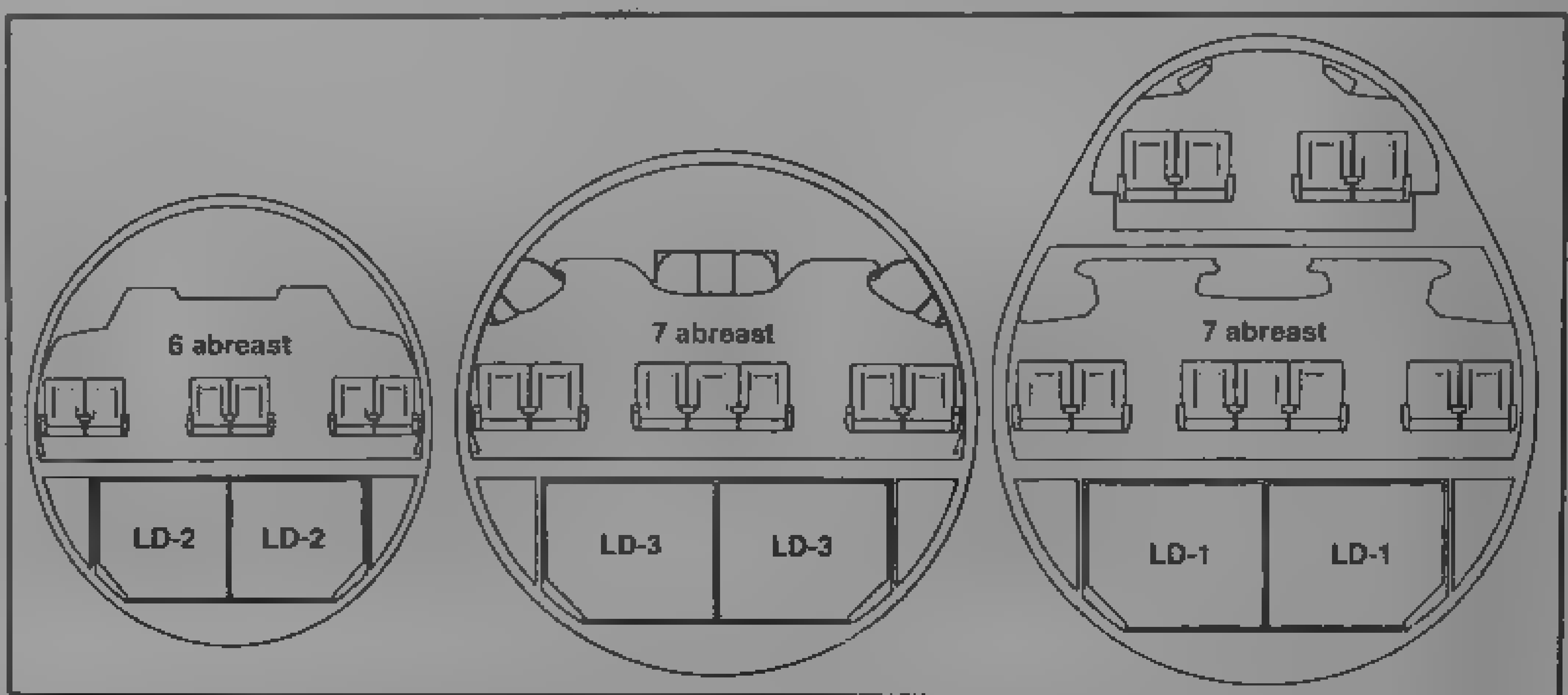
AVIONICS: *Radar:* Bendix/King RDR-4A colour weather radar in aircraft for All-Nippon, Britannia and Transbrasil

Flight Standard ARINC 700 series equipment, including Bendix/King VOR/ILS/marker beacon receivers, ADF, DME, RMI-743 radio magnetic indicator and radio altimeter Honeywell IRS, FMCS and DADC, as described in Boeing 757 entry, dual digital flight management systems, and triple flight control computers, including FCS-700 flight control system, options include Boeing's windshear protection and guidance system

Instrumentation. Bendix/King EFIS-700 electronic flight instrument system

DIMENSIONS, EXTERNAL.

Wing span	47.57 m (156 ft 1 in)
Wing chord, at root	8 57 m (28 ft 1¼ in)
at tip	2 29 m (7 ft 6 in)
Wing aspect ratio	7 99
Length overall 200/200ER	48 51 m (159 ft 2 in)
300/300ER	54 94 m (180 ft 3 in)



Cabin cross-sections of Boeing 767 (left), 777 (centre) and 747 show progression in size designed to afford greater scope in seating layout. External diameter of Boeing 767 is 5 03 m (16 ft 6 in); Boeing 777 is 6 20 m (20 ft 4 in), and Boeing 747 is 6 49 m (21 ft 3½ in). LD-1, 2 and -3 are international-size freight containers. Boeing 747 upper deck extends only part-way along the fuselage

1994

Boeing 767-300ER of Airtours International

1994

Fuselage 200/200ER — 47.24 m (155 ft 0 in)
300/300ER — 53.67 m (176 ft 1 in)
Fuselage: Max width — 5.03 m (16 ft 6 in)
Height overall — 15.85 m (52 ft 0 in)
Tailplane span — 18.62 m (61 ft 1 in)
Wheel track — 9.30 m (30 ft 6 in)
Wheelbase 200/200ER — 19.69 m (64 ft 7 in)
300/300ER — 22.76 m (74 ft 8 in)
Passenger doors (two, fwd and rear, port):
Height — 1.88 m (6 ft 2 in)
Width — 1.07 m (3 ft 6 in)
Galley service door (two, fwd and rear, stbd):
Height — 1.83 m (6 ft 0 in)
Width — 1.07 m (3 ft 6 in)
Emergency exits (two, each): Height — 0.97 m (3 ft 2 in)
Width — 0.51 m (1 ft 8 in)
Cargo doors (two, fwd and rear, stbd):
Height — 1.75 m (5 ft 9 in)
Width — 1.78 m (5 ft 10 in)
* Larger cargo door (fwd, port):
Height — 1.75 m (5 ft 9 in)
Width — 3.40 m (11 ft 2 in)
* *Standard on ER models, optional for -200/300*

DIMENSIONS, INTERNAL:
Cabin, excl flight deck:
Length: 200/200ER — 33.93 m (111 ft 4 in)
300/300ER — 40.36 m (132 ft 5 in)
Max width — 4.72 m (15 ft 6 in)
Max height — 2.87 m (9 ft 5 in)
Floor area: 200/200ER — 154.9 m² (1,667 sq ft)
300/300ER — 184.0 m² (1,981 sq ft)
Volume: 200/200ER — 428.2 m³ (15,121 cu ft)
300/300ER — 485.9 m³ (17,088 cu ft)
Volume, flight deck — 13.5 m³ (478 cu ft)
Baggage holds (containerised), volume:
200/200ER — 74.8 m³ (2,640 cu ft)
300/300ER — 101.9 m³ (3,600 cu ft)
Bulk cargo hold volume:
all models — 12.2 m³ (430 cu ft)
Combined baggage hold/bulk cargo hold volume:
200/200ER — 87.0 m³ (3,070 cu ft)
300/300ER — 114.1 m³ (4,030 cu ft)
Total cargo hold volume:
200/200ER — 111.3 m³ (3,930 cu ft)
300/300ER — 147.0 m³ (5,190 cu ft)

AREAS:
Wings, gross — 283.3 m² (3,050.0 sq ft)
Ailerons (total) — 11.58 m² (124.6 sq ft)
Trailing-edge flaps (total) — 36.88 m² (397.0 sq ft)
Leading-edge slats (total) — 28.30 m² (304.6 sq ft)
Spoilers (total) — 15.83 m² (170.4 sq ft)
Fin — 30.19 m² (325.0 sq ft)
Rudder — 15.95 m² (171.7 sq ft)
Tailplane — 59.88 m² (644.5 sq ft)
Elevators (total) — 7.81 m² (191.7 sq ft)

WEIGHTS AND LOADINGS (A: 767-200 basic/JT9D-7R4D engines, B: 767-200 basic/CF6-80A, C: medium-range version/JT9D-7R4D, D: medium-range version/CF6-80A, E: 767-200ER/PW4050, F: 767-200ER/CF6-80C2B2, G: 767-200ER/PW4056, H: 767-200ER/CF6-80C2B4, J: 767-300/PW4050, K: 767-300/CF6-80C2B2, L: 767-300 higher gross weight version/PW4050, M: 767-300 higher gross weight version/CF6-80C2B2, N: 767-300ER/PW4056, P: 767-300ER/CF6-80C2B4, Q: 767-300ER/PW4060):
Manufacturer's weight empty:
A, C — 74,750 kg (164,800 lb)
B, D — 74,345 kg (163,900 lb)
E — 76,340 kg (168,300 lb)
F — 76,250 kg (168,100 lb)
G — 76,565 kg (168,800 lb)
H — 76,475 kg (168,600 lb)
J, L — 79,560 kg (175,400 lb)
K, M — 79,380 kg (175,000 lb)
N — 80,785 kg (178,100 lb)
P — 80,605 kg (177,700 lb)
Q — 81,375 kg (179,400 lb)
Operating weight empty: A, C — 80,920 kg (178,400 lb)
B, D — 80,510 kg (177,500 lb)
E — 83,550 kg (184,200 lb)
F — 83,460 kg (184,000 lb)
G — 83,780 kg (184,700 lb)
H — 83,690 kg (184,500 lb)
J, L — 87,135 kg (192,100 lb)
K, M — 86,955 kg (191,700 lb)
N — 89,310 kg (196,900 lb)
P — 89,130 kg (196,500 lb)
Q — 89,900 kg (198,200 lb)
Max payload (767-200, 216 passengers, 767-200ER, 174 passengers, 767-300, 261 passengers; 767-300ER, 210 passengers): A, B, C, D — 19,595 kg (43,200 lb)
E, F, G, H — 16,575 kg (36,540 lb)
J, K, L, M — 23,675 kg (52,200 lb)
N, P, Q — 20,005 kg (44,100 lb)
Max fuel weight:
A, B, C, D, J, K, L, M — 51,130 kg (112,725 lb)
E, F — 62,615 kg (138,040 lb)
G, H, N, P, Q — 73,635 kg (162,340 lb)
Max T-O weight: A, B — 136,080 kg (300,000 lb)
C, D — 142,880 kg (315,000 lb)
E, F, J, K — 156,490 kg (345,000 lb)
G, H, N, P — 175,540 kg (387,000 lb)
L, M — 159,210 kg (351,000 lb)
Q — 181,435 kg (400,000 lb)
Max ramp weight: A, B — 136,985 kg (302,000 lb)
C, D — 143,790 kg (317,000 lb)
E, F, J, K — 157,395 kg (347,000 lb)
G, H, N, P — 175,995 kg (388,000 lb)
L, M — 159,665 kg (352,000 lb)
Q — 181,890 kg (401,000 lb)
Max zero-fuel weight: A, B — 112,490 kg (248,000 lb)
C, D — 113,400 kg (250,000 lb)
E, F — 114,755 kg (253,000 lb)
G, H — 117,935 kg (260,000 lb)
J, K, L, M, N, P — 126,100 kg (278,000 lb)
Q — 130,635 kg (288,000 lb)
Max landing weight: A, B — 122,470 kg (270,000 lb)
C, D — 123,375 kg (272,000 lb)
E, F — 126,100 kg (278,000 lb)
G, H — 129,275 kg (285,000 lb)
J, K, L, M, N, P — 136,080 kg (300,000 lb)
Q — 145,150 kg (320,000 lb)
Max wing loading: A, B — 480.24 kg/m² (98.36 lb/sq ft)
C, D — 504.26 kg/m² (103.28 lb/sq ft)
E, F, J, K — 552.25 kg/m² (113.11 lb/sq ft)
G, H, N, P — 619.53 kg/m² (126.89 lb/sq ft)
L, M — 561.87 kg/m² (115.08 lb/sq ft)
Q — 640.33 kg/m² (131.15 lb/sq ft)

PERFORMANCE (at max T-O weight except where indicated):
Normal cruising speed, all versions — Mach 0.80
Approach speed at max landing weight:
A, B, C, D — 136 kts (252 km/h; 157 mph)
E — 138 kts (256 km/h; 159 mph)
F, G, H — 140 kts (259 km/h; 161 mph)
J, K, L, M, N, P — 141 kts (261 km/h; 162 mph)
Q — 145 kts (269 km/h; 167 mph)
Initial cruise altitude: A — 11,950 m (39,200 ft)
B — 12,100 m (39,700 ft)
C — 11,650 m (38,200 ft)
D — 11,800 m (38,700 ft)
E — 11,215 m (36,800 ft)
F — 11,460 m (37,600 ft)
G — 10,925 m (35,850 ft)
H — 10,850 m (35,600 ft)
J, M — 11,250 m (36,900 ft)
K — 11,340 m (37,200 ft)
L — 11,125 m (36,500 ft)
N, P — 10,600 m (34,800 ft)
Q — 10,400 m (34,100 ft)
Service ceiling, OEI: A, C — 6,525 m (21,400 ft)
B, D — 6,430 m (21,100 ft)
E — 6,850 m (22,500 ft)
F — 7,200 m (23,600 ft)
G — 7,250 m (23,800 ft)
H — 7,375 m (24,200 ft)
J, L — 6,035 m (19,800 ft)
K, M — 6,150 m (20,200 ft)
N, P — 6,615 m (21,700 ft)
Q — 6,550 m (21,500 ft)
T-O field length: A, B — 1,798 m (5,900 ft)
C — 1,951 m (6,400 ft)
D — 1,981 m (6,500 ft)
E — 2,347 m (7,700 ft)
F — 2,316 m (7,600 ft)
G, H — 2,774 m (9,100 ft)
J — 2,560 m (8,400 ft)
K — 2,469 m (8,100 ft)
L, M — 2,652 m (8,700 ft)
N — 2,926 m (9,600 ft)
P — 2,956 m (9,700 ft)
Q — 2,774 m (9,100 ft)
Design range: A — 3,160 n miles (5,852 km; 3,636 miles)
B — 3,220 n miles (5,963 km; 3,705 miles)
C — 3,795 n miles (7,028 km; 4,367 miles)
D — 3,850 n miles (7,130 km; 4,430 miles)
E — 5,365 n miles (9,936 km; 6,174 miles)
F — 5,410 n miles (10,019 km; 6,225 miles)
G — 6,770 n miles (12,538 km; 7,791 miles)
H — 6,805 n miles (12,603 km; 7,831 miles)
J — 4,000 n miles (7,408 km; 4,603 miles)
K — 4,020 n miles (7,445 km; 4,626 miles)
L — 4,230 n miles (7,834 km; 4,868 miles)
M — 4,260 n miles (7,889 km; 4,902 miles)
N — 5,740 n miles (10,630 km; 6,605 miles)
P — 5,760 n miles (10,667 km; 6,628 miles)
Q — 6,060 n miles (11,223 km; 6,974 miles)

OPERATIONAL NOISE LEVELS (FAR Pt 36, Stage 3):
T-O at max basic T-O weight: B — 87.1 EPNdB
H — 90.4 EPNdB
Approach at max landing weight: B — 101.6 EPNdB
H — 101.7 EPNdB
Sideline: B — 95.4 EPNdB
H — 96.6 EPNdB

UPDATED

BOEING 767-300 FREIGHTER

TYPE: Freighter version of 767-300ER.

PROGRAMME: First 767 specialised package freighter launched January 1993 by United Parcel Service order, mockup completed early 1994; first flight expected second quarter 1995. The 767-300F for general operation was ordered by Asiana in November 1993 and differs from austere UPS version in having mechanical freight handling on main and lower decks, air conditioning for animals and perishables on main and forward lower decks and more elaborate crew facilities.

CUSTOMERS: UPS ordered 30 (plus 30 options) parcel freighters January 1993, first delivery due October 1995; 11 to follow in 1996. Asiana ordered two 767-300F in November 1993 for delivery in 1996 and 1998.

DESIGN FEATURES: Modifications include reinforced landing gear and internal wing structure, main deck floor strengthened to take 24 containers, no passenger windows, 2.67 × 3.4 m (8 ft 9 in × 11 ft 1¾ in) freight door forward to port, pilot type rating and extensive component commonality with 757 Freighter.

POWER PLANT: In competition between Rolls-Royce RB211-524G and variety of P&W JT9D and PW4000 and GE

CF6-80A and C versions, thrusts between 213.5 kN (48,000 lb) and 269.6 kN (60,600 lb)

DIMENSIONS, INTERNAL:

Main deck container capacity	285.4 m³ (10,080 cu ft)
Lower deck cargo capacity	89.25 m³ (3,153 cu ft)

WEIGHTS AND LOADINGS:

Max payload	50,802 kg (112,000 lb)
Max T-O weight	185,065 kg (408,000 lb)
Planned alternative T-O weight	186,880 kg (412,000 lb)

PERFORMANCE:

Range: with 40,823 kg (90,000 lb) payload
4,000 n miles (7,408 km; 4,603 miles)
with 50,802 kg (112,000 lb) payload
3,000 n miles (5,556 km; 3,452 miles)

UPDATED

BOEING 777

TYPE: Long-range, high-capacity twin-turbofan airliner.

PROGRAMME: Formerly known as 767-X, now 777-200; Boeing board authorised firm offer for sale 8 December 1989; launch order by United Airlines 15 October 1990 (see Customers). Boeing launched production programme of A and B Market 777s and formed 777 Division 29 October 1990; Boeing signed final agreement with Mitsubishi, Kawasaki and Fuji, making them risk sharing programme partners for about 20 per cent of the 777 structure, on 21 May 1991; roll-out occurred 9 April 1994.

First flight (Line no. WA001/N7771), 12 June 1994, WA002 15 July, WA003 2 August, WA004 28 October, WA005 11 November; WA006/G-ZZZA (first with GE90, for British Airways) 2 February 1995, same day as FAA granted engine approval; by mid-February five PW4084- and one GE-90-powered test aircraft then flying had accumulated 1,950 hours of flight time in nearly 1,000 flights. PW-engined aircraft accumulated some 3,235 hours in 2,340 cycles, leading to joint FAA/JAA certification on 19 April 1995; flight test programme included 1,000-cycle service-ready ETOPS trial with aircraft WA004/N773UA fitted with high-time engines to reflect real-world operations, during which it performed eight single-engine diversions, each lasting full 180 minutes. FAA awarded 180 minute ETOPS approval 30 May 1995. United Airlines flight and ground crews partnered Boeing crews for the last 90 cycles of ETOPS trial, operating between representative city pairs on the carrier's routes. First delivery, to United Airlines, on 17 May 1995, service entry with United on 7 June 1995 with inaugural revenue flight (by N777NA) from London to Washington, DC. Second GE90 aircraft for British Airways (WA010/G-ZZZB) scheduled to join WA006 in 1,750 hour, 1,260 cycle test programme, airline personnel partnering Boeing crews on last 90, London-Heathrow-based, sectors of 1,000-cycle ETOPS trial, operating routes to Abu Dhabi, Washington, DC and Newark, New Jersey, certification with GE engine scheduled for August 1995, with deliveries commencing September.

Flight testing of Rolls-Royce Trent 800 on Boeing 747-100 testbed began late March 1995, with first flight of Trent-powered 777 (Boeing test aircraft) in May and Cathay Pacific aircraft in August, two Cathay Pacific aircraft (WA014/VR-HNC and WA019/VR-HND) will perform certification and service readiness trials for Trent, flying 1,700 hours in 1,220 cycles, including 1,000-cycle ETOPS trial operating Hong Kong-Sydney and Hong Kong-Singapore, culminating in certification and first delivery (to Thai International) in January 1996, with ETOPS clearance following two months later. Flight test programme ends March 1996 after planned 7,000 hours in 4,900 cycles; by 21 May 1995, seven aircraft had generated 3,798 hours in 1,973 flights.

CURRENT VERSIONS: **777-200 A Market**: Basic aircraft with maximum T-O weight of 229,520 kg (506,000 lb) and alternative maximum T-O weights 233,600 kg (515,000 lb) and 242,670 kg (535,000 lb); maximum payload 54,930 kg (121,100 lb); twin-aisle cabin layout; 375 to 400 two-class passengers or 305 to 328 three-class passengers or 418 to 440 all-economy depending on choice of nine- or 10-abreast in tourist class and seven- or eight-abreast in business class; range with 375 passengers for three T-O weights respectively 3,930 n miles (7,278 km; 4,522 miles), 4,200 n miles (7,778 km; 4,833 miles) and 4,785 n miles (8,862 km; 5,506 miles).

777-200 B Market: Maximum T-O weight 263,083 kg (580,000 lb) or 267,619 kg (590,000 lb) or 286,897 kg (632,500 lb); maximum payload 54,660 kg (120,500 lb); same passenger capacity as basic aircraft, ranges with 305 passengers for three T-O weights respectively 6,030 nm (11,167 km; 6,939 miles), 6,300 n miles (11,667 km; 7,250 miles) or 7,335 nm (13,584 km; 8,441 miles).

777-200 C Market: Proposed ultra long-range version, with range in excess of 7,000 n miles (12,964 km; 8,055 miles).

777-300: Initially known as 777 Stretch, revealed at Paris Air Show, 14 June 1995, launched by Boeing board 26 June 1995; will feature strengthened airframe, inboard wing and landing gear, and fuselage 10.13 m (33 ft 3 in) longer than that of 777-200 to increase passenger capacity to about 368 in three-class layout, or 550 in high-density configuration; maximum T-O weight 160,000 to 300,000 kg (352,750 to 661,375 lb). Launch commitments for 31 aircraft, valued at $3.1 billion, announced June 1995, comprising: All Nippon Airways (10, with de-rated PW4098 growth engines, for service entry in June 1998), Cathay Pacific Airways (seven, converted from 777-200 orders, with Rolls-Royce Trent 800 engines, for delivery starting May 1998), Korean Airlines (eight, four of which were converted from 777-200 orders, with PW4098 growth engines, for delivery starting June 1998), Thai Airways International (six, with Rolls-Royce Trent 800 engines, for service entry in September 1998). Compared with first-generation 747s, 777-300 carries same number of passengers, but at two-thirds of fuel cost and with 40 per cent less maintenance.

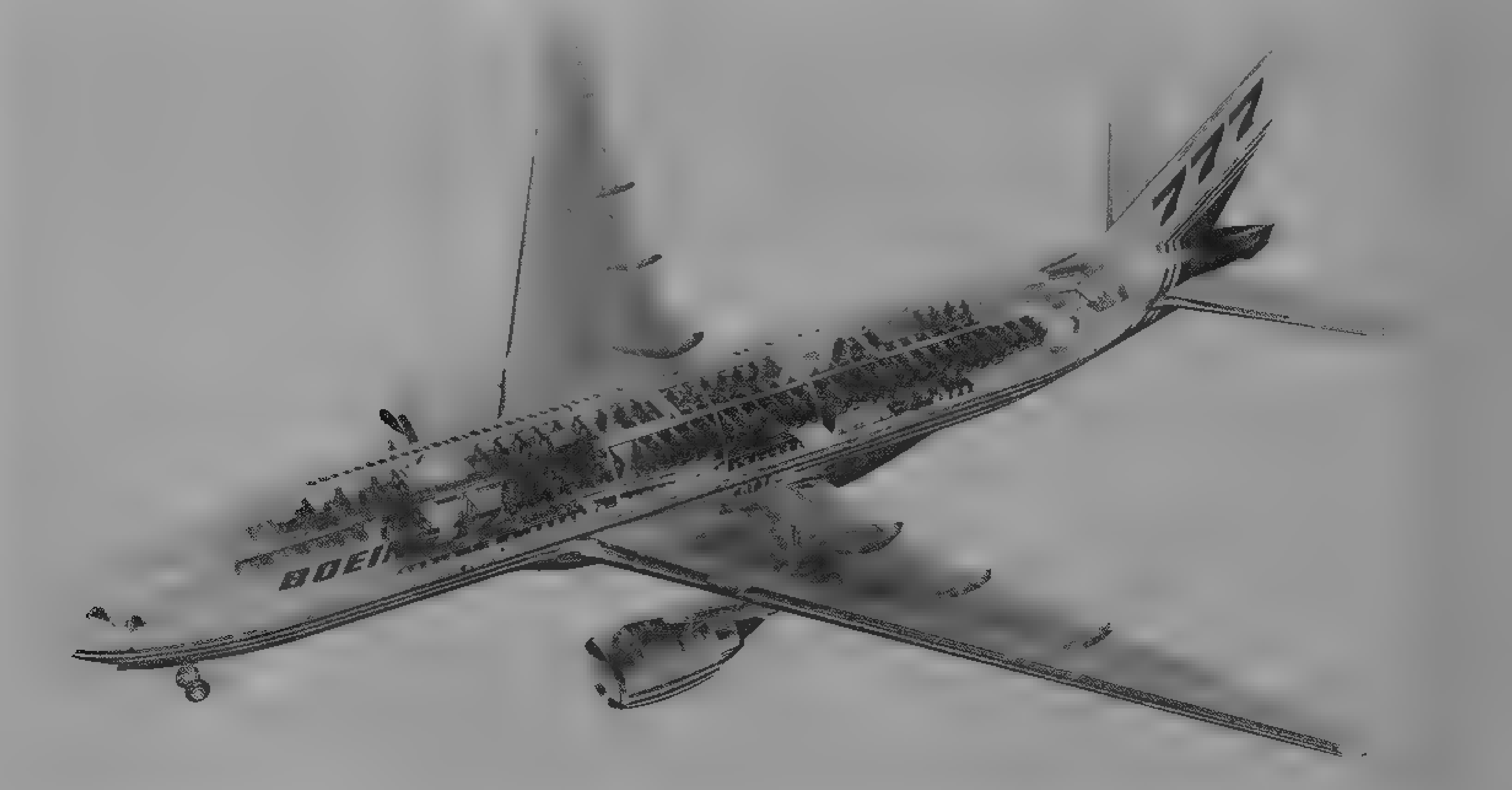
777-100X: Proposed 'shrink' variant, with capacity for 250 passengers, maximum range 8,634 n miles (16,000 km; 9,942 miles); would feature many of the structural modifications of 777-300 and share the same structural weights and engine ratings; launch decision expected by September 1996 with service entry possible by May 1999.

CUSTOMERS: First firm order 34 777-222s plus options for 34 from United Airlines 15 October 1990 (since modified), to be powered by 325 kN (73,000 lb st) Pratt & Whitney PW4073, United version has maximum T-O weight 234,000 kg (515,880 lb) carrying 363 passengers in two classes for up to 4,200 n miles (7,778 km; 4,833 miles), in

BOEING 777-200 ORDER BOOK
(26 June 1995)

Customer	Variant	Engine	First Order	Qty	First Delivery
All Nippon Airways	777-281	PW4074	19 Dec 90	18	Autumn 1995
British Airways	777-236	GE90-B4	21 Aug 91	15	Sep 1995
Cathay Pacific Airways	777-267	RB211 Trent 800	6 May 92	4	Mar 1996
China Southern Airlines	777-200	GE90-B4	17 Dec 92	10	
Continental Airlines	777-200	GE90-B4	12 May 93	5	
Emirates	777-200	RB211 Trent 800	4 Jun 92	7	
Euralair	777-200	GE90-B4	14 Jun 91	2	
EVA Airways	777-200	†	13 Jun 95	4	
ILFC*	777-200	GE90-B4	15 Dec 92	6	
Japan Air System	777-200	PW4074	29 Jun 93	7	
Japan Airlines	777-246	PW4077	24 Jan 92	10	
Korean Air Lines	777-200	PW4090	16 Dec 93	4	
Lauda Air	777-2D7	†	13 Dec 91	4	
Saudia	777-200	†	18 Jun 95	23	1997
Thai Airways	777-200	RB211 Trent 800	20 Jun 91	8	Jan 1996
Transbrasil	777-200	RB211 Trent 800	15 Dec 93	3	
United Airlines	777-222	PW4073	15 Oct 90	34	17 May 1995
Total				**164‡**	

* International Lease Finance Corporation
† Not announced/decided
‡ Not including 777-300 (31 aircraft)



Three-class cabin layout and main structural features of Boeing 777 A Market/B Market

Second Boeing 777 in launch customer United Airliners' livery pictured with the Museum of Flight's Boeing 247

1995

April 1993, four A Market deliveries for 1996 converted to two B Market in 1998 and two in 1999, 11 A Market to be delivered during 1995, other launch customer was All Nippon Airways with 15, plus options for 10 placed 19 December 1990 (PW4074). Disclosed firm Series 200 orders listed in table; Series 300 detailed above

COSTS: Estimated development cost $4 billion (1990); aircraft cost $106 million to 129 million (1991)

DESIGN FEATURES: New wing of 31.6° sweepback at quarter chord incorporates new technology to allow Mach 0.83 cruise in combination with high thickness for economical structure and large internal volume, long span for improved take-off and payload/range and large area for high cruise altitude and low approach speed, no winglets. All features required for 180 minutes ETOPS incorporated and tested in basic aircraft design. Cylindrical fuselage wider than 767 to allow twin aisle seating for from six- to 10-abreast; toilets and overhead baggage bins designed to allow rapid change of layout. Outer 6.48 m (21 ft 3 in) of each wing can, as an option, be folded to vertical to reduce gate width requirement at airports

FLYING CONTROLS: Boeing's first airliner fly-by-wire system; hydraulic fully powered control surface actuators (31) by Teijin Seiki America) electrically signalled from full fly-by-wire system, this signals slats, flaps, spoilers, control feel unit and trimming tailplane as well as inboard flaperons, outboard ailerons, elevators and rudder; system provides flight envelope protection as well as stabilisation and autopilot inputs, but the normal control columns and rudder pedals in cockpit are back driven by the fly-by-wire system to give the pilots direct visual appreciation of the activity of the automatic system

In normal mode, flight guidance commands are generated by Rockwell Collins triple redundant digital autopilot/flight directors and the fly by wire control laws and envelope protection commands are shaped by the GEC-Marconi Avionics triple digital primary flight computers, each of the three primary flight computers contains three 32 bit microprocessors (a Motorola 68040, an Intel 80486 and an AMD 29050), all three programmed in Ada to perform all FBW functions; with power supply and ARINC 629 modules, each microprocessor module constitutes a lane and the three lanes constitute a channel, each lane is compared with the others in its channel, the system not only has high fault tolerance, but allows deferred maintenance, by which failures can be carried over until the next scheduled maintenance

Commands to the powered control units are produced by three Lear Astronics and Teijin Seiki actuator control electronics units, which have a fourth analog channel directly signalled from the sticks and pedals in the cockpit; normal operating mode is for the aircraft to be flown through autopilots, primary flight computers and actuator control electronics, which simultaneously back-drive the sticks and pedals in the cockpit, first degraded (secondary) mode is used if inertial units and standby attitude sensors all become disabled and the pilots take manual control through the digital primary flight computers, second degraded (direct) mode bypasses the main fly-by-wire system with the direct analog link between cockpit and actuator control electronics; ultimate standby is mechanical control of tailplane incidence for the pitch axis and two wing spoiler panels for lateral control. Some powered control units produced by Parker Bertea and Moog, tailplane trim module and hydraulic brake by E Systems

Pitch axis control law is C* U, effectively tending to make the aircraft hold an airspeed and to respond in pitch attitude to a departure from that airspeed, trim changes due to configuration changes are suppressed; the system returns the bank angle to 35° if that angle is exceeded by the pilots and the controls then released, the system prevents exceeding the limiting airspeed and stalling, asymmetric thrust is automatically countered; the variable feel system adjusts control forces to warn of approach to flight envelope limits in manual flight, the fly-by-wire system is linked to the ARINC 629 dual triplex digital databuses (see also aircraft information management system under Avionics heading)

STRUCTURE: Composites of carbon and toughened resin used in skins of tailplane and fin torsion boxes and cabin floor beams; CFRP used for rudder, elevators, ailerons, flaps, engine nacelles and landing gear doors, hybrid composites in wingroot fairing, GFRP in fixed wing leading-edge, tailplane and fin fore and aft panels, wing aft panels, engine pylon fairings and radome. Toughened materials have high damage resistance and allow simple low-temperature bolted repairs. Metal structure includes thick skins without need for tear straps, no bonding; single piece fuselage frames; wing top skin and stringers made in new 7055 aluminium alloy with greater compression strength; 10 per cent of structure weight is composites

Fully digital product definition with all parts created by Dassault/IBM CATIA CAD/CAM and communicated to manufacturing and publications, structure and systems integration, tube and cable run design completed before design release, 238 design/build teams have ensured that design, fabrication and test have proceeded concurrently for structure and systems. Whole aircraft defined in computer system; no mockup built

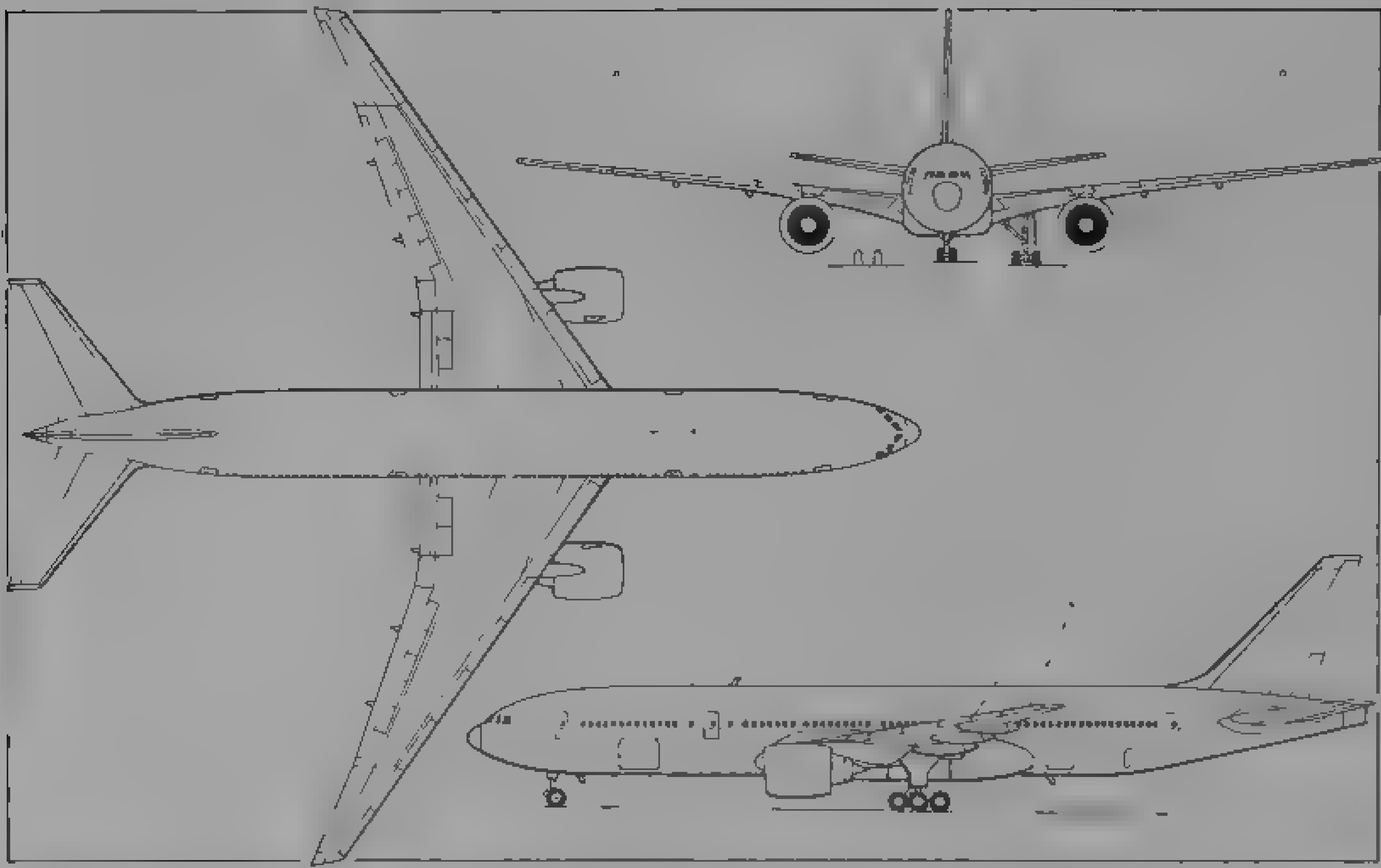
Centre and rear fuselage barrel sections, tailcone, doors, wingroot fairing and landing gear doors made in Japan. Wing and tail leading-edges and moving wing parts, landing gear, floor beams, nose landing gear doors, wingtips, dorsal fin and nose radome made by Rockwell, Northrop Grumman, Kaman, Alenia (Italy), Embraer (Brazil), Short Brothers (UK), Singapore Aerospace Manufacturing, HDH and ASTA (Australia), Korean Air and other subcontractors. Boeing manufactures flight deck and forward cabin, basic wing and tail structures and engine nacelles, assembles and tests completed aircraft

LANDING GEAR: Retractable tricycle type (Menasco/Messier-Bugatti joint design for main gear); two main legs carrying six-wheel bogies with steering rear axles automatically engaged by nose gear steering angle; six-wheel bogies avoid need for third leg in fuselage and simplify braking system, twin-wheel steerable nose gear; Goodyear mainwheel tyres H49 × 19-22 with 32 bias ply rating, Michelin radial nosewheel tyres 44 × 18-18 (24 ply), Bendix Carbenix 4000 mainwheel brakes arranged so that initial toe-pedal pressure used during taxying applies brakes to alternate sets of three wheels to save brake wear, full toe pedal pressure applies all six brakes together

POWER PLANT: 777 A Market at basic and first alternative T-O weights powered by either two P&W PW4074 or two GE GE90-75B or two RR Trent 875; 777 A Market at second alternative maximum T-O weight powered by either two P&W PW4077 or two GE GE90-76B or two RR Trent 877, these engines are variously rated at between 329.17 kN (74,000 lb st) and 342.52 kN (77,000 lb st); 777 B Market at all three alternative T-O weights powered by two P&W PW4084 or two GE GE90-85B or two RR Trent 884 with thrusts in the region of 373.66 kN (84,000 lb), or two PW4090 with thrust in excess of 400.35 kN (90,000 lb st) Growth version of GE90 with 409.24 kN (92,000 lb st) thrust being developed for B Market aircraft with engine certification anticipated in May 1996. All fuel contained in integral tanks in wing torsion box and wing centre-section with reserve tank, surge tank and fuel vent and jettison pipes all inboard of wing fold, combined capacity of main, centre and reserve tanks in A Market 777 is 117,348 litres (31,000 US gallons, 25,813 Imp gallons); B Market 777 fuel capacity is 169,208 litres (44,700 US gallons, 37,220 Imp gallons)

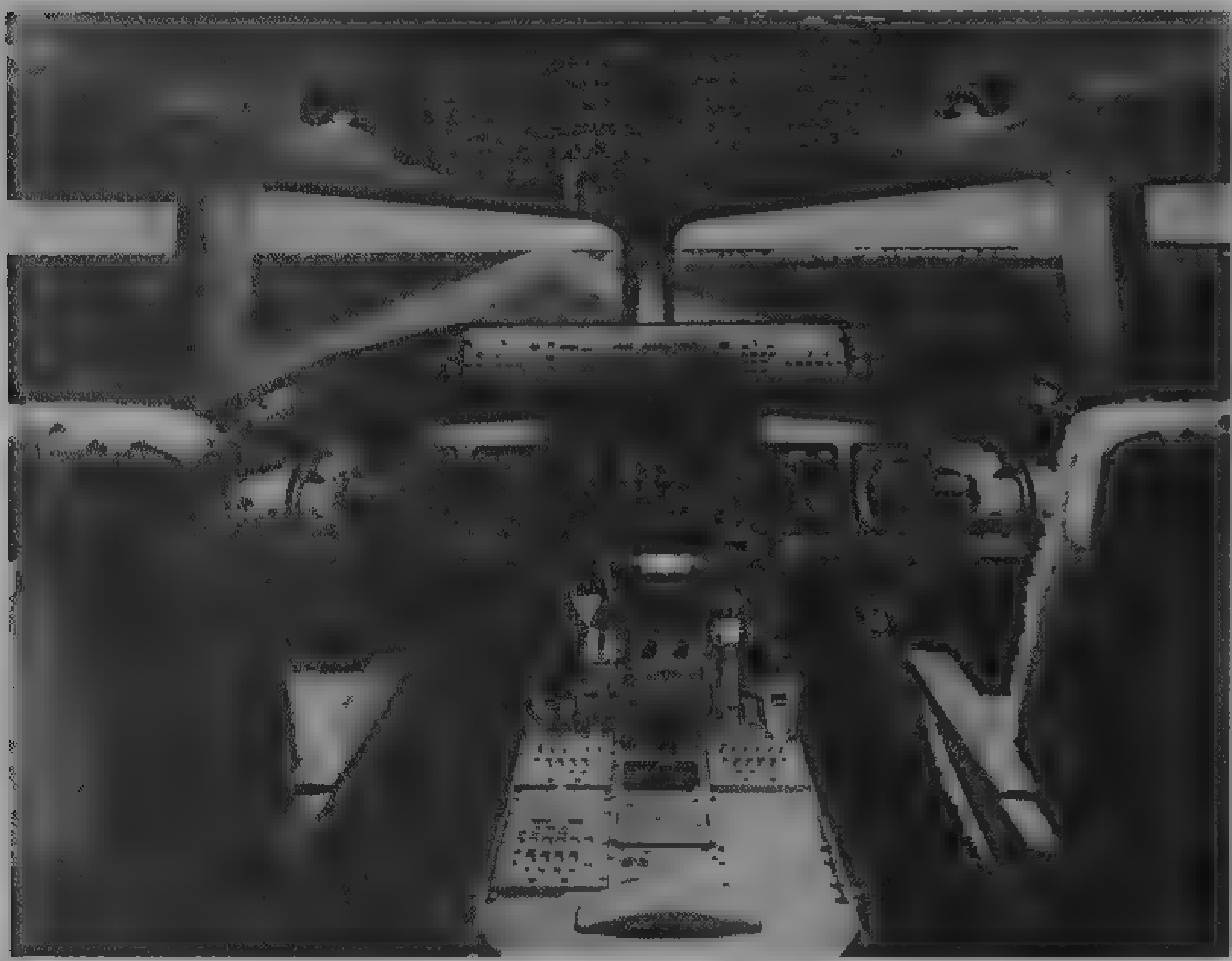
ACCOMMODATION: Two-pilot crew, see under Current Versions for choice of seating capacities, cabin cross-section, which is between that of 747 and 767 (see diagram, Boeing 767 entry), chosen to allow widest selection of twin-aisle class and seating layouts ranging from six- to 10-abreast galleys and toilets can be located at a selection of fixed points in front and rear cabins or freely positioned within large footprints in which they can be moved in 2.5 cm (1 in) increments and attached to prepositioned mounting, plumbing and electric fittings, overhead bins open downward and provide each passenger with 0.08 m³ (3 cu ft) volume; bins can be removed without disturbing ceiling panels, ducts or support structure, advanced cabin management system simplifies cabin management and includes digital sound system of hi-fi quality. Underfloor cargo compartments have mechanical handling system and can accommodate all LD formats and 88 in or 96 in width pallets, up to 33 LD-3 containers plus 17.0 m³ (600 cu ft) bulk cargo can be loaded, optional underfloor crew rest module with same footprint as 96 in pallet contains four bunks, two business class seats and stowage space and requires only electrical connection and hatch in passenger cabin floor

SYSTEMS: AlliedSignal air drive unit, using bleed air from engines, APU or ground supply, drives central hydraulic system, cabin air supply and pressure control by AiResearch. Sundstrand variable-speed, constant frequency AC electrical power generating system, with two 120 kVA integrated drive generators, one APU driven generator and



Boeing 777-200 twin-turbofan high-capacity airliner (*Jane's/Mike Keep*)

1992



Boeing 777 two-man flight deck has five flat panel displays in horizontal row on main panel and two FMS control and display panels and a multifunction display on the centre console

1993

AlliedSignal ram air turbine system AlliedSignal GTCP331-500 APU, Hamilton Standard air conditioning, Smiths Industries ultrasonic fuel quantity gauging system and electrical load management system, optional wingtip folding by E-Systems Montek Division and Frisby Airborne Hydraulics.

AVIONICS: *Radar*: Honeywell weather radar standard.

Flight: Main navigation system is Honeywell air data and inertial reference (ADIRS) containing the Hexad skewed axis arrangement of six ring laser gyros; standby system is the secondary attitude and air data reference unit (SAARU) containing interferometric fibre optic gyros (using light transmitted in two directions along fibre optic paths), which produces a secondary flight director attitude display, airspeed and altimeter, both are linked to the ARINC 629 digital databus, Bendix/King TCAS; Honeywell/Canadian Marconi global navigation satellite sensor with 12-channel receiver, Honeywell/Racal multichannel satcom system optional.

Dual Honeywell aircraft information management system (AIMS) contains the processing equipment required to collect, format and distribute onboard avionic information including the flight management system (FMS), engine thrust control, digital communications management, operation of flight deck displays and monitoring of aircraft condition; both pilots and ground engineers can assess the condition of all onboard avionics systems.

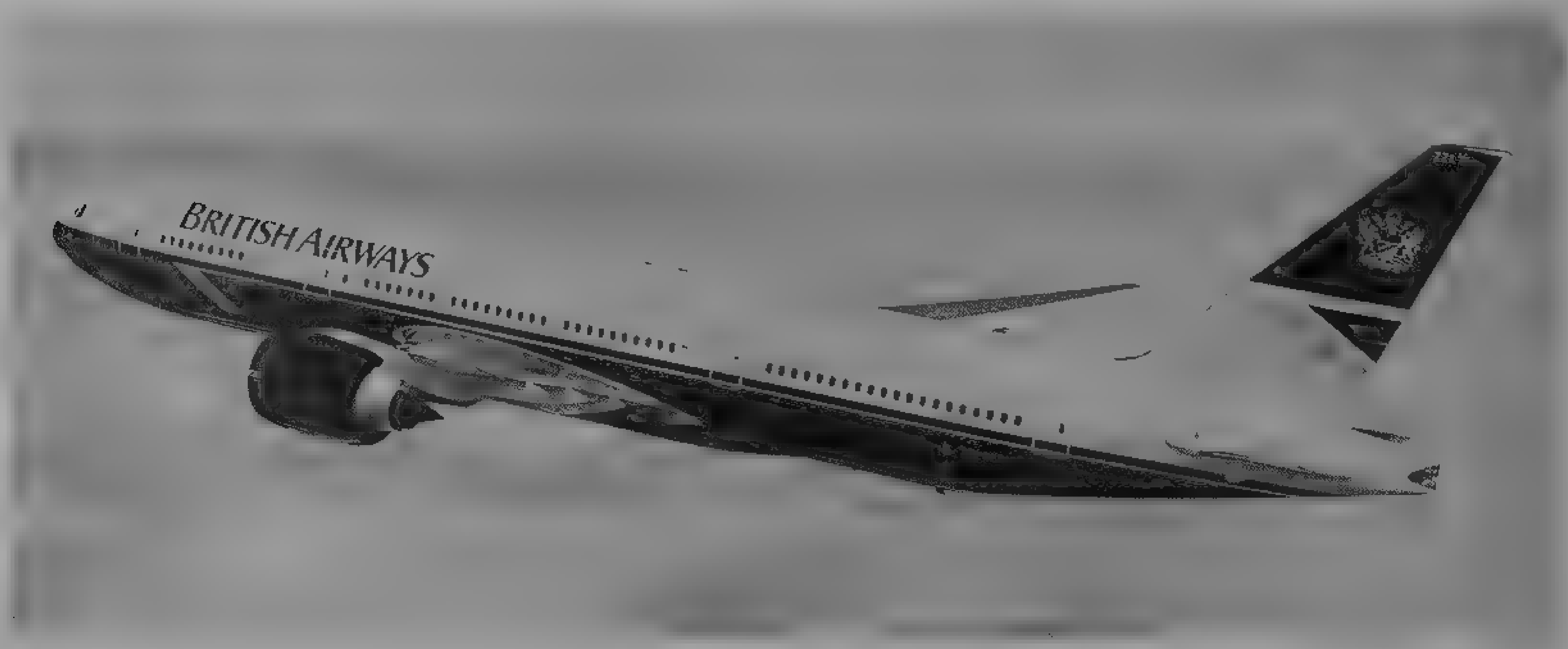
Instrumentation: Based on five-screen EFIS using Honeywell colour liquid crystal flat panel displays (two primary flight displays, two navigation displays and engine indication and crew alerting system display); three multipurpose control and colour display units on centre console provide interface with integrated aircraft information management system, which handles flight management, thrust control and communications control as well as all systems information.

DIMENSIONS, EXTERNAL:

Wing span	60.93 m (199 ft 11 in)
Wing span with tips folded	47.32 m (155 ft 3 in)
Wing aspect ratio	8.68
Length overall: Srs 200	63.73 m (209 ft 1 in)
Srs 300	73.86 m (242 ft 4 in)
Fuselage: Length	62.78 m (205 ft 11½ in)
Max diameter	6.20 m (20 ft 4 in)
Max height: overall	18.51 m (60 ft 9 in)
to tip of folded wing	14.22 m (46 ft 8 in)
Tailplane span	21.52 m (70 ft 7½ in)
Wheelbase	25.88 m (84 ft 11 in)
Wheel track	10.97 m (36 ft 0 in)
Passenger doors (four port, four stbd):	
Height	1.88 m (6 ft 2 in)
Width	1.07 m (3 ft 6 in)
Max height to sill	5.51 m (18 ft 1 in)
Forward cargo door, stbd: Height	1.70 m (5 ft 7 in)
Width	2.72 m (8 ft 11 in)
Max height to sill	3.05 m (10 ft 0 in)
Rear cargo door, stbd, standard:	
Height	1.88 m (6 ft 2 in)
Width	1.78 m (5 ft 10 in)
Max height to sill	3.40 m (11 ft 2 in)
Rear cargo door, stbd, optional: width	2.69 m (8 ft 10 in)
Bulk cargo door, stbd: Height	0.91 m (3 ft 0 in)
Width	1.14 m (3 ft 9 in)
Max height to sill	3.48 m (11 ft 5 in)

DIMENSIONS, INTERNAL:

Cabin: Length	48.97 m (160 ft 8 in)
Max width	5.87 m (19 ft 3 in)
Floor area	279.1 m² (3,004 sq ft)
Max underfloor cargo hold volume	160.16 m³ (5,656 cu ft)



First Boeing 777-236 for British Airways (and first with GE90 engines)

1995

AREAS

Wings, projected	427 8 m² (4,605 0 sq ft)
Horizontal tail surfaces, projected	101 26 m² (1,090 sq ft)
Vertical tail surfaces, projected	53 23 m² (573 sq ft)

WEIGHTS AND LOADINGS (A1, A2, A3: 777-200 A Market, at different max T-O weights. B1, B2, B3: 777-200 B Market, at different max T-O weights):

Operating weight empty: A1, A2	135,580 kg (298,900 lb)
A3	135,875 kg (299,550 lb)
B1, B2	138,120 kg (304,500 lb)
Max payload: A1, A2	54,930 kg (121,100 lb)
A3	54,635 kg (120,450 lb)
B1, B2	54,660 kg (120,500 lb)
Max T-O weight: A1	229,520 kg (506,000 lb)
A2	233,600 kg (515,000 lb)
A3	242,670 kg (535,000 lb)
B1	263,085 kg (580,000 lb)
B2	267,620 kg (590,000 lb)
B3	286,895 kg (632,500 lb)
Max ramp weight allowance: A, B	907 kg (2,000 lb)
Max zero-fuel weight:	
A1, 2, 3	190,510 kg (420,000 lb)
B1, 2, 3	195,045 kg (430,000 lb)
Max landing weight:	
A1, 2, 3	201,850 kg (445,000 lb)
B1, 2, 3	208,650 kg (460,000 lb)
Max fuel weight: A1, 2, 3	94,210 kg (207,700 lb)
B1, 2, 3	135,845 kg (299,490 lb)
Max wing loading: A1, 2, 3	537-566 kg/m² (110-116 lb/sq ft)
B1, 2, 3	615-669 kg/m² (126-137 lb/sq ft)

PERFORMANCE (estimated):

Max cruising speed: A, B	Mach 0.87
Econ cruising speed: A, B	Mach 0.83
Approach speed: A	138 kts (256 km/h; 159 mph)
B	140 kts (259 km/h; 161 mph)
Max certificated altitude: A, B	13,135 m (43,100 ft)
T-O run: A1, 2, 3	2,225-2,469 m (7,300-8,100 ft)
B1, 2, 3	2,652-3,962 m (8,700-13,000 ft)
Landing field length:	
A, B	1,661-1,707 m (5,450-5,600 ft)
Range with 375 two-class passengers: A1	3,970 n miles (7,352 km; 4,568 miles)
A2	4,240 n miles (7,852 km; 4,879 miles)
A3	4,820 n miles (8,926 km; 5,546 miles)
Range with 305 three-class passengers: B1	6,030 n miles (11,168 km; 6,939 miles)
B2	6,300 n miles (11,667 km; 7,250 miles)
B3	7,380 n miles (13,667 km; 8,493 miles)

UPDATED

OTHER AIRCRAFT

Refer to International section for Boeing involvement in the **Ultra High-Capacity Airliner/Very Large Capacity Transport** (UHCA/VLCT) and **Advanced Supersonic Commercial Transport/High Speed Commercial Transport** (ASCT/HSCT) studies. Information on **Boeing 707/720, Boeing 727** and early versions of **Boeing 737** appears in *Jane's Aircraft Upgrades*.

NEW ENTRY

BOEING DEFENSE & SPACE GROUP

PO Box 3999, Seattle, Washington 98124-2499
Telephone: 1 (206) 773 0530
Fax: 1 (206) 773 4261
PRESIDENT: C. G. King
DIRECTOR, PUBLIC RELATIONS AND ADVERTISING:
Peter B. Dakan

In addition to Military Airplanes and Helicopters Divisions, Defense & Space Group controls Electronic Systems Division, Missiles & Space Division and Product Support Division. Major programme activities are the E-3 and 767 airborne warning and control systems (AWACS); partner in F-22 team (see entry for Lockheed Martin F-22A); Inertial Upper Stage rocket motor for Space Shuttle, Avenger air defence system, RAH-66 Comanche combat helicopter (see Boeing Sikorsky entry), B-2 bomber (see Northrop Grumman entry), and V-22 Osprey tilt-rotor aircraft (see Bell/Boeing entry).

UPDATED

ELECTRONIC SYSTEMS DIVISION (Boeing Defense & Space Group)

PO Box 3999, Seattle, Washington 98124
Telephone: 1 (206) 773 0667
Fax: 1 (206) 773 3900
VICE-PRESIDENT AND GENERAL MANAGER: J. Dempster

VERIFIED

BOEING 767AWACS

Japan ASDF designation: E-767

TYPE: Airborne warning and control system successor to E-3.

PROGRAMME: Boeing announced, December 1991, definition studies for modified 767-200ER airliner (which see) with Westinghouse AN/APY-2 radar; project sustained by Japanese interest; engine selection October 1992. Japanese government purchase decision, December 1992, parliamentary approval given early 1993, total requirement for four; first two ordered November 1993; second two in October 1994.

First flight of 'clean' airframe (N767JA, 557th Boeing 767) 10 October 1994 at Seattle, to Wichita, November 1994, for installation of rotodome, new power-generating system and other modifications required by operational equipment, returned to Seattle for equipment integration and flight test, delivery of first two aircraft in 1998, second pair in 1999.

CUSTOMERS: Japan (Model 767-27C), four (two funded in 1993 budget; two in 1994); to be based at Hamamatsu. Boeing anticipates 20 sales, plus further 75 of other military 767 versions.

COSTS: Japan (1993) $840 million for two airframes, systems installation and testing, further $773 million for second pair (1994); unit cost $403 million.

DESIGN FEATURES: See Boeing 767 airliner entry. Additionally, substantial structural modifications (replaced two frames by bulkheads; deepened two frames, reinforced four floor beams) to accommodate rotodome, computer equipment and operators' consoles, ventral fins may be added on rear fuselage. Boeing 767 airframe offers twice floor space and three times internal volume of 707/E-3.

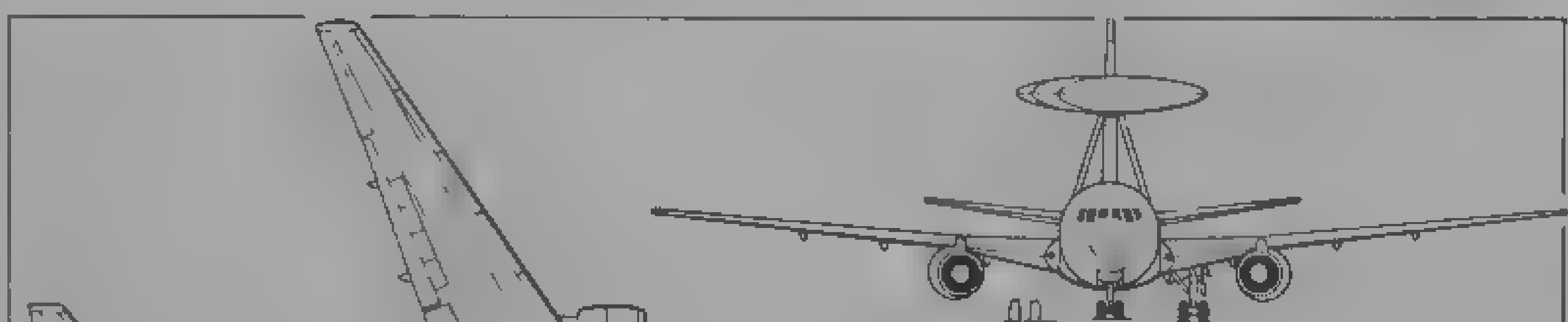
POWER PLANT: Two 273.6 kN (61,500 lb st) General Electric CF6-80C2 turbofans, modified for additional electrical generation. In-flight refuelling receptacle.

ACCOMMODATION: Two-man flight crew, up to 18 mission crew, though latter number can vary for tactical and defence missions. Full crew complement is two pilots, mission director, tactical director, fighter allocator, two weapon controllers, surveillance controller, link manager, seven surveillance operators, communications operator, radar technician, communications technician and computer display technician. Aft of flight deck, from front to rear of fuselage, are communications, data processing and other equipment bays, multipurpose consoles, communications, navigation and identification equipment, and crew rest area, galley and storage space.

SYSTEMS: Two 150 kVA generators on each engine replace single 90 kVA units, total 600 kVA. Typical additional systems in the E-3 Sentry include a liquid cooling system providing protection for the radar transmitter. An air cycle pack system, a draw-through system, and two closed loop ram-cooled environmental control systems to ensure a suitable environment for crew and avionics equipment. Distribution centre for mission equipment power and remote avionics in lower forward cargo compartment. Rear cargo compartment houses radar transmitter. External sockets allow intake of power when aircraft is on ground.

Model of Boeing 767AWACS in flying attitude

1993



AWACS version of Boeing 767 airliner *(Jane's/James Goulding)*

1995

AVIONICS: Based on those of E-3 Sentry, a description of which follows.

Comms: HF, VHF and UHF channels through which information can be transmitted or received in clear or secure mode, in voice or digital form.

Radar: Weather radar in nose. Main system is Westinghouse AN/APY-2, elliptical cross-section rotodome of 9.14 m (30 ft) diameter and 1.83 m (6 ft) maximum depth, mounted above fuselage, comprises four essential elements: a turntable, strut-mounted above rear fuselage, supporting rotary joint assembly to which are attached sliprings for electrical and waveguide continuity between rotodome and fuselage; strengthened centre-section supporting AN/APY-2 surveillance radar and IFF/TADIL-C antennae, radomes, auxiliary equipment for radar operation and environmental control of the rotodome interior liquid cooling of the radar antennae, and two radomes of multilayer glassfibre sandwich material, one for surveillance radar and one for IFF/TADIL-C array. In operation,

Cutaway model of Boeing 767AWACS showing four-abreast operators' consoles and other internal features

1994

rotodome is hydraulically driven at 6 rpm, but during non-operational flights it is rotated at only 1/4 rpm, to keep bearings lubricated

Radar operates in E/F-band and can function as both a pulse and/or a pulse Doppler radar for detection of aircraft targets. A similar pulse radar mode with additional pulse compression and sea clutter adaptive processing is used to detect maritime/ship traffic. Radar is operable in six modes PDNES (pulse Doppler non-elevation scan), when range is paramount to elevation data PDES (pulse Doppler elevation scan) providing elevation data with some loss of range, BTH (beyond the horizon), giving long-range detection with no elevation data, Maritime, for detection of surface vessels in various sea states Interleaved, combining available modes for all-altitude longer range aircraft detection, or for both aircraft and ship detection; and Passive, which tracks enemy ECM sources without transmission-induced vulnerability. Radar antennae, spanning about 7 32 m (24 ft), and 1.52 m (5 ft) deep, scan mechanically in azimuth, and electronically from ground level up into the stratosphere

Flight: Navigation by two modified Litton LN 100G INS/GPS platforms, providing position and velocity data

Mission Heart of the data processing capability is an IBM CC-2E computer with a main storage capacity of 3,145,725 words Data display and control are provided by Hazeltine high resolution colour situation display consoles (SDC) and auxiliary display units (ADU)

Identification is based on an Eaton (AIL) AN/APX 103 interrogator set with airborne IFF interrogator with AIMS Mk X SIF air traffic control and Mk XII military identification friend or foe (IFF) in a single integrated system Simultaneous Mk X and Mk XII multitarget and multimode operations allow the operator to obtain instantaneously the range, azimuth and elevation, code identification, and IFF status, of all targets within radar range. Options include AN/AYR-1 ESM, IRCM, Satcom, JTIDS and Have Quick secure radios

DIMENSIONS, EXTERNAL

Wing span	47 57 m (156 ft 1 in)
Length overall	48 51 m (159 ft 2 in)
Height overall	15 85 m (52 ft 0 in)
Radome diameter	9.14 m (30 ft 0 in)
thickness	1 83 m (6 ft 0 in)

WEIGHTS AND LOADINGS

Max T-O weight	171,255 kg (377,550 lb)

PERFORMANCE (estimated)

Max cruising speed	more than 434 kts (805 km/h; 500 mph)
Service ceiling	10,360-13,100 m (34,000-43,000 ft)
Range, unrefuelled	4,500-5,000 n miles (8,334-9,260 km; 5 178-5,754 miles)
Endurance	
at 1,000 n mile (1,852 km, 1,151 mile) radius	7 h
at 300 n mile (556 km, 345 mile) radius	10 h
with in-flight refuelling	22 h

UPDATED

BOEING HELICOPTERS (Boeing Defense & Space Group, Helicopters Division)

PO Box 16858 Philadelphia, Pennsylvania 19142-0858
Telephone 1 (610) 591 2700
Fax 1 (610) 591 2701

PRESIDENT AND GENERAL MANAGER Denton Hanford

VICE PRESIDENT RESEARCH AND ENGINEERING
William Walls

PUBLIC RELATIONS MANAGER Jack Satterfield

Vertol Aircraft Corporation (formerly Piasecki Helicopter Corporation) purchased in 1960, becoming Vertol Division of Boeing, now Boeing Defense & Space Group (Helicopters Division) Produced more than 2,500 tandem-rotor helicopters for US military services and export Main production programme, modernisation of early CH 47s to CH 47D for US Army and new production of International Chinooks

Boeing Helicopters teamed with Bell Helicopter Textron in V-22 Osprey programme (see Bell/Boeing entry). Joined with Sikorsky Aircraft 3 June 1985 to compete for US Army LH (RAH-66 Comanche) light helicopter, with Boeing integrating avionics; declared competition winner in April 1991 (see under separate Boeing Sikorsky entry for details). All-composite rotor blade for Bell UH 1H developed for US Army; first blade delivered June 1989 to Army Engineering Flight Agency for interchangeability check with Bell produced blade

Boeing Helicopters produces fixed leading-edge components for Boeing 747/757/767/777 and metal leading-edge slats for 757

Manufacturing plant at Ridley Township, Pennsylvania, has 325,150 m² (3,500,000 sq ft) of covered floor space, flight test centre at Greater Wilmington, Delaware, has 8,565 m² (92,200 sq ft) An 11,055 m² (119,000 sq ft) development facility and 17,465 m² (188 000 sq ft) office/laboratory/computer centre added at Ridley Township early 1987

UPDATED

BOEING 114 and 414

US Army designations CH-47 and MH-47 Chinook
Royal Air Force designations Chinook HC. Mk 2 and HC. Mk 3
Spanish Army designation HT 17

TYPE Tandem-rotor, twin-turbine transport helicopter

PROGRAMME. Design of all-weather medium transport helicopter for US Army began 1956 first flight of first of five YCH-47As 21 September 1961; for details of CH-47A (354 built for US Army) and CH 47B (108 built for US Army) see 1974-75 *Jane's* Performance increased in CH-47C by uprated transmissions and 2,796 kW (3,750 shp) T55 L-11A, integral fuel capacity increased to 3,944 litres (1,042 US gallons; 867 6 Imp gallons), first flight 14 October 1967, 270 delivered to US Army from Spring 1968, 182 US Army CH 47Cs retrofitted with composite rotor blades; integral spar inspection system (ISIS) introduced 1973 together with crashworthy fuel system retrofit kit full details in 1980-81 *Jane's*. Transmissions of some As and Bs upgraded to CH 47C standard

CURRENT VERSIONS **CH-47D:** US Army contract to modify one each of CH-47A, B and C to prototype Ds placed 1976 first flight 11 May 1979 first production contract October 1980; first flight 26 February 1982 first delivery 31 March 1982; initial operational capability (IOC) achieved 28 February 1984 with 101st Airborne Division, second multi-year production contract for 144 CH-47Ds awarded 13 January 1989, bringing total CH 47D (and MH 47E) ordered to 472, further two Gulf War attrition replacements authorised August 1992 (these new build), seven ex Australian rebuilds funded June 1993 for delivery January to November 1995; deliveries reached 447 CH 47Cs by December 1993, with completion of main programme US regular Army deliveries mostly completed October 1990 with 17th operating unit (C Company, 228th Aviation Regiment, Fort Wainright, Alaska); remainder of CH 47Ds for Army Reserve and National Guard by late 1993; deliveries to National Guard (Texas) began 1988

CH 47D update included strip down to bare airframe, repair and refurbish, fit AlliedSignal T55 L-712 turboshafts, uprated transmissions with integral lubrication and cooling, composite rotor blades, new flight deck compatible with night vision goggles (NVG), new redundant electrical system, modular hydraulic system, advanced automatic flight control system, improved avionics and survivability equipment, Solar T62 T 2B APU operating hydraulic and electrical systems through accessory gear drive, single-point pressure refuelling, and triple external cargo hooks Principal external change is large, rectangular air intake in leading-edge of rear sail Composites account for 10 to 15 per cent of structure. About 300 suppliers involved

At maximum gross weight of 22,680 kg (50,000 lb), CH 47D has more than double useful load of CH-47A Sample loads include M198 towed 155 mm howitzer,

CH-47D FUNDING

FY	Qty	First aircraft	
81	9	81-23381	
82	19	82 23762	
83	24	83-24102	
84	36*	84-24152	
85	48	85 24322	MYP1
86	48	86-1635	MYP1
87	48	87-0069	MYP1
88	48†	88-0062	MYP1
89	48	89 0130	MYP1
90	47	90-0180	MYP2
91	42	91 0230	MYP2
92	30	92-0280	MYP2
	2	92-	
93	7²	93-	
Sub-total	**456**		
Prototypes	**3**		
Total	**459**		

*One crashed on test
†One to YMH-47E

Notes: All except prototypes issued with new serial numbers on remanufacture to CH-47D

MYP1 First multiyear procurement contract, 8 April 1985

MYP2 Second MYP, 13 January 1989 (MH-47Es listed separately)

¹ Gulf War attrition replacements, 2 August 1992 (are sole new build aircraft in this table)

² Former Australian Air Force CH-47Cs, contract 2 June 1993

32 rounds of ammunition and 11-man crew, making internal/external load of 9,980 kg (22,000 lb); D5 caterpillar bulldozer weighing 11,225 kg (24,750 lb) on centre cargo hook. US Army Milvan supply containers carried at up to 130 knots (256 km/h; 159 mph); up to seven 1,893 litre (500 US gallon, 416 Imp gallon), 1,587 kg (3,500 lb) rubber fuel blivets carried on three hooks. Four CH-47Ds converted for in flight refuelling from C-130 at up to 120 knots (222 km/h, 138 mph) by day and night and in moderate turbulence, approved July 1988, graphite fuel boom at lower starboard side contains telescoping aluminium tube and can accept flow rate of 568 litres (150 US gallons, 125 Imp gallons)/min to refuel completely in 6 minutes, first delivery to US Army July 1988. Test programme begins late 1995 of Chinook with vibration-reducing dynamically tuned fuselage.

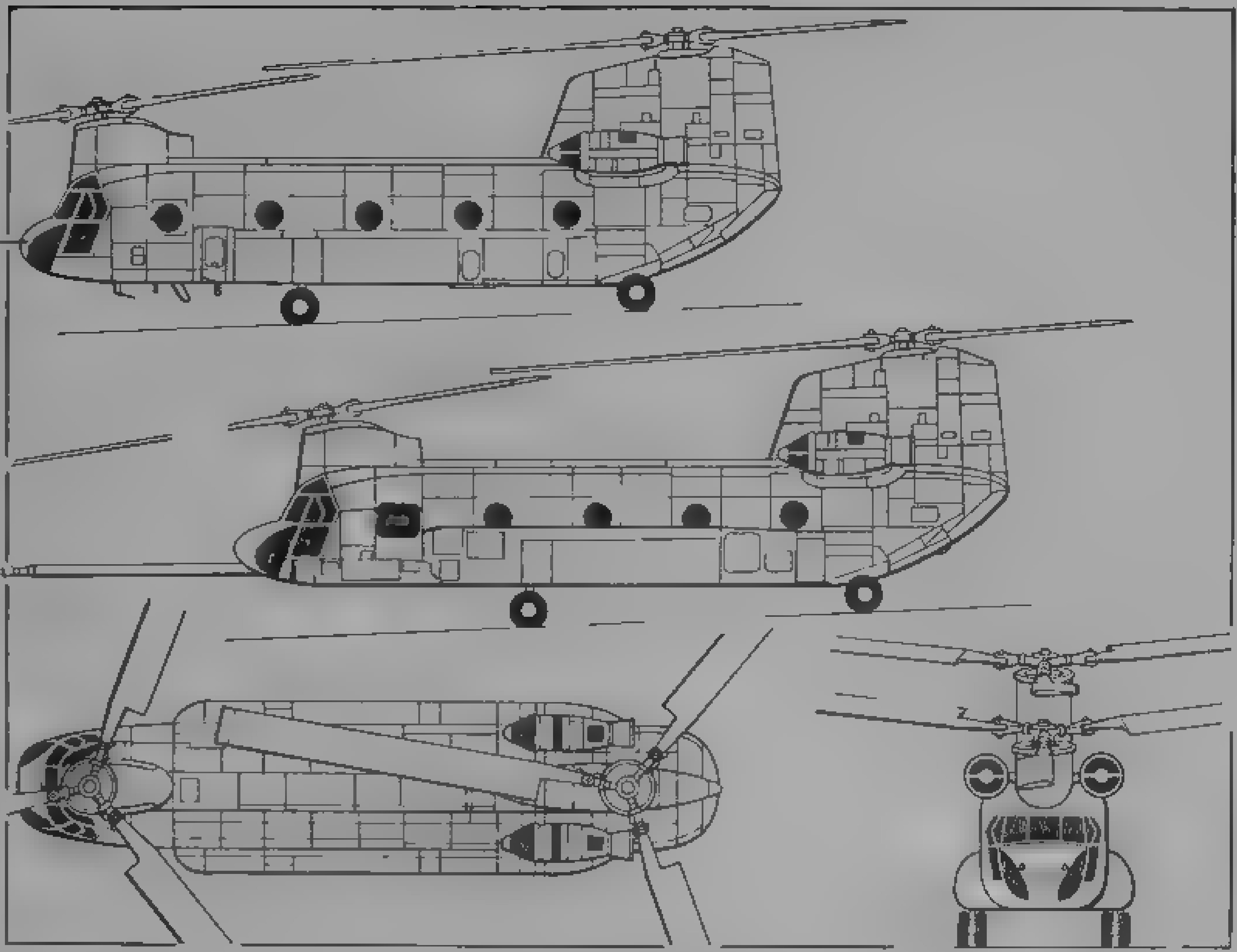
CH/MH-47D Special Operations Aircraft: Two battalions of 160th Special Operations Aviation Regiment (at Fort Campbell, Kentucky, and Hunter AAF, Georgia) equipped pending availability of MH-47E with 32 **CH-47D SOA** fitted with refuelling probes (first refuelling July 1988), thermal imagers, Bendix/King RDR-1300 weather radar, improved communications and navigation equipment, and two pintle-mounted 7.62 mm machine guns. Navigator/commander's station fitted in some SOAs. At least two (83-24110 and 83-24118) converted to **MH-47D**.

GCH-47D: At least 12 Chinooks grounded for engineer training.

JCH-47D: Two CH-47Ds modified for special testing.

MH-47E: Special Forces variant, planned procurement 51, deducted from total 472 CH-47D conversions, prototype development contract 2 December 1987; long lead items for next 11 helicopters authorised 14 July 1989, firm order for 11, plus option on next 14, awarded 30 June 1991, Lot 2 (14 helicopters) confirmed 23 June 1992, total 26 firm orders, plus further 25 required. Prototype (88-0267) flew 1 June 1990; delivered 10 May 1991; initial production aircraft (90-0414) flown 1992, first 11 (of 24 intended) originally due to be delivered from November 1992 to 2 Battalion of 160th Special Operations Aviation Regiment at Fort Campbell, Kentucky. Later helicopters earmarked for 3 Battalion/160 SOAR at Hunter AAF, Georgia, and 1/245th Aviation Battalion (SOA), Oklahoma National Guard, Lexington (eight and 16 MH-47Es respectively). Following mission software problems, deliveries began January 1994 with 91-0498 to Fort Campbell, last of 25 received April 1995.

Mission profile 5½ hour covert deep penetration over 300 n mile (560 km; 345 mile) radius in adverse weather, day or night, all terrain with 90 per cent success probability. Requirements include self-deployment to Europe in stages of up to 1,200 n miles (2,222 km, 1,381 miles), 44-troop capacity, powerful defensive weapons and ECM. Equipment includes IBM-Bendix/King integrated avionics with four-screen NVG compatible EFIS; dual MIL-STD-1553 digital databuses; AN/ASN-145 AHRS, jamming-resistant radios, Rockwell Collins CP1516-ASQ automatic target handoff system, inertial AN/ASN-137 Doppler, Rockwell Collins AN/ASN-149(V)2 GPS receiver and terrain-referenced positioning navigation systems; Rockwell Collins ADF-149, laser (Perkin-Elmer AN/AVR-2), radar (E-Systems AN/APR-39A) and missile (Honeywell AN/AAR-47) warning systems, ITT AN/ALQ-136(V) pulse jammer and Northrop Grumman AN/ALQ-162 CW jammer; Tracor M-130 chaff/flare dispensers; Texas Instruments AN/APQ-174A radar with modes for terrain-following down to 30 m (100 ft), terrain-avoidance, air-to-ground ranging and ground-mapping, Hughes AN/AAQ-16 FLIR in chin turret, digital moving map display, uprated T55-L-714 turboshafts with FADEC, increased fuel capacity; additional troop seating (44 maximum), OBOGS, rotor brake; 272 kg (600 lb) rescue hoist with 61 m (200 ft) usable cable, two M-2 0.50 in window mounted machine guns (port forward, starboard aft), provisions for Stinger AAMs using FLIR for sighting. This system largely common with equivalent Sikorsky MH-60K (which see).



Boeing CH-47D military transport helicopter with additional side view (lower) of MH-47E special forces' variant *(Jane's/James Goulding)*

1995

MH-47E has nose of Commercial Chinook to allow for weather radar, if needed; forward landing gear moved 1.02 m (3 ft 4 in) forward to allow for all-composite external fuel pods (also from Commercial Chinook) that double fuel capacity; Brooks & Perkins internal cargo handling system. See also Chinook HC. Mk 3, below.

MH-47E FUNDING

FY	Qty	First aircraft
90	1	90-0414
91	6	91-0496
92	4	92-0400
93	14	93-
Total	25	

Notes: All included in MYP2 (see CH-47D Funding). Excludes prototype (88-0267), counted in CH-47D total

Chinook HC. Mk 2: RAF version; Mk 1 designation CH-47-352, all survivors of original 41 HC. Mk 1s upgraded to HC. Mk 1B (see 1989-90 and earlier *Jane's*): UK MoD authorised Boeing to update 33 (later reduced to 32) Mk 1Bs to Mk 2, equivalent to CH-47D, October 1989; changes include new automatic flight control system, updated modular hydraulics, T55-L-712F power plants, stronger transmission, improved Solar 71 kW (95 shp) T62-T-2B APU, airframe reinforcements, low IR paint scheme, long-range fuel system and standardisation of defensive aids package (IR jammers, chaff/flare dispensers, missile approach warning and machine gun mountings). Requirement exists for FLIR. Conversion continued from 1991 to July 1995. Chinook HC. Mk 1B ZA718 began flight testing Chandler Evans/Hawker Siddeley dual-channel FADEC system for Mk 2 in October 1989. Same helicopter to Boeing, March 1991, rolled out as first Mk 2 19 January 1993, arrived RAF Odiham 20 May 1993. C(A) clearance November 1993. Initial deliveries pooled at Odiham by Nos. 7 and 27 (Reserve) Squadrons, latter for training, first delivery to No. 18 Squadron at Laarbruch, Germany, 1 February 1994, to No. 78 Squadron, Falkland Islands, February 1994. Final Mk 1 withdrawn from service, May 1994, at which time 11 Mk 2s received. Further three new-build Mk 2s ordered 1993, for delivery from mid-1995, decision to order further 14 Mks 2/3 announced March 1995, total RAF procurement 58 CH-47C/D/Es.

Chinook HC. Mk 3: Nine of 14 additional RAF Chinooks announced March 1995 assigned to Special Forces, configuration not disclosed, but expected to be similar to MH-47E.

HT 17 Chinook: Spanish Army version.

Boeing 234: Commercial version, now out of production, described in 1991-92 *Jane's*.

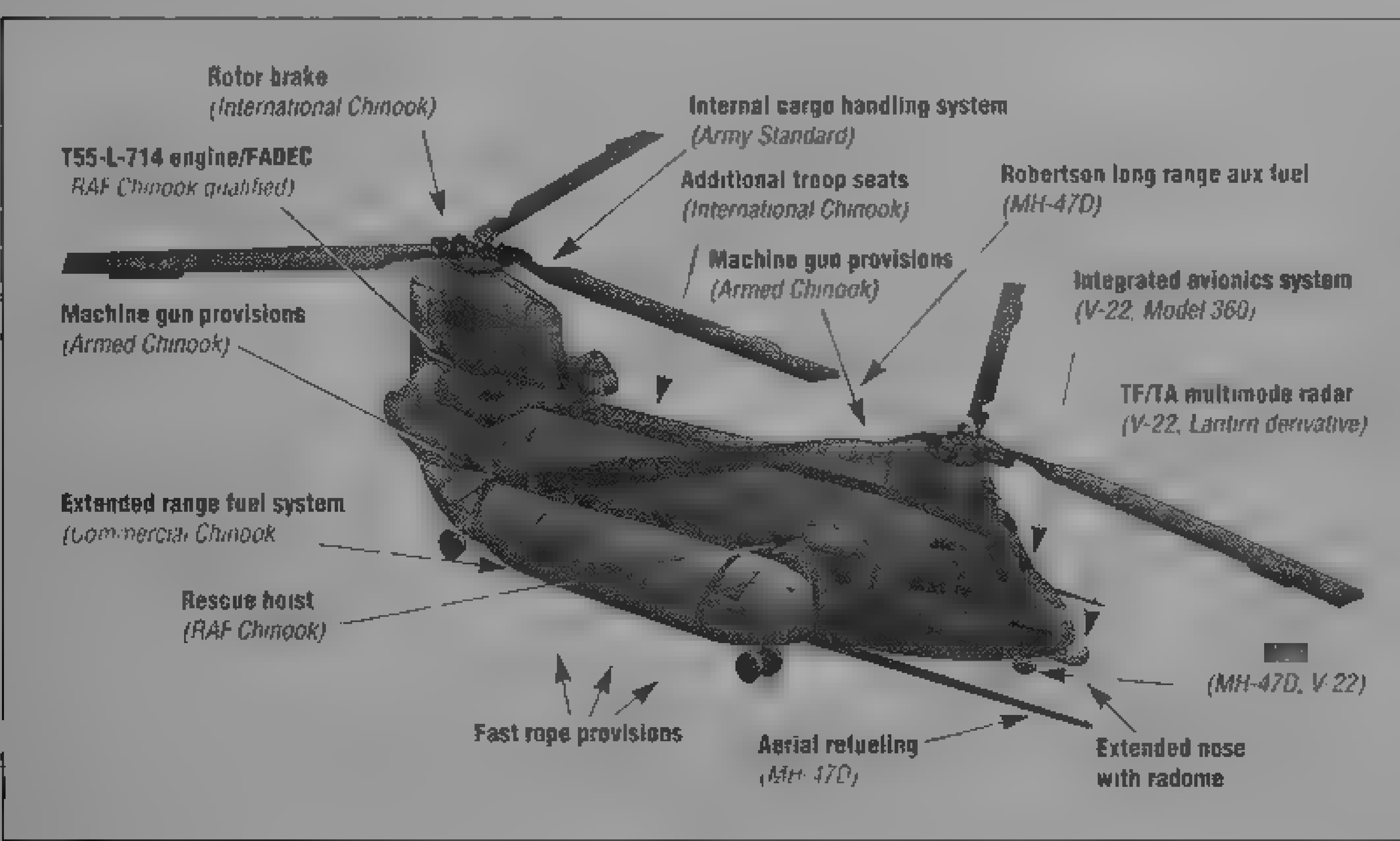
Boeing 414: Export military version, described in 1985-86 *Jane's*. Superseded by CH-47D International Chinook (see below).

CH-47D International Chinook: Boeing 414-100 first sold to Japan, Japan Defence Agency ordered two for JGSDF and one for JASDF Spring 1984, first flight (N7425H) January 1986 and with second machine, delivered to Kawasaki April 1986 for fitting out; co-production arrangement (see under Japan: Kawasaki **CH-47J**), by Spring 1995, 16 firm orders for JASDF and 40 for JGSDF. International Chinook available in four versions with combinations of standard or long-range (MH-47E type) fuel tanks and T55-L-712 SSB or T55-L-714.

CH-47F Advanced Chinook: Chinook upgrade study with 3,729 kW (5,000 shp) class engines, redesigned rotor blades and hubs, and additional (MH-47E) fuel.

CUSTOMERS: Total 732 CH-47A/B/C built and 479 CH-47D/MH-47E conversions authorised for US Army, excluding two new build Gulf War attrition replacements.

Exports (see also rapid reference table) include five CH-47Cs to Argentina (three air force; two army); Australia 12 CH-47Cs with crashworthy fuel system (four refurbished as CH-47D and redelivered from May 1995 to C Squadron of army's 5 Aviation Regiment at Townsville, seven sold to US Army for conversion), Canada nine CH-47Cs designated **CH-147**, delivered from September 1974 (details in 1985-86 *Jane's*), but withdrawn from use and seven sold to Netherlands in July 1993, Japan (two CH-47D International Chinooks, plus six kits to initiate licence production), Netherlands, six ordered in December 1993 for delivery in 1998-99, plus seven ex-Canadian CH-147s upgraded to CH-47D by Boeing and redelivered from 1995, Spanish



Operational enhancements to the MH-47E have been obtained from other programmes at low risk

1995

CHINOOK PRODUCTION

Customer	Boeing	Boeing kits	Agusta	Kawasaki
Civilian	13		6	
Argentina	5			
Australia	12			
Canada	9			
Egypt			15	
Greece			10	
Iran		38	30	
Italy		2	35	
Japan	2	6		48†
Libya			20	
Morocco			9	
Netherlands	6†			
Singapore	6†			
South Korea	24			
Spain	19			
Taiwan	3*			
Thailand	6			
UK (RAF)	58†			
US Army	734		11	
(Total 1,127)	**897**	**46**	**136**	**48**
Rebuilds				
Australia	4			
Greece	9			
Italy			23	
Netherlands	7†			
Spain	9			
UK (RAF)	[illegible]			
US Army	479			
(Total 563)	**540**		**23**	

*Civilian standard
†Deliveries in progress

Army 19, designated HT 17, of which 10 CH-47Cs (one lost) and nine CH-47D International Chinooks delivered to 5th Helicopter Transport Battalion (Bheltra-V) at Colmenar Viejo, Madrid (last six have Bendix King RDR-1400 weather radar), original nine upgraded by Boeing in USA to CH-47D between August 1990 and mid-1993, first redelivery to Spain on 27 September 1991, South Korea, total 24 International Chinooks, comprising 18 for army (six ordered 1987 plus 12 in 1988; deliveries from 1988) and six for air force (ordered early 1990; delivered by February 1992); Singapore, six ordered April 1994 for delivery in 1996-97; Taiwan (three, notionally civil Boeing 234MLR); Thailand, 12 for army (three ordered August 1988, three early 1990, deliveries 1990 to February 1992, all are International Chinook); UK (58, see entry for Chinook HC. Mk 2), 19 civilian, of which few left operating in original oilfield support role; two for trials; 46 in kits, comprising 40 for Italy and six for Japan

MH-47E special forces' variant of Chinook

1995

Agusta sold licence-built CH-47Cs to Egypt (15) Greece (10, of which nine converted to CH-47D by Boeing between March 1992 and 1995, first redelivery in October 1993), Iran (68), Italy (37, including 10 CH-47C Plus, to which standard 23 earlier helicopters converted, refer Italy), Libya (20), Morocco (nine) and Pennsylvania Army National Guard (11). Further six Italian helicopters to Civil Protection Agency. Kawasaki (which see) has firm orders for 56 (air force 16, army 40)

Total Chinook orders, including civil, 1,127. Six CH-47Ds, ordered by China January 1989, embargoed by US government

COSTS: First US Army MYP (1985) $1,200 million for 240 upgrades from CH-47C, second MYP (1989) $773 million for 144 upgrades, $67 million (1993) for 11 upgrades (four Australian Army, seven US Army); approximately $20 million for two new build CH-47Ds (1992)

MH-47E. $81 8 million (placed 1987) for development of MH-47E and conversion of one prototype, $422 million (1989-91) for 11 MH-47Es and option on further 14. £140 million upgrade for RAF aircraft (32 to Mk 2 standard, 1993-95

DESIGN FEATURES: Two three-blade intermeshing contrarotating tandem rotors; front rotor turns anti-clockwise, viewed from above; rotor transmissions driven by connecting shafts from combiner gearbox, which is driven by rear-mounted engines. Classic rotor heads with flapping and drag hinges, manually foldable blades, using Boeing Helicopters VR7 and VR8 aerofoils with cambered leading-edges; blades can survive hits from 23 mm HEI and API rounds, rotor brake optional. Constant cross-section cabin with side door at front, rear-loading ramp that can be opened in flight, underfloor section sealed to give flotation after water landing; access to flight deck from cabin, main cargo hook mounting covered by removable floor panel so that load can be observed in flight

FLYING CONTROLS: Differential fore and aft cyclic for pitch attitude control, differential lateral cyclic pitch (from rud-

RAF Chinook HC. Mk 2 conversion from Mk 1 *(Paul Jackson)*

1995

US ARMY CH-47D CHINOOK WEIGHTS AND PERFORMANCE

	Condition 1	Condition 2	Condition 3	Condition 4
Take-off condition				
Altitude	1,220 m (4,000 ft)	Sea level	1,220 m (4,000 ft)	Sea level
Temperature	35°C (95°F)	15°C (59°F)	35°C (95°F)	15°C (59°F)
Empty weight	10,615 kg (23,402 lb)	10,615 kg (23,402 lb)	10,538 kg (23,232 lb)	10,151 kg (22,379 lb)
T-O weight	19,178 kg (42,280 lb)	22,679 kg (50,000 lb)	19,657 kg (43,336 lb)	22,679 kg (50,000 lb)
Payload: external	6,968 kg (15,362 lb)	10,341 kg (22,798 lb)	—	
internal	—		6,308 kg (13,907 lb)	—
Max level speed, S/L, ISA, max continuous power, no external load	161 kts (298 km/h, 185 mph)	161 kts (298 km/h, 185 mph)	154 kts (285 km/h, 177 mph)	
Average cruising speed	120 kts (222 km/h, 138 mph)	132 kts (245 km/h, 152 mph)	134 kts (248 km/h, 154 mph)	138 kts (256 km/h, 159 mph)
Max rate of climb, S/L, ISA, intermediate rated power	669 m (2,195 ft)/min	464 m (1,522 ft)/min	640 m (2,100 ft)/min	464 m (1,522 ft)/min
Hovering ceiling OGE, ISA, max power	3,215 m (10,550 ft)	1,524 m (5,000 ft)	2,972 m (9,750 ft)	1,524 m (5,000 ft)
Mission radius	30 n miles (55.5 km, 34.5 miles)	30 n miles (55.5 km, 34.5 miles)	100 n miles (185 km, 115 miles)	
Ferry range				1,093 n miles (2,026 km, 1,259 miles)

Condition 1
T-O weight is gross weight for 61 m (200 ft)/min vertical rate of climb to hover OGE at 1,220 m/35°C (4,000 ft/95°F). External payload is carried outbound only. Fuel reserve is 30 minutes cruise fuel. Maximum speed shown is at T-O weight less external payload

Condition 2
T-O gross weight is maximum structural T-O weight for which vertical climb capability at S/L, ISA is 271 m (890 ft)/min. Otherwise same as Condition 1

Condition 3
T-O weight is gross weight for hover OGE at 1,220 m/35°C (4,000 ft/95°F). Radius is with inbound payload 50 per cent of outbound internal payload. Fuel reserve is 30 minutes cruise fuel. Maximum speed shown is at T-O weight

Condition 4
T-O weight is maximum structural T-O weight. Maximum ferry range (internal and external auxiliary fuel). Optimum cruise climb to 2,440 m (8,000 ft) and complete cruise at 2,440 m (8,000 ft). Fuel reserve is 10 per cent of initial fuel

INTERNATIONAL CHINOOK WEIGHTS AND PERFORMANCE

Configuration designation	International CH-47D/-712	International CH-47D/-714	International CH-47D(LR)/-712	International CH-47D(LR)/-714
Power plant	T55-L-712 SSB	T55-L-714	T55-L-712 SSB	T55-L-714
Fuel capacity	3,902 litres (1,030 US gallons; 858 Imp gallons)	3,902 litres (1,030 US gallons, 858 Imp gallons)	7,834 litres (2,068 US gallons, 1,723 Imp gallons)	7,834 litres (2,068 US gallons, 1,723 Imp gallons)
Take-off condition				
Altitude	1,220 m (4,000 ft)	1,220 m (4,000 ft)	1,220 m (4,000 ft)	1,220 m (4,000 ft)
Temperature	35°C (95°F)	35°C (95°F)	35°C (95°F)	35°C (95°F)
Mission T-O weight (hover OGE)	20,094 kg (44,300 lb)	22,426 kg (49,440 lb)	19,695 kg (43,420 lb)	21,918 kg (48,320 lb)
Empty weight	10,670 kg (23,523 lb)	10,693 kg (23,574 lb)	11,016 kg (24,286 lb)	11,039 kg (24,337 lb)
Payload: internal (inbound payload = 50% outbound)	6,739 kg (14,857 lb)	8,895 kg (19,610 lb)	6,018 kg (13,268 lb)	8,081 kg (17,816 lb)
Mission radius[1]	100 n miles (185 km; 115 miles)	100 n miles (185 km; 115 miles)	100 n miles (185 km, 115 miles)	100 n miles (185 km, 115 miles)
Average cruise speed	132 kts (245 km/h; 152 mph)	133 kts (246 km/h, 153 mph)	135 kts (250 km/h, 155 mph)	137 kts (254 km/h, 157 mph)
Max radius: full fuel (inbound payload = 50% outbound)	140 n miles (259 km, 161 miles)	130 n miles (241 km; 150 miles)	335 n miles (621 km, 386 miles)	316 n miles (585 km; 363 miles)
Max level speed, S/L, ISA[1] max continuous power, at T-O weight	156 kts (289 km/h, 180 mph)	161 kts (298 km/h, 185 mph)	153 kts (283 km/h; 176 mph)	157 kts (291 km/h, 181 mph)
Hover ceiling, OGE, max power: ISA, T-O weight[1]	3,080 m (10,100 ft)	2,415 m (7,930 ft)	3,050 m (10,000 ft)	2,395 m (7,850 ft)
35°C (95°F), 22,680 kg (50,000 lb) gross weight	244 m (800 ft)	1,128 m (3,700 ft)	91 m (300 ft)	884 m (2,900 ft)
Max T-O weight	24,494 kg (54,000 lb)	24,494 kg (54,000 lb)	24,494 kg (54,000 lb)	24,494 kg (54,000 lb)

[1]T-O weight is gross weight for hover OGE at 1,220 m/35°C (4,000 ft/95°F). Radius is with inbound payload 50 per cent of outbound payload. Fuel reserve is 30 minutes cruise fuel. Maximum speed shown is at T-O weight

der pedals) for directional control, automatic control to keep fuselage aligned with line of flight. Dual hydraulic rotor pitch-change actuators; secondary hydraulic actuators in control linkage behind flight deck for autopilot/autostabiliser input, autopilot provides stabilisation, attitude hold and outer-loop holds

STRUCTURE: Blades based on D-shaped glassfibre spar fairing assembly of Nomex honeycomb core and crossply glassfibre skin

LANDING GEAR: Non-retractable quadricycle type, with twin wheels on each front unit and single wheels on each rear unit. Oleo-pneumatic shock-absorbers in all units. Rear units fully castoring; power steering on starboard rear unit. All wheels are size 24 × 7.7-VII, with tyres size 8.50-10-III, pressure 4.62 bars (67 lb/sq in). Two single-disc hydraulic brakes. Provision for fitting detachable wheel/skis

POWER PLANT: Two AlliedSignal T55-L-712 turboshafts, pod-mounted on sides of the rear pylon, each with a standard power rating of 2,237 kW (3,000 shp) and maximum rating of 2,796 kW (3,750 shp). AlliedSignal T55-L-712 SSB engine has standard power rating of 2,339 kW (3,137 shp) and maximum of 3,217 kW (4,314 shp), transmission capacity (CH-47D and MH-47E) 5,593 kW (7,500 shp) on two engines and 3,430 kW (4,600 shp) OEI, rotor rpm 225.

Self-sealing pressure refuelled crashworthy fuel tanks in external fairings on sides of fuselage. Total fixed fuel capacity 3,899 litres (1,030 US gallons, 858 Imp gallons). Provision for up to three additional long-range tanks in cargo area, each of 3,028 litres (800 US gallons, 666 Imp

Prototype MH-47E Chinook refuelling from a US Marine Corps KC-130T Hercules

Lifting demonstration of Land Rover and ammunition trailer by RAF Chinook HC. Mk 2 *(Paul Jackson)* *1995*

gallons), maximum fuel capacity (fixed and auxiliary) 6,927 litres (1,830 US gallons; 1,524 Imp gallons). Oil capacity 14 litres (3.7 US gallons, 3.1 Imp gallons).

From January 1991, 100 CH-47Ds fitted with engine air particle separator (also available for RAF variant). Standard in MH-47E and optional in International Chinook are two AlliedSignal T55-L-714 turboshafts, each with a standard power rating of 3,108 kW (4,168 shp) continuous and emergency rating of 3,629 kW (4,867 shp). MH-47E has 7,828 litres (2,068 US gallons, 1,722 Imp gallons) of fuel in panniers, plus 662 litres (175 US gallons; 146 Imp gallons) in floor tanks, total fuel 8,490 litres (2,243 US gallons, 1,868 Imp gallons). CH-47D SOA and MH-47E have 8.53 m (24 ft 0 in) refuelling probe on starboard side of forward fuselage.

ACCOMMODATION: Two pilots on flight deck, with dual controls. Lighting compatible with pilots' NVGs (Nite-Op in RAF variant). Jump seat for crew chief or combat commander. Jettisonable door on each side of flight deck. Depending on seating arrangement, 33 to 55 troops can be accommodated in main cabin, or 24 litters plus two attendants, or (see under Current Versions) vehicles and freight. Rear-loading ramp can be left completely or partially open, or can be removed to permit transport of extra long cargo and in-flight parachute or free-drop delivery of cargo and equipment.

Main cabin door, at front on starboard side, comprises upper hinged section which can be opened in flight, and lower section with integral steps. Lower section is jettisonable. Triple external cargo hook system, with centre hook rated to carry maximum load of 11,793 kg (26,000 lb) and the forward and rear hooks 7,711 kg (17,000 lb) each, or 10,433 kg (23,000 lb) in unison. Provisions are installed for a power-down ramp and water dam to permit ramp operation on water, for forward and rear cargo hooks, internal ferry fuel tanks, external rescue hoist, and windscreen washers.

SYSTEMS: Cabin heated by 200,000 BTU heater/blower. Hydraulic system provides pressure of 207 bars (3,000 lb/sq in) for flying controls. Maximum flow rate 53.0 litres (14 US gallons; 11.65 Imp gallons)/min. Spherical hydraulic reservoir, volume 5,326 cm³ (325 cu in), pressurised to 1.72 bars (25 lb/sq in). Utility hydraulic system, pressure 231 bars (3,350 lb/sq in), maximum flow rate 51.5 litres (13.6 US gallons; 11.3 Imp gallons)/min. Piston type reservoir, volume 7,014 cm³ (428 cu in), of which 5,326 cm³ (325 cu in) are usable, pressurised to 3.86 bars (56 lb/ sq in). Electrical system includes two 40 kVA air-cooled alternators driven by transmission drive system. Solar T62 T-2B APU runs accessory gear drive, thereby operating all hydraulic and electrical systems.

AVIONICS (International CH-47D: US Army CH-47D assumed to be generally similar. Specific MH-47E avionics listed under that heading. Avionics for RAF HC. Mk 1 listed in 1985-86 and earlier editions)

Comms: ARC-102 HF com radio, Collins ARC-186 UHF/AM-FM, Magnavox ARC-164 UHF/AM com, C-6533 intercom, Bendix/King AN/APX-100 IFF.

Flight: APN-209 radar altimeter; AN/ARN-89B ADF; AN/ARN-118 Tacan; AN/ARN-123 VOR/glide slope/marker beacon receiver; and AN/ASN-43 gyromagnetic compass. AFCS maintains helicopter stability, eliminating the need for constant small correction inputs by the pilot to maintain desired attitude. The AFCS is a redundant system using two identical control units and two sets of stabilisation actuators.

Instrumentation: Flight instruments are standard for IFR, and include an AN/AQU-6A horizontal situation indicator.

Mission: Chelton 19-400 satellite communications antenna on some RAF helicopters.

Self-defence: RAF Chinooks have Tracor M-206/M-1 chaff/flare dispensers, GEC-Marconi ARI 18228 RWR and (from 1990) Loral AN/ALQ-157 IR jammers, Honeywell AN/AAR-47 missile approach warning equipment and Racal RNS252 Super TANS INS including GPS.

EQUIPMENT: Hydraulically powered winch for rescue and cargo handling, rearview mirror, plus integral work stands and step for maintenance.

ARMAMENT: Provision for two machine guns in crew door (starboard) and forward hold window (port).

DIMENSIONS, EXTERNAL:

Rotor diameter (each)	18.29 m (60 ft 0 in)
Rotor blade chord (each)	0.81 m (2 ft 8 in)
Distance between rotor centres	11.94 m (39 ft 2 in)
Length overall, rotors turning	30.14 m (98 ft 10¾ in)
fuselage: Army CH-47D	15.54 m (51 ft 0 in)
International CH-47D and MH-47E	15.87 m (52 ft 1 in)
MH-47E including probe	20.90 m (68 ft 7 in)
Width, rotors folded: CH-47D	3.78 m (12 ft 5 in)
MH-47E	4.78 m (15 ft 8 in)
Height to top of rear rotor head:	
CH-47D	5.78 m (18 ft 11½ in)
MH-47E	5.59 m (18 ft 4 in)
Ground clearance, rotors turning:	
front approach	3.33 m (10 ft 11 in)
rear approach: CH-47D	5.78 m (18 ft 11½ in)
MH-47E	5.59 m (18 ft 4 in)
Ground clearance, static, rear approach	4.90 m (16 ft 0½ in)
Wheel track (c/l of shock-absorbers):	
CH-47D	3.20 m (10 ft 6 in)
MH-47E	3.63 m (11 ft 11 in)
Wheelbase: CH-47D	6.86 m (22 ft 6 in)
MH-47E	7.87 m (25 ft 10 in)
Passenger door (fwd, stbd): Height	1.68 m (5 ft 6 in)
Width	0.91 m (3 ft 0 in)
Height to sill	1.09 m (3 ft 7 in)
Rear-loading ramp entrance: Height	1.98 m (6 ft 6 in)
Width	2.31 m (7 ft 7 in)
Height to sill	0.79 m (2 ft 7 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	9.30 m (30 ft 6 in)
Width: mean	2.29 m (7 ft 6 in)
at floor	2.51 m (8 ft 3 in)
Height	1.98 m (6 ft 6 in)
Floor area	21.0 m² (226.0 sq ft)
Usable volume	41.7 m³ (1,474 cu ft)

AREAS:

Rotor blades (each)	7.43 m² (80.0 sq ft)
Rotor discs (total)	525.3 m² (5,655 sq ft)

WEIGHTS AND LOADINGS (CH-47D and International Chinook see tables, MH-47E as below):

Weight empty	12,210 kg (26,918 lb)
Useful load	12,284 kg (27,082 lb)
Max fuel weight	6,815 kg (15,025 lb)
Max T-O weight	24,494 kg (54,000 lb)

PERFORMANCE (CH-47D and International Chinook see tables, MH-47E at 22,680 kg; 50,000 lb as below):

Max level speed	154 kts (285 km/h, 177 mph)
Max cruising speed at S/L	140 kts (259 km/h, 161 mph)
Max rate of climb	561 m (1,840 ft)/min
Service ceiling	3,095 m (10,150 ft)
Hovering ceiling: IGE	2,990 m (9,800 ft)
IGE, ISA + 20°C (68°F)	2,410 m (7,900 ft)
OGE	1,675 m (5,500 ft)
OGE, ISA + 20°C (68°F)	1,005 m (3,300 ft)
Radius of action, deploy special forces team (1,814 kg; 4,000 lb) at 1,220 m (4,000 ft), 35°C (95°F) ambient temperature	505 n miles (935 km, 581 miles)
Range, self-deployment at 24,494 kg (54,000 lb) T-O weight	1,260 n miles (2,333 km, 1,449 miles)

UPDATED

OTHER AIRCRAFT

Details of **V-22 Osprey** will be found under Bell/Boeing entry; **RAH-66 Comanche** under Boeing Sikorsky.

NEW ENTRY

MILITARY AIRPLANES DIVISION (Boeing Defense & Space Group)

PO Box 3707, Seattle, Washington 98124-2207
Telephone: 1 (206) 655 1198
Fax: 1 (206) 655 7012

VICE PRESIDENT AND GENERAL MANAGER: Richard Hardy
PUBLIC RELATIONS MANAGER: Randy Harrison

UPDATED

BOEING 767 MILITARY VERSIONS

TYPE: Tanker/transport, Joint STARS and AWACS variants of Boeing 767 twin-turbofan airliner.

CURRENT VERSIONS: **767AWACS**: Described separately under Boeing Electronic Systems Division.

767T/T: Tanker/transport officially announced by Boeing, February 1995, in anticipation of Japanese order, based on 767-200R and stretched -300R (see Boeing Commercial Airplane Group entry); fuel dispensed through 'flying boom' and two underwing pods; boom remotely controlled from cabin, assisted by CCTV; first aircraft available 40 months from go-ahead. Larger 767-300R T/T will have up to seven underfloor tanks, with combined total of 31,500 litres (8,322 US gallons, 6,929 Imp gallons) of additional fuel and ability to dispense 70,000 kg (154,325 lb) of fuel at range of 500 n miles

(926 km, 575 miles); as freighter (side cargo door and reinforced floor) can carry up to 34,000 kg (74,957 lb) over 5,000 n miles (9,260 km, 5,753 miles)

767 Joint STARS: Boeing 767 proposed as alternative airborne platform to Boeing 707 for export version of this surveillance system (see Northrop Grumman E-8 in this section)

CUSTOMERS: None. Japan understood to require initial six or eight and eventual 14. Anticipated sales of 75, plus about 20 AWACS variants.

NEW ENTRY

BOEING EX

Development of this carrier-compatible maritime surveillance and early warning aircraft has been deferred by the US Navy's 1994 decision to maintain Hawkeye in production beyond 2000. Programme last described in 1994-95 *Jane's*

UPDATED

BOEING CALF (JAST)

TYPE: Advanced (STOVL) Common Affordable Lightweight Fighter

PROGRAMME: Boeing among five contenders in ARPA (US Advanced Research Projects Agency) contest, late 1992, initially rejected, but Boeing elected to continue private funding of own CALF design, hoping to re-enter competition in 1995, technology-sharing agreement with ARPA May 1993; one-tenth scale model testing begun, July 1993, Boeing partners comprise Pratt & Whitney for single YF119 engine and Rolls-Royce for direct lift and engine control technology

ARPA realigned SSF in January 1994 on Congressional instructions, allowing Boeing's direct lift design to compete against remote fans, Boeing awarded $32 million 26 month contract 25 March 1994 to study tri-service weapon system concept ($28 million), build virtual avionics engineering environment ($2 million) and define common tri-service airframe structure ($2 million)

In late 1994, Congress merged ASTOVL/CALF competition with JAST (Joint Advanced Strike Technology) programme, as detailed under US Navy in this section. Three subscale wind tunnel tests completed in 1994, tests of jet effects undertaken on model in NASA tunnel, January 1995, further trials at NASA Langley and NASA Ames into 1996. Testing due to begin in June 1995 at Seattle of 94 per cent scale powered model of Boeing CALF. Dassault of France is subcontractor to Boeing, working on multiservice common airframe concepts

DESIGN FEATURES: One-piece delta wing with movable endplates, normally canted inwards for stability. Single jet engine has second, directional, ventral exhaust nozzle at or near CG for vertical or short take-offs and transition to wingborne flight; VTOL penalty only 5 per cent of empty weight. Small design, weight approximately three-quarters of ARPA upper limit. Variants of production aircraft available for conventional operation from land (USAF), catapult-and-hook aircraft carrier operation (USN), and full STOVL (Marine Corps); last-mentioned has 95 per cent commonality with USAF aircraft, reducing to 87 per cent for USN version

UPDATED

Artist's impression of Boeing 767 Tanker/Transport refuelling AWACS version of 767

1995

Model of Boeing CALF design, developing technology for JAST programme *(Paul Jackson)*

1995

BOEING SIKORSKY

BOEING HELICOPTERS and SIKORSKY AIRCRAFT

Boeing Sikorsky Comanche Joint Program Office, 35 Nutmeg Drive, Trumbull, Connecticut, 06611

Telephone: 1 (203) 383 3.01

Fax: 1 (203) 383 3142

RAH-66 PROGRAMME DIRECTOR: James J. Morris

VICE-PRESIDENT RAH-66 PROGRAMME: Donald F. (Rick) Matson

ARMY PROGRAMME MANAGER: Gen James Snider

PUBLIC AFFAIRS OFFICER: Foster Morgan

Boeing and Sikorsky began LHX collaboration June 1985, development centre initially Wichita, but transferred to Philadelphia in early 1990, then Trumbull in 1992

UPDATED

BOEING SIKORSKY RAH-66 COMANCHE

TYPE: Two-seat reconnaissance/attack and air combat helicopter

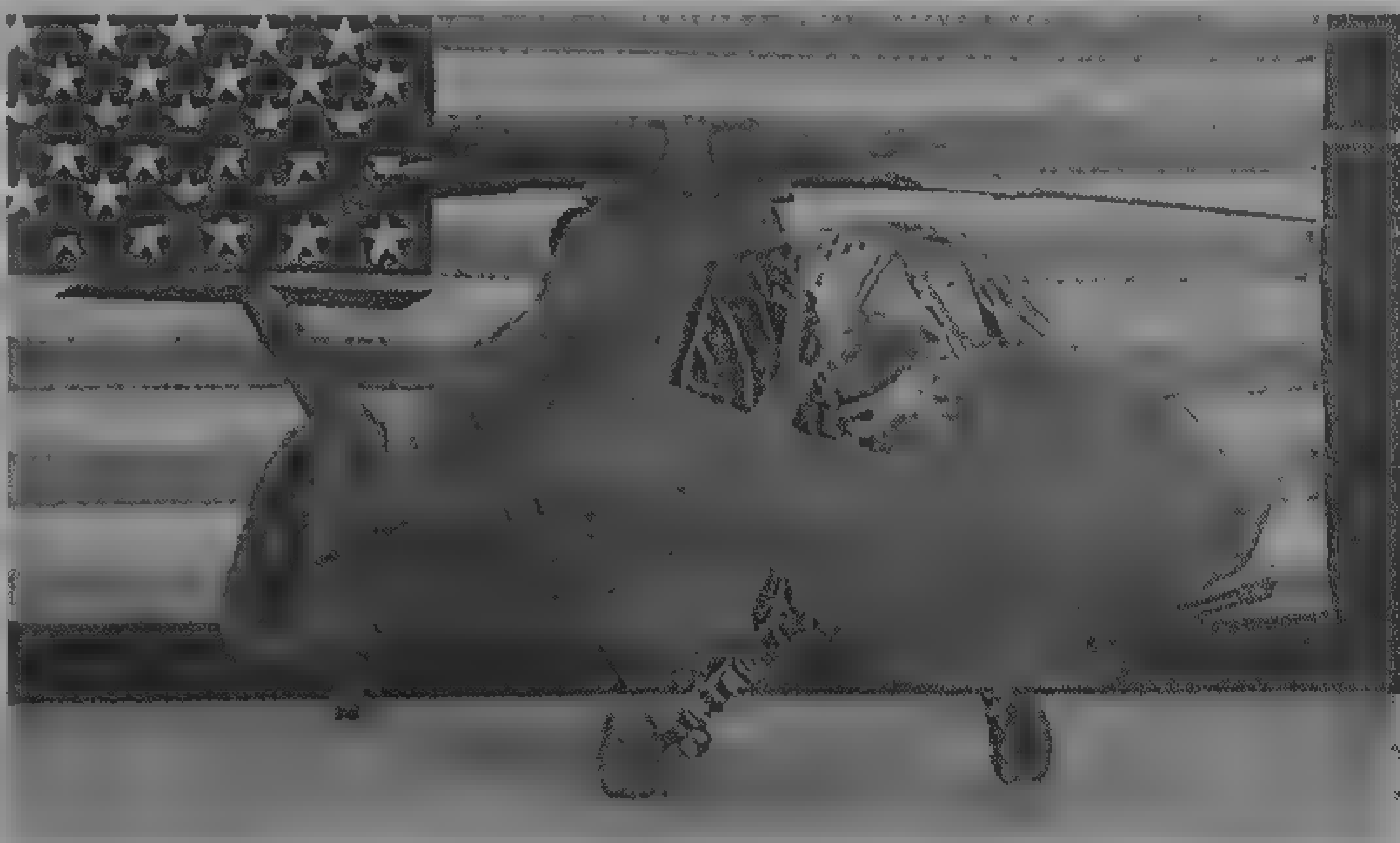
PROGRAMME: Light Helicopter Experimental (LHX) design concepts requested by US Army 1982, numerous changes of programme, current (March 1995) plan being given later in this account, original plan for 5,000 to replace UH-1, AH-1, OH-58 and OH-6, reduced in 1987 to 2,096 scout/attack only, replacing 3,000 existing helicopters, to 1,292 in 1990 (with further 389 possible). LHX request for proposals issued 21 June 1988, 23 month demonstration/validation contracts issued to Boeing Sikorsky First Team and Bell/McDonnell Douglas Super Team. Boeing Sikorsky selected 5 April 1991; to build four (reduced to three in 1992, then two in December 1994) YRAH-66 demonstration/validation prototypes in 78 month programme plus static test article (STA) and propulsion system testbed (PSTB)

LHTEC T800 engine specified October 1988. LHX designation changed to LH early 1990, then US Army designation RAH-66 Comanche in April 1991. Original timetable was: 39 month FSD phase with two additional prototypes, starting August 1995, first low-rate production contract due October 1996; initial 72 helicopters to be built by 2002, first full-rate production contract due November 1998, balance of 1,220 built by 2010. IOC in December 1998. Longbow radar to be installed from production Lot 4 onwards

FY93 budget delayed development and production phases indefinitely, anticipating Longbow integration from first aircraft, development and production phases reinstated January 1993; further three prototypes then scheduled to be built for engineering and manufacturing development (EMD) phase, in FY98-03; first production procurement in FY99; low-rate production of first 24 in FY01, followed by 48 in FY02, 96 in FY03, then 120 per year. IOC in January 2003.

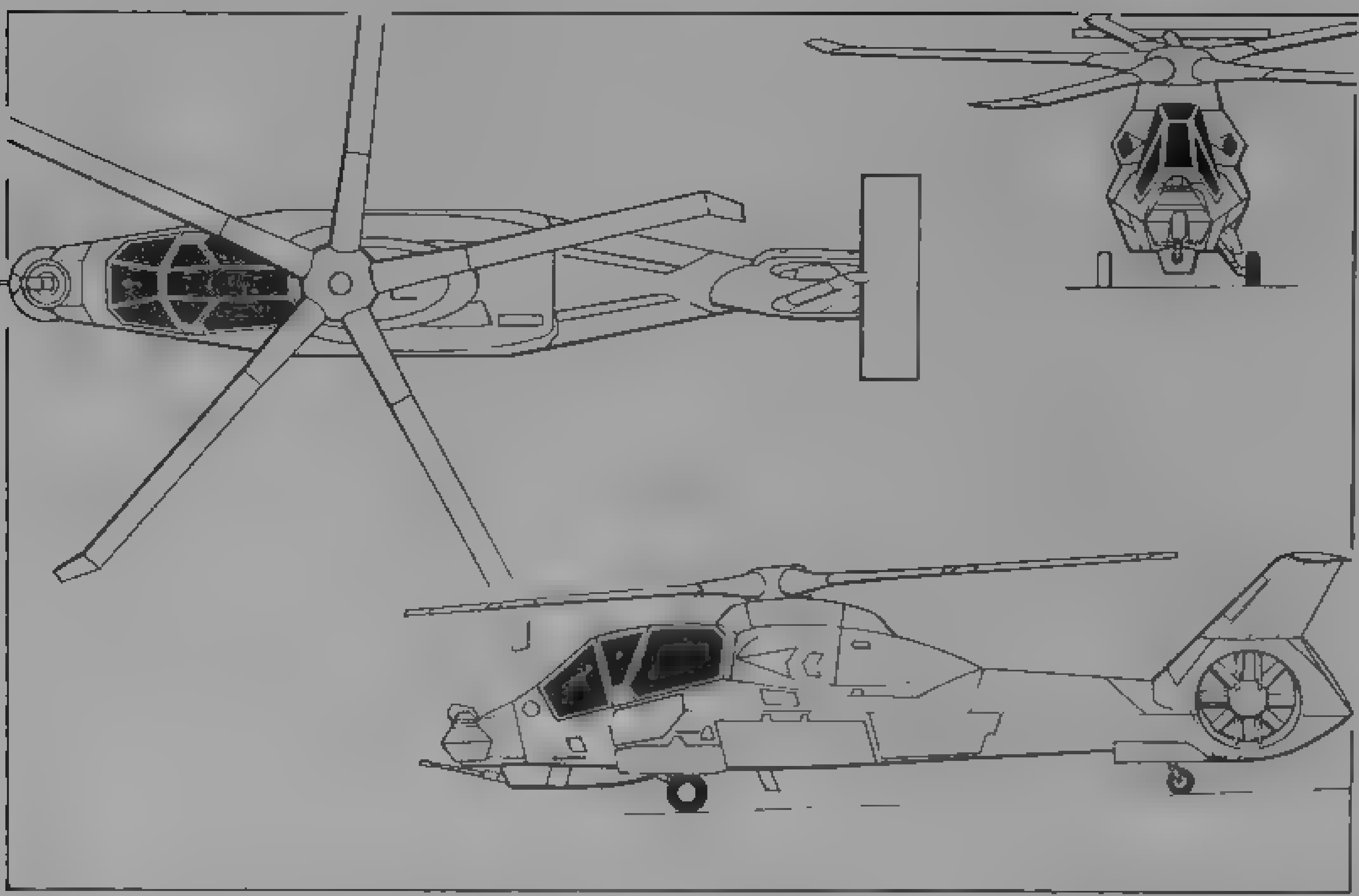
Prototype critical design review, completed in December 1993, authorised production of three YRAH-66 prototypes (first item for which manufactured in September 1993). At same time, however, further R&D economies under study, December 1994 decision reduced dem/val phase to two prototypes (lacking Longbow/Hellfire capability) and recommended deferment of production, funding delay postponed maiden flight target date from November 1995 to May 1996

In early 1995, US Army attempted to restructure programme to reinstate production phase, this successful, and **current Comanche programme** now planned as follows: two prototypes; six 'early operational capability' (EOC) aircraft with reconnaissance equipment only



RAH-66 Comanche roll-out 25 May 1995

1995



Boeing Sikorsky RAH-66 Comanche in revised, 1995, configuration *(Jane's/James Goulding)*

1995

Working mockup of RAH-66 front cockpit shows two central multifunction visual displays and central input keyboard flanked by system and weapon information displays. Sidestick cyclic control is on the starboard console

1995

(no armament) to enter service with US Army trials unit in 2001 for two years of operational development. production decision in 2003, 6,500 hours flown by eight RAH-66s up to 2006, first operational unit to form in 2007 with initial two production aircraft, plus six EOC Comanches which meanwhile retrofitted with armament. (Delay in development of weapons system allows funding to pay for EOC aircraft.) Planned procurement of 1,292

Prototype construction began 29 November 1993 with forward fuselage at Sikorsky, Stratford, Boeing built rear in Philadelphia. STA airframe delivered to Stratford 1994, at which time PSTB under construction there, front and rear sections of prototype joined at Stratford 25 January 1995, completed helicopter rolled-out 25 May 1995, first flight planned in November 1995, second prototype to follow in 1996.

First -801 growth version of T800 turboshaft began bench runs in March 1994, -801 preliminary design review completed May 1993, critical design review March 1995

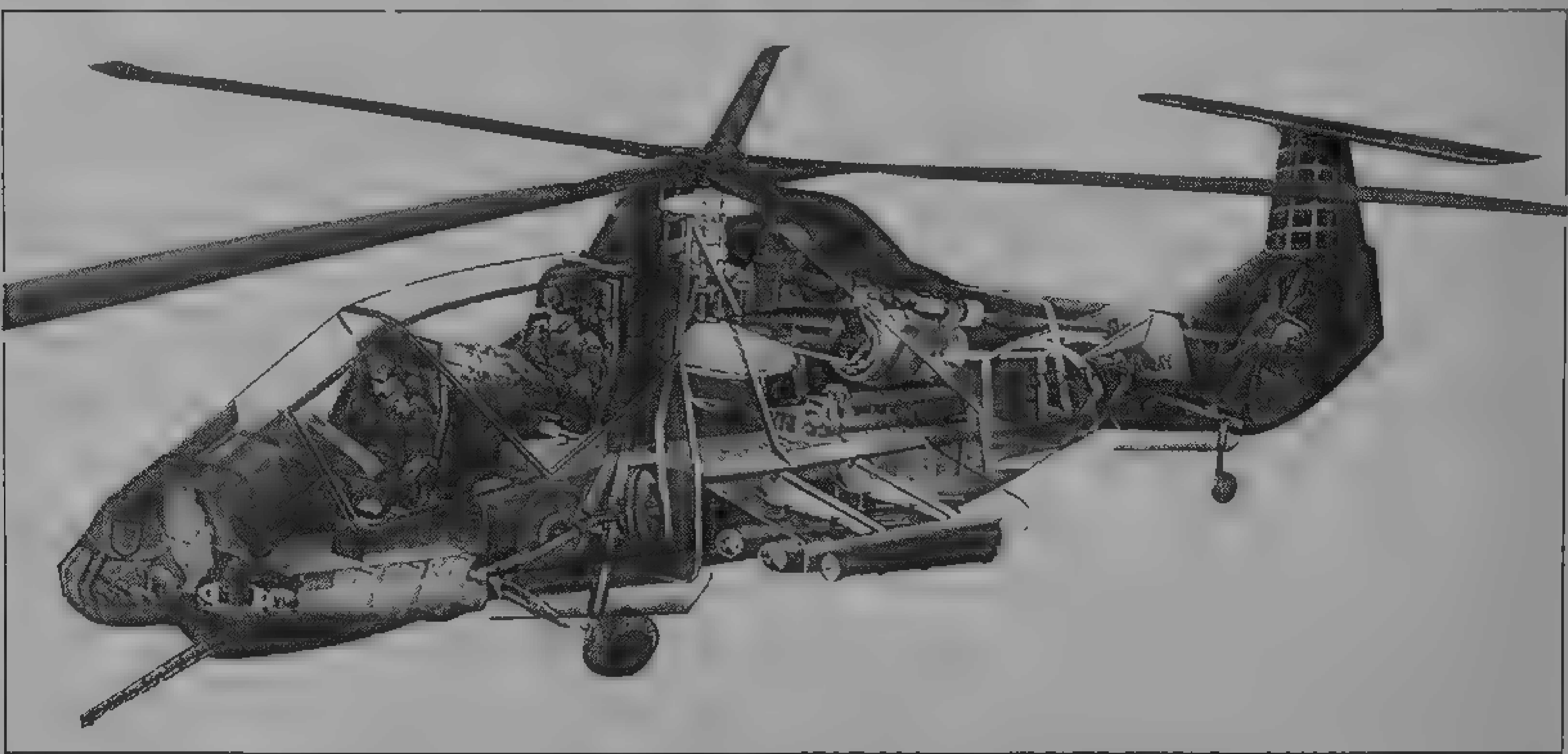
CUSTOMERS: US Army, two prototypes and six 'early operational capability' aircraft

COSTS: $34,000 million programme, including $1 960 million dem/val and $900 million FSD but reduced to $2 240 million dem/val/FSD between 1993-97 by cancellation of three of six planned prototypes, $8 9 million flyaway unit cost (1988 values), increased to $13 million by early 1993 By 1993 (in 1994 dollars, estimated), procurement unit cost $21 million, programme unit cost $27 million, Restructured programme allocated $2 18 billion between FY96 and FY01

DESIGN FEATURES: RAH-66 is lighter, but only slightly smaller, than AH-64 Apache, specified empty weight of 3,402 kg (7,500 lb) increased to 3,522 kg (7,765 lb) by early 1992, as result of Army add-ons, including allowance for Longbow radar, mission equipment package has maximum commonality with F-22A ATF technology Design has eight-blade fan-in-fin shrouded tail rotor and five-blade all-composites bearingless main rotor system, and internal weapon stowage

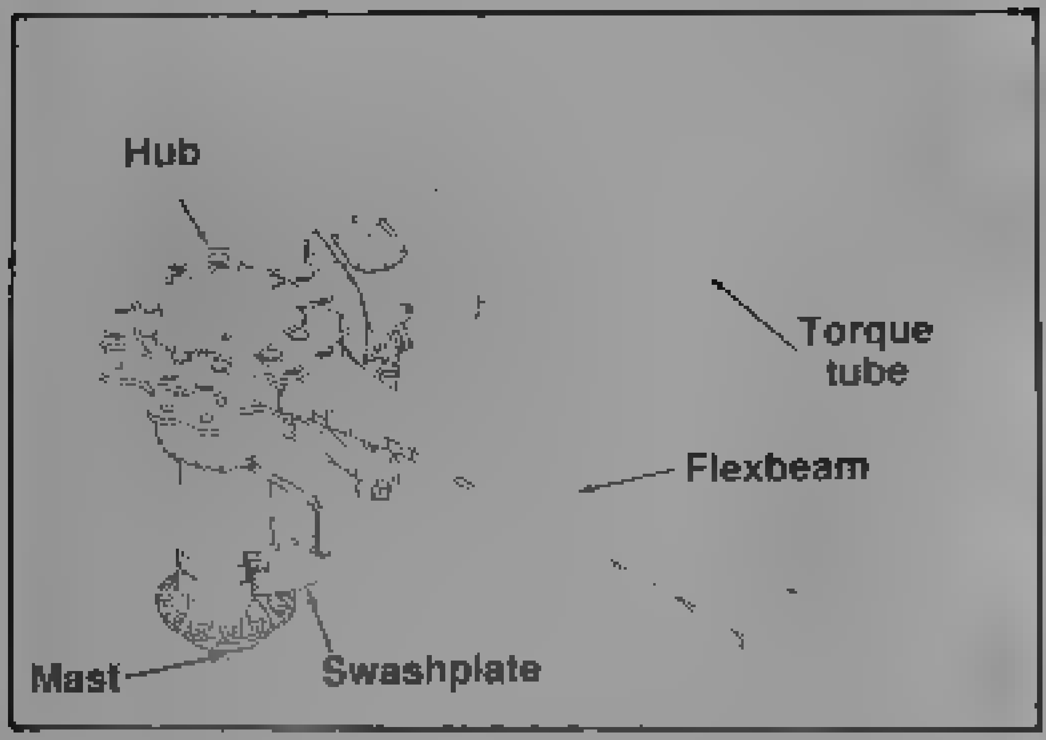
Split torque transmission, obviating need for planetary gearing T tail unit (upper part folds down for air transportation) Detachable stub-wings for additional weapon carriage and/or auxiliary fuel tanks (EFAMS external fuel and armament management system). Radar, infra-red, acoustic and visual signature requirements set to defeat threats postulated by US Army Eight deployable inside Lockheed C-5 Galaxy with only removal of main rotor ready for flight 20 minutes after transport lands. Combat turnround time 13 minutes

Other members of Boeing Sikorsky First Team include Boeing Defense and Space Group (flight control computer), Lockheed Martin Armament Systems, with Giat of France (turreted gun and ammunition feed), Hamilton Standard (flight control computer, wide field of view helmet mounted display system, air data system, environmental control and collective protection system, and air vehicle interface computer), Harris Corporation (3D digital map display, super high-speed databus, sensor data distribution network, multifunction controls and displays), Kaiser Electronics (helmet-mounted display system), Link Flight Simulation (operator training systems), Lockheed Martin (electro-optical night navigation and targeting systems), TRW Military Electronics Division with Westinghouse Defense and Electronics (signal and data processors and aircraft survivability equipment)



Internal arrangement of the Boeing Sikorsky RAH 66 Comanche, nose sensor shape has since been modified

1995



Comanche rotor head design

1995

FLYING CONTROLS: Dual triplex fly-by wire, with sidestick cyclic pitch controllers and normal collective levers. Main rotor blades removable without disconnecting control system.

STRUCTURE: Largely composite airframe and rotor system. Fuselage built around composite internal box beam, non load-bearing skin panels, more than half of which can be hinged or removed for access to interior (for example weapons bay doors can double as maintenance work platforms). Eight-blade Fantail rear rotor operable with 12.7 mm calibre bullet hits, or for 30 minutes with one blade missing. Main rotor blades and tail section by Boeing, forward fuselage and final assembly by Sikorsky.

LANDING GEAR: Retractable tail wheel type, with single wheel on each unit. Main units can 'kneel' for air transportability.

POWER PLANT: Two LHTEC T800-LHT-801 turboshafts, each rated at 1,068 kW (1,432 shp). Transmission rating 1,639 kW (2,198 shp). Internal fuel capacity 1,142 litres (301.6 US gallons, 251.1 Imp gallons). Four external tanks totalling 3,407 litres (900 US gallons, 749.4 Imp gallons) for self-deployment, total fuel capacity 4,548 litres (1,201.6 US gallons, 1,000.5 Imp gallons). Main rotor tip speed (100 per cent N_r) 221 m (725 ft)/s, 355 rpm, normal operation from 95 per cent (quiet mode) to 107 per cent (load factor enhancement).

ACCOMMODATION: Pilot (in front) and WSO in identical stepped cockpits, pressurised for chemical/biological warfare protection. Crew seats resist 11.6 m (38 ft)/s vertical crash landing.

AVIONICS: Maximum commonality required with USAF Lockheed F-22 ATF programme.

Comms: Dual anti-jam VHF-FM and UHF-AM Have Quick tactical communications, VHF-AM, anti-jam HF-SSB IFF.

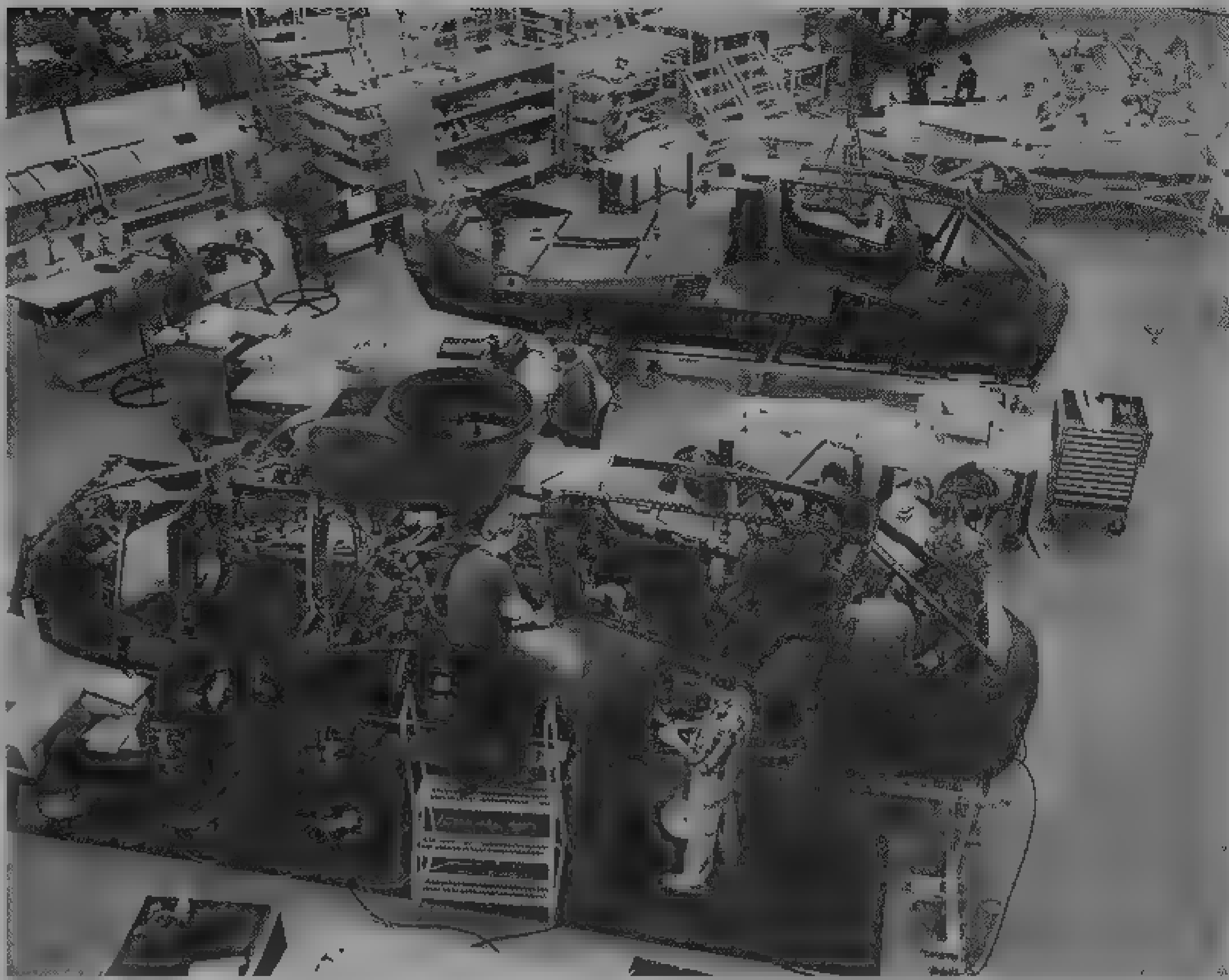
Flight: Airborne target handover system, GPS and radar altimeter. Litton AHRS, comprising two fibre optic LN-210C and one LN-100C gyro platforms.

Instrumentation: Lockheed Martin night vision pilotage system and Kaiser/Hamilton Standard helmet-mounted display, integrated cockpit, second generation FLIR targeting and digital map display. Two 15.2 × 20.3 cm (6 × 8 in) multifunction flat screen LCDs in each cockpit (one monochrome for FLIR/TV, one colour for moving map tactical situation and night operations), plus two 10.2 × 16.9 cm (4 × 6¾ in) multipurpose display (MPD) flat screen monochrome LCDs for fuel, armament and communications information in each cockpit. Three redundant databases: one low-speed (MIL-STD-1553B), one high-speed and one very high-speed (fibre optic based) for signal data distribution.

Mission: Miniaturised version of Longbow radar in one-third of fleet although all to have carriage provision.

Self-defence: Laser warning and radar warning receivers, RF and IR jammers.

ARMAMENT: Lockheed Martin three-barrel 20 mm cannon in Giat undernose turret, with up to 500 rounds (320 rounds normal for primary mission). Side-opening weapons bay door in each side of fuselage, on each of which can be mounted up to three Hellfire or six Stinger missiles or other weapons. Four more Hellfires or eight Stingers can be deployed from multiple carriers under tip of each optional stub-wing, or auxiliary fuel tank for self-deployment. All weapons can be fired, and targets designated, from push-buttons on collective and sidestick controllers.



Final assembly of Comanche prototype forward fuselage at Sikorsky, Stratford, 1994. STA airframe in centre, PSTB at rear

1995

DIMENSIONS, EXTERNAL:

Main rotor diameter	11.90 m (39 ft 0½ in)
Fantail diameter	1.37 m (4 ft 6 in)
Fantail blade chord	0.17 m (6¾ in)
Length, overall, rotor turning	14.28 m (46 ft 10¼ in)
fuselage (excl gun barrel)	13.20 m (43 ft 3¾ in)
Height over tailplane	3.37 m (11 ft 0¾ in)
Fuselage: Max width	2.04 m (6 ft 8¼ in)
Width over mainwheels	2.31 m (7 ft 7 in)
Tailplane span	2.82 m (9 ft 3 in)

AREAS:

Main rotor disc	111.21 m² (1,197.04 sq ft)
Fantail disc	1.47 m² (15.90 sq ft)

WEIGHTS AND LOADINGS (estimated):

Weight empty	3,522 kg (7,765 lb)
Max useful load	2,296 kg (5,062 lb)
T-O weight: primary mission*	4,807 kg (10,597 lb)
max alternative	5,819 kg (12,828 lb)
max (self-deployment)	7,896 kg (17,408 lb)

* *with two crew, full internal fuel, 320 rds gun ammunition, four Hellfires and two Stingers*

PERFORMANCE (at 1,220 m, 4,000 ft and 35°C; 95°F, estimated):

Max level (dash) speed	175 kts (324 km/h; 201 mph)
Vertical rate of climb	432 m (1,418 ft)/min
Masking	1.6 s
180° hover turn to target	4.7 s
Snap turn to target at 80 kts (148 km/h; 92 mph)	4.5 s
Ferry range with external tanks	1,260 n miles (2,334 km; 1,450 miles)
Endurance (standard fuel)	2 h 30 min
g limits	+3.5/−1

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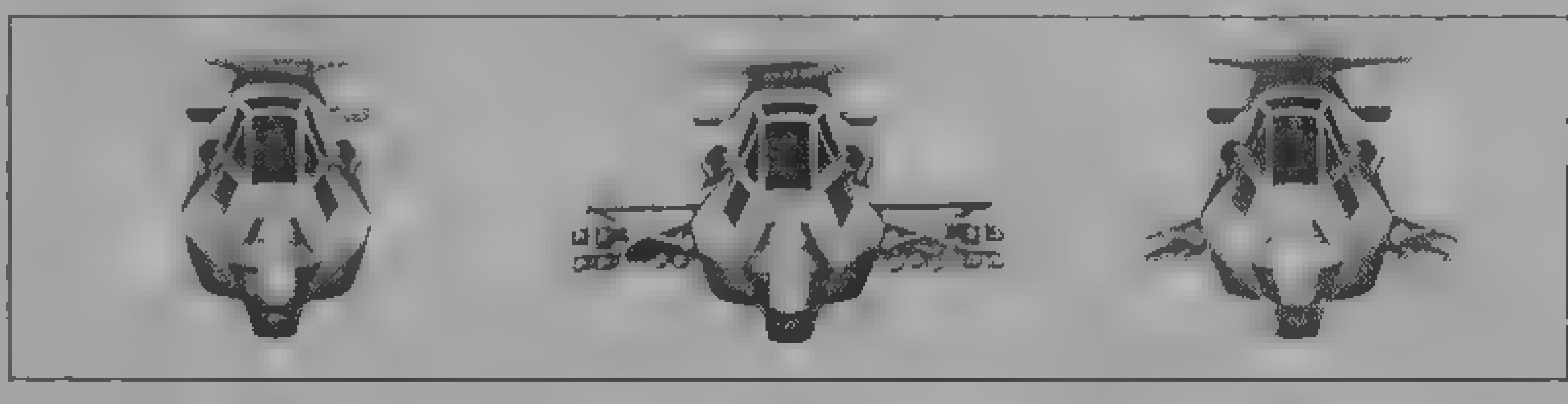


Head-on views of Comanche equipped for armed reconnaissance (left), attack (centre) and air combat

1995

BOWERS

PETER M. BOWERS

10458 16th Avenue South, Seattle, Washington 98168
Telephone: 1 (206) 242 2582

VERIFIED

BOWERS FLY BABY 1-A

The Bowers Fly Baby 1-A and 1-B continue to be built, but only by home constructors. Details of both types appeared in the 1994-95 and earlier *Jane's*.

UPDATED

CESSNA

CESSNA AIRCRAFT COMPANY (Subsidiary of Textron Inc)

PO Box 7706, Wichita, Kansas 67277-7706
Telephone: 1 (316) 941 6000
Fax: 1 (316) 941 7812
Telex: 417 400

CHAIRMAN AND CEO: Russell W. Meyer Jr
EXECUTIVE VICE-PRESIDENT AND COO: David G. Assard
EXECUTIVE VICE-PRESIDENT, AIRCRAFT MARKETING AND PRODUCT SUPPORT: Gary W. Hay
GENERAL MANAGER, SINGLE-ENGINE BUSINESS: Pat Boyarski
VICE-PRESIDENT PUBLIC RELATIONS: David M. Franson

Founded by late Clyde V. Cessna 1911, incorporated 7 September 1927, former Pawnee and Wallace aircraft divisions in Wichita consolidated in Aircraft Division mid-1984, acquired by General Dynamics as wholly owned subsidiary 1985, acquisition by Textron announced February 1992.

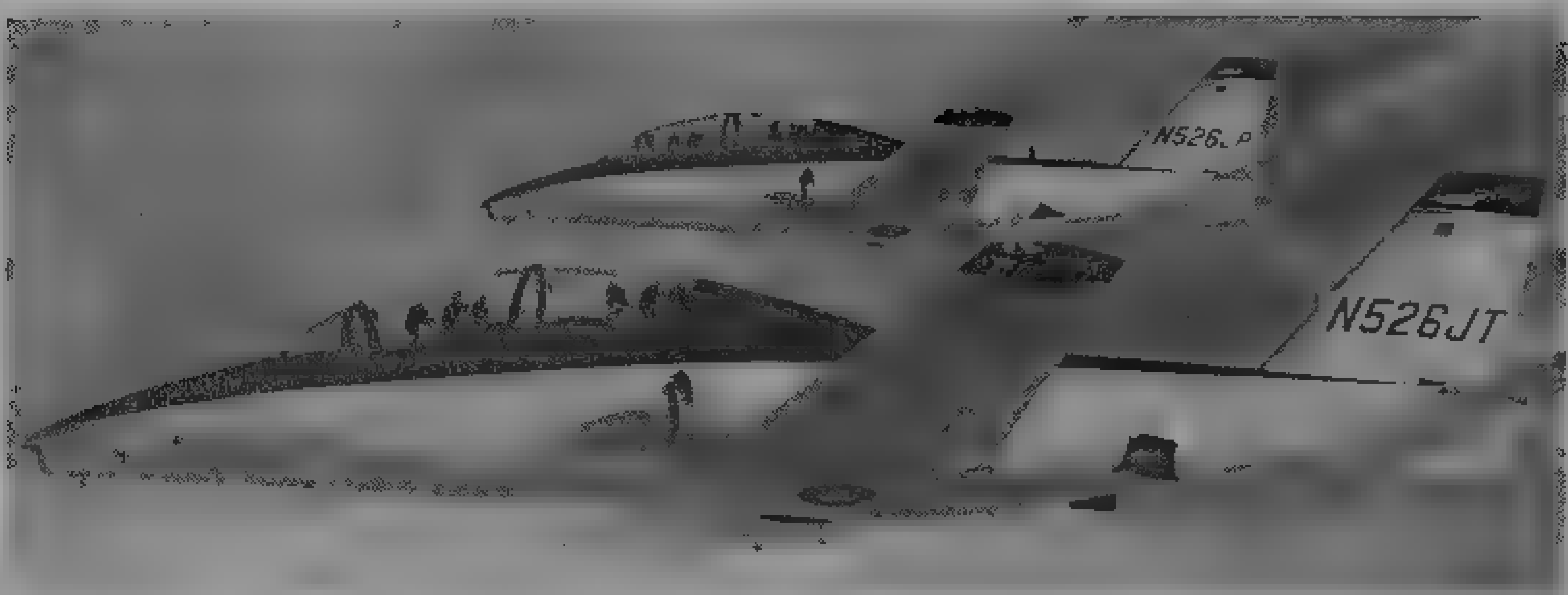
Owned subsidiaries include McCauley Accessory Division, Dayton, Ohio, Cessna Finance Corporation in Wichita. Sold 49 per cent interest in Reims Aviation of France to Compagnie Française Chaufour Investissement (CFCI) February 1989; Reims continues manufacturing Cessna F406 Caravan II and holds option to resume construction of Cessna single-engined aircraft when Cessna restarts production.

Total 178,193 aircraft produced by end of 1994. 172 aircraft delivered in 1994, comprising six Caravans, 45 Grand Caravans, nine Citation IIs, 39 Citation Vs, 10 Citation VIs, 14 Citation VIIs and 49 CitationJets, further 39, including 20 Caravans, in first quarter of 1995. Total employees 5,600.

UPDATED

CESSNA 526 JPATS CITATIONJET

TYPE: Tandem two-seat jet trainer, was unsuccessful contender in USAF/USN Joint Primary Aircraft Training System programme.



First (nearest camera) and second prototypes of the Cessna 526 JPATS CitationJet, note jetpipe deflectors on former

1995

PROGRAMME: Announced intention of entering JPATS competition with 'all American' aircraft, 1992, selected Williams International as engine partner. First flight of first prototype (N526JT) 20 December 1993, second aircraft N526JP) 2 March 1994, certified June 1994.

COSTS: Estimated at under $3 million per aircraft.

DESIGN FEATURES: Based on 525 CitationJet (refer later entry), using similar but shorter three-spar laminar flow wings with modified ailerons, redesigned tail, Williams Rolls engines in fuselage, stepped cockpits under military style canopy. Wings strengthened for 7 g. Similar flight control systems, UPC zero/zero ejection seats, cockpit pressurised to 0.34 bar (5.0 lb/sq in).

STRUCTURE: Almost entirely aluminium alloy, minimal use of composites for non-structural components only.

POWER PLANT: Two Williams-Rolls F129 turbofans, each derated to 6.67 kN (1,500 lb st). Fuel tanks in wings and fuselage.

SYSTEMS: Hydraulic system, pressure 207 bars (3,000 lb/sq in). Electrical system (28 V DC only; no AC) powered by two 300 kVA starter/generators and a 28 V lead-acid battery.

AVIONICS: Bendix/King 'glass' cockpits with 12.7 cm (5 in) square EFIS displays.

DIMENSIONS, EXTERNAL:

Wing span	11.28 m (37 ft 0 in)
Length overall	12.395 m (40 ft 8 in)
Height overall	3.81 m (12 ft 6 in)

WEIGHTS AND LOADINGS:

Weight empty	2,232 kg (4,920 lb)
Fuel weight	907 kg (2,000 lb)
Max T-O weight	3,356 kg (7,400 lb)

PERFORMANCE (estimated):

Max level speed	270 kts (500 km/h, 311 mph) CAS
Approach speed, flaps down, 50% fuel	99 kts (184 km/h, 114 mph) CAS
Stalling speed, flaps down, 50% fuel	76 kts (141 km/h, 88 mph) CAS
Service ceiling	above 10,670 m (35,000 ft)
Time to 5,485 m (18,000 ft)	5 min 48 s
Range, IFR reserves	1,050 n miles (1,945 km, 1,208 miles)

UPDATED

CESSNA SINGLE-ENGINED LIGHT AIRCRAFT

In Autumn 1993, Cessna established Single-Engine Restart Task Force to investigate possibility of resuming manufacture of some piston-engined light aircraft types whose production had been suspended in mid-1980s. Following President Clinton's signature on 17 August 1994 of General Aviation Revitalization Act, the company affirmed plans to resume production of **Cessna 172 Skyhawk, 182 Skylane, 206 Stationair** and **T206 Turbo Stationair**.

On 19 May 1994 Cessna broke ground for a 46,450 m² (500,000 sq ft) new factory at Independence Municipal Airport, Montgomery County, Kansas, to house final assembly, painting, flight test, engineering, finance, marketing and human resource operations for single-engine light aircraft range. Factory scheduled to open on 4 July 1996 and by 1998 will employ 1,000 people, and produce 2,000 aircraft annually.

New aircraft will be manufactured on existing FAA type certificates. Some 90 to 95 per cent of original tooling for 172, 182 and 206 can be salvaged from external store at Cessna's Pawnee, Wichita, plant. Structurally and externally, aircraft are expected to be similar to previous models, but will incorporate new fuel-injected Textron Lycoming engines with revised fuel systems and electronic ignition, new flight control systems, state-of-the-art Bendix/King avionics, metal instrument panels, and new safety features and interiors. Planned engines are 134 kW (180 hp) IO-360-A4M in the 172, 168 kW (225 hp) IO-540 in 182, and IO-580 (540 derivative) in 206. Cessna began taking deposits for delivery positions in June 1995.

The 172 will be first to reappear, in second half of 1996, with first delivery in early 1997, and will form about 45 per cent of first year's production total. Prototype 'Restart 172' (N6786R), modified from 1978 model 172N with 149 kW (200 hp) Textron Lycoming IO-360 engine derated to 119 kW (160 hp), made first flight at Wichita 19 April 1995. Initial batch of 25 to 30 172s will be built at Wichita to serve as company demonstrators prior to start of production at Independence. Manufacture of 182, 206 and T206 will follow at three to four month intervals. First new-production 172 and 182 will be delivered to the Aircraft Owners and Pilots Association for use as prizes in its 1996 and 1997 membership sweepstakes. Other models being considered for resumed production include 152 Aerobat, 172RG Cutlass, 182RG Skylane RG and the 210 Centurion. Descriptions of 172, 182 and 206 (as previously powered) may be found in mid-1980s and earlier editions of *Jane's*.

UPDATED

REIMS-CESSNA F406/CARAVAN II

Turboprop version of Cessna 400 series developed in France by Reims Aviation, which see.

CESSNA 208 CARAVAN I/U-27A

TYPE: Single-turboprop civil and military multimission aircraft.

PROGRAMME: First flight of engineering prototype (N208LP) 9 December 1982; first production Caravan I rolled-out August 1984, FAA certification October 1984, full production started 1985, wheeled float version certificated March 1986.

CURRENT VERSIONS: **208**: Basic utility model for passengers or cargo. Commissioned by Federal Express Corporation as **Cargomaster** freighter with special features including T-O weight 3,629 kg (8,000 lb), Bendix/King avionics, no cabin windows or starboard rear door, more cargo tie-downs, additional cargo net, underfuselage cargo pannier of composite materials, 15.2 cm (6 in) vertical extension of fin/rudder, jetpipe deflected to carry exhaust clear of pannier.

208B: Stretched version, developed at request of Federal Express. Commissioned by Federal Express as **Super Cargomaster**, first flight 3 March 1986, certificated October 1986; first delivery to Federal Express 31 October 1986. Features include fuselage stretched by 1.22 m (4 ft), payload of 1,587 kg (3,500 lb) and 12.7 m³ (450 cu ft) of cargo volume; 503 kW (675 shp) P&WC PT6A-114A from 1991.

Grand Caravan: Announced at NBAA 1990; stretched to accommodate up to 14 passengers in quick-change interior, powered by 503 kW (675 shp) P&WC PT6A-114A.

U-27A: Military utility/special mission derivative of 208 Caravan I, announced Spring 1985. US DoD designation assigned for potential FMS contract purposes only (sponsoring service, US Army), roles include cargo, logistic support, paratroop or supply dropping, medevac, electronic surveillance, forward air control, passenger/troop transport, C³I, maritime patrol, SAR, psychological warfare, radio relay/RPV control, military base support, range safety patrol, reconnaissance and fire patrol. Fittings can include six underwing and one centreline hardpoints, observation windows and bubble windows for downward view, centreline reconnaissance pod, 2.8 m³ (84 cu ft) cargo pannier from 208 and two-part electrically actuated upward- and downward-rolling shutter door with slipstream deflector.

CUSTOMERS: Federal Express Corporation took delivery of 40 208As and 210 208Bs before initial contract fulfilled in February 1992. Further order for 50 in 1994, deliveries of which commenced in January 1995 and will be completed at rate of three per month by May 1996. Brazil Central Air lines operates 19 Caravans and in June 1995 ordered 15 Grand Caravans for delivery commencing February 1996. Other customers include Royal Canadian Mounted Police (first wheeled float version); Brazilian Air Force (three plus four on order), Liberian Army (one), Royal Thai Army (10).

Total of 639 Caravans (all versions) delivered by January 1995, further 20 in first quarter of 1995.

COSTS: $1,005,000 (Caravan I), $1,090,800 (Grand Caravan), $1,138,000 (Super Cargomaster).

DESIGN FEATURES: Claimed as first all-new single-engined turboprop general aviation aircraft, intended to replace de Havilland Canada Beavers and Otters, Cessna 180s, 185s and 206s in worldwide utility role.

Main qualities claimed are high speed with heavy load, compatibility with unprepared strips, economy and reliability with minimum maintenance; can also carry weather radar, air conditioning and oxygen systems; optional packs for firefighting, photography, spraying, ambulance/hearse, border patrol, parachuting and supply dropping, surveillance and government utility missions; optional wheel or float landing gear.

First single-engined aircraft to achieve FAA certification for ILS in Cat. II conditions (Federal Express aircraft equipped), approval for IFR cargo operations 1989 made France and Ireland first European countries to allow single-engined public transport day/night IFR operation, since approved also in Canada, Denmark and Sweden.

Wing aerofoil NACA 23017.424 at root, 23012 at tip, dihedral 3° from root, incidence 2° 37′ at root, −0° 36′ at tip.

FLYING CONTROLS: Plain mechanical controls, lateral control by small ailerons and slot lip spoilers ahead of outer section of flaps, aileron trim standard, all tail control surfaces horn balanced, fixed tailplane with upper surface vortex generators ahead of elevator, elevator trim tabs, electrically actuated single-slotted flaps occupy more than 70 per cent of trailing-edge and deflect to maximum 30°.

STRUCTURE: Fail-safe two-spar wing, conventional fuselage.

LANDING GEAR: Non-retractable tricycle type, with single wheel on each unit. Tubular spring cantilever main units, oil-damped steerable nosewheel. Mainwheel tyres size 6.50-10; nosewheel 6.50-8. Oversize tyres, mainwheels 8.50-10, nosewheel 22 × 8.00-8, and extended nosewheel fork, optional. Hydraulically actuated single-disc brake on each mainwheel. Certificated with Wipline floats (with or without retractable land wheels).

POWER PLANT: 208: one Pratt & Whitney Canada PT6A-114 turboprop, flat rated at 447 kW (600 shp) to 3,800 m (12,500 ft), 208B and Grand Caravan: one 503 kW (675 shp) P&WC PT6A-114A turboprop. McCauley three-blade constant-speed reversible-pitch and feathering metal propeller. Integral fuel tanks in wings, total capacity 1,268 litres (335 US gallons, 279 Imp gallons), of which 1,257 litres (332 US gallons, 276.5 Imp gallons) are usable.

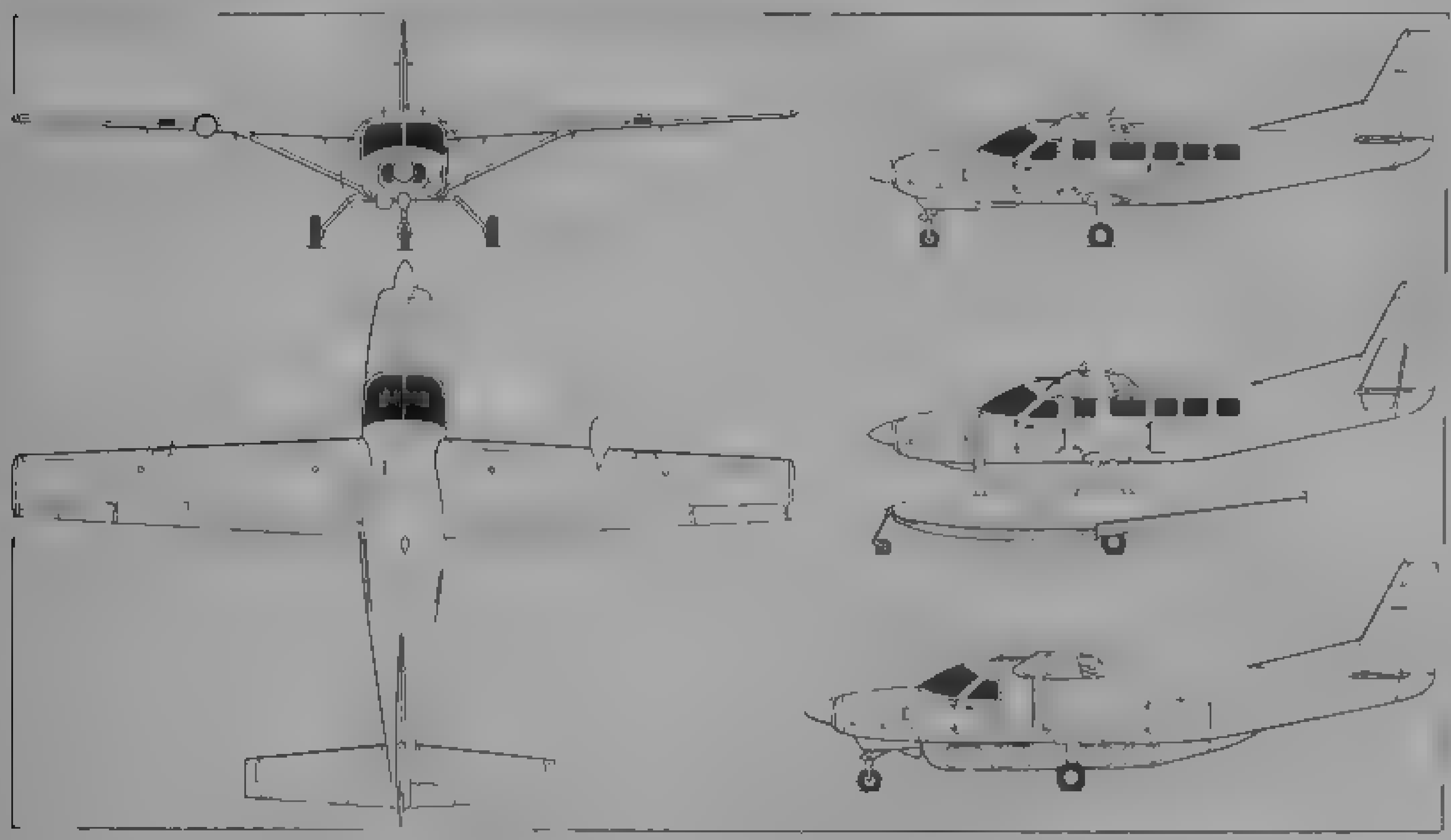
ACCOMMODATION: Pilot and up to nine passengers or 1,360 kg (3,000 lb) of cargo. Maximum seating capacity with FAR Pt 23 waiver is 14. Cabin has a flat floor with Brownline cargo track attachments for a combination of two- and three-abreast seating, with an aisle between seats. Forward hinged door for pilot, with direct vision window, on each side of forward fuselage. Airstair door for passengers at rear of cabin on starboard side. Cabin is heated and

Cessna 208B Caravan with cargo pannier *(Paul Jackson)*

1995

Cessna 'Restart 172' undertaking maiden flight on 17 April 1995

1995



Cessna Caravan I with side views, top to bottom, of 208 Caravan I, 208 wheeled floatplane and 208B Super Cargomaster *(Jane's/Dennis Punnett)*

1992

ventilated. Optional air conditioning. Two-section horizontally split cargo door at rear of cabin on port side, flush with floor at bottom and with square corners. Upper portion hinges upward, lower portion forward 180°. Optional electrically operated, flight openable tambour roll-up door with air flow deflecting spoiler. In a cargo role, cabin will accommodate, typically, two D-size cargo containers or up to ten 208 litre (55 US gallon, 45.8 Imp gallon) drums.

SYSTEMS: Electrical system is powered by 28 V 200 A starter/generator and 24 V 45 Ah lead-acid battery (24 V 40 Ah Ni/Cd battery optional). Standby electrical system, with 95 A alternator, optional. Hydraulic system for brakes only. Oxygen system, capacity 3.31 m³ (116.95 cu ft), optional. Vacuum system standard. Cabin air conditioning system optional from c/n 208-00030 onwards. De-icing system, comprising electric propeller de-icing boots, pneumatic wing, wing strut and tail surface boots, electrically heated windscreen panel, heated pitot/static probe, ice detector light and standby electrical system, all optional.

AVIONICS: Standard Bendix/King Silver Crown package.

Comms: Single VHF transceiver standard.

Radar: Bendix/King RDS-81 colour weather radar optional, housed in pod on starboard wing leading-edge.

Flight: Nav receiver, ADF and transponder standard.

Instrumentation: Sensitive altimeter, electric clock, magnetic compass, attitude and directional gyros, true airspeed indicator, turn and bank indicator, vertical speed indicator, ammeter/voltmeter, fuel flow indicator, ITT indicator, oil pressure and temperature indicator.

EQUIPMENT: Standard equipment includes windscreen defrost, ground service plug receptacle, variable intensity instrument post lighting, map light, overhead courtesy lights (three) and overhead floodlights (pilot and co-pilot), approach plate holder, cargo tiedowns, internal corrosion proofing, vinyl floor covering, emergency locator beacon, partial plumbing for oxygen system, pilot's and co-pilot's adjustable fore/aft/vertical/reclining seats with armrest and five-point restraint harness, tinted windows, control surface bonding straps, heated pitot and stall warning systems, retractable crew steps (port side), rudder gust lock, tiedowns and towbar.

Optional equipment includes passenger seats, stowable, folding utility seats, digital clock, fuel totaliser, turn coordinator, flight hour recorder, fire extinguisher, dual controls, co-pilot flight instruments, floatplane kit (from c/n 208-00030 onwards), hoisting rings (for floatplane), inboard fuel filling provisions (included in floatplane kit), ice detection light, courtesy lights on wing underside, passenger reading lights, flashing beacon, retractable crew step for starboard side, oversized tyres, electric trim system, oil quick drain valve and fan-driven ventilation system.

DIMENSIONS, EXTERNAL (208A):

Wing span	15.88 m (52 ft 1 in)
Wing chord: at root	1.98 m (6 ft 6 in)
at tip	1.22 m (4 ft 0 in)
Wing aspect ratio	9.71
Length overall: landplane	11.46 m (37 ft 7 in)
Height overall: landplane	4.27 m (14 ft 0 in)
amphibian (on land)	5.54 m (18 ft 2 in)
Tailplane span	6.25 m (20 ft 6 in)
Wheel track: landplane	3.56 m (11 ft 8 in)
amphibian	3.25 m (10 ft 8 in)
Wheelbase: landplane	3.54 m (11 ft 7½ in)
amphibian	4.44 m (14 ft 7 in)
Propeller diameter	2.64 m (8 ft 8 in)
Airstair door: Height	1.27 m (4 ft 2 in)
Width	0.61 m (2 ft 0 in)
Cargo door: Height	1.27 m (4 ft 2 in)
Width	1.24 m (4 ft 1 in)

DIMENSIONS, INTERNAL (208A):

Cabin: Length, excl baggage area	4.57 m (15 ft 0 in)
Max width	1.57 m (5 ft 2 in)
Max height	1.30 m (4 ft 3 in)
Volume	9.67 m³ (341.4 cu ft)

AREAS:

Wings, gross	25.96 m² (279.4 sq ft)
Vertical tail surfaces (total, incl dorsal fin)	3.57 m² (38.41 sq ft)
Horizontal tail surfaces (total)	6.51 m² (70.04 sq ft)

WEIGHTS AND LOADINGS (civil 208A. L: landplane, F: floatplane, A: amphibian):

Weight empty: L	1,724 kg (3,800 lb)
F	2,020 kg (4,454 lb)
A	2,177 kg (4,799 lb)
Max baggage (all)	147 kg (325 lb)
Max fuel (all)	1,009 kg (2,224 lb)
Max ramp weight: L	3,327 kg (7,335 lb)
F, A	3,463 kg (7,635 lb)
Max T-O and landing weight, and max zero-fuel weight:	
L	3,311 kg (7,300 lb)
F, A	3,447 kg (7,600 lb)
Max wing loading: L	127.4 kg/m² (26.1 lb/sq ft)
F, A	132.8 kg/m² (27.2 lb/sq ft)
Max power loading: L	7.41 kg/kW (12.17 lb/shp)
F, A	7.71 kg/kW (12.67 lb/shp)

WEIGHTS AND LOADINGS (U-27A. L and A as above):

Weight empty, standard: L	1,752 kg (3,862 lb)
A	2,233 kg (4,922 lb)
Max ramp weight: L	3,645 kg (8,035 lb)
A	3,463 kg (7,635 lb)
Max T-O weight: L	3,629 kg (8,000 lb)
A	3,447 kg (7,600 lb)
Max landing weight: L	3,538 kg (7,800 lb)
A	3,311 kg (7,300 lb)
Max wing loading: L	139.8 kg/m² (28.6 lb/sq ft)
A	132.8 kg/m² (27.2 lb/sq ft)
Max power loading: L	8.11 kg/kW (13.33 lb/shp)
A	7.71 kg/kW (12.67 lb/shp)

PERFORMANCE (civil 208A. L: landplane, F: floatplane, A: amphibian):

Max operating speed (V_{MO}) (all)	175 kts (325 km/h; 202 mph) IAS
Max cruising speed at 3,050 m (10,000 ft):	
L	184 kts (341 km/h; 212 mph)
F	159 kts (295 km/h; 183 mph)
A	153 kts (283 km/h; 176 mph)
Stalling speed, power off:	
L: flaps up	73 kts (135 km/h; 84 mph) CAS
flaps down	60 kts (111 km/h; 69 mph) CAS
F, A, landing configuration	58 kts (107 km/h; 67 mph) CAS
Max rate of climb at S/L: L	370 m (1,215 ft)/min
F	306 m (1,005 ft)/min
A	290 m (952 ft)/min
Service ceiling: L	8,410 m (27,600 ft)
F	7,285 m (23,900 ft)
A	7,010 m (23,000 ft)
Max operating altitude (all)	9,150 m (30,000 ft)
T-O run: L	296 m (970 ft)
T-O run, water: F	468 m (1,535 ft)
A	469 m (1,540 ft)
T-O to 15 m (50 ft): L	507 m (1,665 ft)
F, from water	843 m (2,765 ft)
A, from water	859 m (2,820 ft)
Landing from 15 m (50 ft): L	472 m (1,550 ft)
Landing run: L	197 m (645 ft)
Range with max fuel, at max cruise power, allowances for start, taxi and reserves stated:	
L at 3,050 m (10,000 ft), 45 min	970 n miles (1,796 km; 1,116 miles)
L at 6,100 m (20,000 ft), 45 min	1,275 n miles (2,361 km; 1,467 miles)
F at 3,050 m (10,000 ft), 30 min	898 n miles (1,663 km; 1,033 miles)
A at 3,050 m (10,000 ft), 30 min	868 n miles (1,607 km; 999 miles)
Range with max fuel at max range power, allowances as above:	
L at 3,050 m (10,000 ft)	1,115 n miles (2,065 km; 1,283 miles)
L at 6,100 m (20,000 ft)	1,370 n miles (2,537 km; 1,577 miles)
g limits	+3.8/−1.52

PERFORMANCE (U-27A. L and A as above):

Max cruising speed at 3,050 m (10,000 ft):	
L	184 kts (341 km/h; 212 mph)
A	163 kts (302 km/h; 188 mph)
Stalling speed in landing configuration:	
L	61 kts (113 km/h; 71 mph)
A	58 kts (107 km/h; 67 mph)
Max rate of climb at S/L: L	320 m (1,050 ft)/min
A	274 m (900 ft)/min
Service ceiling: L	7,770 m (25,500 ft)
A	6,100 m (20,000 ft)
T-O run at S/L: L	368 m (1,205 ft)
A, from water	500 m (1,640 ft)
T-O to 15 m (50 ft) at S/L: L	674 m (2,210 ft)
A, from water	872 m (2,860 ft)
Landing from 15 m (50 ft) at S/L, without propeller reversal: L	505 m (1,655 ft)
A	560 m (1,835 ft)
Landing run at S/L, without propeller reversal:	
L	227 m (745 ft)
A	297 m (975 ft)
Range at 3,050 m (10,000 ft) at max cruise power, allowances for T-O, climb, cruise, descent, and 45 min reserves: L	1,085 n miles (2,009 km; 1,249 miles)
A	955 n miles (1,769 km; 1,099 miles)

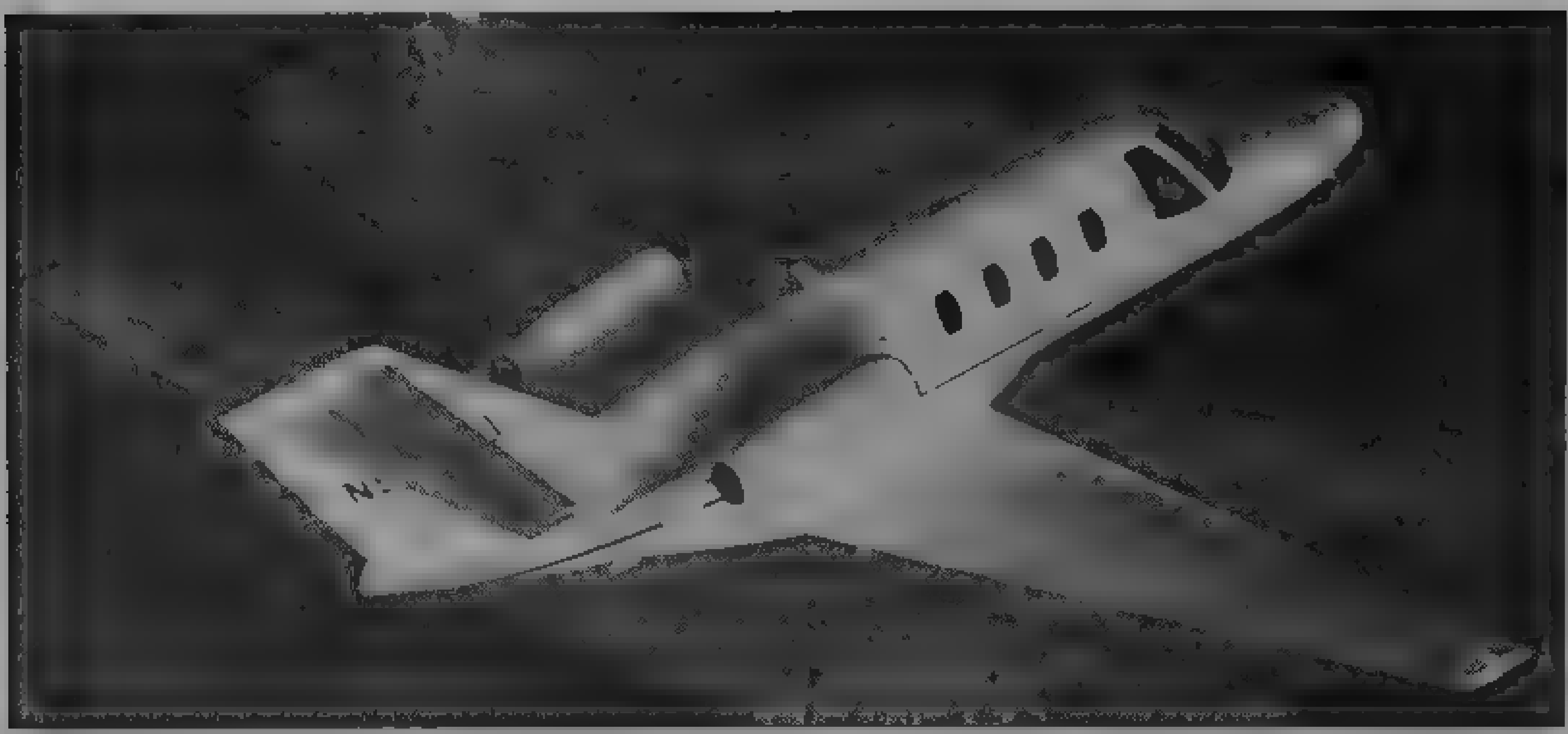
UPDATED

CESSNA 525 CITATIONJET

TYPE: Six/seven-seat business jet.

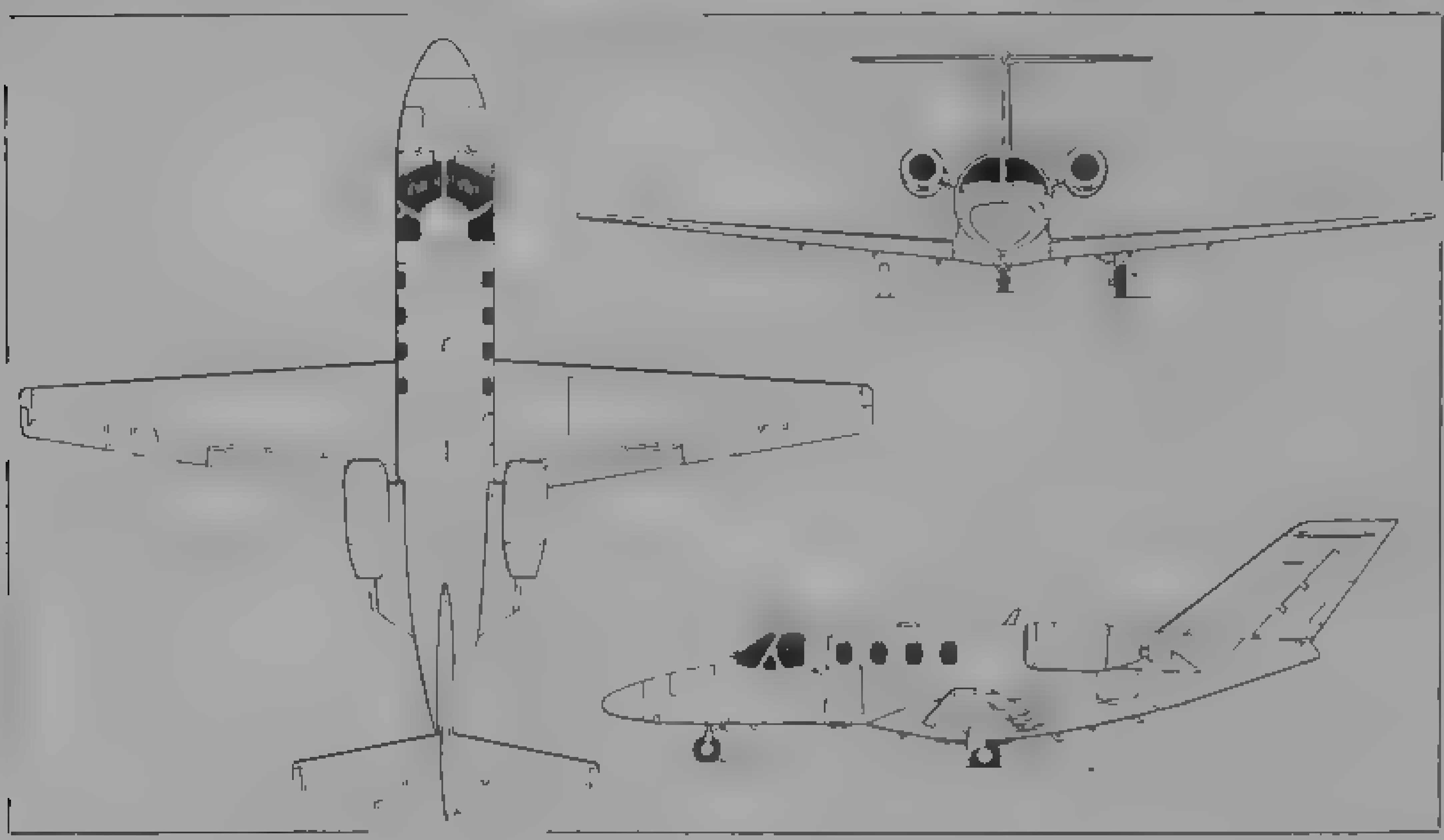
PROGRAMME: Announced at NBAA convention 1989 to replace Citation 500 and I (production of which stopped 1985); first flight of FJ44 turbofans in Citation 500 April 1990; first flight of CitationJet (N525CJ) 29 April 1991; first flight of second (preproduction) prototype 20 November 1991; FAA certification for single-pilot operation received 16 October 1992; first customer delivery 30 March 1993. Anticipated market for 1,000 in 10 years.

CUSTOMERS: Orders for 50 placed at NBAA convention 1989; production sold for 18 months after first delivery; 100th aircraft (N525CC) rolled-out 8 March 1995.



Cessna CitationJet six/seven-seat light business jet

1995



Cessna 525 CitationJet (two Williams-Rolls FJ44 turbofans) *(Jane's/Dennis Punnett)*

1990

COSTS: $3,078,000 (1994)

DESIGN FEATURES: Compared with Citation I, CitationJet has fuselage shortened by 0.27 m (10¾ in) and wing span reduced by 0.57 m (1 ft 10½ in); cabin height increased by 13 cm (5 in) by lowering centre aisle. New supercritical laminar-flow wing aerofoil, high T tail, two FJ44 turbofans, trailing link main landing gear.

POWER PLANT: Two 8.45 kN (1,900 lb st) Williams-Rolls FJ44 turbofans. Fuel load: see under Weights and Loadings.

ACCOMMODATION: Crew of two on flight deck. Main cabin with standard seating for six passengers, two in rearward facing seats at front of cabin, with four in club arrangement; seats have retractable headrests, tray tables which stow in elbow rails, and individual reading lights and ventilation ducts, standard.

SYSTEMS: Pressurisation system, maximum differential 0.58 bar (8.5 lb/sq in).

AVIONICS: Honeywell SPZ 5000 three-axis autopilot/digital flight director as core system.

Comms: Dual Bendix/King 760-channel transceivers, dual Mode S transponders, dual audio amplifiers.

Radar: Bendix/King RDS 81 colour weather radar.

Flight: Dual VHF nav receivers, ADF, DME, RMI.

Instrumentation: Two-tube EFIS with 12.7 × 12.7 cm (5 × 5 in) electronic attitude director indicator (EADI) and electronic horizontal situation indicator (EHSI) displays.

DIMENSIONS, EXTERNAL:

Wing span	14.26 m (46 ft 9½ in)
Wing aspect ratio	9.12
Length overall	12.98 m (42 ft 7¼ in)
Height overall	4.18 m (13 ft 8½ in)
Wheel track	3.84 m (12 ft 7¼ in)
Wheelbase	4.54 m (14 ft 10¾ in)
Tailplane span	5.73 m (18 ft 9½ in)
Crew/passenger door: Height	1.29 m (4 ft 2¾ in)
Width	0.60 m (1 ft 11½ in)

DIMENSIONS, INTERNAL:

Cabin: Length between pressure bulkheads	4.78 m (15 ft 8½ in)
Max width	1.46 m (4 ft 9½ in)
Height	1.46 m (4 ft 9½ in)

AREAS:

Wings, gross	22.30 m² (240.0 sq ft)
Vertical tail surfaces (total, incl tab)	4.74 m² (51.0 sq ft)
Horizontal tail surfaces (total, incl tab)	5.03 m² (54.1 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	2,823 kg (6,224 lb)
Max usable fuel weight	1,460 kg (3,220 lb)
Payload with max fuel	379 kg (836 lb)
Max T-O weight	4,717 kg (10,400 lb)
Max ramp weight	4,763 kg (10,500 lb)
Max zero-fuel weight	3,583 kg (7,900 lb)
Max landing weight	4,400 kg (9,700 lb)
Max wing loading	211.6 kg/m² (43.33 lb/sq ft)
Max power loading	279.3 kg/kN (2.74 lb/lb st)

PERFORMANCE (at max T-O weight except where indicated):

Max operating speed: S/L to 9,300 m (30,500 ft)	260 kts (482 km/h, 299 mph) CAS
above 9,300 m (30,500 ft)	Mach 0.70
Max cruising speed at 3,855 kg (8,500 lb) AUW at 10,060 m (33,000 ft)	383 kts (709 km/h, 441 mph)
Stalling speed, landing configuration	85 kts (157 km/h, 98 mph)
Max rate of climb at S/L	1,009 m (3,311 ft)/min
Rate of climb at S/L, OEI	265 m (868 ft)/min
Max certificated ceiling	12,500 m (41,000 ft)
Service ceiling, OEI	7,985 m (26,200 ft)
T-O balanced field length (FAR Pt 25)	939 m (3,080 ft)
FAR Pt 25 landing field length at max landing weight	838 m (2,750 ft)
Range with max fuel, 45 min reserves	1,456 n miles (2,696 km, 1,675 miles)

UPDATED

CESSNA 550 CITATION II

USAF designation: OT-47B

Spanish Navy designation: U.20

TYPE: Twin-turbofan business jet seating between six and 10 passengers.

PROGRAMME: Announced 14 September 1976, first flight (N550CC) 31 January 1977, FAR Pt 25 Transport Category certification for two-pilot crew March 1978; phased out in favour of Citation S/II 1984, after 503 Citation IIs delivered. Resumed production announced NBAA convention September 1985, again terminated late in 1994.

CURRENT VERSIONS: **550 Citation II**: First version for two-pilot operation. *Data refer to current production 550 Citation II (c/n 0550 and later), unless otherwise indicated.*

Citation Bravo: Described separately.

CUSTOMERS: Total 689 Citation IIs (including 88 II SPs, but excluding prototype, 15 T-47As and 161 S/IIs) delivered by January 1995, including 14 in 1993 and nine in 1994.

COSTS: $3,950,000

DESIGN FEATURES: Fuselage 1.14 m (3 ft 9 in) longer than Citation I, greater wing span, increased fuel and baggage capacities. Wing aerofoil NACA 23014 (modified) at centreline, NACA 23012 at wing station 247.95; dihedral 4°; tailplane dihedral 9°.

FLYING CONTROLS: Mechanically actuated ailerons, manual trim tab on port aileron, manual rudder trim; electric elevator trim tab with manual standby, electrically actuated single-slotted flaps, hydraulically actuated airbrake.

STRUCTURE: Two primary, one auxiliary metal wing spars, three fuselage attachment points, conventional ribs and stringers. All-metal pressurised fuselage with fail-safe design providing multiple load paths.

LANDING GEAR: Hydraulically retractable tricycle type with single wheel on each unit. Main units retract inward into the wing, nose gear forward. Free-fall and pneumatic emergency extension systems. Goodyear mainwheels with tyres size 22.0 × 8.10, 10 ply rating, pressure 6.90 bars (100 lb/sq in). Steerable nosewheel (±20°) with Goodyear wheel and tyre size 18.0 × 4.4, 10 ply rating, pressure 8.27 bars (120 lb/sq in). Goodyear hydraulic brakes. Parking brake and pneumatic emergency brake system. Anti-skid system optional. Minimum ground turning radius about nosewheel 8.38 m (27 ft 6 in).

POWER PLANT: Two Pratt & Whitney Canada JT15D-4B turbofans, each rated at 11.12 kN (2,500 lb st) for take-off, pod-mounted on sides of rear fuselage. Integral fuel tanks in wings, with usable capacity of 2,808 litres (742 US gallons; 618 Imp gallons).

ACCOMMODATION: Crew of two on separate flight deck, on fully adjustable seats, with seat belts and inertia reel shoulder harness. Sun visors standard. Fully carpeted main cabin equipped with seats for six to 10 passengers, with toilet in six/eight-seat versions. Main baggage area at rear of cabin. Second baggage area in nose. Total baggage capacity 522 kg (1,150 lb). Cabin is pressurised, heated and air-conditioned. Individual reading lights and air inlets for each passenger. Dropout constant-flow oxygen system for emergency use. Plug type door with integral airstair at front on port side and one emergency exit on starboard side. Doors on each side of nose baggage compartment. Tinted windows, each with curtains. Pilot's storm window, birdproof windscreen with de-fog system, anti-icing, standby alcohol anti-icing and bleed air rain removal system.

SYSTEMS: Pressurisation system supplied with engine bleed air, maximum pressure differential 0.61 bar (8.8 lb/sq in), maintaining a sea level cabin altitude to 6,720 m (22,040 ft), or a 2,440 m (8,000 ft) cabin altitude to 12,495 m (41,000 ft). Hydraulic system, pressure 103.5 bars (1,500 lb/sq in), with two pumps to operate landing gear and speed brakes. Separate hydraulic system for wheel brakes. Electrical system supplied by two 28 V 400 A DC starter generators, with two 350 VA inverters and 24 V 40 Ah Ni/Cd battery. Oxygen system of 0.62 m³ (22 cu ft) capacity includes two crew demand masks and five dropout constant flow masks for passengers. High capacity oxygen system optional. Engine fire detection and extinguishing systems. Wing leading-edges electrically de-iced ahead of engines, pneumatic de-icing boots on outer wings.

One of three Cessna Citation IIs of Spanish Armada *(Paul Jackson)*

1995

DIMENSIONS, EXTERNAL:
Wing span 15.90 m (52 ft 2 in)
Wing aspect ratio 8.43
Length overall 14.39 m (47 ft 2½ in)
Height overall 4.57 m (15 ft 0 in)
Wheel track 5.36 m (17 ft 7 in)
Wheelbase 5.55 m (18 ft 2½ in)
DIMENSIONS, INTERNAL:
Cabin:
Length, front to rear bulkhead 6.37 m (20 ft 10¾ in)
Max height 1.46 m (4 ft 9½ in)
Baggage volume 1.84 m³ (65.0 cu ft)
AREAS:
Wings, gross 30.00 m² (322.9 sq ft)
Vertical tail surfaces (total) 4.73 m² (50.9 sq ft)
Horizontal tail surfaces (total, incl tab)
6.56 m² (70.6 sq ft)
WEIGHTS AND LOADINGS:
Weight empty, equipped 3,504 kg (7,725 lb)
Max fuel weight 2,272 kg (5,009 lb)
Max T-O weight 6,396 kg (14,100 lb)
Max ramp weight 6,486 kg (14,300 lb)
Max zero-fuel weight 4,990 kg (11,000 lb)
Max landing weight 6,123 kg (13,500 lb)
Max wing loading 201.1 kg/m² (41.19 lb/sq ft)
Max power loading 275.3 kg/kN (2.66 lb/lb st)
PERFORMANCE (at max T-O weight, ISA, except where indicated):
Max operating speed:
S/L to 4,265 m (14,000 ft)
262 kts (486 km/h, 302 mph) IAS
4,265 m (14,000 ft) to 8,530 m (28,000 ft)
277 kts (513 km/h, 319 mph) IAS
8,530 m (28,000 ft) and above Mach 0.705
Cruising speed at average cruise weight of 4,990 kg (11,000 lb) at 7,620 m (25,000 ft)
385 kts (713 km/h, 443 mph)
Stalling speed, clean, at max T-O weight
94 kts (174 km/h, 108 mph) CAS
Stalling speed at max landing weight
84 kts (156 km/h, 97 mph) CAS
Max rate of climb at S/L 1,027 m (3,370 ft)/min
Rate of climb at S/L, OEI 322 m (1,055 ft)/min
Max certificated altitude 13,105 m (43,000 ft)
Service ceiling, OEI 7,680 m (25,200 ft)
T-O to 15 m (50 ft) 727 m (2,385 ft)
T-O balanced field length (FAR Pt 25) 1,051 m (3,450 ft)
FAR Pt 25 landing field length at max landing weight
743 m (2,440 ft)
Range with max fuel, crew of two and six passengers, allowances for T-O, climb, cruise at 13,105 m (43,000 ft), descent, and 45 min reserves
1,760 n miles (3,260 km; 2,025 miles)
OPERATIONAL NOISE LEVELS (FAR Pt 36):
T-O 81.6 EPNdB
Approach 90.5 EPNdB
Sideline 86.4 EPNdB

UPDATED

Standard seven-seat cabin interior of Cessna Citation Bravo

1995

Prototype Cessna Citation Bravo twin-turbofan business jet

1995

CESSNA CITATION BRAVO

TYPE: Six to 10-passenger, twin-turbofan business jet.

PROGRAMME: Announced at Farnborough Air Show September 1994; prototype (N550BB, constructed from 690th production Citation II) first flight 25 April 1995; FAA certification April 1996, first customer delivery June 1996; replaces Citation II.

CUSTOMERS: USAF's Aeronautical Systems Center ordered five as **OT-47B** tracker aircraft with modified Westinghouse AN/APG-66 radars and Westinghouse WF-360 infra-red tracking systems, for delivery by March 1997.

COSTS: $4.395 million, typically equipped (1994).

DESIGN FEATURES: Based on Citation II airframe with advanced technology engines, state-of-the-art avionics and flight controls, trailing link main landing gear, more crew legroom, and cabin seats and interior as those in the Citation V Ultra. Performance improvements over Citation II expected to include 38 minutes faster climb to 12,500 m (41,000 ft), more than 20 knots (37 km/h; 23 mph) faster cruising speed at typical altitudes, and range increase of more than 250 n miles (463 km; 288 miles) with six passengers and VFR reserves.

POWER PLANT: Two 12.23 kN (2,750 lb st) Pratt & Whitney Canada PW530A turbofans, target-type thrust reversers standard.

ACCOMMODATION: Standard cabin seating for seven passengers, on pedestal-mounted seats, refreshment centre and airstair door on port side forward of wing both standard.

SYSTEMS: Oxygen system, capacity 1.81 m³ (64 cu ft) standard.

AVIONICS: Honeywell Primus 1000 with dual digital flight directors and IC 600 integrated avionics computer as core system.

Comms: Dual Bendix/King CN15000 transceivers, dual Mode S transponders, Loral cockpit voice recorder.

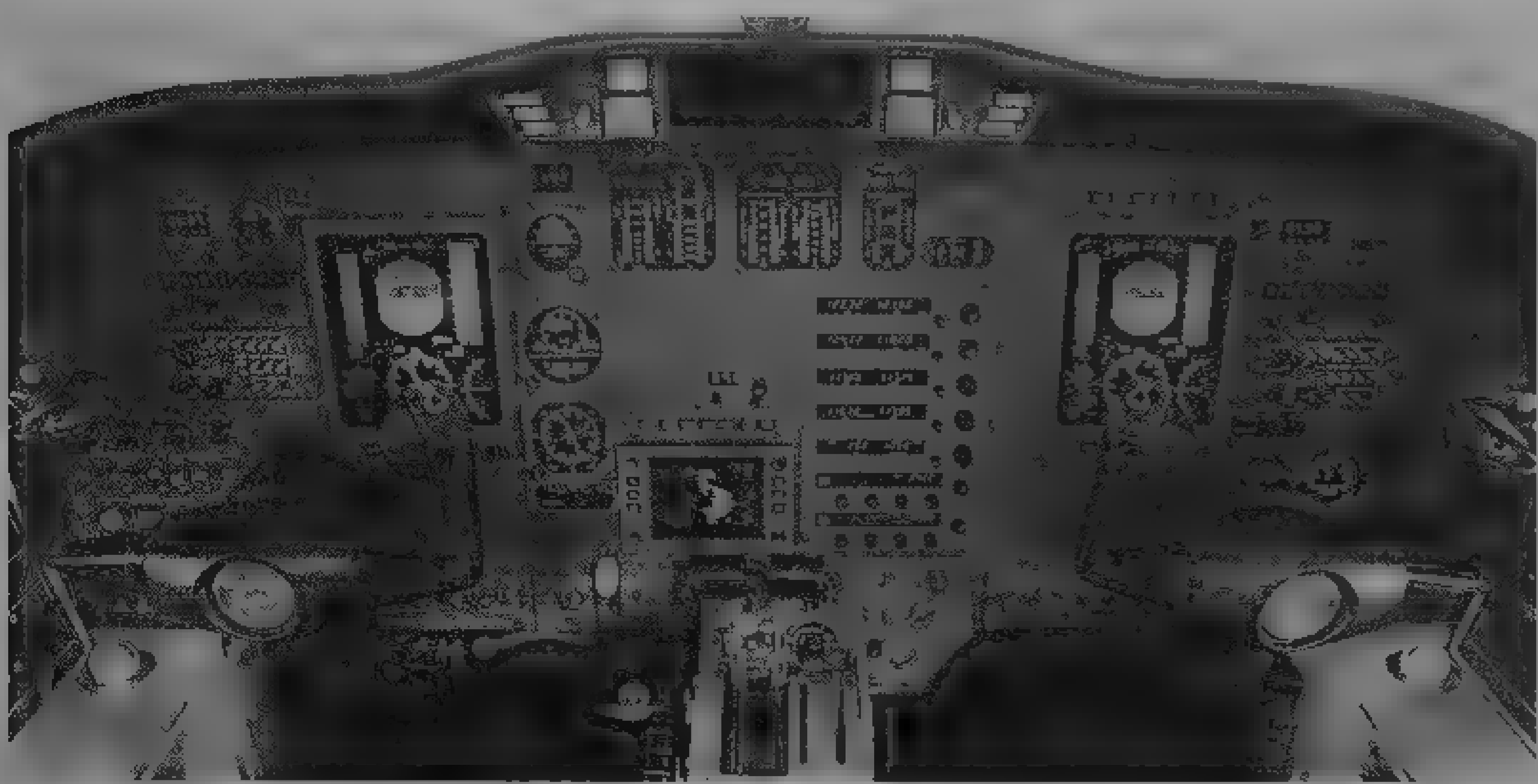
Radar: Bendix/King RDR 2000 colour weather radar.

Flight: Dual Bendix/King CN15000 receiver, DME, ADF and radio altimeter; Global GNS X long-range nav system with GPS and Vnav.

Instrumentation: EFIS with two 17.8 × 20.3 cm (7 × 8 in) primary flight display (PFD) screens combining attitude and HSI formats with additional air data; additional multifunction display (MFD) screen with map/plan/checklist capability optional.

Specification as for Citation II except:

WEIGHTS AND LOADINGS:
Weight empty 3,802 kg (8,383 lb)
Operating weight empty 3,984 kg (8,783 lb)
Max fuel weight (usable) 2,204 kg (4,860 lb)
Payload with max fuel 389 kg (857 lb)
Max ramp weight 6,577 kg (14,500 lb)
Max T-O weight 6,486 kg (14,300 lb)
Max landing weight 6,123 kg (13,500 lb)



Flight deck of Cessna Citation Bravo

1995

Max zero-fuel weight	4,989 kg (11,000 lb)
Max wing loading	216.2 kg/m² (44.29 lb/sq ft)
Max power loading	265.3 kg/kN (2.6 lb/lb st)

PERFORMANCE (at max T-O weight, ISA, except where indicated)

Max operating speed, 2,440 m (8,000 ft) to 8,500 m (27,000 ft)	275 kts (509 km/h, 316 mph)
Max operating speed at 8,500 m (27,880 ft)	Mach 0.70
Max cruising speed at 9,450 m (31,000 ft) at average cruise weight of 5,375 kg (11,850 lb)	394 kts (730 km/h, 453 mph)
Stalling speed in landing configuration	84 kts (156 km/h, 97 mph)
Max rate of climb at S/L	908 m (2,980 ft)/min
Rate of climb at S/L, OEI	271 m (890 ft)/min
Maximum certificated altitude	13,110 m (43,000 ft)
Service ceiling, OEI	8,535 m (28,000 ft)
T-O balanced field length (FAR Pt 25)	1,036 m (3,400 ft)
FAR Pt 25 landing field length at max landing weight	917 m (3,010 ft)
Range with four passengers, 45 min reserves	1,990 n miles (3,685 km, 2,290 miles)

UPDATED

CESSNA 560 CITATION V ULTRA

TYPE: Improved version of Citation V with digital autopilot, EFIS and increased payload and performance.

PROGRAMME: First flight of Citation V engineering prototype (N560CC) August 1987, announced at NBAA convention 1987, first flight of preproduction prototype early 1988, FAA certification 9 December 1988, first delivery April 1989; customers included Spanish Air Force with two SLAR-equipped aircraft, locally designated **TR 20**; total 259 built before mid-1994 change to Citation V Ultra, which announced September 1993, FAA certification June 1994; 300th Citation V/V Ultra delivered 26 July 1995, to Korean Air Lines.

CUSTOMERS: Deliveries of Ultra began July 1994, 24 delivered in 1994, recent customers include Korean Air Lines, which has ordered four as dedicated crew trainers for delivery from second quarter of 1995, and Executive Jet Aviation, with 25 for its NetJets fractional ownership scheme.

COSTS: $5.73 million (1995).

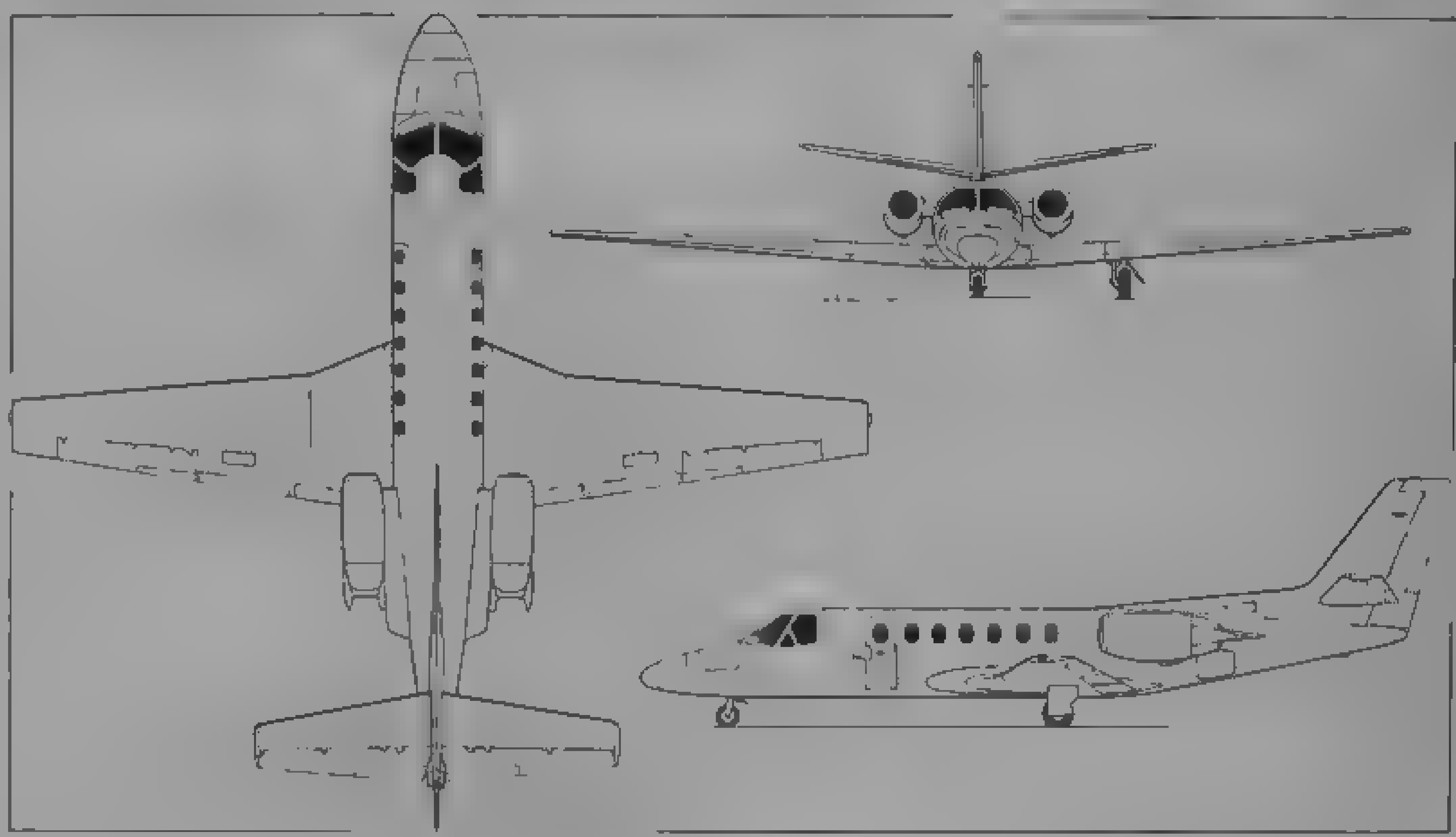
DESIGN FEATURES: Stretched version of Citation S/II for full eight-seat cabin and fully enclosed toilet/vanity area; seventh cabin window each side, two baggage compartments outside main cabin with total volume 1.16 m³ (41 cu ft) and capacity for 385 kg (850 lb) baggage. Other features include Global GNS-X navigation management system, advanced weather radar, dual transponders, encoding and radio altimeters, thrust reversers, engine synchronisers, single-point refuelling/defuelling (from c/n 307 in June 1995), 1.8 m³ (64 cu ft) oxygen system, recognition lights, and in-flight telephone. *Description and specification as for Citation II except as follows:*

POWER PLANT: Two Pratt & Whitney Canada JT15D-5D turbofans, each rated at 13.55 kN (3,045 lb st). Usable fuel 3,259 litres (861 US gallons, 717 Imp gallons).

ACCOMMODATION: Standard seating for eight passengers in double-club arrangement on swivelling and fore/aft/inboard-tracking pedestal seats, refreshment centre in forward cabin area, lavatory/vanity centre with sliding doors to rear, metallic plating on cabin fittings, veneer overlay on armrests, pleated window shades and cabin divider mirror standard, space in aft section of cabin for 272 kg (600 lb) of baggage, in addition to external baggage compartments in nose and rear fuselage.

SYSTEMS: Pressurisation system, maximum differential 0.61 bar (8.9 lb sq in).

Cessna Citation V Ultra cabin interior *1995*



Cessna 560 Citation V Ultra (two Pratt & Whitney Canada JT15D-5D turbofans) *(Jane's/Dennis Punnett)* *1988*

AVIONICS: Standard avionics package based on Honeywell Primus 1000 digital flight control system with integrated avionics computer.

Comms: Dual transponders, dual altitude reporting systems, cockpit voice recorder and in-flight telephone standard.

Radar: Colour weather radar standard.

Flight: Dual DME, coupled vertical navigation system Global GNS-X/ES with GPS, expanded keyboard and colour CDU display standard.

Instrumentation: Three-tube EFIS with 20.3 × 17.8 cm (8 × 7 in) CRTs comprising pilot's and co-pilot's primary flight display (PFD) and centrally mounted multifunction display (MFD). PFDs integrate functions of five flight instruments and several sources of navigation data, and provide trend data for airspeed, altitude and rate of climb.

DIMENSIONS, EXTERNAL:

Wing span	15.91 m (52 ft 2¼ in)
Length overall	14.90 m (48 ft 10¾ in)
Height overall	4.57 m (15 ft 0 in)
Tailplane span	6.55 m (21 ft 6 in)
Wheelbase	6.06 m (19 ft 10⅝ in)

DIMENSIONS, INTERNAL:

Cabin: Length, excluding cockpit	5.31 m (17 ft 5 in)
Max width	1.50 m (4 ft 11 in)
Max height	1.40 m (4 ft 7 in)

AREAS:

Horizontal tail surfaces (total)	7.88 m² (84.8 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	4,196 kg (9,250 lb)
Operating weight empty	4,377 kg (9,650 lb)
Payload with max fuel	470 kg (1,036 lb)
Max fuel weight (usable)	2,637 kg (5,814 lb)
Max ramp weight	7,484 kg (16,500 lb)
Max T-O weight	7,393 kg (16,300 lb)
Max zero-fuel weight	5,534 kg (12,200 lb)
Max landing weight	6,894 kg (15,200 lb)
Max wing loading	246.5 kg/m² (50.48 lb/sq ft)
Max power loading	273.1 kg/kN (2.68 lb/lb st)

PERFORMANCE (at max T-O weight, ISA, except where indicated):

Max operating speed (V_{MO}) at 8,810 m (28,900 ft)	Mach 0.75

Cessna 560 Citation V Ultra eight-seat business jet *1995*

Max cruising speed at 10,670 m (35,000 ft)
430 kts (796 km/h; 495 mph)
Stalling speed, flaps down 82 kts (152 km/h, 95 mph)
Max rate of climb at S/L 1,249 m (4,100 ft)/min
Rate of climb at S/L, OEI 367 m (1,207 ft)/min
Max certificated altitude 13,715 m (45 000 ft)
Service ceiling, OEI 7,894 m (25,900 ft)
T-O balanced field length (FAR 25) 970 m (3,180 ft)
Landing from 15 m (50 ft) at max landing weight
854 m (2 800 ft)
Range with five passengers
1,960 n miles (3,630 km, 2 255 miles)

UPDATED

CESSNA 560XL CITATION EXCEL

TYPE: Eight to 10-seat, twin-turbofan business jet

PROGRAMME: Announced at National Business Aircraft Association Convention in New Orleans October 1994; will replace Citation VI. Construction of prototype began February 1995, first flight planned for March 1996. FAA certification anticipated March 1997; first delivery December 1997

CUSTOMERS: Total of more than 50 orders received by end of January 1995; launch customers included distributor Taxi Aereo Marilia of Brazil, which has ordered six for delivery commencing during the last quarter of 1998 and concluding early in 2000

COSTS: $6.595 million (1994)

DESIGN FEATURES: Combines modified wing and tail surfaces of Citation V Ultra with shortened version of Citation X's fuselage, providing cabin with stand-up headroom

LANDING GEAR: Trailing link main landing gear

POWER PLANT: Two 16.19 kN (3,640 lb st) Pratt & Whitney Canada PW545A turbofans. Integral fuel tank in each wing, total capacity 3,694 litres (976 US gallons; 813 Imp gallons) of which 3,668 litres (969 US gallons; 807 Imp gallons) usable; single-point pressure refuelling

ACCOMMODATION: Standard seating for eight to 10 passengers with aft lavatory and dressing room. Baggage compartment in rear fuselage with external access door

SYSTEMS: Pressurisation system, maximum differential 0.64 bar (9.3 lb/sq in). Freon air conditioning system. Oxygen system, capacity 1.81 m³ (64 cu ft). Engine inlet anti-icing system. Wing leading-edges de-iced by engine bleed air; tailplane has de-icer boots, fin unprotected

AVIONICS: Standard Honeywell Primus 1000 integrated digital avionics suite with IC-600 avionics computer as core system. Collins system optional.

Radar: Honeywell Primus 650 colour weather radar.

Instrumentation: Three-tube EFIS with 20.3 × 17.8 cm (8 × 7 in) CRT screens comprising dual primary flight displays (PFDs) showing attitude/heading and all air data information, and single multifunction display (MFD) for map/plan, weather and checklist data

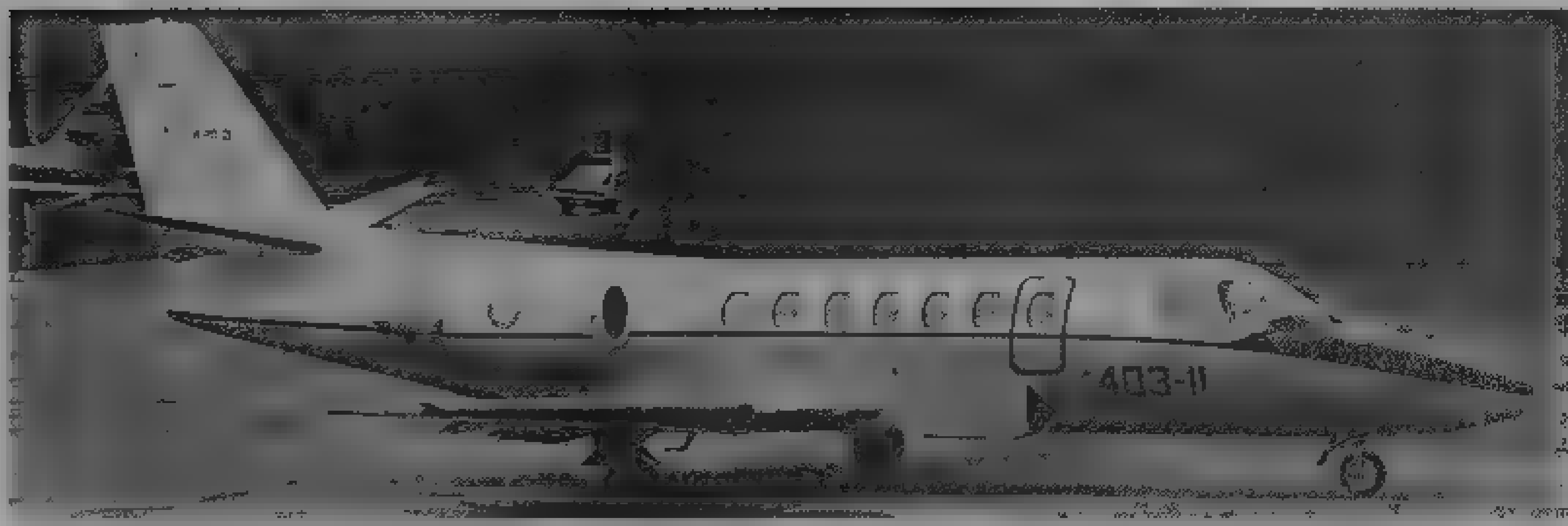
DIMENSIONS, EXTERNAL:
Wing span 16.98 m (55 ft 8½ in)
Wing aspect ratio 8.39
Length overall 15.88 m (52 ft 1¼ in)
Length of fuselage 15.24 m (50 ft 0 in)
Height overall 5.27 m (17 ft 3½ in)
Tailplane span 6.55 m (21 ft 6 in)
Wheelbase 4.60 m (15 ft 1¼ in)

DIMENSIONS, INTERNAL:
Cabin: Length
between pressure bulkheads 7.01 m (23 ft 0 in)
excl cockpit 5.74 m (18 ft 10 in)
Max width 1.70 m (5 ft 7 in)
Max height 1.73 m (5 ft 8 in)
Baggage capacity (aft) 2.18 m³ (77.0 cu ft)

AREAS:
Wings, gross 34.35 m² (369.7 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, approx 4,746 kg (10,463 lb)
Operating weight empty 5,153 kg (11,360 lb)
Max fuel weight (usable) 2,966 kg (6,540 lb)
Payload with max fuel 453 kg (1,000 lb)
Max ramp weight 8,573 kg (18,900 lb)
Max T-O weight 8,482 kg (18,700 lb)
Max landing weight 7,892 kg (17,400 lb)
Max zero-fuel weight 6,078 kg (13,400 lb)
Max wing loading 246.96 kg/m² (50.58 lb/sq ft)
Max power loading 262.11 kg/kN (2.57 lb/lb st)

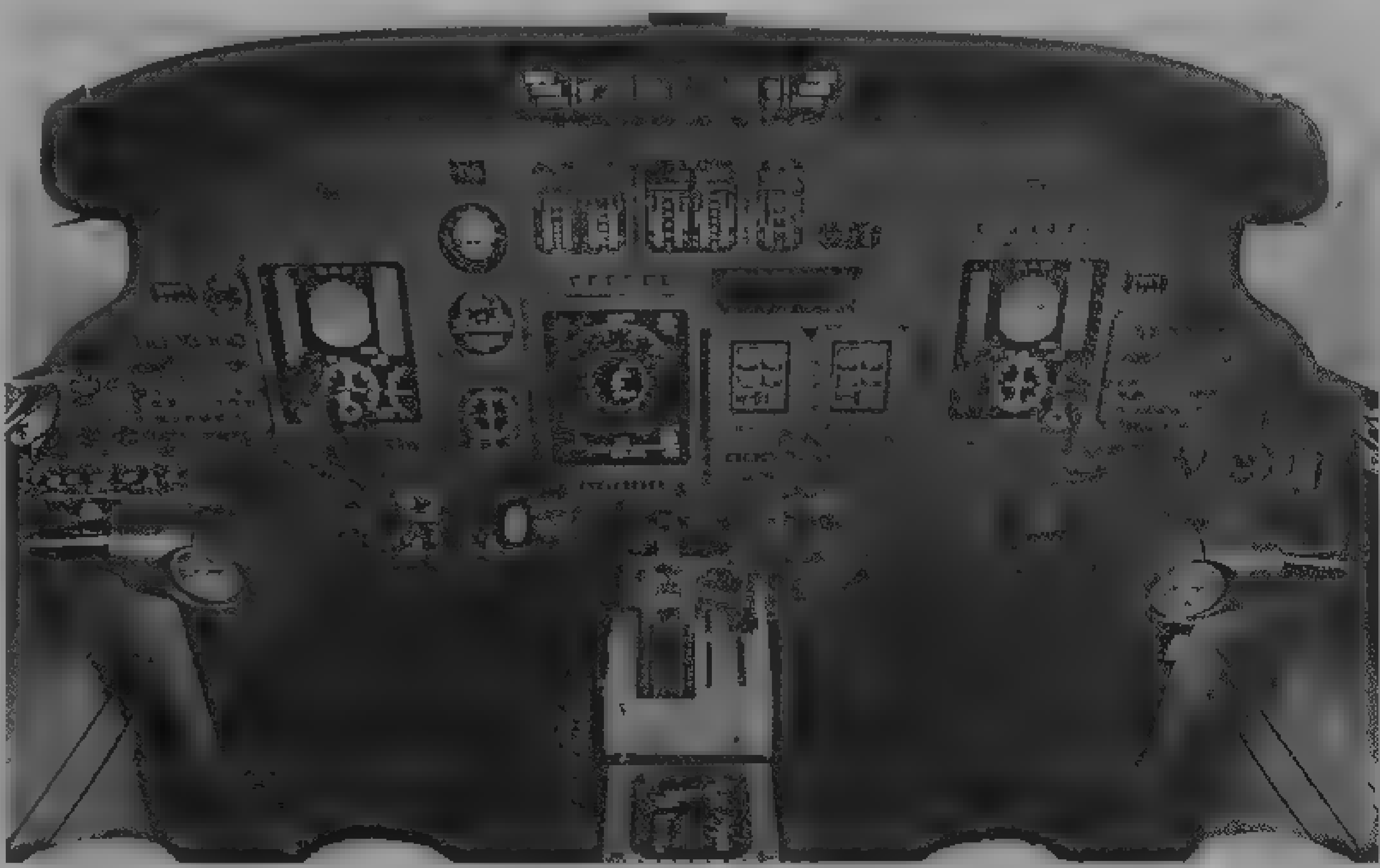
PERFORMANCE (at max T-O weight, ISA, except where indicated):
Max operating speed (V_{MO}): S/L to 8,320 m (27,300 ft)
300 kts (555 km/h; 345 mph) CAS
above 8,320 m (27,300 ft) Mach 0.75
Max cruising speed at 10,670 m (35,000 ft)
430 kts (796 km/h; 495 mph)
Stalling speed in landing configuration
86 kts (159 km/h; 99 mph)



Spanish Air Force TR 20 (Cessna 560 Citation V) fitted with SLAR on port side, ahead of wingroot *(SIRPA-Air)* *1995*

Computer-generated image of Cessna 560XL Citation Excel *1995*


Eight-seat cabin interior of Cessna 560XL Citation Excel *1995*


Cockpit of Cessna Citation Excel showing Honeywell Primus 1000 avionics with three-tube EFIS *1995*

Max rate of climb at S/L	1,125 m (3,691 ft)/min
Rate of climb at S/L, OEI	374 m (1,229 ft)/min
Max certificated altitude	13,715 m (45,000 ft)
Service ceiling, OEI	9,860 m (32,350 ft)
T-O balanced field length (FAR Pt 25)	1,040 m (3,414 ft)
FAR Pt 25 landing field length at max weight	1,072 m (3,515 ft)
Range with four passengers, 45 min reserves	2,055 n miles (3,805 km, 2,364 miles)

NEW ENTRY

CESSNA 650 CITATION VI

TYPE: Six- to 10-passenger business jet; simplified, lower cost version of Citation III.

PROGRAMME: Announced 1990; first aircraft rolled-out 2 January 1991; first delivery 1992.

CUSTOMERS: Total deliveries 39 (14 in 1992, 13 in 1993, 10 in 1994 and two in 1995), including two to Civil Aviation Administration of China for navaid flight inspection. Further 202 (and two prototype) Citation IIIs built previously; production of VI suspended late 1994.

COSTS: $8,150,000.

DESIGN FEATURES: Citation III airframe, retains AlliedSignal TFE731-3B-100 turbofans.

FLYING CONTROLS: Variable incidence tailplane and elevator, rudder boosted to counteract asymmetric thrust, hydraulically powered ailerons with manual reversion assisted after 3° movement by outboard spoiler panel, four hydraulically powered spoiler panels on each wing, of which outboard assists aileron, two centre panels act as airbrakes and all four panels used for emergency descent and lift dumping after touchdown. Electrically actuated trailing-edge flaps in three sections each side. Stall strips on inner and outer wings and small fence and turbulators ahead of outer flaps.

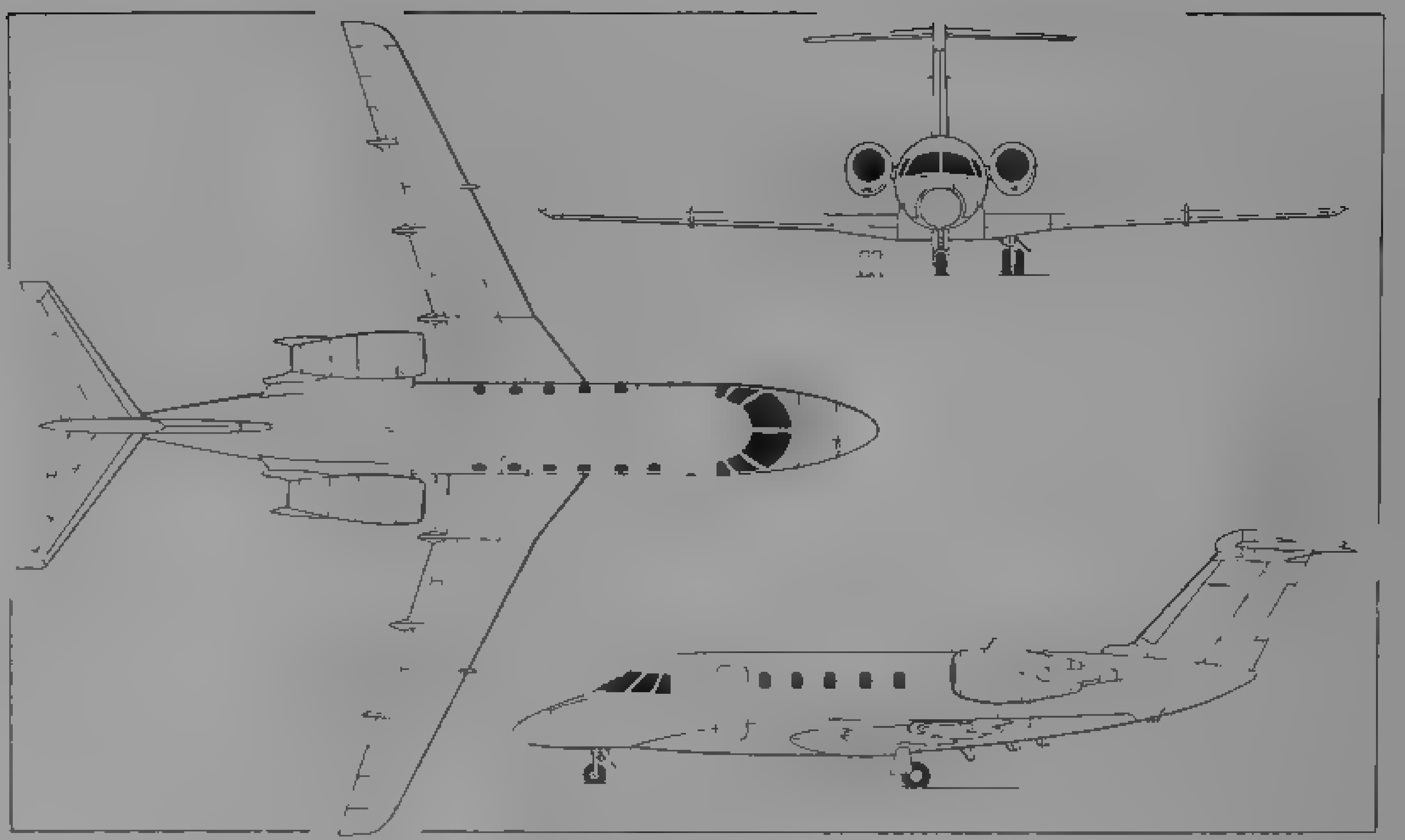
STRUCTURE: Conventional light alloy pressurised fuselage of circular section, fail-safe in pressurised area, light alloy tail surfaces, two-spar, fail-safe light alloy wing of bonded and riveted construction, wing built in three sections, flaps of Kevlar and graphite composites.

LANDING GEAR: Hydraulically retractable tricycle type. Main units retract inward into the undersurface of the wing centre-section, nosewheel forward and upward into the nose. Main units of trailing link type, each with twin wheels, steerable nose unit has a single wheel, maximum steering angle ±70 to 80°. Oleo-pneumatic shock-absorber in each unit. Hydraulically powered nosewheel steering with an accumulator to provide steering after a loss of normal hydraulic power. Emergency landing gear extension by manual release and free-fall to locked position, pneumatic blowdown system for back-up. Mainwheel tyres size 22.0 × 5.75, 10 ply rating, pressure 10.20 bars (148 lb/sq in). Nosewheel tyre size 18.0 × 4.4, 10 ply rating, pressure 8.62 bars (125 lb/sq in). Fully modulated hydraulically powered anti-skid brake system. In the event of hydraulic system failure, an electrically driven standby pump provides pressure for the brakes. Emergency pneumatic brake system. Parking brake. Turning circle based on nosewheel 6.63 m (21 ft 9 in).

POWER PLANT: Two AlliedSignal TFE731-3B-100S turbofans, each rated at 16.24 kN (3,650 lb st) for take-off, pod mounted on sides of rear fuselage. Hydraulically operated Rohr target type thrust reversers standard. Two independent fuel systems, with integral tanks in each wing, usable capacity 4,141 litres (1,014 US gallons, 911 Imp gallons). Additional fuel cell behind rear fuselage bulkhead. Single-point pressure refuelling on starboard side of fuselage, to rear of wing trailing-edge. Gravity refuelling point on upper surface of each wing. A boost pump in the port wing fills the fuselage tank when pressure refuelling is not available.

ACCOMMODATION: Crew of two on separate flight deck, and up to 10 passengers. Standard interiors only, with six individual seats, toilet at rear of cabin. The fuselage nose incorporates a radome, high-resolution radar, avionics bay and a storage compartment for crew baggage. Electrically heated baggage compartment in rear fuselage with external door on port side. Airstair door forward of wing on port side. Overwing emergency escape hatch on starboard side. Cabin is pressurised, heated and air conditioned. Windscreen anti-icing by engine bleed air, with alcohol spray back-up for port side of the windscreen. Windscreen demisting by warm air, and rain removal by engine bleed air and a mechanically actuated air flow deflector.

SYSTEMS: Environmental control system, with separate control of flight deck and cabin conditions. Direct engine bleed pressurisation system, with nominal pressure differential of 0.67 bar (9.7 lb/sq in), provides 2,440 m (8,000 ft) cabin environment to maximum certificated altitude and can maintain a sea level cabin environment to approximately 7,620 m (25,000 ft). Electrical system includes two 28 V 400 A DC starter/generators, two 200/115 V 5 kW three-phase engine-driven alternators, two 115 V 400 Hz solid-state static inverters, two 24 V 22 Ah Ni/Cd batteries and an external power socket in the tailcone. Hydraulic system of 207 bars (3,000 lb/sq in) powered by two engine-driven pressure compensated pumps for operation of spoilers, brakes, landing gear, nosewheel steering and thrust reversers. Hydraulic reservoir with integral reserve and an electrically driven hydraulic pump to provide emergency power. Oxygen system of 1.39 m³ (49 cu ft) capacity with automatic dropout constant flow oxygen mask for each passenger and a quick-donning pressure demand mask for each crew member. Engine fire detection and extinguishing system. Wing leading-edges de-iced by engine bleed air; tailplane electrically de-iced; fin unprotected. Engine intake anti-icing system.



Cessna Citation VI (two AlliedSignal TFE731-3B-100S turbofans) *(Jane's/Dennis Punnett)* *1992*

AVIONICS: Honeywell SPZ-650 integrated autopilot/digital flight director as core system. Bendix/King Series II integrated nav/com, EFIS and radar system optional.

Comms: Dual Collins VHF-22A 720-channel com transceivers, TDR-90 transponder; dual Avtech audio amplifiers, Telex microphones, headsets and speakers.

Radar: Honeywell Primus 300SL colour weather radar.

Flight: Honeywell AD650A ADI, RD650A HSI with C-14D compass system, GH-14 ADI and RD650A HSI with C-14D compass system for co-pilot, AA-300 radio altimeter; dual Collins VIR-32 nav receivers with VOR/LOC/GS and marker beacon receivers, dual RMI 30 and DME-42, single ADF 60; Jet Inc standby attitude gyro. Teledyne angle of attack system, air data computer. Stall warning system.

Instrumentation: Dual altimeters, Mach/airspeed indicators, angle of attack indicator, instantaneous rate of climb indicators and outside air temperature gauge.

EQUIPMENT: Standard equipment includes crew seats with vertical, fore, aft and recline adjustments, seat belts, shoulder harnesses and inertia reels, six individual passenger seats, three forward- and three aft-facing with vertical, fore and aft adjustment, lateral tracking and recline adjustments, seat belts and shoulder harnesses, sun visors, flight deck divider with curtain, map case, openable storm windows, electroluminescent and edge-lit instrument panels, cockpit and cabin fire extinguishers, indirect cabin lighting, cabin aisle lights, door courtesy lights, refreshment centre, executive table, aft cabin divider with curtain, emergency exit signs, internal corrosion proofing, emergency battery pack, emergency portable cabin oxygen, navigation and recognition lights, dual landing and taxi lights, dual anti-collision strobe lights, red flashing beacon, dual wing ice lights, lightning protection, static discharge wicks and tie-down provisions.

DIMENSIONS, EXTERNAL:	
Wing span	16.31 m (53 ft 6 in)
Wing mean aerodynamic chord	2.08 m (6 ft 9¾ in)
Wing aspect ratio	9.17
Length overall	16.90 m (55 ft 5½ in)
Height overall	5.12 m (16 ft 9½ in)
Tailplane span	5.60 m (18 ft 4½ in)
Wheel track	2.84 m (9 ft 4 in)
Wheelbase	6.50 m (21 ft 4 in)
Cabin door: Width	0.61 m (2 ft 0 in)
Height	1.37 m (4 ft 6 in)
DIMENSIONS, INTERNAL:	
Cabin:	
Length: front to rear bulkhead	7.25 m (23 ft 9⅛ in)
aft of cockpit divider	5.70 m (18 ft 8⅜ in)
Max width	1.73 m (5 ft 8 in)
Max height	1.73 m (5 ft 8 in)
Baggage capacity (aft)	1.56 m³ (55.0 cu ft)
Crew baggage compartment (nose)	0.17 m³ (6.0 cu ft)
AREAS:	
Wings, gross	28.99 m² (312.0 sq ft)
Vertical tail surfaces (total)	6.04 m² (65.0 sq ft)
Horizontal tail surfaces (total)	6.26 m² (67.4 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, standard	5,851 kg (12,900 lb)
Max fuel weight	3,349 kg (7,384 lb)
Max payload	1,583 kg (3,489 lb)
Max T-O weight	9,979 kg (22,000 lb)
Max ramp weight	10,070 kg (22,200 lb)
Max landing weight	9,072 kg (20,000 lb)
Max zero-fuel weight	7,212 kg (15,900 lb)
Max wing loading	344.2 kg/m² (70.51 lb/sq ft)
Max power loading	307.24 kg/kN (3.01 lb/lb st)
PERFORMANCE (at max T-O weight, ISA, except where indicated):	
Max operating speed (V_{MO}): S/L to 2,440 m (8,000 ft)	305 kts (565 km/h, 351 mph) IAS
at 11,130 m (36,525 ft)	278 kts (515 km/h, 320 mph) IAS
above 11,130 m (36,525 ft)	Mach 0.851
Max cruising speed at 10,670 m (35,000 ft) and 7,257 kg (16,000 lb) cruise weight	472 kts (874 km/h, 543 mph)
Stalling speed: clean, at max T-O weight	125 kts (232 km/h, 144 mph) CAS
flaps and wheels down, at max landing weight	97 kts (515 km/h, 112 mph) CAS
Max rate of climb at S/L	1,127 m (3,700 ft)/min
Rate of climb at S/L, OEI	245 m (805 ft)/min
Time to 13,100 m (43,000 ft)	33 min
Certificated ceiling	15,545 m (51,000 ft)
Ceiling, OEI	7,165 m (23,500 ft)
FAR 25 T-O field length at S/L	1,579 m (5,180 ft)
FAR 25 landing field length at max landing weight	884 m (2,900 ft)
Range, zero wind, with allowances for T-O, climb, descent and 45 min reserves (two crew, four passengers)	2,346 n miles (4,345 km, 2,700 miles)
g limits	+3.2 −1
OPERATIONAL NOISE LEVELS (FAR Pt 36):	
T-O	74.0 EPNdB
Approach	85.0 EPNdB
Sideline	81.0 EPNdB

UPDATED

CESSNA 650 CITATION VII

TYPE: More powerful version of Citation VI (which see).

PROGRAMME: Announced 1990; engineering prototype first flew February 1991, FAR Pt 25 certification January 1992.

CUSTOMERS: First production aircraft (N701CD) as demonstrator, first customer delivery (N1AP) to golfer Arnold Palmer April 1992. Total deliveries 37 by end of 1994, including 14 in 1994, 53 built by May 1995.

COSTS: $9,845,125.

DESIGN FEATURES: Citation VI airframe with 18.41 kN (4,140 lb st) AlliedSignal TFE731-4R-2S turbofans for improved hot/high performance.

AVIONICS: Honeywell SPZ 8000 autopilot/flight director as core system.

Radar: Primus 870 Doppler colour weather radar.

Flight: VOR/DME, DME, Loran C, GPS, VLF/Omega and IRS/INS, digital flight control system with duplex autopilot that allows each flight guidance computer to perform independently, then monitor each other for discrepancies; Global Wulfsberg GNS X flight management system (FMS) optional.

Instrumentation: Four-tube EFIS with 12.7 × 15.2 cm (5 × 6 in) displays, five-tube EFIS optional.

Specification otherwise as Citation VI except:

WEIGHTS AND LOADINGS:	
Weight empty, standard	5,307 kg (11,700 lb)
Max fuel weight	3,350 kg (7,385 lb)
Max T-O weight	10,183 kg (22,450 lb)

Max ramp weight 10,274 kg (22,650 lb)
Max landing weight 9,072 kg (20,000 lb)
Max zero-fuel weight 7,484 kg (16,500 lb)
Max wing loading 351.3 kg/m² (71.96 lb/sq ft)
Max power loading 276.67 kg/kN (2.71 lb/lb st)

PERFORMANCE (at max T-O weight, ISA, except where indicated):
Max operating Mach number (MMO) 0.851
Max operating speed (VMO): S/L to 2,440 m (8,000 ft) 275 kts (509 km/h; 317 mph) IAS
at 11,130 m (36,525 ft) 278 kts (515 km/h; 320 mph) IAS
Max cruising speed at 11,890 m (39,000 ft) and 7,257 kg (16,000 lb) cruise weight 476 kts (881 km/h; 548 mph)
Stalling speed, flaps and wheels down, at max landing weight 97 kts (180 km/h; 112 mph)
Max rate of climb at S/L 1,354 m (4,442 ft)/min
Rate of climb at S/L, OEI 329 m (1,080 ft)/min
FAR Pt 25 T-O field length at S/L 1,430 m (4,690 ft)
FAR Pt 25 landing field length at max landing weight 881 m (2,910 ft)
Range with max fuel, six passengers and 45 min reserves 2,220 n miles (4,111 km; 2,554 miles)
g limits +3/−1

OPERATIONAL NOISE LEVELS (FAR Pt 36):
T-O (7° flap) 69.3 EPNdB
Approach (full flap) 84.8 EPNdB

UPDATED

CESSNA 750 CITATION X

TYPE: High-speed long-range business jet.

PROGRAMME: Announced October 1990; engine flew on Citation VII testbed (N650) 21 August 1992, first flight (N750CX) 21 December 1993, two preproduction aircraft to aid integration of production systems, first of these (N751CX) flown 27 September 1994, second (N752CX) flown 11 January 1995, total of 1,200 flight test hours and 750 flights by June 1995, certification scheduled for November 1995, first customer delivery April 1996.

CUSTOMERS: Total 30 orders by June 1995, representing production up to third quarter of 1997, golfer Arnold Palmer sole named customer.

COSTS: $12.95 million equipped and furnished.

DESIGN FEATURES: High maximum operating Mach number; US transcontinental and transatlantic range. Wing sweepback 37°.

FLYING CONTROLS: Dual hydraulically powered controls with manual reversion, one-piece all-moving tailplane; speed brakes and spoilers with manual back-up.

STRUCTURE: Thick wing skins, milled from solid.

The following data are provisional

LANDING GEAR: Trailing link main units, each with twin wheels, powered anti-skid brakes; steerable nose unit with twin wheels.

POWER PLANT: Two Allison AE 3007C turbofans, each rated at 28.47 kN (6,400 lb st) for take-off, pod-mounted on sides of rear fuselage, FADEC. Hydraulically operated target type thrust reversers standard. Single point refuelling.

ACCOMMODATION: Crew of two on separate flight deck, and up to 12 passengers, interior custom designed, cabin is pressurised, heated and air conditioned; 1.76 m (5 ft 9½ in) stand-up headroom, heated and pressurised baggage compartment in rear fuselage with external door. Windscreen electrically heated and demisted.

SYSTEMS: AiResearch GTCP36-150 integrated APU/air turbine starter.

AVIONICS: Honeywell Primus 2000 autopilot/flight director as core system.

Flight: Dual flight management systems (FMS), dual attitude and heading reference systems, and Honeywell GPS standard.

Instrumentation: Five-tube EFIS with 17.8 × 20.3 cm (7 × 8 in) primary flight display (PFD) and multifunction display (MFD) for pilot and co-pilot, similarly sized engine instrument and crew alerting system (EICAS) display in centre.

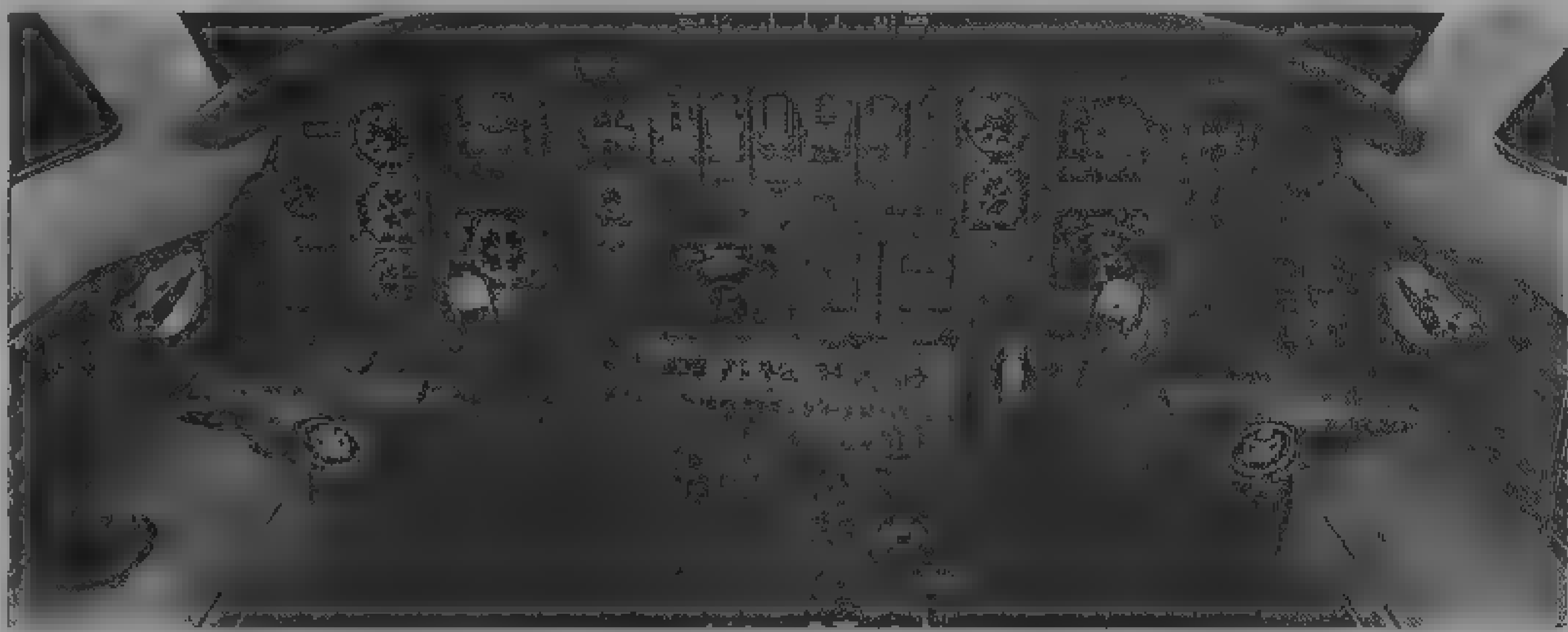
DIMENSIONS, EXTERNAL:
Wing span 19.48 m (63 ft 11 in)
Length overall 22.00 m (72 ft 2 in)
Height overall 5.77 m (18 ft 11 in)

DIMENSIONS, INTERNAL:
Cabin: Length, front to rear pressure bulkhead 8.69 m (28 ft 6 in)
Max width 1.74 m (5 ft 8½ in)
Max height 1.76 m (5 ft 9½ in)
Baggage compartment volume (aft) 2.04 m³ (72.0 cu ft)

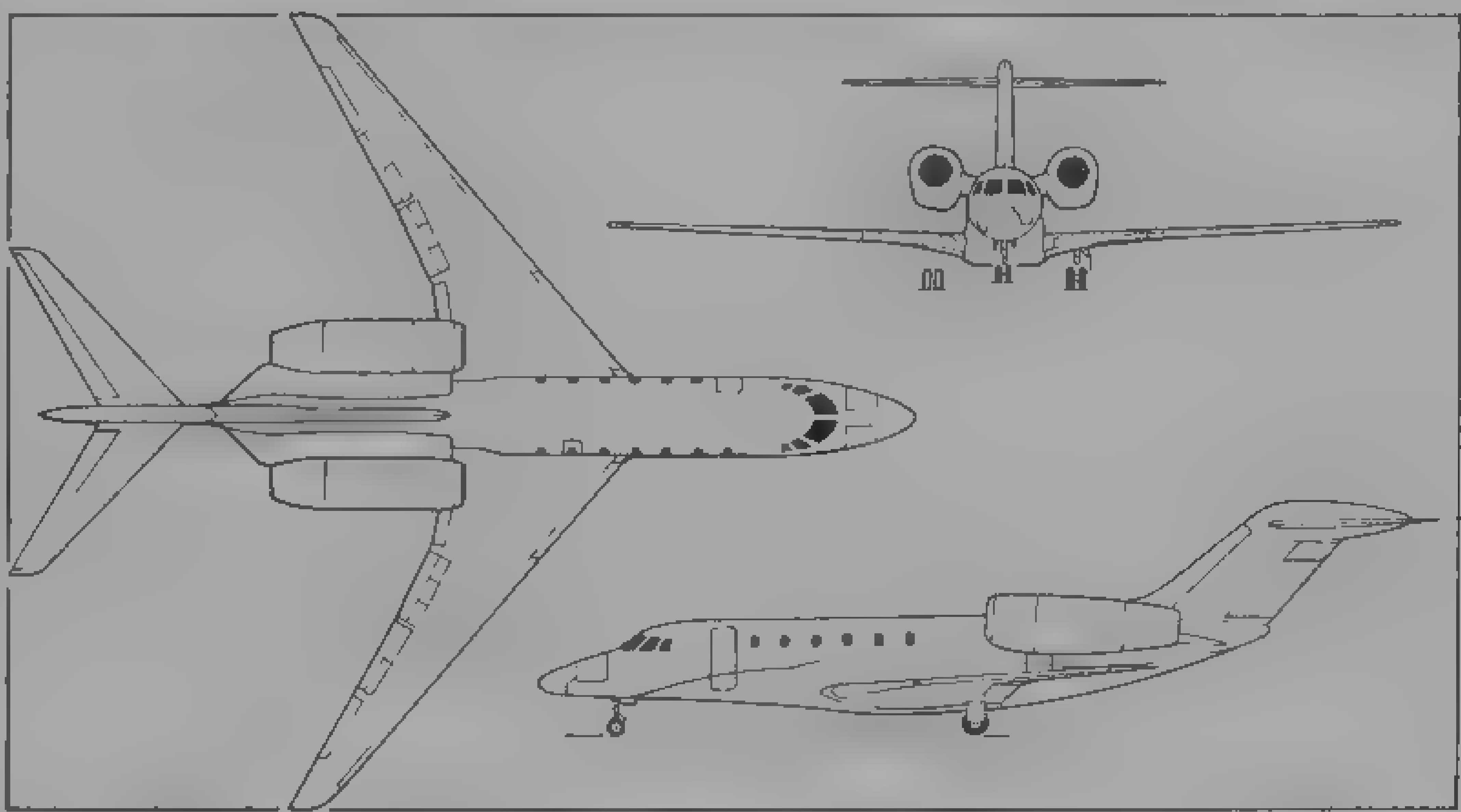
WEIGHTS AND LOADINGS:
Weight empty, standard 9,163 kg (20,200 lb)
Max fuel weight 5,897 kg (13,000 lb)
Payload with max fuel 544 kg (1,200 lb)
Max T-O weight 15,649 kg (34,500 lb)
Max ramp weight 15,785 kg (34,800 lb)
Max landing weight 14,062 kg (31,000 lb)
Max power loading 262.48 kg/kN (2.70 lb/lb st)

PERFORMANCE (at max T-O weight, ISA, except where indicated):
Max operating Mach number (MMO) 0.92

Cessna Citation VII (AlliedSignal TFE731-4R-2S turbofan engines) *1995*



Cessna Citation VII flight deck *1995*



Cessna 750 Citation X *(Jane's/Dennis Punnett)* *1995*

Prototype Cessna 750 Citation X business jet *1995*

Max operating speed (VMO)
350 kts (648 km/h; 403 mph)
Max cruising speed, mid-cruise weight at 11,275 m (37,000 ft) Mach 0.88
Max rate of climb at S/L 1,219 m (4,000 ft)/min
Max operating altitude 15,545 m (51,000 ft)
T-O balanced field length (FAR Pt 25) 1,701 m (5,580 ft)
FAR Pt 25 landing field length 1,067 m (3,500 ft)
Range, with allowances for T-O, climb, cruise, descent and 45 min reserves 3,300 n miles (6,117 km, 3,798 miles)

UPDATED

Cessna 750 Citation X cabin interior
1995

CIRRUS

CIRRUS DESIGN CORPORATION

4515 Taylor Circle, Duluth, Minnesota 55811
Telephone: 1 (218) 727 2337
Fax: 1 (218) 727 2148
PRESIDENT: Alan Klapmeier

Previously engaged in production of kits, Cirrus now to concentrate on fully certificated factory built aircraft, first such product is ST 50.

UPDATED

CIRRUS DESIGN CIRRUS VK30

TYPE: Four/five-seat high-performance homebuilt.

PROGRAMME: First flight 11 February 1988, available in prefabricated kit form. 45 kits delivered of which 12 completed and flown by March 1995, including Allison 250-B17C turboprop-powered version.

COSTS: Airframe kit $64,500; engine kit $36,000 (turbocharged $56,000).

DESIGN FEATURES: Include natural laminar flow wing sections, large Fowler flaps, and a tail mounted pusher propeller. Current model concentrates on the Allison 250 turboprop engine. Wing sections based on NASA NLF(1)-0414F.

STRUCTURE: Wings constructed of glassfibre and polyurethane foam, with graphite spar caps. Fuselage has polyurethane foam core, graphite longerons and glassfibre skins. Ailerons and flaps are of graphite/polyurethane/vinylester, and rudder/elevators/tailplane of Kevlar/polyurethane/vinylester.

LANDING GEAR: Retractable tricycle type.

POWER PLANT: One 313 kW (420 shp) Allison 250-B17C turboprop, or 224 kW (300 hp) Teledyne Continental IO-550-G or 261 kW (350 hp) TSIO-550-B flat-six engine, driving an MT MTV-9 three-blade pusher propeller. Fuel capacity 397 litres (105 US gallons; 87.4 Imp gallons).

DIMENSIONS, EXTERNAL:
Wing span 12.09 m (39 ft 8 in)
Wing aspect ratio 12.38
Length overall 7.92 m (26 ft 0 in)
Height overall 3.25 m (10 ft 8 in)
Propeller diameter 1.88 m (6 ft 2 in)

AREAS:
Wings, gross 11.71 m² (126.0 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 1,089 kg (2,400 lb)
Max T-O weight 1,610 kg (3,550 lb)
Max wing loading 137.56 kg/m² (28.17 lb/sq ft)

PERFORMANCE (with 261 kW, 350 hp TSIO-550-B engine):
Cruising speed, 75% power
260 kts (483 km/h; 300 mph)
Stalling speed, flaps down, engine idling
56 kts (104 km/h; 65 mph)
Max rate of climb at S/L 549 m (1,800 ft)/min
T-O run 412 m (1,350 ft)
Landing run 328 m (1,075 ft)
Range with max fuel, 75% power, with reserves
1,347 n miles (2,494 km; 1,550 miles)
g limits +5/−3

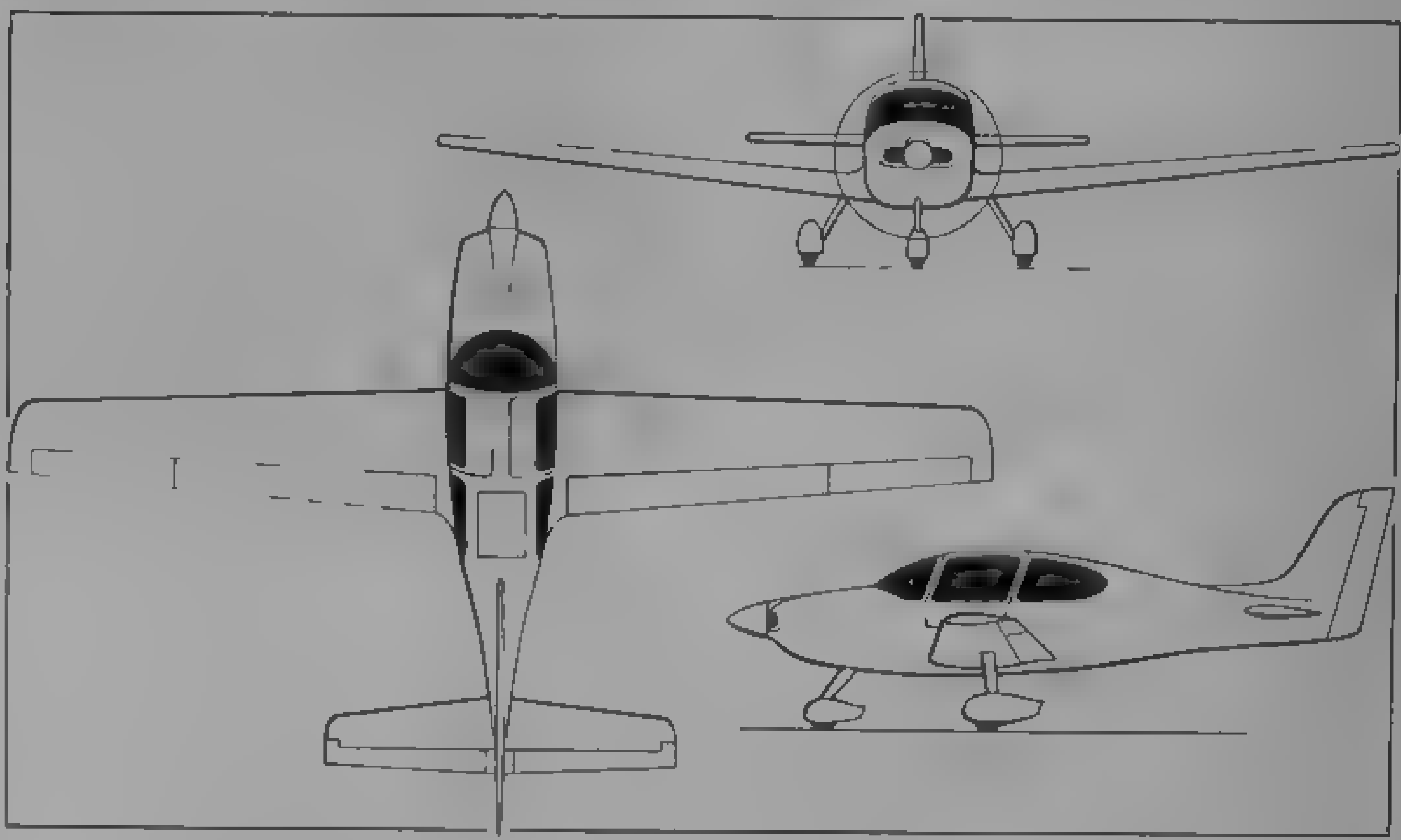
UPDATED

CIRRUS DESIGN ST 50

TYPE: Five-passenger business aircraft.

PROGRAMME: Announced 1993, first flight 7 December 1994. Cirrus Design was contracted to develop the ST 50 by Israviation Ltd (which see under Israel for ST 50 description and illustration).

UPDATED



Cirrus Design SR-20 (one Teledyne Continental IO-360ES) *(Jane's/James Goulding)*
1995

CIRRUS DESIGN SR-20

TYPE: Four-seat business aircraft.

PROGRAMME: Mockup revealed at Oshkosh 1994, first flight (N200SR) 31 March 1995, for FAR Pt 23 certification and production in 1996. Intended to develop into family of aircraft, including two-seat trainer version.

COSTS: About $130,000.

DESIGN FEATURES: Low-wing monoplane with upturned wingtips, mid-set tailplane with horn balanced elevators, horn balanced rudder, fixed tab on starboard aileron.

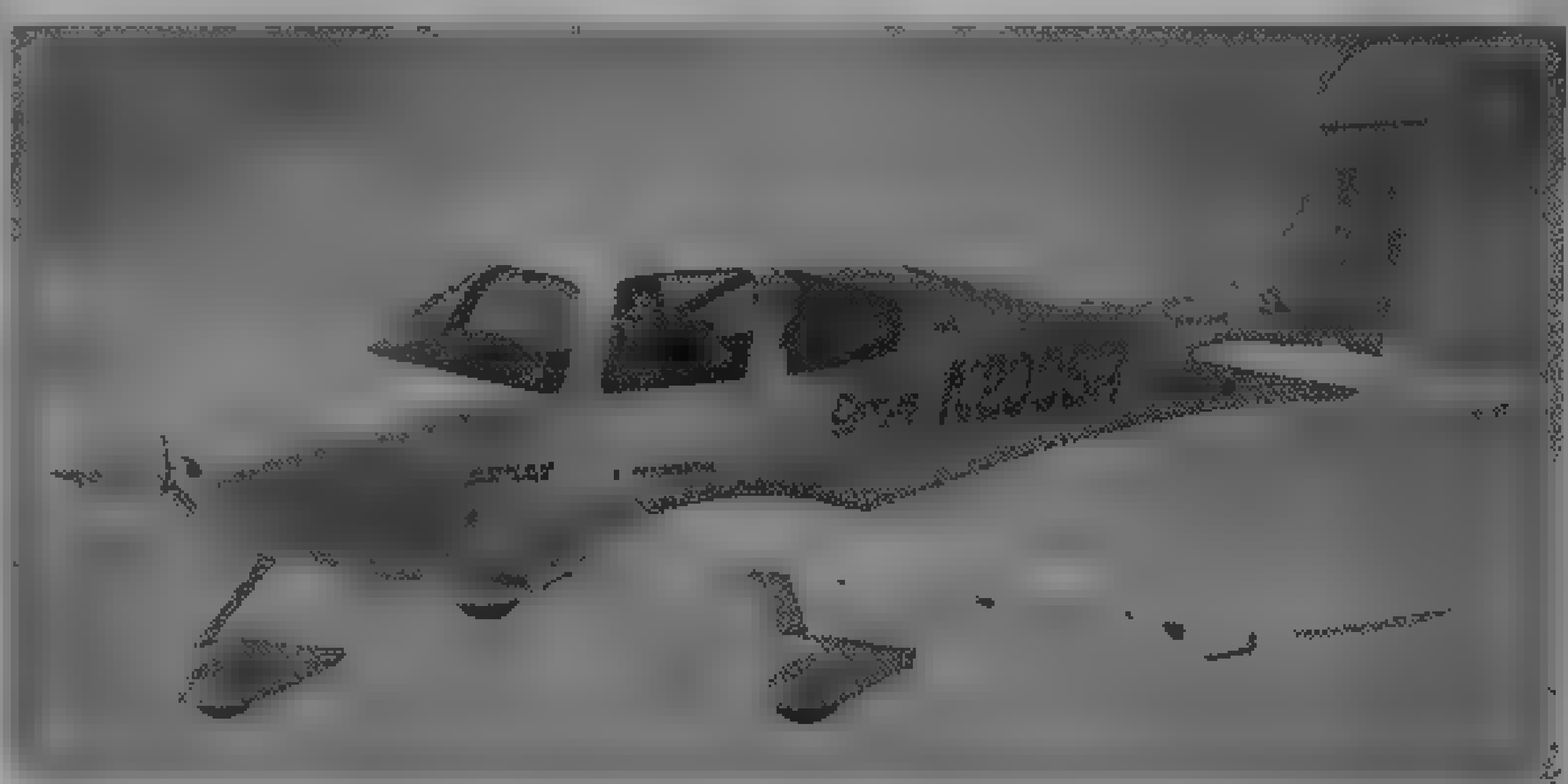
LANDING GEAR: Fixed, tricycle, single wheels and speed fairings throughout.

ACCOMMODATION: Four seats in pairs, two forward-hinged passenger doors.

POWER PLANT: One 149 kW (200 hp) Teledyne Continental IO-360ES driving three-blade propeller.

DIMENSIONS, EXTERNAL:
Wing span 10.67 m (35 ft 0 in)
Wing aspect ratio 9.14
Length overall 7.62 m (25 ft 0 in)
Height overall 2.80 m (9 ft 2¼ in)

Piston-engined example of the Cirrus VK30 four/five-seat homebuilt
1993



Cirrus Design SR-20 on an early test flight
1995

DIMENSIONS, INTERNAL:

Cabin: Length	3.35 m (11 ft 0 in)
Max width	1.21 m (3 ft 11½ in)
Max height	1.25 m (4 ft 1¼ in)

AREAS:

Wings, gross	12.45 m² (134.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	789 kg (1,740 lb)
Max fuel weight	163 kg (360 lb)
Max T-O weight	1,315 kg (2,900 lb)
Max wing loading	105.66 kg/m² (21.64 lb/sq ft)
Max power loading	8.82 kg/kW (14.5 lb/hp)

PERFORMANCE (estimated):

Max cruising speed	162 kts (300 km/h; 186 mph)
Stalling speed	54 kts (100 km/h; 62 mph)
Max rate of climb at S/L	300 m (984 ft)/min
Range	799 n miles (1,480 km; 919 miles)

NEW ENTRY

CLASSIC

CLASSIC AIRCRAFT CORPORATION

Capital City Airport, Lansing, Michigan 48906
Telephone: 1 (517) 321 7500
Fax: 1 (517) 321 5845
PRESIDENT: Richard S. Kettles
ENGINEERING MANAGER: Robert Edelstein
SALES MANAGER: Donald C. Kettles

VERIFIED

CLASSIC WACO CLASSIC YMF SUPER

TYPE: Three-seat sport biplane.

PROGRAMME: Construction began March 1984 under type certificate of original Waco YMF-5; first flight of prototype (N1935B) 20 November 1985; FAA certification 11 March 1986.

CURRENT VERSIONS: **YMF Super:** Larger front cockpit than previously standard F-5 version (see 1992-93 *Jane's*) for commercial pleasure flying; enlarged forward door; front and rear cockpits 10 cm (4 in) longer; front cockpit 6.3 cm (2½ in) wider.

CUSTOMERS: Total 59 (including F-5s) delivered by early 1995.

COSTS: Standard equipment aircraft $215,000.

DESIGN FEATURES: Wing section Clark Y; dihedral 2°; incidence 0° on upper and lower wings.

FLYING CONTROLS: Ailerons on upper and lower wings; no tabs. Tailplane trim by screwjack actuator; ground adjustable trim tab on rudder; elevators.

STRUCTURE: Modern construction techniques, tolerances and materials applied to original design. N type interplane struts; streamlined stainless steel flying and landing wires; all-wood wing with Dacron covering; aluminium ailerons with external chordwise stiffening. Fuselage of 4130 welded steel tubes with internal oiling for corrosion protection, wooden bulkheads, Dacron covering. Braced welded steel tube tail surfaces with Dacron covering.

LANDING GEAR: Non-retractable tailwheel type. Shock-absorption by oil and spring shock-struts. Steerable tailwheel. Cleveland 30-67F hydraulic brakes on mainwheels only. Cleveland 40-101A mainwheels, tyre size 7.50-10. Cleveland 40-199A tailwheel, tyre size 3.50-4. Mainwheel fairings standard, tailwheel fairing optional. Float and amphibious landing gear optional.

POWER PLANT: One 205 kW (275 hp) Jacobs R-755-B2 air-cooled radial engine (remanufactured), driving a two-blade fixed-pitch wooden propeller. Constant-speed propeller with spinner optional. Engine enclosed with streamline aluminium 'bump' (helmeted) cowling. Fuel contained in two aluminium tanks in upper wing centre-section, total capacity 182 litres (48 US gallons; 40 Imp gallons). Refuelling point for each tank in upper wing surface. Auxiliary tanks, capacity 45 litres (12 US gallons; 10 Imp gallons) each, optional in either or both inboard upper wing panels. Standard oil capacity 15 litres (4 US gallons; 3.33 Imp gallons), with auxiliary fuel tanks 19 litres (5 US gallons; 4.2 Imp gallons).

ACCOMMODATION: Three seats in tandem open cockpits, two side by side in front position, single seat at rear. Dual

Classic Waco Classic YMF Super recreation of the Waco YMF-5 three-seat biplane *1995*

controls, seat belts with shoulder harness, and pilot's adjustable seat, standard. Front baggage compartment, capacity 11.3 kg (25 lb); rear baggage compartment, volume 0.2 m³ (7.5 cu ft), capacity 34 kg (75 lb).

SYSTEMS: 24 V electrical system with battery, alternator and starter for electrical supply to navigation, strobe and rear cockpit lights. Hydraulic system for brakes only.

AVIONICS: Customer specified.

EQUIPMENT: Toe brakes standard in rear cockpit. Compass, airspeed indicator, turn and bank indicator, rate of climb indicator, sensitive altimeter, recording tachometer, cylinder head temperature gauge and oil pressure and oil temperature gauges standard in rear cockpit. Front cockpit instruments optional. Front and rear windscreens (front removable), front and rear cockpit covers, instrument post lighting, heated pitot, tiedown rings and three-colour paint scheme with choice of two designs, also standard. Optional equipment includes exhaust gas temperature gauge, carburettor temperature gauge, g meter, vacuum or electrically driven gyro system, Hobbs meter (engine-time recorder), outside air temperature gauge, manifold gauge, oil cooler for wooden propeller, ground service plug, landing and taxi lights, front and rear cockpit heaters, flight-approved metal front cockpit cover, map case, glider tow hook, deluxe interior with carpet, leather sidewalls and interior trim, and special exterior paint designs.

DIMENSIONS, EXTERNAL:

Wing span:	
upper: F-5, YMF Super	9.14 m (30 ft 0 in)
lower: F-5, YMF Super	8.18 m (26 ft 10 in)
Length overall: F-5	7.10 m (23 ft 3⅛ in)
YMF Super	7.26 m (23 ft 10 in)
Height overall: F-5	2.57 m (8 ft 5⅛ in)
YMF Super	2.59 m (8 ft 6 in)
Wheelbase: F-5, YMF Super	1.95 m (6 ft 5 in)
Propeller diameter:	
F-5, YMF Super	2.44 m (8 ft 0 in)

AREAS:

Wings, gross	21.69 m² (233.5 sq ft)

WEIGHTS AND LOADINGS:

Basic weight empty: F-5	880 kg (1,940 lb)
YMF Super	900 kg (1,985 lb)
Max T-O and landing weight: F-5	1,256 kg (2,770 lb)
YMF Super	1,338 kg (2,950 lb)
Max wing loading: F-5	52.26 kg/m² (10.71 lb/sq ft)
YMF Super	61.67 kg/m² (12.63 lb/sq ft)
Max power loading: F-5	6.21 kg/kW (10.20 lb/hp)
YMF Super	6.53 kg/kW (10.73 lb/hp)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (VNE):	
F-5, YMF Super	186 kts (344 km/h; 214 mph)
Max level speed at S/L:	
F-5, YMF Super	117 kts (217 km/h; 135 mph)
Max cruising speed at S/L:	
F-5, YMF Super	104 kts (193 km/h; 120 mph)
Econ cruising speed at 2,440 m (8,000 ft):	
F-5, YMF Super	95 kts (177 km/h; 110 mph)
Stalling speed, power off:	
F-5	51 kts (94 km/h; 58 mph)
YMF Super	53 kts (97 km/h; 60 mph)
Max rate of climb at S/L:	
F-5, YMF Super	235 m (770 ft)/min
T-O run: F-5, YMF Super	152 m (500 ft)
Range, standard fuel, 30 min reserves:	
F-5, YMF Super	286 n miles (531 km; 330 miles)

UPDATED

COMMANDER

COMMANDER AIRCRAFT COMPANY

Wiley Post Airport, 7200 North West 63rd Street, Bethany Oklahoma 73008
Telephone: 1 (405) 495 8080
Fax: 1 (405) 495 8383
PRESIDENT: Gene Criss
VICE-PRESIDENTS:
Dick Smiley (Production Assurance)
Walter Murphy (Sales and Marketing)
Steve Buren (Finance)

Company acquired manufacturing, marketing and support rights for Rockwell Commander 112 and 114 from Gulfstream Aerospace Corporation Summer 1988; spares and support services for existing aircraft and manufacturing based in Oklahoma. Commander 114 remains in production. Dealerships/representatives in Abu Dhabi, Australia, Germany, Netherlands, Switzerland, UK and USA (nine).

UPDATED

COMMANDER 114B

TYPE: New production version of four-seat, single-engined Commander 114A.

PROGRAMME: Certificated 5 May 1992; now in production.

CURRENT VERSIONS: **Commander 114B:** Basic version, *as detailed*.

Commander 114AT: Optimised for pilot training.

Commander 114TC: Powered by Textron Lycoming turbocharged engine, driving three-blade McCauley propeller; engineering began 1993, first flight October 1994.

CUSTOMERS: Total 93 built by January 1995; 25 delivered in 1992, 38 in 1993; 30 in 1994, 50 planned for 1995.

COSTS: Standard IFR-equipped aircraft $298,500.

DESIGN FEATURES: Improvements in 114B include new cowling design, improved cooling and induction, specially developed McCauley three-blade metal propeller, NACA scoop in dorsal fin, new interior trim and seats, better soundproofing, 28 V electrical system, and custom metal instrument panel.

FLYING CONTROLS: Conventional; electric flap control, elevator and rudder trim, dual controls.

LANDING GEAR: Retractable tricycle type; nosewheel (steerable) tyre size 5.00-5 (6 ply), mainwheel tyres size 6.00-6 (6 ply); dual brakes.

POWER PLANT: One 194 kW (260 hp) Textron Lycoming IO-540-T4B5 flat-six engine, driving a McCauley B3D 32C 419/82NHA-5 three-blade constant-speed metal propeller. Fuel in two integral wing tanks, maximum capacity 265 litres (70 US gallons; 58.3 Imp gallons), of which 257 litres (68 US gallons; 56.6 Imp gallons) are usable. Maximum oil capacity 7.6 litres (2 US gallons; 1.67 Imp gallons).

SYSTEMS: 28 V DC electrical, hydraulic, cabin heating and ventilation.

AVIONICS: *Comms:* Standard includes Bendix/King KMA 24-03 audio panel and KT 76A transponder.

Flight: KX 155 digital nav and Terra AT 3000 altitude encoder.

DIMENSIONS, EXTERNAL:

Wing span	9.98 m (32 ft 9 in)
Wing aspect ratio	7.06
Length overall	7.59 m (24 ft 11 in)
Height overall	2.57 m (8 ft 5 in)
Tailplane span	4.10 m (13 ft 5½ in)
Wheel track	3.34 m (10 ft 11½ in)
Wheelbase	2.11 m (6 ft 11 in)
Propeller diameter	1.96 m (6 ft 5 in)
Propeller ground clearance	0.19 m (7½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	1.91 m (6 ft 3 in)
Max width	1.19 m (3 ft 11 in)
Max height	1.24 m (4 ft 1 in)
Volume	2.83 m³ (100.0 cu ft)
Baggage compartment volume	0.62 m³ (22.0 cu ft)

AREAS:

Wings, gross	14.12 m² (152.0 sq ft)

Commander Aircraft Commander 114B

1995

WEIGHTS AND LOADINGS

Weight empty	927 kg (2,044 lb)
Baggage capacity	91 kg (200 lb)
Max T-O weight	1,474 kg (3,250 lb)
Max ramp weight	1,479 kg (3,260 lb)
Max wing loading	104.5 kg/m² (21.4 lb/sq ft)
Max power loading	7.62 kg/kW (12.54 lb/hp)

PERFORMANCE (at max T-O weight, ISA)

Max level speed	164 kts (304 km/h; 189 mph)
Cruising speed, 75% power	160 kts (296 km/h; 184 mph)
Stalling speed: flaps and wheels up	61 kts (113 km/h; 71 mph)
flaps and wheels down	56 kts (104 km/h; 65 mph)
Max rate of climb at S/L	326 m (1,070 ft)/min
Service ceiling	5,120 m (16,800 ft)
T-O run	317 m (1,040 ft)
T-O to 15 m (50 ft)	610 m (2,000 ft)
Landing from 15 m (50 ft)	366 m (1,200 ft)
Landing run	220 m (720 ft)
Range: at 75% power	630 n miles (1,167 km; 725 miles)
at 65% power	725 n miles (1,343 km; 835 miles)

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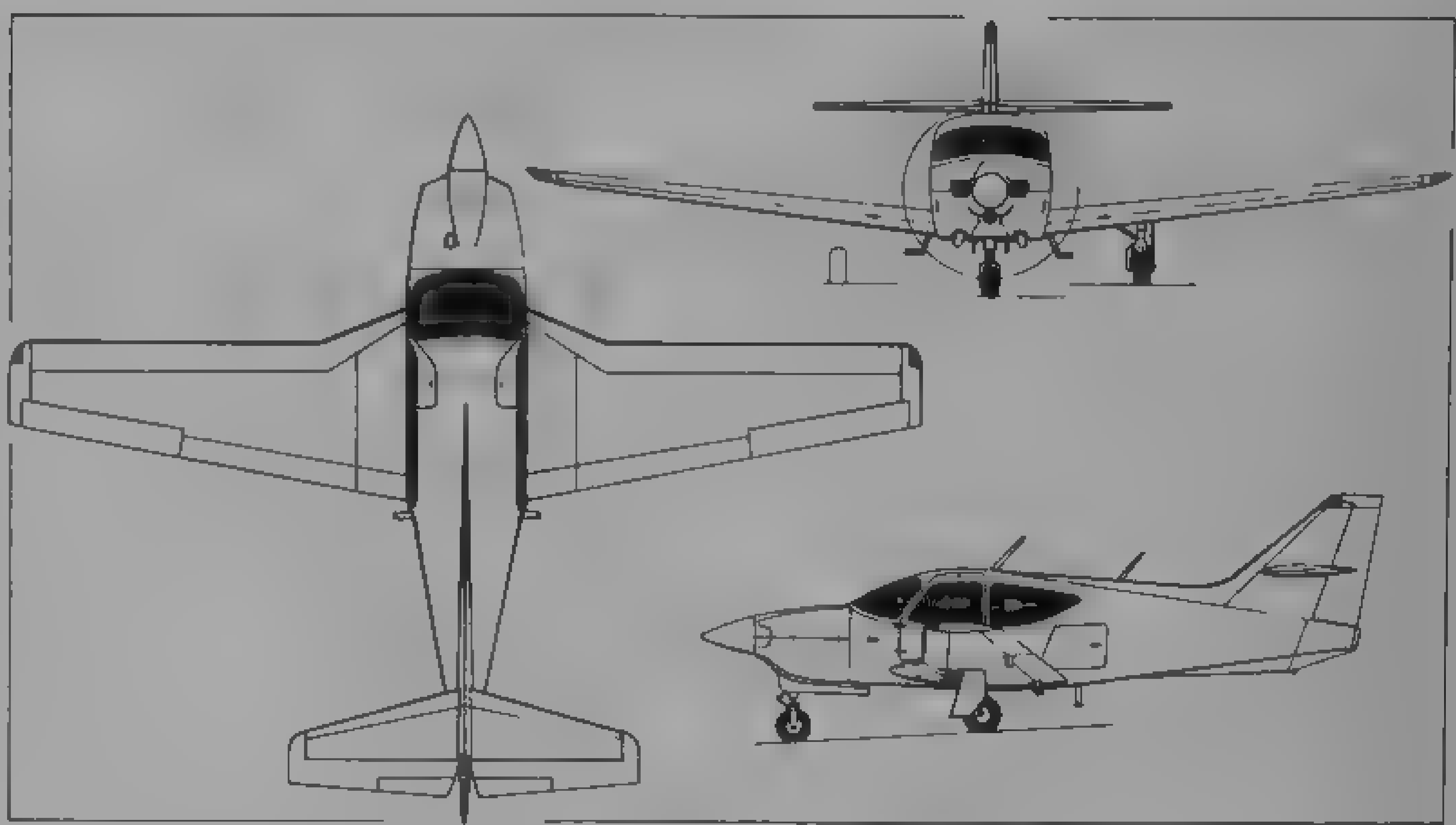


Commander 114B four-seat touring aircraft *(Jane's/Dennis Punnett)*

1995

DOUGLAS — *see McDonnell Douglas*

EXPRESS DESIGN INC

PO Box 609, 1266 South-East Lake Road, Redmond, Oregon 97756
Telephone: 1 (503) 548 2723
Fax: 1 (503) 548 2949
PRESIDENT: David Ulrich

EDI acquired assets of former Wheeler Technology Inc (1992-93 *Jane's*) which became bankrupt in late 1990; resumed production and customer support for former Wheeler Express homebuilt. Factory floor area 1,951 m² (21,000 sq ft)

VERIFIED

EDI EXPRESS

TYPE: Four seat, dual-control cross-country kit aircraft; conforms to FAR Pt 23.

PROGRAMME: Designed by Wheeler Technology Inc as high-speed cross-country kitplane, with unusual seating arrangement of one forward- and one aft-facing seat in rear, behind two side by side front seats with dual controls. Three prototypes built from kits of premoulded parts; first flight 28 July 1987. First, larger, production line Express demonstrator made first flight May 1990, powered by Teledyne Continental engine. Delivered kits incomplete at time of Wheeler bankruptcy, deficiencies made good by EDI, and at least six aircraft now completed. Complete kits now available from Express Design incorporate some modifications, which can also be retrofitted to existing aircraft.

Six-seat version also available with higher powered 194 kW (260 hp) engine under name **Loadmaster 3200**.

COSTS: Airframe kit $34,965. Loadmaster 3200 airframe kit $37,915. Engine, propeller, upholstery, finish paint and instruments not included.

DESIGN FEATURES: Wing section NASA NFL-1 0215 F (laminar flow).

STRUCTURE: Constructed of composites: sandwich material, comprising polyurethane foam core, glassfibre, unidirectional glassfibre tape and vinylester resin.

LANDING GEAR: Non-retractable tricycle type standard. Retractable gear optional.

POWER PLANT: Demonstrator fitted with 156.6 kW (210 hp) Teledyne Continental IO-360-ES1 flat-four engine; 119 or 134 kW (160 or 180 hp) Textron Lycoming engine

optional Fuel capacity 204 litres (54 US gallons, 45 Imp gallons); optional 348 litres (92 US gallons, 76.6 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span	9.45 m (31 ft 0 in)
Wing aspect ratio	7.39
Length overall	7.92 m (26 ft 0 in)
Height overall	2.13 m (7 ft 0 in)

AREAS:

Wings, gross	12.08 m² (130.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	771 kg (1,700 lb)
Baggage capacity, with four 77 kg (170 lb) persons	29 kg (64 lb)
Max T-O weight	1,313 kg (2,895 lb)
Max wing loading	108.73 kg/m² (22.27 lb/sq ft)

PERFORMANCE (149 kW; 200 hp engine, retractable landing gear):

Max cruising speed at 2,290 m (7,500 ft), 75% power	165 kts (306 km/h, 190 mph)
Stalling speed at max T-O weight:	
flaps up	55 kts (101 km/h, 63 mph)
flaps down	50 kts (92 km/h, 57 mph)
Max rate of climb at S/L	427 m (1,400 ft)/min
Service ceiling	6,100 m (20,000 ft)
T-O run	274 m (900 ft)
Landing run	366 m (1,200 ft)
Range 55% power, no reserves	991 n miles (1,835 km, 1,140 miles)
Range with auxiliary fuel tank	1,688 n miles (3,125 km, 1,942 miles)
g limits	+4.4/−2.2
	+8.8/−4.4 ultimate
Demonstrated crosswind T-O and land	29 kts (54 km/h, 33 mph)

UPDATED

EDI Express four-seat kit aircraft

1995

ENSTROM

THE ENSTROM HELICOPTER CORPORATION

PO Box 490, 2209 North 22nd Street, Twin County Airport, Menominee, Michigan 49858-0490

Telephone: 1 (906) 863 1200

Fax: 1 (906) 863 6821

PRESIDENT AND CEO: Robert M. Tuttle

VICE-PRESIDENT, MANUFACTURING: John E. Hansen

VICE-PRESIDENT, ENGINEERING: Robert L. Jenny

DIRECTOR OF MARKETING: Bill May

Founded in 1959, Enstrom company passed through several hands before 1990 acquisition by investors based in Los Angeles. More than 1,000 helicopters produced. Production in China planned at Wuhan; Wuhan Helicopter Company (WHC) has been established for this purpose with four-year programme and production capacity of 100 per year for sale only in China.

UPDATED

ENSTROM F28 and 280

TYPE: Three-seat light helicopter

PROGRAMME: Basic F-28A and 280 described in 1978-79 *Jane's*; replaced by turbocharged F28C and 280C, certificated by FAA 8 December 1975 and last described in 1984-85 *Jane's*; production of these models ceased November 1981, succeeded by F28F and 280F Shark described in 1985-86 *Jane's*, and 280FX, current models detailed here.

CURRENT VERSIONS: **F28F Falcon**: Basic model certificated to FAR Pt 6 on 31 December 1980. Recent developments include redesigned main gearbox with heavy wall main rotor shaft (standard on all new F28s and retrofittable to all existing F models); optional lightweight exhaust silencer, reducing noise in hover by 40 per cent and by 30 per cent when flying at 152 m (500 ft) (can be retrofitted to existing F28F, 280F and 280FX); lightweight starter motor recently introduced for all models.

Enstrom wet and dry agricultural kit comprises two side-mounted hoppers with quick fill openings, total capacity 303 litres (80 US gallons, 67 Imp gallons), spraybar 9.04 m (29 ft 8 in) wide, extendable to 11.07 m (36 ft 4 in), manually operated clutch gives positive control of centrifugal pump with capacity for 227 litres (60 US gallons, 50 Imp gallons)/min, dry discharge rate variable from 0 to 272 kg (600 lb)/min, weight of entire quickly removable dispersal system 48 kg (105 lb).

F28F-P Sentinel: Dedicated police patrol version, first delivery October 1986, can be fitted with Locator B, Spectrolabe SX-5 or Carter searchlight and specialised police radio; same specifications and performance as F28F, can also be fitted with FLIR system.

280FX Shark: Certificated to FAR Pt 6 on 14 January 1985. Features include new seats with lumbar support and energy-absorbing foam, new tailplane with endplate fins, tail rotor guard, covered tail rotor shaft, redesigned air inlet system, and completely faired landing gear; optional pneumatic door opener; optional internal tank extends range to 339 n miles (627 km, 390 miles).

Enstrom F28F Falcon three-seat light helicopter

1995

CUSTOMERS: Chilean Army operates 15 280FXs for primary and instrument training, Peruvian Army has 10 F28Fs for training duties; Colombian Air Force operates 12 F28Fs for primary and instrument training. More than 170 F28F and 280FX helicopters in service worldwide. F28 continues in low rate production (one added to US civil register in 1994), no 280FXs since early 1992, approximately 790 F28s, 145 F280s and 72 F280FXs built.

COST: Basic price $219,900 for Falcon, $236,900 for Shark (1995).

DESIGN FEATURES: Three-blade fully articulated head with blades attached by retention pin and drag link, control rods pass inside tubular rotor shaft to swashplate inside fuselage, blade section NACA 0013.5, blades do not fold, two-blade teetering tail rotor. Poly V-belt drive system from horizontally mounted engine to transmission also acts as clutch.

STRUCTURE: Bonded light alloy blades. Fuselage has glassfibre and light alloy cabin section, steel tube centre-section frame, and stressed skin aluminium tailboom.

LANDING GEAR: Skids carried on Enstrom oleo-pneumatic shock absorbers. Air Cruiser inflatable floats available optionally.

POWER PLANT: One 168 kW (225 hp) Textron Lycoming HIO-360-F1AD flat-four engine with Rotomaster 3BT5EE10J2 turbocharger. Two fuel tanks, each of 79.5 litres (21 US gallons, 17.5 Imp gallons). Total standard fuel capacity 159 litres (42 US gallons, 35 Imp gallons), of which 151 litres (40 US gallons, 33.3 Imp gallons) are usable. Auxiliary tank, capacity 49 litres (13 US gallons, 10.8 Imp gallons), can be installed in the baggage compartment. Oil capacity 9.5 litres (2.5 US gallons, 2.1 Imp gallons).

ACCOMMODATION: Pilot and two passengers, side by side on bench seat; centre place removable. Fully transparent removable door on each side of cabin. Baggage space aft of engine compartment, capacity 49 kg (108 lb), with external door. Cabin heated and ventilated.

SYSTEMS: Electrical power on F28F provided by 12 V 70 A engine-driven alternator; 24 V 70 A system optional on F28F, standard on 280FX.

AVIONICS: Variety of fits from AR Nav, Bendix/King II Morrow and Northstar.

Instrumentation: Standard equipment includes airspeed indicator, sensitive altimeter, compass, outside air temperature gauge, turn and bank indicator, rotor/engine tachometer, manifold pressure/fuel flow gauge, EGT gauge, oil pressure gauge, gearbox and oil temperature gauge, ammeter, cylinder head temperature gauge, and fuel quantity gauge. Eight light annunciator panel consisting of low rotor rpm, chip detectors (main and tail rotor transmissions), overboost, clutch not fully engaged, low fuel pressure, starter, and low voltage warning lights.

EQUIPMENT: Shoulder harnesses for two seats, instrument lighting with dimmer control, position light on each horizontal stabiliser tip, anti-collision strobe light, landing lights, adjustable nose light and soundproofing.

Enstrom 280FX Shark (Textron Lycoming HIO-360 engine)

1995

DIMENSIONS, EXTERNAL:
Main rotor diameter 9.75 m (32 ft 0 in)
Tail rotor diameter 1.42 m (4 ft 8 in)
Distance between rotor centres 5.56 m (18 ft 3 in)
Main rotor blade chord 0.24 m (9½ in)
Tail rotor blade chord 0.11 m (4½ in)
Length overall, rotors stationary 8.92 m (29 ft 3 in)
Height to top of rotor head 2.79 m (9 ft 2 in)
Skid track 2.21 m (7 ft 3 in)
Cabin doors (each): Height 1.04 m (3 ft 5 in)
Width 0.84 m (2 ft 9 in)
Height to sill 0.64 m (2 ft 1 in)
Baggage door: Height 0.55 m (1 ft 9½ in)
Width 0.39 m (1 ft 3½ in)
Height to sill 0.86 m (2 ft 10 in)

DIMENSIONS, INTERNAL:
Cabin: Max width: F28F 1.55 m (5 ft 1 in)
280FX 1.50 m (4 ft 11 in)
Baggage compartment volume 0.18 m³ (6.3 cu ft)

AREAS:
Main rotor disc 74.69 m² (804.0 sq ft)
Tail rotor disc 1.66 m² (17.88 sq ft)

WEIGHTS AND LOADINGS (F28F Normal category):
Weight empty, equipped: F28F 712 kg (1,570 lb)
280FX 719 kg (1,585 lb)
Max T-O weight: F28F, 280FX 1,179 kg (2,600 lb)
Max disc loading:
F28F, 280FX 15.77 kg/m² (3.23 lb/sq ft)

PERFORMANCE (both versions at AUW of 1,066 kg; 2,350 lb except where indicated):
Never-exceed speed (VNE):
F28F 97 kts (180 km/h, 112 mph)
280FX 102 kts (189 km/h, 117 mph)
Max level speed, S/L to 915 m (3,000 ft):
F28F 97 kts (180 km/h; 112 mph) IAS
280FX 102 kts (189 km/h, 117 mph) IAS
Econ cruising speed:
F28F 89 kts (165 km/h, 102 mph)
280FX 93 kts (172 km/h, 107 mph)
Max rate of climb at S/L 442 m (1,450 ft)/min
Certificated operating ceiling 3,660 m (12,000 ft)
Hovering ceiling:
IGE at 1,179 kg (2,600 lb) AUW 2,345 m (7,700 ft)
OGE at 1,066 kg (2,350 lb) AUW 2,650 m (8,700 ft)
Max range, standard fuel, no reserves:
F28F 228 n miles (423 km, 263 miles)
280FX 260 n miles (483 km, 300 miles)
Max endurance 3 h 30 min

UPDATED

ENSTROM 480

Military designation: TH-28

TYPE: Five-seat turbine-powered helicopter.

PROGRAMME: Proof-of-concept 280FX powered by Allison 250 turboshaft, flown December 1988; first flight of definitive wide cabin 480/TH-28 five-seat prototype (N8631E) in October 1989; second 480/TH-28 (production prototype) flew December 1991; TH-28 model FAA certificated September 1992; four helicopters accumulated over 1,500 flight hours in test programme; FAA certification completed 1994.

CURRENT VERSIONS: **480**: Basic civil version, with four staggered seats or convertible to three-seat training/executive layout; smaller instrument console than TH-28. *Description applies to this version.*

TH-28: Military training/light patrol version, equipped with three crashworthy seats and crashworthy fuel system, capable of training two students simultaneously. Two alternative avionics configurations, one for VFR and one for IFR training.

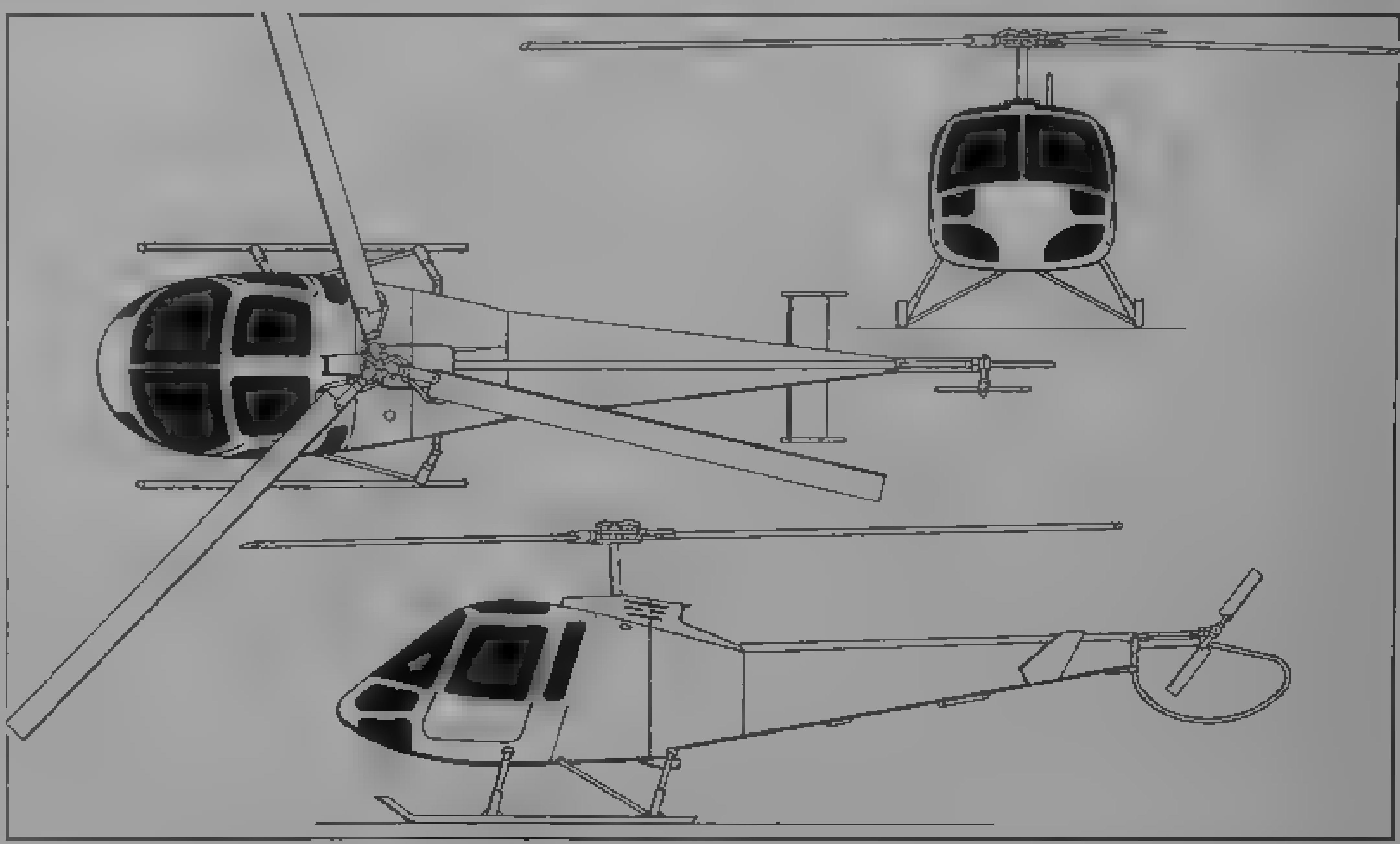
CUSTOMERS: First production 480 (N480EN) built January 1994 and to UK as demonstrator; low rate production under way, operating in Brazil, Canada, China, Germany, Switzerland, UK and USA.

COSTS: Basic price $460,000 for 480, $500,000 for TH-28 (1994).

DESIGN FEATURES: Three-blade main rotor and dynamic system as for 280FX; 313 kW (420 shp) Allison 250-C20W turboshaft, derated to 212.5 kW (285 shp) for take-off and 191 kW (256 shp) maximum continuous. Extensive crashworthiness features. Standard engine air inlet particle separator. New widened cabin able to seat three-abreast behind front seats. Civil cabin layout can be quickly rearranged (see Current Versions).

First production Enstrom 480 five-seat turbine-powered light helicopter

1995



Enstrom 480 light helicopter (Allison 250-C20W turboshaft) *(Jane's/Mike Keep)*

1993

FLYING CONTROLS: As for 280FX.

DIMENSIONS, EXTERNAL: As for 280FX except:
Distance between rotor centres 4.90 m (16 ft 1 in)
Height to top of rotor head 2.92 m (9 ft 7 in)
Skid track 2.50 m (8 ft 2½ in)

DIMENSIONS, INTERNAL:
Cabin: Max width 1.80 m (5 ft 10¾ in)

WEIGHTS AND LOADINGS:
Weight empty 760 kg (1,675 lb)
Max T-O weight 1,293 kg (2,850 lb)
Max disc loading 17.31 kg/m² (3.54 lb/sq ft)

PERFORMANCE (at max T-O weight, ISA, except where indicated):
Never-exceed speed (VNE)
121 kts (225 km/h, 140 mph)
Cruising speed: at AUW of 1,293 kg (2,850 lb)
106 kts (196 km/h, 122 mph)
at AUW of 1,134 kg (2,500 lb)
114 kts (211 km/h, 131 mph)
Max rate of climb at S/L:
at AUW of 1,293 kg (2,850 lb) 442 m (1,450 ft)/min
at AUW of 1,134 kg (2,500 lb) 482 m (1,583 ft)/min
Service ceiling 3,965 m (13,000 ft)
Hovering ceiling:
IGE:
at AUW of 1,293 kg (2,850 lb) 3,050 m (10,000 ft)
at AUW of 1,134 kg (2,500 lb) 4,265 m (14,000 ft)
OGE:
at AUW of 1,293 kg (2,850 lb) 2,105 m (6,900 ft)
at AUW of 1,134 kg (2,500 lb) 3,660 m (12,000 ft)
Max range 382 n miles (707 km, 439 miles)
Endurance 4 h 42 min

UPDATED

EXPERIMENTAL

EXPERIMENTAL AVIATION INC

3025 Airport Avenue, Santa Monica, California 90405
Telephone: 1 (310) 391 1943
Fax: 1 (310) 391 8645
CHIEF DESIGNER: Dave Ronneberg
VICE-PRESIDENT, OPERATIONS: Diane Moser

VERIFIED

EXPERIMENTAL AVIATION BERKUT

TYPE: Tandem two-seat monoplane.

PROGRAMME: Named after Asian eagle; first flight 11 July 199?.

COSTS: Kit $29,400 (1995). Complete aircraft $65,000.

CUSTOMERS: Total of 47 sold by early 1995.

DESIGN FEATURES: Rear mounted wings with 23° of sweep, with winglets. Straight foreplane. Resembles Rutan Long-EZ, of which Dave Ronneberg built seven examples, but features larger cabin and wing strakes with upper camber lift. Intended first for sport and recreational flying; seen to have business applications as well as military. Construction takes about 1,500 to 2,000 working hours.

FLYING CONTROLS: Ailerons and rudders on main wing, elevators on canard, electrically actuated airbrake under fuselage.

STRUCTURE: Carbonfibre main spar; canard has solid core with no ribs. GFRP, Styrofoam, PVC foam and Kevlar also used.

LANDING GEAR: Electrohydraulically retractable tricycle landing gear. Marco calliper brakes and wheels.

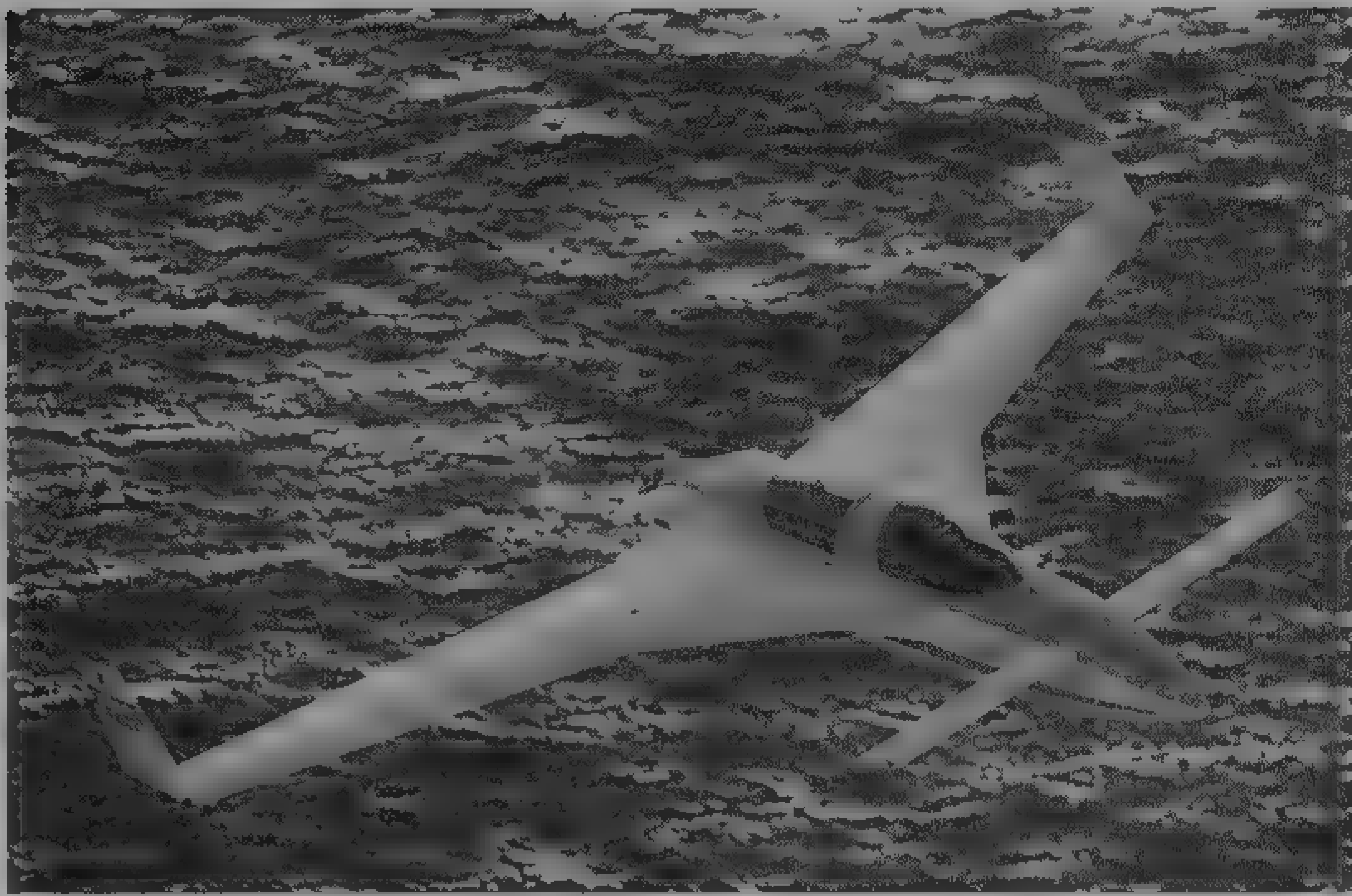
POWER PLANT: One 153 kW (205 hp) Textron Lycoming IO-360-B1A flat-four engine, driving a Light Speed Engineering Black Bart pusher propeller. Usable fuel capacity 219 litres (58 US gallons, 48 Imp gallons).

ACCOMMODATION: Two seats in tandem. 0.31 m³ (11 cu ft) baggage space in wing strakes and nose.

SYSTEMS: Hydraulic system (96.5 bars; 1,400 lb/sq in) for landing gear; 12 V electrical system with 30 Ah battery.

DIMENSIONS, EXTERNAL:

Wing span	8.13 m (26 ft 8 in)
Length overall	5.64 m (18 ft 6 in)
Height overall	2.29 m (7 ft 6 in)
Propeller diameter	1.70 m (5 ft 7 in)



Experimental Aviation Berkut two-seat canard monoplane *(Eric Sander)* *1995*

WEIGHTS AND LOADINGS:

Weight empty	469 kg (1,035 lb)
Max T-O weight	907 kg (2,000 lb)
Max power loading	5.93 kg/kW (9.76 lb/hp)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (V_{NE})	300 kts (556 km/h, 345 mph)
Max level speed at 1,830 m (6,000 ft)	215 kts (399 km/h, 248 mph)
Cruising speed at 2,440 m (8,000 ft)	208 kts (385 km/h, 239 mph)
Econ cruising speed at 2,440 m (8,000 ft)	187 kts (346 km/h, 215 mph)
Stalling speed (of canard)	54 kts (100 km/h, 62 mph)
Max rate of climb at S/L	610 m (2,000 ft)/min
Service ceiling	9,750 m (32,000 ft)
Range at econ cruising speed	1,290 n miles (2,389 km, 1,485 miles)

UPDATED

FAIRCHILD

FAIRCHILD AIRCRAFT INCORPORATED

PO Box 790490, San Antonio, Texas 78279-0490
Telephone: 1 (210) 824 9421
Fax: 1 (210) 820 8656
CHAIRMAN, CEO AND PRESIDENT: Carl A. Albert
EXECUTIVE VICE-PRESIDENT AND CHIEF FINANCIAL OFFICER: Caesar Rodriguez
EXECUTIVE VICE-PRESIDENT, SECRETARY AND TREASURER: Elaine Teng
PRESIDENT, GOVERNMENT PROGRAMMES: Hector Cuellar
PRESIDENT, FAIRCHILD AIRCRAFT SERVICES: Ron Stotz
ACTING SENIOR VICE-PRESIDENT, OPERATIONS: Herb Lanthorp
SENIOR VICE-PRESIDENT, MARKETING: James P. Foody
SENIOR VICE-PRESIDENT AND GENERAL COUNSEL: James E. Walsh III
VICE-PRESIDENTS, AIRLINE SALES:
Randolph R. Becker
Calvin Humphrey
David E. Norgart
Juan Gonzalez
VICE-PRESIDENT, CORPORATE COMMUNICATIONS: Mark A. Morro
MANAGER, PROMOTIONS: Steve Cerna (ext 7322)

Fairchild Aircraft produces Metroliner series of 19/20-passenger regional airliners operated by commuter/regional airlines worldwide. Also produces C-26 military communications aircraft, the Multi Mission Surveillance Aircraft (MMSA); Expediter 23 for cargo/express package operations and Merlin 23 business aircraft. Workforce 1,250 in early 1994. Merlin Express Inc (MEI) established 1983 with responsibility for operations, management and maintenance of United Parcel Service Express Package Expediter fleet and provides logistics support for C-26 fleet. Fairchild Aircraft Services provides operators with repair, refurbishment, modification, engineering and spares support; also a Fairchild Marketing and Support facility in Brussels, Belgium, and a joint venture company is planned to market and support the Russian Ilyushin Il-103 light aircraft (which see); sales of Il-103 could begin at the end of 1995.

UPDATED

FAIRCHILD SA227-CC and -DC METRO 23, MERLIN 23 and EXPEDITER I and 23

US military designations: C-26A/B

TYPE: Twin-turboprop 19/20-passenger commuter airliner.

PROGRAMME: Metro III originally SFAR 41 approved; FAR 23 commuter type approval June 1990 for SA227-CC with TPE331-11U-612G engines and SA227-DC with TPE331-12-UAR-701Gs. British CAA certification of SA227-AC August 1988, required modifications included dual-redundant stall warning system, dual continuous water/alcohol injection system, modified aileron aerofoil section and externally operable escape hatches. FAR 23 commuter category requirements include all significant CAA certification modifications as required on SA227-AC aircraft. Revised airframe and engine inspection programme announced 19 August 1993, reducing phase inspections per cycle from eight to six and claiming reduction of costs for routine inspections by "upwards of 40 per cent".

CURRENT VERSIONS: **SA227-CC and -DC Metro 23**: Current high gross weight aircraft. *Detailed description applies to these versions, except where indicated.*

Tp 88: Swedish Air Force transport, three delivered, all later sold.

C-26A and C-26B: Six C-26As ordered March 1988 as US Air National Guard Operational Support Transport Aircraft (ANGOSTA), later increased to 13, delivered between March 1989 and August 1990; these have quick change passenger, medevac or cargo interiors. Contract awarded January 1991 by USAF Aeronautical Systems Division for delivery and logistics support of up to 53 C-26Bs (37 firm, options for 16) over five-year period from January 1992. First 23 C-26Bs delivered to Air and Army National Guard during 1992, first handed over on 2 January and delivered to 128th TFW at Truax Field, Wisconsin, 12 January; C-26 is first military aircraft qualified for TCAS II and GPS. See table.

Expediter I: All-cargo version, air conditioning ducts moved to increase cargo volume; reinforced cabin floor, cargo nets and guards, reduced empty weight allowing maximum payload of more than 2,268 kg (5,000 lb); first 10 to operator SAT-AIR (now Merlin Express) on behalf of United Parcel Service; first of 10 Expediter Is delivered to DHL Worldwide Courier Express April 1985 with structurally reinforced landing gear and wing main spar for maximum T-O weight 7,257 kg (16,000 lb).

Expediter 23: Increased maximum T-O weight 7,484 kg (16,500 lb), maximum payload capability about 2,495 kg (5,500 lb).

Merlin 23: Business aircraft version of Metro 23, 12- and 14-passenger interiors, certificated in FAR 23 commuter category.

CUSTOMERS: More than 950 Metro/Merlin/Expediter/Special Mission aircraft operating in 43 countries; among recent orders were two Metro 23s for Australian regional airline Kendell Airlines, 15 for Chicago based Midway Connection, two for Airwork (NZ) Limited of New Zealand, one for Hazelton Airlines (Australia) and one for LoneStar. See Current Versions for military operators. In 1994, 16 Metro 23s were delivered.

DESIGN FEATURES: Certification to FAR 23 commuter category (Amendment 34) covers ICAO Annex 8; Metro 23 has maximum T-O weight of 7,484 kg (16,500 lb); changes from Metro III include increased maximum T-O weight for increased payload, numerous minor changes arising from change from SFAR 41 to FAR 23 commuter category certification basis, continuous alcohol water injection system components relocated from nose bay to wing centre-section, and stall avoidance system. Certificated for flight into known icing, lightning strike protection equivalent to that of commercial jet transports.

FLYING CONTROLS: Mechanically operated, aerodynamically and mass balanced, manual trim tab in rudder and each aileron, electrically operated variable incidence tailplane, small ventral fin. Hydraulically operated double slotted trailing-edge flaps.

STRUCTURE: Two-spar fail-safe wing made in one piece, main spar beams have laminated caps (titanium laminations in centre-section), pressurised cylindrical fuselage of 2024

US MILITARY C-26s

Type	Equivalent	First aircraft	First delivery	Qty	Service(s)
C-26A	SA227-AC Metro III	86-0450	Mar 89	10	Air NG
C-26A	SA227-BC Metro III	87-1000	1990	2	Army NG
C-26A	SA227-BC Metro III	89-0460	1990	1	Air NG
C-26B	SA227-DC Metro 23	90-0523	Jan 92	37*	Air/Army NG
C-26B	SA227-DC Metro 23	—		(16†)	Air/Army NG
C-26B	SA227-DC Metro 23	89-0515		1	Army NG
UC-26C	SA227-AT Merlin IVC	89-1471		1	Air NG
Total				**52 (+16†)**	

* First 29 include seven for Army National Guard
† Options

Fairchild C-26A in Air National Guard markings

1995

Fairchild MMSA with Lockheed Martin sensor pod

1995

aluminium alloy, flush riveted, glassfibre honeycomb nose cap can contain 0.46 m (18 in) diameter weather radar antenna

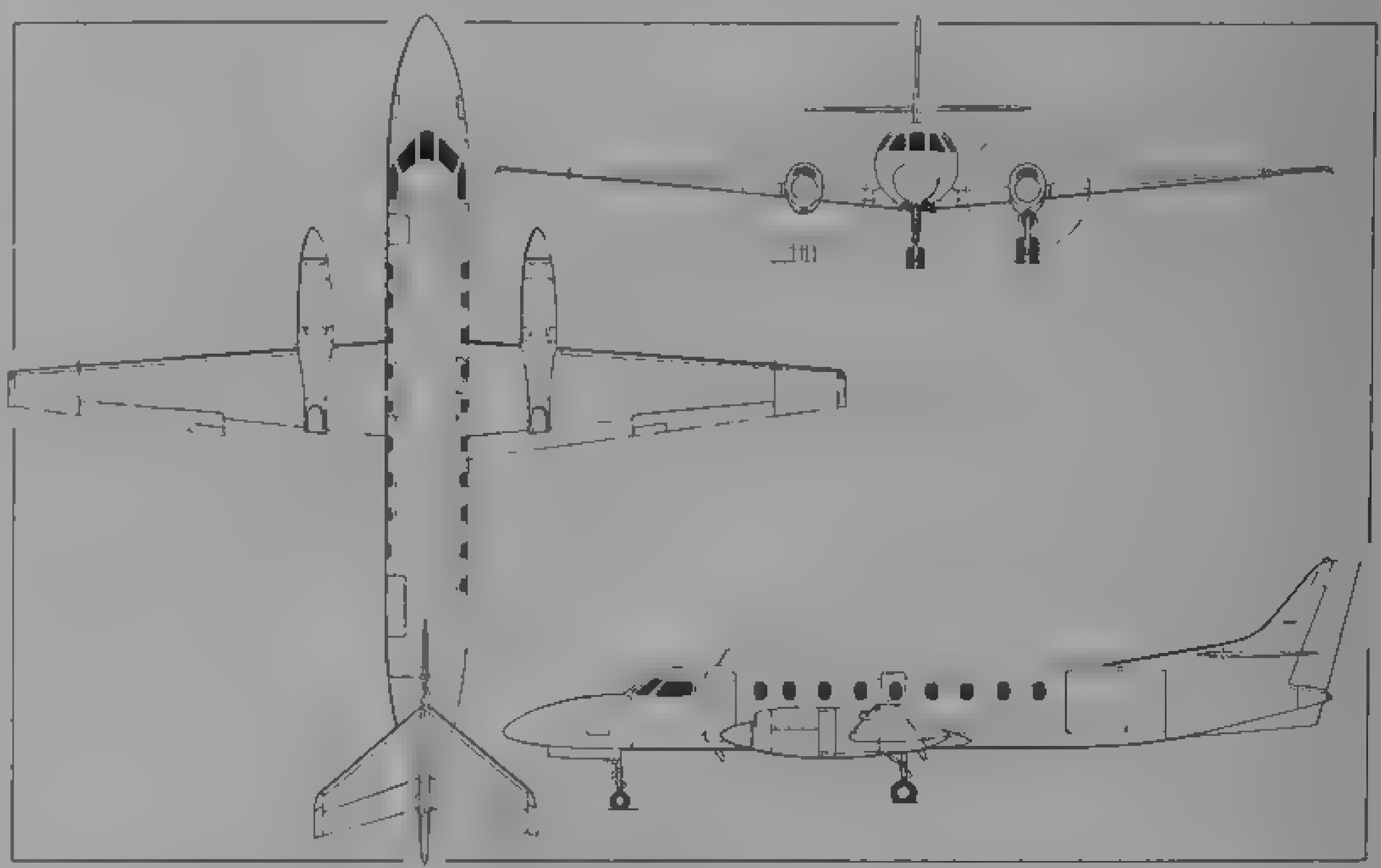
LANDING GEAR: Retractable tricycle type with twin wheels on each unit. Hydraulic retraction, with dual actuators on each unit. All wheels retract forward, main gear into engine nacelles and nosewheels into fuselage. Oleo-pneumatic shock-absorber struts. Nosewheel steerable variable authority (±63° maximum) through rudder pedals or tiller. Free-fall emergency extension, with back-up of hand-operated hydraulic pump. 18 × 5.5 type VII mainwheels with tubeless tyres, size 19.5 × 6.75-10 ply, nosewheels and low-pressure tubeless tyres, size 18 × 4.40-10 ply, type VII. Tyre pressures at standard T-O weight: nosewheel 4.83 bars (70 lb/sq in), mainwheels 7.31 bars (106 lb/sq in). Aircraft Braking Systems (ABS) self-adjusting hydraulically operated dual rotor disc brakes

POWER PLANT: Metro 23 (SA227-CC) has two 746 kW (1,000 shp) AlliedSignal TPE331-11U-612G turboprops, Metro 23 (SA227-DC) has TPE331-12UHR, giving 820 kW (1,100 shp) dry and 820 kW (1,100 shp) with continuous alcohol/water injection system and 746 kW (1,000 shp) maximum continuous power. McCauley four-blade constant-speed fully feathering reversible pitch metal propellers; automatic propeller synchronising standard, in-flight windmill, start capability. Integral fuel tank in each wing, each with a usable capacity of 1,226 litres (324 US gallons; 270 Imp gallons). Total usable fuel capacity 2,452 litres (648 US gallons; 540 Imp gallons). Refuelling point in each outer wing panel. Automatic fuel heating. Oil capacity 15.1 litres (4 US gallons, 3.3 Imp gallons). Alcohol/water tank in wing centre-section, capacity 53 litres (14 US gallons, 11.7 Imp gallons), with two pumps to pump fluid to engines. Flush-mounted fuel vents. Single point rapid defuelling provisions. Negative torque sensing, single red line/autostart, automatic engine temperature limiting and engine fire extinguishing systems

ACCOMMODATION: Crew of two on flight deck (Metro 23 single pilot approved). Dual controls standard. Bulkhead between cabin and flight deck. Standard accommodation for 19 or 20 passengers seated two-abreast, on each side of centre aisle. High-back passenger seats mounted on tracks and quickly removable. Interior convertible to all-cargo or mixed passenger/cargo configuration with movable bulkhead between passenger and cargo sections. Snap-in carpeting. Tiedown fittings for cargo at 0.76 m (30 in) spacing. Integral-step passenger door on port side of fuselage, immediately aft of flight deck. Large cargo loading door on port side of fuselage at rear of cabin, hinged at top. Three window emergency exits, one on the port, two on the starboard side. Forward baggage/avionics compartment in nose, capacity 363 kg (800 lb). Pressurised rear cargo compartment, capacity 385 kg (850 lb). Cabin air conditioned and pressurised

SYSTEMS: AiResearch automatic cabin pressure control system, maximum differential 0.48 bar (7.0 lb/sq in), providing a sea level cabin altitude to 5,120 m (16,800 ft). Engine bleed air heating, dual air cycle cooling system, with automatic temperature control. Air blower system for on-ground ventilation. Vapour cycle (CFC free) cooling system may be fitted for ground and in-flight operation. Independent hydraulic system for brakes. Dual engine-driven hydraulic pumps, using fire resistant MIL-H-83282 hydraulic fluid, provide 138 bars (2,000 lb/sq in) to operate flaps, landing gear actuators and nosewheel steering. Hydraulic system flow rates 30.3 litres (8 US gallons; 6.7 Imp gallons)/min at idle power, both engines; 46.7 litres (12.34 US gallons, 10.27 Imp gallons)/min at T-O and climb power. Air/oil reservoir, pressure 2.27 bars (33 lb/sq in). Electrical system supplied by two 300 A 28 V DC starter/generators. Fail-safe system with overload and overvoltage protection. Redundant circuits for essential systems. Two 350 VA solid-state inverters supply 115 V and 26 V AC. Two 24 V 23 Ah Ni/Cd batteries for main services. Engine fire detection system and fire extinguishing system standard. Wing overheat detection system. Oxygen system of 1.39 m³ (49 cu ft) capacity with flush outlets at each seat; system with capacity of 5.04 m³ (178 cu ft) optional. Redundant stall avoidance system comprising angle indicator, visual and aural warning. Goodrich automatic, bleed air operated pneumatic de-icing boots on wing and fin, tailplane equipped with abrasion boot. Engine inlet de-icing by bleed air. Electric oil cooler inlet anti-icing. Electric propeller and windscreen de-icing

AVIONICS: All commercial avionics systems (Collins, Bendix/King and others) fitted as desired; flight data recorder and cockpit voice recorder, special/military equipment installed on request. Autopilots, global navigation and global positioning, weather/mapping/tracking radars available. Provision for installation of remotely mounted or panel-mounted avionics

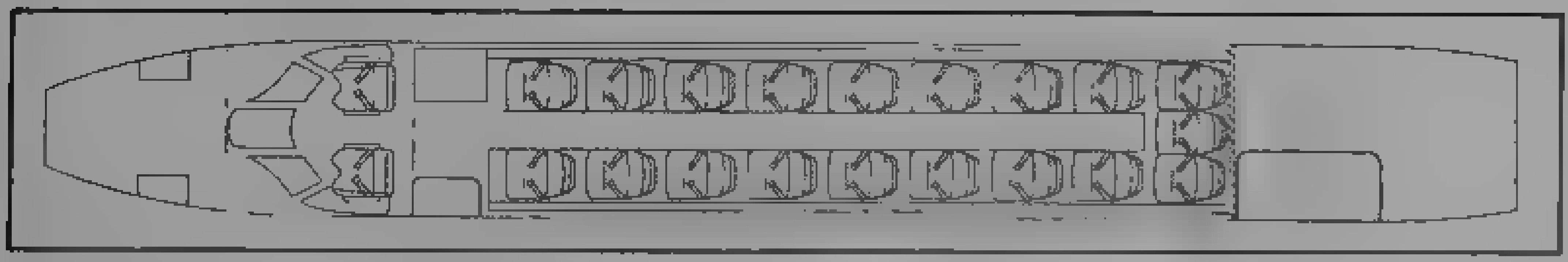


Fairchild 19/20-seat Metro 23 commuter airliner *(Jane's/Dennis Punnett)*

1992

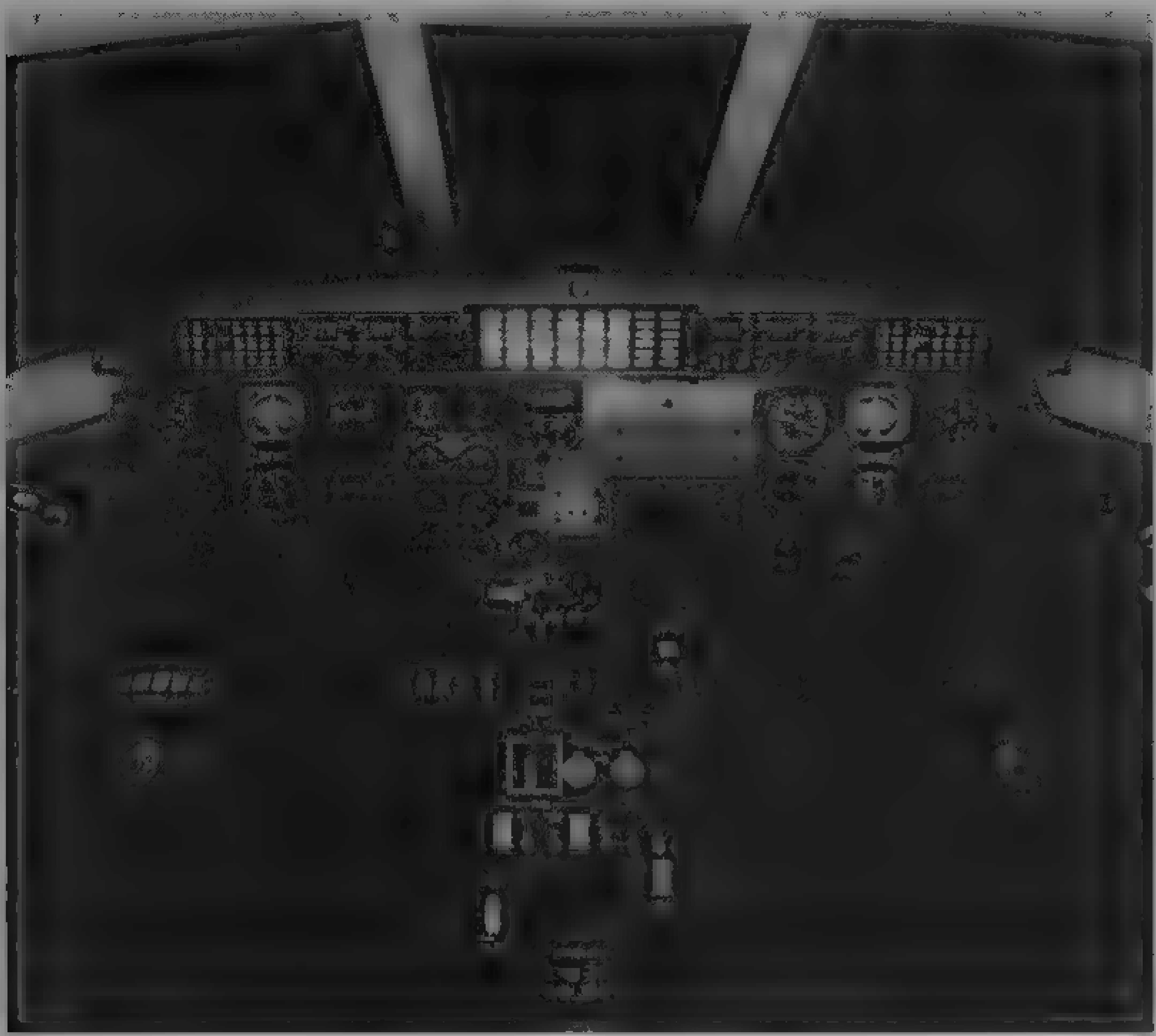
Fairchild Metro 23 of Kendell Airlines of Australia

1995



Typical seating plan (76 cm, 30 in pitch) for Metro 23

1995



Fairchild Metro 23 flight deck

1993

EQUIPMENT: Standard equipment includes pilot and co-pilot foot warmers, edge lit consoles, pedestal and switch panels, integrally lit instruments; annunciator panel with 48 indicators; internally operated control locks, individual reading lights and air vents for each passenger; heated pitot, heated static sources; lights for baggage compartment, cargo compartment, entrance, map and instrument panel, ice inspection, landing gear inspection, navigation rotating beacon and taxi; two-speed windscreen wipers automatic engine start cycle, external power socket, and static wicks

DIMENSIONS, EXTERNAL

Wing span	17.37 m (57 ft 0 in)
Wing mean aerodynamic chord	1.84 m (6 ft 0¼ in)
Wing aspect ratio	10.51
Length overall	18.09 m (59 ft 4¼ in)
Height overall	5.08 m (16 ft 8 in)
Tailplane span	4.86 m (15 ft 11½ in)
Wheel track	4.57 m (15 ft 0 in)
Wheelbase	5.83 m (19 ft 1½ in)
Propeller diameter	2.69 m (8 ft 10 in)
Passenger door (fwd): Height	1.35 m (4 ft 5 in)
Width	0.64 m (2 ft 1 in)
Cargo door (rear): Height	1.30 m (4 ft 3¼ in)
Width	1.35 m (4 ft 5 in)
Height to sill	1.30 m (4 ft 3¼ in)
Forward baggage doors (two, each):	
Height	0.64 m (2 ft 1 in)
Width	0.46 m (1 ft 6 in)
Emergency exits (three, each):	
Height	0.71 m (2 ft 4 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL

Cabin, excl flight deck and rear cargo compartment:	
Length	7.75 m (25 ft 5 in)
Max width	1.57 m (5 ft 2 in)
Max height (aisle)	1.45 m (4 ft 9 in)
Floor area	13.01 m² (140.0 sq ft)
Volume	13.88 m³ (490.0 cu ft)
Rear cargo compartment (pressurised):	
Length	2.34 m (7 ft 8 in)
Max width	1.57 m (5 ft 2 in)
Max height	1.45 m (4 ft 9 in)
Volume	4.06 m³ (143.5 cu ft)
Nose cargo compartment (unpressurised):	
Length	0.91 m (3 ft 0 in)
Volume	0.85 m³ (30.0 cu ft)

AREAS

Wings, gross	28.71 m² (309.0 sq ft)
Ailerons (total)	1.31 m² (14.12 sq ft)
Trailing-edge flaps (total)	3.78 m² (40.66 sq ft)
Fin, incl dorsal fin	3.40 m² (36.62 sq ft)
Rudder, incl tab	1.80 m² (19.38 sq ft)
Tailplane	5.08 m² (54.7 sq ft)
Elevators	1.98 m² (21.27 sq ft)

WEIGHTS AND LOADINGS (Metro 23):

Operating weight empty	4,300 kg (9,480 lb)
Max fuel weight	1,969 kg (4,342 lb)
Max T-O weight	7,484 kg (16,500 lb)
Max ramp weight	7,530 kg (16,600 lb)
Max zero-fuel weight	6,577 kg (14,500 lb)
Max landing weight	7,110 kg (15,675 lb)
Max wing loading	261 kg/m² (53.3 lb/sq ft)
Max power loading	4.56 kg/kW (7.5 lb/shp)

PERFORMANCE (Metro 23 SA227 DC at max T-O weight of 7,484 kg, 16,500 lb, ISA, except where indicated):

Design diving speed (V_D)
311 kts (576 km/h, 358 mph) CAS

Max operating speed (V_{MO})
246 kts (455 km/h; 283 mph) CAS

Max operating Mach number (M_{MO}) 0.52

Max cruising speed at 97% rpm, bleed low, at 3,350 m (11,000 ft) 293 kts (542 km/h, 337 mph)

Stalling speed:

flaps and wheels up
103 kts (191 km/h, 118 mph) IAS

flaps and wheels down
89 kts (164 km/h, 102 mph) IAS

Max rate of climb at S/L, bleed open
823 m (2,700 ft)/min

Rate of climb at S/L, OEI, bleed closed
176 m (580 ft)/min

Service ceiling	7,620 m (25,000 ft)
Service ceiling, OEI	3,535 m (11,600 ft)
T-O to 15 m (50 ft), wet power	1,414 m (4,640 ft)
Landing run	843 m (2,766 ft)

Range, Metro 23 (SA227 DC):

with 19 passengers and baggage, FAA IFR reserves
over 1,115 n miles (2,065 km, 1,283 miles)

with 2,268 kg (5,000 lb), FAA IFR reserves
over 533 n miles (988 km; 614 miles)

Range, C-26 with 1,315 kg (2,900 lb) payload, 1,969 kg (4,342 lb) fuel, VFR reserves
1,614 n miles (2,990 km; 1,858 miles)

UPDATED

FAIRCHILD SPECIAL MISSION AIRCRAFT

TYPE: Special mission versions of Metro 23; replaced Metro III.

PROGRAMME: Development and production on demand

CURRENT VERSIONS: **Multi-Mission Surveillance Aircraft (MMSA)**: MMSA provides aircraft not permanently configured for single mission, capable of performing multiple missions while preserving ability to return quickly to passenger, VIP, cargo or airborne ambulance/evacuation configuration. Fairchild and General Dynamics (now Lockheed Martin Tactical Aircraft Systems) joined in developing and marketing MMSA as low-cost, very capable surveillance system consisting of Metro 23, centreline-mounted surveillance pod, mission dedicated radar system, cabin-mounted command control communications and intelligence (C³I) and sensor control console and pilot displays. Electronic reconnaissance systems also available. Surveillance/reconnaissance system at time of launch (1993) comprised electro-optical camera, Loral FLIR and infra-red line scanner, Mitsubishi pilot's FLIR, systems operator's console, long-range optical system and air-to-air radar or maritime radar; other options available.

Airborne early warning: Swedish Defence Materiel Administration (FMV) ordered Fairchild study of airborne early warning (AEW) version of Metro III in 1982, carrying dorsal active array radar antenna, ordered Metro III to test Ericsson PS-890 (now FSR 890) Erieye early 1986; first flight with mockup antenna October 1986, with operating radar January 1991. See 1993-94 and earlier *Jane's* for further details. FMV eventually selected Saab 340B for AEW role.

Multimission C³I and surveillance: Multirole, multimission capability with interchangeable mission configuration units (MCUs), AN/APG-66 radar, and surveillance pod for FLIR/cameras (air-to-air and air-to-ground), capabilities and configurations, and C³I systems, can be tailored to mission requirements; special equipment modification and support are offered.

Other variants include **flight inspection, photo reconnaissance, electronic intelligence** and **airborne critical care**.

CUSTOMERS: Total 44 delivered in various configurations (Metro III, 23 and C-26). MMSA evaluated by Poland and Hungary 1993.

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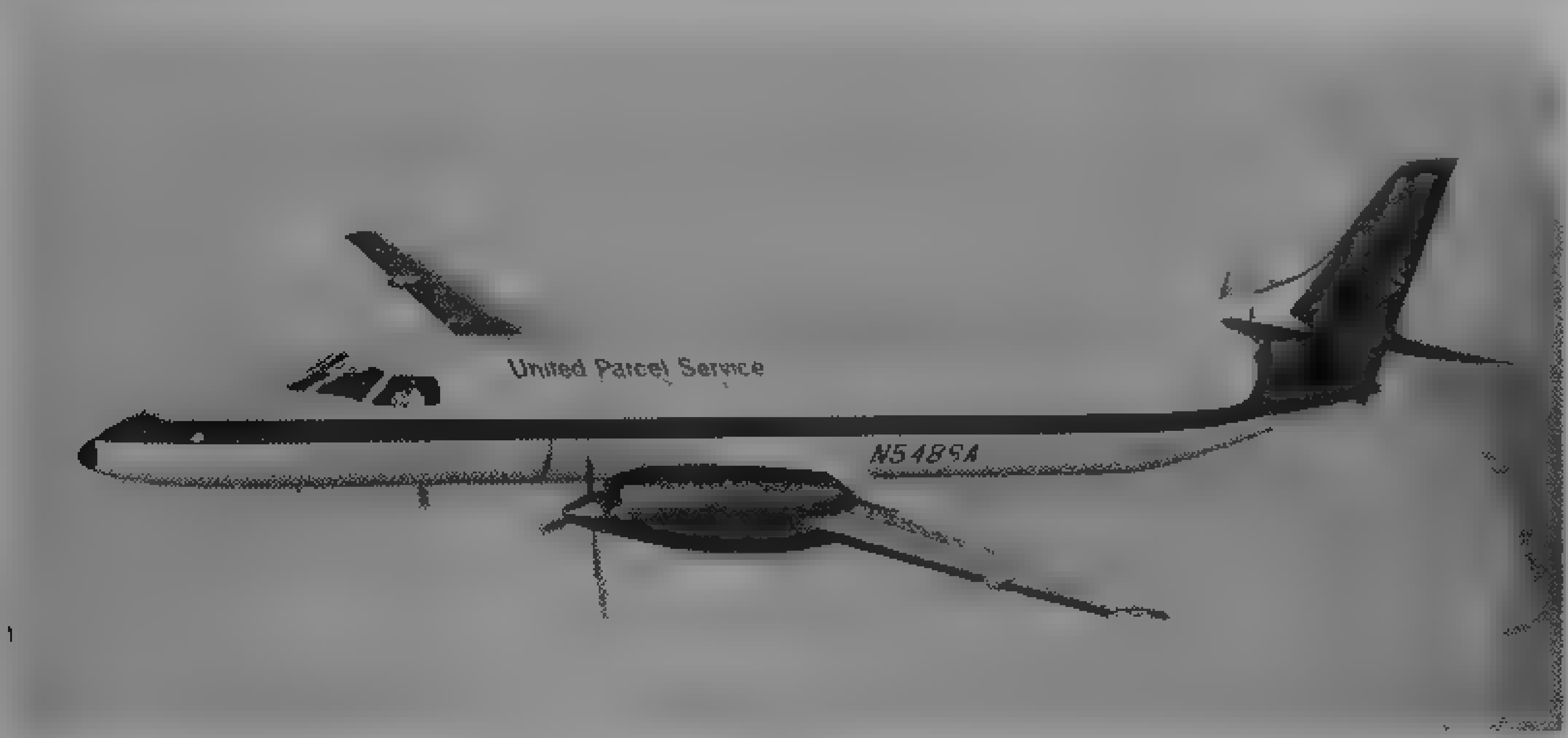


Fairchild Expediter I with blanked cabin windows, operated on behalf of United Parcel Service

1993

FREEWING

FREEWING AERIAL ROBOTICS CORPORATION

Building 340, University of Maryland, College Park, Maryland 20742
Telephone: 1 (301) 314 7794 and 7795
Fax: 1 (301) 314 9592/9590
PRESIDENT: Hugh Schmittle
EXECUTIVE VICE-PRESIDENT: Odile Legeay

Company formed as result of sponsored and partially state-funded research and flight testing of Freewing principle at University of Maryland. Four manned prototypes tested in flight or wind tunnel, leading to Mk 5 production version. Tilt body principle developed for use in US Department of Defense UAV Joint Project Office close range and vertical launch and recovery UAV programmes (see *Jane's Unmanned Aerial Vehicles and Targets* for details).

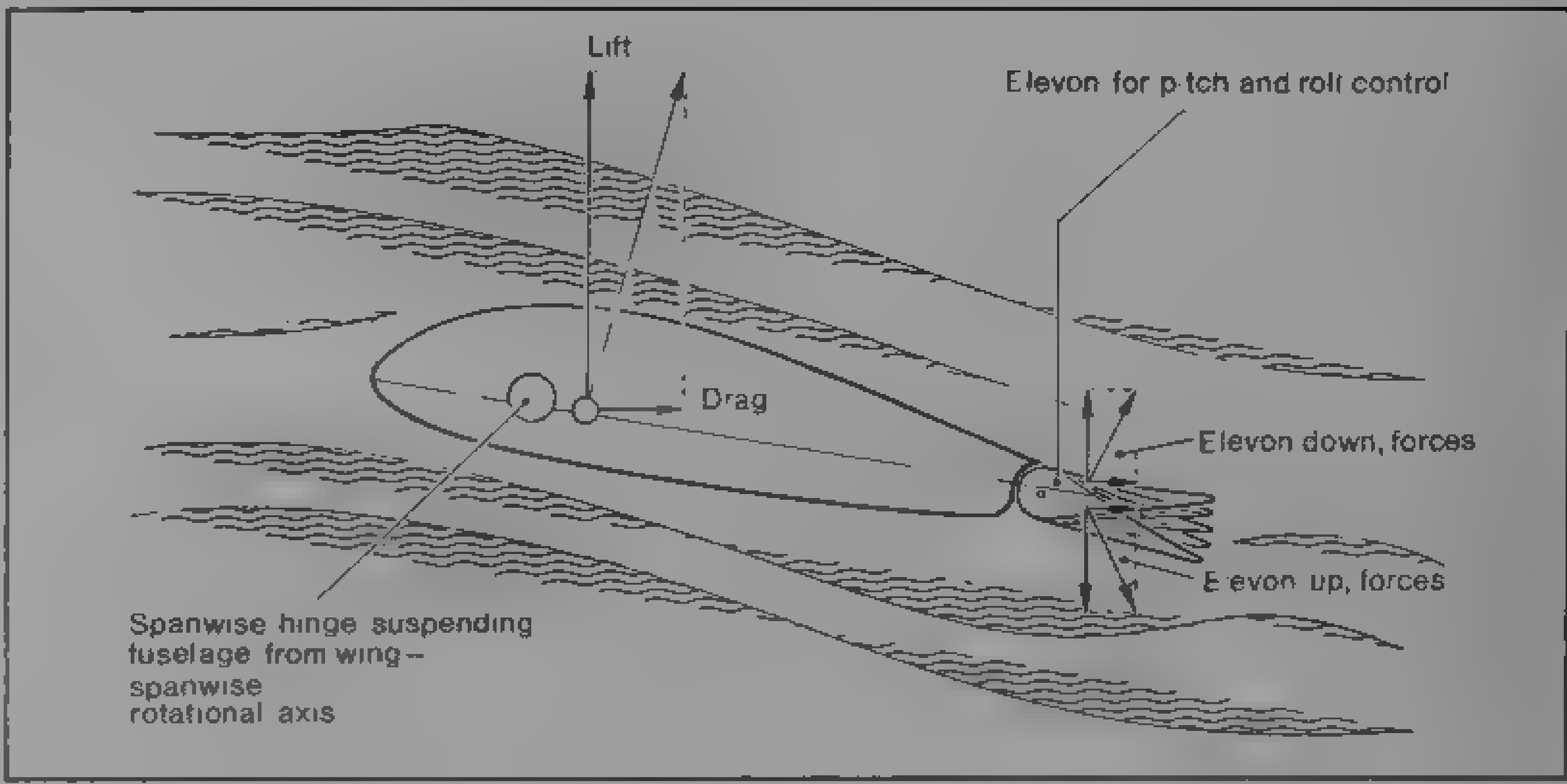
Freewing is working with Burt Rutan of Scaled Composites Inc (which see) on small UAVs using the Freewing principle with payloads up to 22.7 kg (50 lb). Company signed partnership agreement with Matra Défense in June 1994 to adapt its Scorpion Tilt-Body UAV for use on French frigates, named Marvel. Increasing emphasis on UAVs led company to change its name from Freewing Aircraft Corporation to Freewing Aerial Robotics Corporation on 23 December 1993.

UPDATED

FREEWING CONCEPT

Wing is attached to fuselage by spanwise hinges rather than by fixed bolts, and its angle of attack to air flow is governed by natural aerodynamic forces rather than through a conventional tailplane and elevator. With a conventional aircraft, rigging angle of incidence of wing to fuselage is constant, and angle of attack of wing is varied by pilot's control actions. In the Freewing, angle of attack is relatively constant and angle of incidence of wing to fuselage is allowed to vary. In flight, fuselage remains at a constant angle and wing responds to changes of air flow such as result from turbulence, by changing its angle with respect to the fuselage. This is claimed to be stall-resistant; to give very good gust response in turbulence, and to allow a wide CG range of fuselage, since torque is not transmitted through a hinge. Pitch control is through elevons on wing, the elevator on tailplane being used to set correct fuselage angle to air flow for minimum drag. Several patents cover the Freewing concept.

UPDATED



The Freewing principle, spanwise hinge mounting of wing to fuselage *(Jane's/Keith Fretwell)* *1994*

FREEWING FREEBIRD Mk 5

TYPE: Two-seat light aircraft embodying Freewing principle.

PROGRAMME: Four previous versions tested, first flight Mk 5 with 48.5 kW (65 hp) Rotax 582 two-stroke, 22 March 1993, since re-engined with 74.6 kW (100 hp) Mid-West Aero (Londavia) MWAE100R twin-chamber rotary; company plans to manufacture Freebird delayed due to concentration on tilt-body UAVs. Freewing is discussing possible licensed production with various manufacturers.

DESIGN FEATURES: Freewing principle of spanwise hinge mounting wing to fuselage (see Concept entry above); lateral control is by normal outboard ailerons; fuselage attitude is controlled separately by using elevator; CG limits of fuselage are controlled essentially by available tail trim force.

The production version Mk 5 normally flies in this mode but, in order to allow flap to be used to steepen approach and increase lift at low airspeed (which cannot be done with flying wing), wing of Mk 5 can be locked at incidence of 2° in flight; wing elevons are then used as flaps, and trimming surfaces at fuselage tail become normal elevators; mechanical switching ensures that control column always produces normal aircraft reactions.

Wing of Mk 5 has Roncz aerofoil designed for maximum C_L at low airspeed and is reflexed at trailing-edge to counter rotational moment at higher speeds; wing is free to tilt through arc of 35°; chord constant, sweep angle 10°, dihedral 0°; wing of production aircraft will be adapted for greater speed range.

FLYING CONTROLS: Mechanical, with aileron and elevator linkages passing through pivot centre; normal dual control columns operate ailerons and wing trailing-edge elevators in Freewing flight, ailerons and fuselage elevator in fixed wing flight; normal dual rudder pedals and throttle; locking lever to lock/unlock wing and transfer control functions.

STRUCTURE: Fabric covered steel tube fuselage and tail; steel tube wing centre-section, metal covered; remainder of wing is fabric covered wood; GFRP engine cowling.

LANDING GEAR: Prototype has non-retractable tailwheel type; production aircraft would have tricycle gear.

POWER PLANT: One 74.6 kW (100 hp) Mid West MWAE100R water-cooled twin-chamber rotary engine.

DIMENSIONS, EXTERNAL:	
Wing span	10.16 m (33 ft 4 in)
Wing aspect ratio	7.27
AREAS:	
Wings, gross	14.19 m² (152.78 sq ft)
Ailerons (total)	1.40 m² (15.2 sq ft)
Flaps (total)	1.12 m² (12.0 sq ft)
Tailplane	1.07 m² (11.8 sq ft)
Elevators (total)	0.84 m² (9.0 sq ft)
WEIGHTS AND LOADINGS:	
Basic weight empty	304 kg (670 lb)
Max T-O and landing weight	476 kg (1,050 lb)
Max wing loading	3.12 kg/m² (6.87 lb/sq ft)
Max power loading	3.95 kg/kW (11.67 lb/hp)
PERFORMANCE:	
Never-exceed speed (VNE)	78 kts (145 km/h, 90 mph)
Max level speed	70 kts (129 km/h, 80 mph)
Cruising speed, 5,500 rpm	61 kts (113 km/h, 70 mph)
Stalling speed, flaps up	26 kts (48 km/h, 30 mph)
Max rate of climb, pilot only	305 m (1,000 ft)/min
Normal T-O run, flaps up	91 m (300 ft)
Min T-O run, flaps up	61 m (200 ft)
Landing run, flaps up	122 m (400 ft)
Range, no reserves	113 n miles (209 km, 130 miles)
Endurance	3 h
g limits	+4/−2

Claimed gust response for Freewing-type aircraft *(Jane's/Keith Fretwell)* *1994*

UPDATED

Freewing Freebird Mk 5 light aircraft with wing which can be used in either the Tilt-body or lockable mode *1995*

GENERAL DYNAMICS

Military aircraft activities of General Dynamics sold to Lockheed in December 1992, becoming Lockheed Fort Worth on 1 March 1993. Details of F-16 Fighting Falcon appear on Lockheed Martin Tactical Aircraft Systems pages of this edition; other GD aerospace activities outlined in 1992-93 and earlier *Jane's*.

UPDATED

GEVERS

GEVERS AIRCRAFT INC

PO Box 430, Brownsburg, Indiana 46112
Telephone: 1 (317) 367 5550
Fax: 1 (317) 852 2735
PRESIDENT, CHIEF ENGINEER: David E. Gevers
VICE-PRESIDENT: Lawrence B. Schmidt
BUSINESS MANAGER: Theresa A. Gevers
MARKETING: Robert L. Glasa

Gevers Aircraft formed 1988 to investigate feasibility of several interesting design features for new general aviation aircraft, including ability to extend or reduce wing span in flight through telescopic-mounted wingtip section, multiconfiguration landing gear; and propeller drive system resistant to engine failure.

UPDATED

GEVERS GENESIS

TYPE: Six-seat amphibious monoplane.

PROGRAMME: Design began in 1981, radio-controlled model flown in 1990; wind tunnel testing and extensive computer aided stability analysis completed 1993. Prototype construction started 1994, investment for production being sought. Patents apply.

DESIGN FEATURES: Goals include improved performance over conventional aircraft, modular and interchangeable subassemblies, twin-engined reliability with no asymmetric effect if one engine fails, multipurpose landing gear, and manufacturing and construction simplicity. Can be used as training aircraft capable of simulating variety of configurations, and as testbed for aerofoils.

Wing has centre-section attached to top of fuselage and two telescopic sections that extend wing span, movable wing sections completely enclosed by centre-section when retracted inwards. Amphibious hull, and T tail above long sweptback fin. Wing centre-section aerofoil NACA 66_3-018, dihedral 3°; sweepback 3° 17′ at quarter-chord, 0° sweep for wing extensions.

FLYING CONTROLS: Ailerons (inboard droop with extension of flaps), balance tab in rudder and anti-balance in elevator; fixed leading-edge slats on wing extensions and movable slats on centre-section, flight adjustable tailplane incidence.

STRUCTURE: Riveted aluminium alloy wings, tail and lower fuselage; cabin compartment of glassfibre.

LANDING GEAR: Converts in flight for water, land, snow or intermittent snow/hard surface operation, retractable.

POWER PLANT: Two 242.4 kW (325 hp) Textron Lycoming TIO-540 flat six engines, mounted in tandem in fuselage driving two Hartzell contrarotating, two-blade constant-speed feathering and reversible-pitch metal pusher propellers mounted aft of wing trailing-edge. In the event of failure of one engine, remaining engine drives both propellers; there is no asymmetric moment. Total usable fuel capacity 757 litres (200 US gallons, 166 Imp gallons) in two wing-mounted bladder type tanks, fuel gravity fed, with electric pumps for back-up and operation under negative g.

ACCOMMODATION: Clamshell type doors on both sides of cabin allow each passenger direct exit. Optional cabin configurations include medical and cargo layouts. During water operations, only upper half of door operational, during non-water operations lower half of door opens to floor level for ease of loading.

SYSTEMS: Pressurised and unpressurised models to be offered.

AVIONICS: *Instrumentation*: Dual VFR and IFR instrument panels, with day and night capability.

DIMENSIONS, EXTERNAL:

Wing span: extended	15.24 m (50 ft 0 in)
retracted	7.87 m (26 ft 0 in)
Wing chord: at fixed root	3.25 m (10 ft 8 in)
at fixed tip	2.03 m (6 ft 8 in)
at extension root and tip	1.12 m (3 ft 8 in)
Wing aspect ratio: extended	8.17
retracted	3.07
Length overall	11.58 m (38 ft 0 in)
Height overall	3.76 m (12 ft 4 in)
Tailplane span	4.45 m (14 ft 7 in)
Wheel track	3.20 m (10 ft 6 in)
Wheelbase	6.35 m (20 ft 10 in)
Propeller diameter	1.98 m (6 ft 6 in)
Passenger door: Height	0.965 m (3 ft 2 in)
Width	2.24 m (7 ft 4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	3.05 m (10 ft 0 in)
Max width	1.21 m (3 ft 11½ in)
Max height	1.07 m (3 ft 6 in)
Volume	3.74 m³ (132.0 cu ft)
Nose baggage compartment	0.28 m³ (10.0 cu ft)
Rear baggage compartment	0.42 m³ (15.0 cu ft)

AREAS:

Wings, gross: extended	28.61 m² (308.0 sq ft)
retracted	20.44 m² (220.0 sq ft)
Ailerons: retracted (total)	1.16 m² (12.50 sq ft)
extended (total)	2.79 m² (30.0 sq ft)
Trailing-edge flaps (total)	0.71 m² (7.67 sq ft)
Fin	4.16 m² (44.8 sq ft)
Rudder, incl tab	1.39 m² (15.0 sq ft)
Tailplane	3.81 m² (41.0 sq ft)
Elevator, incl tab	1.90 m² (20.5 sq ft)

WEIGHTS AND LOADINGS (estimated):

Weight empty	1,542 kg (3,400 lb)
Max T-O weight	2,722 kg (6,000 lb)
Max wing loading:	
extended	95.1 kg/m² (19.48 lb/sq ft)
retracted	133.2 kg/m² (27.27 lb/sq ft)
Max power loading	5.61 kg/kW (9.23 lb/hp)

PERFORMANCE (estimated, at max T-O weight, ISA):

Max level speed	267 kts (496 km/h, 308 mph)
Cruising speed at S/L:	
75% power	225 kts (417 km/h, 260 mph)
65% power	214 kts (396 km/h, 246 mph)
OEI	192 kts (356 km/h, 221 mph)
Stalling speed: flaps, landing gear and wings retracted	95 kts (175 km/h, 109 mph)
flaps, landing gear and wings extended	55 kts (102 km/h, 63 mph)
Rotation speed	66 kts (123 km/h, 76 mph)
Approach speed	71 kts (132 km/h, 82 mph)
T-O run: on land	183 m (600 ft)
on water	305 m (1,000 ft)
T-O to 15 m (50 ft) on land	427 m (1,400 ft)
Landing from 15 m (50 ft) on land	607 m (1,990 ft)
Landing run: on land	71 m (230 ft)
on water	152 m (500 ft)
Range with max usable fuel	1,912 n miles (3,540 km, 2,200 miles)

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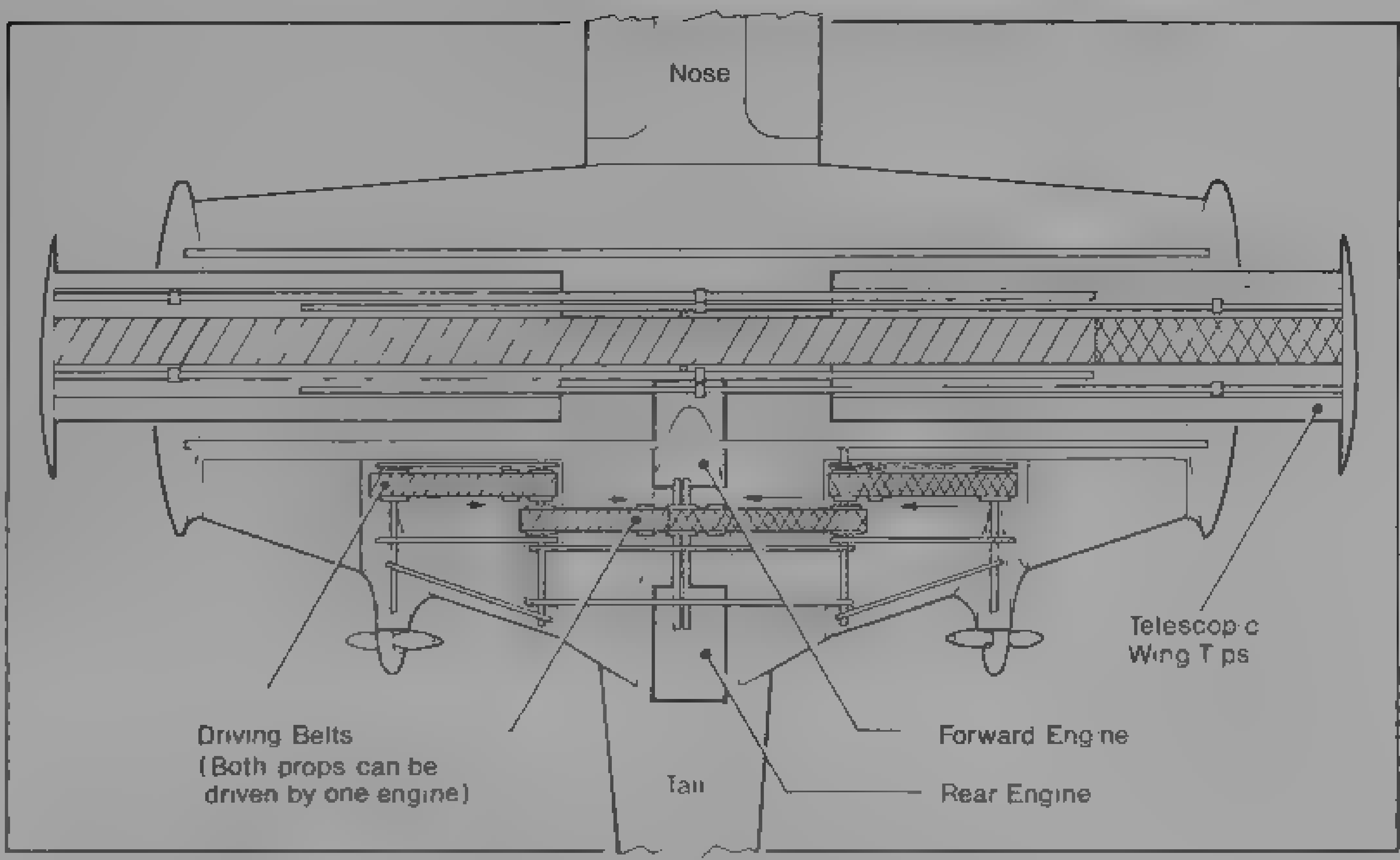
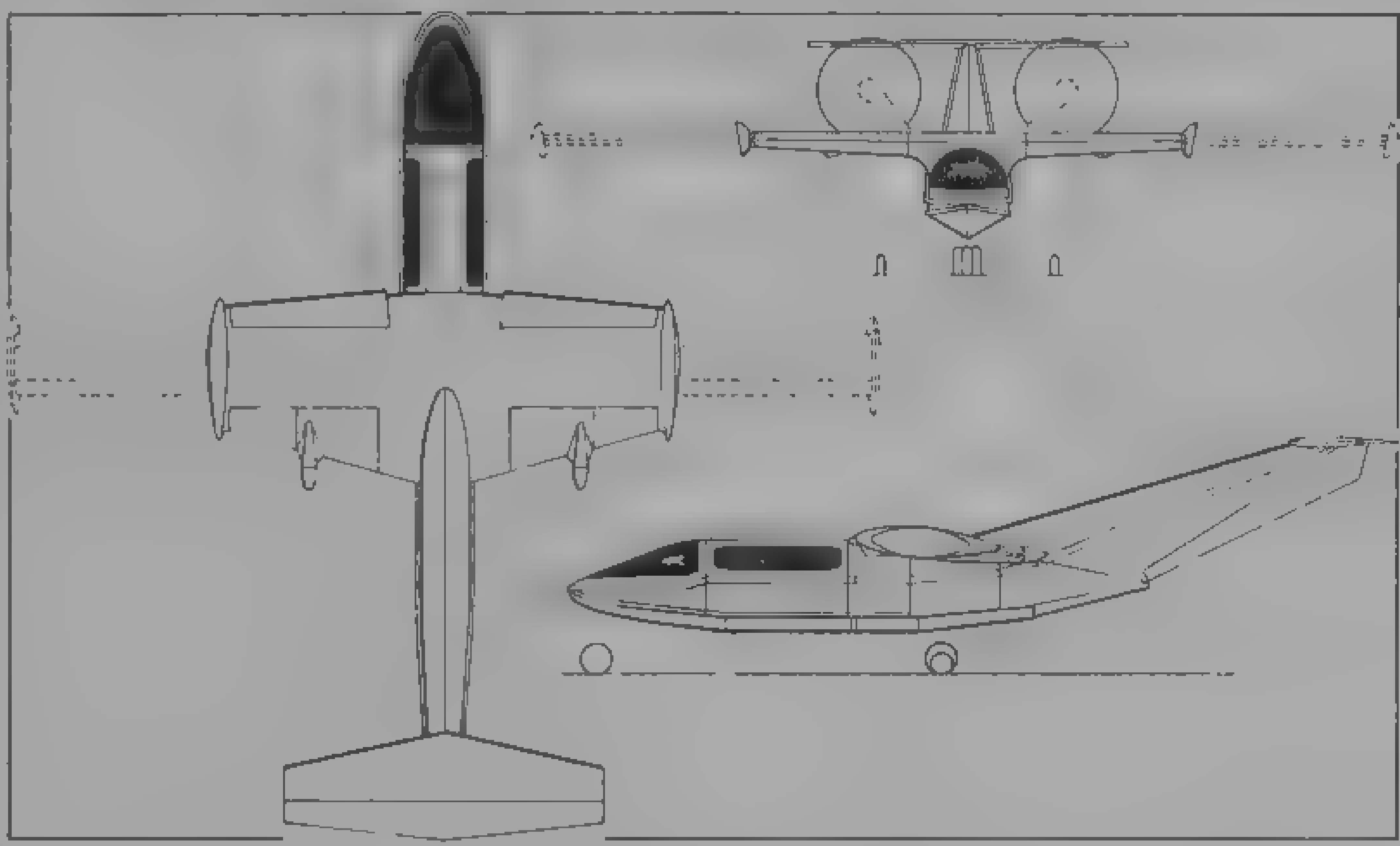


Gevers Genesis wing, engine and propeller arrangement *(Jane's/Keith Fretwell)* *1994*



Gevers Genesis variable span amphibian with landing gear configured for runway operation *(Jane's/Mike Keep)* *1994*

GLOBAL

GLOBAL HELICOPTER TECHNOLOGY INC

Information on the Huey 800 conversion of Bell UH-1H appears in *Jane's Aircraft Upgrades*.

UPDATED

GREAT PLAINS

GREAT PLAINS AIRCRAFT SUPPLY CO INC

PO Box 545, Boys Town, Nebraska 68010
Telephone: 1 (402) 493 6507
Fax: 1 (402) 333 7750
MARKETING DIRECTOR: Steve Bennett

VERIFIED

GREAT PLAINS SONERAI II, IIL, II-LT and II-LTS

TYPE: Two-seat, dual control sporting homebuilt.

PROGRAMME: Prototype of tandem two-seat Sonerai II first flown July 1973, at least 500 since built and flown. Many components, complete kits for fuselage, tail and wings, and materials, available to amateur constructors; estimated building time 850 working hours.

CURRENT VERSIONS: **Sonerai II**: Standard mid-wing model. *Description applies to this version except where indicated.*

Sonerai IIL: Low-wing instead of mid-wing configuration and 3° dihedral, first flight June 1980.

Sonerai II-LT: Similar to Sonerai IIL but has 2,200 cc VW engine standard, tricycle landing gear and larger front cockpit for taller pilot; retrofit kit was produced to allow existing Sonerais to be fitted with tricycle gear; first flight January 1983.

Sonerai II-LTS Stretched version of Sonerai II LT, first flight June 1984

COSTS: Kit: $5 200. Plans: $99 95

DESIGN FEATURES: Wing section NACA 64212

STRUCTURE: Wings of aluminium alloy construction, full-span aluminium alloy ailerons. Welded steel tube fuselage and tail unit, fabric covered except for glassfibre engine cowling

LANDING GEAR: Non-retractable tailwheel type

POWER PLANT: One 44.7, 56 or 61 kW (60, 75 or 82 hp) Great Plains converted Volkswagen 1,600, 1,834 or 2,200 cc motorcar engine, 2 200 cc version is standard for Sonerai II LT and II-LTS. Fuel capacity 38 litres (10 US gallons, 8 3 Imp gallons) for all versions except Sonerai II-LTS, which has standard capacity of 68 litres (18 US gallons; 15 Imp gallons)

DIMENSIONS, EXTERNAL:

Wing span	5 69 m (18 ft 8 in)
Wing aspect ratio	4.15
Length overall:	
all, except Sonerai II LTS	5 74 m (18 ft 10 in)
Sonerai II LTS	6 20 m (20 ft 4 in)
Propeller diameter	1 32-1 37 m (4 ft 4 in-4 ft 6 in)

AREAS:

Wings, gross	7 80 m² (84.0 sq ft)

WEIGHTS AND LOADINGS (Sonerai II):

Weight empty	227 kg (500 lb)
Utility max T-O weight	431 kg (950 lb)
Max T O weight	521 kg (1,150 lb)
Max wing loading	66 84 kg/m² (13 69 lb/sq ft)

Great Plains Sonerai II two-seat homebuilt *(Peter M. Bowers)*

1991

PERFORMANCE (Sonerai II/IIL with 1,700 cc engine, at max T-O weight. ISA):

Max level speed at S/L	139 kts (257 km/h, 160 mph)
Econ cruising speed at S/L	113 kts (209 km/h, 130 mph)
Stalling speed	38 kts (71 km/h, 44 mph)
Max rate of climb at S/L	152 m (500 ft)/min
T-O run	274 m (900 ft)
Landing run	152 m (500 ft)
Range, with reserves	304 n miles (563 km, 350 miles)
g limits: pilot only, aerobatic	±6
max T-O weight, utility	±4.4

VERIFIED

GRUMMAN — *see Northrop Grumman*

GULFSTREAM AEROSPACE

GULFSTREAM AEROSPACE CORPORATION

PO Box 2206, Savannah International Airport, Savannah, Georgia 31402-2206
Telephone: 1 (912) 965 3000
Fax: 1 (912) 965 3775/4171
Telex: 546470 GULF AERO

CHAIRMAN: Theodore (Ted) J. Forstmann

PRESIDENT AND COO: Fred A. Breidenbach

EXECUTIVE VICE-PRESIDENT: W. W. (Bill) Boisture

SENIOR VICE-PRESIDENT GULFSTREAM V PROGRAMME: Preston A. Henne

SENIOR VICE-PRESIDENT NORTH AMERICAN SALES: Joseph Kent Walker

EXECUTIVE VICE-PRESIDENT MARKETING: Robert H. Cooper

EXECUTIVE VICE-PRESIDENT INTERNATIONAL SALES: Gene Rainville

MANAGER MARKETING COMMUNICATIONS AND PUBLIC RELATIONS: Julia D. Stone

Original works purchased by Allen E. Paulson from Grumman Corporation in 1978, facilities expanded and two Gulfstream models introduced when company purchased from Mr Paulson by Chrysler Corporation in 1985, Mr Paulson and Forstmann Little and Company completed repurchase from Chrysler Corporation 19 March 1990, Forstmann Little and Company bought out Paulson September 1992

AlliedSignal AiResearch facility at Long Beach International Airport, California, bought by Gulfstream in 1986 and expanded to accommodate outfitting and completion of 17 Gulfstream IVs at a time. Gulfstream also operates manufacturing plant in Oklahoma City and Mexicali, Mexico. Oklahoma Corporation's three facilities cover more than 185,800 m² (2 0 million sq ft) of manufacturing and servicing space

Certification announced 18 October 1993 of 'Quiet Spey' production hushkit to enable earlier Gulfstreams II, IIB and III (over 440 of which in worldwide service) to comply with FAR Stage 3 noise regulations

Gulfstream Aerospace Technologies (Oklahoma Operations) contracted to produce 200 wing sets for Jetstream 41 (see UK section) between 1990 (first delivery November) and 2000

UPDATED

GULFSTREAM AEROSPACE GULFSTREAM IV, IV-SP, IV-MPA and IV-B

TYPE: Twin-turbofan long-range business transport

PROGRAMME: Design started March 1983, manufacture of four production prototypes (one for static testing) began 1985, first aircraft (N404GA) rolled out 11 September 1985, first flight 19 September 1985, first flight of second prototype 11 June 1986 and third prototype August 1986; FAA certification 22 April 1987 after 1,412 hours flight testing. Westbound round-the-world flight from Le Bourget Airport, Paris, on 12 June 1987, covering 19,887.9 n miles (36,832 44 km, 22,886.6 miles), took 45 hours 25 minutes at average 437 86 knots (811.44 km/h, 504 2 mph) and set 22 world records, eastbound round-the-world flight in N400GA from Houston, Texas, on 26 and 27 February 1988 covered 20 028 68 n miles (37,093 1 km, 23,048 6 miles) in 36 hours 8 minutes 34 seconds at average 554.15 knots (1,026 29 km/h, 637 71 mph), setting 11 records and bettering United Airlines 747SP circuit flown 30 days before, aircraft carried 3,629 kg (8 000 lb) optional internal long-range tank. In March 1993, Gulfstream IV-SP N485GA set new world speed and distance records in class, at 503 57 knots (933.21 km/h; 579 87 mph) and 5,139 n miles (9,524 km, 5,918 miles) respectively, on routine business flight from Tokyo, Japan, to Albuquerque, USA

CURRENT VERSIONS: **Gulfstream IV**: Current version until 1992, *detailed description applies to this model except where indicated.* Aircraft Service Change (ASC) 190 announced 21 September 1993 costing $875,790 installed (eight-week downtime) and increasing ramp weight by 635 kg (1,400 lb) and landing weight by 3,402 kg (7,500 lb) to 29,937 kg (66,000 lb)

Gulfstream IV SP: Improved, higher weight version announced at NBAA Convention, Houston, in October 1991, prototype (N476GA, converted from standard) first flown 24 June 1992, designation applies to all new IVs sold after 6 September 1992, maximum payload increased by 1,134 kg (2,500 lb) and maximum landing weight increased by 3,402 kg (7,500 lb), with no increase in guaranteed manufacturer's bare weight empty. Payload/range envelope extended, expanded capability Honeywell SPZ-8400 flight guidance and control system

Gulfstream IV-MPA: Multi Purpose Aircraft, announced September 1994; derived from US Navy C-20G Operational Support Aircraft (which see below) to provide commercial operators with quick-change interior for up to 26 passengers in high-density shuttle layout low-density executive configuration, 2,177 kg (4,800 lb) cargo capacity, or combination, large cargo door and larger/additional emergency exits standard

Gulfstream IV-B: Improved, longer range version,

Gulfstream Aerospace Gulfstream IV SP (Special Performance)

1995

announced September 1994 as subject of development study by Gulfstream Aerospace and Texas Aerostructures, would feature increased wingspan incorporating winglet design from Gulfstream V and additional fuel capacity, providing 400 n mile (741 km; 460 mile) increase in range; project postponed, June 1995, for at least 12 months following marketing study.

SRA-4, C-20, Tp 102: Special missions aircraft described separately.

CUSTOMERS: 250th production Gulfstream IV rolled out September 1994, total 257 Gulfstream IV and IV-SPs delivered by end 1994, including 22 in 1994; 270 built 10 June 1995; order backlog stood at 30 in June 1995, ensuring that production will continue beyond 2000, with at least 100 additional aircraft manufactured. Recent customers include Executive Jet Aviation (EJA) which placed firm order in January 1995 for seven Gulfstream IV-SPs for delivery in 1995 and 1996, with options on a further 13; these aircraft will be used in EJA's NetJets fractional ownership programme.

COSTS: $23.5 million 'green' (1994).

DESIGN FEATURES: Differences from Gulfstream III (1987-88 and earlier *Jane's*) include aerodynamically redesigned wing contributing to lower cruise drag; wing also structurally redesigned with 30 per cent fewer parts, 395 kg (870 lb) lighter and carrying 544 kg (1,200 lb) more fuel; increased tailplane span; fuselage 1.37 m (4 ft 6 in) longer, with sixth window each side; Rolls-Royce Tay turbofans; flight deck with electronic displays, digital avionics; and fully integrated flight management and autothrottle systems.

Advanced sonic rooftop aerofoil, sweepback at quarter-chord 27° 40'; thickness/chord ratio 10 per cent at wing station 50, 8.6 per cent at station 414; dihedral 3°; incidence 3° 30' at root, −2° at tip. NASA (Whitcomb) winglets.

FLYING CONTROLS: Hydraulically powered flying controls with manual reversion; trim tab in port aileron and both elevators; two spoilers on each wing act differentially to assist aileron and together with third spoiler each side act collectively as airbrakes and lift dumpers; single-slotted Fowler flaps; four vortillons and a single 'tripper' strip under leading-edge of each wing ensure inboard wing stalls before outboard section.

STRUCTURE: Wing manufactured by Textron Aerostructures. Light alloy airframe except for carbon composites ailerons, spoilers, rudder and elevators, some tailplane parts, some cabin floor structure, and parts of flight deck; winglets of aluminium honeycomb.

LANDING GEAR: Retractable tricycle type with twin wheels on each unit. Main units retract inward, steerable nose unit forward. Mainwheel tyres size 34 × 9.25-16 for IV and H34 × 9.25-18 for IV-SP, pressure 12.07 bars (175 lb/sq in). Nosewheel tyres size 21 × 7.25-10, pressure 7.9 bars (115 lb/sq in). IV has Aircraft Braking Systems air-cooled carbon brakes and IV-SP has Dunlop air-cooled carbon brakes, both use Aircraft Braking Systems anti-skid units and digital electronic brake-by-wire system. Dowty electronic steer-by-wire system.

POWER PLANT: Two Rolls-Royce Tay Mk 611-8 turbofans, each flat rated at 61.6 kN (13,850 lb st) to ISA +15°C. Target type thrust reversers. Fuel in two integral wing tanks, with total capacity of 16,542 litres (4,370 US gallons; 3,639 Imp gallons). Single pressure fuelling point in leading-edge of starboard wing.

ACCOMMODATION: Crew of two plus cabin attendant. Standard seating for 14 to 19 passengers in pressurised and air-conditioned cabin. 'Quick Change' cargo/passenger version, certificated for up to 26 passengers, announced 22 December 1993. Galley, toilet and large baggage compartment, capacity 907 kg (2,000 lb), at rear of cabin. Integral airstair door at front of cabin on port side. Baggage compartment door on port side. Electrically heated wraparound windscreen. Six cabin windows, including two overwing emergency exits, on each side.

SYSTEMS: Cabin pressurisation system maximum differential 0.65 bar (9.45 lb/sq in); dual air conditioning systems. Two independent hydraulic systems, each 207 bars (3,000 lb/sq in). Maximum flow rate 83.3 litres (22 US gallons; 18.3 Imp gallons)/min. Two bootstrap type hydraulic reservoirs, pressurised to 4.14 bars (60 lb/sq in). AlliedSignal GTCP36-100 APU in tail compartment, flight rated to 12,500 m (41,000 ft) since s/n 1156. Electrical system includes two 36 kVA alternators with two solid-state 30 kVA converters to provide 23 kVA 115/200 V 400 Hz AC power and 250 A of regulated 28 V DC power; two 24 V 40 Ah Ni/Cd storage batteries and external power socket. Wing leading-edges and engine inlets anti-iced.

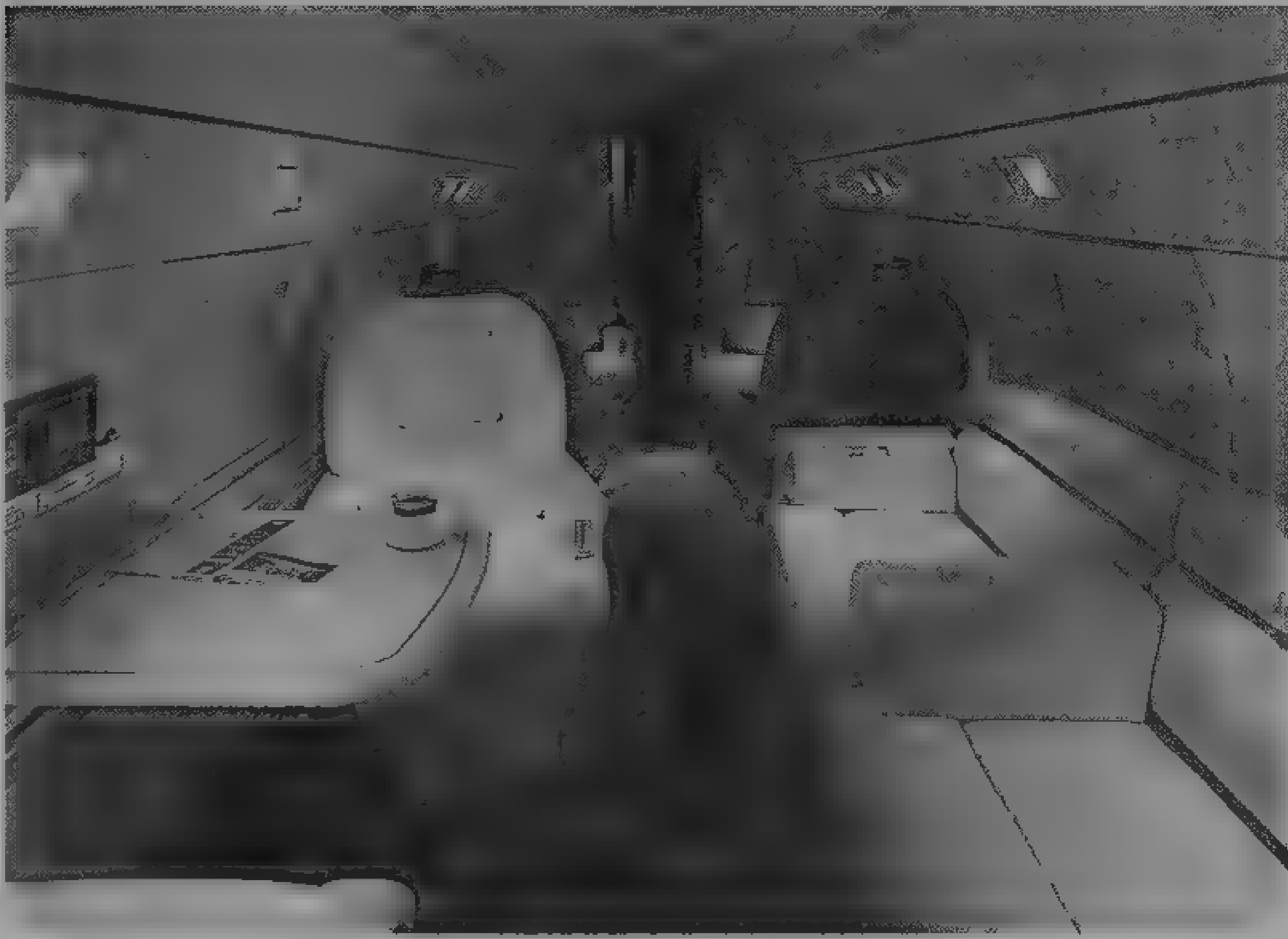
AVIONICS: *Comms*: Dual VHF/HF transceivers, transponders and cockpit audio systems, cockpit voice recorder; Racal Satfone satellite communications equipment optional.

Radar: Digital colour weather radar.

Nav: Dual VOR/LOC/GS with marker beacon receivers, dual DME, dual ADF, dual radio altimeters, optional MLS, GPS and VLF Omega.

Flight: Honeywell SPZ-8400 digital AFCS, Honeywell FMZ-800 Phase II flight management system (FMS), dual fail-operational flight guidance systems including autothrottles; dual air data systems; dual flight guidance and performance computers, dual laser INS, AHRS, flight data recorder. System integration is accomplished through a Honeywell avionics standard communications bus (ASCB).

Instrumentation: Six 20.3 × 20.3 cm (8 × 8 in) colour CRT EFIS screens, two each for primary flight display (PFD), navigation display (ND) and engine instrument and crew alerting system (EICAS).



Cabin interior of Gulfstream IV-SP business jet

1995

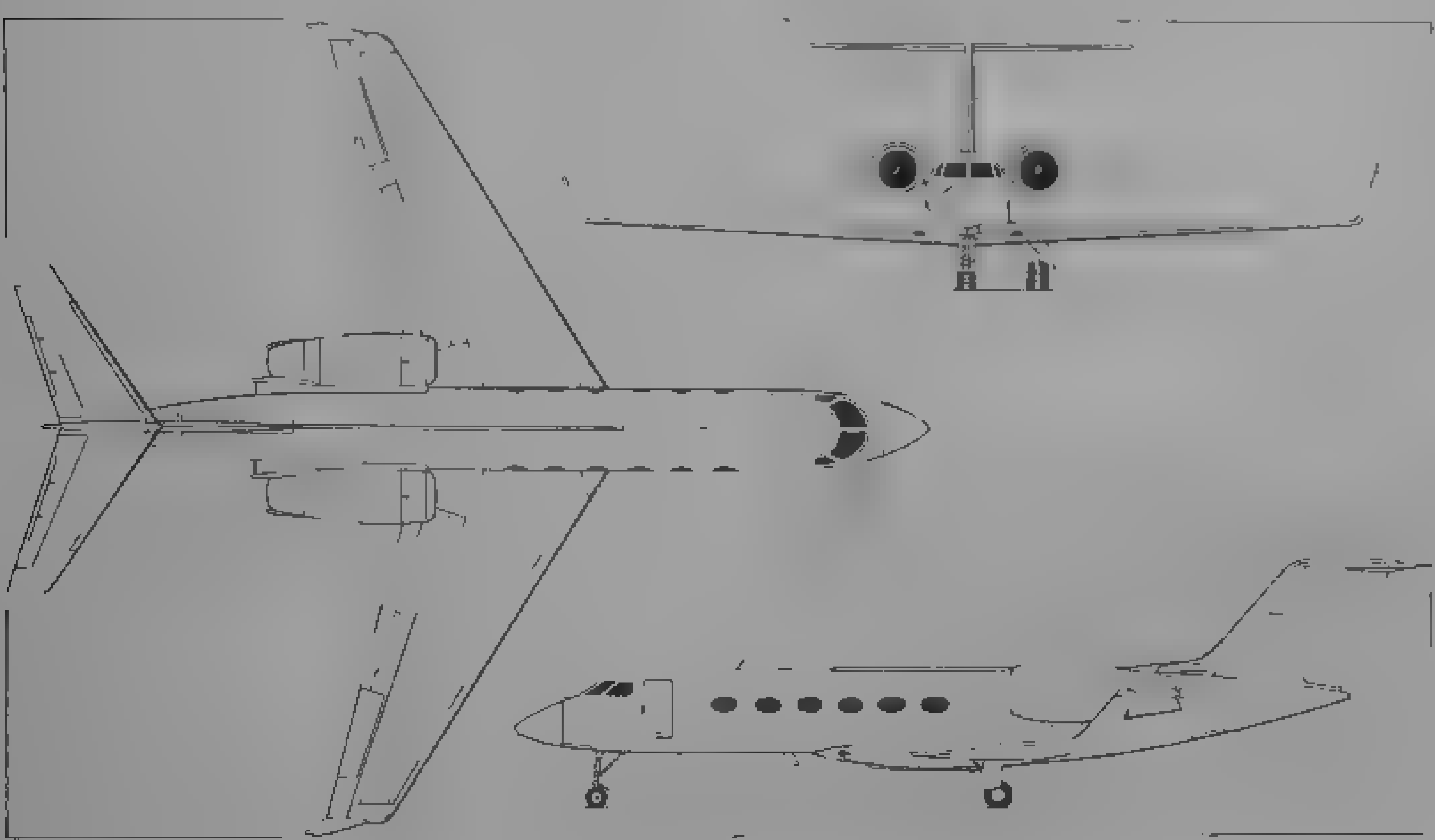
DIMENSIONS, EXTERNAL:
- Wing span over winglets: 23.72 m (77 ft 10 in)
- Wing chord
  - at root (fuselage centreline): 5.94 m (19 ft 5¾ in)
  - at tip: 1.85 m (6 ft 0¾ in)
- Wing aspect ratio: 5.92
- Length overall: 26.92 m (88 ft 4 in)
- Fuselage: Length: 24.03 m (78 ft 10 in)
  - Max diameter: 2.39 m (7 ft 10 in)
- Height overall: 7.45 m (24 ft 5¼ in)
- Tailplane span: 9.75 m (32 ft 0 in)
- Wheel track: 4.17 m (13 ft 8 in)
- Wheelbase: 11.61 m (38 ft 1¼ in)
- Passenger door (fwd, port): Height: 1.57 m (5 ft 2 in)
  - Width: 0.91 m (3 ft 0 in)
- Baggage door (rear): Height: 0.91 m (2 ft 11¾ in)
  - Width: 0.72 m (2 ft 4⅜ in)

DIMENSIONS, INTERNAL:
- Cabin
  - Length, incl galley, toilet and baggage compartment: 13.74 m (45 ft 1 in)
  - Max width: 2.24 m (7 ft 4 in)
  - Max height: 1.88 m (6 ft 2 in)
  - Floor area: 22.9 m² (247 sq ft)
  - Volume: 47.97 m³ (1,694 cu ft)
- Flight deck volume: 3.51 m³ (124.0 cu ft)
- Rear baggage compartment volume: 4.78 m³ (169.0 cu ft)

AREAS:
- Wings, gross: 88.29 m² (950.39 sq ft)
- Ailerons (total, incl tab): 2.68 m² (28.86 sq ft)
- Trailing-edge flaps (total): 11.97 m² (128.84 sq ft)
- Spoilers (total): 7.46 m² (80.27 sq ft)
- Winglets (total): 2.38 m² (25.60 sq ft)
- Fin: 10.92 m² (117.53 sq ft)
- Rudder, incl tab: 4.16 m² (44.75 sq ft)
- Horizontal tail surfaces (total): 18.83 m² (202.67 sq ft)
- Elevators (total, incl tabs): 5.22 m² (56.22 sq ft)

WEIGHTS AND LOADINGS:
- Manufacturer's weight empty
  - IV, IV-SP: 16,102 kg (35,500 lb)
- Typical operating weight empty
  - IV, IV-SP: 19,278 kg (42,500 lb)
- Max payload: IV: 1,814 kg (4,000 lb)
  - IV-SP: 2,948 kg (6,500 lb)
- Max usable fuel: IV, IV-SP: 13,381 kg (29,500 lb)
- Max T-O weight: IV: 33,203 kg (73,200 lb)
  - IV-SP: 33,838 kg (74,600 lb)
- Max ramp weight: IV: 33,384 kg (73,600 lb)
  - IV-SP: 34,019 kg (75,000 lb)
- Max zero-fuel weight: IV: 21,092 kg (46,500 lb)
  - IV-SP: 22,226 kg (49,000 lb)
- Max landing weight: IV: 26,535 kg (58,500 lb)
  - IV-SP: 29,937 kg (66,000 lb)
- Max wing loading: IV: 375.9 kg/m² (77.02 lb/sq ft)
  - IV-SP: 383.2 kg/m² (78.49 lb/sq ft)
- Max power loading: IV: 269.6 kg/kN (2.64 lb/lb st)
  - IV-SP: 274.7 kg/kN (2.69 lb/lb st)

PERFORMANCE (at max T-O weight, ISA, except where indicated):
- Max operating speed: 340 kts (629 km/h; 391 mph) CAS *or* Mach 0.88
- Max cruising speed at 9,450 m (31,000 ft): 505 kts (936 km/h; 582 mph)



Gulfstream Aerospace Gulfstream IV twin-turbofan business transport *(Jane's/Dennis Punnett)*

1983

Normal cruising speed at 13,715 m (45,000 ft)
Mach 0 80 (459 kts, 850 km/h, 528 mph)
Stalling speed at max landing weight.
IV, wheels and flaps up
122 kts (227 km/h, 141 mph)
IV-SP, wheels and flaps up
130 kts (241 km/h, 150 mph)
IV, wheels and flaps down
108 kts (200 km/h, 124 mph)
IV-SP, wheels and flaps down
115 kts (213 km/h; 133 mph)
Approach speed at max landing weight
IV 140 kts (259 km/h, 161 mph)
IV-SP 149 kts (276 km/h; 172 mph)
Max rate of climb at S/L IV 1,220 m (4,000 ft)/min
IV-SP 1,210 m (3,970 ft)/min
Rate of climb at S/L, OEI IV 337 m (1,105 ft)/min
IV SP 314 m (1,030 ft)/min
Max operating altitude 13,715 m (45,000 ft)
Runway PCN 25
FAA balanced T-O field length at S/L
IV 1,609 m (5,280 ft)
IV SP 1,662 m (5,450 ft)
Landing from 15 m (50 ft) IV 1,032 m (3,386 ft)
IV-SP 973 m (3,190 ft)
Range
with max payload, normal cruising speed and NBAA IFR reserves IV
3,633 n miles (6,728 km; 4,181 miles)
IV SP 3,338 n miles (6,182 km; 3,841 miles)
with max fuel, eight passengers, at Mach 0.80 and with NBAA IFR reserves
4 220 n miles (7 815 km 4,856 miles)
OPERATIONAL NOISE LEVELS (FAR Pt 36)
T-O IV [illegible] EPNdB
IV-SP [illegible] EPNdB
Approach IV [illegible] EPNdB
IV-SP [illegible] EPNdB
Sideline IV [illegible] EPNdB
IV-SP 86 6 EPNdB

UPDATED

GULFSTREAM AEROSPACE SRA-4

Swedish Air Force designation Tp 102
US military designations: C-20F/G/H
Japan Defence Agency designation U-4

TYPE: Special requirements aircraft version of Gulfstream IV

PROGRAMME: Development aircraft (N413GA) for electronic warfare support version, integrated by Electrospace Systems Inc (now CTAS see under Chrysler heading), exhibited at Farnborough Air Show 1988

CURRENT VERSIONS: **Electronic warfare support:** Development aircraft had forward underfuselage pod for jamming antennae, cabin contains operators' consoles and microwave generator and amplifier rack, modulation generator rack, radio racks, chaff supply and cutters to simulate EW from adversary aircraft and missiles, aircraft could be used to test and evaluate weapon systems and to develop electronic warfare tactics

Electronic surveillance/reconnaissance: Possible sensors include side looking synthetic aperture radar in belly mounted pod under forward fuselage, long-range oblique photographic camera (LOROP), ESM, VHF/UHF/HF communications for C³, chaff dispensers, infrared countermeasures in tailcone, SAR equipment and accommodation for operators for each system. Typical mission profile with 1,950 kg (4,300 lb) payload allows 10½ hours on station at loiter altitudes between 10,670 m and 15,550 m (35,000 ft and 51,000 ft).

Maritime patrol Equipment includes high-definition surface search radar, forward-looking infra-red detection system (IRDS), electronic support measures (ESM), flare/marker launch tubes, nav/com and ESM consoles, positions for up to eight observers/console operators, stowage and deployment for survival equipment, and crew rest area SRA-4 with 1,950 to 4,173 kg (4,300 to 9,200 lb) mass on payload including 272 kg (600 lb) expendable stores can operate at 600 n mile (1,112 km; 690 mile) radius for four to six hours; outbound flight at 12,500 m (41,000 ft) and 454 knots (841 km/h, 523 mph), search at 3,050 m (10,000 ft), but spend one-third of time at 61 m (200 ft); return flight at 13,715 m (45,000 ft.

Gulfstream C-20G Operational Support Aircraft of the US Navy

1995

ASW Equipment includes nose radar able to detect periscope and snorkels, FLIR, sonobuoy launchers, acoustic processor, magnetic anomaly detector (MAD) in tail, ESM torpedo stowage in weapon bay under forward fuselage, and anti shipping missile carried on each underwing hardpoint. Mission profile with six crew and 2,503 kg (5,518 lb) payload can stay over 4¼ hours in hi-lo loitering and manoeuvring at 1,000 n mile (1,852 km; 1,151 mile) radius. Mission profile for **anti-shipping** with two missiles allows 1,350 n mile (2,500 km, 1,553 mile) outbound flight at high altitude; descent to 61 m (200 ft) for 100 n mile (185 km, 115 mile) attack run at 350 knots (649 km/h 403 mph); launch missile 50 n miles (93 km, 57 miles) from target, return to base at 13,715 m (45,000 ft)

Medical evacuation: Accommodation for 15 stretchers and attendants

Priority cargo transport: Cargo door (see below) plus floor-mounted cargo roller system

C-20F: US Army administrative transport (one), delivered to Davison Air Command, Andrews AFB, Maryland, 1991

C-20G. Operational Support Aircraft (OSA) for US Navy (four) and USMC (one). Convertible interior for passengers and cargo (26 passengers; large cargo door, larger/additional emergency exits). First two for USN delivered 4 February and 7 March 1994 and equip VR-48 at Naval Air Facility at Washington, DC

C-20H USAF aircraft, one delivered March 1994 and based at Andrews AFB, Maryland, second aircraft scheduled for delivery December 1995

U-4 Selected late 1994 by Japanese Air Self-Defence Force for U-X multimission aircraft requirement, funds for two VIP/transport/training/support aircraft, valued at $72 million, included in FY95 budget, total order will be for nine aircraft, two for delivery in 1995 and 1996, three in 1997 and two in 1998, configuration to be confirmed, but expected to include medevac capability, high-density seating for up to 18 passengers plus crew, and possibly cargo door

CUSTOMERS US services, as detailed above Swedish Defence Materiel Administration (FMV) concluded contract 29 June 1992 for three Gulfstream IVs, one as **Tp 102** transport (delivered 24 October 1992 to F16 Wing at Uppsala), remaining two to be modified as **Tp 102B** for electronic intelligence gathering, to be operated by Swedish Air Force delivery in 1995 and enter operational service 1997, replacing Caravelles. Japanese Civil Aviation Bureau SRA airways flight inspection aircraft delivered December 1993 Turkish Air Force one in 1993 Other sales to undisclosed customers

DESIGN FEATURES Missions include surveillance/reconnaissance, electronic warfare support, maritime patrol, antisubmarine warfare, medical evacuation priority cargo and administrative transport. Cabin arranged for rapid role changes; upward-opening cargo door 1 60 m (5 ft 3 in) high by 2.11 m (6 ft 11 in) wide can be fitted to starboard ahead of wing to allow for bulky cargo, mission equipment or stretchers

UPDATED

GULFSTREAM AEROSPACE GULFSTREAM V

TYPE: Twin turbofan, long range business transport

PROGRAMME Study announced at NBAA Convention, Houston, in October 1991. Go-ahead commitment and engine selection (BMW Rolls-Royce BR710) announced at Farnborough Air Show in September 1992, Risk-sharing agreement with wing designers/manufacturers (Vought, now Northrop Grumman, and ShinMaywa) announced at Paris Air Show in June 1993, and with tail (and later floor panel) manufacturer (Fokker) at NBAA Convention in September 1993. Production parts manufacturing commenced in September 1993, first metal for tail cut April 1994, first fuel ground run of engine 1 September 1994, assembly of first wing began mid-October 1994, first fuselage joined May 1995; first tail assembly delivered by Fokker June 1995. Maiden flight scheduled for 15 November 1995; three (of four) test aircraft, including one static test article, to be completed during 1995; certification in mid-October 1996, five production aircraft scheduled for completion in 1996, building up to an annual production rate of 24 in 1997 and beyond

Freight door of C-20G, starboard side, forward of wing *(Paul Jackson)*

1995

CUSTOMERS $2 billion firm order backlog by June 1995, with $3 billion/100 order backlog anticipated by time of first customer delivery in late 1996 break even on non-recurring research and development costs expected at or before sale of 65th aircraft, only announced customer Executive Jet Aviation took options on two aircraft in January 1995, for delivery in 1998-99

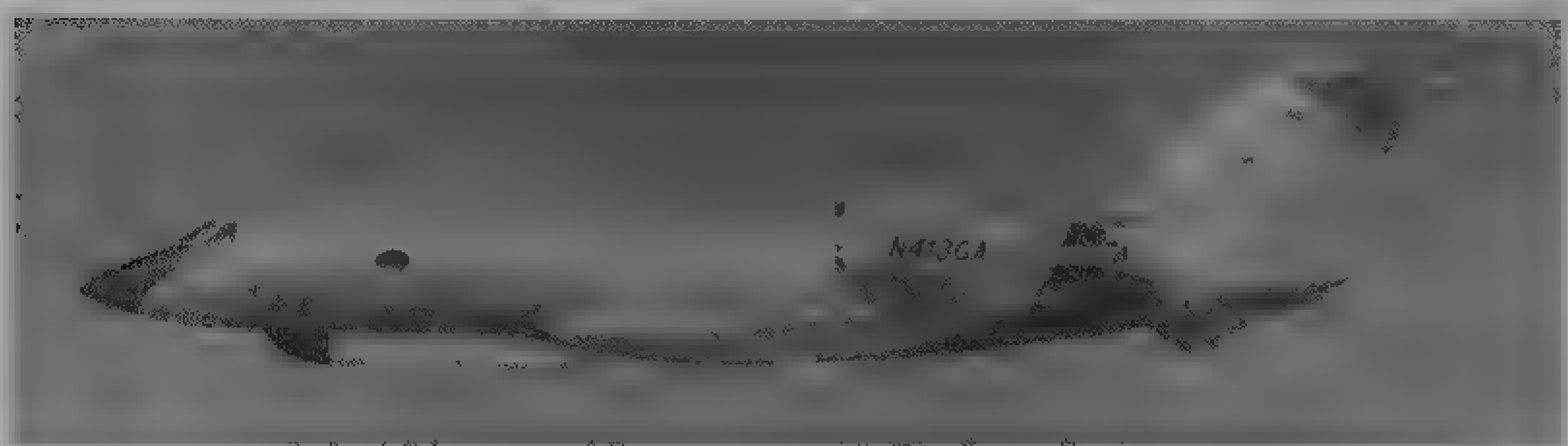
COSTS $29.5 million (fixed price) for first 24 aircraft, then $30.5 million (fixed price) up to 39th aircraft

DESIGN FEATURES. Gulfstream IV fuselage stretched by plugs behind cockpit and over wing, larger wing of same basic shape and interior structure, but 10 per cent more efficient than Gulfstream IV's, larger vertical and horizontal tail surfaces, flight deck volume increased by moving bulkhead 0.30 m (1 ft) aft to provide more space for pilots and to accommodate full size jump seat· cockpit layout and instrumentation generally similar to Gulfstream IV-SP, but redesigned to incorporate human engineering changes in system control functions, airstair door moved aft by 1 52 m (5 ft); avionics bay relocated Computational fluid dynamics and CATIA design system used extensively in development.

POWER PLANT Two 65 61 kN (14,750 lb st) BMW Rolls-Royce BR710-48 turbofans

ACCOMMODATION· Crew of two/three plus cabin attendant Standard seating for 15 to 19 passengers in pressurised and air conditioned cabin

SYSTEMS Cabin pressurisation system is digitally controlled to provide a fully automatic cabin altitude up to 15,545 m (51 000 ft) Sundstrand electrical power generating system profile integrated with the flight management system (FMS), and will maintain equivalent of 1,830 m (6,000 ft) AlliedSignal RE220 APU, designed specifically for



Development prototype of the Gulfstream SRA-4 electronic warfare support aircraft

1991

Gulfstream V, will provide engine-starting capability up to 13,110 m (43,000 ft), 40 kVA of electrical power for ground and flight use up to 13,715 m (45,000 ft), and ground air conditioning, with almost twice the cooling air flow rate of the Gulfstream IV's APU.

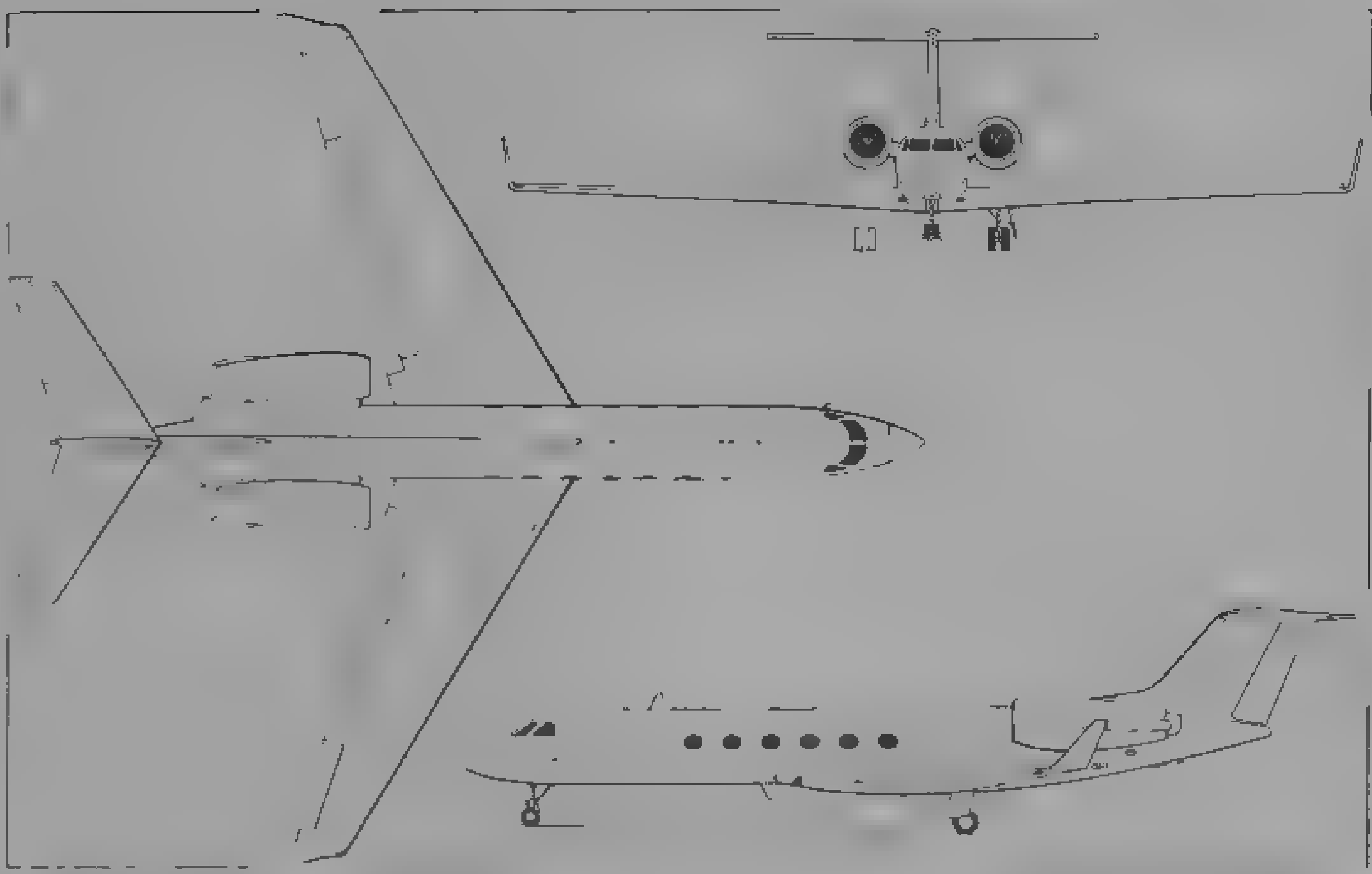
AVIONICS: *Flight:* Bendix/King enhanced ground proximity warning system (EGPWS); Sundstrand maintenance data acquisition unit.

Instrumentation: Honeywell SPZ-8000 digital AFCS/FMS with six 20.3 × 20.3 cm (8 × 8 in) colour LCD EFIS displays, Honeywell/GEC Marconi Model 2020 HUD.

Mission: IBM satellite based international communications system, including airborne voice, data, networking, fax and teleconferencing facilities, provides Gulfstream V with 'office in the sky' capability.

DIMENSIONS, EXTERNAL:	
Wing span over winglets	28.50 m (93 ft 6 in)
Length overall	29.39 m (96 ft 5 in)
Height overall	7.72 m (25 ft 4 in)
Tailplane span	10.72 m (35 ft 2 in)
DIMENSIONS, INTERNAL:	
Cabin:	
Length, aft of flight deck	15.26 m (50 ft 1 in)
Max width	2.24 m (7 ft 4 in)
Max height	1.88 m (6 ft 2 in)
Volume	47.26 m³ (1,669 cu ft)
Baggage compartment: Volume	6.40 m³ (226 cu ft)
AREAS:	
Wings, gross	105.63 m² (1,137.0 sq ft)
WEIGHTS AND LOADINGS:	
Basic operating weight (three crew)	21,228 kg (46,800 lb)
Max payload	2,948 kg (6,500 lb)
Max fuel	18,597 kg (41,000 lb)
Payload with max fuel	726 kg (1,600 lb)
Max T-O weight	40,370 kg (89,000 lb)
Max ramp weight	40,551 kg (89,400 lb)
Max zero-fuel weight	24,176 kg (53,300 lb)
Max landing weight	32,659 kg (72,000 lb)
Max wing loading	382.18 kg/m² (78.28 lb/sq ft)
Max power loading	307.85 kg/kN (3.02 lb/lb st)
PERFORMANCE (at max T-O weight, ISA, except where indicated):	
Max cruising speed	Mach 0.87
Long-range cruising speed	Mach 0.80
Max rate of climb at S/L	1,276 m (4,188 ft)/min
Max operating altitude	15,545 m (51,000 ft)
T-O distance, S/L, ISA, max T-O weight	1,789 m (5,870 ft)
Landing distance, S/L, ISA, max landing weight	900 m (2,950 ft)
Max range, eight passengers and four crew, Mach 0.80, NBAA IFR reserves	6,500 n miles (12,038 km, 7,480 miles)

UPDATED



Gulfstream Aerospace Gulfstream V long-range business transport (*Jane's/Dennis Punnett*)

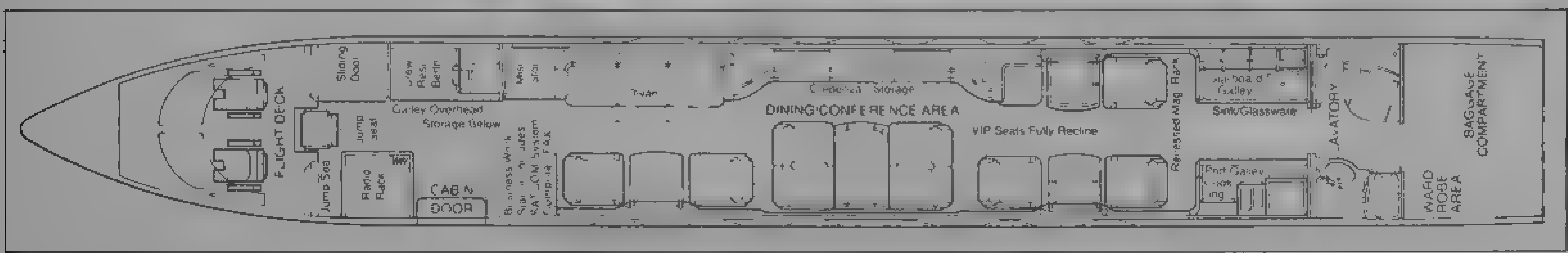
1993

Computer generated image of the long range twin-turbofan Gulfstream V

1995

Cabin interior of Gulfstream V in typical executive layout

1995



Proposed executive/VIP cabin layout for Gulfstream V

1995

HAMILTON

HAMILTON AEROSPACE

San Antonio, Texas

PRESIDENT: George Hamilton

SALES AGENCY:

TrustOne Pacific Reserve (HK) Ltd

9891 Broken Land Parkway, Columbia, Maryland 21046

Telephone: 1 (410) 720 5160

Fax: 1 (410) 381 7887

MANAGING DIRECTOR: Dr Charles R Green

Recent designs of Hamilton Aerospace include the HX-1 tactical aircraft and HXT-2 trainer, as described in the 1991-92 *Jane's*; and HX-321 piston-engined F-16 lookalike for home assembly (1987-88 edition, Sport Aircraft section). No further progress has been made with the A-II all-composite fighter described in the 1994-95 edition.

UPDATED

HELI-AIR

HELI-AIR (JAFFE HELICOPTER INC)

The Heli-Air/Bell 222 is now described in *Jane's Aircraft Upgrades*

UPDATED

HILLER

HILLER AIRCRAFT CORPORATION

7980 Enterprise Drive, Newark, California 94560-3497
Telephone: 1 (510) 744 1500
Fax: 1 (510) 744 1600
PRESIDENT AND CEO: Jeffrey H. Hiller
VICE-PRESIDENT MARKETING: Don Malcolm
DIRECTOR, CUSTOMER SUPPORT: Walt Dalrymple
CHIEF ENGINEER: Harley Stallman
DIRECTOR OF COMMUNICATIONS: Charles M. Evans

Production assets acquired in 1994 from Rogerson Aircraft Company by investment consortium led by Jeffrey Hiller, son of Hiller Aircraft's original founder Stanley Hiller; company relocated from Port Angeles, Washington State, to Newark, California; company's programme includes supply of spare parts and support to operators of Hiller UH-12 series helicopters, has resumed production of three-place UH-12E series of light utility helicopters. Operations at Newark started September 1994, resuming production of spare parts for some 1,000 Hiller helicopters still flying. Flight testing of new UH-12E5 five-seat helicopter began January 1995.

UPDATED

HILLER UH-12E3 and UH-12E3T

TYPE: Three-seat utility helicopter

PROGRAMME: Resumed production of Hiller UH-12E in 1995.

CUSTOMERS: Since 1959, nearly 1,500 UH-12E series have been built. First flight, UH-12E3 from new production (N101BX), 2 June 1995, individual certification 6 June 1995, type certification expected late 1995. Deliveries begun of 15 for sales agency in Southeast Asia; production, three a month; first two UH-12E3T versions to fly in Autumn 1995.

POWER PLANT: One 253.5 kW (340 hp) Textron Lycoming VO-540-C2A flat-six engine, installed vertically and derated to 227.5 kW (305 hp). Engine muffler optional. Alternatively, UH-12E3T version with 313 kW (420 hp) Allison 250-C20B turbine, derated to 224 kW (300 hp). Single bladder fuel cell, capacity 174 litres (46 US gallons; 38 Imp gallons), mounted in lower portion of rear fuselage, beneath engine. Two optional auxiliary fuel tanks, mounted in fuselage on each side of engine, capacity 76 litres (20 US gallons; 16.6 Imp gallons) each.

ACCOMMODATION: Three persons side by side on bench seat. Seat belts with provision for shoulder harness. Dual controls optional. Forward-hinged door on each side, with sliding window. Baggage compartment immediately aft of engine. Heater/defroster optional.

DIMENSIONS, EXTERNAL:	
Main rotor diameter	10.80 m (35 ft 5 in)
Tail rotor diameter	1.68 m (5 ft 6 in)
Length overall, rotors turning	12.41 m (40 ft 8½ in)
fuselage	8.69 m (28 ft 6 in)
Height to top of rotor head	3.08 m (10 ft 1¼ in)
Skid track	2.29 m (7 ft 6 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	1.52 m (5 ft 0 in)
Max width	1.50 m (4 ft 11 in)
Max height	1.35 m (4 ft 5 in)
Floor area	1.16 m² (12.5 sq ft)
AREAS:	
Main rotor disc	91.97 m² (990.0 sq ft)
Tail rotor disc	2.57 m² (27.7 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	798 kg (1,759 lb)
Max T-O weight	1,406 kg (3,100 lb)
Max disc loading	15.28 kg/m² (3.13 lb/sq ft)

PERFORMANCE (Lycoming piston engine, at max T-O weight, except where indicated):

Never-exceed (V_{NE}) and max level speed	83 kts (154 km/h; 96 mph)
Cruising speed	78 kts (145 km/h; 90 mph)
Max rate of climb at S/L	393 m (1,290 ft)/min
Vertical rate of climb at S/L	225 m (740 ft)/min
Service ceiling:	
at AUW of 1,270 kg (2,800 lb)	4,575 m (15,000 ft)
at max T-O weight	2,255 m (7,400 ft)
Hovering ceiling IGE:	
at AUW of 1,270 kg (2,800 lb)	3,170 m (10,400 ft)
at max T-O weight	2,315 m (7,600 ft)
Hovering ceiling OGE:	
at AUW of 1,270 kg (2,800 lb)	2,070 m (6,800 ft)
at max T-O weight	1,155 m (3,800 ft)
Range, 30 min reserves:	
standard fuel	150 n miles (278 km; 173 miles)
auxiliary fuel	316 n miles (585 km; 364 miles)
Endurance with auxiliary fuel, 30 min reserves	4 h

UPDATED

First new production Hiller UH-12E3 three-seat light helicopter *1995*

New five-seat Hiller UH-12E5 in intended production form *1995*

HILLER UH-12E5

TYPE: Five-seat utility helicopter

PROGRAMME: Flight testing began early 1995 (N20EW converted from UH-12E4). First new-build UH-12E5 completed June 1995. Deliveries in hand of five for sales agency in Southeast Asia.

DESIGN FEATURES: Similar to UH-12E3, but seats two in front and three in rear of enlarged cabin, latter based on Hiller 'L' series with wider doors.

NEW ENTRY

ISAE

INTEGRATED SYSTEMS AERO ENGINEERING INC

Hangar FL-7, Logan Airport, Logan, Utah 84321
Telephone: 1 (801) 753 2224/2218
Fax: 1 (801) 753 2975
PRESIDENT: Brent Brown
SALES AND MARKETING MANAGER: David Repko

UPDATED

ISAE OMEGA 2

TYPE: Light tandem-seat sport and aerobatic aircraft

PROGRAMME: Evolved from Streak 90 Palomino of 1966. ISAE President Brent Brown bought Palomino prototype and tooling; Omega 2 is revised design; first public appearance at Experimental Aircraft Association Convention in 1993. Initially produced in kit form but kits withdrawn in 1994. FAR 23 aerobatic certification continues in 1995.

DESIGN FEATURES: Low-wing monoplane, tandem seating and retractable undercarriage to give low drag; slightly swept fin and tailplane; fin and both tailplane units are identical to simplify building; construction time about 1,900 hours.

FLYING CONTROLS: Frise ailerons, conventional elevators and rudder; three-position manually operated flaps; electric pitch trim through stick-switch operating elevator tab.

STRUCTURE: Two-spar wing; aluminium alloy skins.

LANDING GEAR: Retractable tricycle type, hydraulically actuated; all tyres 5.00-5; steerable nosewheel.

POWER PLANT: One 224 kW (300 hp) Textron Lycoming AEIO-540-L engine, driving a Hartzell constant-speed propeller. Fuel in wing integral tanks, capacity 170 litres

(45 US gallons, 37.5 Imp gallons); fuel selector on cockpit floor ahead of front seat

ACCOMMODATION: Tandem seats adjustable fore and aft, provision for parachutes for aerobatic training, if required

SYSTEMS: 28 V electrics; hydraulic power pack for landing gear

AVIONICS: Customer fi

DIMENSIONS, EXTERNAL

Wing span	8.61 m (28 ft 3 in)
Wing aspect ratio	7.47
Length overall	7.62 m (25 ft 0 in)
Wheel track	1.83 m (6 ft 0 in)

AREAS

Wings, gross	9.92 m² (106.8 sq ft)

WEIGHTS AND LOADINGS

Operating weight empty	680 kg (1,500 lb)
Max baggage weight	54 kg (120 lb)
Max payload	363 kg (800 lb)
Max T-O weight	1,043 kg (2,300 lb)
Max wing loading	105.15 kg/m² (21.54 lb/sq ft)
Max power loading	4.67 kg/kW (7.67 lb/hp)

PERFORMANCE (at max T-O weight, ISA, unless otherwise indicated)

Max normal operating speed (VNO)	200 kts (370 km/h; 230 mph)
Max level speed at S/L	205 kts (380 km/h; 236 mph)
Cruising speed at 75% power, 1,830 m (6,000 ft)	194 kts (359 km/h; 223 mph)
Roll rate, aerobatic	150°/s
Stalling speed, power off: flaps up	70 kts (130 km/h; 81 mph)
flaps down	61 kts (113 km/h; 70 mph)
Max rate of climb at S/L	915 m (3,000 ft)/min
T-O distance	336 m (1,100 ft)
Landing distance	366 m (1,200 ft)
Range	652 n miles (1,207 km; 750 miles)
g limits	+6/−3

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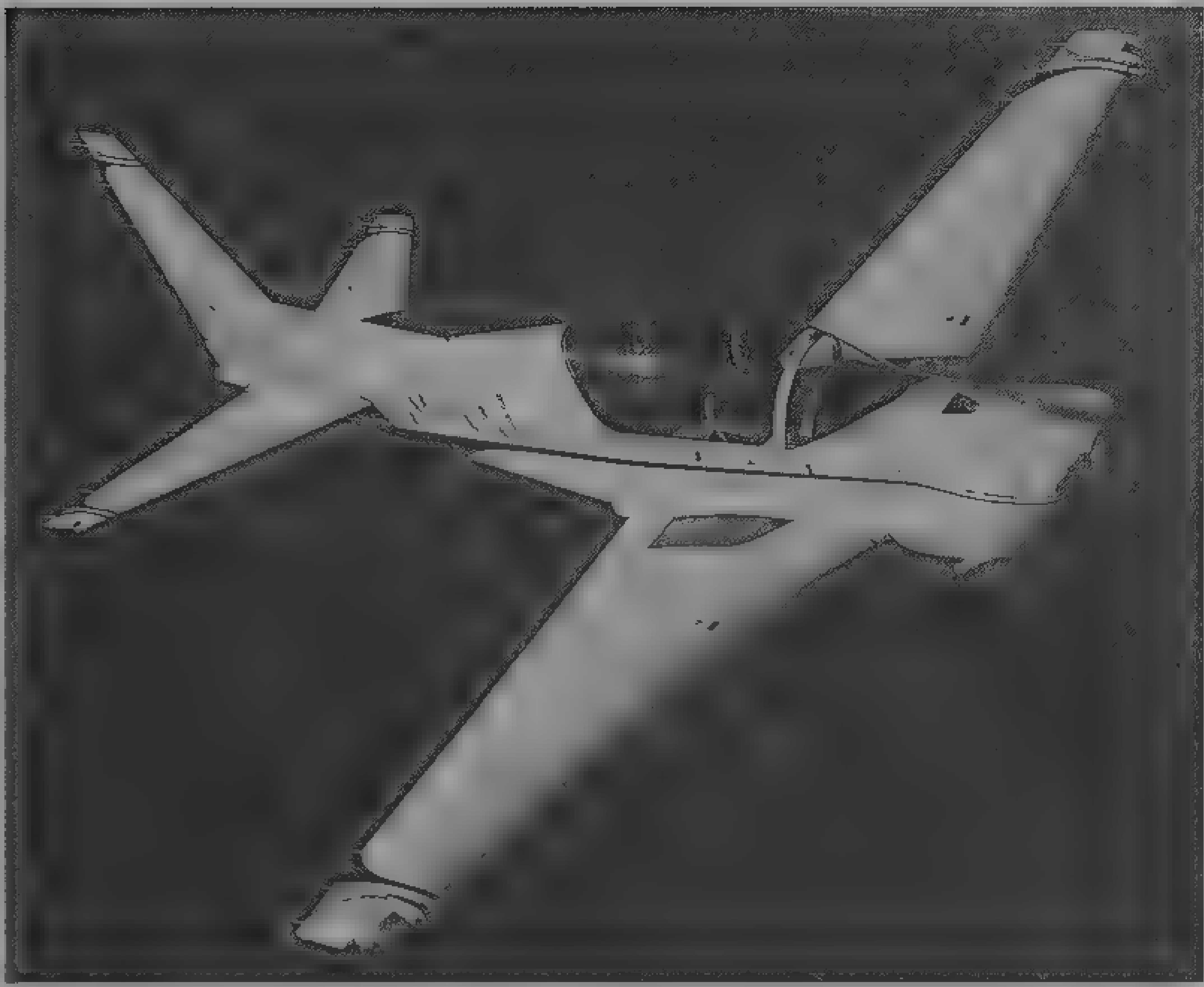

ISAE Omega 2 tandem-seat sport/aerobatic light aircraft

1995

ISHIDA

ISHIDA AEROSPACE RESEARCH INC

1850 Crown Drive, Suite 1112, Farmers Branch, Texas 75234
Telephone: 1 (214) 444 9034
Fax: 1 (214) 444 9560
VICE-PRESIDENT: S. Sugiyama
PROGRAMME MANAGER: Narinder N. Batra
PARENT ORGANISATION:
The Ishida Foundation, Roots Store building-I, 2-13 Yotsuka Dori, Chikusa-Ku, Nagoya-464, Japan
Telephone: 81 (52) 783 2700
Fax: 81 (52) 783 3940
CHAIRMAN AND CEO: Taiichi Ishida

Ishida Aerospace Research (IAR), a US-registered aerospace-related R&D company, is a subsidiary of Ishida Foundation of Nagoya, Japan, a non-profit organisation concentrating on research in transportation systems. IAR participates in tilt-wing aircraft research with long-term intention of forming joint venture with other US research organisations and aerospace companies for development and production phases of tilt-wing aircraft. In July 1993, Ishida Foundation directed that engineering work on TW-68 be put temporarily on hold while IAR reorganised towards more emphasis on R&D. A second subsidiary of the Foundation, TW-68 Industries Inc (see 1993-94 *Jane's*), originally designated to be responsible for prototype and production phases, has been disbanded.

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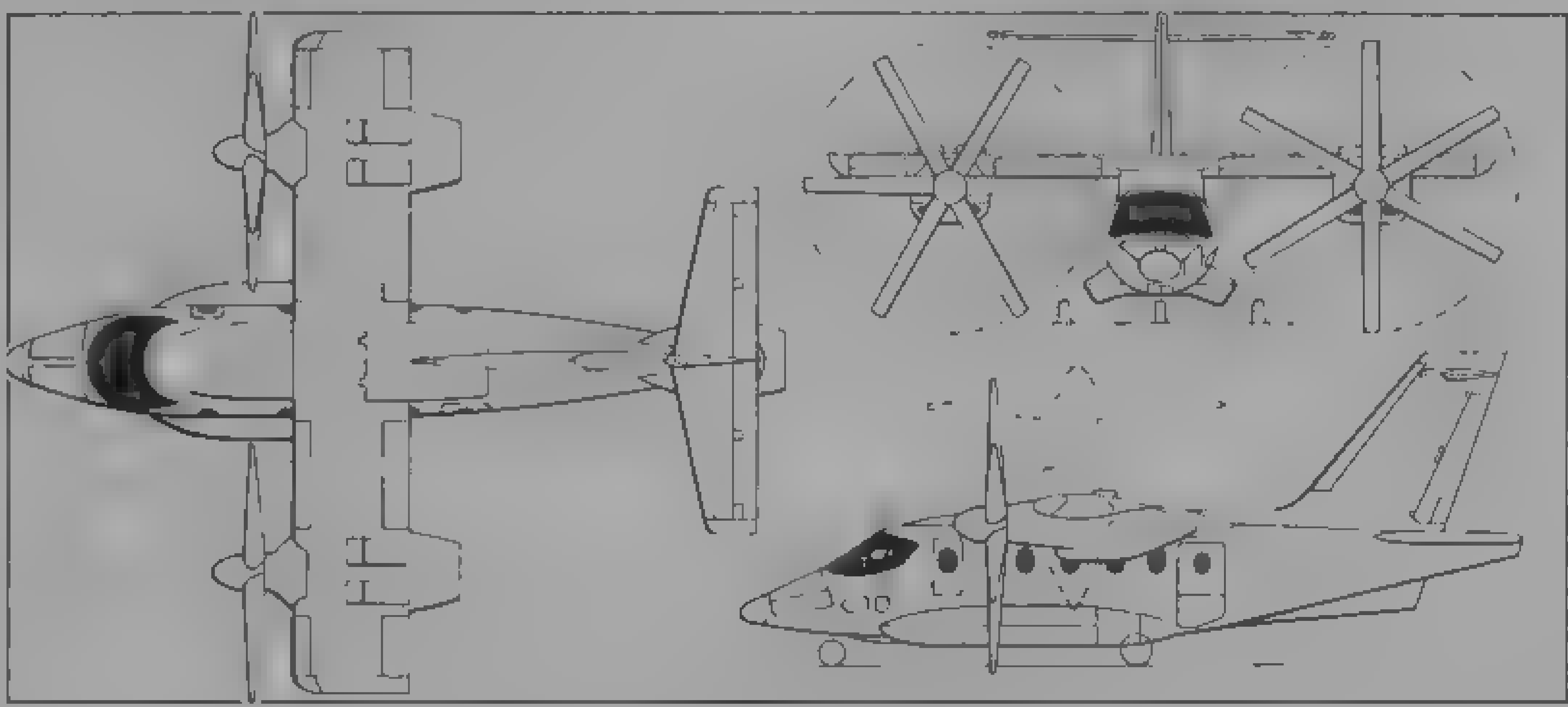


Ishida TW-68 (four P&WC PT6B-67R turboshafts) *(Jane's/Mike Keep)*

1992

ISHIDA TW-68

TYPE: Four-engine twin-propeller tilt-wing utility transport.

PROGRAMME: See Japanese section of 1993-94 *Jane's* for previous history. Development launched in Fort Worth, Texas, in 1987, with aim of 1996 first flight; FAA has accepted application for civil certification, aircraft intended to meet interim airworthiness criteria for powered lift transport category aircraft. Intended primarily for offshore oil and commercial utility markets, secondary uses are intercity transportation and public service roles.

COSTS: Projected development costs approximately $400 million, standard aircraft $8 to 9 million (1994).

DESIGN FEATURES: Designed as 14-passenger V/STOL transport, wings pivoting from horizontal to vertical to achieve this. High-mounted wing pivots at centre section to align propeller thrust vector with direction of flight (vertical for hovering T-O and spot landing, intermediate wing incidence for short T-O, run-on landing, climb and approach, horizontal for conventional forward cruise). Large diameter propellers ensure strong slipstream across full span of wings; slipstreams combined with full-span leading-edge slats and trailing-edge flaps assist in maintaining attached air flow and are designed to permit flights through high angles of attack during steep descents at mid-conversion wing incidence.

Designed to achieve short-field T-O in two to three fuselage lengths, integrated design of propeller/wing aerodynamics, high-lift devices and flight control system enables approaches at glide slope descent angles of up to 10° in level attitude. Horizontal T tail changes incidence as a function of wing incidence to enhance smooth transitions through conversion; limited tailplane incidence range ensures a fully flying tail without stall during transition from VTOL to aeroplane mode flight. Ducted tail fan at aft end of fuselage designed for quiet operation, and is less vulnerable to damage than a conventional tail rotor.

FLYING CONTROLS: Manual/electrical control of wing incidence. Conventional aileron/elevator/rudder control during flight in aeroplane mode; in VTOL mode with wings fully tilted, roll control is by differential propeller thrust, pitch control by tail fan, and yaw by differential flap settings. Propeller pitch controls thrust in both modes. Tail fan stopped in forward cruise, when elevators take over pitch control function.

LANDING GEAR: Retractable tricycle type. Main units retract into fairings on fuselage sides.

POWER PLANT: Four 1,025 kW (1,375 shp) P&WC PT6B-67R turboshafts, two in each nacelle, adapted for vertical operation, each pair driving a six-blade slow-turning propeller

Artist's impression of Ishida TW-68

1994

(800 rpm for V/STOL, 680 rpm in cruise). Engine pair each side drive propeller via twin-pack gearbox, and are cross-shafted across wing to ensure continuous power to both propellers in the event of an engine failure. See under Weights and Loadings for fuel details.

ACCOMMODATION: Flight crew of two. Cabin seating for nine (corporate) or 14 (commuter) passengers, or equivalent freight or other payload.

DIMENSIONS, EXTERNAL:

Wing span	12.44 m (40 ft 9½ in)
Total span (incl propellers)	13.53 m (44 ft 4¾ in)
Wing chord, constant	2.32 m (7 ft 7¼ in)
Wing aspect ratio	5.37
Length overall	15.42 m (50 ft 7¼ in)
Fuselage: Max width	1.86 m (6 ft 1¼ in)
Height overall	5.55 m (18 ft 2½ in)
Propeller diameter	5.46 m (17 ft 10¾ in)

DIMENSIONS, INTERNAL:

Cabin: Length	5.58 m (18 ft 3½ in)
Max width	1.86 m (6 ft 1¼ in)
Max height	1.76 m (5 ft 9½ in)
Volume	14.55 m³ (514 cu ft)
Baggage volume	3.57 m³ (126 cu ft)

AREAS:

Wings, gross	28.80 m² (310.0 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty	5,618 kg (12,386 lb)
Max fuel weight	2,097 kg (4,624 lb)
Payload with max fuel	903 kg (1,990 lb)
Max T-O weight	8,618 kg (19,000 lb)
Max wing loading	299.2 kg/m² (61.29 lb/sq ft)
Max power loading	2.10 kg/kW (3.45 lb/shp)

PERFORMANCE (estimated):

Max cruising speed at 7,620 m (25,000 ft)	310 kts (574 km/h, 357 mph)
Best range speed at 7,620 m (25,000 ft)	250 kts (463 km/h, 288 mph)
Time to climb to 7,620 m (25,000 ft)	9 min
Max certificated ceiling	8,840 m (29,000 ft)
Hovering ceiling IGE: normal	1,495 m (4,900 ft)
OEI	1,035 m (3,400 ft)
Max range: 14 passengers	760 n miles (1,408 km, 875 miles)
nine passengers	920 n miles (1,705 km, 1,059 miles)

UPDATED

ISOLAIR

ISOLAIR INC

The company's Terminator II water-bomber conversion of Mil Mi-14 helicopter is now described in *Jane's Aircraft Upgrades*.

UPDATED

KAMAN

KAMAN AEROSPACE CORPORATION (Subsidiary of Kaman Corporation)

Old Windsor Road, PO Box No. 2, Bloomfield, Connecticut 06002
Telephone: 1 (203) 243 7100 or 242 4461
Fax: 1 (203) 243 7514
Telex: 710 425 3411
PRESIDENT AND CEO: Walter R. Kozlow
VICE-PRESIDENT ENGINEERING: David J. White
MARKETING MANAGER: William H. G. Douglass
DIRECTOR, PUBLIC RELATIONS: J. Kenneth Nasshan
PUBLIC RELATIONS REPRESENTATIVE: Elizabeth K. Healey

Founded 1945 by Charles H. Kaman, now Chairman and CEO of Kaman Corporation. Developed servo-flap control of helicopter main rotor, initially in contrarotating two-blade main rotors, and still used in H-2 Seasprite four-blade main rotor. R&D programmes sponsored by US Army, Air Force, Navy and NASA include advanced design of helicopter rotor systems, blades and rotor control concepts, component fatigue life determination and structural dynamic analysis and testing. Kaman has undertaken helicopter drone programmes since 1953, is continuing advanced research in rotary-wing unmanned aerial vehicles (UAVs).

Kaman is major subcontractor in many aircraft and space programmes, including design, tooling and fabrication of components in metal, metal honeycomb, bonded and composites construction using techniques such as filament winding and braiding. Participates in programmes including Northrop Grumman A-6 and F-14, Bell/Boeing V-22, Boeing 737, 747, 757 and 767, Sikorsky UH-60 and SH-60, and NASA Space Shuttle Orbiter. Kaman also supplies acoustic engine ducts for P&W JT8D and thrust reversers for GE CF6-80C/E engines.

Kaman designed and, since 1977, has been producing all-composite rotor blades for Bell AH-1 Cobras for US and foreign armies, participated in AH-1 air-to-air Stinger (ATAS) programme, supplied composite-blade kits for Boeing CH-46 Sea Knights.

UPDATED

KAMAN SH-2G SUPER SEASPRITE

No new SH-2Gs have been built since 1993, but 18 SH-2Fs have been converted to this standard for the US Navy and a further 10 are being upgraded for Egypt under a $100 million contract awarded 22 February 1995, as described in *Jane's Aircraft Upgrades*.

UPDATED

KAMAN K-1200 K-MAX

TYPE: Single-seat external lift intermeshing rotor helicopter and military multimission intermeshing rotor aircraft (MMIRA). Sometimes known as 'Aerial Truck'.

PROGRAMME: First flight (N3182T) 23 December 1991, first public showing 22 March 1992; first flights of second prototype (N131KA) 18 September 1993 and first production aircraft (N132KA) 12 January 1994, third prototype is static and drop test aircraft to prove 20 year life at 1,000 hours per year and with 30 return logging sorties per hour. Certification to FAR Pts 27 and 133 achieved 30 August 1994 after 800 hour/32 month programme. Deliveries one every two months until September 1995, then one per month. N133KA of Scott Paper achieved 1,000 hours in eight months, 22 June 1995, as first K-Max to achieve this total. Uses include logging, firefighting, agricultural spraying, constructing and surveying.

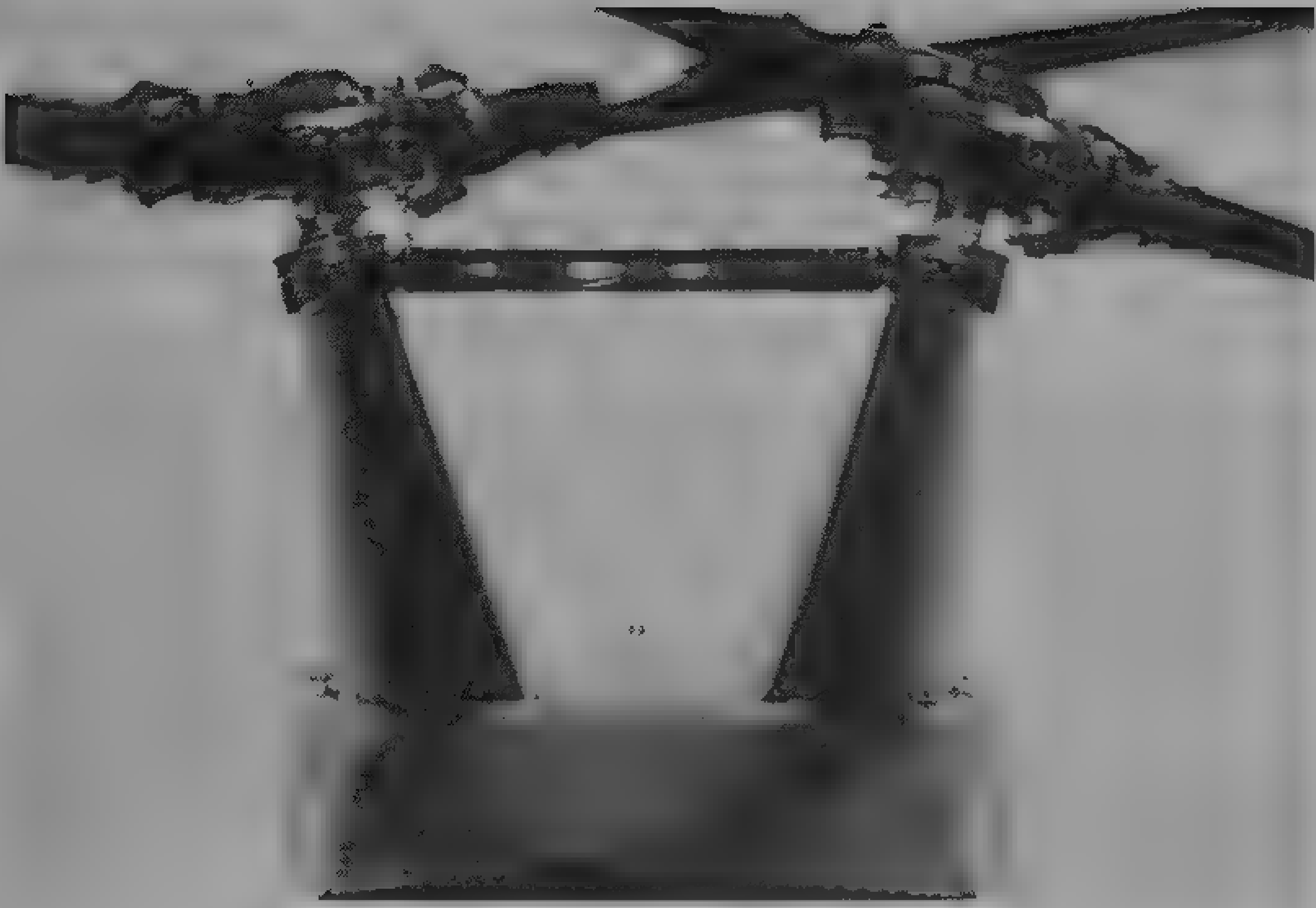
CUSTOMERS: First six purchase-leased to operators on $1,000 per hour, 1,000 hours per year basis; initial customer Erickson Air Crane ordered three, received two before company restructuring required return in March 1995, others to Louisiana-Pacific from October 1994, Scott Paper November 1994 and Weyerhauser December 1994. (Pilot training by Kaman on two HH-43F Huskies.) Further orders from Midwest Helicopters of Canada (delivery June 1995), Saab Helicopters AB (Scandinavian sales agent), Wescor Forest Products Co, Heli-Union of France (placed 12 June 1995) and, in Switzerland, Heliog (first delivery, May 1995) and Heliswiss. Kyokuto Boeki Kaisha appointed Japanese K-Max agency in June 1994 and to receive first of expected five K-Maxes, plus one HH-43 trainer, October 1995.

COSTS: $3,500,000.

DESIGN FEATURES: Kaman intermeshing rotor ensures all engine power produces lift, rotor disc loading is very low and airspeed is limited to reduce rotor stresses, rotor transmission life intended to be same as airframe life; all internal spaces painted white and provided with lights to ease night-time servicing, freight compartment beneath transmission casing allows carriage of special tools or parts, no hydraulics, transmission and engine fluid lines located on opposite sides of helicopter to avoid servicing errors; fuselage is narrow to give good downward view; panels in domed side windows can be opened to give direct vision or doors can be removed altogether. Electronic engine instruments and hook load measuring sensor record engine

Kaman K-Max single-seat helicopter in the insignia of Erickson Air-Crane

1994



Detail of Kaman K-Max rotors

1993

cycles and any overloads, but also give the pilot an immediate record of operations for billing purposes, avoiding paperwork for pilot. Inter blade drag damper pins can be removed so that blades swing sideways to align for parking in narrow spaces

Normal rotor rpm range between 250 and 270 unloaded and 260 and 270 with external load, giving maximum blade tip speed of 200 m (658 ft)/min, translational lift is attained at 12 knots (22 km/h; 14 mph), rpm reduced to 200 for autorotation and airspeed of 50 knots (92 km/h, 57 mph) then gives a power-off descent rate of 366 to 427 m (1,200 to 1,400 ft)/min

FLYING CONTROLS: Blade angle of attack controlled by trailing-edge tabs and light control linkage, avoiding need for hydraulic power; an electric actuator in each tab control run is operated by pilot to track the blades on ground or in flight

In normal powered flight, turns at or near the hover are effected by applying differential torque to the rotors by means of differential collective pitch commanded from the foot pedals; a small fore-and-aft cyclic pitch change also occurs, at low powers near autorotation, this would produce directional control reversal, because differential collective pitch change would cause drag on the unwanted side so a non-linear cam between collective lever and rotor blade controls phases out differential collective from a 'dwell zone' at about 25 per cent collective demand and replaces it progressively with differential cyclic

Intermeshing rotors cause pronounced pitch attitude change in response to collective pitch change; the K-Max tailplane is connected to collective to alleviate this, to reduce blade stresses and produce touchdown and lift-off in level attitude, fixed fins on tailplane are in rotor downwash and rear fin is outside rotor disc; rudder is connected to foot pedals to help balance turns

STRUCTURE: Light alloy airframe; GFRP and CFRP rotor blades and tabs. Tail assembly weighs 36.3 kg (80 lb) and can be removed quickly by two people

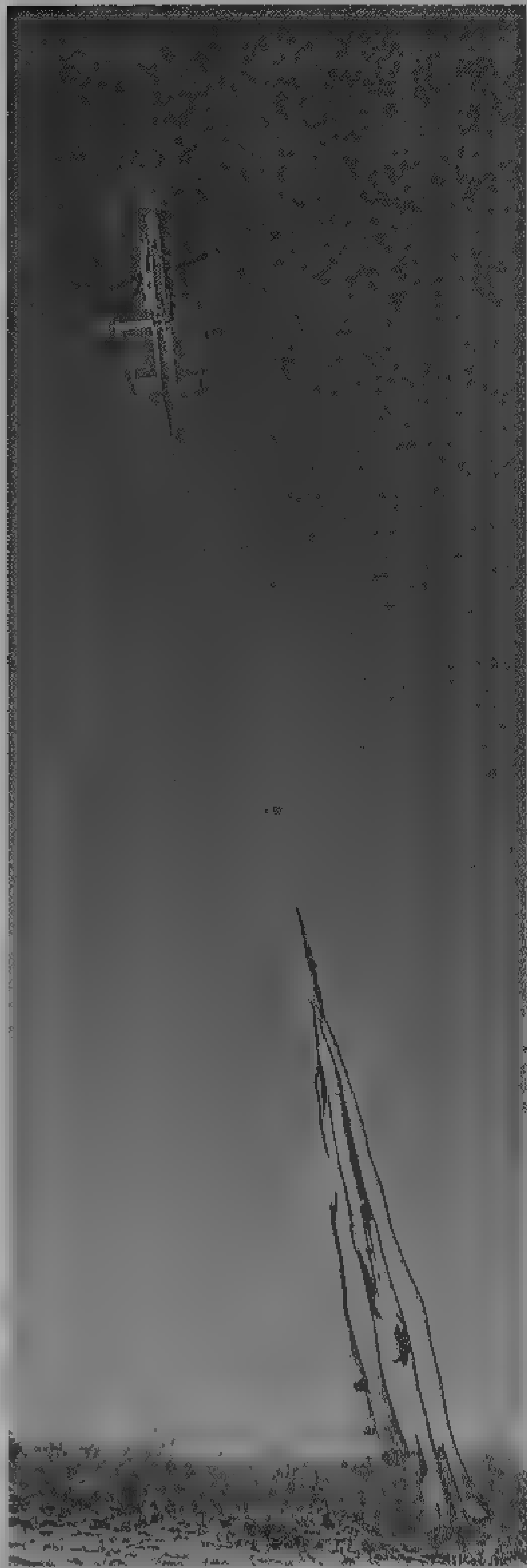
LANDING GEAR: Fixed, tricycle, nosewheel is out of pilot's field of view, impact sustaining suspension with transverse mounting tube for mainwheels; rubber-in-compression suspension for mainwheels; oleo for nosewheel, bear paw plate round each wheel for operation from soft ground and snow; nosewheel swivels and locks, mainwheels have individual foot-powered brakes and parking brake

POWER PLANT: One 1,118 kW (1,500 shp) Lycoming T53-17A-1 turboshaft (civil equivalent of military T53 L-703), with particle separator, flat rated at 1,007 kW (1,350 shp) for take-off up to about 2,315 m (7,600 ft) and 1,007 kW (1,340 shp) continuous up to about 1,980 m (6,500 ft), transmission rated at 1,119 kW (1,500 shp) and designed for 10,000 hour life with 1,500 hour overhaul intervals. Fuel capacity 863 litres (228 US gallons, 199 Imp gallons) located at aircraft CG, receptacle for hot refuelling with rotors running, dual electric fuel pumps

ACCOMMODATION: Pilot only, in Simula crash impact absorbing seat with five-point harness, seat and rudder pedals adjustable; heater and windscreen demister; windows removable for operation in hot weather, curved windscreen in production version. Tool/cargo compartment 0.74 m³ (26 cu ft) fitted with 2,268 kg (5,000 lb) stress tiedown rings. Design includes provision for unmanned operation

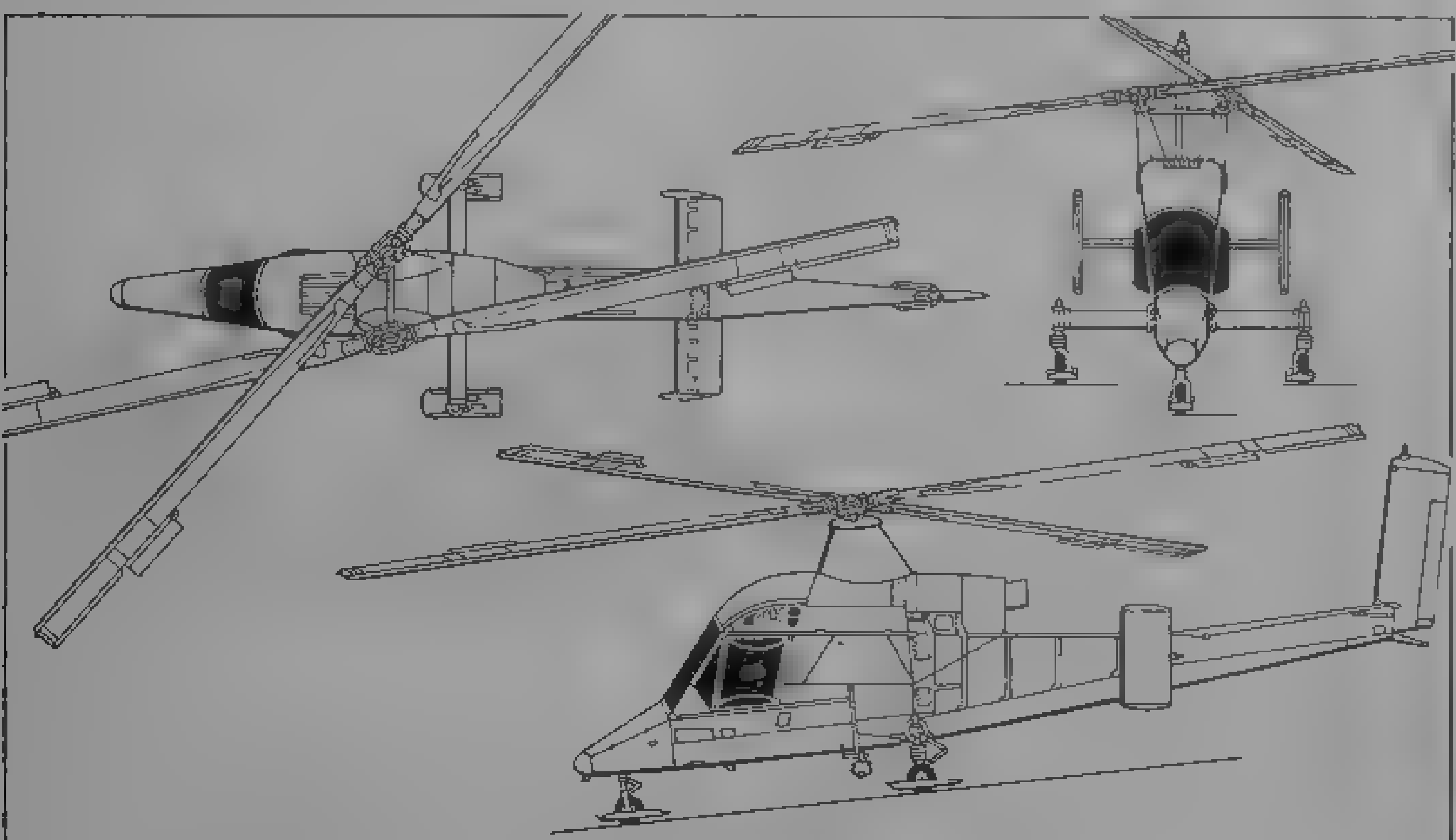
SYSTEMS: DC electrical system with starter/generator, no hydraulics

EQUIPMENT: Pilot-controlled swivelling landing light, standard configuration is for lifting slung loads, but electrical fittings provided for Bambi firefighting bucket, Loadcell and long-line hook gear, kits planned for patrol, firefighting tank and snorkel system, agricultural applications and similar missions



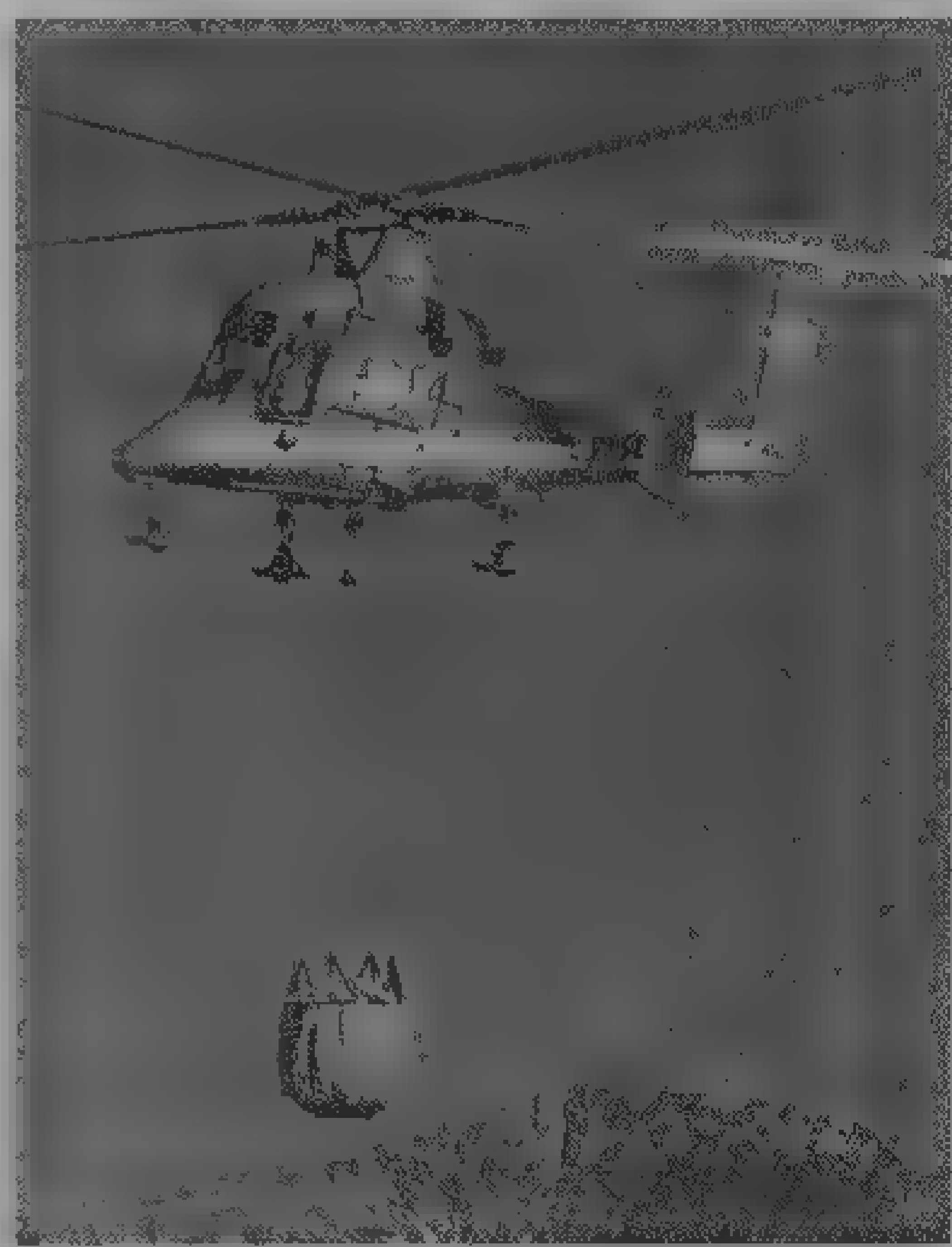
Kaman K-Max in operational role

1995



Production version of Kaman K-Max intermeshing rotor helicopter (*Jane's/Mike Keep*)

1993



K-Max demonstrator lifting 2,498 litre (660 US gallon; 550 Imp gallon) Bambi fire-bucket

1995

DIMENSIONS, EXTERNAL:

Rotor diameter, each	14.73 m (48 ft 4 in)
Length overall, rotors turning	15.85 m (52 ft 0 in)
Wheel track	3.56 m (11 ft 8 in)

WEIGHTS AND LOADINGS:

Operating weight empty	2,041 kg (4,500 lb)
Max hook capacity	2,721 kg (6,000 lb)
Max fuel weight	699 kg (1,541 lb)
Max T-O weight:	
without jettisonable load	2,721 kg (6,000 lb)
with jettisonable load	5,216 kg (11,500 lb)
Max transmission power loading (T-O power)	4.25 kg/kW (7.0 lb/shp)

PERFORMANCE:

Never-exceed speed (VNE): clean	100 kts (185 km/h, 115 mph)
with external load	80 kts (148 km/h, 92 mph)
Max rate of climb at S/L, normal flat rated torque	762 m (2,500 ft)/min
Target hovering performance: OGE with 2,268 kg (5,000 lb) slung load and 1½ h fuel	2,440 m (8,000 ft)

OPERATING NOISE LEVEL (FAR Pt 36), limit 87 dB(A):

Flyover	Average of 82 dB(A)

UPDATED

KESTREL

KESTREL AIRCRAFT COMPANY

Max Westheimer Airport, PO Box 720960, Norman, Oklahoma 73070
Telephone: 1 (405) 373 0090
Fax: 1 (405) 329 8844
PRESIDENT AND CEO: Donald L. Stroud
MARKETING DIRECTOR: Duane L. Closs

KAC employs over 50 persons at its Norman plant.

NEW ENTRY

KESTREL KL-1

TYPE: Four/six-seat, single-engine utility aircraft.

PROGRAMME: Designed to meet FAA Pt 23 Normal and Utility requirements; rolled-out (N960KA) 21 April 1995, first flight expected in August/September 1995.

CURRENT VERSIONS: Five projected variants:

KL-1A: Baseline version, *to which description below generally refers*.

KL-1B: Deluxe four-seat version, Textron Lycoming IO-360-ES engine derated to 142 kW (190 hp) at 2,550 rpm and driving three-blade, constant-speed propeller. Estimated price $107,750 (1995).

KL-1C: High-performance version, Textron Lycoming IO-520 engine derated to 172 kW (230 hp) at 2,400 rpm and driving three-blade, constant-speed propeller. Estimated price $135,000 (1995).

KL-1D: Six-seat utility and cargo version; Textron Lycoming TSIO-550-B engine derated to 242 kW (325 hp) at 2,500 rpm and driving three-blade, constant-speed propeller; floatplane conversion available. Estimated price $225,000 (1995).

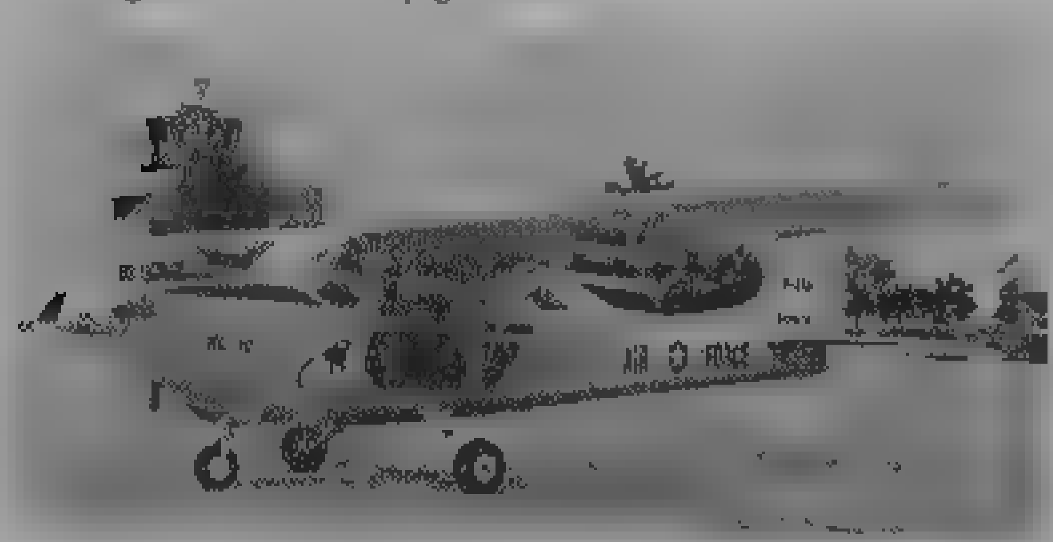
KL-1R: Retractable landing gear version of baseline or deluxe aircraft, 142 kW (190 hp) IO-360-ES engine. Estimated price $125,000 (1995).

COSTS: $89,000 (1995) for KL-1A; other prices as above.

DESIGN FEATURES: Cantilever, high-wing monoplane designed with CAD and constructed from graphite composites. Military version has observation windows at cabin floor level and provision for underwing armament.

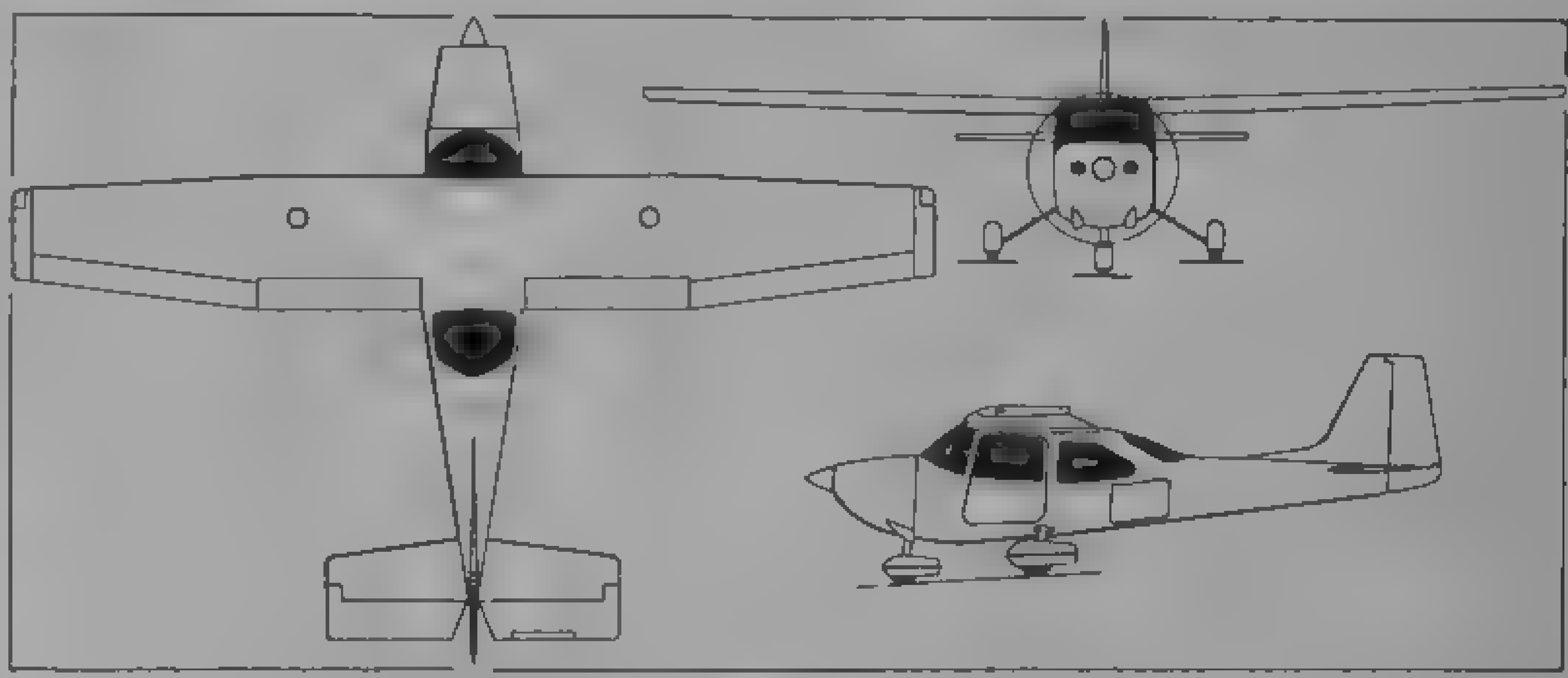
LANDING GEAR: Fixed tricycle, spring steel, single wheels throughout.

POWER PLANT: One 119 kW (160 hp) Textron Lycoming O-320-D2G four-cylinder piston engine, driving two-blade, fixed-pitch propeller. Fuel capacity 265 litres (70 US gallons, 58.3 Imp gallons).



Mockup of military version of KL-1C with additional observation windows and armament *1995*

Prototype Kestrel KL-1A (Lycoming O-320 piston engine) *1995*



Kestrel KL-1A four-seat utility aircraft (*Jane's/Paul Jackson*) *1995*

AVIONICS: Basic equipment included in list price.

ARMAMENT: Provision for light weapons pylon under each wing of military versions.

DIMENSIONS, EXTERNAL:

Wing span	11.20 m (36 ft 9 in)
Wing chord: at root	1.63 m (5 ft 4 in)
at tip	1.13 m (3 ft 8½ in)
Length overall	8.15 m (26 ft 9 in)
Height overall	2.73 m (8 ft 11½ in)
Tailplane span	3.56 m (11 ft 8 in)
Tailplane chord: at root	1.27 m (4 ft 2 in)
at tip	1.00 m (3 ft 3¼ in)
Wheel track	2.69 m (8 ft 10 in)
Propeller diameter	1.88 m (6 ft 2 in)

AREAS:

Wings, gross	16.69 m² (179.6 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	624 kg (1,375 lb)
Max T-O weight	1,134 kg (2,500 lb)
Max wing loading	67.96 kg/m² (13.92 lb/sq ft)
Max power loading	9.51 kg/kW (15.63 lb/hp)

PERFORMANCE:

Cruising speed: 75% power	124 kts (230 km/h, 143 mph)
65% power	108 kts (200 km/h, 124 mph)
Stalling speed	47 kts (87 km/h, 54 mph)
Max rate of climb at S/L	213 m (700 ft)/min
Service ceiling	3,965 m (13,000 ft)
T-O run	272 m (890 ft)
Landing run	165 m (540 ft)
Range at 2,440 m (8,000 ft), no reserves	946 n miles (1,752 km, 1,088 miles)

NEW ENTRY

KING'S

THE KING'S ENGINEERING FELLOWSHIP

Municipal Airport, Orange City, Iowa 51041
Telephone: 1 (712) 737 4444
Fax: 1 (712) 737 3344
PRESIDENT: Carl A. Mortenson
MANUFACTURING: Angel Aircraft Corporation (same address)
MARKETING: TradeLink Inc, Roanoke, Texas
Telephone: 1 (817) 491 2442
Fax: 1 (817) 430 4807

Angel, developed by The King's Engineering Fellowship (TKEF) through donations and designed by Carl Mortenson, follows earlier Evangel (described in 1974-75 *Jane's*).

VERIFIED

KING'S 44 ANGEL

TYPE: Light twin-engined STOL utility aircraft.

PROGRAMME: Design started November 1972; prototype construction began January 1977; prototype (N44KE) built on production tooling, first flight 13 January 1984; structural testing began 1990; certification to FAR Pt 23 (Normal category) for day, night, VFR and IFR conditions gained 20 October 1992. Production began December 1993, planned three aircraft in 1994 and 10 in 1995; none appears to have been completed.

COSTS: Standard aircraft, IFR-equipped $585,000 (1995).

Full description in 1994-95 edition; abbreviated entry follows.

DESIGN FEATURES: Designed for missionary air taxi, air ambulance, air observation/patrol, fishery/pipeline/border inspection, tracking, mining/oil/rubber/forestry operations, ranching and firefighting leader roles.

Wing section NACA 23018-23010 with modified leading-edge; sweepback 15° 36′ at leading edge, 11° at quarter-chord; dihedral 5° 24′, incidence 3° at root, −0° 22′ at tip.

FLYING CONTROLS: Manual (cable) actuated. Almost full span hydraulically actuated semi-Fowler flaps deflecting to maximum 37°. Lateral control by multiple small plate spoilers immediately forward of flaps; spoilers outboard of flaps to assist during single-engined flight.

Prototype King's Angel 44 light twin for missionary and commercial roles (*Kenneth Munson*) *1995*

STRUCTURE: Riveted aluminium alloy and welded steel tube, broad-chord fin and rudder with large dorsal fin.

LANDING GEAR: Retractable tricycle type. Minimum ground turning radius 5.11 m (16 ft 9 in).

POWER PLANT: Two 224 kW (300 hp) Textron Lycoming IO-540-M1C5 flat-six engines, mounted on top of the wings inboard and each driving a Hartzell three-blade constant-speed feathering pusher propeller. Fuel capacity 844 litres (223 US gallons, 185.7 Imp gallons).
ACCOMMODATION: Up to eight persons, including pilot
DIMENSIONS, EXTERNAL:

Wing span	12.16 m (39 ft 10¾ in)
Wing aspect ratio	7.06
Length overall	10.21 m (33 ft 6 in)
Height overall	3.51 m (11 ft 6 in)

AREAS:

Wings, gross	20.94 m² (225.4 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	1,760 kg (3,880 lb)
Max T-O and landing weight	2,631 kg (5,800 lb)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (VNE)	209 kts (387 km/h, 240 mph)
Max level speed at S/L	180 kts (333 km/h, 207 mph)
T-O run	201 m (658 ft)
T-O to 15 m (50 ft)	387 m (1,270 ft)
Landing from 15 m (50 ft)	325 m (1,065 ft)
Landing run	178 m (584 ft)
Range with max fuel, VFR reserves: 65% power	1,263 n miles (2,339 km, 1,453 miles)

UPDATED

LAKE

LAKE AIRCRAFT INC

Laconia Airport, 50 Airport Road, Gilford, New Hampshire 03246
Telephone: 1 (603) 524 5868
Fax: 1 (603) 524 5728
WORKS: 606 North Dyer Boulevard, Kissimmee Airport, Kissimmee, Florida 34741
Telephone: 1 (407) 847 9000
Fax: 1 (407) 847 4516
PRESIDENT: Armand E. Rivard
EXECUTIVE VICE-PRESIDENT: Gordon Collins
EXECUTIVE VICE-PRESIDENT MARKETING: J. Douglas Hinton
VICE-PRESIDENT INTERNATIONAL: Haig Hagopian

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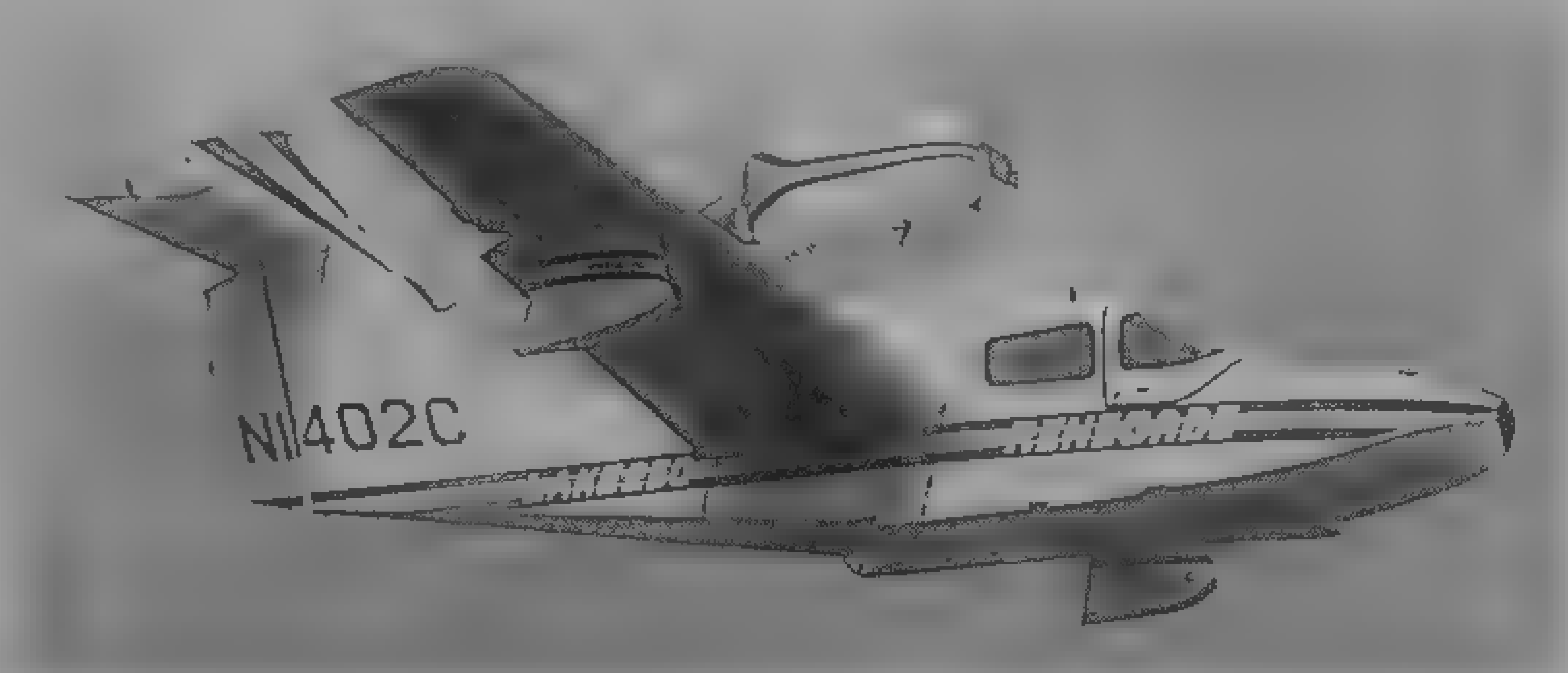


Lake LA-250 Renegade (250 shp Textron Lycoming IO-540-C4B5) *(Mike Vines/Photolink)* 1995

LAKE LA-250 RENEGADE and TURBO 270 RENEGADE

TYPE: Lengthened five-passenger version of LA4-200.
PROGRAMME: LA-250 FAA certificated August 1983.
CURRENT VERSIONS: **LA-250 Renegade:** Standard version. *Described below.*

Turbo 270 Renegade: Turbocharged version with Textron Lycoming TIO-540. Set world altitude record of 7,465 m (24,500 ft) for small amphibians August 1983. Exports to China 1995 preceding planned licenced assembly and eventual manufacture in that country (see CAWAC entry in International section).

Special Edition Sea Fury: Renegade with salt water operating package including lifting rings, stainless steel brake discs, custom interior and survival package. Available since Summer 1990.

LM Lean Machine: Low-cost version of Renegade with basic instrumentation, standard fuel tanks, 45 kg (99 lb) increase in payload. Announced late 1994, but not officially launched by early 1995, pending minimum launch orders of 15 aircraft.

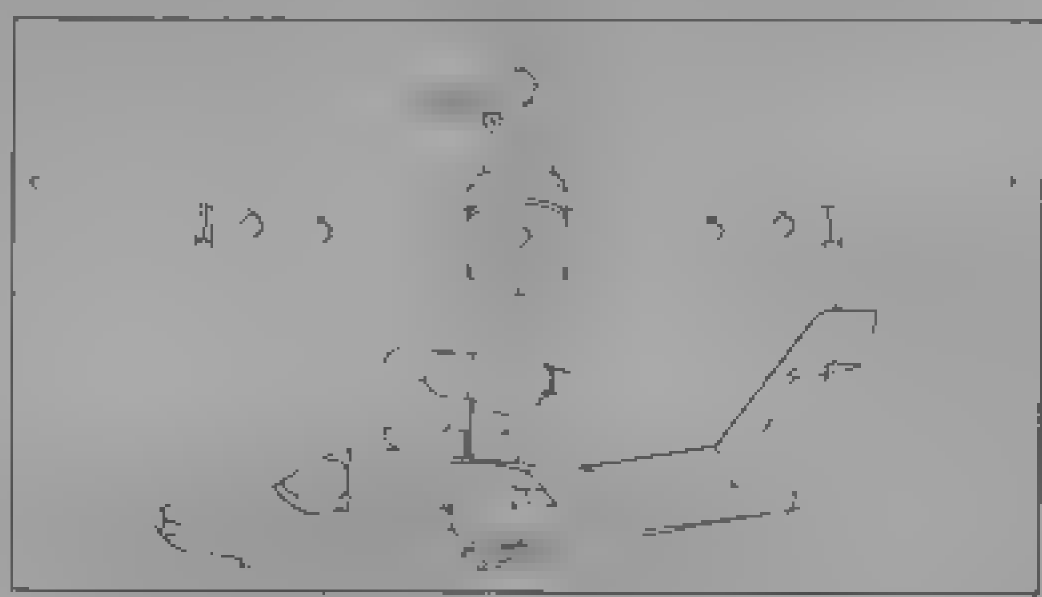
Seawolf: Military version, radar mounted ahead of engine pod, two hardpoints beneath each wing. Described in 1992-93 *Jane's*. No known customers, but marketing under way in 1995.

CUSTOMERS: Well over 100 sold, no new aircraft registered in USA since late 1980s.
DESIGN FEATURES: Single-step all-metal double-sealed boat hull, 1.05 m (3 ft 5 in) longer than LA4-200 with deeper V bottom and additional strakes, retractable water rudder in base of aerodynamic rudder. Tapered wings attached directly to hull sides; wing section NACA 4415 at root, 4409 at tip, dihedral 5° 30′, incidence 3° 15′.
FLYING CONTROLS: Manually operated ailerons, elevators and rudder; ground adjustable aileron trim tabs, outer portion of port elevator separate from inboard and operated hydraulically as trimmer; hydraulically operated slotted flaps.
STRUCTURE: Wing has duralumin leading/trailing-edge torsion boxes separated by single main spar, light alloy monocoque wing floats, hull alodined and zinc chromated inside and out, polyurethane external paint, metal ailerons and tail surfaces.

LANDING GEAR: Hydraulically retractable tricycle type. Consolidated oleo-pneumatic shock absorbers in main gear, which retracts inward into wings. Nosewheel retracts forward. Oleo extension increased compared with LA4-200 for greater ground clearance, wheelbase increased by 0.43 m (1 ft 5 in). Gerdes mainwheels with Goodyear tyres, size 6.00-6, pressure 2.41 bars (35 lb/sq in). Gerdes nosewheel with Goodyear tyre size 5.00-5, pressure 1.38 bars (20 lb/sq in). Gerdes disc brakes, parking brake. Nosewheel free to swivel 30° left/right.
POWER PLANT: One 186 kW (250 hp) Textron Lycoming IO-540-C4B5 flat-six engine in Renegade and Sea Fury driving a Hartzell three-blade constant speed Q-tip metal pusher propeller. Turbocharged TIO-540-AA1AD engine of same rating in Turbo Renegade. Standard usable fuel capacity 204 litres (54 US gallons, 45 Imp gallons), optional usable capacity of 340 litres (90 US gallons; 75 Imp gallons).
ACCOMMODATION: Enclosed cabin seating pilot and five passengers. Front and rear seats removable. Front seats have inertia reel harnesses as standard. Dual controls standard, dual brakes for co-pilot optional. Entry via two front-hinged windscreen sections, upward-hinged gull-wing cargo door standard. Baggage compartment (larger than in LA4-200) aft of cabin. Windscreen defrosting.
SYSTEMS: Vacuum system for flight instruments. Hydraulic system, pressure 86.2 bars (1,250 lb/sq in), for flaps, horizontal trim and landing gear actuation, hand pump provided for emergency operation. Engine-driven 12 V 60 A alternator and 12 V 30 Ah battery. Janitrol 30,000 BTU heater optional.
AVIONICS: Bendix/King, Collins and Narco, and autopilots by Brittain and Edo-Aire Mitchell, are available to customers' requirements. Basic installation includes com and nav antennae, cabin speaker, microphone and circuit breakers.
EQUIPMENT: Standard equipment includes:

Instrumentation: Full blind-flying instruments, electric clock, manifold pressure gauge, outside air temperature gauge, recording tachometer, fuel pressure and quantity indicators, oil pressure and temperature indicators, cylinder head temperature gauge, ammeter and stall warning device. Control locks, carpeted floor, four fresh air vents, tinted glass for all windows, dual windscreen defrosters, inertia reel shoulder harness on front seats, shoulder restraining on rear seats, map pocket on front seats, baggage tiedown straps, landing and taxi lights, navigation lights, strobe light, heated pitot, fuselage nose bumper, paddle, cleat, line, full flow oil filter, quick fuel drains, and inboard and outboard tiedown rings.

Optional equipment includes hour meter, shoulder harness for rear seats, alternate static source, manual/automatic bilge pump, cabin fire extinguisher, and external metallic paint finish.



Views of Lake Seawolf showing radar and weapons pylons 1995

DIMENSIONS, EXTERNAL:

Wing span	11.68 m (38 ft 4 in)
Wing chord, mean	1.35 m (4 ft 5 in)
Wing aspect ratio	8.64
Length overall	8.64 m (28 ft 4 in)
Height overall	3.05 m (10 ft 0 in)
Tailplane span	3.05 m (10 ft 0 in)
Wheel track	3.40 m (11 ft 2 in)
Wheelbase	3.13 m (10 ft 3 in)
Propeller diameter	1.93 m (6 ft 4 in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.03 m (6 ft 8 in)
Max width	1.05 m (3 ft 5½ in)
Max height	1.32 m (3 ft 11½ in)

AREAS:

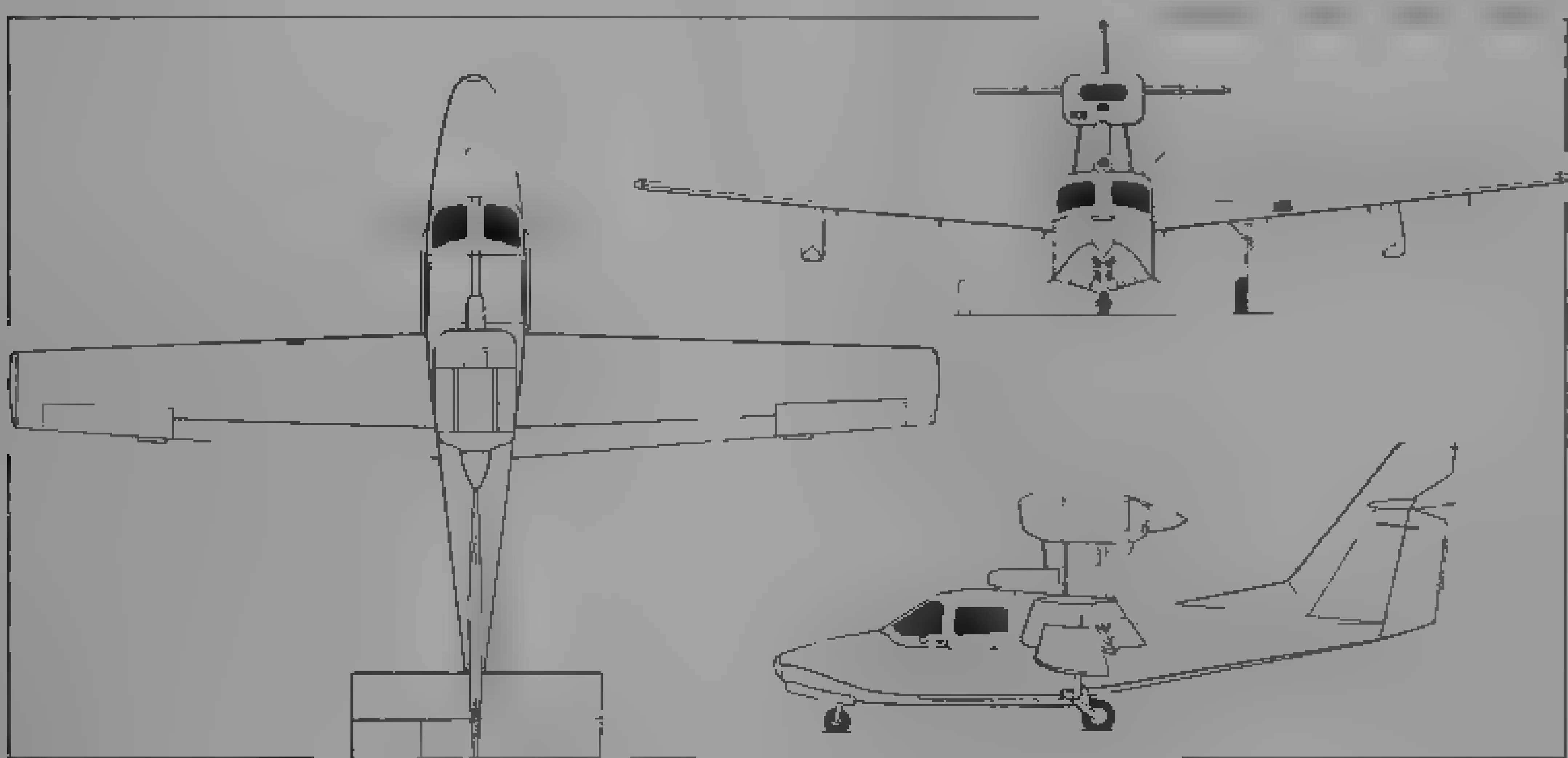
Wings, gross	15.79 m² (170.0 sq ft)
Ailerons (total)	1.16 m² (12.5 sq ft)
Trailing-edge flaps (total)	2.28 m² (24.5 sq ft)
Fin	1.25 m² (13.5 sq ft)
Rudder	0.79 m² (8.5 sq ft)
Tailplane	1.45 m² (15.6 sq ft)
Elevators (total)	0.78 m² (8.4 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped: Renegade	839 kg (1,850 lb)
Turbo Renegade	875 kg (1,930 lb)
Max usable fuel	240 kg (528 lb)
Max ramp, T-O and landing weight	1,383 kg (3,050 lb)
Max wing loading	87.6 kg/m² (17.94 lb/sq ft)
Max power loading	7.42 kg/kW (12.2 lb/hp)

PERFORMANCE (at max T-O weight, S/L, ISA):

Never-exceed speed (VNE): Renegade	148 kts (274 km/h, 170 mph)
Max level speed at 1,980 m (6,500 ft): Renegade	139 kts (258 km/h, 160 mph)



Lake LA-250 Renegade six-seat amphibian *(Jane's/Dennis Punnett)* 1991

Max cruising speed
Renegade, 75% power at 1,980 m (6,500 ft)
132 kts (245 km/h, 152 mph)
Turbo Renegade, 78% power at 6,100 m (20,000 ft)
148 kts (274 km/h, 170 mph)
Stalling speed, power off:
landing gear and flaps up
54 kts (100 km/h, 62 mph) IAS
landing gear and flaps down
48 kts (89 km/h, 56 mph) IAS
Max rate of climb at S/L 274 m (900 ft)/min
Service ceiling: Renegade 4,480 m (14,700 ft)
Turbo Renegade 6,100 m (20,000 ft)
T-O run: from land 268 m (880 ft)
from water 381 m (1,250 ft)
Range with max fuel, 30 min reserves:
Renegade 900 n miles (1,668 km, 1,036 miles)
Endurance at 78% power: Turbo Renegade 5 h 18 min

UPDATED

LANCAIR

LANCAIR INTERNATIONAL INC

2244 Airport Way, Redmond, Oregon 97756
North American dealer: Neico Aviation Inc, at same address
PRESIDENT, LANCAIR AND NEICO AVIATION: Lance Neibauer

More than 1,377 Lancairs (including out of production Model 235) sold to customers in 34 countries.

UPDATED

LANCAIR INTERNATIONAL LANCAIR 320

TYPE: Side by side two-seat sporting and cross-country kit aircraft.

PROGRAMME: Followed Lancair 235 (1993-94 *Jane's*), introducing larger fuselage, increased flap effectiveness, and longer landing gear with oleo-pneumatic nose strut. On 8 January 1990 received FAA approval under 51 per cent rule for **Fast-Build** kit, which reduces construction time by more than 700 working hours.

CUSTOMERS: 990 kits sold, 300 flying by early 1995.

COSTS: 1995: Kits $20,950, Fast Build $27,950. Plans $425.

DESIGN FEATURES: See Programme. Wing section NLF 0215F.

STRUCTURE: Composite airframe of Nomex honeycomb, polyimide Rohacell foam and epoxy resin.

LANDING GEAR: Retractable tricycle type.

POWER PLANT: One 119 kW (160 hp) Textron Lycoming O-320 flat-four engine. Fuel capacity 163 to 200 litres (43 to 53 US gallons; 36 to 44 Imp gallons). Two optional 38 litre (10 US gallon; 8.3 Imp gallon) auxiliary fuel tanks.

ACCOMMODATION: Two seats, side by side, under single piece, forward-hinged canopy.

DIMENSIONS, EXTERNAL:
Wing span 7.16 m (23 ft 6 in)
Wing aspect ratio 7.27
Length overall 6.40 m (21 ft 0 in)
Height overall 2.13 m (7 ft 0 in)
Propeller diameter 1.78 m (5 ft 10 in)
AREAS:
Wings, gross 7.06 m² (76.0 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 472 kg (1,040 lb)
Max T-O weight 764 kg (1,685 lb)
Max wing loading 108.25 kg/m² (22.17 lb/sq ft)
Max power loading 6.42 kg/kW (10.53 lb/hp)
PERFORMANCE:
Max level speed at S/L 226 kts (418 km/h, 260 mph)
Cruising speed at 2,285 m (7,500 ft)
208 kts (386 km/h, 240 mph)
Stalling speed 55 kts (102 km/h; 63 mph)
Max rate of climb at S/L 503 m (1,650 ft)/min
Service ceiling 5,485 m (18,000 ft)
T-O run 214 m (700 ft)
Range, no reserves 1,260 n miles (2,333 km, 1,450 miles)
g limits +9/-4.5 ultimate

UPDATED

Lancair ES fixed gear four seater

1995

Kenyan registered Lancair 320 *(Paul Jackson)*

1995

LANCAIR INTERNATIONAL LANCAIR 360

Similar to Lancair 320 but with 134 kW (180 hp) Textron Lycoming O-360 engine. Empty weight 442 to 483 kg (975 to 1,065 lb), maximum level speed 230 knots (426 km/h, 265 mph); maximum rate of climb at S/L 594 m (1,950 ft)/min.

VERIFIED

Lancair International Lancair IV with retractable undercarriage

1995

LANCAIR INTERNATIONAL LANCAIR IV

TYPE: Four-seat homebuilt with dual controls.

PROGRAMME: Kit deliveries began 1990. On 20 February 1991, prototype set NAA world speed record between San Francisco and Denver of 314.7 knots (583.2 km/h, 362.4 mph).

CURRENT VERSIONS: **Lancair IV**: Standard version, *to which description mainly applies*.

Lancair IV-P: Pressurised version, first flight 1 November 1993. Provides 0.34 bar (5.0 lb/sq in) differential, equipment from Dukes of California, which also supplies Beech 1900 and Aerostar 601.

CUSTOMERS: 337 kits sold, eight flying by early 1995.

COSTS: Kit: $47,900 (1995), pressurised version: $69,900.

DESIGN FEATURES: Conventional seating for four persons in airframe of new design, high cruising speeds.

FLYING CONTROLS: Conventional control plus Fowler flaps.

STRUCTURE: Carbonfibre/Kevlar/epoxy airframe, with Nomex honeycomb cores.

LANDING GEAR: As Lancair 320.

POWER PLANT: One 261 kW (350 hp) Teledyne Continental TSIO-550-B1B twin-turbocharged flat-six engine. Fuel capacity 303 litres (80 US gallons; 66.6 Imp gallons).

DIMENSIONS, EXTERNAL:
Wing span 9.19 m (30 ft 2 in)
Wing aspect ratio 9.29
Length overall 7.62 m (25 ft 0 in)
Height overall 2.44 m (8 ft 0 in)
Propeller diameter 1.93 m (6 ft 4 in)
AREAS:
Wings, gross 9.10 m² (98.0 sq ft)

WEIGHTS AND LOADINGS

Weight empty	794 kg (1,750 lb)
Max T-O weight	1,315 kg (2,900 lb)
Max wing loading	144.5 kg/m² (29.59 lb/sq ft)
Max power loading	5.04 kg/kW (8.29 lb/hp)

PERFORMANCE

Cruising speed, 75% power	287 kts (531 km/h, 330 mph)
Stalling speed	63 kts (116 km/h, 72 mph)
Max range, 75% power at 7,620 m (25,000 ft), standard fuel, no reserves	1,260 n miles (2,333 km, 1,450 miles)
g limits	+9/-4.5 ultimate

UPDATED

LANCAIR INTERNATIONAL LANCAIR ES

TYPE: Four-seat cabin monoplane.

PROGRAMME: Prototype unveiled at Oshkosh Autumn 1992; flight testing continuing 1993. Certification awaiting new simplified version of FAR Pt 23 governing light aircraft.

CUSTOMERS: 52 kits sold by Spring 1994, two flying by March 1995.

COSTS: $34,950 for kit.

DESIGN FEATURES: Low-wing monoplane; hardtop cabin with paired side by side seats.

STRUCTURE: All-composites.

LANDING GEAR: Non-retractable tricycle type.

POWER PLANT: One 149 kW (200 hp) Teledyne Continental IO-360 flat six engine; two-blade constant-speed propeller.

WEIGHTS AND LOADINGS

Max T-O weight	1,315 kg (2,900 lb)

PERFORMANCE

Max cruising speed	more than 165 kts (306 km/h, 190 mph)
Max range	more than 1,130 n miles (2,092 km, 1,300 miles)

UPDATED

LARON

LARON AVIATION TECHNOLOGIES INC

PO Box 5026, Borger, Texas 79008-5026
Telephone: 1 (806) 273 8513
Fax: 1 (806) 273 8375

Laron Aviation Technologies is US distributor for CFM Shadow and Streak Shadow (see UK section).

NEW ENTRY

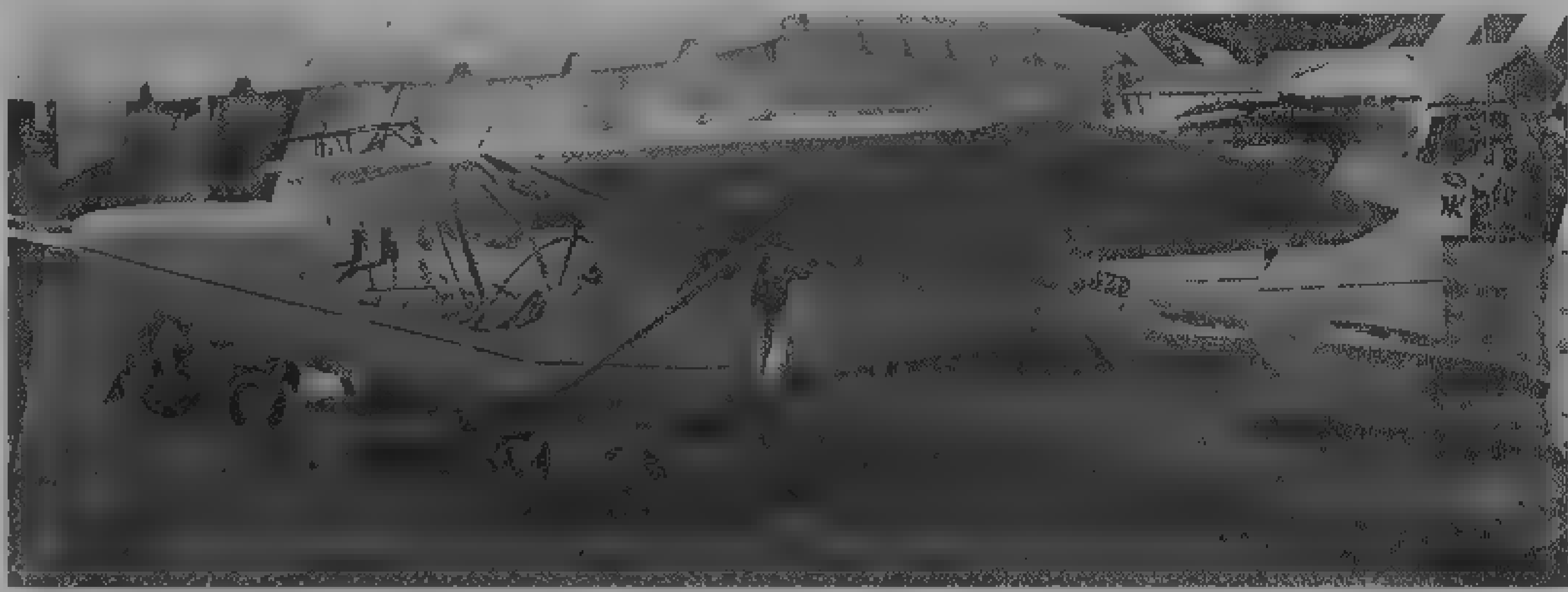
LARON STAR STREAK

TYPE: Modified CFM Shadow.

PROGRAMME: Introduced 1995.

DESIGN FEATURES: Climb performance and cruising speed improved by use of 70.8 kW (95 hp) Hirth F-30 four-cylinder two-stroke engine and redesigned wing. Wing chord reduced by 20.3 cm (8 in) and span increased by 0.61 m (2 ft 0 in) with tapered wingtips.

NEW ENTRY



Laron Wizard (Rotax 582 engine) *(Geoffrey P. Jones)* 1995

LARON WIZARD

TYPE: Two-seat light aircraft.

PROGRAMME: South Korean design by Ho Sun Park, chairman of Dong-In Industrial Company, refined following May 1994 agreement with Laron; production kit deliveries expected to begin by mid-1995.

DESIGN FEATURES: Braced high-wing monoplane with pusher engine, twin-boom tail unit and tricycle landing gear; sits tail-down on ground.

FLYING CONTROLS: Conventional mechanical with electric trim. Electrically actuated trailing-edge flaps.

STRUCTURE: Preformed glassfibre epoxy. Available as starter kit, quick-build kit, or four-stage kit (fuselage/wings/tail/engine and instruments).

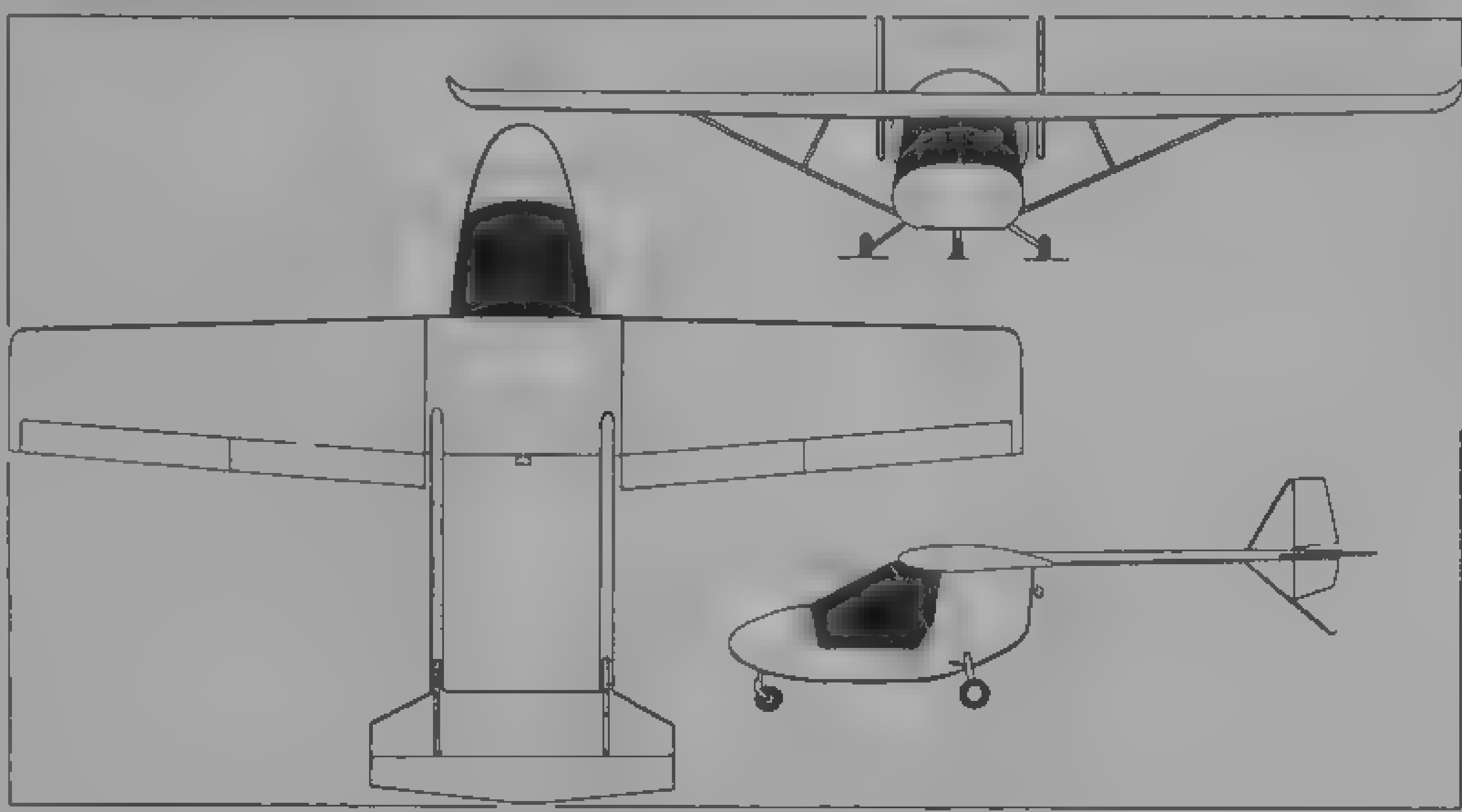
LANDING GEAR: Non-retractable tricycle type with steerable nosewheel. Hydraulic disc brakes. Float and ski gear optional.

POWER PLANT: One 47 kW (63 hp) Rotax 582 two-cylinder two-stroke engine, driving a three-blade fixed-pitch ground-adjustable pusher propeller; 59.6 kW (80 hp) Rotax 912 optional. Fuel capacity 38 litres (10 US gallons, 8.3 Imp gallons).

ACCOMMODATION: Side by side seats for two persons with full safety harnesses and dual controls.

AVIONICS: *Instrumentation:* VFR standard.

EQUIPMENT: Navigation lights and Honda Goldwing conversion optional.



Laron Aviation Technologies two-seat lightplane *(Jane's/Paul Jackson)* 1995

DIMENSIONS, EXTERNAL

Wing span	9.45 m (31 ft 0 in)
Length overall	6.10 m (20 ft 0 in)
Height overall	1.37 m (4 ft 6 in)
Propeller diameter	1.32 m (4 ft 4 in)

AREAS

Wings, gross	13.01 m² (140.0 sq ft)

WEIGHTS AND LOADINGS

Weight empty	209.5 kg (462 lb)
Fuel weight	17 kg (38 lb)
Max T-O weight	419 kg (924 lb)
Max wing loading	32.22 kg/m² (6.60 lb/sq ft)
Max power loading	8.93 kg/kW (14.67 lb/hp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (V_{NE})	104 kts (193 km/h, 120 mph)
Max level speed	87 kts (161 km/h, 100 mph)
Max cruising speed, 80% power	69 kts (129 km/h, 80 mph)
Econ cruising speed, 50% power	65 kts (121 km/h, 75 mph)
Stalling speed: flaps up	35 kts (65 km/h, 41 mph)
flaps down	30 kts (56 km/h, 35 mph)
Max rate of climb at S/L: two-seat	274 m (900 ft)/min
single-seat	457 m (1,500 ft)/min
Service ceiling	4,575 m (15,000 ft)
T-O and landing run	61 m (200 ft)
Range: at max cruising speed	174 n miles (322 km; 200 miles)
at econ cruising speed	186 n miles (344 km, 214 miles)

NEW ENTRY

LEARJET

LEARJET INC
(Subsidiary of Bombardier Inc)

One Learjet Way, PO Box 7707, Wichita, Kansas 67277
Telephone: 1 (316) 946 2000
Fax: 1 (316) 946 2220
Telex: 417441

PRESIDENT AND CEO: Brian E. Barents

VICE-PRESIDENT, MARKETING AND SALES: Ted Farid

VICE-PRESIDENT, OPERATIONS: Richard E. Hamlin

VICE-PRESIDENT, PRODUCT SUPPORT: Donald E. Grommesh

VICE-PRESIDENT, ENGINEERING: William W. Greer

VICE-PRESIDENT, INTERNATIONAL MARKETING: Robert Williams

MANAGER, TECHNICAL MARKETING: M. Terry Noss

DIRECTOR, PUBLIC AFFAIRS: Jeff Miller

Company originally founded 1960 by Bill Lear Snr as Swiss American Aviation Corporation (SAAC); transferred to Kansas 1962 and renamed Lear Jet Corporation. Gates Rubber Company bought about 60 per cent of company 1967, company renamed Gates Learjet Corporation. 64.8 per cent of company acquired by Integrated Acquisition Inc September 1987 and renamed Learjet Corporation; all manufacturing moved from Tucson, Arizona, to Wichita during 1988, leaving customer service completion and modification centre in Tucson.

Acquisition of Learjet by Canada's Bombardier announced April 1990 and concluded 22 June 1990 for $75 million; name changed to Learjet Inc. Bombardier assumed responsibility for Learjet's line of credit, now part of Bombardier Aerospace Group, North America (which see under Canada). Wichita workforce 2,915 in 1994, Tucson 600; total 3,773 at all locations.

Learjet is major subcontractor for Lockheed Martin Astronautics, Boeing and US Air Force. Has subsidiary to maintain 82 Learjet 35As operating with US Air Force and Air National Guard (as C-21As). Total 1,790 Learjets built by June 1995, including 362 LJ23/24s, 367 LJ25s, five LJ28s, four LJ29s, 63 LJ36s and 147 LJ55s.

Learjet bought manufacturing and marketing rights and tooling of Aeronca thrust reversers, for application to Learjet and other aircraft, March 1989.

Total of 39 deliveries in 1993, 36 in 1994.

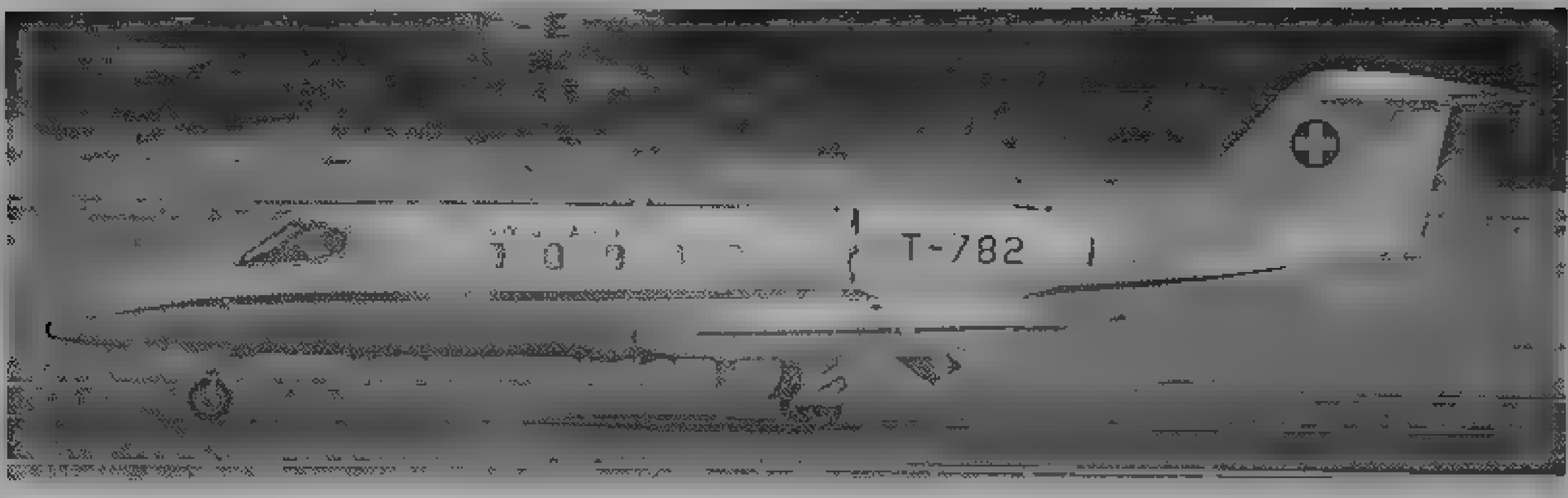
UPDATED

LEARJET 35A and 36A

US Air Force designation: C-21A

TYPE: Light twin-turbofan business jet.

PROGRAMME: First flight of first turbofan Learjet (known as Model 26 and using AlliedSignal TFE731-2s), 4 January 1973; production Models 35 and 36, differing in fuel capacity and accommodation, announced May 1973. FAA



Learjet 35A of Swiss Air Force *(Paul Jackson)*

1995

certification July 1974. French and UK certification 1979. Currently available to special order only.

CURRENT VERSIONS: **Learjet 35A** and **36A**: Current production models of 35 and 36, with higher standard maximum T-O weight. *Abbreviated description of this version follows*; full details in 1994-95 and earlier editions.

C-21A: USAF received 80 Learjet 35As, used as Operational Support Aircraft for priority cargo, medevac and personnel transport; four more C-21As bought 1987 by Air National Guard and assigned to Andrews AFB, Maryland.

Special missions versions: Described separately.

CUSTOMERS: Three 35As and one 36A delivered 1993, none delivered in 1994. Total 676 built.

COSTS: Standard 35A $4.94 million (1993); 36A $5.14 million (1993).

DESIGN FEATURES: Wing section NACA 64A109 with modified leading-edge, dihedral 2° 30′, incidence 1°, sweepback at quarter-chord 13°.

FLYING CONTROLS: Manually actuated flying controls, balance tabs in both ailerons and electrically operated trim tab in port aileron; electrically actuated variable incidence tailplane, electric trim tab in rudder; small ventral fin; hydraulically actuated single-slotted flaps, hydraulically actuated spoilers ahead of flaps.

STRUCTURE: All-metal, eight-spar wing with milled skins, fail-safe fuselage.

LANDING GEAR: Retractable tricycle type, with twin wheels on each main unit and single steerable nosewheel (±45°).

POWER PLANT: Two AlliedSignal TFE731-2-2B turbofans, each rated at 15.6 kN (3,500 lb st), pod-mounted on sides of rear fuselage.

ACCOMMODATION: Crew of two on flight deck, with dual controls. Up to eight passengers in Learjet 35A; Learjet 36A can accommodate up to six passengers.

SYSTEMS: Heating and pressurisation by engine bleed air, with a maximum pressure differential of 0.65 bar (9.4 lb/sq in), maintaining a cabin altitude of 1,980 m (6,500 ft) to a height of 13,715 m (45,000 ft).

Hydraulic system supplied by two engine-driven pumps. Pneumatic system of 124 to 207 bars (1,800 to 3,000 lb/sq in) pressure for emergency extension of landing gear and operation of brakes. Electrical system powered by two 30 V 400 A brushless generators. Oxygen system for emergency use.

AVIONICS: *Comms*: Dual Collins VHF-22A com transceivers, Bendix/King KHF 950 HF.

Radar: Honeywell Primus 450 colour weather radar.

Flight: Dual Collins VIR-32 nav receivers; ADF-60; dual DME-42, dual TDR-90 transponders.

DIMENSIONS, EXTERNAL:
- Wing span over tip tanks: 12.04 m (39 ft 6 in)
- Length overall: 14.83 m (48 ft 8 in)
- Height overall: 3.73 m (12 ft 3 in)

DIMENSIONS, INTERNAL:
- Cabin: Length incl flight deck: 35A: 6.63 m (21 ft 9 in)
  - 36A: 5.77 m (18 ft 11 in)
  - excl flight deck: 35A: 5.21 m (17 ft 1 in)
  - 36A: 4.06 m (13 ft 4 in)
  - Max width: 1.50 m (4 ft 11 in)
  - Max height: 1.32 m (4 ft 4 in)

AREAS:
- Wings, gross: 23.53 m² (253.3 sq ft)

WEIGHTS AND LOADINGS (35A and 36A):
- Weight empty, equipped: 4,590 kg (10,119 lb)
- Max payload (incl full fuselage tank): 1,534 kg (3,381 lb)
- Max T-O weight: 8,300 kg (18,300 lb)

PERFORMANCE (35A and 36A, at max T-O weight, ISA, except where indicated):
- Max operating Mach number (MMO): 0.81
- Max level speed at 7,620 m (25,000 ft): 471 kts (872 km/h; 542 mph)
- Max cruising speed, mid-cruise weight, at 12,500 m (41,000 ft): 460 kts (852 km/h; 529 mph)
- Max rate of climb at S/L: 1,323 m (4,340 ft)/min
- Service ceiling: 12,500 m (41,000 ft)
- Range with four passengers, max fuel and 45 min reserves:
  - 35A: 2,196 n miles (4,067 km; 2,527 miles)
  - 36A: 2,522 n miles (4,671 km; 2,902 miles)

UPDATED

LEARJET 35A/36A SPECIAL MISSIONS VERSIONS

TYPE: Special mission adaptations for Learjet 35A/36A.

CURRENT VERSIONS: **EC-35A**: Used for EW training simulation or as standoff ECM/ESM platform.

PC-35A: Maritime patrol; equipment includes 360° sea surveillance digital radar, high-resolution TV, FLIR, IRLS, ESM, MAD, integrated tactical displays, and VLF Omega or other long-range navaids, hardpoint under each wing with Alkan 165B ejector for external stores up to 454 kg (1,000 lb); drop hatch for rescue gear, multitrack digital recorders, homing systems, ASW sonobuoy systems and data annotated hand-held cameras.

RC-35A and RC-36A: Reconnaissance versions, standard installations include long-range oblique photographic (LOROP) cameras, side-looking synthetic aperture radars, and surveillance camera system in external pods. Geological versions delivered to China (see Customers).

UC-35A: Utility versions for transport, navaids calibration, medevac and target towing. Certificated tow systems include Hayes Universal Tow Target System (HUTTS) with or without MTR-101, Flight Refuelling LLHK, MRTT and EMT TGL targets, and Marquardt aerial target launch and recovery tow reel.

U-36A: Extensively modified for Japan Maritime Self-Defence Force (JMSDF). Six delivered for target towing, anti-ship missile simulation and ECM, tip pods extended in association with ShinMaywa, to house HWQ-1T missile seeker simulator, AN/ALQ-6 jammer and cameras. Additional equipment includes long range ocean surveillance radar in underbelly fairing, AN/ALE-43 chaff dispenser, ARS-1-L high-speed tow sleeve with scoring, two-piece windscreen with electrical demisting for low level missions, expanded underwing stores capability, greater maximum T-O and landing weights.

CUSTOMERS: Total of 23 customer countries include Argentina, Australia, Bolivia, Brazil, Chile, People's Republic of China (two 36As delivered 1984, plus three 35As with geological equipment and Goodyear SLAR delivered 1985), Finland (three 35A target tugs also equipped for mapping, medevac, pollution control, oblique photography and SAR), Germany (four 35A/36A target tugs), Japan, Mexico, Peru, Saudi Arabia, Sweden, Switzerland, Thailand, UK, USA and Yugoslavia. Nearly 200 Learjet 30 Series aircraft now flying with or for military services, including 84 C-21As (see previous entry).

DESIGN FEATURES: Civilian and paramilitary missions include aerial survey, aeronautical research, airways calibration, ASW, atmospheric research, border patrol, ESM/ECM, geophysical survey, maritime patrol, pilot training, radar surveillance, reconnaissance, search and rescue, and weather modification.

PERFORMANCE (PC-35A at max T-O weight, ISA):
- Operating speed:
  - at 11,275-12,500 m (37,000-41,000 ft): 415 kts (769 km/h; 478 mph)
  - at 4,575-7,620 m (15,000-25,000 ft): 319 kts (590 km/h; 367 mph)
  - S/L to 610 m (2,000 ft): 250 kts (463 km/h; 288 mph)
- Max rate of climb at S/L: 1,380 m (4,525 ft)/min
- Range:
  - at high altitude: 2,249 n miles (4,165 km; 2,588 miles)
  - at medium altitude: 1,617 n miles (2,995 km; 1,861 miles)
  - at low altitude: 1,060 n miles (1,963 km; 1,220 miles)

UPDATED

LEARJET 31A

TYPE: Twin-turbofan business jet.

PROGRAMME: Learjet 31 introduced September 1987, first flight of aerodynamic prototype 11 May 1987; first production aircraft (N311DF) used as systems testbed. FAA certification 12 August 1988. Learjet 31A and 31A/ER announced October 1990 to replace Learjet 31.

CURRENT VERSIONS: **Learjet 31**: See 1990-91 *Jane's*.

Learjet 31A: Current version, *description applies to this model, except where indicated*.

Learjet 31A/ER: Optional extended range version with 2,627 litres (694 US gallons; 578 Imp gallons) fuel and higher maximum T-O weight.

CUSTOMERS: Total of 105 built by June 1995, including 36 of original Learjet 31, 18 Learjet 31As delivered in 1993 and 14 in 1994. Recent new orders include one 31A delivered to the government of Namibia for use of head of state and two 31As for delivery in September 1995 to Singapore Airlines, joining four 31s already in service for cadet pilot and first officer training.

COSTS: Standard Learjet 31A $4.59 million (1995).

DESIGN FEATURES: Learjet 31 (1990-91 *Jane's*) combined fuselage/cabin and power plant of Learjet 35A/36A with wing of Learjet 55, delta fins added to eliminate Dutch roll, stabilise aircraft at high airspeeds, induce docile stall and reduce approach speeds and field lengths; stick pusher/puller and dual yaw dampers no longer required for departure; stick shaker and single yaw damper retained for comfort.

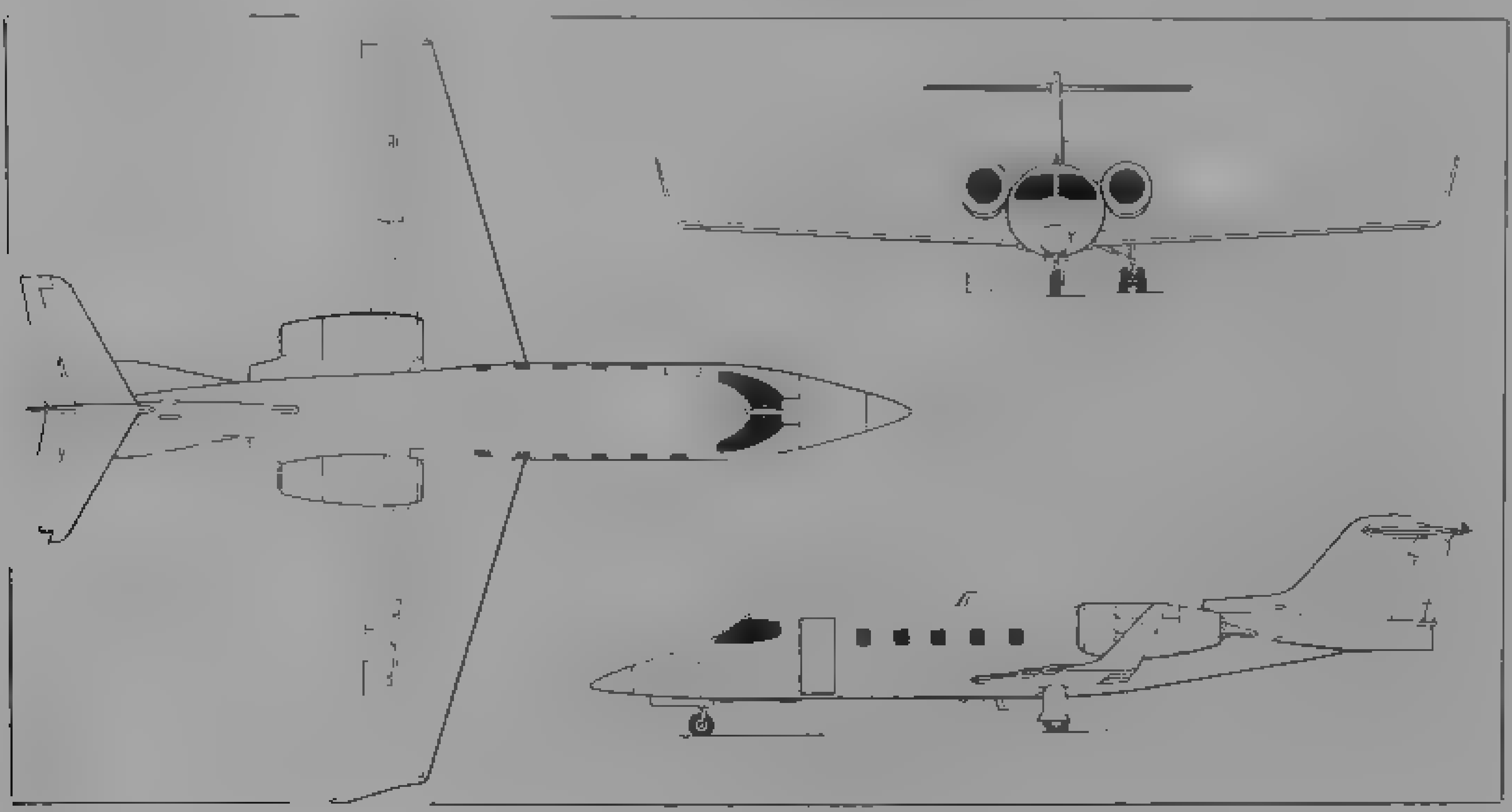
Additional features of Learjet 31A include cruise Mach number up to 12,500 m (41,000 ft) increased 4 per cent to 0.81 and VMO increased from 300 knots (556 km/h; 345 mph) to 325 knots (602 km/h; 374 mph) IAS. Increases mainly benefit descent from high altitudes. Learjet 31A also features integrated digital avionics package.

FLYING CONTROLS: All control surfaces mechanically actuated, ailerons have brush seals and geared tabs, electrically actuated trim tab on port aileron. Electrically actuated tailplane incidence control has separate motors for pilot and co-pilot and single fault survival protection, aircraft can be manually controlled following tailplane runaway and landed with reduced flap. Rudder has electric trim tab, automatic electric rudder assist servo operates automatically if rudder pedal loads exceed 22.6 kg (50 lb). Full-chord fences bracket the ailerons, air flow between fences corrected by arrowhead energisers on leading-edge, row of round-head screws aft of leading-edge and two rows of energiser strips near ailerons. Single spoiler panel in each wing used as airbrake and lift dumper. Hydraulically actuated flaps extend to 40°. Optional drag parachute mounted on inside of baggage hatch under tail.

STRUCTURE: Multispar wing with machined skins.

LANDING GEAR: Retractable tricycle gear, main legs retract inward, nose leg forward, twin mainwheels with anti-skid disc brakes; nosewheel has full-time digital steer-by-wire replacing speed limited steering of Learjet 31. Maximum airspeed with gear extended 260 knots (481 km/h; 299 mph); tyre limiting speed 183 knots (339 km/h; 210 mph). Ground turning radius about nosewheel 11.91 m (39 ft 1 in).

POWER PLANT: Two 15.56 kN (3,500 lb st) AlliedSignal TFE731-2-3B turbofans with digital electronic engine



Learjet 31A business aircraft *(Jane's/Dennis Punnett)*

1991

controller giving automatic retention of power settings above 4,575 m (15,000 ft) and special idling control for descent from 15,545 m (51,000 ft). Engine synchroniser fitted. Optional Dee Howard 4000 thrust reverser system weighs 109 kg (240 lb). One integral fuel tank in each wing holds 641 kg (1,413 lb), standard fuselage tank 608 kg (1,340 lb), ER fuselage tank 804 kg (1,773 lb), fuselage fuel transferred by gravity or pump, single-point pressure refuelling standard.

ACCOMMODATION: Cabin furnishings include a three-seat divan, four Erda 10-way adjustable individual seats in club seating arrangement, side-facing seat with toilet, two folding tables, baggage compartment, forward privacy curtain, overhead panels with reading lights, indirect lighting, air vents and oxygen masks. New interior offering 0.5 cm (2 in) more headroom and three cabin configurations announced October 1994 and introduced on 100th aircraft May 1995.

SYSTEMS: Hydraulic system operates flaps, landing gear, airbrake, wheelbrakes and thrust reversers; system pressure 69 to 120.6 bars (1,000 to 1,750 lb/sq in); pneumatic standby for gear extension and wheelbrakes. Normal cabin pressure differential 0.64 bar (9.4 lb/sq in) with automatic flood engine bleed if cabin altitude exceeds 2,820 m (9,250 ft), pop-out emergency oxygen for passengers and masks for crew. Electrical system based on two starter/generators, two Ni/Cd batteries and two inverters; both buses can run from one engine, electrics operate tailplane incidence, rudder assister and nosewheel steering. De-icing by bleed air for wing, engine intakes and windscreen, tailplane electrically heated, fin not protected. Alcohol spray for radome to stop shed ice entering engines, controls prevent internal ice and condensation during long descents. Single engine at idle, burning 15.9 kg (35 lb) fuel every 10 minutes, acts as APU.

AVIONICS: Bendix/King integrated digital avionics package with five-tube EFIS. Universal UNS-1M flight management system (FMS), and dual KFC 3100 autopilots/flight directors.

EQUIPMENT: Throttle-mounted landing gear warning mute and go-around switches, nacelle heat annunciator, engine synchroniser and synchroscope, recognition light, wing ice light, emergency press override switches, transponder ident switch in pilot's control wheel, engine synchroniser and synchroscope, flap preselect, crew lifejackets, cockpit dome lights, cockpit speakers, crew oxygen masks and fire extinguisher are standard.

DIMENSIONS, EXTERNAL:

Wing span	13.33 m (43 ft 8 in)
Wing aspect ratio	7.21
Length overall	14.83 m (48 ft 8 in)
Height overall	3.73 m (12 ft 3 in)

DIMENSIONS, INTERNAL:

Cabin: Length	
incl flight deck: 31A	6.63 m (21 ft 9 in)
31A/ER	6.27 m (20 ft 7 in)
excl flight deck: 31A	5.21 m (17 ft 1 in)
31A/ER	4.85 m (15 ft 11 in)
Max width: 31A, 31A/ER	1.50 m (4 ft 11 in)
Max height: 31A, 31A/ER	1.32 m (4 ft 4 in)
Volume, incl flight deck: 31A	9.12 m³ (322.0 cu ft)
31A/ER	8.83 m³ (312.0 cu ft)
Baggage compartment: 31A	1.13 m³ (40.0 cu ft)
31A/ER	0.85 m³ (30.0 cu ft)

AREAS:

Wings, gross	24.57 m² (264.5 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: 31A	4,700 kg (10,361 lb)
31A/ER	4,717 kg (10,400 lb)
Basic operating weight empty: 31A	4,881 kg (10,761 lb)
31A/ER	4,899 kg (10,800 lb)
Max payload: 31A	1,016 kg (2,239 lb)
31A/ER	998 kg (2,200 lb)
* Payload with max fuel: 31A	846 kg (1,865 lb)
31A/ER	588 kg (1,297 lb)
Max fuel weight: 31A	1,890 kg (4,166 lb)
31A/ER	2,086 kg (4,599 lb)
Max T-O weight: 31A (standard)	7,031 kg (15,500 lb)
31A (optional), 31A/ER	7,484 kg (16,500 lb)
Max ramp weight: 31A (standard)	7,144 kg (15,750 lb)
31A (optional), 31A/ER	7,597 kg (16,750 lb)
Max zero-fuel weight	5,896 kg (13,000 lb)
Max landing weight	6,940 kg (15,300 lb)
Max wing loading: 31A	286.1 kg/m² (58.60 lb/sq ft)
31A/ER	304.6 kg/m² (62.38 lb/sq ft)
Max power loading: 31A	225.32 kg/kN (2.21 lb/lb st)
31A/ER	239.87 kg/kN (2.36 lb/lb st)

** 31A at optional T-O/ramp weights*

PERFORMANCE (at max standard T-O weight, S/L, ISA, except where indicated):

Never-exceed speed (V_{NE}): 325 kts (602 km/h; 374 mph) IAS

Max operating Mach number (M_{MO}), up to 12,500 m (41,000 ft): 0.81

Cruising speed:
- at 13,715 m (45,000 ft): 449 kts (832 km/h; 516 mph)
- at 10,975-12,500 m (36,000-41,000 ft): 463 kts (855 km/h; 532 mph)

Stalling speed at typical landing weight: 93 kts (173 km/h; 107 mph)

Learjet 31A twin-turbofan business jet

1995

Max rate of climb at S/L: 31A	1,670 m (5,480 ft)/min
31A/ER	1,555 m (5,100 ft)/min
Rate of climb at S/L, OEI: 31A	576 m (1,890 ft)/min
31A/ER	466 m (1,530 ft)/min
Max certificated ceiling	15,545 m (51,000 ft)
Service ceiling, OEI: 31A	9,510 m (31,200 ft)
31A/ER	8,840 m (29,000 ft)
T-O balanced field length, FAR Pt 25: 31A	893 m (2,930 ft)
31A/ER	1,000 m (3,280 ft)
FAR Pt 91 landing distance: 31A and 31A/ER	844 m (2,767 ft)
Range at econ cruising speed with four passengers, 45 min reserves: 31A	1,561 n miles (2,892 km; 1,797 miles)
31A/ER	1,806 n miles (3,346 km; 2,079 miles)

OPERATIONAL NOISE LEVELS (FAR Pt 36):

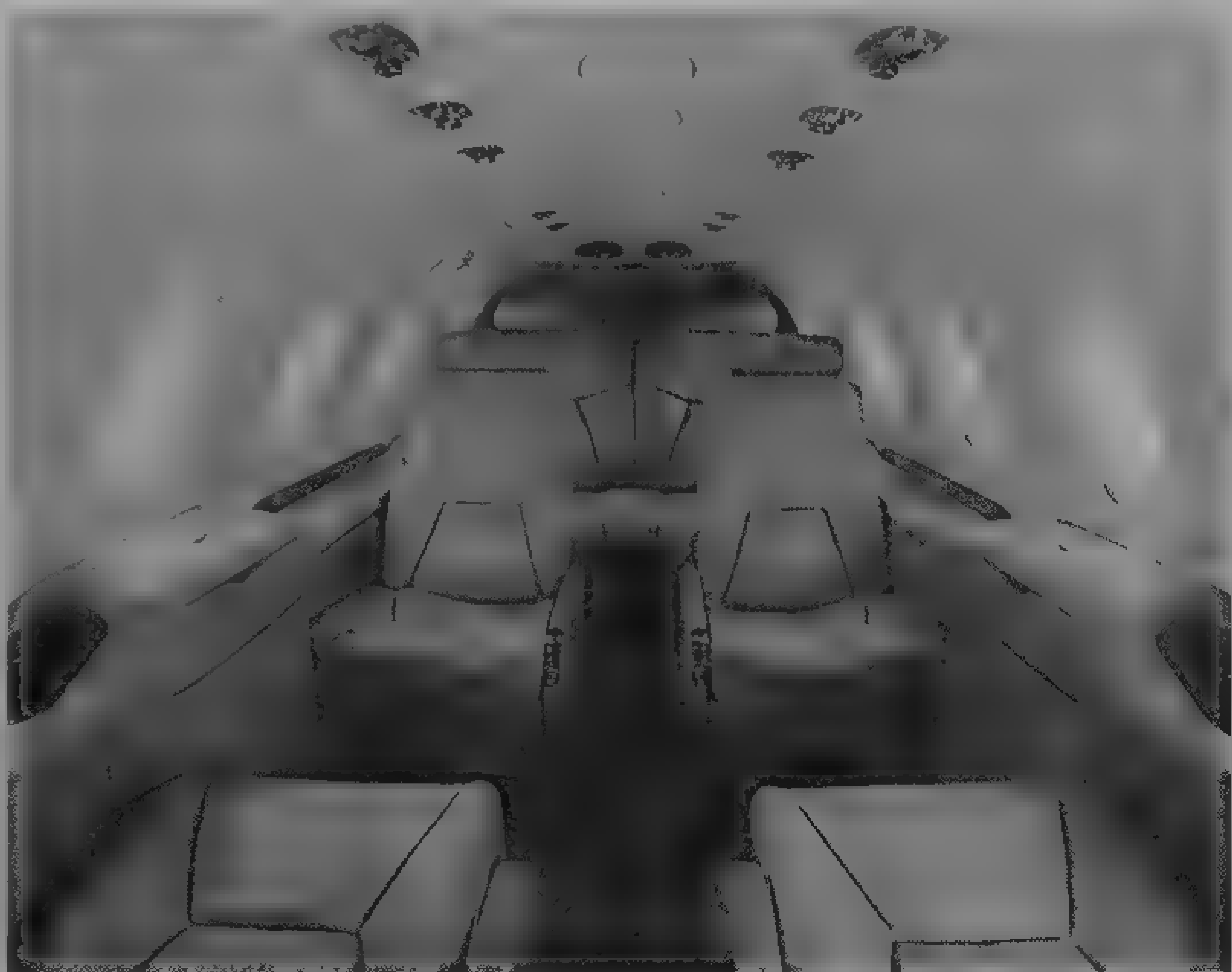
T-O: 31A	79.5 EPNdB
31A/ER	81.0 EPNdB
Approach: 31A and 31A/ER	92.6 EPNdB
Sideline: 31A	87.2 EPNdB
31A/ER	87.0 EPNdB

UPDATED

LEARJET 45

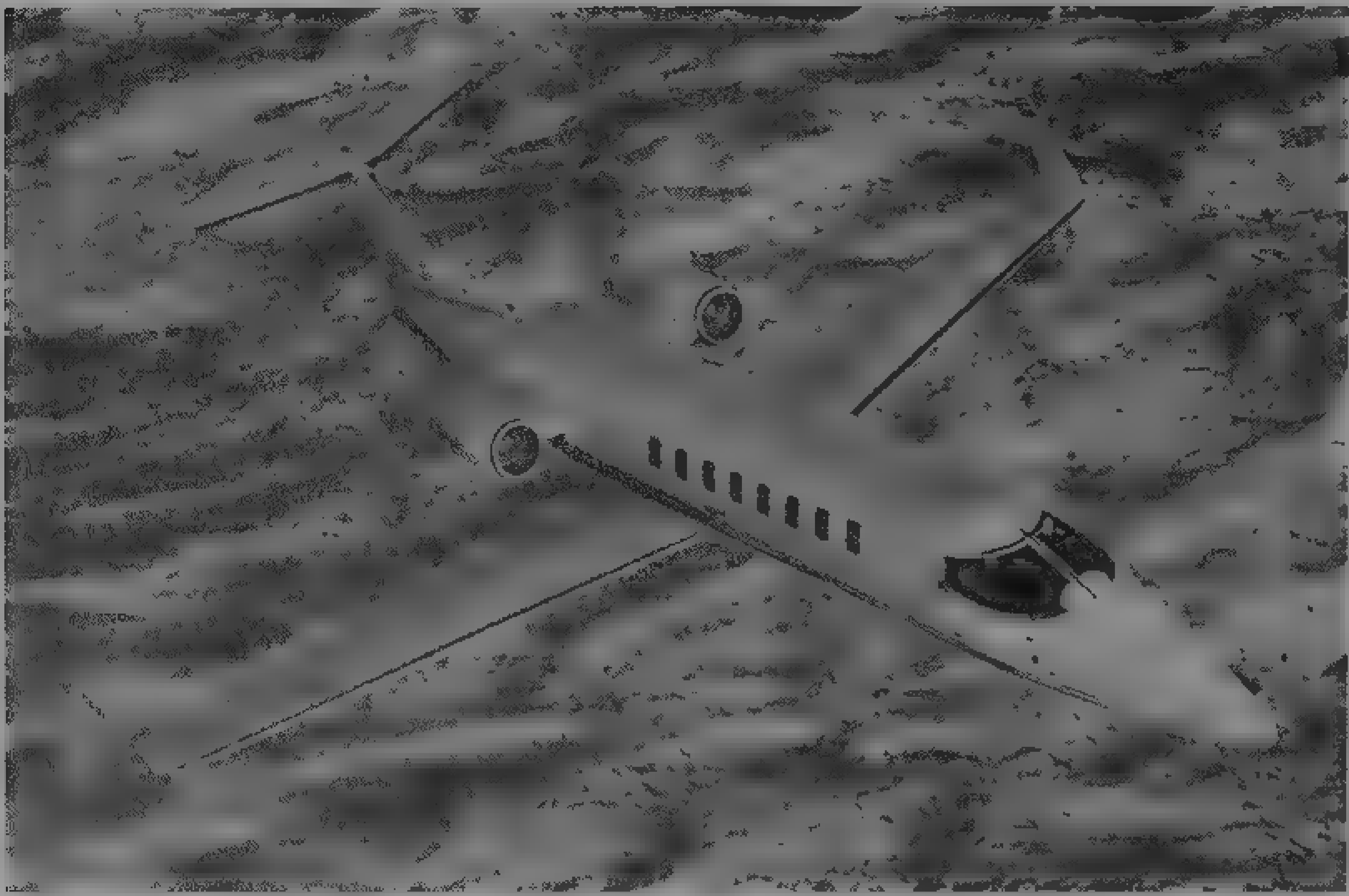
TYPE: 10/12-seat business jet.

PROGRAMME: Design started September 1992, unveiled at NBAA Convention 20 September 1992, certification planned for 1996 to latest FAR and JAR standards, production planned for maximum rate of 60 per year. Other members of Bombardier group are involved. Learjet is responsible for project co-ordination, final assembly, testing and certification. Wing and fuselage of first production aircraft mated at Wichita 4 November 1994; first flight scheduled 22 September 1995, five aircraft to be used for aerodynamic, mechanical systems, avionics and function



New Learjet 31A interior, with increased headroom, introduced in mid-1995 from 100th aircraft (N31LR)

1995



Computer-generated image of Learjet 45 eight/10-passenger business jet

1995

and reliability testing leading to FAA certification in December 1996, first deliveries January 1997. Production will total 24 in 1996, 36 in 1997 and 48 in 1998.

CUSTOMERS: More than 100 ordered by June 1995, including four by Singapore Airlines for delivery in fourth quarter of 1997 as crew trainers.

COSTS: $6.095 million (June 1995)

DESIGN FEATURES: Designed to combine docile handling characteristics of 31/31A and 60 with exceptional fuel efficiency and good overall performance, and offer increased maintainability and reliability, new larger fuselage, wing and tail unit, exceptional head and shoulder room, wing carry-through spar recessed beneath floor; latest technology systems. Wing designed with NASA.

STRUCTURE: Computervision CADDS 5 digital design system adopted by Learjet for tail design and Shorts for fuselage, concurrent engineering technique used. Short Brothers of UK manufacture the fuselage and de Havilland of Canada the wings.

LANDING GEAR: Retractable tricycle trailing-link type, for softer and smoother taxying.

POWER PLANT: Two AlliedSignal TFE731-20 turbofans, each flat rated at 15.57 kN (3,500 lb st), target type thrust reversers; FADEC engine control. Total fuel capacity 3,392 litres (896 US gallons; 746 Imp gallons). Engine testing began January 1995 with TFE731-20 installed in one nacelle of Learjet 31A test bed.

ACCOMMODATION: Two pilots plus eight to 10 passengers. Galley and coat closet.

AVIONICS: Honeywell Primus 1000 integrated avionics system.

Comms: Dual Primus II nav/ident radios.

Radar: Primus 650 weather radar standard. Primus 870 advanced weather radar with turbulence detection optional.

Flight: Dual Primus II nav radios. Microwave landing system (MLS) optional. Primus 1000 digital autopilot/flight director standard. Honeywell traffic collision and alert system (TCAS II) optional.

Instrumentation: Primus 1000 with EICAS, dual PFDs and MFDs, flight and navigation information displayed on four 20.3 × 17.8 cm (8 × 7 in) EFIS screens, heart of system is IC-600 integrated avionics computer, which combines EFIS and EICAS processor.

DIMENSIONS, EXTERNAL:

Wing span	13.35 m (43 ft 9½ in)
Length overall	17.89 m (58 ft 8½ in)
Height overall	4.48 m (14 ft 8½ in)

DIMENSIONS, INTERNAL:

Cabin:	
Length: incl flight deck	7.54 m (24 ft 9 in)
excl flight deck	6.02 m (19 ft 9 in)
Max width	1.55 m (5 ft 1 in)
Max height	1.50 m (4 ft 11 in)
Volume, excl flight deck	14.02 m³ (495 cu ft)
Baggage compartment volume	1.42 m³ (50.0 cu ft)

WEIGHTS AND LOADINGS:

Weight empty	5,307 kg (11,700 lb)
Max payload	1,497 kg (3,300 lb)
Max fuel weight	2,721 kg (6,000 lb)
Max T-O weight	8,845 kg (19,500 lb)
Max ramp weight	8,958 kg (19,750 lb)
Max landing weight	8,709 kg (19,200 lb)
Max zero-fuel weight	6,804 kg (15,000 lb)
Max power loading	284.0 kg/kN (2.79 lb/lb st)

PERFORMANCE (estimated, at max T-O weight):

Max cruising speed at 11,275 m (37,000 ft)	464 kts (859 km/h; 534 mph)
Econ cruising speed at 13,715 m (45,000 ft)	407 kts (753 km/h; 468 mph)
Max rate of climb at S/L	975 m (3,200 ft)/min
Service ceiling	13,715 m (45,000 ft)
T-O to 10.7 m (35 ft)	1,280 m (4,200 ft)
Landing from 15 m (50 ft)	911 m (2,990 ft)
Range with four passengers, zero wind, ISA:	
VFR	2,200 n miles (4,074 km; 2,532 miles)
NBAA IFR	1,850 n miles (3,426 km; 2,129 miles)

UPDATED

LEARJET 60

TYPE: Medium-range business jet.

PROGRAMME: Announced 3 October 1990 as Learjet 55C successor; first flight of proof-of-concept aircraft with one PW305 turbofan 18 October 1990; flight testing resumed 13 June 1991 with two PW305s and stretched fuselage (more than 300 hours flown by May 1992); first production aircraft first flight (N601LJ) 15 June 1992; certification awarded 15 January 1993, deliveries started immediately.

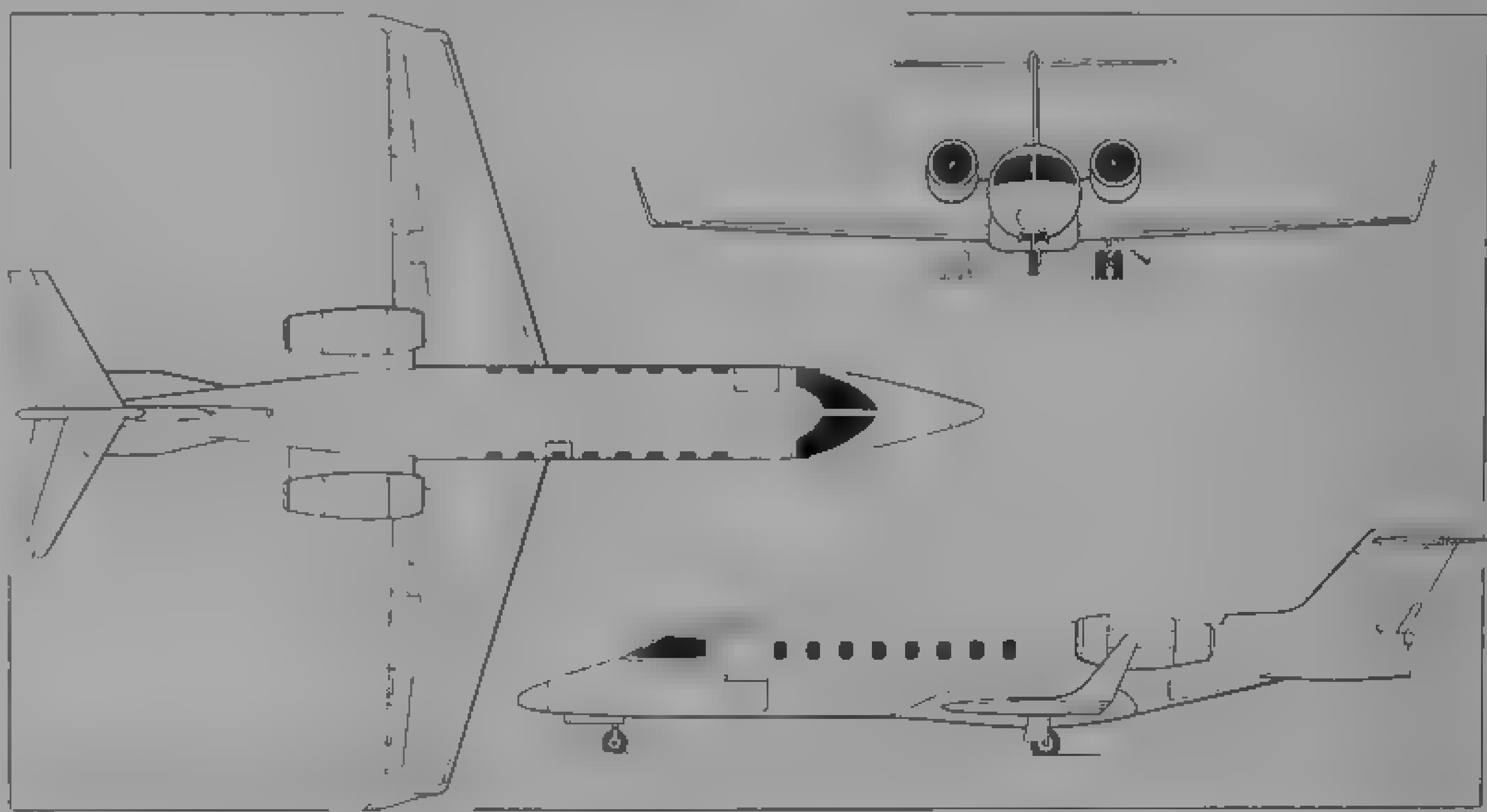
CUSTOMERS: Total 16 delivered in 1993, 22 in 1994; 51 delivered by June 1995 including 11 in first quarter of that year. Customers include the FAA, which has ordered five, with seven options, to be outfitted by E-Systems, Greenville, Texas, Division for flight inspection missions, first delivery 28 June 1995, and the government of Malaysia, which is scheduled to take delivery of a flight inspection aircraft in December 1995.

DESIGN FEATURES: Largest Learjet, P&WC PW305 engines; T tail, winglets, delta fins.

FLYING CONTROLS: Spoilers can be partially extended to adjust descent rates.

POWER PLANT: Two Pratt & Whitney Canada PW305 turbofans with FADEC, each flat rated at 20.46 kN (4,600 lb st) at up to 27°C (80°F). Total fuel capacity 3,560 kg (7,850 lb).

ACCOMMODATION: Two crew and six to nine passengers; gross pressure cabin volume 15.57 m³ (550 cu ft); compared with 55C, main cabin is 0.71 m (2 ft 4 in) longer and rear baggage hold section 0.38 m (1 ft 3 in) longer; full-across aft toilet has flat floor, large mirror, coat closet and external servicing, total 1.67 m³ (59 cu ft) baggage capacity divided between an externally accessible hold (larger than that of Learjet 55C) and internal pressurised, heated compartment



Learjet 45 eight/10-passenger business jet (two AlliedSignal TFE731-20 turbofans) *(Jane's/Dennis Punnett)*

1995

Assembly of first Learjet 45 began at Wichita 4 November 1994

1995

that is accessible in flight, galley cabinet has storage for dinnerware, warming oven, cold liquid dispensers and ice storage, entertainment centre, 10-way adjusting seating is standard

SYSTEMS: Windscreen demisted by electrically heated gold film which also diminishes sun heating in flight and on ground and produces warmth during prolonged flight at high altitude. Full time digital steer by wire nosewheel control operates throughout taxying, take-off and landing

AVIONICS: Standard fully integrated all-digital Collins Pro Line 4

Flight: Four-tube EFIS, dual digital air data computers, dual navigation and communications radios, dual automatic AHRS, Collins AMS-850 avionics management system, advanced Collins autopilot and long-range navaid as standard, circuit breaker and controls panels redistributed as in Learjet 31A

DIMENSIONS, EXTERNAL:

Wing span	13.34 m (43 ft 9 in)
Wing chord: at root	2.74 m (9 ft 0 in)
at tip	1.12 m (3 ft 8 in)
Length: overall	17.88 m (58 ft 8 in)
fuselage	17.02 m (55 ft 10 in)
Height overall	4.47 m (14 ft 8 in)
Tailplane span	4.47 m (14 ft 8 in)
Cabin door: Width	0.64 m (2 ft 1 in)
Height to sill	0.69 m (2 ft 3 in)

DIMENSIONS, INTERNAL:

Cabin: Length, incl flight deck	7.04 m (23 ft 1 in)
Max width	1.80 m (5 ft 10⅞ in)
Max height	1.71 m (5 ft 7½ in)

WEIGHTS AND LOADINGS (A: standard, B: optional):

Weight empty: A, B	6,278 kg (13,840 lb)
Max fuel (usable): A, B	3,560 kg (7,850 lb)
Max T-O weight: A	10,319 kg (22,750 lb)
B	10,478 kg (23,100 lb)
Max ramp weight: A	10,432 kg (23,000 lb)
B	10,591 kg (23,350 lb)
Max landing weight: A, B	8,845 kg (19,500 lb)
Max power loading: A	252.3 kg/kN (2.47 lb/lb st)
B	256.2 kg/kN (2.51 lb/lb st)

PERFORMANCE (estimated at max T-O weight, ISA):

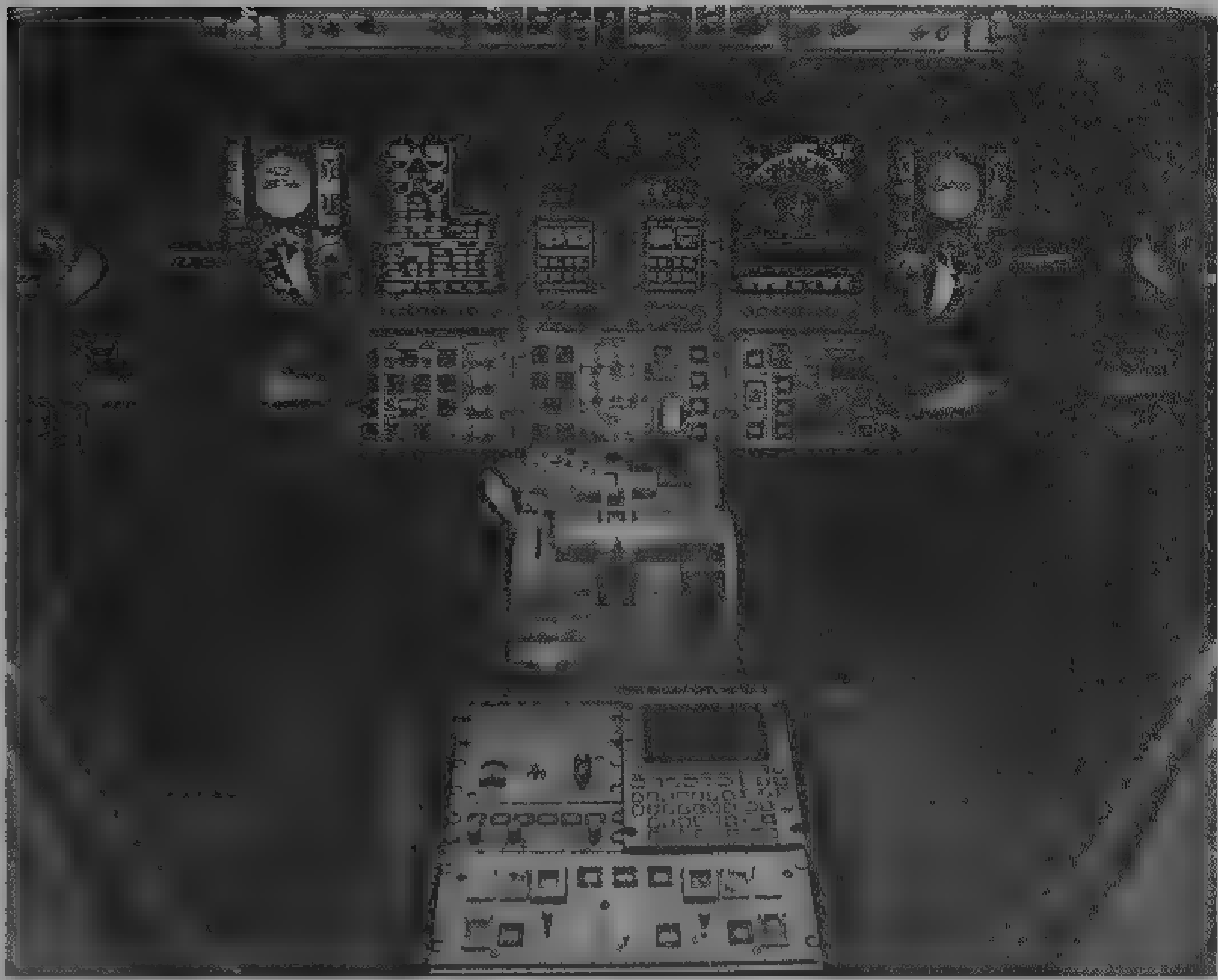
Max cruising speed	463 kts (858 km/h; 533 mph)
Max operating altitude	15,545 m (51,000 ft)
Balanced field length: A	1,582 m (5,190 ft)
B	1,634 m (5,360 ft)

Range with VFR reserves
2,740 n miles (5,074 km; 3,153 miles)

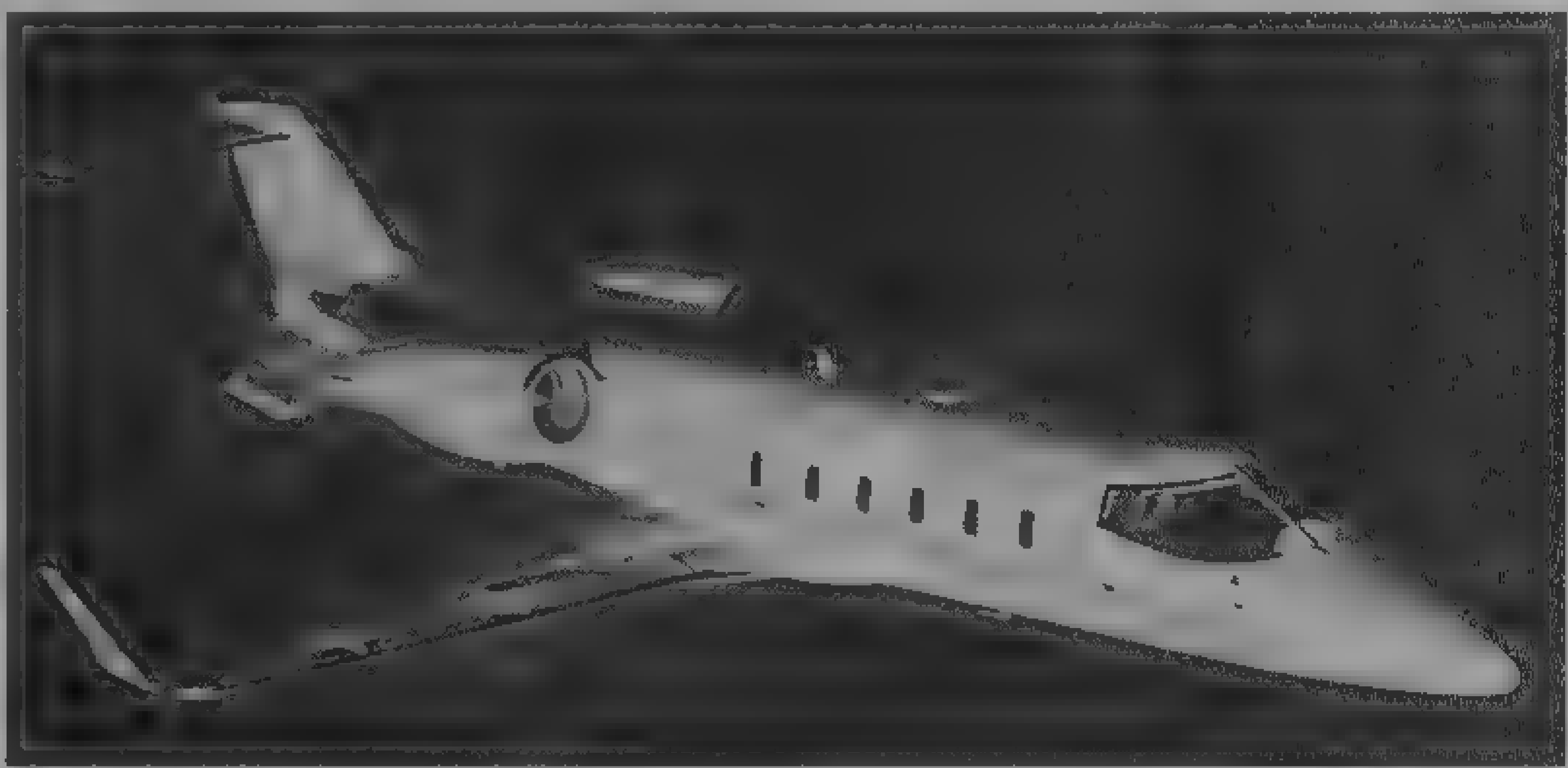
Range with four passengers from runway shorter than 1,494 m (4,900 ft)
2,398 n miles (4,441 km; 2,760 miles)

Range examples:
can fly New York-Los Angeles against 85 per cent Boeing winds with NBAA reserves
can reach either US coast after taking off from Aspen, Colorado, in ISA + 20° with four passengers

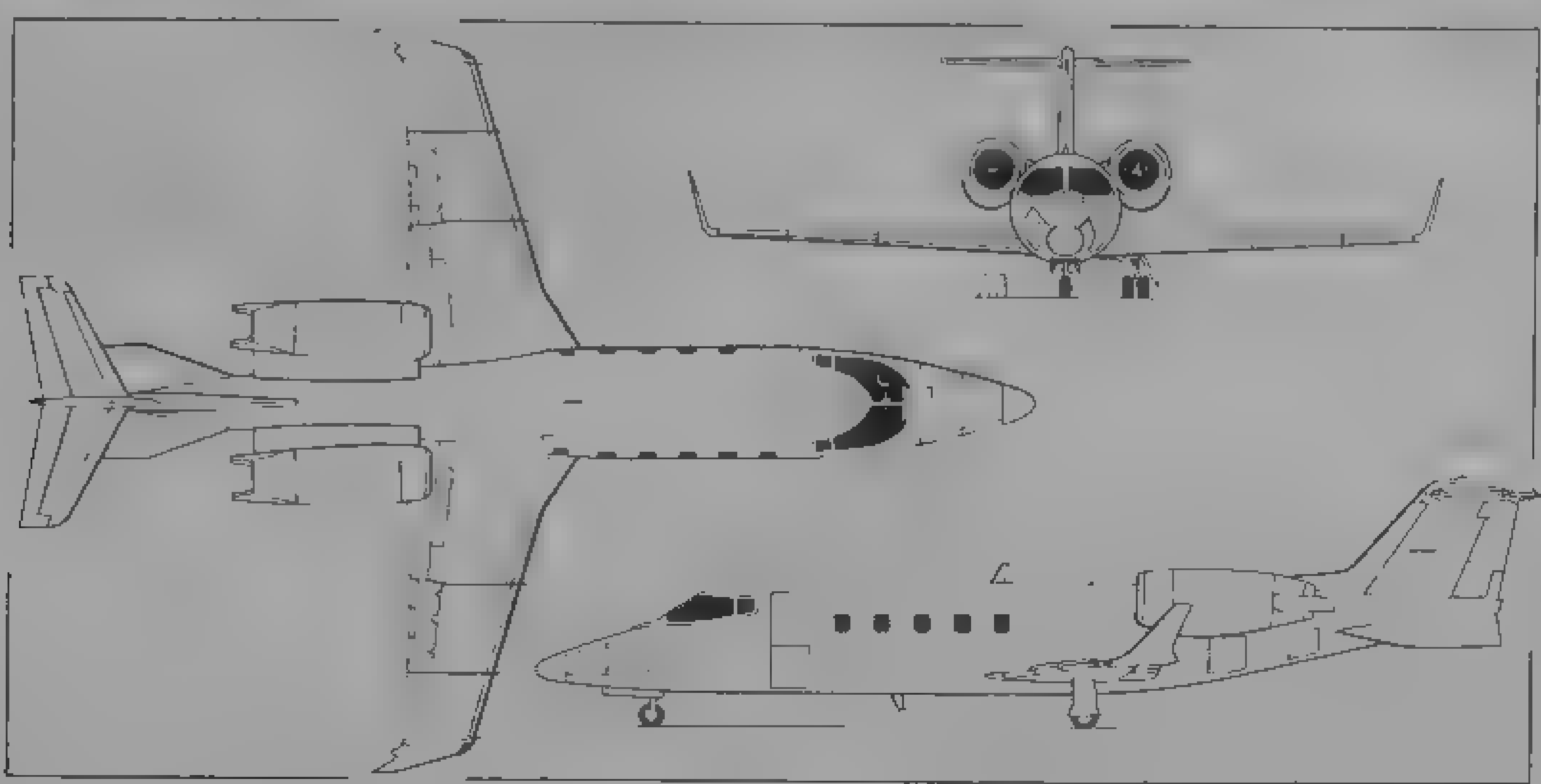
UPDATED



Learjet 45 flight deck with Honeywell Primus 1000 integrated avionics system
1995



Learjet 60 medium range business jet (two P&WC PW305 turbofans)
1995



Learjet 60 business transport
(Jane's/Dennis Punnett)
1991

LIGHTNING BUG

LIGHTNING BUG AIRCRAFT CORPORATION

PO Drawer 40, Sheldon, South Carolina
Telephone: 1 (803) 846 8584/1800

Company is under same ownership as White Lightning Aircraft Corporation (which see)

NEW ENTRY

LB AIRCRAFT LIGHTNING BUG

TYPE: Single-seat high-performance sporting monoplane

CUSTOMERS: Five flying by April 1995. Production rate approximately one kit every three weeks (1995)

COSTS: $20,500 (1995) for kit which includes engine and propeller. $1,000 deposit on ordering

DESIGN FEATURES: Compact, low-wing monoplane; conforms to FAR Pt 23 Utility category at 480 kg (900 lb); Aerobatic category at 363 kg (800 lb). Claimed that basic airframe can be flown after only 300 man-hours of work. Four kits will fit into standard container for shipping

FLYING CONTROLS: Conventional mechanical ailerons, elevator and rudder. Elevator tab for pitch trim, fixed tabs on ailerons and rudder

STRUCTURE: General construction of composites, stainless steel and aluminium 2024-T3 or 7075-T6. Moulded parts use E glass, epoxy resin, PVC foam and Baltek mat

LANDING GEAR: Fixed mainwheels with spats, retractable nosewheel. Same wheels and tyres as Long EZ.

POWER PLANT: One 67.1 kW (90 hp) AMW Cuyuna 745 FI liquid-cooled two-stroke engine, with fuel injection and dual ignition, driving fixed-pitch propeller through reduction gear; variable pitch propeller under investigation. Fuel capacity 87 litres (23 US gallons; 19.2 Imp gallons); grades 100 LL or Mogas.

ACCOMMODATION: Single seat accommodates pilot with maximum weight of 127 kg (280 lb) and maximum height 1.98 m (6 ft 6 in).

SYSTEMS: Electrical system 12 V 30 Ah battery, alternator fit appropriate to engine.

AVIONICS: Customer specified.

DIMENSIONS, EXTERNAL:
Wing span — 5.44 m (17 ft 10 in)
Wing aspect ratio — 7.95
Length overall — 5.32 m (17 ft 5½ in)
Height overall — 1.55 m (5 ft 1 in)
Tailplane span — 1.78 m (5 ft 10 in)
Propeller diameter — 1.37 m (4 ft 6 in)

AREAS:
Wings, gross — 3.72 m² (40.0 sq ft)
Tailplane — 0.77 m² (8.26 sq ft)

WEIGHTS AND LOADINGS:
Weight empty — 215 kg (475 lb)
Max fuel weight — 62.6 kg (138 lb)
Max T-O weight: Utility category — 408 kg (900 lb)
Aerobatic category — 363 kg (800 lb)
Max wing loading — 109.85 kg/m² (22.50 lb/sq ft)
Max power loading — 6.09 kg/kW (10.00 lb/hp)

PERFORMANCE (at max T-O weight, ISA):
Max level speed — 217 kts (402 km/h, 250 mph)
Econ cruising speed at 75% power — 200 kts (370 km/h, 230 mph)
Stalling speed, power off:
flaps up — 74 kts (137 km/h, 86 mph)
flaps down — 54 kts (100 km/h, 62 mph)
Max rate of climb at S/L at 139 kts (257 km/h, 160 mph) — 457 m (1,500 ft)/min
Service ceiling — 6,100 m (20,000 ft)
T-O run — 244 m (800 ft)
Landing run — 305 m (1,000 ft)
Range with max fuel, 75% power — 764 n miles (1,416 km, 880 miles)

NEW ENTRY

LOCKHEED MARTIN

LOCKHEED MARTIN CORPORATION

6801 Rockledge Drive, Bethesda, Maryland 20817
Telephone: 1 (301) 897 6000
Fax: 1 (301) 897 6028
CHAIRMAN AND CEO: Daniel M. Tellep
PRESIDENT: Norman Augustine

Former Lockheed Aircraft Corporation renamed Lockheed Corporation in September 1977. Merger with Martin Marietta announced 30 August 1994 and completed 15 March 1995. Combined corporation is largest defence contractor in USA, with annual sales worth $23 billion. Activities include design and production of aircraft, electronics, satellites, space systems, missiles, ocean systems, information systems, and systems for strategic defence and for command, control, communications and intelligence.

Lockheed Martin Corporation is largest US DoD contractor, largest NASA contractor and largest US DoE contractor, 1995 merger having resulted in emergence of company with 170,000 employees and organised into four major business groups. **Aeronautics Sector** (see next entry); **Information and Technology Services Sector** (comprising Lockheed Martin Management & Data Systems, Lockheed Martin Information Sciences Group, Lockheed Martin Services Group, Lockheed Martin IMS, Lockheed Martin Commercial Products Group, Lockheed Martin Manned Space Systems and Lockheed Martin Space Operations), **Electronics Sector** (comprising Lockheed Martin Armament Systems, Lockheed Martin Communications Systems, Lockheed Martin Control Systems, Lockheed Martin Defense Systems, Lockheed Martin Electronics & Missiles, Lockheed Martin Government Electronic Systems, Lockheed Martin Ocean, Radar & Sensor Systems and Sanders); and **Space and Strategic Missiles Sector** (comprising Lockheed Martin Missiles & Space, Lockheed Martin Astronautics, Lockheed Martin Astro Space and Lockheed Martin Technical Operations). Subsidiary concerns include Lockheed Martin Energy Systems, Lockheed Martin Specialty Components, Lockheed Martin Environmental Systems & Technologies, Lockheed Martin Idaho Technologies, Lockheed Martin Utility Services and Sandia Corporation.

UPDATED

LOCKHEED MARTIN AERONAUTICS SECTOR (LMAS)

6801 Rockledge Drive, Bethesda, Maryland 20817
Telephone: 1 (301) 897 6252
Fax: 1 (301) 897 6252
PRESIDENT: James A. Blackwell Jr
VICE-PRESIDENT, BUSINESS DEVELOPMENT: James F. Maclwel

LMAS includes six operating companies.

Lockheed Martin Aeronautical Systems
Next entry

Lockheed Martin Skunk Works
Follows Aeronautical Systems

Lockheed Martin Tactical Aircraft Systems
Follows Skunk Works

Lockheed Martin Aircraft Services
Follows Tactical Aircraft Systems

Lockheed Martin Logistics Management

Lockheed Martin Aero & Naval Systems

Prior to merger that culminated in creation of Lockheed Martin Aeronautics Sector, Lockheed aircraft manufacturing activity consolidated at Marietta in 1990, with move of P-3 Orion assembly line from Palmdale, established work on C-130 and P-3 programmes, plus F-22 development, continues at Marietta under management of Lockheed Martin Aeronautical Systems. Lockheed Martin Skunk Works retains autonomy at Palmdale within LMAS grouping, which has workforce in excess of 40,000.

UPDATED

LOCKHEED MARTIN AERONAUTICAL SYSTEMS (Division of Lockheed Martin Aeronautics Sector)

86 South Cobb Drive, Marietta, Georgia 30063-0264
Telephone: 1 (404) 494 44..
Telex: 542642 LOCKHEED MARA
PRESIDENT: John S. McLellan
EXECUTIVE DIRECTOR, PUBLIC AFFAIRS: Brian Johnstone

In April 1991, Lockheed won competition to produce F-22 with General Dynamics (now Lockheed Martin Tactical Aircraft Systems) and Boeing Military Airplanes. Lockheed and Vought are studying advanced tactical surveillance aircraft (ATS), based on combining S-3A airframe with electronically scanned array radar in triangular dorsal radome, to replace E-2C; studies into Future Theater Airlifter (FTA) for 21st century tactical transport; company expects to be involved in NASA High-Speed Civil Transport (HSCT) programme.

Other long-term activities at Marietta include production of C-130H and C-130J Hercules. Re-winging of C-5A completed 1987 and new C-5Bs completed March 1989; C-5D offered in 1995 to meet possible USAF requirement; other new work consists of P-3C line, transferred from Burbank, and F-22. Between December 1991 and December 1993 Marietta conducted $20 million concept exploration and development contract for potential A-X (later A/F-X) attack aircraft for US Navy in consortium also including Boeing and General Dynamics. Following cancellation of A/F-X, Lockheed Martin continuing private-venture development VG strike fighter derivative of F-22.

Lockheed Martin working to develop standard avionics suite for future versions (upgrades) of P-3 Orion, S-3 Viking and AEW aircraft, open architecture design for maximum flexibility and system growth, elements include AN/APS-145 radar, GPS and communications/navigation system.

Marietta workforce cut by over 2,000 to 10,500 by end of 1995.

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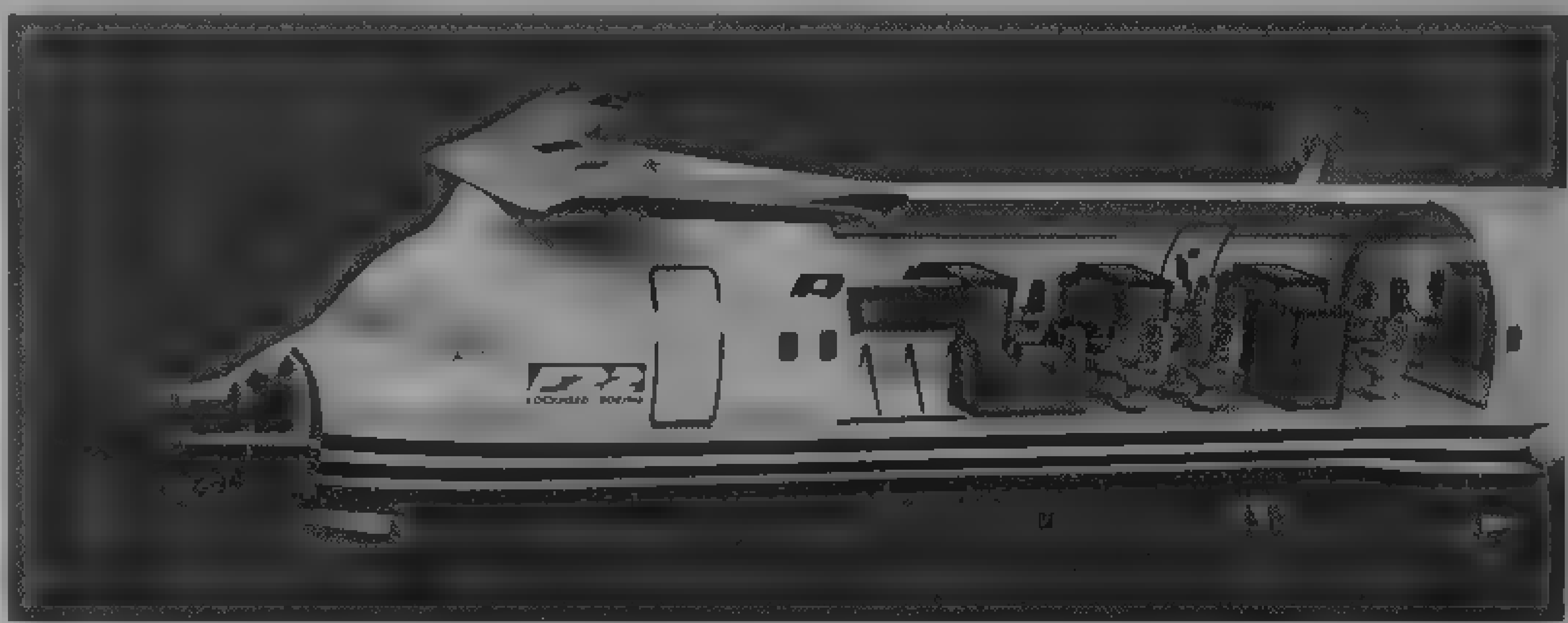


Model of Boeing 757 modified to serve as F-22 Flying Test Bed with nose radar and representative wing section above flight deck

1995

LOCKHEED MARTIN 645

US Air Force designation: F-22

TYPE: US Air Force next generation tactical fighter, formerly known as Advanced Tactical Fighter (ATF) programme.

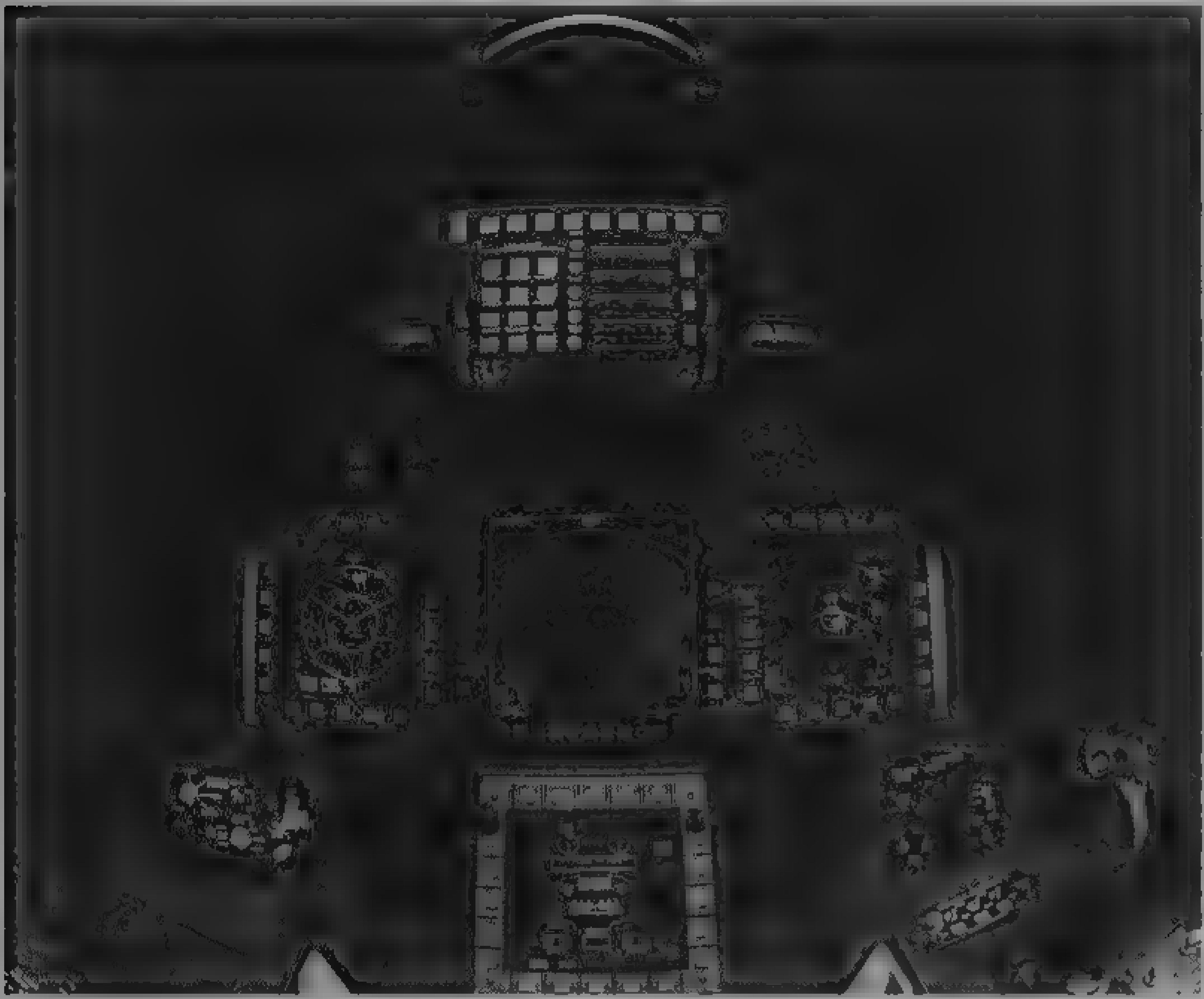
PROGRAMME: US Air Force ATF requirement for 750 (now 442) McDonnell Douglas F-15 Eagle replacements incorporating low observables technology and supercruise (supersonic cruise without afterburning), parallel assessment of two new power plants, request for information issued 1981, concept definition studies awarded September 1983 to Boeing, General Dynamics, Grumman, McDonnell Douglas, Northrop and Rockwell, requests for proposals issued September 1985; submissions received by 28 July 1986. USAF selection announced 31 October 1986 of demonstration/validation phase contractors, Lockheed YF-22 and Northrop YF-23 (see 1991-92 *Jane's*), each produced two prototypes and ground-based avionics testbed; first flights of all four prototypes 1990. Competing engine demonstration/validation programmes launched September 1983, ground testing began 1986-87, flight-capable Pratt & Whitney YF119s and General Electric YF120s ordered early 1988: all four aircraft/engine combinations flown.

Decision of 11 October 1989 extended evaluation phase by six months, draft request for engineering and manufacturing development (EMD) proposals issued April 1990: first artists' impressions released May 1990; final engineering and manufacturing development (EMD) requests issued for both weapon system and engine 1 November 1990; proposals submitted 2 January 1991, F-22 and F119 power plant announced by USAF as winning combination 23 April 1991. EMD contract given 2 August 1991 for 11 (since reduced to nine) flying prototypes (including two tandem-seat F-22Bs), plus one static and one fatigue test airframes, design underwent several detail refinements through early 1990s, immediately previous layout being Configuration 644, first flight mid-1997, some 12 months late, due to three consecutive fiscal year budget cuts, preliminary design review covering all aspects of the design completed 30 April 1993, final assembly will remain at Marietta rather than moving to LMTAS (Lockheed Martin Tactical Aircraft Systems) at Fort Worth, critical design review February 1995, preproduction batch of four aircraft scheduled to be awarded 1997, IOC 2004. Minor design changes for production F-22 announced July 1991; see Design Features, Dimensions and Areas. Suggested name of SuperStar rejected in 1991 and F-22 remains unnamed. Ground attack role added May 1993 (see under Armament).

Lockheed teamed with General Dynamics (Fort Worth) and Boeing Military Airplanes to produce two YF-22 prototypes, civil registrations N22YF (with GE YF120) and N22YX (P&W YF119), USAF serial numbers

87-0700 and 87-0701 assigned, but only 87-0701 applied during second phase of testing, from late 1991. N22YF rolled out at Palmdale 29 August 1990; first flight/ferry to Edwards AFB 29 September 1990 first air refuelling (11th sortie) 26 October 1990; thrust vectoring in flight 15 November 1990; anti-spin parachute for high angle of attack tests on 34th to 43rd sorties, flight testing temporarily suspended 28 December 1990; 43 sorties/52 hours 48 minutes. N22YX first flight Palmdale-Edwards 30 October 1990, AIM-9M Sidewinder (28 November 1990) and AIM-120A AMRAAM (20 December 1990) launch demonstrations; achieved Mach 1 8 on 26 December 1990; temporarily grounded after 31 sorties/38 hours 48 minutes, 28 December 1990. Flight test demonstrations included 100°/s roll rate at 120 knots (222 km/h, 138 mph) and supercruise flight in excess of Mach 1 58 without afterburner

Second (F119-powered) YF-22 taken by road to Palmdale mid-1991, fitted with strain gauges, began further 100 hour test programme 30 October 1991, gathered data on aerodynamic loads, flight control aerodynamic effects, vibration/acoustic fatigue and maximum coefficient of lift, flown by 6511th Test Squadron (F-22 Combined Test Force) of 6510th Test Wing at Edwards AFB, non-fatal crash landing at Edwards 25 April 1992, following pilot induced oscillations, total 100 hours 24 minutes in 70 flights since October 1990, non flyable, but repaired for use as antenna testbed at Rome Air Development Center Griffiss AFB, New York



F-22 cockpit concept demonstrator at Marietta

1995

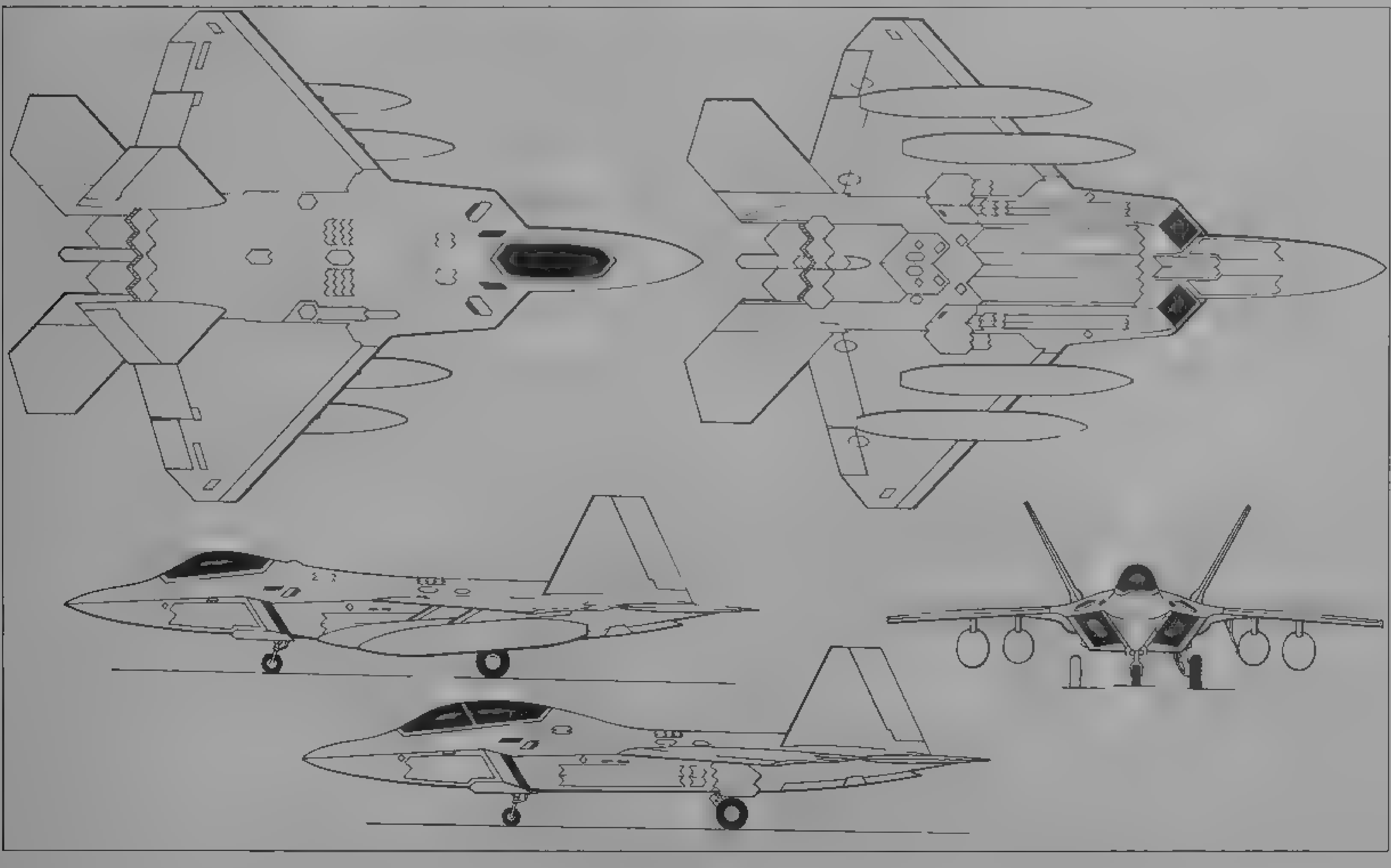
Combat roles reassessment of early 1993 added air-to-ground attack with precision guided munitions (PGMs) to F 22's roles Under $6 5 million contract addition on 25 May 1993, weapon bay and avionics to be adapted for delivery of AIM-9X missile and 454 kg (1,000 lb) Joint Direct Attack Munition (JDAM), two JDAMs will replace two AIM 120A AMRAAMs in main weapon bay, required provision for two AGM 137A Tri Service Standoff Attack Missiles (TSSAM) on underwing pylons later cancelled, as was TSSAM programme. Decision of April 1995 permitted 3 per cent weight increase as consequence of Critical Design Review completed two months previously, new limit is 14,365 kg (31,670 lb) including uncertainty allowance of 227 kg (500 lb)

Lockheed responsible for project control and systems integration, workload shared equally between three partners during dem/val phase, EMD and production plan calls for Lockheed Martin Aeronautical Systems to construct forward fuselage and components, including cockpit, with avionics architecture and functional design, displays, controls, air data system, apertures, edges, tail assembly, landing gear, environmental control system and final assembly Boeing responsible for wings, fuselage aft sections, powerplant installation, auxiliary power generation system radar, infra-red search and track system (if fitted in production aircraft) and avionics ground prototype

Avionics flight tested in a modified Boeing 757 (N757A) (first flight 17 July 1989) Follow-on modifications to 757 will involve mounting representative F 22 wing section above forward fuselage to test conformal antennae plus radar in F-22-type nosecone. Boeing providing supporting simulators and training systems. LMTAS responsible for mid-fuselage and key systems including electrical, hydraulic, fuel, flight controls and armament also integrated electronic warfare system (INEWS), integrated communications/navigation/identification avionics (CNI) and INS subsystems Acquisition of former General Dynamics gave Lockheed Martin control of 67 5 per cent of programme; this involves 650 suppliers in 42 US states

EMD aircraft (c/n 4001) first flight planned Summer 1997; low-rate production decision in August 1998; first production delivery August 2000; high-rate production decision due March 2002

CURRENT VERSIONS (specific): Test programme to begin with first flight of initial EMD aircraft in May 1997, will subsequently extend over five years, involving total of nine EMD aircraft, plus two non-flying static and fatigue test articles and four preproduction verification (PPV) F-22s In excess of 2,900 test flights and approximately 5 500 hours expected to be accumulated at Edwards AFB Flight Test Center



Production (Configuration 645) Lockheed Martin F-22A with additional side view of two-seat F-22B
(Jane's/James Goulding)

1995

Clear division of test assignments will result in four aircraft being allocated to airframe structure evaluations, with remaining five concentrating on avionics test taskings. Use of separate instrumentation configurations for airframe and avionics-dedicated test articles provides back-up for almost every F-22 aircraft and offers potential to switch missions between test fleet if necessary. Specific tasks allocated to EMD aircraft currently anticipated to be as follows

Aircraft **4001** Initial flight set for May 1997 at Lockheed Martin's Marietta, Georgia facility. Transfer to Edwards likely after completion of about six sorties, with subsequent role being evaluation of flying qualities, flutter and loads characteristics

Aircraft **4002**: Maiden flight due late 1997 or early 1998. Tasks to include performance assessment plus stores separation and jettison as well as some electronic warfare and infra-red signature evaluations

Aircraft **4003**: Expected to enter flight test approximately 16 months after initial example (late in third quarter of 1998). Earmarked for loads testing plus crosswind landings, validation of arrester hook and weapons bay environment work

Aircraft **4004** Due to begin flight test in about April 1999. Allocated to avionics development, but also to be used for low observables evaluation including radar cross-section and infra-red signature assessments

Aircraft **4005**: Avionics development tasks, from mid-1999

Aircraft **4006**. Avionics development tasks, from about fourth quarter of 1999

Aircraft **4007**: First two-seat F-22B, with flight trials due to begin early 2000. Initial objectives are clearance of two-seat airframe configuration, embracing structural load assessment. Will subsequently be allocated to avionics development.

Aircraft **4008**: To join test effort about Spring 2000. Allocated to avionics development tasks and also destined to validate F-22 observability specification data

Aircraft **4009**: Second F-22B, due to fly about mid-2000. Avionics development and observability trials

PPV F-22A aircraft numbers **4010** to **4013** will be responsible for majority of military utility test tasks, including one allocated to hot and cold trials using climatic laboratory at Eglin AFB, Florida

CURRENT VERSIONS (general) **F-22A/B**: Single/two-seat production versions for USAF

NATF Projected US Navy variant to replace Grumman F-14 Tomcat, development abandoned

CUSTOMERS: US Air Force two YF-22 demonstrators planned 11 EMD aircraft reduced to nine (including two tandem-seat), plus one static and one fatigue test airframes in January 1993; original 648 production aircraft programme reduced to 442 in January 1994, latter to be funded from 1997, beginning with four preproduction verification (PPV) aircraft, followed by series production of 438, final delivery in 2011

F-22 PLANNED PROCUREMENT

FY	Lot	F-22A	F-22B	Total
91	EMD	7	2	9
97	PPV	4	0	4
98	1	4	0	4
99	2	10	2	12
00	3	22	2	24
01	4	30	6	36
02	5	42	6	48
03	6	42	6	48
04	7	42	6	48
05	8	42	6	48
06	9	42	6	48
07	10	42	6	48
08	11	42	6	48
09	12	20	6	26
Total		**391**	**60**	**451**

COSTS: $818 million contracts to both ATF teams, October 1986, for 54 month studies, each airframe team investing own funds (Lockheed/Boeing/GD team investment totalled $675 million), each engine contractor, about $50 million, total $3,800 million spent by USAF on both ATFs up to April 1991; programme cost for 648 aircraft was $13,000 million for development (1991 base year) and $52,500 million for production (1994 then year), programme acquisition cost $162 million (1994), fly-away cost $61.2 million at 1991 prices. EMD contract, August 1991, comprised $9,550 million for 11 (subsequently nine) airframes, plus $1,375 million to P&W for 33 (later amended to 27) engines. FY94 US Congressional appropriation of $2,100 million was $163 million below expectations, resulting in slippage of critical design review and first flight. Similarly, FY95 appropriation of $2,300 million was $100 million below expected figure, leading to further delay in maiden flight and on 9 December 1994, Defense Secretary William Perry announced 10 per cent cut (approximately $210 million) in FY96 budget for F-22 programme

Lockheed Martin YF-22 prototype during trials

1995

DESIGN FEATURES (F-22) Low observables configuration and construction; stealth/agility trade-off decided by design team; target thrust/weight ratio 1.4 (achieved ratio possibly 1.1 at T-O weight), greatly improved reliability and maintainability for high sortie-generation rates, including under 20 minute combat turnround time; enhanced survivability through 'first-look first-kill' capability; short T-O and landing distances; supersonic cruise and manoeuvring (supercruise) in region of Mach 1.5 without afterburning, internal weapons storage and generous internal fuel, conformal sensors

Wing and horizontal tail leading-edge sweep 42° (both 48° on YF-22), trailing-edge 17° forward, increased to 42° outboard of ailerons (straight trailing-edge on YF-22); all-moving five-edged horizontal tail (four-edged elements on YF-22). Vertical tail surfaces (18 per cent larger on YF-22) canted outwards at 28°; leading- and trailing-edge sweep 22.9°, biconvex aerofoil. F-22's wing and stabilator areas same as YF-22, despite re-profiling. F-22 wing taper ratio 0.169, leading-edge anhedral 3.25°; root twist 0.5°, tip twist –3.1°, thickness/chord ratio 5.92 at root, 4.29 at tip, custom-designed aerofoil. Horizontal tails have no dihedral or twist

Sidewinder AAMs stored internally in sides of intake ducts, with AMRAAMs, Sidewinders or JDAM 1000 precision guided munitions in ventral weapons bay. Diamond-shaped cheek air intakes with highly contoured air ducts, intakes approximately 0.46 m (1 ft 6 in) farther forward on YF-22, single-axis thrust vectoring included on PW119, but specified performance achievable without

Additional production F-22 changes from YF-22 include decreased wingroot thickness, modified camber and twist (increasing anhedral), all 48° plan angles changed to 42°; blunter nose, wheelbase reduced by approximately 0.46 m (1 ft 6 in); wheel track reduced by same; revised undercarriage legs and doors; constant chord ailerons, re-profiled cockpit canopy; dorsal airbrake deleted

FLYING CONTROLS Triplex, digital, fly-by-wire system with sidestick control, using line-replaceable electronic modules to enhance maintainability, thrust vectoring utilised to augment aerodynamic pitch control power and provide firm control even at low speeds and high angles of attack. Technology and control concepts demonstrated throughout the flight envelope during Prototype Air Vehicle test programme, including flight at AoA greater than 60°, wind tunnel testing with models of production aircraft successfully attained AoAs greater than 85°

Ailerons and flaperons occupy almost entire wing trailing-edge; full-span leading-edge flaps, conventional rudders in vertical tail surfaces; slab taileron surfaces, air brake not included (differential rudder for speed control) sidestick controller. Control surface authorities: leading-edge flaperons 3° up/35° down (5°/37° overtravel), trailing-edge flaperons 20° up/40° down; aileron ±20°, horizontal tail 30° up/25° down, rudder ±30°, speedbrake (rudder) 30° out

STRUCTURE Largely metal (aluminium/titanium/steel 33/24/5 per cent) in prototypes. Extensive use of thermoset and thermoplastic composite structures; combined total of between 27 and 28 per cent in production aircraft

LANDING GEAR Menasco retractable tricycle type, stressed for no-flare landings of up to 3.05 m (10 ft)/s. Nosewheel tyre 23.5 × 7.5-10; mainwheel tyres 37 × 11.5-18

POWER PLANT: Two 155 kN (35,000 lb st) class Pratt & Whitney F119-PW-100 advanced technology reheated engines reportedly developed from F100 turbofan. Two-dimensional convergent/divergent exhaust nozzles with thrust vectoring for enhanced performance and manoeuvrability

ACCOMMODATION Pilot only on zero/zero modified ACES II ejection seat and wearing tactical life support system with improved g-suits and pressure breathing. Pilot's view over nose is –15°

SYSTEMS. Include Normalair-Garrett OBOGS, AlliedSignal APU and Smiths 270 V DC electrical distribution system

AVIONICS. Final integration, as well as integration of entire suite with non-avionics systems, undertaken at F-22 Avionics Integration Laboratory, Seattle, Washington, airborne integration supported by Boeing 757 flying testbed

Radar Westinghouse/Texas Instruments AN/APG-77 radar (air-to-air and navigation)

Flight: TRW communications-navigation-identification subsystem, Litton inertial reference system

Instrumentation Fused situational awareness information is displayed to pilot via four Sanders/Kaiser colour liquid crystal multifunction displays (MFD); MFD bezel buttons provide pilot format control

Mission: Hughes common integrated processor (CIP); CIP also contains mission software that uses tailorable mission planning data for sensor emitter management and multisensor fusion, mission-specific information delivered to system through Fairchild data transfer equipment that also contains mass storage for default data and air vehicle operational flight programme, stores management system. General purpose processing capacity of CIP is rated at more than 700 million instructions per second (Mips) with growth to 2,000 Mips, signal processing capacity greater than 20 billion operations per second (Bops) with expansion capability to 50 Bops; CIP contains more than 300 Mbytes of memory with growth potential to 650 Mbytes

Self-defence. Sanders/General Electric AN/ALR-94 electronic warfare (RF warning and countermeasures) subsystem

ARMAMENT. Internal long-barrel M61A2 20 mm cannon with hinged muzzle cover and 480-round magazine capacity (production F-22). Three internal bays (see Design Features) for AIM-9 Sidewinder (one in each side bay) and/or four AIM-120A or six AIM-120C AMRAAM AAMs and/or JDAM 1000 PGMs on hydraulic weapon racks in main weapons bay. Four underwing stores stations at 317 mm (125 in) and 442 mm (174 in) from centreline of fuselage capable of carrying 2,268 kg (5,000 lb) each

DIMENSIONS, EXTERNAL:

Wing span: YF-22	13.11 m (43 ft 0 in)
F-22	13.56 m (44 ft 6 in)
Wing chord	
at root (theoretical)	9.85 m (32 ft 3¾ in)
at tip (reference)	1.66 m (5 ft 5½ in)
at tip (actual)	1.14 m (3 ft 9 in)
Wing aspect ratio: YF-22	2.20
F-22	2.36
Length overall YF-22	19.56 m (64 ft 2 in)
F-22	18.92 m (62 ft 1 in)
Height overall YF-22	5.36 m (17 ft 7 in)
F-22	5.00 m (16 ft 5 in)
Tail span: horizontal surfaces	8.84 m (29 ft 0 in)
vertical surfaces	5.97 m (19 ft 7 in)

Wheelbase	6.04 m (19 ft 9¾ in)
Weapon bay ground clearance	0.94 m (3 ft 1 in)
AREAS:	
Wings, gross: YF-22 and F-22	78.0 m² (840.0 sq ft)
Leading-edge flaps (total)	4.76 m² (51.2 sq ft)
Flaperons (total)	5.10 m² (55.0 sq ft)
Ailerons (total)	1.98 m² (21.4 sq ft)
Vertical tails (total): YF-22	20.25 m² (218.0 sq ft)
F-22	16.54 m² (178.0 sq ft)
Rudders/speedbrakes (total): F-22	5.09 m² (54.8 sq ft)
Stabilators (total):	
YF-22 and F-22	12.63 m² (136.0 sq ft)
WEIGHTS AND LOADINGS (estimated):	
Weight empty: YF-22	over 13,608 kg (30,000 lb)
F-22, target	14,365 kg (31,670 lb)
Max T-O weight: F-22	almost 27,216 kg (60,000 lb)
PERFORMANCE (YF-22, demonstrated):	
Max level speed: supercruise	Mach 1.58
with afterburning	Mach 1.7 at 9,150 m (30,000 ft)
Ceiling	15,240 m (50,000 ft)
g limit	+7.9
PERFORMANCE (F-22A, design target, estimated):	
Max level speed at S/L	800 kts (1,482 km/h, 921 mph)
g limit	+9

UPDATED

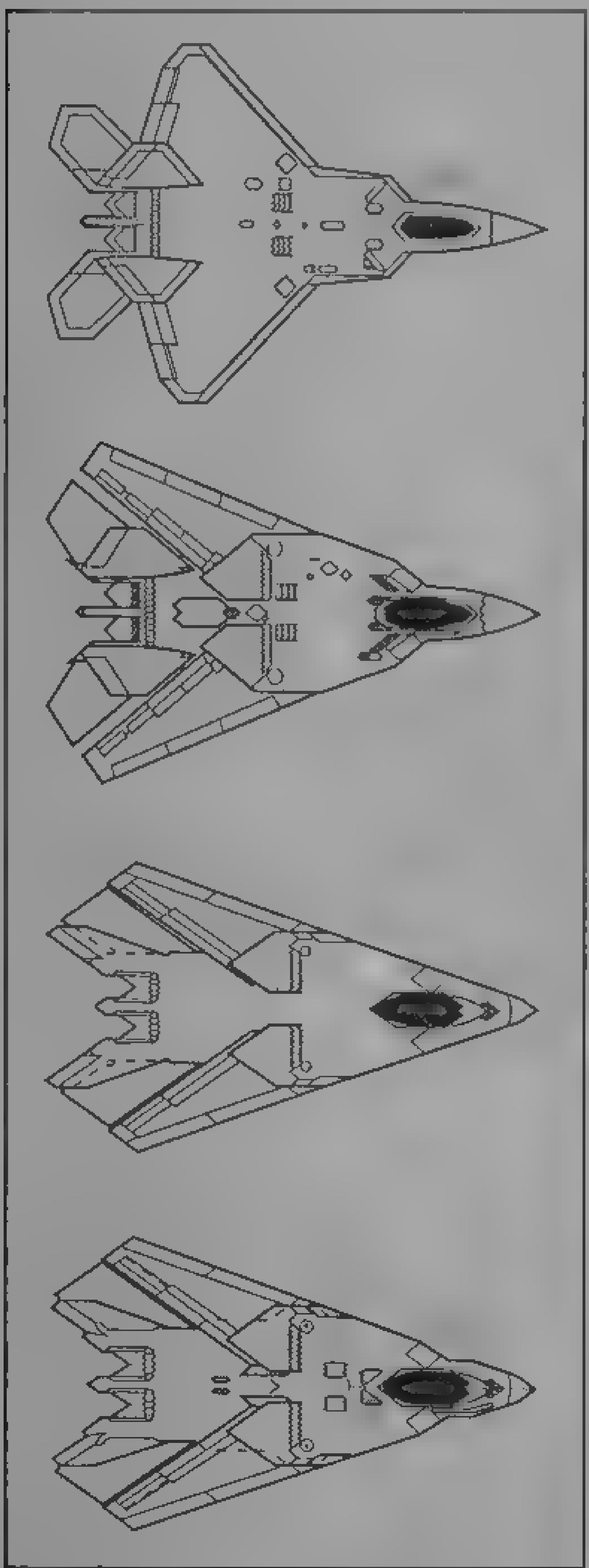
Lockheed Martin YF-22 prototype showing thrust-vectoring nozzles

1994

LOCKHEED MARTIN/BOEING/P&W F-22 NAVAL VARIANT ('A/F-22X')

TYPE: Two-seat naval strike/attack fighter.

PROGRAMME: Private venture by Lockheed ASC/Boeing/Lockheed Fort Worth, derived from F-22/NATF/AF-X contracts. NATF and AF-X cancelled and Lockheed's concept exploration and development contract (in parallel with six rival companies and consortia) expired on 17 December 1993; Lockheed further refined design to A/F-22X as possible Grumman A-6 Intruder replacement; to await USN decision on follow-on to A/F-X.



Derivation of Lockheed's 'A/F-22X' (bottom) from F-22A (top) via NATF/A and A-X (A/F-X)

1994

DESIGN FEATURES: Incorporates variable geometry and thrust vectoring, similar in size to Grumman F-14 Tomcat; folded size slightly larger than McDonnell Douglas F/A-18 Hornet; low-observables concept with four internal weapons bays. Almost 20 per cent parts commonality with F-22; 50 per cent technology commonality. Leading-edge sweepback 16° (fully forward) to 71° (fully swept); oversweep for carrier stowage, 77°; horizontal tail sweepback, 55°; vertical tail sweepback, 60°; vertical tails divergence, 60°.

POWER PLANT: Two 112.5 kN (25,300 lb st) Pratt & Whitney PW7000 turbofans (developed from F-22's F119) with thrust vectoring.

ARMAMENT: Internal stowage for weapons up to size of McDonnell Douglas AGM-84 Harpoon anti-ship missile.

DIMENSIONS, EXTERNAL:	
Wing span: fully forward	20.62 m (67 ft 8 in)
fully swept	11.33 m (37 ft 2 in)
Length overall	18.80 m (61 ft 8 in)
Height overall	4.52 m (14 ft 10 in)

UPDATED

LOCKHEED MARTIN/AERMACCHI/ROLLS-ROYCE L839 T-BIRD II

TYPE: Jet primary trainer (unsuccessful JPATS candidate); modified Aermacchi MB 339A.

PROGRAMME: Lockheed received MB 339A as demonstrator May 1992, cylindrical wingtip fuel tanks as on MB-339C and small wing fences added, engine hushkit being developed by Aermacchi and Rolls-Royce, negligible performance difference between T-Bird II and MB-339A with Viper 680-582 engine and hushkit fitted; Martin-Baker Mk 16L zero/zero seats; Textron Aerostructures selected as manufacturing partner, mid-1993. Completed joint USAF/USN evaluation in September 1994. Further details in Aermacchi entry in Italian section.

UPDATED

LOCKHEED MARTIN 185/285/685/785 ORION

US Navy designation: P-3

Canadian Forces designations: CP-140 Aurora/CP-140A Arcturus

TYPE: Land-based maritime patrol and ASW aircraft.

PROGRAMME: Lockheed won competition for off-the-shelf ASW aircraft 1958; first flight aerodynamic prototype 19 August 1958; first flight fully equipped YP-3A (YP3V-1) 25 November 1959; details of initial production P-3A and WP-3A in 1978-79 *Jane's*, details of P-3B and EP-3B in 1983-84 *Jane's*. P-3C produced from 1969. P-3A/B are Model 185, P-3C is Model 285. Total 641 P-3s built in

Artist's impression of 'A/F-22X' proposal

1994

Lockheed Martin/Aermacchi MB-339 evaluated in JPATS competition

1995

Grey camouflaged Lockheed Martin P-3C-IIIR of Jacksonville based VP-5 *(Paul Jackson)*

1995

California (Burbank, then Palmdale), last delivered (to Canada) May 1991, production line reopened at Marietta, Georgia, August 1991, first P-3C from Marietta (for Korea) rolled out 28 June 1994, first flight October 1994, delivery March 1995. Following cancellation of P-7, USN, Germany, UK and others considering upgraded Orion.

In near term, USN to implement Anti-Surface Warfare Improvement Program (AIP) to enhance operational capability. Loral Electronic Systems prime contractor for $115 million project and will supply information processing and display system with upgrade package including fleet-wide standardisation on Texas Instruments APS-137 radar and addition of synthetic-aperture ground imaging capability. Improved Loral AN/ALR-66 ESM also to be fitted, plus long-range electro-optical sensor and compatibility with Hughes AGM-65D Maverick ASM. Lockheed Martin Aircraft Services responsible for aircraft integration.

Structural life enhancement of older Orions addressed by USN's Sustained Readiness Program (SRP), won by E-Systems/Northrop Grumman team which was awarded initial $203 million contract covering 68 P-3Cs in late 1994. Lockheed also to update radio fit under Communications Improvement Program (CIP). Previously announced USN intent to retain 247 P-3Cs until 2015 evidently threatened by reductions expected to result in front-line force of eight squadrons with 12 aircraft each, plus slightly smaller Reserve component.

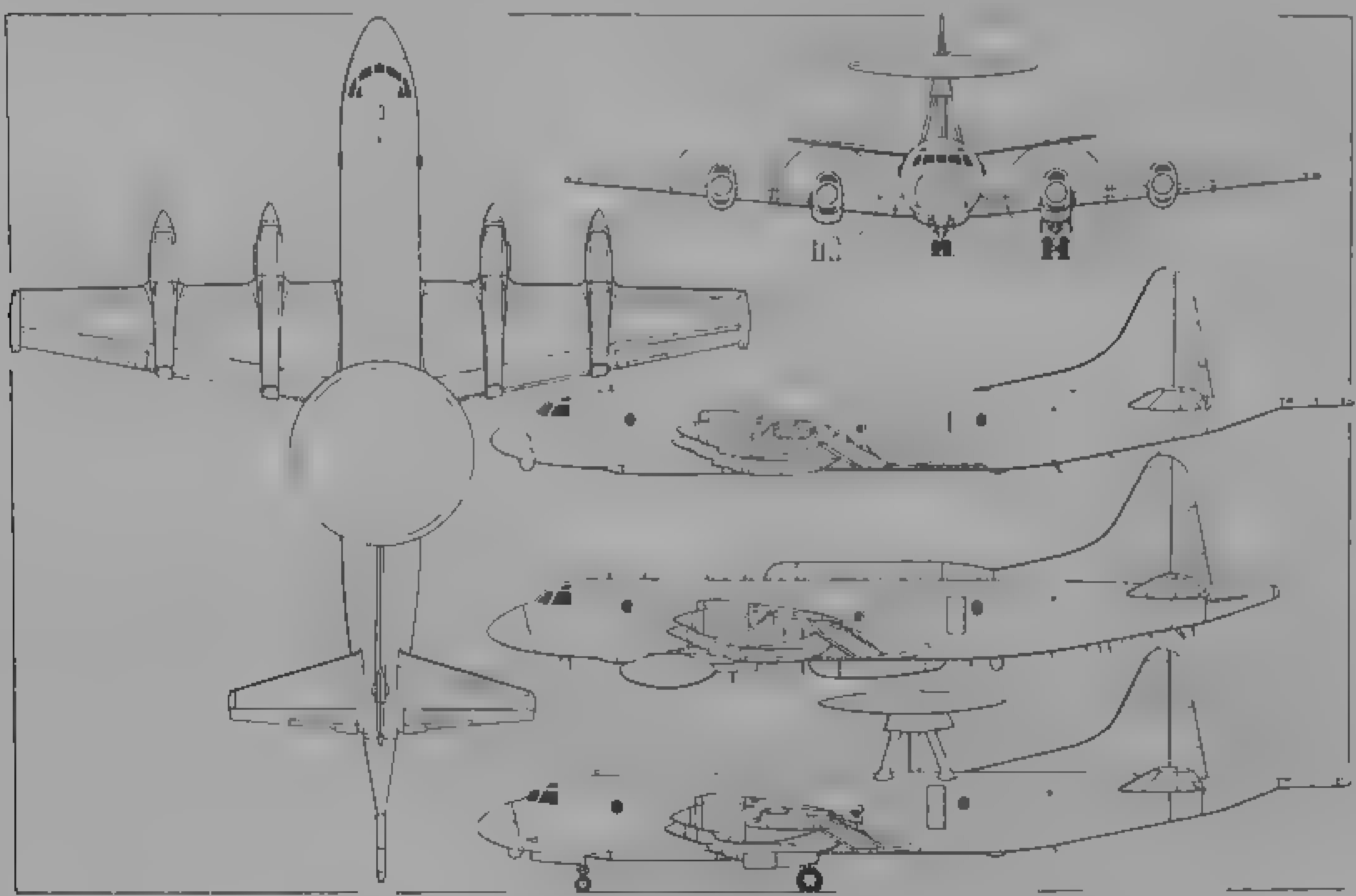
Production of new Orions (temporarily) ends in 1995, following final Korean aircraft. In longer term, Lockheed offering upgraded Orion 2000 (see below) to UK as Nimrod replacement for RAF; interest also from US Navy, sales prospects in Middle East and Pacific Rim.

CURRENT VERSIONS: **P-3C**: First flight 18 September 1968, in service 1969, introduced A-NEW system based on Univac computer integrating all ASW information for retrieval, display and transmission of tactical data without routine log-keeping. USN received 118 of P-3C Baseline variant.

P-3C Update I: (Model 285A, Baseline P-3Cs followed from January 1975 by 31 P-3C Update I; new avionics and software included magnetic drum to increase computer memory sevenfold, new versatile computer language, Omega navigation, improved directional acoustic frequency analysis and recording (DIFAR) processing sensitivity, AN/ASA-66 tactical displays for two sensor stations, and improved magnetic tape transport.

Update II: (Model 285A) Applied to 45 aircraft built from August 1977; added infra-red detection system (IRDS) and sonobuoy reference system (SRS), Harpoon missile system incorporated from August 1977. Further 36 USN P-3Cs as interim **Update II.5** of 1981 including more reliable navigation and communication systems, IACS submarine communications link, MAD compensation group adaptor; standardised wing pylons; and improved fuel tank vents.

Update III: (Model 285G for USN) Deliveries started May 1984, applied to last 36 USN P-3Cs, includes new IBM Proteus acoustic processor (doubling sonobuoy handling capacity), new sonobuoy receiver replacing DIFAR, improved APU, and higher capacity environmental control system. Baseline P-3C to III retrofit kit first installed in P-3C of VP-31 in 1987 (new designation **IIIR**), fitting of 18 more kits started June 1987; USN planned force of 138 Update III/IIIR aircraft, following cancellation of Update IV, further 109 may be added, giving standard fleet of 247 P-3Cs by 2006. Pakistan Orions, basically Update IIIs, have certain systems replaced by export-standard equipment and thus known as **II.75** versions. *Detailed description applies to P-3C/Update III except where indicated.*



Lockheed P-3 AEW&C, with added side views of EP-3E Aries II (centre) and P-3C Orion (top) *(Jane's/Dennis Punnett)*

1993

Update IV: Programme cancelled by US Navy on 14 October 1992, but was in full-scale development by Boeing Defense and Space Group for installation from early 1990s; prototype conversion (160292) flew December 1991; equipment stripped out and prototype returned to normal use, originally intended for P-7A LRAACA, all 109 P-3C Update I, II and II.5 were to be retrofitted.

Outlaw Hunter/OASIS: Single P-3C (159507) of VP-19 modified for 1991 Gulf War by USN and Tiburon Systems under Outlaw Hunter programme as over-the-horizon (OTH) targeting platform with ability to maintain battle area overall plot for battle group commanders. Two further P-3Cs (157329, 161011), designated OASIS I and II (OTH Airborne Sensor Information System) modified for joint operation.

AP-3C: Upgrade of Australian P-3C/Ws, involving 18 aircraft to be refurbished with new radar, com/nav systems plus new acoustic processor and data management system. Joint US/Australian venture with E-Systems of Dallas, Texas as prime contractor, handling development, engineering, prototype and test phases. Aerospace Technologies to modify remaining 17 Orions at Avalon and also responsible for logistics support management. AWA Defence Industries to lead development of integration and test and training centre in Australia and also develop operational mission simulator software. Honeywell to undertake navigation system upgrades, cockpit modifications and weapon systems maintenance training. First modified aircraft due for return to RAAF in late 1997 and last in 2000.

NP-3C: Proposed Kawasaki built calibration aircraft, cancelled when role transferred to UP-3C.

UP-3C: Kawasaki built service trials and training aircraft; one for JMSDF funded FY91, first flight (9151) late 1994.

UP-3D: Kawasaki ECM trainer for JMSDF, two ordered from FY94 and FY95 funds.

EP-3: Elint version of P-3C developed by Kawasaki (which see) for JMSDF (first flight October 1990), two aircraft (9171-9172) ordered FY87 and FY88, delivered March and November 1991. Further two ordered FY93 and FY95 from JMSDF requirement for five.

EP-3E Aries II: Ten P-3As and two EP-3Bs converted to EP-3E Aries I or similar 'Deepwell' (seven) and 'Batrack' (EP-3Bs) standards; radars in large canoe-shaped fairings above and below fuselage and ventral radome forward of wing, avionics believed to include GTE-Sylvania AN/ALR-60 communications intercept and analysis system, Raytheon AN/ALQ-76 noise jamming pod, Loral AN/ALQ-78 automatic ESM system, Magnavox AN/ALQ-108 IFF jammer, Sanders AN/ALR-132 infra-red jammer, ARGO Systems AN/ALR-52 instantaneous frequency measuring equipment, Texas Instruments AN/APS-115 frequency agile search radar, Hughes AN/AAR-37 infra-red detector, Loral AN/ASA-66 tactical display, Cardion AN/ASA-69 scan converter and Honeywell AN/ASQ-114 computer.

Twelve low-houred P-3Cs selected to replace EP-3E Aries I with USN special reconnaissance squadrons VQ-1 at Agana NAS, Guam, and VQ-2 at Rota, Spain, equipment transferred from original EP-3E but moderate upgrade includes faster processing and standardisation of previous two configurations within Aries I and addition to wingtips of IBM AN/ALR-76 ESM/RWR in pods, first Aries II conversion (156507) completed November 1988, to Patuxent River test centre 21 July 1990; first delivery (157320) to VQ-2 29 June 1991, initial five conversions by Lockheed Aircraft Service Company (now LMAS,

Two 'Slicks' and a 'Dome'— P-3A(CS) and P-3 AEW&C, respectively — of the US Customs Service

1993

Aeromod Center at Greenville, South Carolina, but contract then reassigned to Naval Air Depot, Alameda, 31 July 1991 before being suspended in October 1992 with seven conversions incomplete

CP 140A Arcturus: Three P-3s for Canadian Forces, no ASW equipment, for environmental and fishery patrol replacing CP-121 Trackers; equipment includes Texas Instruments AN/APS-134 Plus radar, Honeywell AN/APN-194 RAWS, Bendix/King AN/ASW 502 AFCS, Canadian Marconi AN/APN 510 Doppler radar, Litton LN 33 INS and a Leigh AN/ASH-502 flight recorder Delivered to IMP Group at Halifax, Nova Scotia, for completion, final departure from Palmdale, 30 May 1991 delivery to CF December 1992 (140119) to February 1993 based at Greenwood

P-3 AEW&C: Airborne early warning and control, first flight of prototype (N91LC) converted from Australian P-3B and fitted with empty Randtron AN/APA-171 7 32 m (24 ft) diameter rotodome 14 June 1984, testing of installed General Electric AN/APS-125 radar began 1988 Proposed military version would include C[3] system to receive, process and transmit tactical information on HF, UHF, VHF and Satcom channels, AN/ARC-187 satellite communication system, and Collins five-tube colour EFIS 86B flight instruments General Electric AN/APS 145 radar available from late 1989

First order from US Customs May 1987 for one plus option for three, first flight US Customs aircraft with AN/APS-125 radar 8 April 1988 aircraft (N145CS ex N91LC) called *Blue Eagle* delivered to NAS Corpus Christi, Texas 17 June 1988 and used for anti-narcotics patrol over Caribbean and Gulf of Mexico, retrofitted with AN/APS-138, second ex-RAAF P-3 AEW&C (N146CS) *Blue Eagle II*, fitted with improved AN/APS-138 radar, delivered to US Customs June 1989, third and fourth (N147CS and N148CS, both ex-USN P-3Bs) delivered 26 June 1992 and 26 May 1993 Requirement exists for further two Additional systems include CDC AN/AYK-14 computer with Honeywell 160LM array processor, dual Sanders Milgraphics touch-sensitive colour display screens for digital target data, Hazeltine AN/TPX-54 IFF, dual AN/ARC-182 VHF/UHF com radios, dual AN/ARC-207 HF and dual Wulfsberg VHF/UHF-FM radios. Type nickname P 3 Dome

P-3 Orion II: Marketing abandoned mid-1993. Proposed P-3C upgrade to replace cancelled P-7A Update IV avionics plus new wings and engines (Allison T406 or GE T407) and, possibly HUDs and flat-panel cockpit displays having high commonality with Hercules II

EP-3J Orion: Electronic warfare trainer based on conversion of P-3B with AN/USQ-113 communications intrusion and deception system, plus AN/ALQ 167, AN/ALQ-170 and AN/AST-4/6 pods. Modified by Chrysler Technologies Service with VAQ-33 squadron at Key West; first delivery 17 March 1992, two aircraft (152719 and 152745), transferred to VP 66 in 1993 Planned Phase 2 modifications to include AN/ALT 40(V) radar jammer

P-3T/UP-3T: Conversions of USN P-3A for Thailand five airframes purchased 1992, two for modification to P-3T, one to UP-3T, and two for spares breakdown. P-3T modifications at NAS Jacksonville, Florida. ASW configuration similar to TacNavMod, with AN/AWG-19 HACLCS Harpoon control system. UP-3T utility aircraft retains some sensor capability, including SENTAC, ESM, AN/AAS-36 IR detection and TO-441/A tactical computer

P-3W: Australian P 3Cs have AQS 901 processing system and Barra sonobuoys in place of Proteus and AN/AQA-7 equipment of USN P-3C Upgrade of 10 with Elta ESM equipment (replacing AN/ALQ-78) begun by AWADI in Australia, 1991; other upgrades planned P-3W is local designation of P 3C-II 5, earlier P-3C IIs retain original designation See AP 3C entry

First Marietta built Orion is also first P 3C for Korea

1995

Orion 2000: Under development with GEC Marconi and Hunting to meet RAF requirement for BAe Nimrod replacement, draws on technology developed for C-130J Hercules (which see) including engines and propellers and on interior developed for CP 140 Aurora, although with high proportion of UK avionics. Improved colour displays, increased sonobuoy stowage and ergonomic improvements to reduce crew fatigue, two-crew flight deck with observer's seat

CUSTOMERS: US Navy, 552, comprising one YP-3, 157 P-3As of which 38 modified to UP 3A, seven to EP 3A, six to RP-3A, five to VP-3A (three via WP-3A), 12 to TP-3A two to EP-3B and 10 to EP-3E, 124 P-3Bs one converted to NP-3B and one under conversion in 1991 to RP-3B, 267 P-3Cs, 12 intended for EP-3E-II conversion, one RP-3D two National Oceanographic and Atmospheric Administration WP 3Ds Final USN P 3C (163295) delivered 17 April 1990. Status of USN Orion force after 1995

ORION DISPOSITION 1995

Variant	Active	Stored
US Navy:		
P-3A		32
EP-3A/B		2
TP-3A	11	
UP-3A	6	6
VP-3A	5	
P-3B	8	80
NP-3B	1	
UP-3B	2	2
P 3C	248	
NP-3D	14	
RP-3D		3
EP-3E	16	3
EP-3J	2	
Sub-total	**313**	**128**
Export:		
Australia P 3C	19	
Canada CP-140	21	
Chile P-3A/UP-3A	2/6	
Greece[2]	—	—
Iran P 3F	1	4
Japan E/U/P-3C	*	
Netherlands P-3C	13	
New Zealand P-3K	6	
Norway P 3C/P-3N	4/2	
Pakistan P 3C		3
Portugal P-3P	6	
South Korea	8[3]	
Spain P 3A/B	2/5	
Thailand P-3A(T)/UP 3A(T)	2/1	
Civilian		
Aero Union P 3A	1	
Chrysler P-3A (bailed)	1	
US Customs P 3A/AEW&C	4/4	
US Forestry P-3A	6[4]	1
US Dept of Commerce WP 3D/P 3B	2/1	
NASA P 3B	1	1
Total	**431***	**137**

* Remains in production in Japan, where 108 on order by 1995

[1] To receive three P 3B for training and support duties

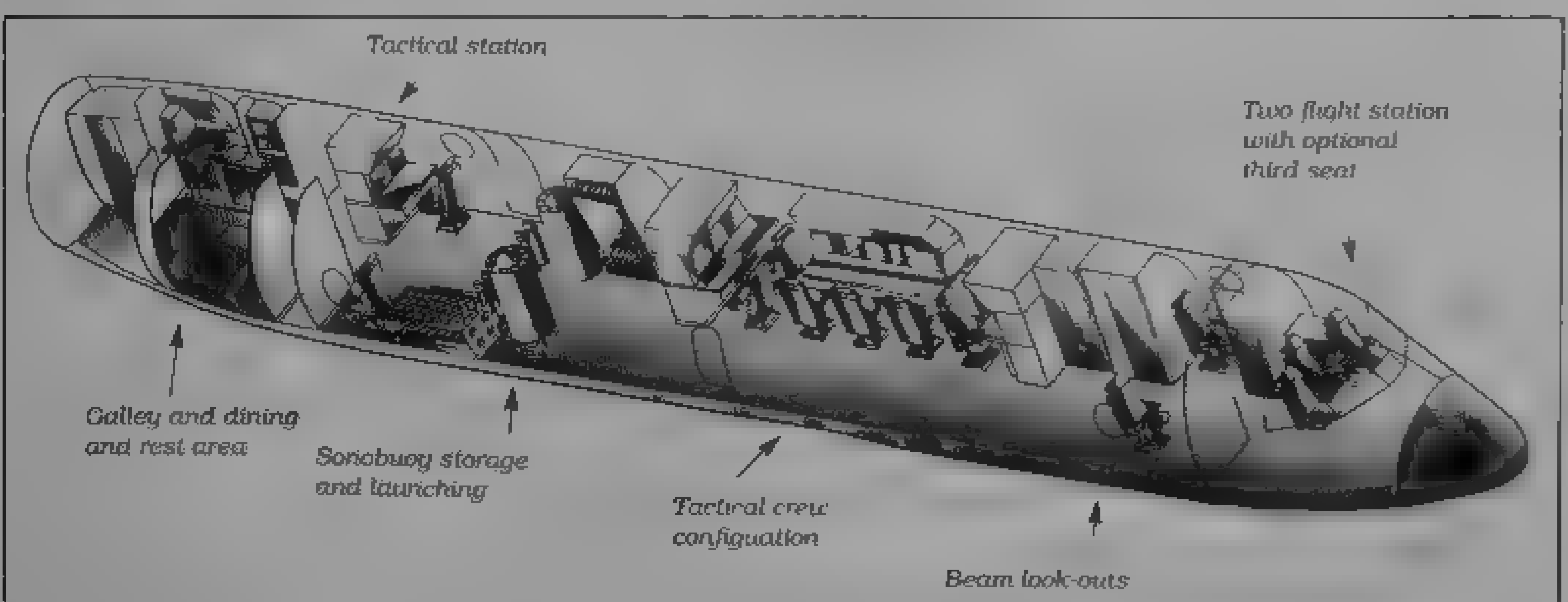
[2] To receive four P-3Bs, plus four P-3As for spares breakdown

[3] South Korean aircraft in process of delivery

[4] Aerostar firefighting conversions

Cutaway drawing of P-3 AEW&C showing surveillance operators' positions

1995



Revised crew positions in proposed Orion 2000

1995

disbandments shown in table, new total of 13 regular ASW squadrons. Last Reserve P-3A ASW mission 22 March 1990 (152158 of VP-64); last regular USN P-3B ASW mission 11 September 1990 (VP-22). P-3B retired by Reserve in 1994 but few special mission aircraft still active. Total of 14 test dedicated aircraft of Naval Air Warfare Center given common NP-3D designation in 1994 (previously RP-3A, UP-3A, EP-3B, RP-3D).

Total 90 P-3s from Californian production for export to Australia (10 Model 185B P-3Bs, one transferred from US Navy; 10 P-3C IIs and 10 P-3C-II.5s, both Model 285D); six P-3Bs transferred to Portugal as P-3P, one to New Zealand, two to US Customs (after conversion to AEW&C); Canada (18 CP-140 Auroras, three CP-140A Arcturus); Iran (six Model 685A P-3Fs); Japan (three Model 785A P-3C-II.5s from Lockheed, Kawasaki 66 P-3C-II.5s and 27 P-3C IIIs, including two EP-3s and one UP-3C, delivered by 31 March 1994, with five more P-3C-IIIs, one UP-3C, two UP-3Ds and two EP-3s to follow; P-3C-II.5 to be updated); Netherlands (13 Model 285E P-3C-II.5s); New Zealand (five P-3Bs updated to P-3Ks, plus one ex-Australian P-3K); Norway (five Model 185C P-3Bs, two transferred from US Navy, and four P-3C-IIIs, five P-3Bs transferred to Spain and two converted to P-3N, last conversion re-delivered 21 June 1992) and Pakistan (three P-3C Update II.75s, crew training completed December 1991, aircraft embargoed by US government and stored). Marietta production initially for South Korea (eight P-3C Update IIIs with AN/APS-134 radar, first flight, by 165098, October 1994, last delivery September 1995). Four USN P-3As transferred to US Customs as UP-3As (alternative designation P-3A(CS) 'Slick') fitted with IR detection system and AN/APG-63 lookdown radar. Chile obtained two P-3As and six UP-3As from USN, first delivery 3 March 1993, no sensor upgrade planned.

COSTS: $600 million for eight P-3Cs for South Korea 1990; $840 million (1990) including engines, training and spares. C$159 million for three semi-complete CP-140A airframes, plus C$59 million for radar, spares, logistics and project management.

DESIGN FEATURES: Pressurised cabin. Wing section NACA 0014 (modified) at root, NACA 0012 (modified) at tip; dihedral 6°, incidence 3° at root, 0° 30′ at tip.

FLYING CONTROLS: Hydraulically boosted ailerons, elevators and rudder; fixed tailplane. Lockheed-Fowler trailing-edge flaps.

STRUCTURE: Conventional aluminium alloy with fail-safe box beam wing.

LANDING GEAR: Hydraulically retractable tricycle type, with twin wheels on each unit. All units retract forward, main wheels into inner engine nacelles. Oleo-pneumatic shock-absorbers. Mainwheels have size 40-14 type VII 26 ply tubeless tyres, pressure 7.58 to 12.41 bars (110 to 180 lb/sq in) at 36,287 kg (80,000 lb) T-O weight, 12.41 bars (180 lb/sq in) at 57,606 kg (127,000 lb) T-O weight, 13.10 bars (190 lb/sq in) at 61,235 kg (135,000 lb) maximum normal T-O weight. Nosewheels have size 28-7.7 type VII tubeless tyres, pressure 10.34 bars (150 lb/sq in). Hydraulic brakes. No anti-skid units.

POWER PLANT: Four 3,661 kW (4,910 ehp) Allison T56-A-14 turboprops, each driving a Hamilton Standard 54H60-77 four-blade constant-speed propeller. Fuel in one tank in fuselage and four wing integral tanks, with total usable capacity of 34,826 litres (9,200 US gallons; 7,660 Imp gallons). Four overwing gravity fuelling points and central pressure refuelling point. Oil capacity (minimum usable) 111 litres (29.4 US gallons; 24.5 Imp gallons) in four tanks.

ACCOMMODATION: Normal 10-man crew: pilot, co-pilot and flight engineer on flight deck, tactical co-ordinator, nav/com operator, two acoustic sensor operators, radar/ESM/IRDS/MAD operator, ordnance man and flight technician, up to 11 additional relief crew or passengers. Flight deck has wide vision windows, and circular windows for observers are provided fore and aft in the main cabin, each bulged to give 180° view. Main cabin is fitted out with five-man tactical compartment (containing advanced electronic, magnetic and sonic detection equipment), an all-electric galley and large crew rest area.

SYSTEMS: Air conditioning and pressurisation system supplied by two engine-driven compressors. Pressure differential 0.37 bar (5.4 lb/sq in). Hydraulic system, pressure 207 bars (3,000 lb/sq in), for flaps, control surface boosters, landing gear actuation, brakes and bomb bay doors. Three hydraulic pumps, each rated at 30.3 litres (8.0 US gallons; 6.7 Imp gallons)/min at 0 to 152 bars (0 to 2,200 lb/sq in); 22.7 litres (6.0 US gallons; 5.0 Imp gallons)/min at 205 bars (2,975 lb/sq in). Class one non-separated air/oil reservoir, Type B pressurised. Electrical system utilises three 60 kVA generators for 120/208 V 400 Hz AC supply. 24 V DC supply. Integral APU with 60 kVA generator for ground air conditioning, electrical supply and engine starting. Anti-icing by bleed air on wing and electrical heating on tailplane and fin. Electrically de-iced propeller spinners.

AVIONICS: *Comms*: Two AN/ARC-161 HF transceivers, two AN/ARC-143 UHF transceivers, AN/ARC-101 VHF receiver/transmitter, AN/AIC-22 interphone set and AN/APX-72 IFF transponder.

Radar: AN/APS-115 (360° coverage).

Flight: Two LTN-72 inertial navigation systems, AN/APN-227 Doppler; two VIR-31 VOR/LOC/GS/MB receivers, AN/ARN-83 LF-ADF, AN/ARA-50 UHF direction finder, AN/ARN-81 Loran A and C, AN/ARN-118 Tacan, AN/APN-194 radar altimeter, two AN/APQ-107 radar altimeter warning systems, A/A24G-9 true airspeed computer, AN/ASW-31 automatic flight control system and glide slope indicator. P-3Cs delivered from 1975 have Omega navigation.

Instrumentation: AN/AJN-15 flight director indicator for tactical directions. HSI for long range flight directions. AN/ASA-70 tactical display. AN/ASA-66 pilot's display. AN/ASA-70 radar display, two auxiliary readout (computer stored data) displays.

Mission: Core system of P-3C Update III is AN/UYS-1 Proteus. AN/ASQ-114 general purpose digital computer. AN/AYA-8 data processing equipment and computer-controlled display systems; on-top position indicator. ASW equipment includes two AN/ARR-72 sonar receivers, replaced in Update III by AN/ARR-78, two AN/AQA-7(V)8 DIFAR (directional acoustic frequency analysis and recording) sonobuoy indicator sets, hyperbolic fix unit, acoustic source signal generator; time code generator; AN/AQH-4(V) sonar tape recorder, AN/ASQ-81 MAD; AN/ASA-64 submarine anomaly detector, AN/ASA-65 magnetic compensator; AN/ASA-69 radar scan converter, undernose AN/AAS-36 IRDS, KA-74 forward computer-assisted camera, KB-18A automatic strike assessment camera with horizon-to-horizon coverage, RO-308 bathythermograph recorder, AN/AGC-6 teletype and high-speed printer, HF and UHF secure communications units, AN/ACQ-5 datalink communication set, AN/APX-76 SIF interrogator.

P-3Cs delivered from 1975 have AN/ASA-66 tactical display for the sonar operators; updated avionics/electronics package featuring addition of an extra 393K memory drum and fourth logic unit, new magnetic tape transport and, to accommodate the new systems, revised

US NAVY ORION SQUADRONS

Squadron	Variant	Base
Regular Navy		
VP-1	P-3C-IIIR	Barbers Point, Hawaii
VP-4	P-3C-IIIR	Barbers Point, Hawaii
VP-5	P-3C-III/IIIR	Jacksonville, Florida
VP-8	P-3C-II.5/IIIR	Brunswick, Maine
VP-9	P-3C-III/IIIR	Barbers Point, Hawaii
VP-10	P-3C-II/II.5	Brunswick, Maine
VP-11	P-3C-II/II.5	Brunswick, Maine
VP-16	P-3C-III/IIIR	Jacksonville, Florida
VP-26	P-3C-II/II.5	Brunswick, Maine
VP-30	P-3C-II/IIIR, TP-3A, VP-3A	Jacksonville, Florida
VP-40	P-3C-III/IIIR	Whidbey Island, Washington
VP-45	P-3C-IIIR	Jacksonville, Florida
VP-46	P-3C-III/IIIR	Whidbey Island, Washington
VP-47	P-3C-III/IIIR	Barbers Point, Hawaii
VPU-1	P-3B	Brunswick, Maine
VPU-2	P-3C-I, P-3B, UP-3A	Barbers Point, Hawaii
VQ-1	EP-3E, UP-3A/B	Agana, Guam
VQ-2	EP-3E, P-3C-II	Rota, Spain
VRC-30	UP-3A	North Island, California
VX-1	P-3C-II/III/IIIR	Patuxent River, Maryland
Reserves		
VP-62	P-3C-III/IIIR	Jacksonville, Florida
VP-64	P-3C-II	Willow Grove, Pennsylvania
VP-65	P-3C-I/II.5	Point Mugu, California
VP-66	P-3C-II, EP-3J	Willow Grove, Pennsylvania
VP-68	P-3C-I	Andrews AFB, Maryland
VP-69	P-3C-I/II	Whidbey Island, Washington
VP-91	P-3C-III/IIIR	Moffett Field, California
VP-92	P-3C-II	South Weymouth, Massachusetts
VP-94	P-3C-II.5	New Orleans, Louisiana

ORION PRODUCTION

FY	P-3A	P-3B USN	P-3B Export	P-3C USN	P-3C Export	P-3D	Remarks
59	7						
61	12						
62	42						
63	48						
64	48						
65		48	5*				* New Zealand
66		44		1*			* YP-3C prototype
67		32	15*				* Norway 5, Australia 10
68				24			
69				23			
70				23		1*	* RP-3D
71				12			
72				24			
73				12	6*		* Iran (P-3F)
74				12		2*	* WP-3D
75				12			
76				11			
77				13	10*		* Australia
78				16	4*		* Canada CP-140
79				12	14*		* Canada CP-140
80				12	5*		* Japan 3, Netherlands 2
81				12	4*		* Netherlands
82				12	4*		* Netherlands
83				6	13*		* Netherlands 3, Australia 10
84				5			
85				9			
86				9			
87				7	4*		* Norway
89					3*		* Pakistan
90					3*		* Canada CP-140A
91					8*		* Korea
		124	20	267	78		
Sub-total	**157**	**144**		**345**		**3**	
Total			**649***				

* See Japanese section for details of 105 ordered from Kawasaki licenced production

operational software computer program in CMS-2 language. GEC Marconi AQS 901 acoustic signal processing and display system in P-3Ws of RAAF. Netherlands aircraft to receive AN/AAQ-22 SAFIRE FLIR as retrofit.

Self-defence. AN/ALQ-78 electronic countermeasures set. AN/ALR 66(V)3 installed in Japanese and Norwegian P-3Cs and as retrofit in P-3P and CP-140; wing span increased by some 0.81 m (2 ft 8 in) to accommodate associated ESM antennae and receivers. Similar Israeli Elta equipment for Australian retrofit. Loral AN/ALQ-157 IR jammers retrofitted each side of rear fuselage on USN P-3Cs.

EQUIPMENT: Searchlight replaces one wing pylon, starboard. Search stores, such as sonobuoys and sound signals, are launched from inside cabin area in the P-3A/B. In the P-3C sonobuoys are loaded and launched externally and internally. Sonobuoys are ejected from P-3C aircraft with explosive cartridge actuating devices (CAD), eliminating the need for a pneumatic system. Australian P-3s use SSQ-801 Barra sonobuoys.

ARMAMENT: Weapons bay, 2.03 m wide, 0.88 m deep and 3.91 m long (80 × 34.5 × 154 in), forward of wing, and 10 underwing pylons. Stores can include (weapons bay/underwing, maximum): Mk 46 torpedo 8/0; Mk 50 torpedo 6/0; Mk 54 depth bomb 8/10, Mk 82 560 lb bomb 8/10, Mk 83 980 lb bomb 3/8, Mk 36 destructor 8/10; Mk 40 destructor 3/8; LAU-68A pod (seven 2.75 in rockets), or LAU-69A (19 2.75 in rockets), or LAU-10A/C (four 5 in rockets), or SUU-44A (eight flares) 0/4, Mk 52 mine 3/8, Mk 55 or Mk 56 mine 1/6, Mk 60 torpedo 0/6; AGM-84 Harpoon anti-ship missile 0/8. Two AIM-9L Sidewinder AAMs underwing for self-defence. Maximum total weapon load includes six 2,000 lb mines under wings and a 3,290 kg (7,252 lb) internal load made up of two Mk 101 depth bombs, four Mk 44 torpedoes, pyrotechnic pistol and 12 signals, 84 sonobuoys, 100 Mk 50 underwater sound signals (P-3A/B), 18 Mk 3A marine markers (P-3A/B), 42 Mk 7 marine markers, two B.T. buoys, and two Mk 5 parachute flares. Harpoon missiles are standard fit on a proportion of US Navy P-3Cs and AGM-65D Maverick ASM capability to be added as part of Anti Surface Warfare Improvement Program.

DIMENSIONS, EXTERNAL:

Wing span	30.37 m (99 ft 8 in)
Wing chord, at root	5.77 m (18 ft 11 in)
at tip	2.31 m (7 ft 7 in)
Wing aspect ratio	7.5
Length overall	35.61 m (116 ft 10 in)
Height overall	10.27 m (33 ft 8½ in)
Fuselage diameter	3.45 m (11 ft 4 in)
Tailplane span	13.06 m (42 ft 10 in)
Wheel track (c/l shock-absorbers)	9.50 m (31 ft 2 in)
Wheelbase	9.07 m (29 ft 9 in)
Propeller diameter	4.11 m (13 ft 6 in)
Cabin door: Height	1.83 m (6 ft 0 in)
Width	0.69 m (2 ft 3 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck and electrical load centre:	
Length	21.06 m (69 ft 1 in)
Max width	3.30 m (10 ft 10 in)
Max height	2.29 m (7 ft 6 in)
Floor area	61.13 m² (658.0 sq ft)
Volume	120.6 m³ (4,260 cu ft)

AREAS:

Wings, gross	120.77 m² (1,300.0 sq ft)
Ailerons (total)	8.36 m² (90.0 sq ft)
Trailing-edge flaps (total)	19.32 m² (208.0 sq ft)
Fin, incl dorsal fin	10.78 m² (116.0 sq ft)
Rudder, incl tab	5.57 m² (60.0 sq ft)
Tailplane	22.39 m² (241.0 sq ft)
Elevators, incl tabs	7.53 m² (81.0 sq ft)

WEIGHTS AND LOADINGS (P-3B/C):

Weight empty	27,890 kg (61,491 lb)
Max fuel weight	28,350 kg (62,500 lb)
Max expendable load	9,071 kg (20,000 lb)
Max normal T-O weight	61,235 kg (135,000 lb)
Max permissible weight	64,410 kg (142,000 lb)
Design zero-fuel weight	35,017 kg (77,200 lb)
Max landing weight	47,119 kg (103,880 lb)
Max wing loading	507.0 kg/m² (103.8 lb/sq ft)
Max power loading	4.18 kg/kW (6.87 lb/ehp)

PERFORMANCE (P-3B/C, at max T-O weight, except where indicated otherwise):

Max level speed at 4,575 m (15,000 ft) at AUW of 47,625 kg (105,000 lb)	411 kts (761 km/h, 473 mph)
Econ cruising speed at 7,620 m (25,000 ft) at AUW of 49,895 kg (110,000 lb)	328 kts (608 km/h, 378 mph)
Patrol speed at 457 m (1,500 ft) at AUW of 49,895 kg (110,000 lb)	206 kts (381 km/h, 237 mph)
Stalling speed: flaps up	133 kts (248 km/h, 154 mph)
flaps down	112 kts (208 km/h, 129 mph)
Rate of climb at 457 m (1,500 ft)	594 m (1,950 ft)/min
Time to 7,620 m (25,000 ft)	30 min
Service ceiling	8,625 m (28,300 ft)
Service ceiling, OEI	5,790 m (19,000 ft)
T-O run	1,290 m (4,240 ft)
T-O to 15 m (50 ft)	1,673 m (5,490 ft)
Landing from 15 m (50 ft) at design landing weight	845 m (2,770 ft)
Mission radius (3 h on station at 457 m, 1,500 ft)	1,345 n miles (2,494 km, 1,550 miles)
Max mission radius (no time on station) at 61,235 kg (135,000 lb)	2,070 n miles (3,834 km, 2,382 miles)
Ferry range	4,830 n miles (8,945 km, 5,558 miles)
Max endurance at 4,575 m (15,000 ft):	
two engines	17 h 12 min
four engines	12 h 20 min

UPDATED

LOCKHEED MARTIN 182/282/382 HERCULES

US Air Force designations: C-130, AC-130, DC-130, EC-130, HC-130, JC-130, LC-130, MC-130, NC-130, RC-130 and WC-130

US Navy designations: C-130, DC-130, EC-130, LC-130 and TC-130

US Marine Corps designation: KC-130

US Coast Guard designations: C-130, EC-130 and HC-130

Canadian Forces designations: CC-130 and CC-130T

RAF designations: Hercules C. Mk 1K, C. Mk 1P, W. Mk 2 and C. Mk 3P

Spanish designations: T.10, TK.10 and TL.10

Swedish designation: Tp 84

Export designations: C-130H, C-130H-30, KC-130H, C-130H-MP, VC-130H and C-130J

Israel Defence Force names: C/KC-130 Karnaf (Rhinoceros), EC-130 Aya (Condor)/Sapeer (Sapphire)

TYPE: Tactical transport and multimission aircraft.

PROGRAMME: US Air Force specification issued 1951; first production contract for C-130A to Lockheed September 1952, two prototypes, 231 C-130As, 230 C-130Bs and 491 C-130Es manufactured (details in earlier *Jane's*). For later military versions, see below; more than 70 models, variants delivered. Lockheed delivered 2,000th Hercules (C-130H 91-1231 to 165th ALS, Kentucky ANG) 14 May 1992, 2,100th Hercules delivered early 1995.

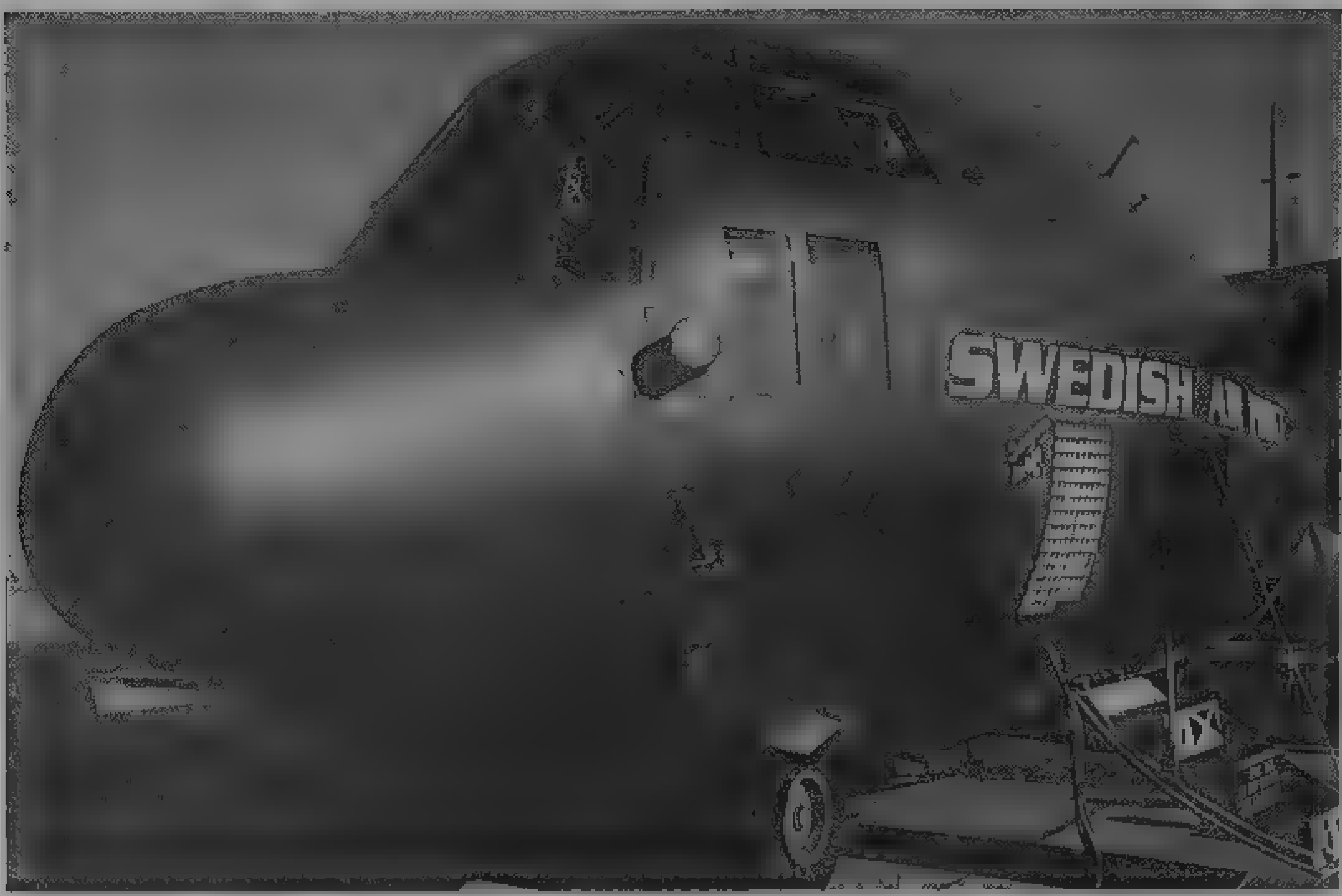
Small selection (14) of nearly 40 Hercules which celebrated the aircraft's 40th birthday at Fairford, UK, in 1994 *(Paul Jackson)*

1995

USAF HERCULES PROCUREMENT

FY	C-130A	C-130B	C-130D	C-130E	HC-130	C-130H	MC-130H	AC-130U	Remarks
53	7								1 to AC-
54	20								7 to AC
55	48								7 to AC-
56	84								3 to AC-
57	48	5	12						
58		48							
59		15							
60		18							
61		41		16					3 to WC-
62		6		83					1 to MC
									8 to HC
63				144					8 to LC
									1 to MC
64				81*	15†				* 14 to MC
									* 3 to WC-,
									† 1 to EC
									† 1 to WC-
65					33				8 to C
									6 to WC-
66					15				
68				18					
69				18*	15				* 10 to AC-130H
70				18					
72				12					
73						15			12 to EC-
74						53			1 to YMC-
78						8			
79						8			
80						8			
81						6			
82						8			
83						8*	1		* 4 to LC-
84						10	2		
85						16	2		
86						16	1		
87						8	5	1	
88					2	16	7		
89						20	4	6	
90						12	2	5	
91					1	16			
92						34*		1	* 2 to LC
93					3	24			
94						15			Incl 2 C-130J
Sub-totals	207	133	12	390	84	301	24	13	
Total					1,164				

Note: Not all conversions are given



Detail of Swedish C-130H Hercules modified for war zone relief operations with missile approach warner (beside flight deck side windows) and fairing containing two flare dispensers (two chaff and two flare units also in each main landing gear pannier) *(Paul Jackson)*

1995

Artist's impression of C-130J Hercules II in Royal Air Force configuration with in-flight refuelling probe

1995

CURRENT VERSIONS. **C-130H**: Deliveries started March 1965 to Royal New Zealand Air Force; in service with 49 countries. Features include updated avionics, improved wing, new corrosion protection, and Allison T56-A-15 engines flat rated at 3,362 kW (4,508 shp). Can deliver up to 19,052 kg (42,000 lb) by low-velocity air drop, or by low altitude parachute extraction system (LAPES). Total 301 regular transport C-130Hs funded for USAF/ANG/AFRes in FY73-94; from 1994, new aircraft have Bendix/King TCAS II collision avoidance system. Night Vision Instrument System introduced to USAF aircraft from May 1993, others for special roles, as detailed below. C-130Hs of 757th ALS, AFRes, at Youngstown, Ohio, are sole USAF aircraft equipped for aerial spraying. In January 1993, Chrysler Technologies Airborne Systems and Bendix/King won cockpit upgrade competition for USAF Hercules (and 148 C-141s) involving four 150 × 200 mm (6 × 8 in) liquid crystal displays, Bendix/King digital autopilot, Sundstrand ground collision avoidance and other avionics improvements. Total 672 Hercules to be modified, including C-130Es and Hs. *Detailed description applies mainly to C-130H except where indicated.*

C-130H-MP: Maritime patrol version, one delivered to Indonesian Air Force, three to Royal Malaysian Air Force. Maximum T-O weight 70,310 kg (155,000 lb), maximum payload 18,630 kg (41,074 lb), and T56-A-15 engines; search time 2 hours 30 minutes at 1,525 m (5,000 ft) at 1,800 n mile (3,333 km, 2,070 mile) radius or 16 hours 50 minutes at 200 n mile (370 km, 230 mile) radius. Optional and standard search features include sea search radar, observer seats and windows, INS/Omega navigation, crew rest and galley slide-in module, flare launcher, loudspeaker, rescue kit airdrop platform, side-looking radar, passive microwave imager, low-light TV, infra-red scanner, camera with data annotation and ramp equipment pallet with observer station.

C-130H-30: Stretched version of current production C-130; fuselage lengthened by 4.57 m (15 ft 0 in); troop and cargo capability increased by 40 per cent.

AC-130H Spectre: Gunship version with sideways-firing 105 mm recoilless howitzer, 40 mm cannon and two 20 mm Vulcan guns; infra-red and low-light TV sensors, and side-looking head-up display for aiming at night while circling target; in-flight refuelling. Conversion by Lockheed Aircraft Service Company (now LMAS). New fire control computers and navigation and sensors installed under Special Operations/Forces Improvements (SOFI), include Magnavox AN/ARC-187 UHF satellite navigation. Flight testing began September 1989; first upgrade completed mid-1990, last of current nine completed 1993. In service with 16th Special Operations Squadron at Hurlburt Field, Florida.

EC-130H Compass Call: Works with ground-based C^3CM to jam enemy command, control and communications. Operated by 41st and 43rd Electronic Combat Squadrons at Davis-Monthan AFB, Arizona. (Eight earlier EC-130Es of 7th ACCS being updated by Loral to ABCCC III standard in $34 million programme, 1990.)

HC-130H: Extended range USAF aircraft for aerial recovery of personnel or equipment and other duties; 43 delivered from October 1964; update announced Spring 1987 includes self-contained navigation, night vision goggles cockpit and new communications equipment, applied to 31 aircraft, 21 of these modified for in-flight refuelling and now designated HC-130P (which see). US Coast Guard ordered 35, including 10 as HC-130H-7 with T56-A-7B power plants; 31 in USCG service, 1994. Further six HC-130H(N)s funded FY88 to FY93 for 210th RQS, ANG, in Alaska, delivered from 28 November 1990; has helicopter refuelling capability from outset.

JC-130H: Four US Air Force HC-130Hs equipped to recover re-entering space capsules.

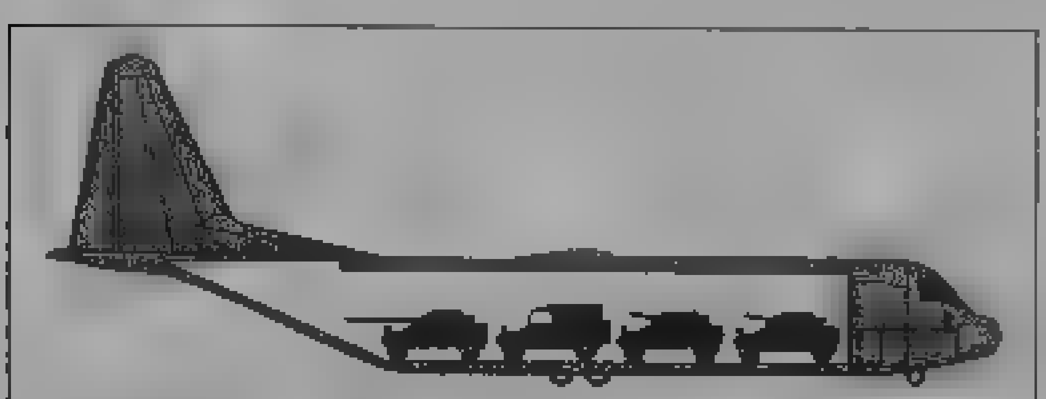
DC-130H: Two US Air Force HC-130Hs modified for drone control.

KC-130H: Probe-drogue tanker similar to KC-130R, exported to Argentina (two), Brazil (two), Israel (two), Morocco (two), Saudi Arabia (eight), Singapore (one) and Spain (five).

LC-130H: Similar to LC-130R (which see); four acquired by 139th AS, ANG, at Schenectady. Two more currently on order.

MC-130H Combat Talon II: Conversion of new-build C-130H for day/night infiltration and exfiltration, resupply of Special Operations Forces, psychological warfare and aerial reconnaissance; terrain-following radar; six-man crew; 25 (including YMC-130H prototype 74-1686, now retired, and special test aircraft 83-1212, which alternatively designated C-130X) funded in FY83-90; first flight by E-Systems (see below) at Greenville Spring 1988; flight testing began at Edwards AFB September 1988; MC-130Hs augment MC-130Es at Hurlburt Field; first four delivered 17 October 1991 and temporarily with 8th SOS prior to formation of 15th SOS on 1 October 1992; others to 1st SOS at Kadena, Japan; 7th SOS at Alconbury (now Mildenhall), UK (beginning with 86-1699 on 10 September 1992); and 1550th ATS (training) at Kirtland AFB, New Mexico (three aircraft).

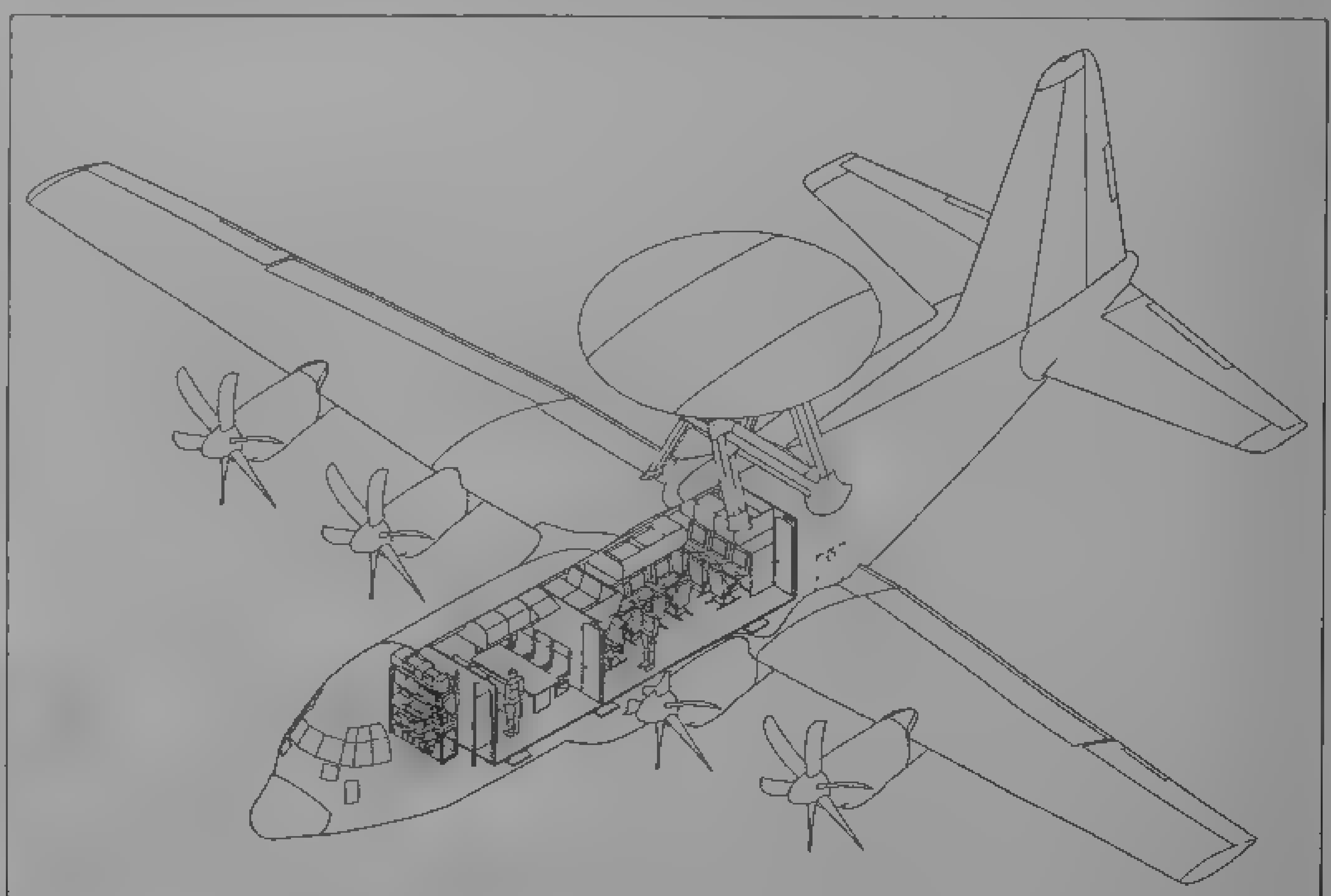
Equipment includes Emerson Electric AN/APQ-170 precision ground-mapping/weather/terrain-following and avoidance radar in enlarged radome, inertial navigation, automatic computed air release point, high-speed low-level release system, ground acquisition receiver/interrogator, Texas Instruments AN/AAQ-15 infra-red detection system, eight multifunction displays, secure voice UHF-VHF-FM radios, retractable FLIR pod, angle of attack probe, AN/ALQ-8 ECM pod under each wing, and in-flight refuelling. Defensive equipment includes Litton AN/ALR-69 RWR, ITT AN/ALQ-172 detector/jammer,



Hercules Model	Cargo Length	463L Pallets	Medical Litters	CDS Bundles	Combat Troops	Para-Troops
C-130J	40.4 ft	5	74	18	92	64
C-130J-30	55.4 ft	7	97	24	128	92
Increase	37%	40%	31%	50%	39%	44%

C-130J Hercules II accommodation; standard and (illustrated) stretched versions compared

1995



Internal arrangement of a proposed AEW variant of Hercules II

1995

Royal Jordanian Air Force Lockheed Martin C-130H Hercules *(Paul Jackson)*

1995

Watkins Johnson WJ-1840 signal detector, Cincinnati Electronics AN/AAR-44 launch warning receiver, Northrop Grumman QRC-84-02 IR jammer and chaff/flare dispensers. IBM Federal Systems Division is prime contractor for systems integration, with E-Systems as subcontractor for avionics installation and modification

MC-130H FUNDING

FY	Lot	Qty	First aircraft
–	—	1	74-1686
83	1	1	83 1212
84	2	2	84-0475
85	3	2	85-0011
86	4	1	86-1699
87	5	5	87-0023
88	6	7	88-0191
89	7	4	89-0280
90	8	2	90-0161
Total		25	

RC-130H Unofficial designation for two Moroccan aircraft (CN-AOP and CN-AOQ) fitted with SLAR on port undercarriage pannier by Flight Systems Inc

VC-130H: VIP transport

C-130J: Lockheed designation for next-generation Hercules with new power plant and digital avionics. 25 ordered by RAF in December 1994 with deliveries from 1996. See Hercules II

C-130K. RAF version of C-130H, much of avionics and instrumentation made in UK. 66 delivered as **Hercules C. Mk 1** beginning September 1966; one modified by Marshall of Cambridge for RAF Meteorological Research Flight as **Hercules W Mk 2**. Thirty lengthened by 4.57 m (15 ft), equivalent to commercial L-100-30, and redesignated **Hercules C. Mk 3**: first aircraft modified at Marietta, remaining 29 by Marshall of Cambridge. Six modified to **C. Mk 1K** tankers, of which four received Racal Orange Blossom ESM, which also fitted to one C Mk 1; 20 C. Mk 3s received AN/APN 169B station-keeping equipment, some have provision for AN/ALQ-157 IR jammers, AN/ALR-66 RWR fitted inside wingtips from late 1993; all fitted with refuelling probes 1982 89

HC-130N US Air Force search and rescue version of C-130H for recovery of aircrew and space capsules; 15 delivered with helicopter refuelling capability, advanced direction finding equipment.

HC-130P: C-130H modified for refuelling helicopters in flight and recovering parachute-borne payloads, 20 built for USAF, details in 1979 80 *Jane's*. HC-130N/Ps to be upgraded by Rockwell with SOF Improvement package including self-protection aids for refuelling operations in hostile airspace

EC-130Q: Similar to earlier EC-130G, but with improved equipment and crew accommodation for TACAMO command communication with submarines. 18 built, HF and VLF SIMOP (simultaneous operation). Last aircraft (161531) retired from VQ-4 on 26 May 1992, replaced by Boeing E-6A, two EC-130Qs converted to TC-130Q; three to NASA as transports; remainder to storage

TC-130Q. Two surplus EC-130Qs with trailing wire aerial removed to permit normal cargo loading via rear doors, wingtip pods retained; first (159348) noted 1990. Two TC-130Qs are similar

KC-130R Probe-drogue tanker version of C-130H; 14 delivered to US Marine Corps VMGR-252 and 352, changes from KC-130F (1975-76 *Jane's*) include 3,362 kW (4,508 shp) engines, higher T-O and landing weights, external fuel tanks for additional 10,296 litres (2,720 US gallons; 2,265 Imp gallons) fuel, and removable 13,627 litre (3,600 US gallon, 2,997 Imp gallon) fuel tank in cargo hold (all fuel can be used to increase tanker's range), single-point refuelling of normal and additional tanks from existing filler, operating weight empty 36,279 kg (79,981 lb), maximum T-O weight 79,378 kg (175,000 lb), can offload up to 20,865 kg (46,000 lb) of fuel, equivalent to 26,790 litres (7,077 US gallons, 5,893 Imp gallons), at radius of 1,000 n miles (1,852 km, 1,151 miles); maximum fuel offload capability 31,750 kg (70,000 lb), equivalent to 40,765 litres (10,769 US gallons, 8,967 Imp gallons)

LC-130R: C-130H with wheel/ski landing gear for US Navy Squadron VXE-6 in Antarctic; details in 1979-80 *Jane's*

Hercules 'single engine demonstrator' fitted with AE 2100 engine and R391 propeller in C-130J trials programme *(Paul Jackson)*

1994

CC-130T: Canadian Forces' designation for five CC-130s converted by Northwest Industries, 1992-93, as tankers with two FRL Mk 32B hose-drum units beneath wings and 13,627 litre (3,600 US gallon, 2,998 Imp gallon) tank in cargo hold

KC-130T: Tanker for US Marine Corps (Reserve), able to refuel helicopters and fighters, eight delivered to Marine Aerial Refueller Transport Squadron 234 (VMGR-234), starting November 1983, others to VMGR-452; deliveries two per year since 1990 total 28 required by 1995 (14 per squadron), but only 24 ordered to date. Similar to KC-130R, but with updated avionics including INS, Omega and Tacan, new autopilot and flight director and solid-state search radar. KC-130Ts delivered in 1984 had Bendix/King AN/APS-133 colour radar, flush antennae and orthopaedically designed crew seats

KC-130T-30: Stretched KC-130T (similar to C-130H 30) for US Navy; first (164597) delivered to VMGR-452, 29 October 1991, second in November 1991 to VMGR-234

C-130T: Transport, with secondary refuelling capability, for US Navy, first of six (164762) to VR-54 at New Orleans 20 August 1991, first of six to VR 48 at NARF Andrews, Maryland, October 1992, but subsequently reassigned to VR-53 at same base. VR-55 at Alameda, California expected to be third unit with this version. Total 22 required, 18 ordered to date

AC-130U Spectre: Third-generation gunship version of C-130H, details under Rockwell entry

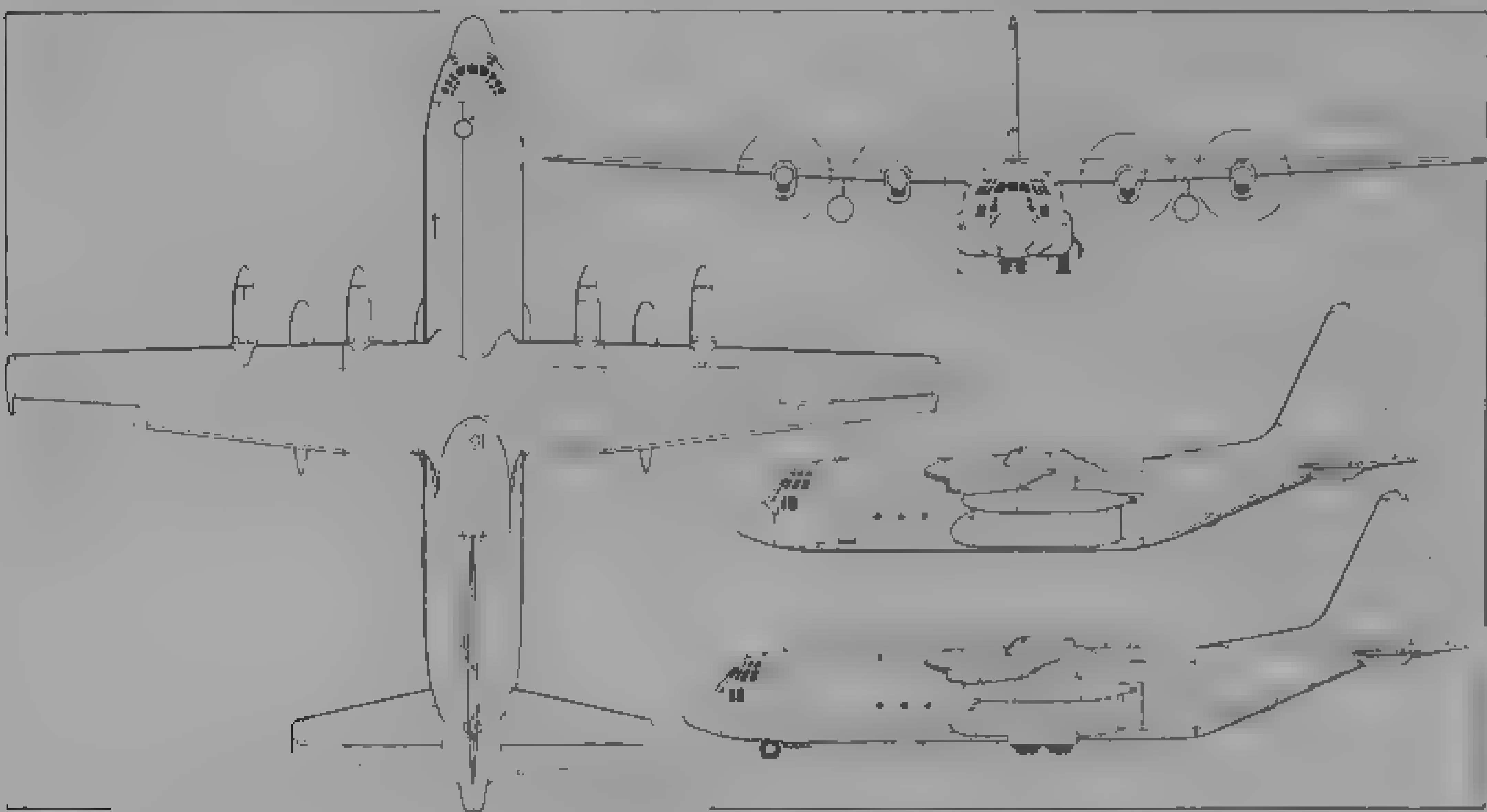
EC-130V Surveillance conversion of USCG HC-130H (1721) with E-2C Hawkeye's AN/APS 125 radar. Conversion by General Dynamics, Fort Worth, first flight 31 July 1991; to CGAS Clearwater, Florida. Programme terminated, April 1993, due to budget cuts, aircraft transferred to USAF's 514th Test Squadron at Hill AFB, Utah, late 1993. However, USCG HC 130H 1502 received AN/APS-137 radar in 1994 after modification at Elizabeth City CGAS

Hercules II. Privately funded development, launched 1991. First customer is RAF, which ordered 25 in December 1994, three to be delivered in 1996, followed by nine, eight and five respectively in 1997-99. Powered by Allison AE 2100 turboprops, six-blade Dowty R391 propellers and equipped with new two-crew glass cockpit (optional navigator/engineer position available). Also known as **C-130J**, or **L-100J** in civilian form. Optional refuelling probe on upper port side of fuselage; available in standard length and -30 versions. Performance improvements over C 130E Hercules include 40 per cent additional range, 40 per cent higher cruise ceiling, 50 per cent reduction in time to cruise height; 22 per cent reduction in take-off run and 21 per cent increase in cruise speed

Hercules II/C 130J optimised for economical operations, justifying customers' substitution for earlier C 130s on 30 year lifetime savings alone. Entirely revised flight deck reduces LRUs by half and wire assemblies by 85 per cent, has four 15 × 20 cm (6 × 8 in) LCDs, plus HUD for both pilots, lighting compatible with NVGs. Most systems digitalised, although hydraulics largely unaltered, provision for integrated self-defence suite (RWR, MAW, chaff/flare and IR jammers). Manpower requirements of typical 18 aircraft squadron reduced by 38 per cent (661 down to 406) compared with earlier C-130 versions, as

Lockheed Martin LC-130H Hercules equipped with ski landing gear and JATO, operated by 139th AS of New York ANG *(Paul Jackson)*

1995



Lockheed Martin C-130H-30 stretched Hercules, with upper side view of standard C-130H *(Jane's/Dennis Punnett)*

1993

result of halved flight crew and 50 per cent better maintainability

Parts fabrication began 2 March 1994 for c/n 5408, roll out due July 1995, first flight November 1995. Five to be built in 1995, increasing to 36 by 1997. RAF is launch customer; USAF requires about 200 (plus more for ANG later) but funded only initial two for evaluation purposes, strong interest from Australia and New Zealand. Sales anticipated as 400 to 700 over 10 years

RAF Hercules C Mk 1 XV181 fitted by Marshall Aerospace with AE 2100 engine and R391 propeller in port inner position to assess physical aspects of installation in Hercules airframe and measure blade/shaft stress and noise/vibration characteristics. Designated 'single engine demonstrator', began 50 hour flight test programme on 19 March 1994, subsequently returned to standard after successful trials

CUSTOMERS: Military and government Hercules operators for C-130H export versions only are given in the table

COSTS: Specific figures not available, but in region of $30 to $40 million for C-130H, for C-130J $40 million (1995)

DESIGN FEATURES: Can deliver loads and parachutists over lowered rear ramp and parachutists through side doors, removable external fuel tanks outboard of engines are standard fittings, cargo hold pressurised. Wing section NACA 64A318 at root and NACA 64A412 at tip; dihedral 2° 30', incidence 3° at root, 0° at tip

FLYING CONTROLS: All control surfaces boosted by dual hydraulic units, trim tabs on ailerons, both elevators and rudder; elevator tabs have AC main supply and DC standby; Lockheed Fowler trailing-edge flaps, provision for two removable afterbody ventral strakes

C-130J has same flying controls, integrated with digital autopilot/flight director

STRUCTURE: All-metal two-spar wing with integrally stiffened taper-machined skin panels up to 14.63 m (48 ft 0 in) long

LANDING GEAR: Hydraulically retractable tricycle type. Each main unit has two wheels in tandem, retracting into fairings built on to the sides of the fuselage. Nose unit has twin wheels and is steerable ±60°. Oleo shock-absorbers. Mainwheel tyres size 56 × 20-20, pressure 6.62 bars (96 lb/sq in), Nosewheel tyres size 39 × 13-16, pressure 4.14 bars (60 lb/sq in). Goodyear air-cooled multiple disc hydraulic brakes with anti skid units. Retractable combination wheel/skis available. Minimum ground turning radius C-130H, 11.28 m (37 ft) about nosewheel and 25.91 m (85 ft) about wingtip; C-130H-30, 14.33 m (47 ft) about nosewheel and 27.43 m (90 ft) about wingtip. Identical figures applicable to C-130J and C-130J-30 respectively

C-130J has new, modular mainwheels with self-jacking struts for simplified replacement and improved nose gear strut to assist rough field operations

POWER PLANT: Four 3,362 kW (4,508 shp) Allison T56-A-15 turboprops, each driving a Hamilton Standard 54H60 four blade constant-speed fully feathering reversible-pitch propeller. Fuel in six internal (four integral and two bladder type) tanks in wings, with total capacity of 25,816 litres (6,820 US gallons, 5,679 Imp gallons) and two optional underwing pylon tanks, each with capacity of 5,300 litres (1,400 US gallons; 1,166 Imp gallons). Total fuel capacity 36,416 litres (9,620 US gallons, 8,010 Imp gallons). Single pressure refuelling point in starboard wheel well. Overwing gravity fuelling. Oil capacity 182 litres (48 US gallons, 40 Imp gallons)

C-130J powered by four 4,474 kW (flat-rated to 6,000 shp) Allison AE 2100D3 turboprops fitted with Dowty R391 six-blade composites propellers and Lucas Aerospace FADEC, propulsion system provides 31 per cent more take-off thrust and is 18 per cent more efficient, propeller has 90 per cent fewer parts and weighs 15 per cent less. New fuel system

ACCOMMODATION: Crew of four on flight deck, comprising pilot, co-pilot, navigator and systems manager (fully performance qualified flight engineer on USAF aircraft). Provision for fifth man to supervise loading. Sleeping bunks for relief crew, and galley. Flight deck and main cabin pressurised and air conditioned. Standard complements for C-130H are as follows: 92 troops, 64 paratroopers, 74 litter patients plus two attendants. Corresponding data for C-130H-30 are 128 troops, 92 paratroopers, and 97 litter patients plus four attendants. Air transport and airdrop loads such as Sheridan light armoured vehicle, 19 051 kg (42,000 lb) when rigged for airdrop, are common to both C-130H and C-130H-30; light and medium towed artillery weapons, or variety of wheeled and tracked vehicles and multiple 463L supply pallets (five in C-130H and seven in C-130H-30, plus one on rear ramp for each model) are transportable; C-130H-30 is only airlifter which can airdrop entire field artillery section (ammo platform, weapon, prime mover, and eight crew jumping over ramp) in one pass. Hydraulically operated main loading door and ramp at rear of cabin. Paratroop door on each side aft of landing gear fairing. Two emergency exit doors standard; two additional doors optional on C-130H-30

C-130J has accommodation for two flight deck crew members, with provisions for optional engineer/navigation workstation

SYSTEMS: Air conditioning and pressurisation system maximum pressure differential 0.52 bar (7.5 lb/sq in). Three independent hydraulic systems, utility and booster systems operating at a pressure of 207 bars (3,000 lb/sq in), rated at 65.1 litres (17.2 US gallons, 14.3 Imp gallons)/min for utility and booster systems, 30.3 litres (8.0 US gallons, 6.7 Imp gallons)/min for auxiliary system. Reservoirs are unpressurised. Auxiliary system has hand-pump for emergencies. Electrical system supplied by four 40 kVA AC alternators, plus one 40 kVA auxiliary alternator driven by APU in port main landing gear fairing. Four transformer-rectifiers for DC power. There are differences between the installed components for US government and export versions. Babcock Power Ltd High Volume Mine Layer (HVML) system available as an option, using modular roll-on pallets. Leading-edges of wing, tailplane and fin anti-iced by engine bleed air

C-130J will have Lucas generator. C-130J environmental control system similar to that of C-130H model, incorporating dual air-cycle machines, but with 30 per cent greater cooling capacity and a digital electronic control system

Flight deck of C-130J Hercules II, showing HUDs and modernised instrumentation

1994

AVIONICS: *Comms:* Dual AN/ARC 190 HF, dual AN/ARC 186 VHF, dual AN/ARC-164 UHF, AN/AIC-13 PA system, AN/AIC-18 intercom, AN/APX-100 IFF/AIMS ATC transponder, A-100A cockpit voice recorder, emergency locator transmitter provision for KY 58 secure voice communications, provision for USTS Satcom system, C 130J to have AN/ARC-222 VHF

Radar: Westinghouse low-power colour radar (LPCR 130-1B) replaced Sperry radar from March 1993. C 130J will also have low power colour radar, but specific model undetermined

Flight: Dual AN/ARN-118 UHF nav, dual AN/ARN-147 VHF nav, self contained navigation system (SCNS), AN/ARN 152(V) microwave landing system, dual AN/ARN 149 ADF, DG-301E UHF direction-finder, AN/APN-218 Doppler nav, AN/APN-232 combined altitude radar altimeter, dual FD-109 flight director system. Sundstrand ground proximity warning system, Kollsman altitude alerter, flight data recorder. C-130J equipment will include HG 9550 radar altimeter, AN/ARN-153(V) Tacan, a Digital Autopilot/Flight Director (DA/FD), dual Honeywell laser INS with embedded GPS receivers, E-TCAS and provision for microwave landing system

Instrumentation: C-130J to utilise Flight Dynamics HUD at pilot and co-pilot positions, plus four colour liquid-crystal displays which are NVG-compatible.

Mission: AN/APN-169C station keeping equipment. C-130J to use Co-ordinated Aircraft Positioning System, type to be determined

Self-defence: C-130H/J models have provisions for Loral AN/AAR-47 missile warning system, Sanders AN/ALQ-157 infra-red countermeasures system, Tracor AN/ALE-40 or AN/ALE-47 chaff/flare dispensing systems and AN/ALR-69 enhanced radar warning system

EQUIPMENT: Some USAF and RAF Hercules fitted with Aero Consultants cockpit armour for relief flights into war zones, 1993

ARMAMENT: Fitment of Rockwell Hellfire ASM to AC-130H/U studied 1991-92

DIMENSIONS, EXTERNAL:

Wing span	40.41 m (132 ft 7 in)
Wing chord, at root	4.88 m (16 ft 0 in)
mean	4.16 m (13 ft 8½ in)
Wing aspect ratio	10.07
Length overall	
all except HC-130H and C-130H 30	29 79 m (97 ft 9 in)
C-130H-30	34 37 m (112 ft 9 in)
Height overall	11.66 m (38 ft 3 in)
Tailplane span	16.05 m (52 ft 8 in)
Wheel track	4.35 m (14 ft 3 in)
Wheelbase	9 77 m (32 ft 0¾ in)
Propeller diameter	4 11 m (13 ft 6 in)
Main cargo door (rear of cabin):	
Height	2 77 m (9 ft 1 in)
Width	3 12 m (10 ft 3 in)
Height to sill	1 03 m (3 ft 5 in)
Paratroop doors (each): Height	1 83 m (6 ft 0 in)
Width	0 91 m (3 ft 0 in)
Height to sill	1 03 m (3 ft 5 in)
Emergency exits (each): Height	1 22 m (4 ft 0 in)
Width	0 71 m (2 ft 4 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck	
Length excl ramp: C-130H	12.50 m (41 ft 0 in)
C 130H-30	17 07 m (56 ft 0 in)
Length incl ramp: C-130H	15 73 m (51 ft 8¼ in)
C-130H-30	20 33 m (66 ft 8½ in)
Max width	3 12 m (10 ft 3 in)
Max height	2 81 m (9 ft 2¾ in)
Floor area, excl ramp: C-130H	39 5 m² (425 0 sq ft)
Volume, incl ramp: C-130H	123 2 m³ (4,351 0 cu ft)
C-130H-30	161 3 m³ (5,696.0 cu ft)

AREAS:

Wings, gross	162 12 m² (1 745 0 sq ft)
Ailerons (total)	10.22 m² (110 0 sq ft)
Trailing-edge flaps (total)	31.77 m² (342 0 sq ft)
Fin	20.90 m² (225.0 sq ft)
Rudder, incl tab	6.97 m² (75 0 sq ft)
Tailplane	35 40 m² (381 0 sq ft)
Elevators, incl tabs	14.40 m² (155 0 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty	
C 130H	34,686 kg (76,469 lb)
C-130H-30	36,397 kg (80,242 lb)
C 130J	32,614 kg (71,902 lb)
C-130J 30	34,326 kg (75,675 lb)
Max fuel weight, internal (C-130H/J)	20,108 kg (44,330 lb)
external (C-130H/H-30 only)	8.255 kg (18,200 lb)
Max payload: C-130H	22,597 kg (49,818 lb)
C-130H 30	20,886 kg (46 045 lb)

MILITARY/GOVERNMENT C-130H DELIVERIES

To January 1995; excluding USA

Country	H	H-30	KC	Other
Abu Dhabi	6			
Algeria	10	8		
Argentina	5		2	
Australia	12			
Belgium	12			
Bolivia	2			
Brazil	6		2	
Cameroon	2	1		
Canada	12			
Chad	1	1		
Chile	2			
Colombia	2			
Denmark	3			
Dubai		1		
Ecuador	3			
Egypt	23	3		
France	3	9		
Gabon	1			
Greece	12			
Indonesia	3	7		1 (-MP)
Iran	32			
Israel	10		2	
Italy	14			
Japan	15			
Jordan	4			
Korea, South	8	4		
Libya	16			
Malaysia	6	1		3 (-MP)
Morocco	15		2	2 (RC-)
Netherlands		2		
New Zealand	5			
Niger	2			
Nigeria	6	3		
Norway	6			
Oman	3			
Philippines	3			
Portugal	5	1		
Saudi Arabia	35	2	8	1 (VC-)
	3 HS	1 HS		
Singapore	5		1	
Spain	7	1	5	
Sudan	6			
Sweden	6			
Taiwan	17			
Thailand	6	6		
Tunisia	2			
UK				66 (K)
Venezuela	8			
Yemen	2			
Zaire	7			
Total (520)	**374**	**51**	**22**	**73**

Key: MP. C-130H MP maritime patrol
RC. RC-130H electronic reconnaissance
VC. VC 130H VIP transport
HS. C 130/L 100 airborne hospital
K. C-130K UK variant

Notes: Customers and variants as delivered, transfers and conversions not listed

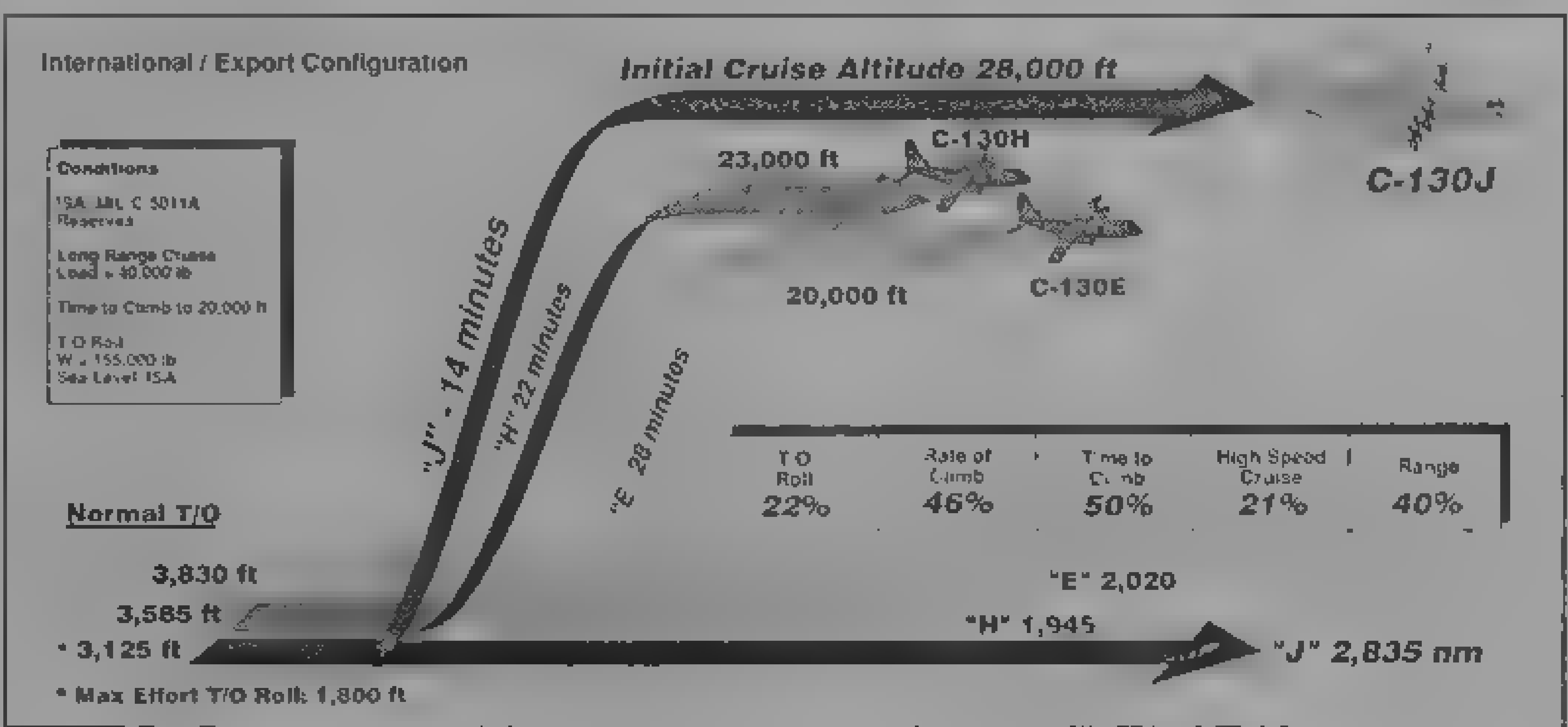
Only eight delivered to Libya: balance completed between November 1973 and October 1974, but subsequently held in long term storage due to embargo

Royal Air Force Hercules C. Mk 1 in newly applied (1994) overall grey camouflage *(Paul Jackson)*

1995

Artist's impression of commercial L-100J Hercules II

1995



C-130J Hercules II's performance improvements over C-130E and C-130H

1995

C-130J	21,785 kg (48,028 lb)
C-130J-30	20,074 kg (44,255 lb)
Max normal T-O weight	70,305 kg (155,000 lb)
Max overload T-O weight	79,380 kg (175,000 lb)
Max normal landing weight	70,305 kg (155,000 lb)
Max overload landing weight	79,380 kg (175,000 lb)
Max zero-fuel weight, 2.5g:	
C-130H	55,210 kg (121,720 lb)
C-130J	54,095 kg (119,255 lb)
Max wing loading (normal): C-130H	433.68 kg/m² (88.83 lb/sq ft)
Max power loading (normal): C-130H	5.23 kg/kW (8.60 lb/shp)
C-130J	3.93 kg/kW (6.45 lb/shp)

PERFORMANCE (at max normal T-O weight, unless indicated otherwise):

Max cruising speed:	
C-130H	315 kts (583 km/h; 362 mph)
C-130J	348 kts (645 km/h; 400 mph)
Econ cruising speed:	
C-130H	300 kts (556 km/h; 345 mph)
C-130J	339 kts (628 km/h; 390 mph)
Stalling speed	100 kts (185 km/h; 115 mph)
Max rate of climb at S/L:	
C-130H	548 m (1,800 ft)/min
C-130J	640 m (2,100 ft)/min
Time to 6,100 m (20,000 ft): C-130H	22 min
C-130J	14 min
Cruising altitude: C-130H	7,010 m (23,000 ft)
C-130J	8,535 m (28,000 ft)
Service ceiling at 66,681 kg (147,000 lb) AUW:	
C-130H	8,075 m (26,500 ft)
C-130J	9,315 m (30,560 ft)
Service ceiling, OEI, at 66,678 kg (147,000 lb) AUW:	
C-130H	5,485 m (18,000 ft)
C-130J	6,955 m (22,820 ft)
Runway LCN: asphalt	37
concrete	42
T-O run: C-130H	1,219 m (4,000 ft)
C-130J	1,003 m (3,290 ft)
T-O to 15 m (50 ft): C-130H	1,676 m (5,500 ft)
C-130J	1,433 m (4,700 ft)
Landing from 15 m (50 ft) at 58,967 kg (130,000 lb) AUW:	
C-130H	762 m (2,500 ft)
C-130J	777 m (2,550 ft)
Landing run at 58,967 kg (130,000 lb) AUW:	
C-130H	457 m (1,500 ft)
C-130J	427 m (1,400 ft)
Range with 18,144 kg (40,000 lb) payload and Mil-C-5011A reserves:	
C-130H	1,945 n miles (3,602 km; 2,238 miles)
C-130J	2,835 n miles (5,250 km; 3,262 miles)

UPDATED

LOCKHEED MARTIN L-100 SERIES COMMERCIAL HERCULES

TYPE: Civilian version of C-130.

PROGRAMME: Initial variants described in earlier *Jane's*; current models below.

CURRENT VERSIONS: **L-100-20 (Model 382E)**: Fuselage stretched by 2.54 m (8 ft 4 in); certificated 4 October 1968. Allison 501-D22A engines; one L-100-20 was Lockheed HTTB testbed (see 1991-92 *Jane's*); military/government operators listed under C-130 entry.

L-100-30 (Model 382G): Fuselage stretched 4.57 m (15 ft 0 in); military operators listed under C-130 entry; first civil operator Saturn Airways in December 1970.

L-100-30HS: Hospital version fitted by Lockheed Martin Aircraft Service Company (which see) with operating theatre, intensive care, advanced anaesthesia and X-ray facilities; five delivered to Saudi Arabia; electrical generators and air conditioners in underwing pods allow hospital to operate independently for 72 hours.

L-100J (Model 382J): Civil equivalent of military Hercules II, with AE 2100 turboprops, Pemco cargo loading system; able to carry standard M-1/M-2 containers, loaded via standard rear ramp/door or optional 2.74 × 3.51 m (9 ft 0 in × 11 ft 6 in) port side cargo door; maximum cargo payload 20,553 kg (45,312 lb) palletised, 21,625 kg (47,675 lb) bulk; maximum zero-fuel weight 56,245 kg (124,000 lb); range at MZFW 1,997 n miles (3,701 km; 2,300 miles).

CUSTOMERS: See table.

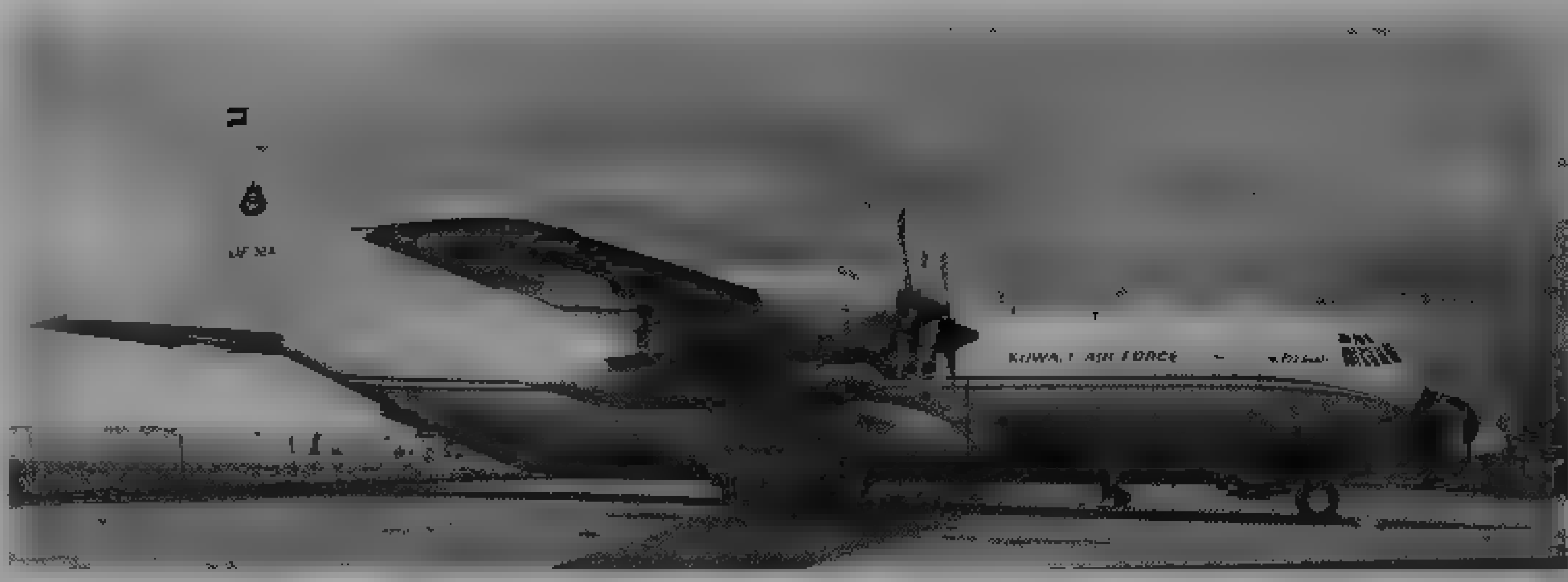
DESIGN FEATURES: Details of C-130H apply to L-100, except as detailed below. All C-130s and L-100s delivered since April 1984 have two 0.61 × 1.22 m (24 × 48 in) emergency exits which, together with rear personnel doors, allow carriage of 79 passengers; optional additional exit each side allows for 100 passengers; supplemental oxygen provided for passengers; various galley and toilet layouts available.

FLYING CONTROLS: As C-130H.

STRUCTURE: As C-130H.

LANDING GEAR: As for C-130H, except mainwheel tyre pressure 3.24 to 7.38 bars (47 to 107 lb/sq in) and nosewheel tyre pressure 4.14 bars (60 lb/sq in). Minimum ground turning radius: L-100-20, 26.8 m (88 ft); L-100-30, 27.5 m (90 ft).

POWER PLANT: Four 3,362 kW (4,508 shp) Allison 501-D22A turboprops.



Lockheed Martin L-100-30 of the Kuwait Air Force (*Paul Jackson*) *1994*

DIMENSIONS, EXTERNAL: As for C-130H except:

Length overall: L-100-20	32.33 m (106 ft 1 in)
L-100-30/L-100J	34.37 m (112 ft 9 in)
Wheelbase: L-100-20	11.30 m (37 ft 1 in)
L-100-30/L-100J	12.32 m (40 ft 5 in)
Crew door (integral steps): Height	1.14 m (3 ft 9 in)
Width	0.76 m (2 ft 6 in)
Height to sill	1.04 m (3 ft 5 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck:	
Length: L-100-20	15.04 m (49 ft 4 in)
L-100-30, excl ramp	17.07 m (56 ft 0 in)
L-100-30, incl ramp	19.93 m (65 ft 4¾ in)
Max height	2.74 m (9 ft 0 in)
Floor area, excl ramp: L-100-20	46.36 m² (499.0 sq ft)
L-100-30	52.30 m² (563.0 sq ft)
Floor area, ramp	9.57 m² (103.0 sq ft)
Volume, incl ramp: L-100-20	150.28 m³ (5,307 cu ft)
L-100-30	171.1 m³ (6,042 cu ft)

WEIGHTS AND LOADINGS:

Operating weight empty:	
L-100-20	34,781 kg (76,680 lb)
L-100-30	35,260 kg (77,736 lb)
L-100J	34,438 kg (75,923 lb)
Max payload: L-100-20	23,637 kg (52,110 lb)
L-100-30	23,158 kg (51,054 lb)
L-100J	21,808 kg (48,078 lb)
Max ramp weight	70,670 kg (155,800 lb)
Max T-O weight	70,308 kg (155,000 lb)
Max landing weight	61,235 kg (135,000 lb)
Max zero-fuel weight: L-100-30	58,420 kg (128,790 lb)
L-100J	56,245 kg (124,000 lb)
Max fuel weight: L-100-30	29,380 kg (64,772 lb)
L-100J	20,726 kg (45,694 lb)
Max wing loading	433.5 kg/m² (88.8 lb/sq ft)
Max power loading	5.23 kg/kW (8.6 lb/shp)

PERFORMANCE (at max T-O weight, except where indicated):

Max cruising speed at 6,100 m (20,000 ft) at 54,430 kg (120,000 lb) AUW: L-100-30	308 kts (571 km/h; 355 mph)
L-100J	358 kts (663 km/h; 412 mph)
Landing speed	124 kts (230 km/h; 143 mph)
Max rate of climb at S/L: L-100-30	518 m (1,700 ft)/min
L-100J	640 m (2,100 ft)/min
Runway LCN: asphalt	37
concrete	42
FAR T-O field length	1,905 m (6,250 ft)
FAR landing field length at max landing weight	1,478 m (4,850 ft)
Range:	
L-100-30 with max payload, 200 n miles (370 km; 230 miles) to alternate and 45 min reserves	1,244 n miles (2,303 km; 1,431 miles)
L-100J	1,999 n miles (3,702 km; 2,300 miles)
L-100-30 with zero payload	3,264 n miles (6,045 km; 3,756 miles)
L-100J	4,087 n miles (7,569 km; 4,703 miles)

OPERATIONAL NOISE LEVELS (FAR Pt 36, Stage 2):

T-O sideline	96.7 EPNdB
T-O flyover: at T-O power	97.8 EPNdB
at cutback power	94.8 EPNdB
Approach flyover	98.1 EPNdB

UPDATED

LOCKHEED MARTIN GALAXY

USAF designation: C-5

TYPE: Strategic transport.

PROGRAMME: Total 81 C-5As and 50 C-5Bs built for USAF; final delivery 17 April 1989; all except five C-5As remain in service; last described in 1989-90 *Jane's*.

US Congress, concerned over McDonnell Douglas C-17 Globemaster III (which see) cost and performance, ordered USAF to investigate possible alternative in 1994 for November 1995 decision. Lockheed Martin offering restart of C-5 production against main alternative of military Boeing 747.

CURRENT VERSIONS: **C-5D**: Offered for USAF's Non-Developmental Airlift Aircraft (NDAA) requirement. Changes include new power plant and digital avionics adapted from C-130J (identical hardware and 60 per cent of software), including Sanders mission computers and flat panel displays and Honeywell autopilot.

POWER PLANT: Four 222 kN (50,000 lb st) General Electric CF6-80C2 turbofans.

NEW ENTRY

LOCKHEED MARTIN L-100 OPERATORS

Operator (in January 1995)	L-100	L-100-20	L-100-30
Advanced Leasing Corporation			1
Air Algérie			2
Air Gabon			[illegible]
Argentine Air Force			[illegible]
China General Aviation Corporation			2
Dubai (UAE) Air Force			1
Ecuador Air Force			1
Ethiopian Airlines			2
Frame Air			1
Gabon Air Force		1	1
Indonesian Air Force			1
Jamahiriya Air Transport (Libya)		2	3
Kuwait Air Force			3
Lockheed			2
Merpati (Indonesia)			2
Northwest Territories (Canada)			1
Pakistan Air Force	1		
Pelita Air Service (Indonesia)			4
Peru Air Force		5	
Petroléos Mexicanos			1
Philippine Air Force		2	
Safair Freighters			9
Saudi government			6
Southern Air Transport		[illegible]	16
Tepper			2
Transafrik (Sao Tomé)		1	2
Uganda Air Cargo			1
Worldwide Trading (USA)			1
Written off	8	15	13
Total (116)	**9**	**27**	**80**

LOCKHEED MARTIN SKUNK WORKS (Division of Lockheed Martin Aeronautics Sector)

1011 Lockheed Way, Palmdale, California 93599-3740
Telephone 1 (805) 572 2974
Fax 1 (805) 572 2209
PRESIDENT: Jack S Gordon
DIRECTOR OF PUBLIC RELATIONS: James W Ragsdale

Nickname, Skunk Works became official title when former Lockheed Advanced Development Company renamed in 1995. LMSW functions autonomously at Palmdale, has specialised in 'black' or covert development programmes, including U 2/TR 1, SR 71 and F-117A

UPDATED

COMMON AFFORDABLE LIGHTWEIGHT FIGHTER (CALF)/JAST

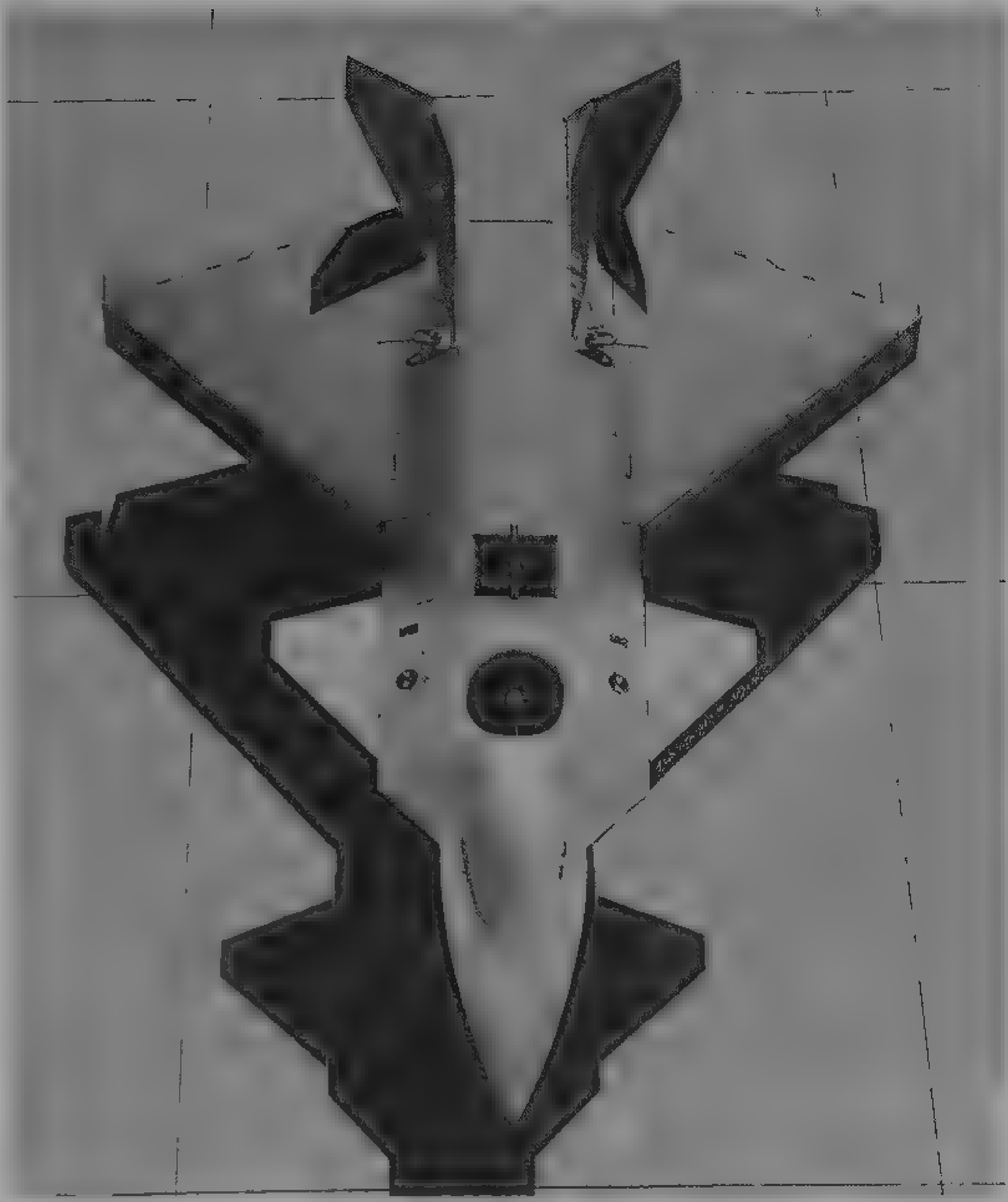
TYPE: Strike-fighter technology demonstrator

PROGRAMME: US Department of Defense designation **X-32** allocated for technology demonstrator phase of Advanced Research Projects Agency (ARPA) programme. CALF project initially launched as STOVL Strike Fighter (SSF now envisaged as X-32B) to provide US Navy/Marine Corps with replacement for F/A 18 Hornet and AV 8B Harrier II later expanded to include USAF F-16 replacement candidate (X-32A), in which vertical lift system eliminated in favour of additional fuel to produce longer range, conventional take-off aircraft

Lockheed Martin one of four teams in contention for X 32 contract, others headed by Boeing, McDonnell Douglas and Northrop Grumman. Lockheed Martin partnered by Allison, Pratt & Whitney and Rolls-Royce engine manufacturers. Congressional pressure in Autumn 1994 resulted in CALF project merging with Joint Advanced Strike Technology (JAST) programme (see US Navy entry)

On 27 April 1995, Lockheed unveiled 86 per cent scale model of JAST demonstrator for wind tunnel tests and in June revealed agreement with Yakovlev of Russia to purchase data on cancelled Yak-141 programme, which employed similar propulsion system. Model JAST, with F100 engine, to begin tunnel trials at NASA Ames September 1995

NEW ENTRY


Wind tunnel model (86 per cent scale) of Lockheed Martin JAST demonstrator

1995

LOCKHEED MARTIN F-117A NIGHTHAWK

TYPE: Precision attack aircraft with stealth elements, optimised for radar energy dispersion and low IR emission

PROGRAMME: Production complete, details of development and early service appeared in the 1993-94 and earlier *Jane's*. Navalised A/F-117X proposal described separately

CURRENT VERSIONS: **F-117A**: *As described*

F-117A+: Proposed modification of existing F-117A aircraft, utilising latest technology, Lockheed Martin quoting programme development cost of $79 million, covering operational prototype and including detail design, tooling modification of test aircraft, manufacture of full-size pole model, ground and flight trials plus full-scale development of 18 advanced low-observable technologies. Company claims result to be vastly enhanced stealth fighter with greatly improved survivability prospects in high-threat environment


Lockheed Martin F-117A revealing details of FLIR air intake grilles and auxiliary intake doors *(Paul Jackson)*

1995

F-117B: Skunk Works proposal for new-build programme taking advantage of commonality with A/F-117X naval version (which see). Features redesigned wing and horizontal tail surfaces of A/F-117X and GE F414 afterburning turbofan engines, plus all weather sensors advanced signature reduction and improved aerodynamic qualities. Maximum gross take-off weight 33,203 kg (73,200 lb); internal payload 4,536 kg (10,000 lb), combat radius 980 n miles (1,815 km, 1,127 miles). Current Lockheed Martin sales effort envisages joint Air Force/Navy programme to capitalise on modular production methods and economies of scale

A/F-117X: See next entry

CUSTOMERS: USAF, five preseries plus 59 production, deliveries seven, eight, eight, eight, eight, seven, five, four and three in calendar years 1982-90 final delivery of 88-0843 on 12 July 1990) Currently operational at Holloman AFB New Mexico, with 49th Fighter Wing (7th, 8th and 9th Fighter Squadrons)

COSTS: $6,560 million programme (1990), including $2,000 million R&D $4,270 million for procurement and $295 4 million for infrastructure. Average unit cost $42 6 million (then year dollars

DESIGN FEATURES: Multifaceted airframe designed to reflect radar energy away from originating transmitter, particularly downward-looking AEW aircraft, vortexes from many sharp edges, including leading-edge of wing designed to form co-ordinated lifting air flow pattern wings have 67° 30′ sweepback, much greater than needed for subsonic performance, with aerofoil formed by two flat planes underneath and three on upper surface, forward underwing surface blends with forward fuselage, all doors and access panels have serrated edges to suppress radar reflection, internal weapons bay 4 7 m (15 ft 5 in) long and 1 75 m (5 ft 9 in) wide divided longitudinally by two lengthwise doors hinged on centreline; boom refuelling receptacle on port side of top plate, aft of cockpit. Frontal radar cross-section estimated as 0 01 m² (0 1 sq ft)

FLYING CONTROLS: Four omnidirectional air probes at nose indicate GEC Astronics quadruplex fly-by-wire control system, similar to that of F-16, using two-section elevons and all-moving ruddervators together for control and stability, ruddervators swept about 65° and set at 85° to each other

STRUCTURE: Material principally aluminium, two-spar wings, fuselage has flat facets mounted on skeletal subframe, jointed without contour blending; surfaces coated with various radar-absorbent materials Weapons bay doors and landing gear leg doors of composites, nickel alloy honeycomb jetpipes

LANDING GEAR: Tricycle type by Menasco, with single wheels all retracting forward. Loral brakes (steel originally, being replaced by carbon/carbon), wheels (F-15E size) and

Artist's impression of Lockheed Martin A/F-117X stealth fighter proposal to US Navy

1995

anti-skid system. Goodyear tyres. All doors have serrated edges to suppress radar reflections. Emergency arrester hook with explosively jettisoned cover. Pioneer Aerospace braking parachute (black).

POWER PLANT: Two 48.0 kN (10,800 lb st) class General Electric F404-GE-F1D2 non-augmented turbofans. Rectangular overwing air intakes with 2.5 × 1.5 cm (1 × ⅝ in) heated grid for anti-icing and low observability. Auxiliary air intake doors in horizontal surface immediately to the rear. Part of cold air ingested bypasses engine and is mixed with exhaust gases for cooling. Narrow-slot 'platypus' exhausts, designed by Astech/MCI, in rear fuselage, 1.65 m (5 ft 5 in) long and 0.10 m (4 in) high, with extended lower lip, surrounded by heat tiles of type used on Space Shuttle and with 11 vertical, internal guide vanes. Sundstrand air turbine starter. In-flight refuelling receptacle in decking aft of cockpit, illuminated for night refuelling by lamp at apex of cockpit. Optional drop tank on internal weapon pylon.

ACCOMMODATION: Pilot only. McDonnell Douglas ACES II zero/zero ejection seat. Five Sierracin/Sylmar Corporation individually framed flat-plate windows, including single-piece windscreen. Transparencies gold-coated for radar dissipation. Canopy hinged to open upward and backward.

SYSTEMS: AiResearch environmental control, auxiliary power and emergency power systems.

AVIONICS: *Comms:* Retractable radio antennae on spine and beneath fuselage, ahead of port main landing gear.

Flight: GEC-Marconi flight control computer/navigation interface and autopilot computer (NIAC) system, Honeywell SPN-GEANS INS (replaced by Honeywell H 423/E ring laser gyro from August 1991), Rockwell Collins GPS to be added, SLI Avionic Systems Corporation expanded data transfer system and AHRS, Honeywell radar altimeter.

Instrumentation: HUD based on Kaiser AN/AVQ-28, large head-down display for FLIR imagery flanked by two multifunction CRTs, Harris Corporation digital moving map added as retrofit with full colour MFDs.

Mission: Texas Instruments retractable downward looking infra-red (DLIR) sensor and laser designator beneath forward fuselage to starboard of nosewheel bay. Texas Instruments foward looking infra-red (FLIR) sensor, with dual fields of view, in recessed emplacement, covered by fine mesh screen, below windscreen. (FLIR and DLIR to be replaced by improved equipment during third phase retrofit in 1994.) IBM AP-102 mission computer (replacing original three Delco M362F computers).

ARMAMENT: "Full range of USAF tactical fighter ordnance", principally two 2,000 lb bombs: BLU 109B low level laser guided or GBU-10/GBU-27 laser-guided glide weapons; alternatively, AGM-65 Maverick or AGM-88 HARM ASMs. Provision for AIM-9 Sidewinder (against AWACS aircraft). Internal carriage on two extensible beams in weapon bay. (Only missiles with seeker heads extended below aircraft prior to launch, bombs released from within weapons bay.)

DIMENSIONS, EXTERNAL:

Wing span	13.20 m (43 ft 4 in)
Length overall	20.08 m (65 ft 11 in)
Height overall	3.78 m (12 ft 5 in)

AREAS (estimated):

Wings, gross	84.8 m² (913.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty (estimated)	13,381 kg (29,500 lb)
Internal weapons load	2,268 kg (5,000 lb)
Max T-O weight	23,814 kg (52,500 lb)

PERFORMANCE (* = not confirmed by USAF):

Max level speed	561 kts (1,040 km/h; 646 mph)
Normal max operating speed	Mach 0.9
* T-O speed at normal combat weight	165 kts (306 km/h; 190 mph)
* Landing speed	150 kts (227 km/h; 172 mph)
Mission radius, unrefuelled, 2,268 kg (5,000 lb) weapon load	570 n miles (1,056 km; 656 miles)
g limit	+6

UPDATED

LOCKHEED MARTIN A/F-117X

TYPE: Private venture, long-range, naval strike/attack aircraft.

PROGRAMME: Proposed adaptation of F-117, revealed 1993 under designation F-117N Seahawk; potential gap-filler between 1999 retirement of Grumman A-6 Intruder and service entry of JAST replacement for cancelled A/F-X, complement to F/A-18E Hornet. Low-risk development, meeting most A/F-X requirements apart from folded size and maximum speed. Lockheed to guarantee radar signature and weapon delivery accuracy. Original F-117N proposal rejected by Pentagon, mid-1993; resubmitted as A/F-117X with afterburning engines early 1994 to improve multirole characteristics. Navy lacks funding to pursue A/F-117X.

CUSTOMERS: Nil. First delivery possible within five years of order.

COSTS: Figures quoted 1993 for concept definition and development, $2,600 to $2,900 million, plus $4,360 million for 50 aircraft built at eight per year; or $7,450 million for 100 aircraft at 16 per annum. Programme cost, including initial spares, training and support: $8,460 million for 50, $12,250 million for 100. Later cost estimate (April 1994) quotes flyaway price of $76 million, based on 100-aircraft production run.

DESIGN FEATURES: Based on F-117A, but with new wing of 48° sweep, incorporating folding for onboard stowage; and additional horizontal tail surfaces. Modified jet exhaust, improved coatings, new aperture and edge technologies reduce enemy's detection and engagement possibilities by 50 per cent. Enlarged weapons bay and provision for external stores stowage triples combat load.

STRUCTURE: Centre and aft fuselage dimensionally similar to F-117A, but with structural strengthening; forward fuselage and vertical tails identical to earlier version. Keel dropped 0.48 m (1 ft 7 in) and curved weapons bay doors added to double internal weapons capacity. Navalisation adds 4,082 kg (9,000 lb) to empty weight.

LANDING GEAR: Original F-117A landing gear replaced by units from Grumman F-14 Tomcat.

POWER PLANT: Two afterburning General Electric F414 turbofans.

ACCOMMODATION: Pilot only, beneath all-transparent canopy.

AVIONICS: Some 80 to 85 per cent commonality with F-117A, but existing sensors replaced by integrated radar and IR system comprising high-resolution ground-targeting radar, FLIR and IRST; data presentation on 20 × 20 cm (8 × 8 in) LCD.

ARMAMENT: Internally, up to four 2,000 lb Joint Direct Attack Munitions or four GBU-27 LGBs in attack role, or, in air defence role, four AIM-120 AMRAAMs (clipped fin modification); or two bombs and two AAMs (AIM-120 or AIM-9 Sidewinder). Externally, total of four underwing pylons for standoff missiles or fuel.

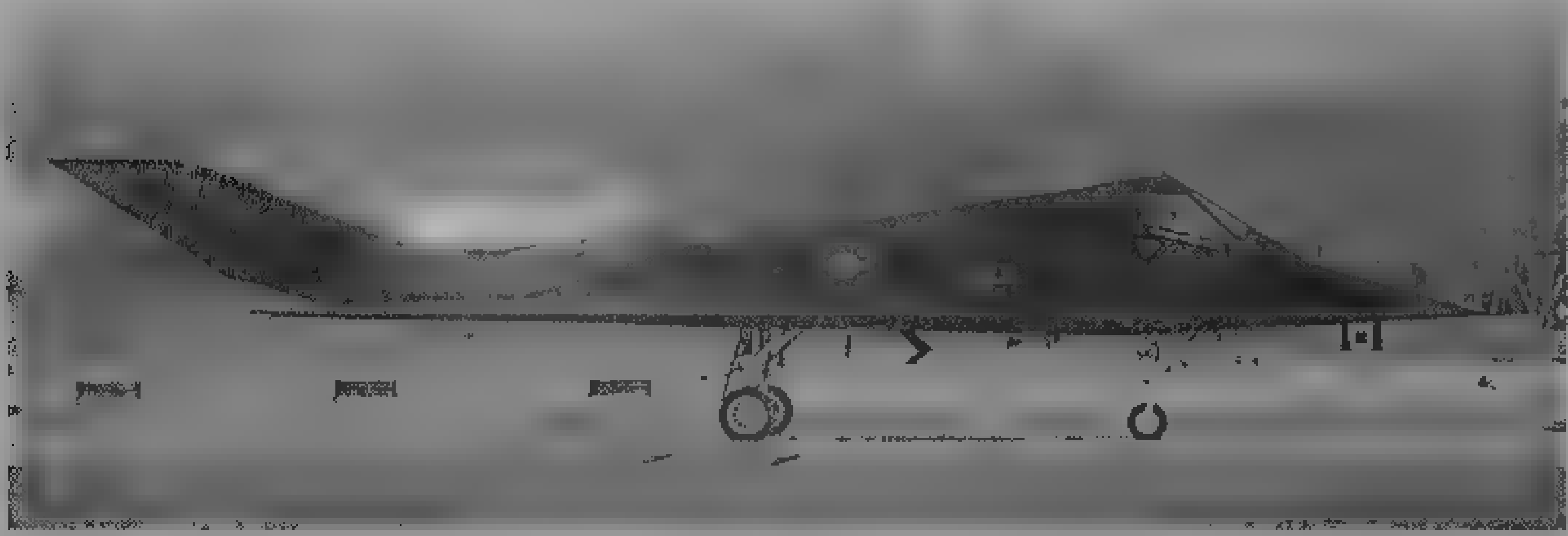
WEIGHTS AND LOADINGS:

Weapon load: internal	4,536 kg (10,000 lb)
external	3,629 kg (8,000 lb)
Stores 'bring back' capability	5,443 kg (12,000 lb)
Max T-O weight	29,841 kg (65,789 lb)

PERFORMANCE:

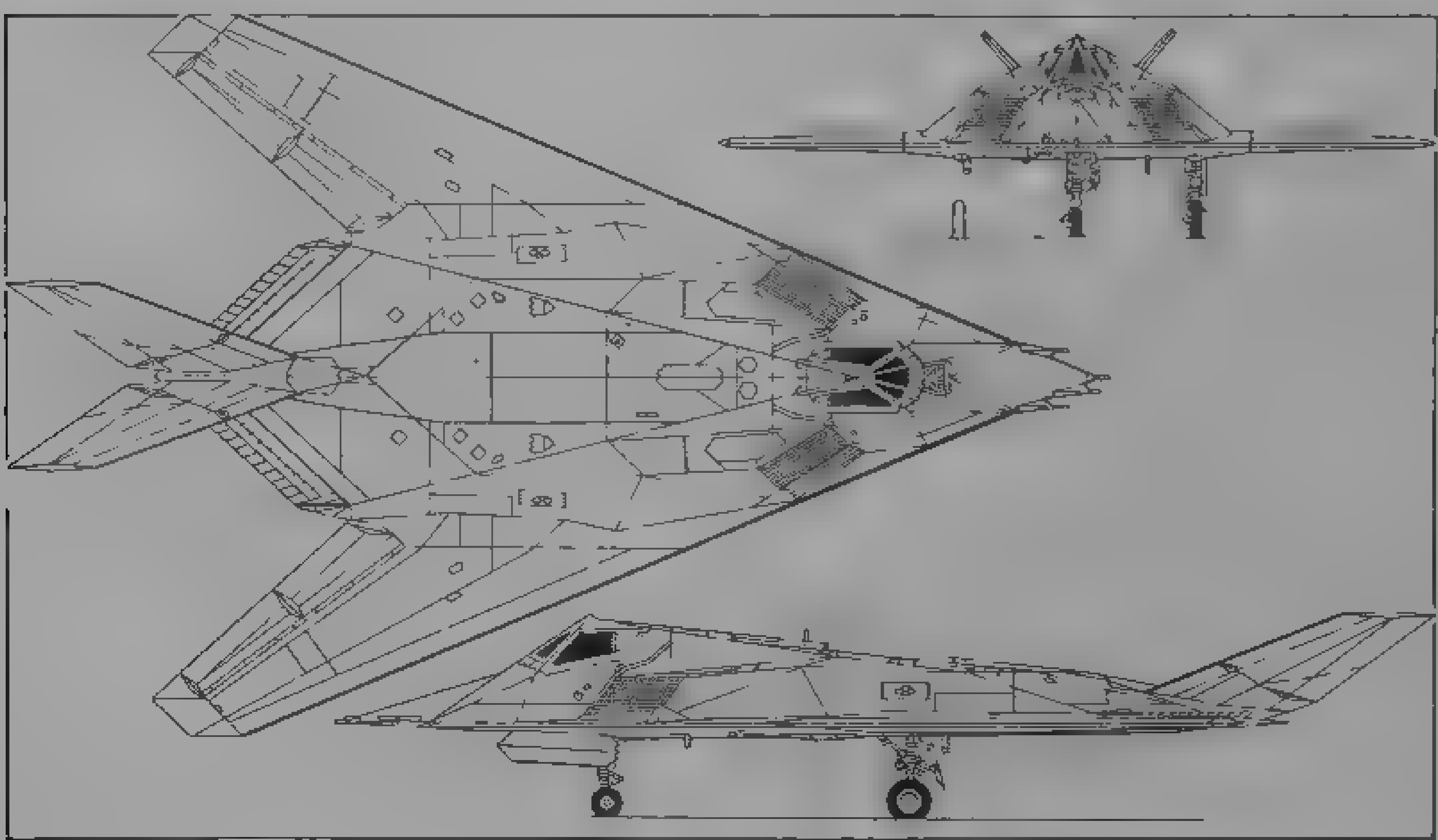
Mission radius, unrefuelled	680 n miles (1,260 km; 783 miles)

UPDATED



Lockheed Martin F-117A Nighthawk, the original 'stealth fighter' *(Paul Jackson)*

1995



Lockheed Martin F-117A stealth attack aircraft *(Jane's/Mike Keep)*

1991

LOCKHEED MARTIN TACTICAL AIRCRAFT SYSTEMS (Division of Lockheed Martin Aeronautics Sector)

Lockheed Boulevard, Fort Worth, Texas 76108
Telephone: 1 (817) 777 2000
Fax: 1 (817) 763 4797
PRESIDENT: Dain M Hancock
MANAGER, PUBLIC AFFAIRS: Joe W Stout

General Dynamics' Tactical Military Aircraft Division at Fort Worth sold to Lockheed, became Lockheed Fort Worth Company on 1 March 1993, renamed LMTAS following merger between Lockheed and Martin in 1995

Fort Worth activities include production of F-16 Fighting Falcon, previously shared development of F-22A ATF (with Lockheed and Boeing). Also receiving development contracts eventually to be worth $800 million in connection with Mitsubishi FS-X design and anticipates over $2,000 million of production work when manufacture begins in Japan, provides technical support for Taiwan's IDF combat aircraft development programme. Has design leadership over Skunk Works in connection with submissions for JAST programme (see US Navy entry). Fort Worth workforce reduced to 13,000 by 1995

UPDATED

LOCKHEED MARTIN (GENERAL DYNAMICS) F-16 FIGHTING FALCON

Israel Defence Force names: F-16A/B Netz (Falcon), F-16C Barak (Lightning) and F-16D Brakeet (Thunderbolt)

TYPE: Single- and two-seat multirole fighter

PROGRAMME: Emerged from YF-16 of US Air Force Lightweight Fighter prototype programme 1972 (details under General Dynamics in 1977-78 and 1978-79 *Jane's*), first flight of prototype YF-16 (72-01567) 2 February 1974 first flight of second prototype (72-01568) 9 May 1974 selected for full-scale development 13 January 1975; day fighter requirement extended to add air-to-ground capability with radar and all-weather navigation, production of six single-seat F-16As and two two-seat F-16Bs began July 1975; first flight of full-scale development aircraft 8 December 1976, first flight of F-16B 8 August 1977 Fleet of 3,300 F-16s achieved 5 millionth flying hour late in 1993 and 3,500th aircraft delivered 27 April 1995

After adjusting production rates in mid-1993, Lockheed to build 150 F-16s in 1994, followed by 90, 90 and 159 up to 1997 Final 12 F-16s for USAF ordered in FY94, but USAF considering plan to build 120 F-16C/Ds with funds from proposed USAF sale of older F-16A/Bs; if approved, first six to be funded in FY96

CURRENT VERSIONS: **F/A-16.** Proposed modification of 300 Block 30/32 aircraft for close air support (CAS)/battlefield air interdiction (BAI) in late 1990s; head-steered FLIR, Pave Penny laser ranger and 30 mm cannon pod 200 F-16Cs to have received CAS/BAI modifications from 1995, including DTS, Navstar GPS and improved data modem. Block 30/32 upgrade abandoned January 1992 in favour of CAS/BAI assignment of Block 40/42 aircraft, having LANTIRN capability; these require more simple modification with ground datalink, laser spot tracker, anti jam radio, missile approach warner, provision for pilot's night vision goggles and upgrades to LANTIRN pods Deployment plan envisages 4½ wings of Block 40/42s for night CAS and two wings of Block 30/32s for day CAS Meanwhile, first dedicated CAS/BAI aircraft were F-16As of ANG's 138th FS at Syracuse, New York, operational 1989, equipment including fixed GPU-5/A 30 mm centreline cannon; first improved data modem installed November 1990; squadron received F-16Cs in 1991

Half brothers from the Lockheed Martin stable, an F-16C Fighting Falcon formates with a P-38 Lightning *(Paul Jackson)*

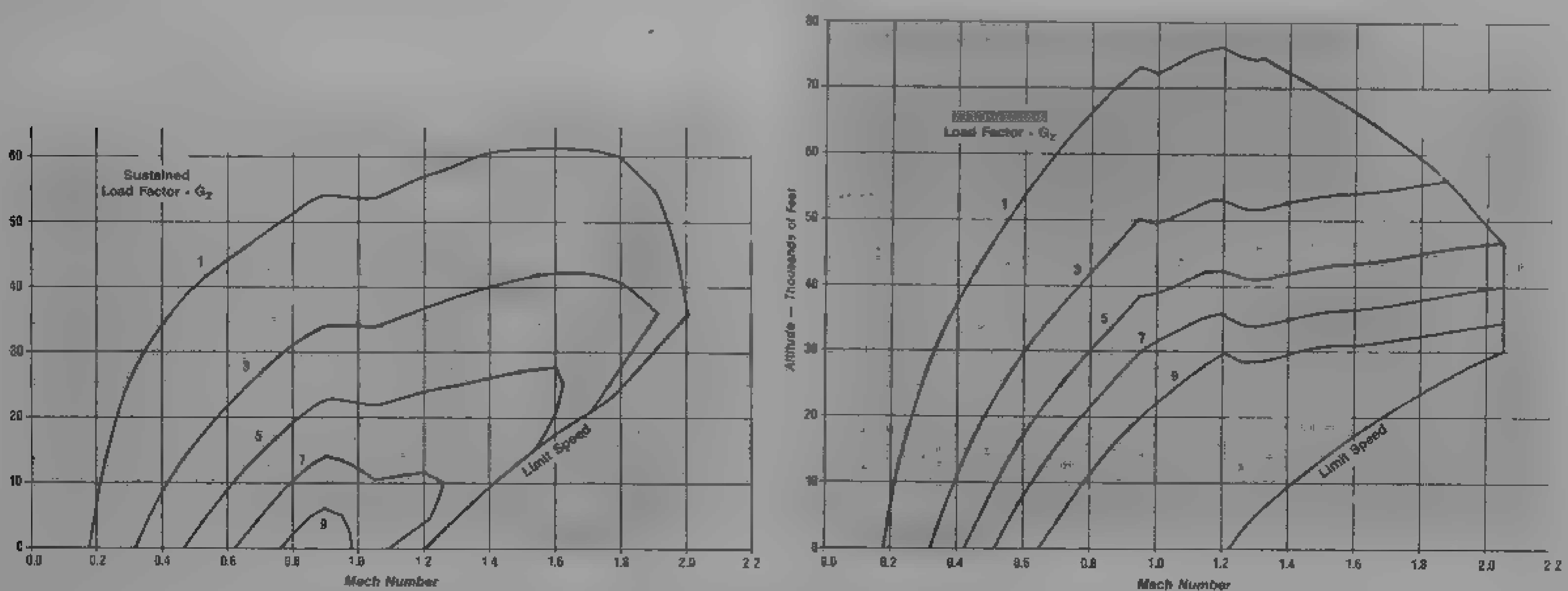
1995

F-16A. First production version for air-to-air and air-to-ground missions; production for USAF completed March 1985, but still available for other customers, international sales continue; powered since late 1988 (Block 15OCU) by P&W F100-PW-220 turbofan, Westinghouse AN/APG-66 range and angle track radar; first flight of first aircraft (78-0001) 7 August 1978, entered service with 388th TFW at Hill AFB, Utah, 6 January 1979; combat ready October 1980, when named Fighting Falcon; most now serving ANG and AFRES, power plants being upgraded to F100-PW-220E, 1991-96. In 1994, first AFRes F-16A/Bs gained BAe Terprom (terrain profile matching) software for ground collision avoidance. Also produced in Europe Built in Blocks 01, 05, 10 and 15, of which Blocks 01 and 05 retrofitted to Block 10 standard 1982-84, Block 15 retrofitted to OCU standard from late 1987 First **GF-16A** ground trainers relegated to instructional use at 82nd Training Wing, Sheppard AFB, by 1993

Taiwanese F-16A/Bs, due for delivery from July 1996, are to unique Block 20 standard; avionics configuration similar to MLU, including colour displays and AN/APX-111 IFF; Block 20 combat potential exceeds that of early F-16Cs

Operational Capabilities Upgrade (OCU): USAF/NATO co-operative programme to equip F-16A/B for next-generation BVR air-to-air and air-to-surface weapons; radar and software updated, fire control and stores management computers improved, data transfer unit fitted, combined radar-barometric altimeter fitted, and provision for AN/ALQ-131 jamming pods. Ring laser INS and upgrade from P&W F100-PW-200 to F100-PW-220E planned for 1990s FMS exports since 1988 to Block 15OCU standard with F-16C features including ring laser INS, AN/ALR-69 RWR, F100-PW-220 power plant and AIM-9P-4 Sidewinder AAM capability

Mid-Life Update (MLU): Development authorised 3 May 1991 (signature of final partner), US government contract to GD 15 June 1991, originally planned to be applied to 533 aircraft of USAF (130), Belgium (110), Denmark (63), Netherlands (172) and Norway (58) from 1996 in co-development/co-production programme. USAF withdrew 1992, but ordered 223 modular computer retrofit kits from MLU to equip Block 50/52 aircraft. European share renegotiated on 28 January 1993 to new totals of Belgium 48 plus 24 options, Denmark 61, Netherlands 136; and Norway 56, letters of offer and acceptance finalised 30 June 1993 Lockheed awarded contract for 301 MLU kits for European air forces on 17 August 1993, kit deliveries begin to air forces in October 1996, for completion in late 1999 Cockpit similar to F-16C/D Block 50 with wide-angle HUD, night vision goggle compatibility, modular mission computer replacing existing three, BAe Terprom digital terrain system, AN/APG-66(V2A) fire control radar, GPS, improved data modem, two Honeywell 10 cm



F-16 MANOEUVRABILITY

Fighting Falcon's reputation for agility is demonstrated by manoeuvring envelopes at progressively higher *g*, sustained loadings left, instantaneous right, both assume half fuel and armament of two wingtip Sidewinder AAMs and full (511 rounds) cannon

1995

Among Fort Worth's recent deliveries are first Block 52D F-16Cs to South Korea

1995

(4 in) square LCD colour displays (replacing mono CRTs) and provision for microwave landing system (MLS). Inlet hardpoints and wiring for FLIR pods will be added to Block 10 aircraft. Options include helmet-mounted display and Hazeltine AN/APX 111 IFF interrogator/transponder both taken up by Netherlands and Norway. Aircraft for prototype conversion to GD in September 1992, including Danish F-16B ET-204, Netherlands F-16B J-650, Norwegian F-16A 299 and USAF/ANG F-16A 80-0584. First flight (by last-mentioned aircraft) 28 April 1995, formal debut 11 May 1995.

F-16(ADF). Modification of 279 (actually 272 because of preconversion attrition) Block 15 F-16A/Bs as USAF air defence fighters to replace F-4s and F-106s with 11 Air National Guard squadrons, ordered October 1986. Modifications include upgrade of AN/APG-66 radar to improve small target detection and provide continuous-wave illumination, provision of AMRAAM datalink, improved ECCM, Bendix/King AN ARC-200 HF/SSB radio (F-16A only), Teledyne/E-Systems Mk XII advanced IFF, provision for Navstar GPS Group A, low-altitude warning, voice message unit, night identification light (port forward fuselage of F-16A only), and ability to carry and guide two AIM-7 Sparrow missiles. First successful guided launch of AIM-7 over Point Mugu range, California, February 1989. F-16(ADF) can carry up to six AIM-120 AMRAAM or AIM-9 Sidewinder or combinations of all three missiles, retains internal M61 20 mm gun. GD converted one prototype, then produced modification kits for installation by USAF Ogden Air Logistics Center, Utah, in conjunction with upgrade to OCU avionics standard; first Ogden aircraft, F-16B 81-0817, completed October 1988. Development completed at Edwards AFB during 1990, operational test and evaluation with 57th Fighter Weapons Wing at Nellis AFB, Nevada, first F-16(ADF), 81-0801, delivered to 114th Fighter Training Squadron at Kingsley Field, Oregon, 1 February 1989; 194th Fighter Interceptor Squadron, California ANG, Fresno, achieved IOC in 1989, following receipt of first aircraft (F-16B 82-1048) on 13 April 1989, first AIM-7 launch by ANG (159th FS) June 1991. Programme completed early 1992, includes approximately 30 F-16Bs. Majority of F-16(ADF) aircraft now in storage.

F-16B: Standard tandem two-seat version of F-16A fully operational both cockpits, fuselage length unaltered, reduced fuel.

GF-16B Ground trainers in use for instructional tasks at Sheppard AFB by 1993.

F-16C/D: Single-seat and two-seat USAF Multinational Staged Improvement Program (**MSIP**) aircraft respectively, implemented February 1980. **MSIP** expands growth capability to allow for ground attack and beyond visual-range missiles, and all-weather, night and day missions; **Stage I** applied to Block 15 F-16A/Bs delivered from November 1981 included wiring and structural changes to accommodate new systems. **Stage II** applied to Block 25 F-16C/Ds from July 1984 includes core avionics, cockpit and airframe changes. **Stage III** includes installation of systems as they become available, beginning 1987 and extending up to Block 50/52, including selected retrofits back to Block 25. Changes include Westinghouse AN/APG-68 multimode radar with improved range, resolution, more operating modes and better ECCM than AN/APG-66, advanced cockpit with upgraded interfaces and up-front controls, GEC-Marconi wide-angle HUD, two multifunction displays, Fairchild mission data transfer equipment and radar altimeter, expanded base of fin giving space for proposed later fitment of AN/ALQ-165 Airborne Self-Protection Jamming system (since cancelled), increased electrical power and cooling capacity; structural provision for increased take-off weight and manoeuvring limits; and MIL-STD-1760 weapons interface for use of smart weapons such as AIM-120A AMRAAM and AGM-65D IR Maverick. First AIM-120 operational launch (by any aircraft), 27 December 1992. F-16D (90-0778) of 33rd FS/363rd FW destroyed Iraqi MiG-25.

Common engine bay introduced at **Block 30/32** (deliveries from July 1986) to allow fitting of either P&W F100-PW-220 (Block 32) or GE F110-GE-100 (Block 30) Alternate Fighter Engine. Other changes include computer memory expansion and seal-bonded fuselage fuel tanks. First USAF wing to use F-16C/Ds with F110 engines was 86th TFW at Ramstein AB, Germany, from October 1986. Additions in 1987 included full Level IV multitarget compatibility with AMRAAM (as Block 30B), voice message unit, Shrike anti-radiation missiles (from August), crash survivable flight data recorder and modular common inlet duct allowing full thrust from F110 at low airspeeds.

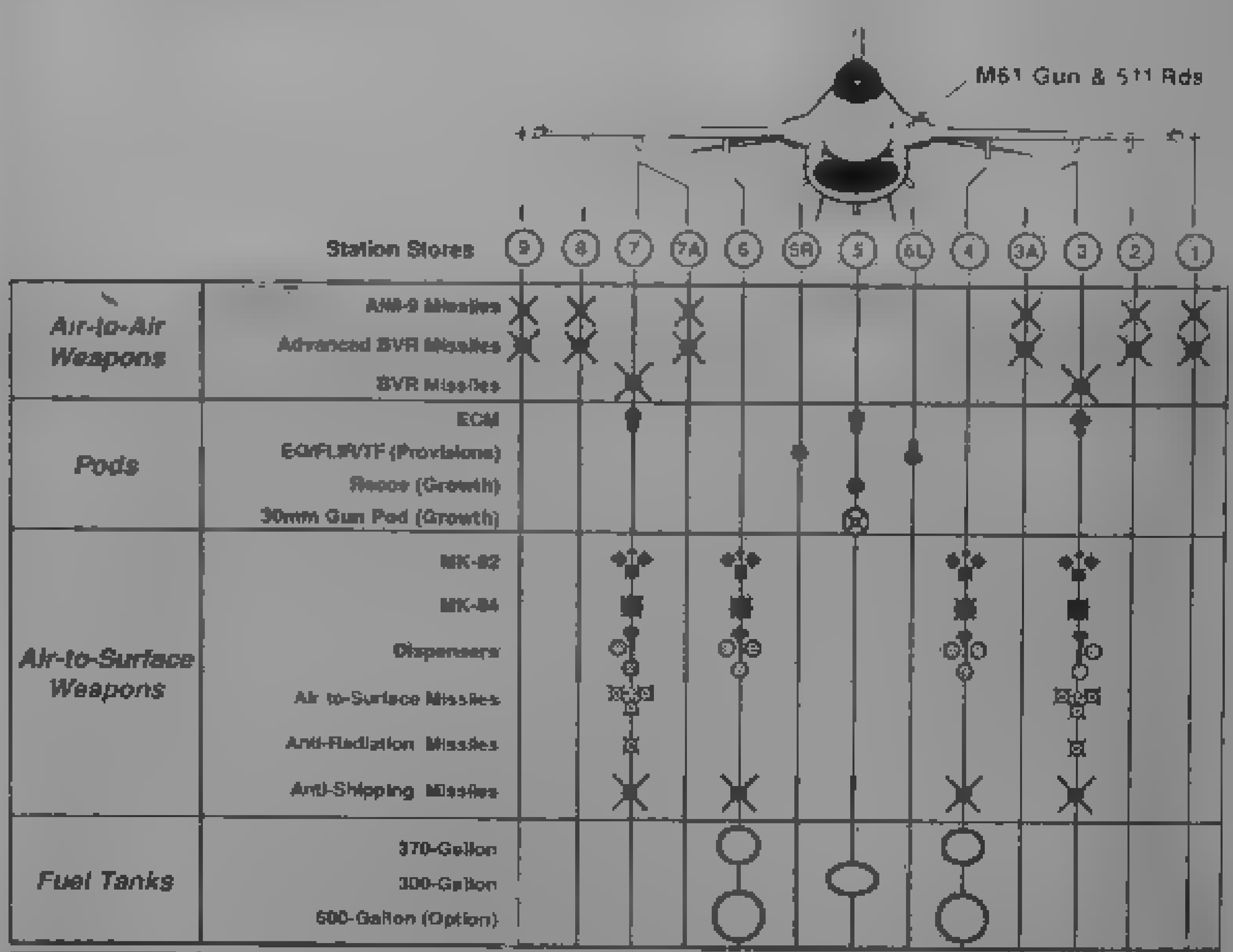
Software upgraded for full Level IV multitarget compatibility with AMRAAM early 1988. Industry-sponsored development of radar missile capability for several European air forces resulted in firing of AIM-7F and AIM-7M missiles from F-16C in May 1988, capability introduced mid-1991, missiles guided using pulse Doppler illumination while tracking targets in a high PRF mode of the AN/APG-68 radar.

Block 40/42 Night Falcon (deliveries from December 1988) upgrades include AN/APG-68(V) radar allowing 100 hour operation before maintenance, full

First Block 50D version of F-16C (91-0360) during a predelivery test flight

1994

LOCKHEED MARTIN F-16C FIGHTING FALCON WEAPON OPTIONS



STATION CAPACITY	9	8	7	7A	6	5R	5	5L	4	3A	3	2	1
Capacity (lb)	425	700	3500	450	4500	550	2200	550	4500	450	3500	700	425
Load Factor (g)	9.0	5.5	5.5	9.0	5.5	9.0	5.5	9.0	5.5	9.0	5.5	5.5	9.0
Alternate Cap. at 9g	425	450	2000	450	2500	550	1200	550	2500	450	2000	450	425

1995

Conformal fuel tanks were evaluated on a modified F-16C during 1994

1995

compatibility with Lockheed Martin low-altitude navigation and targeting infra-red for night (LANTIRN) pods, four-channel digital flight control system, expanded capacity core computers, diffractive optics HUD, enhanced envelope gunsight, GPS, improved leading-edge flap drive system, improved cockpit ergonomics, high gross weight landing gear, structural strengthening, and provision for improved EW equipment. LANTIRN gives day/night standoff target identification, automatic target handoff for multiple launch of Mavericks, autonomous laser-guided bomb delivery and precision air-to-ground laser ranging. Combat Edge pressure breathing system installed 1990 for higher pilot g tolerance.

First Block 40 F-16C/Ds issued in late 1990 to 363rd FW (Shaw AFB, South Carolina), first LANTIRN pods to 36th FS/51st FW at Osan, South Korea, in 1992.

Block 50/52 (deliveries began with F-16C 90-0801 in October 1991 for operational testing) upgrades include F110-GE-129 and F100-PW-229 increased performance engines (IPE), AN/APG-68(V5) radar with advanced programmable signal processor employing VHSIC technology, Have Quick IIA UHF radio, Have Sync VHF anti-jam radio and AN/ALR-56M advanced RWR. Changes initiated at **Block 50D/52D** in 1993 include full integration of HARM/Shrike anti-radiation missiles via Texas Instruments interface, upgraded programmable display generator with digital terrain system (DTS) provisions and scope for digital map capability, ring laser INS (Honeywell H-423 selected 1990) and AN/ALE-47 advanced chaff/flare dispenser.

First Block 50D/52D (91-0360) delivered to USAF on 7 May 1993, optimised for defence suppression missions having software for horizontal situation display on existing two MFDs and provision for one of 100 HARM (AGM-88 High-Speed Anti-Radiation Missile) targeting systems ordered by USAF includes Pave Penny sensor in pod on starboard side of nose, ahead of cockpit; AN/ASQ-213 HARM targeting system has 40 to 80 per cent of F-4G 'Wild Weasel' Phantom's capability but can receive accurate threat location information from F-4Gs via improved data modem (IDM) also added at Block 50D/52D stage together with HARM aircraft-launcher interface, doubled-capacity (128 Kbits) flight planning cartridge and new VHF antenna in fin. (Block 30/32 and later F-16Cs had lower level of HARM capability employed by 52nd FW at Spangdahlem AB, Germany, until replaced by Block 50/52 aircraft in 1993-94.)

Deliveries of Block 50/52 began to 4th FS of 388th FW at Hill AFB, Utah, from October 1992; others to 480th FS of 52nd FW at Spangdahlem, Germany, replacing Block 30 aircraft from (first delivery) 20 February 1993. Block 50D/52D aircraft initially to 309th FS (now 79th FS) of 363rd (now 20th) FW at Shaw AFB, South Carolina, followed by 23rd FS/52nd FW at Spangdahlem, Germany, from 14 January 1994, then squadrons at Mountain Home AFB, Idaho, and Misawa, Japan. Final 144 F-16Cs and 20 F-16Ds (including FY94) will be Block 50/52Ds.

GF-16C: Ground trainers in use at Sheppard AFB for instructional purposes in 1993.

Block 50 Plus: Projected version with synthetic aperture radar mode for adverse-weather delivery of JDAM weapons; passive missile warning; terrain-referenced navigation and 2,271 litre (600 US gallon; 500 Imp gallon) external tanks.

Block 60: LANTIRN nav/attack avionics installed internally; APU; additional internal fuel in Israeli-style enlarged spine. Proposal only.

Block 60/62. Projected development to meet possible USAF multirole fighter requirement, employing technology from F-22A programme.

NF-16D: Variable stability in-flight simulator test aircraft (**VISTA**) modified from Block 30 F-16D (86-0048) ordered December 1988 to replace NT-33A testbed. Features include vertical surface direct force generators above and below wings, Calspan variable stability flight control system, fully programmable cockpit controls and displays, additional computer suite, permanent flight test data recording system, variable feel centrestick and computer, and safety pilot in rear cockpit. Internal gun, RWR and chaff/flare equipment removed, providing space for Phase II and III growth including additional computer, reprogrammable display generator and customer hardware allowance. 'Israeli-type' bulged spine. First flight 9 April 1992; delivery due July 1992 but aircraft stored after five flights because of funding shortage; fitted with axisymmetric thrust vectoring engine nozzle (AVEN) for 90 flight, 120 hour MATV (Multi-Axis Thrust Vectoring) trials programme beginning 2 July 1993; thrust vectoring first used on 30 July, all except first few sorties flown at Edwards AFB; demonstrated transient 115° AoA and sustained 80°; nose-pointing authority demonstrated at 90° AoA at zero airspeed. MATV test programme completed 15 March 1994 after 95 sorties and 135.7 flight hours. NF-16D subsequently returned to VISTA configuration. See table under NASA heading for performance comparison of MATV F-16 with Rockwell/DASA X-31A and McDonnell Douglas F/A-18HARV.

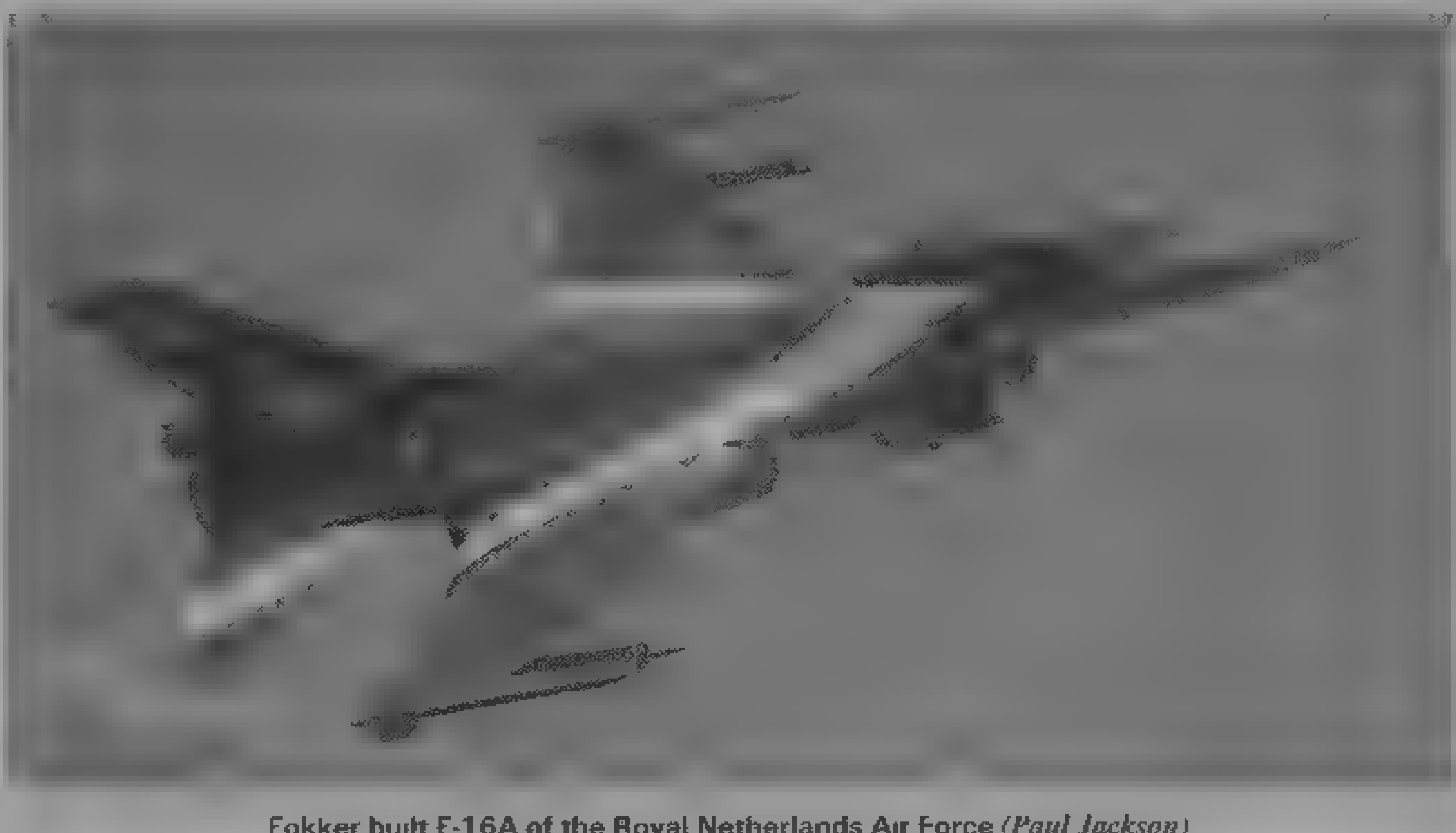
USAF intends to install permanent thrust vectoring nozzle on VISTA aircraft to continue trials programme. If funding can be obtained, this is expected in 1997.

F-16N: US Navy supersonic adversary aircraft (SAA) modified from F-16C/D Block 30; selected January 1985, deliveries of 26 aircraft started 1987 and completed 1988; features include AN/APG-66 instead of AN/APG-68 radar, F110-GE-100 engine, deletion of M61 gun, AN/ALR-69 RWR, titanium in lower wing fittings instead of aluminium and cold working of lower wing skin holes to resist greater frequency of high g; wingtips fitted only for AIM-9 practice missiles and ACMI AIS pods, but normal tanks and stores on other stations. Four of 26 are two-seat **TF-16N**. F/TF-16Ns serve, or have served, with 'Top Gun' Fighter Weapons School (eight) and with VF-126 (six) at NAS Miramar, California, VF-45 (six) at NAS Key West, Florida, and VF-43 (six) at NAS Oceana, Virginia. Inactivations and reductions in size of Navy adversary training force has resulted in first examples being placed in storage during 1994, with more expected to follow and these aircraft subject of possible transfer to Bahrain in exchange for F-5 Tiger fleet.

FS-X and TFS-X. F-16 derivatives selected by Japan Defence Agency for its FS-X requirement 19 October 1987, details under Mitsubishi in Japan section.

F-16 Recce: Four existing European recce pods, including that for Tornado, demonstrated in flight on F-16 fighters with minimum changes. RNethAF reconnaissance **F-16A(R)** operational since 1983 with Orpheus pods, some Danish F-16As given reconnaissance tasking from January 1994 using locally designed Per Udsen MRP (modular reconnaissance pod) with interchangeable wet film and electro-optical sensors. Following 1993 cancellation of ATARS centreline pod for F-16 Block 30, USAF seeking new sensors for podded installation on up to 60 Block 42 F-16Cs.

AFTI/F-16: Modified preseries F-16A (75-0750) used for US Air Force Systems Command Advanced Fighter Technology Integration (AFTI), first flight 10 July 1982, previous achievements detailed in 1986-87, 1987-88 and 1991-92 *Jane's*, currently with Block 15 horizontal tail surfaces, Block 25 wing and Block 40 avionics. Trials programmes include automatic target designation and attack (1988), night navigation and map displays (1988-89), digital datalink and two-aircraft operations (1989), autonomous attack (1989-91) and night attack (1989-92), tested automatic ground collision avoidance system and pilot-activated, low-level pilot disorientation recovery system 1991, LANTIRN pod and Falcon Night FLIR trials, 1992. Most recent test project concerned live firing of AGM-88 HARM as part of demonstration of advanced technology



Fokker built F-16A of the Royal Netherlands Air Force *(Paul Jackson)*

1994

Late standard F-16 cockpit, as planned for MLU

1995

applicable to Suppression of Enemy Air Defence (SEAD) mission. Total 600 plus sorties by mid-1994.

F-16XL: Two F-16XL prototypes, in flyable storage since 1985, leased from General Dynamics by NASA; first flight of single-seat N848NA/75-0749, 9 March 1989. NASA modified this aircraft at Dryden with wing glove having laser-perforated skin to smooth air flow over cranked arrow wing in supersonic flight, reducing drag and turbulence and saving fuel. Two-seat N849NA/75-0747, with GE F110-GE-129 engine, similarly converted early 1992. One aircraft presently earmarked to test laminar flow panel installed on upper port wing as part of NASA's High Speed Research Program. Project expected to last one year from September 1995. F-16XL described in 1985-86 *Jane's*.

F-16B-2. Second preseries F-16B (75-0752) converted to private-venture testbed of close air support and night navigation and attack systems; equipment includes F-16C/D HUD, helmet sight or GEC-Marconi Cat's Eyes NVGs, Falcon Eye head-steered FLIR or LANTIRN nav/attack pods, digital terrain system (Terprom), and automatic target handoff system. Alternative nav/attack FLIR pods comprise GEC-Marconi Atlantic and Lockheed Martin Pathfinder (LANTIRN derivative). NVG compatible cockpit lighting. Equipment testing continues on AFTI testbed, which see.

F-16ES. Enhanced Strategic two-seat, long-range interdictor F-16 proposal, developed November 1993 in response to Israeli preference for F-15I Eagle, additional fuel in one 2,271 litre (600 US gallon; 500 Imp gallon) centreline tank and two conformal tanks, each of 1,893 litres (500 US gallons, 417 Imp gallons), on sides of Israeli-style enlarged spine. Combat radius extended to in excess of 1,000 n miles (1,852 km; 1,151 miles). Not purchased, but conformal tanks flight tested on leased F-16C (83-1120) from 5 November 1994. Demonstrator vehicle featured 7.32 m (24 ft 0 in) shapes representative of tanks attached to upper wing and fuselage on each side to validate predicted aerodynamic effects and flight performance. Other F-16ES features, including simulated FLIR sensor installation, also evaluated during 21 sortie programme that was completed in January 1995. Estimated cost of production F-16ES in vicinity of $25 million.

F-16U: Proposed two-seat version being offered to United Arab Emirates which has admitted requirement for up to 80 interdictor aircraft, other contenders for this order comprising McDonnell Douglas F-15U Plus Strike Eagle and Sukhoi Su-37. Lockheed proposal features extended-range capability, superior to that of F-16ES derivative, plus delta-wing planform. Presentation of data was expected to take place in October 1994, with the UAE decision likely to follow in 1995. Likely to possess internally mounted IR navigation and targeting sensor equipment.

Length increased to 16.15 m (53 ft 0 in); span to 11.90 m (39 ft 0 in); wing area more than doubled, to 65.03 m² (700 sq ft); empty weight 11,294 kg (24,900 lb); fuel weight up 134 per cent to 11,793 kg (26,000 lb); maximum T-O weight increased to 23,609 kg (52,050 lb); and range (hi-lo-hi with four 2,000 lb bombs) doubled to 755 n miles (1,400 km; 870 miles).

F-16X. Projected development for 2010 service entry. 1.42 m (5 ft 0 in) fuselage stretch; modified F-22 delta wing with increased leading-edge sweep, but similar taper, section, twist, camber, moving surfaces and structure; some 80 per cent additional internal fuel, obviating drop tanks for most combat missions; conformal AIM-120 AMRAAM carriage; developed version of F100 or F110 engine; cost, two-thirds of F/A-18E Hornet.

CUSTOMERS: See tables. Total 3,964 production aircraft ordered by December 1994, including planned USAF procurement of 2,208 and 28 embargoed Pakistan Air Force examples.

COSTS: $18 million, USAF flyaway, FY92 prices. $20 million, export, 1995 prices. $31.5 million for modification of one F-16D Block 30 as NF-16D, which see, placed December 1988. MLU worth $2,000 million, 1991, including $300 million development phase. F-16 ADF programme cost $1 million per aircraft.

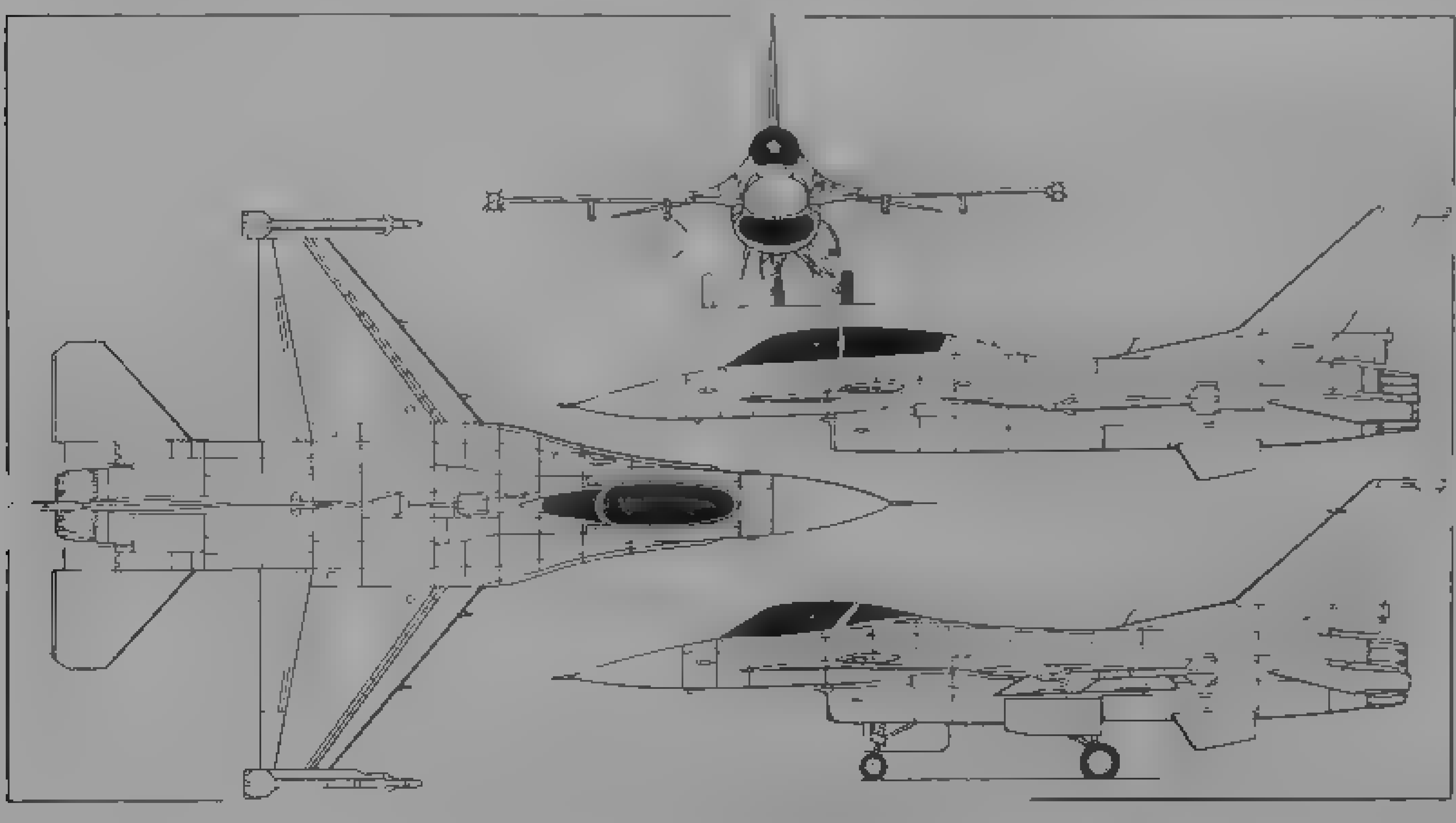
DESIGN FEATURES (refers mainly to Block 40 F-16C/D): Cropped delta wings blended with fuselage, with highly swept vortex control strakes along fuselage forebody and joining wings to increase lift and improve directional stability at high angles of attack; wing section NACA 64A-204, leading-edge sweepback 40°, relaxed stability (rearward CG) to increase manoeuvrability; deep wing-roots increase rigidity, save 113 kg (250 lb) structure weight and increase fuel volume, fixed geometry engine intake; pilot's ejection seat inclined 30° rearwards; single-piece birdproof forward canopy section, two ventral fins below wing trailing-edge. Baseline F-16 airframe life planned as 8,000 hours with average usage of 55.5 per cent in air combat training, 20 per cent ground attack and 24.5 per cent general flying, structural strengthening programme for pre-Block 50 aircraft required during 1990s.

FLYING CONTROLS: Four-channel digital fly-by-wire (analog in earlier variants), pitch/lateral control by pivoting monobloc tailerons and wing-mounted flaperons; maximum rate of flaperon movement 52°/s, automatic wing leading-edge manoeuvring flaps programmed for Mach number and angle of attack, flaperons and tailerons interchangeable left and right, sidestick control column with force feel replacing almost all stick movement.

STRUCTURE: Wing, mainly of light alloy, has 11 spars, five ribs and single-piece upper and lower skins, attached to fuselage by machined aluminium fittings; leading-edge flaps are one-piece bonded aluminium honeycomb and driven by rotary actuators; fin is multispar, multirib with graphite epoxy skins; brake parachute or ECM housed in fairing aft of fin root; tailerons have graphite epoxy laminate skins, attached to corrugated aluminium pivot shaft and removable full-depth aluminium honeycomb leading-edge, ventral fins have aluminium honeycomb and skins, split speedbrakes in fuselage extensions inboard of tailerons open to 60°. Nose radome by Brunswick Corporation.

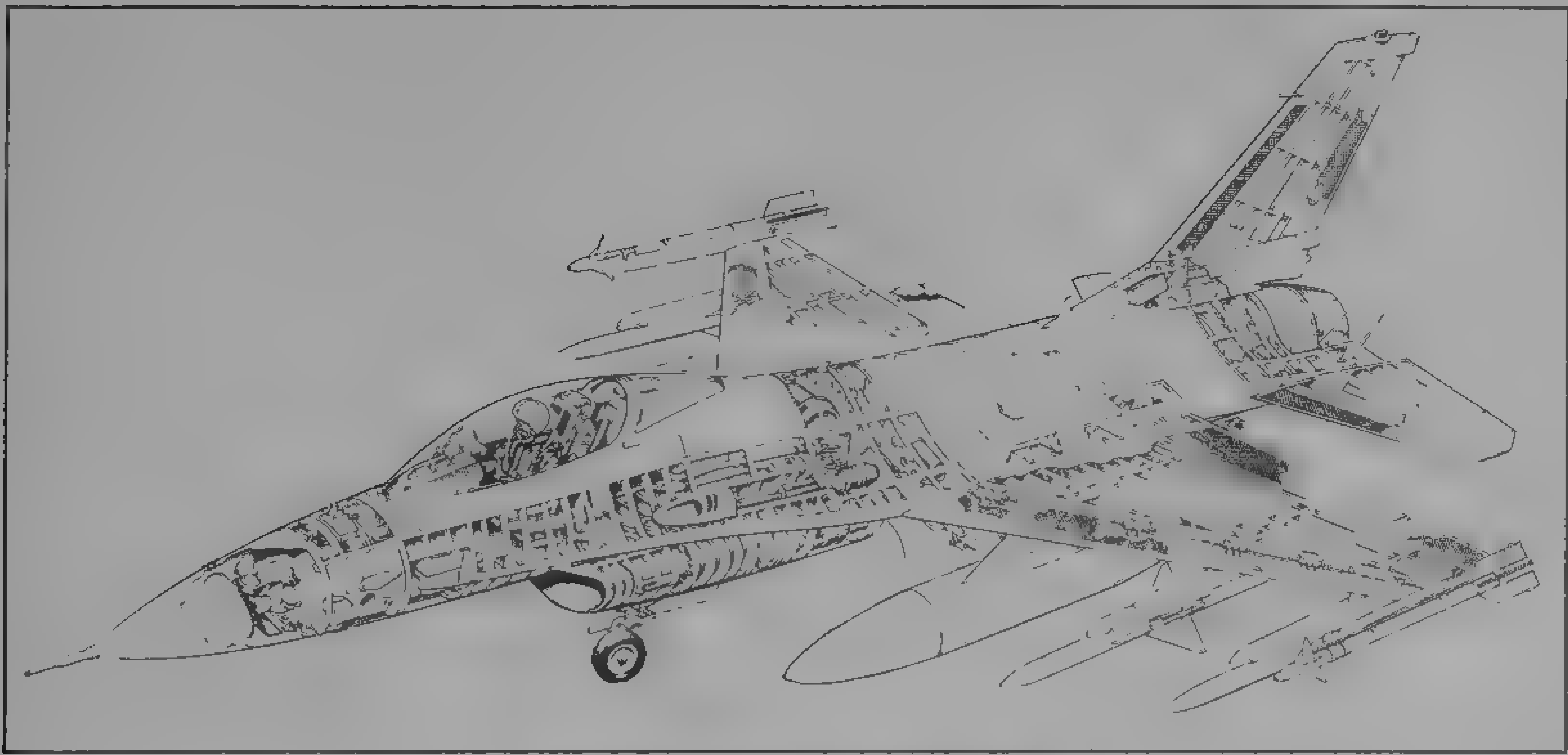
LANDING GEAR: Menasco hydraulically retractable type, nose unit retracting rearward and main units forward into fuselage. Nosewheel is located aft of intake to reduce the risk of foreign objects being thrown into the engine during ground operation, and rotates 90° during retraction to lie horizontally under engine air intake duct. Oleo-pneumatic struts in all units. Aircraft Braking Systems mainwheels and brakes, Goodyear or Goodrich mainwheel tyres, size 27.75 × 8.75-14.5, pressure 14.48 to 15.17 bars (210 to 220 lb/sq in) at T-O weights less than 13,608 kg (30,000 lb). Steerable nosewheel with Goodyear, Goodrich or Dunlop tyre, size 18 × 5.7-8, pressure 20.68 to 21.37 bars (300 to 310 lb/sq in) at T-O weights less than 13,608 kg (30,000 lb). All but two main unit components interchangeable. Brake-by-wire system on main gear, with Aircraft Braking Systems anti-skid units. Runway arresting hook under rear fuselage. Irvin 7.01 m (23 ft 0 in) diameter braking parachute fitted in Greek, Indonesian, Netherlands (retrofit completed December 1992), Norwegian, Turkish and Venezuelan F-16s. Landing/taxi lights on nose landing gear door.

POWER PLANT: One 131.6 kN (29,588 lb st) General Electric F110-GE-129, or one 129.4 kN (29,100 lb st) Pratt & Whitney F100-PW-229 afterburning turbofan as alternative standard. These Increased Performance Engines (IPE) installed from late 1991 in Block 50 and Block 52 aircraft. Immediately previous standard was 128.9 kN (28,984 lb st) F110-GE-100 or 105.7 kN (23,770 lb st) F100-PW-220 in Blocks 40/42. Of 1,416 F-16Cs and F-16Ds ordered by USAF, 555 with F100 and 861 with F110. IPE variants have half share each in FY92 procurement of 48 F-16s for USAF, following eight reliability trial installations including six Block 30 aircraft which flew 2,400 hours between December 1990 and September 1992. F100s of ANG and AFRes F-16A/Bs upgraded to 220E standard from late 1991. Fixed geometry intake, with boundary layer splitter plate, beneath fuselage. Apart from first few, F110-powered aircraft have intake widened by 30 cm (1 ft 0 in) from 368th F-16C (86-0262). Israeli second batch F-16D-30s have power plants locally modified by Bet-Shemesh Engines to F110-GE-110A with provision for up to 50 per cent emergency thrust at low level. USAF AVEN (axisymmetric vectoring engine nozzle) trials, 1992, involved F100-IPE-94 and F110; possible application to F-16.



F-16C (GE F110 turbofan) with extra side view (top) of two-seat F-16D (P&W F100 turbofan) *(Jane's/Dennis Punnett)*

1990



Cutaway drawing of Lockheed Martin F-16

1995

Standard fuel contained in wing and five seal-bonded fuselage cells which function as two tanks, 3,986 litres (1,053 US gallons; 876 Imp gallons) in single-seat aircraft, 3,297 litres (871 US gallons; 726 Imp gallons) in two-seat aircraft. Halon inerting system. In-flight refuelling receptacle in top of centre-fuselage, aft of cockpit. Auxiliary fuel can be carried in drop tanks: one 1,136 litres (300 US gallons, 250 Imp gallons) under fuselage. 1,402 litres (370 US gallons, 308 Imp gallons) under each wing. Optional 2,271 litre (600 US gallon, 500 Imp gallon) underwing tanks.

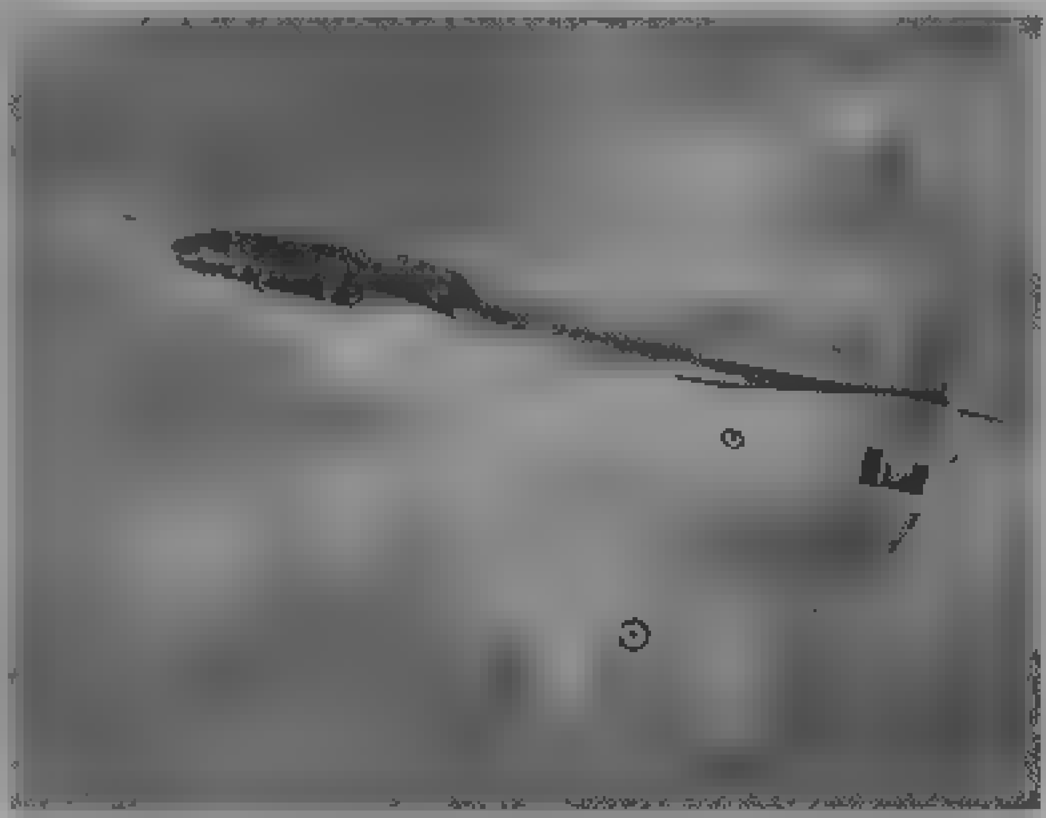
ACCOMMODATION: Pilot only in F-16C, in pressurised and air conditioned cockpit. McDonnell Douglas ACES II zero/zero ejection seat. Bubble canopy made of polycarbonate advanced plastics material. Inside of USAF F-16C/D canopy (and most Belgian, Danish, Netherlands and Norwegian F-16A/Bs) coated with gold film to dissipate radar energy. In conjunction with radar-absorbing materials in air intake, this reduces frontal radar signature by 40 per cent. Windscreen and forward canopy are an integral unit without a forward bow frame, and are separated from the aft canopy by a simple support structure which serves also as the breakpoint where the forward section pivots upward and aft to give access to the cockpit. A redundant safety lock feature prevents canopy loss. Windscreen/canopy design provides 360° all-round view, 195° fore and aft, 40° down over the side, and 15° down over the nose. To enable the pilot to sustain high *g* forces, and for pilot comfort, the seat is inclined 30° aft and the heel line is raised. In normal operation the canopy is pivoted upward and aft by electrical power; the pilot is also able to unlatch the canopy manually and open it with a back-up handcrank. Emergency jettison is provided by explosive unlatching devices and two rockets. A limited displacement, force-sensing control stick is provided on the right hand console, with a suitable armrest, to provide precise control inputs during combat manoeuvres.

The F-16D has two cockpits in tandem, equipped with all controls, displays, instruments, avionics and life support systems required to perform both training and combat missions. The layout of the F-16D second station is similar to the F-16C, and is fully systems-operational. A single-enclosure polycarbonate transparency, made in two pieces and spliced aft of the forward seat with a metal bow frame and lateral support member, provides outstanding view from both cockpits.

SYSTEMS: Regenerative 12 kW environmental control system, with digital electronic control, uses engine bleed air for pressurisation and cooling of crew station and avionics compartments. Two separate and independent hydraulic systems supply power for operation of the primary flight control surfaces and the utility functions. System pressure (each) 207 bars (3,000 lb/sq in), rated at 161 litres (42.5 US gallons, 35.4 Imp gallons)/min. Bootstrap type reservoirs, rated at 5.79 bars (84 lb/sq in).

Electrical system powered by engine-driven Westinghouse 60 kVA main generator and 10 kVA standby generator (including ground annunciator panel for total electrical system fault reporting), with Sundstrand constant speed drive and powered by a Sundstrand accessory drive gearbox. 17 Ah battery. Four dedicated, sealed cell batteries provide transient electrical power protection for the fly-by-wire flight control system.

An onboard Sundstrand/Solar jet fuel starter is provided for engine self start capability. Simmonds fuel measuring system. AlliedSignal emergency power unit automatically



Artist's impression of F-16U proposed to United Arab Emirates

1995

drives a 5 kVA emergency generator and emergency pump to provide uninterrupted electrical and hydraulic power for control in the event of the engine or primary power systems becoming inoperative.

AVIONICS: *Comms:* Magnavox AN/ARC-164 UHF transceiver (AN/URC-126 Have Quick IIA in Block 50/52); provision for Magnavox KY-58 secure voice system; Collins AN/ARC-186 VHF AM/FM transceiver (AN/ARC-205 Have Sync Group A in Block 50/52), ARC-190 HF radio, government furnished AN/AIC-18/25 intercom and SCI advanced interference blanker. Teledyne Electronics AN/APX 101 IFF transponder with government furnished IFF control, government furnished National Security Agency KIT-1A/TSEC cryptographic equipment.

Radar: Westinghouse AN/APG-68(V) pulse Doppler range and angle track radar, with planar array in nose. Provides air-to-air modes for range-while-search, uplook search, velocity search, air combat, track-while-scan (10 targets), raid cluster resolution, single target track and (later) high PRF track to provide target illumination for AIM-7 missiles, plus air-to-surface modes for ground mapping, Doppler beam-sharpening, ground moving target, sea target, fixed target track, target freeze after pop-up, beacon, and air-to-ground ranging.

Flight: Litton LN-39 standard inertial navigation system (ring laser Litton LN-93 or Honeywell H-523 in Block 50/52 and current FMS F-16A/B: LN-93 for Egypt, Indonesia, Israel, South Korea, Pakistan, Portugal and Taiwan plus Netherlands retrofit and Greek second batch); Collins AN/ARN-108 ILS, Collins AN/ARN-118 Tacan, Rockwell GPS, Honeywell central air data computer, General Dynamics enhanced stores management computer, Gould AN/APN-232 radar altimeter. BAe Terprom digital terrain system to be installed in all new USAF F-16s, USAF reserve F-16s and 301 European aircraft destined for MLU in first instance, but could be offered to FMS customers from 1996 on Block 20 F-16A/B aircraft. Optional equipment includes Collins VIR 130 VOR/ILS.

Instrumentation: GEC-Marconi wide-angle holographic electronic HUD with raster video capability (for LANTIRN) and integrated keyboard; data entry/cockpit interface and dedicated fault display by Litton Canada and Lockheed Martin, Astronautics cockpit/TV set.

Mission: Honeywell multifunction displays. Lockheed Martin LANTIRN package comprises AN/AAQ-13 (navigation) and AN/AAQ-14 (targeting) pods. Turkish aircraft (150+ to be modified by 1996) to share 60 LANTIRN pod systems. LANTIRN also purchased by Greece and South Korea and required for second Thailand batch. Enhanced capability LANTIRN incorporating second-generation FLIR tested by F-16 at Eglin AFB early 1995. Sharpshooter pod (down-rated export version of AAQ-14 LANTIRN targeting system) acquired by Bahrain and Israel, but latter to get indigenous Rafael Litening IR targeting and navigation pod as replacement (initial funding already undertaken with first delivery expected 1996). Pakistan F-16s carry Thomson-CSF Atlis laser designator pods. Singapore considering LANTIRN, GEC-Marconi TIALD and Rafael Litening options. Texas Instruments AN/ASQ-213 HARM Targeting System (HTS) pod carried by Block 50/52D aircraft. Entered service 1994 and currently deployed by USAF units in USA, Japan and Germany. Some Netherlands F-16As equipped with early Delft Orpheus reconnaissance pods, Danish F-16As with Per Udsen recce pods. Historical details in 1986-87 and earlier editions. New modular mission computer and colour displays for retrofit as part of MLU and new production in Block 20 F-16A/Bs.

Self defence: Dalmo Victor AN/ALR-69 radar warning system replaced in USAF Block 50/52 by Loral AN/ALR-56M advanced RWR, which also ordered for USAF Block 40/42 retrofit and (first export) Korean Block 52s. Provision for Westinghouse AN/ALQ-131 or Raytheon AN/ALQ-184 jamming pods. AN/ALQ-131 supplied to Bahrain, Egypt, Netherlands and Pakistan. Taiwan to get 80 Raytheon AN/ALQ-184 (first export order and first foreign use). Israeli Air Force F-16s extensively modified with locally designed and manufactured equipment, as well as optional US equipment to tailor them to the IAF defence role. This includes Elisra SPS 3000 self protection jamming equipment in enlarged spines of F-16D-30s and Elta EL/L-8240 ECM in third batch of F-16C/Ds, replacing Loral AN/ALQ-178(V)1 Rapport ECM in Israeli F-16As. Belgian F-16s have Dassault Electronique Carapace passive ECM system in fin-root housing on 100 aircraft (with some reserve systems) from April 1995 (to be used in conjunction with active AN/ALQ-131 jamming pods to be obtained from surplus US stocks). Loral AN/ALQ-178(V)3 Rapport III integral self-protection system in Turkish F-16C/Ds. In March 1993 Greece ordered integrated Litton ASPIS self defence system, comprising AN/ALR-93 RWR, Tracor chaff/flare dispensers and (initially on only 35 aircraft) Raytheon AN/ALQ-187 IDIAS jammer. Denmark has Northrop Grumman AN/ALQ-162 jammer integrated in one wing pylon. Tracor AN/ALE-40(V)-4 chaff/flare dispensers (AN/ALE-147 in Block 50/52).

ARMAMENT: General Electric M61A1 20 mm multibarrel cannon in the port side wing/body fairing, equipped with a General Electric ammunition handling system and an enhanced envelope gunsight (part of the head-up display system) and 511 rounds of ammunition. There is a mounting for an air-to-air missile at each wingtip, one underfuselage centreline hardpoint, and six underwing hardpoints for additional stores. For manoeuvring flight at 5.5 *g* the underfuselage station is stressed for a load of up to 1,000 kg (2,200 lb), the two inboard underwing stations for 2,041 kg (4,500 lb) each, the two centre underwing

stations for 1,587 kg (3,500 lb) each, the two outboard underwing stations for 318 kg (700 lb) each, and the two wingtip stations for 193 kg (425 lb) each. For manoeuvring flight at 9 g the underfuselage station is stressed for a load of up to 544 kg (1,200 lb), the two inboard underwing stations for 1,134 kg (2,500 lb) each, the two centre underwing stations for 907 kg (2,000 lb) each, the two outboard underwing stations for 204 kg (450 lb) each, and the two wingtip stations for 193 kg (425 lb) each. There are mounting provisions on each side of the inlet shoulder for the specific carriage of sensor pods (electro-optical, FLIR and so on); each of these stations is stressed for 408 kg (900 lb) at 5.5 g, and 250 kg (550 lb) at 9 g.

Typical stores loads can include two wingtip-mounted AIM-9L/M/P Sidewinders, with up to four more on the outer underwing stations. Rafael Python 3 on Israeli F-16s from early 1991, centreline GPU-5/A 30 mm cannon, drop tanks on the inboard underwing and underfuselage stations, a Lockheed Martin Pave Penny laser spot tracker pod along the starboard side of the nacelle, and bombs, air-to-surface missiles or flare pods on the four inner underwing stations. Stores can be launched from Aircraft Hydro-Forming MAU-12C/A bomb ejector racks, Hughes LAU-88 launchers, or Orgen triple or multiple ejector racks. Non-jettisonable centreline GPU-5/A 30 mm gun pods on dedicated USAF ground-attack F-16As. Weapons launched successfully from F-16s, in addition to Sidewinders and AIM-120A AMRAAM, include radar guided Sparrow and Sky Flash air-to-air missiles, French Magic 2 infra-red homing air-to-air missiles,

F-16 TABLES

Table 1 provides a rapid reference to customers and quantities; more detailed information on production rates appears in Tables 2 and 3

TABLE 1 F-16 CUSTOMERS

Operator	Total	Single-seat	Qty	Two-seat	Qty	Power plant	First aircraft A/C	First aircraft B/D	First delivery	Squadrons (or base)
Bahrain	12	F-16C-40	8	F-16D-40	4	F110-GE-100	101	150	March 1990	(Sheikh Isa)
Belgium	160[1]	F-16A-10	55	F-16B-10	12	F100-PW-200	FA01	FB01	January 1979	
		F-16A-15	41	F-16B-15	8	F100-PW-200	FA56	FB13	October 1982	1, 2, 23, 31, 349, 350
		F-16A-15OCU	40	F-16B-15OCU	4	F100-PW-220	FA97	FB21	January 1988	
Denmark	70	F-16A-10	30[2]	F-16B-10	8[3]	F100-PW-200	E-174	ET-204	January 1980	723, 727, 730
		F-16A-15	16	F-16B-15	4	F100-PW-200	E-596	ET-613	May 1982	723, 727, 730
		F-16A-15OCU	8[3]	F-16B-15OCU	4[3]	F100-PW-220	E-004	ET-197	December 1987	726
Egypt	175	F-16A-15	34	F-16B-15	8[5]	F100-PW-200	9301	9201	March 1982	72, 74
		F-16C-32	34	F-16D-32	6	F100-PW-220	9501	9401	August 1986	(Beni Sueif)
		F-16C-40	34	F-16D-40	7	F110-GE-100	9901	9801	October 1991	(Abu Sueir)
		F-16C-40	1	F-16D-40	5	F110-GE-100	9935	9808	1994	
		F-16C-40	34[8]	F-16D-40	12[8]	F110-GE-129	9951	9851	March 1994	(Saqqara)
Greece	80	F-16CG-30	34	F-16DG-30	6	F110-GE-100	110	144	November 1988	330, 346
		F-16CG-50D	32	F-16DG-50D	8	F110-GE-129			March 1997	
Indonesia	12	F-16A-15OCU	8	F-16B-15OCU	4	F100-PW-220	S-1605	S-1601	December 1989	3
Israel	210	F-16A-10	67	F-16B-10	8	F100-PW-200	100	001	January 1980	140, 147, 253
		F-16C-30	51	F-16D-30	24	F110-GE-100A	301	020	December 1986	101, 105, 109, 110, 117
		F-16C-40	30	F-16D-40	30	F110-GE-200	502	601	July 1991	101, 105, 109, 110, 117
Korea, South	160	F-16C-32	30	F-16D-32	10	F100-PW-220	85-574	84-370	March 1986	161, 162
		F-16C-52D	80[9]	F-16D-52D	40[9]	F100-PW-229	92-000	92-028	December 1994	
Netherlands	213[3]	F-16A-10	47	F-16B-10	13	F100-PW-200	J-212	J-259	June 1979	
		F-16A-15	83	F-16B-15	18	F100-PW-200	J-258	J-649	May 1982	306, 311, 312, 313, 314, 315, 322, 323
		F-16A-15OCU	47	F-16B-15OCU	5	F100-PW-220	J-141	J-065	1988	
Norway	74	F-16A-10	29[3]	F-16B-10	7[3]	F100-PW-200	272	301	January 1980	332, 338
		F-16A-15	31[3]	F-16B-15	5[3]	F100-PW-200	300	690	June 1982	331, 334
				F-16B-15OCU	2	F100-PW-220	—	711	July 1989	331
Pakistan	68	F-16A-15	28	F-16B-15	12	F100-PW-200	82-701	82-601	January 1983	9, 11, 14
		F-16A-15OCU	13	F-16B-15OCU	15	F100-PW-220	91-729	91-613	—	See note 11
Portugal	20	F-16A-15OCU	17	F-16B-15OCU	3	F100-PW-220E	15101	15118	February 1994	201
Singapore	26[7]	F-16A-15OCU	4	F-16B-15OCU	4	F100-PW-220	880	884	February 1988	140
		F-16C-52D	8	F-16D-52D	10	F100-PW-229			March 1998	
Taiwan	150	F-16A-20	120	F-16B-20	30	F100-PW			July 1996	
Thailand	36	F-16A-15OCU	14	F-16B-15OCU	4	F100-PW-220	10305	10301	June 1988	103
		F-16A-15OCU	12	F-16B-15OCU	6	F100	07020	07032	March 1995	
Turkey	240[4]	F-16C-30	34	F-16D-30	9	F110-GE-100	86-0066	86-0191	May 1987	142, Oncel Flight
		F-16C-40	102	F-16D-40	15	F110-GE-100	88-0033	88-0014	July 1990	141, 161, 162, 191, 192, 181, 182
		F-16C-50D	68	F-16D-50D	12	F110-GE-129			July 1996	151, 152
USAF	2,208	F-16A	6[10]	F-16B	2	F100-PW-200	75-0745	75-0751	—	Preproduction
		F-16A-10	255	F-16B-10	74	F100-PW-200	78-0001	78-0077	August 1978	See note A
		F-16A-15	409[5]	F-16B-15	46[6]	F100-PW-200	80-0541	80-0638	September 1981	See note A
		F-16C-25	209	F-16D-25	35	F100-PW-200	83-1118	83-1174	July 1984	See note B
		F-16C-30/32	360/56	F-16D-30/32	48/5	both (100/220)	85-1398	85-1509	July 1986	See note B
		F-16C-40/42	235/149	F-16D-40/42	31/47	both (100/220)	87-0350	87-0391	December 1988	See note B
		F-16C-50/52	159/42	F-16D-50/52	28/12	both (129/229)	90-0801	90-0834	October 1991	See note B
US Navy	26	F-16N-30	22	TF-16N-30	4	F110-GE-100	163268	163278	June 1987	Mostly stored
Venezuela	24	F-16A-15	18	F-16B-15	6	F100-PW-200	1041	1715	September 1983	161, 162
Totals	**3,964**		**3,244**		**720**					

Notes

[1] Built by Sabca (Belgium). 221st and last Sabca F-16 (BAF FA-136) delivered 22 October 1991
[2] One built by Fokker (Netherlands)
[3] Built by Fokker; 300th and last Fokker F-16 (RNethAF J-021) delivered 27 February 1992
[4] Two F-16Cs and six F-16Ds built by GD; remainder by TAI
[5] Two built by Fokker
[6] Three built by Sabca
[7] Plus seven F-16As and two F-16Bs leased from USAF with 425th FS at Luke AFB, Arizona
[8] TAI production
[9] 12 built by GD, 36 CKD kits and 72 produced locally by Samsung Aerospace
[10] Two converted to F-16XL, including one as two-seat
[11] Embargoed. Pakistan offered compromise batch of 38 aircraft. Offer rejected and 28 completed aircraft of follow-on order for 71 placed in storage at Davis-Monthan AFB, Arizona. Alternative buyer being sought

Note A. Currently operated by 56th FW, Luke AFB, Arizona (307 FS/Singapore training element) and also 93 FS of AFRes, 111, 114, 148, 152, 178, 179, 182, 184, 186, 195 and 198 FSs, ANG.
Note B. Currently operated by 8th FW, Kunsan AB, South Korea (35, 80 FSs); 20th FW, Shaw AFB, South Carolina (77, 78, 79 FSs); 23rd W, Pope AFB, North Carolina (74 FS); 31st FW, Aviano AB, Italy (510, 555 FSs), 35th FW, Misawa AB, Japan (13, 14 FSs), 51st FW, Osan AB, South Korea (36 FS), 52nd FW, Spangdahlem AB, Germany (22, 23 FSs); 57th W, Nellis AFB, Nevada (USAF Weapons School, 414 Test Sqdn, 422 Test and Evaluation Sqdn, Thunderbirds Air Demonstration Sqdn), 347th FW, Moody AFB, Georgia (68, 69 FSs), 354th FW, Eielson AFB Alaska (18 FS), 366th W, Mountain Home AFB, Idaho (389 FS), 388th FW, Hill AFB, Utah (4, 34, 421 FSs), and also 302, 457, 466, 704 and 706 FSs, AFRes, 107, 112, 113, 119, 120, 121, 124, 125, 134, 138, 149, 157, 159, 160, 162, 170, 174, 175, 176, 188 and 194 FSs, ANG.

Blocks 1 and 5 retrofitted to Block 10 standard 1982-84, Block 15 retrofitted to Block 15OCU (avionics standard only) from 1987. New build F-16As are Block 15OCU from November 1987.

Export programme code-names are: Bahrain - Peace Crown, Egypt - Peace Vector I, II, III, IIIA and IV, Greece - Peace Xenia I-II, Indonesia - Peace Bima Sena, Israel - Peace Marble I-III, South Korea - Peace Bridge I-II, Pakistan - Peace Gate I-IV, Portugal - Peace Atlantis, Singapore - Peace Carven I-II, Taiwan - Peace Fenghuang, Thailand - Peace Naresuan I-II, Turkey - Peace Onyx I-II (and CAE-Link simulator, Peace Onyx III) and Venezuela - Peace Delta.

Omitted are two YF-16s.

Recent orders. Turkey firmed-up option on 40 F-16C/Ds in February 1994. Singapore ordered 18 F-16C/D-52Ds in July 1994, with follow-on negotiations expected to add further six aircraft under FMS programme in March 1995.
Intentions: Israel planning 30 F-16C-40s and 30 F-16D-40s for delivery from July 1997.
Transfers. Israel received 36 F-16As and 14 F-16Bs from surplus USAF stocks August 1994 to March 1995. Denmark received three ex-USAF F-16As in July 1994

AGM-65A/B/D/G Maverick air-to-surface missiles, HARM and Shrike anti-radiation missiles, Harpoon anti-ship missiles (clearance trials 1993-94), and, in Royal Norwegian Air Force service, the Penguin Mk 3 anti-ship missile

DIMENSIONS, EXTERNAL (F-16C, D):

Wing span: over missile launchers 9.45 m (31 ft 0 in)
over missiles 10.00 m (32 ft 9¾ in)
Wing aspect ratio 3.20
Length overall 15.03 m (49 ft 4 in)
Height overall 5.09 m (16 ft 8½ in)
Tailplane span 5.58 m (18 ft 3¾ in)
Wheel track 2.36 m (7 ft 9 in)
Wheelbase 4.00 m (13 ft 1½ in)

AREAS (F-16C, D):

Wings, gross 27.87 m² (300.0 sq ft)
Flaperons (total) 2.91 m² (31.32 sq ft)
Leading-edge flaps (total) 3.41 m² (36.72 sq ft)
Fin, incl dorsal fin 4.00 m² (43.10 sq ft)
Rudder 1.08 m² (11.65 sq ft)
Horizontal tail surfaces (total) 5.92 m² (63.70 sq ft)

WEIGHTS AND LOADINGS:

Weight empty:
F-16C: F100-PW-220 8,273 kg (18,238 lb)
F110-GE-100 8,627 kg (19,020 lb)
F-16D: F100-PW-220 8,494 kg (18,726 lb)
F110-GE-100 8,853 kg (19,517 lb)
Max internal fuel: F-16C 3,104 kg (6,846 lb)
F-16D 2,567 kg (5,659 lb)
Max external fuel (both) 3,066 kg (6,760 lb)
Max external load (both) 5,443 kg (12,000 lb)
Typical combat weight:
F-16C (F110) 10,780 kg (23,765 lb)
Max T-O weight:
air-to-air, no external tanks:
F-16C (F110) 12,331 kg (27,185 lb)
with external load:
F-16C Block 30/32 17,010 kg (37,500 lb)
F-16C Block 40/42 19,187 kg (42,300 lb)
Wing loading:
at 12,927 kg (28,500 lb) AUW 464 kg/m² (95.0 lb/sq ft)
at 19,187 kg (42,300 lb) AUW 688 kg/m² (141.0 lb/sq ft)
Thrust/weight ratio (clean) 1.1 to 1

PERFORMANCE:

Max level speed at 12,200 m (40,000 ft) above Mach 2.0
Service ceiling more than 15,240 m (50,000 ft)
Radius of action:
F-16C Block 40, two 907 kg (2,000 lb) bombs, two Sidewinders, 3,940 litres (1,040 US gallons; 867 Imp gallons) external fuel, tanks dropped when empty, hi-lo-lo-hi 740 n miles (1,371 km; 852 miles)

TABLE 2: F-16A/B PRODUCTION

Date	Block	USAF		Belgium		Denmark		Egypt		Indonesia		Israel		Netherlands		Norway		Pakistan		Portugal		Singapore		Taiwan		Thailand		Venezuela	
		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	—	6	2																										
Aug 78	01	21	22	17	6	3	2							12	6	3	2												
Oct 79	05	89	27	8	4	12	3					18	8	14	2	10	2												
Oct 80	10	26	4	5		6	1					10		5	1	5	1												
Jan 81	10A	28	5	7	1	3	1					10	—	7	1	4	—												
Apr 81	10B	29	6	6	1	2	1					4	—	4	1	6	1												
Jul 81	10C	27	4	6	—	4	—					16	—	4	2	—	1												
Sep 81	10D	35	6	6	—							9	—																
Sub-total		**261**	**76**	**55**	**12**	**30**	**8**					**67**	**8**	**46**	**13**	**28**	**7**												
Nov 81	15	31	2			2	1							4	–	3	1												
Feb 82	15A	25	1					3	4																				
Apr 82	15B	26			[illegible]	[illegible]	[illegible]	2	1					[illegible]	2	4	1												
Jun 82	15C	26	1					2	1																				
Aug 82	15D	25	2	4	4	4	—	3	—					6	1	4	1	—	2										
Oct 82	15E	25	2					3	—																				
Dec 82	15F	25	2	5		3	[illegible]	3						6	2	4	1	2	2										
Mar 83	15G	24	2					4	–																				
Apr 83	15H	24	2	6	—	2	—	4	—					6	2	4	1												
Jun 83	15J	25	3					2	—																				
Aug 83	15K	20	5	8	—			3	—					4	2	8	—											1	3
Oct 83	15L	21	4					3	—																			2	—
Dec 83	15M	21	4	8	—			2	—					4	1	5	—	2	2										
Feb 84	15N	21	3					—	1									1	2										
Apr 84	15P	18	4	5	—			—	1					5	—			3	—										
Jul 84	15Q	22	6			—	1											5	—										
Oct 84	15R	19	2	4	—									10	2			4	—										
Jan 85	15S	11	—															5	—										
Mar 85	15T													7	2			2	—									3	3
Jan 85	15U													10	2			4	1									8	-
Oct 85	15V																		3									4	
	15W													9	2														
—	15X													8	—														
Sub-total		**670**	**122**	**96**	**20**	**46**	**12**	**34**	**8**			**67**	**8**	**130**	**31**	**60**	**12**	**28**	**12**									**18**	**6**
—	15Y			7	—	—	4							7	1							—	1						
Jan 88	15Z																												
Feb 88	15AA			7	1	4	—							7	1							2	2			1	3		
Jun 88	15AB																					2	1			7	1		
—	15AC			7	1	4	—							7	1														
May 89	15AD															—	2												
Aug 89	15AE			6	2					—	2			7	2														
Sep 89	15AF									2	2																		
Mar 90	15AG			8	—					6	—			8	—														
—	15AH																												
Jan 91	15AJ			5	—									8	—											6	–		
—	15AK																												
—	15AL													3	—														
Nov 91	15AM																	6	5										
—	15AN																												
	15AP																												
Apr 93	15AQ																	5	1										
Oct 93	15AR																	[illegible]	3										
Jan 94	15AS																	—	2										
Jan 94	15AT																			3	3								
Mar 94	15AU																	—	4										
Jun 94	15AV																			10									
Oct 94	15AW																			4	—								
Feb 95	15AX																										4		
Jun 95	15AY																									4			
Oct 95	15AZ																									8	2		
Sub-total	20	**670**	**122**	**136**	**24**	**54**	**16**	**34**	**8**	**8**	**4**	**67**	**8**	**177**	**36**	**60**	**14**	**41**	**27**	**17**	**3**	**4**	**4**	**—** 120	**—** 30	**26**	**10**	**18**	**6**
Totals		**670**	**122**	**136**	**24**	**54**	**16**	**34**	**8**	**8**	**4**	**67**	**8**	**177**	**36**	**60**	**14**	**41**	**27**	**17**	**3**	**4**	**4**	**120**	**30**	**26**	**10**	**18**	**6**
Grand total														**1,744**															

Notes: OCU standard from Block 15Y
Date of manufacture refers to Fort Worth only: overseas production varies slightly

UPDATED

F-16C Block 40, four 907 kg (2,000 lb) bombs, two Sidewinders, 1,136 litres (300 US gallons, 250 Imp gallons) external fuel, tanks retained, hi-lo-lo-hi
340 n miles (630 km, 392 miles)
F-16C Block 40, two Sparrows and two Sidewinders, 3,940 litres (1,040 US gallons, 867 Imp gallons) external fuel, 2 h 10 min CAP
200 n miles (371 km, 230 miles)
F-16C Block 40, as immediately above, point intercept
710 n miles (1,315 km, 818 miles)

Ferry range, with drop tanks
more than 2,100 n miles (3,890 km; 2,417 miles)
Symmetrical g limit with full internal fuel +9

UPDATED

TABLE 3. F-16C/D PRODUCTION

Date	Block	USAF		USN		Bahrain		Egypt		Greece		Israel		Korea		Singapore		Turkey	
		F-16C	F-16D	F-16N	TF-16N	F-16C	F-16D	F-16C	F-16D	F-16C	F-16D	F-16C	F-16D	F-16C	F-16D	F-16C	F-16D	F-16C	F-16D
Jul 84	25	7	4																
Dec 84	25A	16	3																
Mar 85	25B	25	5																
Jun 85	25C	35	5																
Oct 85	25D	40	4																
Feb 86	25E	47	4																
Jun 86	25F	39	10																
Sub-total		**209**	**35**																
Jun 86	30	16	2									4	—						
Jun 86	32							1	4					2	4				
Oct 86	30A	40	2									15	1						
Oct 86	32A							13	2					4	2				
Feb 87	30B	47	3	4	—							15						17	6
Feb 87	32B							20	—					4	—				
Jun 87	30C	35	2	8	—							16	—						
Jun 87	32C	20	3											4	—				
Oct 87	30D	42	4	8	—							1	4						
Oct 87	32D	13	—											4	—				
Feb 88	30E	55	5	2	4							—	10					17	3
Feb 88	32E													4	—				
Jun 88	30F	51	6									—	9						
Jun 88	32F	2	1											4	—				
Oct 88	30H	34	12							2	4								
Oct 88	32H	11	1											4	—				
Feb 89	30J	25	8							12	2								
Feb 89	32J	10																	
Jun 89	30K	15	3							16	—								
Oct 89	30L									4	—								
Sep 91	32Q													—	4				
—	30VISTA	—	1																
Sub-total		**625**	**88**	**22**	**4**			**34**	**6**	**34**	**6**	**51**	**24**	**30**	**10**			**34**	**9**
Dec 88	40	2	—																
Feb 89	40A	6	3															17	3
Feb 89	42A	5	3																
Jun 89	40B	22	–																
Jun 89	42B	7	13																
Oct 89	40C	38	3																
Oct 89	42C	17	2																
Feb 90	40D	38	2			2	4											17	3
Feb 90	42D	17	3																
Jun 90	40E	37	—			6	—												
Jun 90	42E	18	5																
Oct 90	40F	33	4															17	3
Oct 90	42F	15	8																
Feb 91	40G	31	5					2	—										
Feb 91	42G	21	3																
Jun 91	40H	14	5					—	4			6	4						
Jun 91	42H	27	6																
Oct 91	40J	7	5					9	2			8	8					16	3
Oct 91	42J	21	4																
Jun 92	40K	7	4					15	1			8	8						
Jun 92	42K	1	—																
Jan 93	40L							8	—			8	10					17	3
May 93	40M							1	1										
Aug 93	40N							—	8										
—	40P																	18	—
Apr 94	40Q							3	3										
Jul 94	40R							31	5										
Sub-total		**1,009**	**166**	**22**	**4**	**8**	**4**	**103**	**30**			**81**	**54**					**136**	**24**
Oct 91	50	4	-																
Apr 92	50A	7	7																
Apr 92	52A	1	1																
Dec 92	50B	24	8																
Jun 93	50C	21	4																
Apr 93	50D	103	9																
Apr 93	52D	41	11																
Oct 94	52G													1	4				
Dec 94	52H													1	6				
Aug 95	52J													2	—				
Oct 95	52K													5	1				
Feb 96	52L													5	1				
Jun 96	52M													4	2				
Oct 96	52N													10	6				
	50									32	8							68	12
—	52													52	20	8	10		
Totals		**1,210**	**206**	**22**	**4**	**8**	**4**	**103**	**30**	**66**	**14**	**81**	**54**	**110**	**50**	**8**	**10**	**204**	**36**
Grand total										**2,220**									

Note: Date of manufacture refers to Fort Worth only, overseas production varies slightly

UPDATED

LOCKHEED MARTIN AIRCRAFT SERVICES (LMAS) (Division of Lockheed Martin Aeronautics Sector)

1800 East Airport Drive, Ontario, California 91761-0033
Telephone: 1 (909) 395 2411
PRESIDENT: Harold T Bowling
EXECUTIVE VICE-PRESIDENT: Arthur J Schwetz
VICE-PRESIDENT PROGRAMMES: Ned Duffield
VICE-PRESIDENT OPERATIONS: Robert Chambers
DIRECTOR, COMMUNICATIONS: Ronald C Lindeke

LMAS (known until 1995 as Lockheed Aircraft Service Company) is oldest aircraft modification company in the world; has designed, fabricated and installed major aircraft structural modifications and integrated complete avionic systems for US military, foreign governments and commercial customers; has completed conversions on such aircraft as Boeing KC-135 and 707, McDonnell Douglas DC-8 and Lockheed Martin C-130, C-141, L-188 Electra, L-1011 and P-3. Manufactures solid state flight data recorders and tactical reconnaissance pods, operates OMNILOG (worldwide logistics support service) which tracks more than 20 million aircraft components. Lockheed Aeromod Center Inc (LACI) of Greenville, South Carolina, maintains and modifies large military and civil aircraft; in December 1990 opened 21,740 m² (234,000 sq ft) western area facility for commercial aircraft maintenance and modification at Tucson, Arizona.

Airod Sdn Bhd (see 1994-95 *Jane's*), joint venture between LAS International and Aerospace Industries Malaysia, maintains, modifies and overhauls aircraft at Subang International Airport, Kuala Lumpur. Guangzhou Aircraft Maintenance Engineering Company Limited (GAMECO) is joint venture company formed by Civil Aviation Administration of China-Guangzhou Regional Administration (CAAC-GRA), Lockheed Aircraft Service International (LASI) and Hutchison China Trade Holdings Limited (HCT); new maintenance hangar is the largest in China and able to accommodate one Boeing 747 and two 737s or four 737s simultaneously; hangar and adjoining shop complex occupy 14,000 m² (150,700 sq ft).

In February 1992, LAS formed joint venture, Aeroplex of Central Europe (ACE), with Malév Hungarian Airlines for upgrading existing facilities and expansion of commercial aircraft maintenance and overhaul capability at Budapest International Airport (Ferihegy). ACE provides aircraft maintenance and support of Malév fleet of Boeing 737-200 and Tu-154 and -134 aircraft and offers third-party maintenance to airlines in Central Europe, Middle East and Africa.

Latest joint venture involves new subsidiary company established in Argentina, where LMAS won contract to operate Córdoba Material Area for 25 years, beginning 1 July 1995. Depot managed by Lockheed Aircraft Argentina SA (LAASA) and work includes aircraft maintenance support under terms of agreement with Argentine Ministry of Defence, plus modernisation of 18 A-4M Skyhawks bought from US Navy for Argentine service (further 18 to be overhauled by LMAS at Chino, California). Whole project valued at $200 million and will entail inspection and rewiring, engine refurbishment; upgraded avionics; pilot and technician training; spares support and provision of technical manuals.

LAS specialises in design and application of special mission packages for converted C-130s, for electronic warfare, command control communication and countermeasure systems, and signal intelligence; completed upgrading of nine AC-130H Spectre gunships into Special Operations Forces Improvement (SOFI) configuration in 1993.

Lockheed L-1011 TriStar conversions have included range, MTOW and fuel capacity increases; VIP custom interiors, and L-1011 Freighter 2000 programme.

Further data in 1991-92 *Jane's* and in *Jane's Aircraft Upgrades*.

UPDATED

MAULE

MAULE AIR INC

2099 GA Highway, 133 South, Moultrie, Georgia 31768
Telephone: 1 (912) 985 2045
Fax: 1 (912) 890 2402
Telex: 804613 MAULE MOUL
PRESIDENT AND ENGINEERING MANAGER: Belford D Maule
VICE-PRESIDENT, SECRETARY AND TREASURER: June D. Maule
ENGINEER: Don Richie
SALES MANAGER: Don Merrill

Original Maule Aircraft Corporation formed to manufacture M-4, a four-seat extrapolation of Piper Cub, transferred to Moultrie, Georgia, 1968; production ceased 1975. Maule Air Inc formed 1984 to produce uprated M-5 Lunar Rocket and M-7 Super Rocket; Lunar Rocket discontinued, but variants listed below currently available. Employment 100 in February 1995. Sales revenue for 1994 totalled $6 million.

UPDATED

MAULE TRAINER, STAR ROCKET, SUPER ROCKET and STAR CRAFT

TYPE: Two/four/five-seat light aircraft.

CURRENT VERSIONS: **MX-7-160 Sportplane**: Mid-length wingspan four-seater, 119 kW (160 hp) Textron Lycoming O-320-B2D engine, Sensenich two-blade fixed-pitch metal propeller, and four-position flaps.

MXT-7-160 Trainer: As MX-7-160, but tricycle landing gear; two seats standard, four seats optional.

MX-7-180A Sportplane: As MX-7-160, but 134 kW (180 hp) Textron Lycoming O-360-C4F engine.

MXT-7-180A Trainer: As MXT-7-180A, but tricycle landing gear, two seats standard, four seats optional.

MX-7-180B Star Rocket: Short wingspan four-seater (fifth seat optional), 134 kW (180 hp) Textron Lycoming O-360-C1F engine, Hartzell two-blade constant-speed metal propeller, 265 litre (70 US gallon, 58 Imp gallon) fuel tanks standard, and five-position flaps.

MXT-7-180 Star Craft: As MX-7-180B, but mid-length wingspan and tricycle landing gear.

M-7-235B Super Rocket: Long wingspan five-seater, choice of 175 kW (235 hp) carburetted Textron Lycoming O-540-J1A5D, low-compression Mogas approved O-540-B4B5 or fuel-injected IO-540-W1A5D engines, Hartzell constant-speed propeller, 265 litre (70 US gallon, 58 Imp gallon) fuel tanks standard, five-position flaps, fuselage raised 12.7 cm (5 in) at trailing-edge of wing and baggage area moved aft 12.7 cm (5 in) to accommodate fifth seat, recommended for high gross weight short field operation, and for floatplane operation.

MT-7-235 Super Rocket: As M-7-235B, but tricycle landing gear, mid-length wingspan, four-position flaps and IO-540-W1A5D engine only.

MX-7-235 Super Rocket: Short wingspan four-seater (fifth optional); power plant as M-7-235B, five-position flaps.

M-8-235: Mid-length wingspan four-seater (fifth optional) with wide-track spring steel landing gear instead of oleo legs; Textron Lycoming O-540-J1A5D or IO-540-W1A5D engine, Hartzell constant-speed propeller, 265 litre (70 US gallon; 58 Imp gallon) fuel tanks standard and four-position flaps.

MX-7-420 Starcraft: Short wingspan, 313 kW (420 shp) Allison 250-B17C turboprop driving Hartzell HC-B3TF-7A three-blade constant-speed feathering and reversing propeller; 265 litre (70 US gallon, 58 Imp gallon) fuel tanks.

Maule MXT-7-160 trainer two/four-seat light aircraft *1995*

MXT-7-420 Starcraft: As MX-7-420, but tricycle landing gear.

M-7-420 Starcraft: As MX-7-420, but EDO 2500 amphibious floats.

CUSTOMERS: Total of more than 1,900 produced, 71 delivered in 1994, 1995 deliveries expected to total 100. Mexican Air Force received 10 MXT-7-180s in 1994.

COSTS (1994, standard equipment): MX-7-160 $90,063; MXT-7-160 $98,700; MX-7-180A $94,999; MXT-7-180A $103,635; MX-7-180B $105,850; MXT-7-180 $115,353; M-7-235B (O-540 engine) $118,062; M-7-235B (IO-540 engine) $125,062; MT-7-235 $135,707; M-8-235 (O-540 engine) $123,369; M-8-235 (IO-540 engine) $130,369; MX-7-420 $450,000; MXT-7-420 $490,000; M-7-420 $550,000.

DESIGN FEATURES: USA 35B (modified) wing section, dihedral 1°, incidence 0° 30′, cambered wingtips standard.

FLYING CONTROLS: Ailerons linked to rudder servo tab to allow normal flying with aileron wheel only; trim tab in port elevator, rudder trim by spring to starboard rudder pedal; flap deflection 40° down for slow flight (further setting of 48° down on some models), 24° down, 0° and 7° up for improved cruise performance; underfin on floatplane and amphibious versions.

STRUCTURE: All-metal two-spar wing with dual struts and glassfibre tips; fuselage frame of welded 4130 steel tube with Ceconite covering aft of cabin and metal doors and skin round cabin; glassfibre engine cowling.

LANDING GEAR: Non-retractable tailwheel or nosewheel type. Maule oleo-pneumatic shock-absorbers in main units on M-7 and MX-7 models, streamlined spring steel main units on M-8 tailwheel and all tricycle landing gear models. Maule steerable tailwheel. Cleveland mainwheels with Goodyear or McCreary tyres size 17 × 6.00-6, pressure 1.79 bars (26 lb/sq in). Tailwheel tyre size 8 × 3.50-4, pressure 1.03 to 1.38 bars (15 to 20 lb/sq in). Cleveland hydraulic disc brakes. Parking brake. Oversize tyres, size 20 × 8.50-6 (pressure 1.24 bars; 18 lb/sq in), and fairings aft of mainwheels optional. Provisions for fitting optional Aqua 2400 or Edo 2400B floats or Edo 797-2500 amphibious floats (not on tricycle gear models).

POWER PLANT: One flat-four or flat-six engine as described under Current Versions, driving a Hartzell, McCauley or Sensenich two-blade constant-speed propeller. Three-blade McCauley propeller optional (on 175 kW, 235 hp versions). Two fuel tanks in wings with total usable capacity of 151 litres (40 US gallons, 33 Imp gallons). Auxiliary fuel tanks in outer wings (standard on some models), to provide total capacity of 265 litres (70 US gallons, 58 Imp gallons). Refuelling points on wing upper surface.

ACCOMMODATION: Two, four or five seats according to model, as described under Current Versions: individual, adjustable front seats, rear bench seat. Dual controls standard. Baggage compartment, capacity 113 kg (250 lb), aft of seats, cargo capacity with passenger seats removed 349 kg (770 lb). One front-hinged door on port side; three doors on starboard side, forward and centre doors hinged at front edge, rear baggage door hinged at rear edge to form double cargo door providing an opening 1.30 m (4 ft 3 in) wide to facilitate loading of bulky cargo; aircraft may be flown with doors removed. Accommodation heated and ventilated.

SYSTEMS: Hydraulic system for brakes only; electrical system powered by 60 A engine-driven alternator; 12 V battery (24 V battery on turboprops).

AVIONICS: *Comms*: Single Bendix/King KX 125-01 nav/com and KT-76AA transponder, Narco AR-850 altitude encoder, EBC102A ELT, broadband antenna, microphone, and cabin overhead speaker. Options include Bendix/King KX-155-38 or KX-155-42 nav/com, Trans-Cal KE-127 altitude encoder, Sigtronics SPA-400 intercom, push-to-talk switch, dual microphone/headphone jacks in front or rear, marker beacon antenna, Telex ProAir 2000E headset.

Flight: Optional choice of KI-203-00/204-02/206-04/208-00/209-01 VOR/LOC/GS indicators, KN 62A-01 or KN-64-00 DME, KN 75-00 glide slope receiver, KNS 80-00 integrated nav/RNAV/DME, KR-21 marker beacon receiver, KR-86-21 or KR-87-16 digital ADF, Narco ELT910 ELT, Garmin 100-321 GPS, Trimble TNL2000A GPS, Century IIB autopilot, avionics master switch and avionics cooling kit.

M-7-235B Super Rocket five-seat light aircraft

1995

Instrumentation: Standard (MX-7, MXT-7, M-7 and M-8 models, but others generally similar) includes full gyro panel/vacuum system, SigmaTek true airspeed indicator, carburettor air temperature gauge, acoustic stall warner, Alcor EGT gauge (one-, four- or six-cylinder), vertical speed indicator, alt meter, compass, tachometer, electric turn co-ordinator, electric fuel gauge, fuel pressure gauge, cylinder head temperature, manifold pressure gauge, oil temperature/pressure gauges, OAT gauge, ammeter, clock and stall warning light.

EQUIPMENT (MX-7, MXT-7, M-7 and M-8, others similar): Includes instrument and dome lights, auxiliary cabin heater, auxiliary fuel pump, auxiliary power plug, heated pitot tube, cabin soundproofing, cloth velour upholstery, cabin steps, cargo tiedowns, landing light in port wing, navigation lights, wingtip strobe lights, tinted windscreen, windscreen defroster, and standard external paint scheme in Maule White base colour with two-tone trim. Optional equipment includes dual-calliper brakes, dynamically balanced propeller, McCauley three-blade constant-speed metal propeller (175 kW, 235 hp models only), wing corrosion proofing, fuselage/tail surfaces/engine mount powder coating, Aviall hour meter, jump seat in baggage compartment, cabin door pockets, Plexiglas door, observation window, skylight, pilot's or co-pilot's swing-out window, shoulder harnesses, landing light in starboard wing, fuselage grab handles, fire extinguisher, float reinforcement, lift rings and fairing, Schweizer glider tow/release kit and aircraft tow bar.

DIMENSIONS, EXTERNAL:
Wing span: short wing models 9.40 m (30 ft 10 in)
mid-length wing models 10.03 m (32 ft 11 in)
long wing models 10.26 m (33 ft 8 in)
Wing chord, constant, all 1.60 m (5 ft 3 in)
Wing aspect ratio: short wing models 6.02
long wing models 6.40
Length overall: piston-engined models 7.16 m (23 ft 6 in)
turboprop models 7.32 m (24 ft 0 in)
Height overall:
tailwheel models 1.93 m (6 ft 4 in)
tricycle models 2.54 m (8 ft 4 in)
floatplane 3.05 m (10 ft 0 in)
amphibian 3.20 m (10 ft 6 in)
Propeller diameter: MX-7-160, MXT-160
1.88 m (6 ft 2 in)
MX-7-180A, MXT-7-180A, MX-7-180B, MXT-7-180
1.93 m (6 ft 4 in)
M-7-235, MT-7-235, MX-7-235, M-8-235
2.06 m (6 ft 9 in)
M-7-235, MT-7-235, MX-7-235 three-blade
option 1 2.03 m (6 ft 8 in)
option 2 2.08 m (6 ft 10 in)
MX-7-420, MXT-7-420, M-7-420 2.03 m (6 ft 8 in)

DIMENSIONS, INTERNAL:
Cabin:
Max width: piston-engined models 1.07 m (3 ft 6 in)
turboprop models 0.96 m (3 ft 2 in)

AREAS:
Wings, gross: short wing models 14.67 m² (157.9 sq ft)
long wing models 16.44 m² (177.0 sq ft)

WEIGHTS AND LOADINGS:
Weight empty: MX-7-160 603 kg (1,330 lb)
MXT-7-160 635 kg (1,400 lb)
MX-7-180A 612 kg (1,350 lb)
MXT-7-180A 644 kg (1,420 lb)
MX-7-180B 619 kg (1,365 lb)
MXT-7-180 517 kg (1,140 lb)
M-7-235B landplane 680 kg (1,500 lb)
M-7-235B floatplane 794 kg (1,750 lb)
MX-7-235 676 kg (1,490 lb)
M-8-235 696 kg (1,535 lb)
MX-7-420 626 kg (1,380 lb)
Max T-O weight: MX-7-160, MXT-7-160
998 kg (2,200 lb)
MX-7-180A, MXT-7-180A 1,089 kg (2,400 lb)
all other landplanes 1,134 kg (2,500 lb)
M-7-235B floatplane 1,247 kg (2,750 lb)
Max wing loading:
MX-7-180B, MX-7-235, MX-7-420
77.30 kg/m² (15.83 lb/sq ft)
M-7-235B 68.96 kg/m² (14.12 lb/sq ft)
M-7-235B floatplane 75.86 kg/m² (15.54 lb/sq ft)
Max power loading:
MX-7-160, MXT-7-160 8.37 kg/kW (13.75 lb/hp)
MX-7-180A, MXT-7-180A 8.12 kg/kW (13.33 lb/hp)
MX-7-180B, MXT-7-180 8.45 kg/kW (13.89 lb/hp)
M-7-235B, MX-7-235, M-8-235
6.47 kg/kW (10.64 lb/hp)
M-7-235B floatplane 7.12 kg/kW (11.70 lb/hp)
MX-7-420 3.62 kg/kW (5.95 lb/shp)

PERFORMANCE (at max T-O weight, ISA):
Max level speed:
M-7-235B floatplane 130 kts (241 km/h; 150 mph)
MX-7-420 174 kts (322 km/h; 200 mph)
Cruising speed (75% power) at optimum altitude:
MXT-7-160 113 kts (209 km/h; 130 mph)
MX-7-160, MXT-7-180A
117 kts (217 km/h; 135 mph)
MXT-7-180, MX-7-180A
120 kts (225 km/h; 139 mph)
MX-7-180 126 kts (233 km/h; 145 mph)
MX-7-235, M-7-235B, M-8-235
139 kts (257 km/h; 160 mph)
M-7-235 floatplane 125 kts (232 km/h; 144 mph)
MX-7-420: 50% power 156 kts (290 km/h; 180 mph)
75% power 169 kts (314 km/h; 195 mph)
Stalling speed, flaps down, power off:
MX-7-160, MXT-7-160, MX-7-180A, MXT-7-180A,
MX-7-180B, MXT-7-180
MX-7-235 35 kts (64 km/h; 40 mph)
M-7-235B, M-8-235 31 kts (57 km/h; 35 mph)
M-7-235B floatplane 47 kts (87 km/h; 54 mph)
MX-7-420 44 kts (81 km/h; 50 mph)
Max rate of climb at S/L:
MX-7-160, MXT-7-160 251 m (825 ft)/min
MX-7-180A, MXT-7-180A 280 m (920 ft)/min
MX-7-180B, MXT-7-180 365 m (1,200 ft)/min
M-7-235B, MT-7-235, MX-7-235, M-8-235
609 m (2,000 ft)/min
M-7-235B floatplane 411 m (1,350 ft)/min
MX-7-420 1,432 m (4,700 ft)/min
Service ceiling:
MX-7-160, MXT-7-160 3,965 m (13,000 ft)
MX-7-180A, MXT-7-180A, MX-7-180B,
MXT-7-180 4,575 m (15,000 ft)
M-7-235B, MT-7-235, MX-7-235, M-8-235,
MX-7-420 6,100 m (20,000 ft)
M-7-235B floatplane 5,180 m (17,000 ft)
T-O run:
MX-7-160, MXT-7-160, MX-7-180B 183 m (600 ft)
MXT-7-180, MX-7-420 61 m (200 ft)
MX-7-180A, MXT-7-180A 168 m (550 ft)
MX-7-235 (O-540 engine) 46 m (150 ft)
MX-7-235 (IO-540 engine), M-7-235B,
M-8-235 38 m (125 ft)
M-7-235B floatplane 305 m (1,000 ft)
T-O to 15 m (50 ft):
MX-7-160, MXT-7-160 360 m (1,180 ft)
MX-7-180A, MXT-7-180A 350 m (1,150 ft)
MX-7-180B, MXT-7-180, M-7-235B,
MX-7-235, M-8-235 183 m (600 ft)
M-7-235B floatplane 381 m (1,250 ft)
Landing from 15 m (50 ft):
all landplane models 152 m (500 ft)
M-7-235B floatplane 305 m (1,000 ft)
Landing run:
MX-7-420 91 m (300 ft)
M-7-235B floatplane 244 m (800 ft)
Range with max fuel, 30 min reserves:
MX-7-160, MXT-7-160
469 n miles (869 km; 540 miles)
MX-7-180A, MXT-7-180A
434 n miles (804 km; 500 miles)
MXT-7-180 825 n miles (1,528 km; 950 miles)
Range with max fuel, no reserves:
MX-7-180 912 n miles (1,689 km; 1,050 miles)
MX-7-235, M-7-235B, M-8-235: O-540 engine
760 n miles (1,408 km; 875 miles)
MX-7-235, M-7-235B, M-8-235:
IO-540 engine 829 n miles (1,537 km; 955 miles)
M-7-235B floatplane: O-540 engine
608 n miles (1,126 km; 700 miles)
IO-540 engine 669 n miles (1,239 km; 770 miles)
MX-7-420: 75% 457 n miles (846 km; 526 miles)
50% power 644 n miles (1,194 km; 742 miles)

UPDATED

MCDONNELL DOUGLAS

MCDONNELL DOUGLAS CORPORATION

PO Box 516, St Louis, Missouri 63166-0516
Telephone: 1 (314) 232 0232
Fax: 1 (314) 234 3826

Corporate Office

CHAIRMAN AND CEO: John F McDonnell
EXECUTIVE VICE-PRESIDENT: John Capellupo
SENIOR VICE-PRESIDENT, NEW AIRCRAFT AND MISSILE PROGRAMS NAMP: James M Sinnett
SENIOR VICE-PRESIDENT, C-17 PROGRAM: Donald Kozlowski
VICE-PRESIDENT AND GENERAL MANAGER, NAMP: David O Swain

Formed 28 April 1967 by merger of Douglas Aircraft Co Inc and the McDonnell Company, encompasses their subsidiaries plus former Hughes Helicopter Company acquired in 1984 and renamed McDonnell Douglas Helicopter Company; helicopter company was for sale for a time but then incorporated in main company, now as McDonnell Douglas Helicopter Systems. Employees totalled 68,500 worldwide in early 1995, some 18,500 fewer than in 1992.

McDonnell Douglas was largest US defence contractor prior to 1995 formation of Lockheed Martin; early 1990s strategy has been return to profitability; this achieved 1993 and improved in 1994, despite continued fall in airliner sales after reorganising to recover from combined downturn in defence and civil markets. Workforce reduced by 20 per cent and non-core businesses sold. Company is looking for risk-sharing partners for new civil programmes in order to extend its family of airliners and its market share.

Major operating units of McDonnell Douglas Corporation (MDC) Aerospace Group were reorganised in August 1992 and are:

McDonnell Douglas Aerospace (MDA)

Follows this entry

MDA administratively divided into MDA East and MDA West and comprises the government aerospace business of McDonnell Douglas Corporation including the C-17 Globemaster III formerly a Douglas Aircraft programme. MDA W address is 5301 Bolsa Avenue, Huntington Beach, California 92647. *Telephone:* 1 (714) 896 1300 *Fax:* 1 (714) 896 1308

Douglas Aircraft Company (DAC)

Self-contained civil airliner manufacturer. Follows McDonnell Douglas Aerospace entry.

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MCDONNELL DOUGLAS AEROSPACE (Division of McDonnell Douglas Corporation)

PO Box 516, St Louis, Missouri 63166-0516
Telephone: 1 (314) 232 0232
Fax: 1 (314) 234 3826

EXECUTIVE VICE-PRESIDENT: John P Capellupo
VICE-PRESIDENT/GENERAL MANAGER, F-15: Craig L Johnson
VICE-PRESIDENT/GENERAL MANAGER, F/A-18: Michael M Sears
DIRECTOR OF COMMUNICATIONS: James R Reed

MDA consists of:

McDonnell Aircraft Company
Follows this entry

McDonnell Douglas Aerospace Transport Aircraft
Follows McDonnell Aircraft Company

McDonnell Douglas Helicopter Systems
Follows McDonnell Douglas Aerospace Transport Aircraft

McDonnell Douglas Missile Systems Company
McDonnell Douglas Space Systems Company
McDonnell Douglas Electronic Systems Company
See previous editions of *Jane's*

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MCDONNELL AIRCRAFT COMPANY (Division of McDonnell Douglas Aerospace)

PO Box 516, St Louis, Missouri 63166-0516
Telephone: 1 (314) 232 0232
Fax: 1 (314) 234 3826

Development and production continues to concentrate on F/A-18 Hornet, T-45 Goshawk, F-15 Eagle and AV-8B Harrier II. McDonnell teamed with Vought in study of potential replacement for A-12A Advanced Tactical Aircraft, designated A/F-X, which subsequently cancelled. Joined with British Aerospace, February 1992, to study joint advanced STOVL fighter (see International section); currently involved in design of contender for JAST programme (see US Navy entry). V/STOL research centre established at St Louis January 1994. St Louis delivered 10,000th military jet aircraft in February 1993.

UPDATED

Lockheed Martin LANTIRN sensors on F-15E. AN/AAQ-13 navigation pod to starboard (left in photograph) and AN/AAQ-14 targeting pod *(Paul Jackson)*

1995

MCDONNELL DOUGLAS F-15C/D EAGLE

Israel Defence Force names: F-15A/B Baz (Eagle), F-15C/D Akef (Buzzard)

US production of interceptor F-15A/B/C/D Eagles completed in 1992, but F-15C/D continues (in F-15J/DJ form) in Japan by Mitsubishi (which see). Refer also to production tables with F-15E entry which follows.

USAF proceeding with development of SEAD capability for F-15C using $21 million and $37.4 million appropriations in FY94 and FY95. Demonstration/validation programme to be conducted with F-15 Precision Direction Finder in conjunction with Texas Instruments AGM-88 HARM. If successful, could pave way for suitably adapted Eagles to replace F-4G Phantom in 'Wild Weasel' role from about 1997-98. Consideration also being given to using F-15C in reconnaissance role, following two-flight evaluation of Loral Fairchild ATARS sensor pod system on F-15D, first flight 19 April 1995; however, F-16C remains favoured USAF candidate for this mission.

UPDATED

MCDONNELL DOUGLAS F-15E/I/S EAGLE

Israel Defence Force name: Ra'am (Thunder)

TYPE: Two-seat dual role attack/air superiority fighter.

PROGRAMME: Demonstration of industry funded Strike Eagle prototype (71-0291) modified from F-15B, including accurate blind weapons delivery, completed at Edwards AFB and Eglin AFB during 1982; product improvements for the F-15E were tested on four Eagles, amongst which were the Strike Eagle prototype, an F-15C and an F-15D, between November 1982 and April 1983, including first take-off at 34,019 kg (75,000 lb), 3,175 kg (7,000 lb) more than F-15C with conformal tanks; new weight included conformal tanks, three other external tanks and eight 500 lb Mk 82 bombs; 16 different stores configurations tested, including 2,000 lb Mk 84 bombs, and BDU-38 and CBU-58 weapons delivered visually and by radar.

Full programme go-ahead announced 24 February 1984; first flight of first production F-15E (86-0183) 11 December 1986; first delivery to Luke AFB, Arizona, 12 April 1988; first delivery 29 December 1988 to 4th Wing at Seymour Johnson AFB, North Carolina. Small number of F-15Es used for trials with 3246th Test Wing at Eglin AFB, Florida, and 6510th TW (412th TW from October 1992) at Edwards AFB, California; trials include 87-0180 with GE F110-GE-129 engines in place of F100s. P&W F100-PW-229 first flown in F-15E of 6510th TW on 2 May 1990.

CURRENT VERSIONS: **F-15E**: Basic version, *as detailed*.

F-15F: Proposed single-seat version, optimised for air combat, not built.

F-15H: Proposed export version, lacking specialised air-to-ground capability, supplanted by F-15S.

F-15I: Israeli export version of F-15E, selected November 1993, confirmed 27 January 1994; 21 ordered 12 May 1994 for delivery from 1997 at one per month; option on four more. Tactical electronic warfare system deleted, to be replaced by Israeli built integrated system including active jamming, radar- and missile-warning and dispenser subsystems. Otherwise identical to USAF F-15E, with F100-PW-229 engines, provision for LANTIRN pods, full capability AN/APG-70 radar, Kaiser holographic HUD, Litton ring laser INS and VHSIC central computer.

F-15S: Saudi Arabian export version of F-15E, lacking some air-to-air and air-to-ground capabilities. Saudi Arabian request for 72 aircraft approved by US government in December 1992, initially designated **F-15XP**; first funds assigned by US government on 23 December 1992, contract signature by Saudi government May 1993; planned delivery rate halved early 1994, now to be one per month from 1995. First F-15S flown 19 June 1995, official roll-out 12 September 1995.

Saudi versions comprise 24 optimised for air-to-air missions and 48 optimised for air-to-ground; largely outfitted with F-15C/D systems, AN/APG-70 radar 'de-tuned' to match AN/APG-63 performance, lacking computerised mapping; some ECM deleted. Lockheed Martin Sharpshooter reduced capability version of LANTIRN nav/attack pods; no conformal tanks (or tangential stores carriage). Armament includes AGM-65D/G Maverick, AIM-9M and AIM-9S Sidewinder missiles, CBU-87 submunitions dispenser and GBU-10/12 bombs. Saudi programme includes about 154 Pratt & Whitney F100-PW-229 engines.

F-15U Plus: Version conceived to satisfy United Arab Emirates requirement for 20 to 80 long-range interdictor aircraft, in which it is competing against Lockheed Martin F-16, Dassault Rafale, Eurofighter 2000 and Sukhoi Su-37 (Su-30MK). F-15U Plus proposal anticipates extended range, with additional 2,570 kg (5,665 lb) of fuel in thicker clipped-delta, 50° leading-edge sweep wing, more stores stations and internally situated infra-red navigation and targeting sensor suite in lieu of LANTIRN. Typical ordnance loads would comprise nine 2,000 lb Mk 84 bombs or seven laser guided GBU-24s.

Offer envisages co-development, with UAE funding cost of developing and testing any new components; alternative proposal envisages delivery to UAE of standard F-15E Strike Eagle under FMS, either option dependent upon US government policy, which still to be established.

CUSTOMERS: USAF funding for originally planned 392 reduced to 200; however, further nine funded in FY91 and FY92, comprising three Desert Storm loss replacements and six with proceeds of sale to Saudi Arabia of 24 surplus F-15C/Ds. Saudi Arabia 72 (F-15Ss), Israel 21 (F-15I). USAF offered follow-on procurement from 1995 to coincide with start of Saudi deliveries.

USAF F-15E PROCUREMENT

Batch	FY	Qty	First aircraft
Lot 1	86	8	86-0183
Lot 2	87	42	87-0169
Lot 3	88	42	88-1667
Lot 4	89	36	89-0471
Lot 5	90	36	90-0227
Lot 6	91	36	91-0300
Lot 7	91	6	91-0600
Lot 8	92	3	92-0364
		—	
Total		**209**	

Initial USAF unit 4th Wing, declared operational October 1989, currently with 333, 334, 335 and 336 Squadrons and others with 57th Wing USAF Weapons School at Nellis AFB, Nevada. 90th FS of 3rd Wing at Elmendorf, Alaska, received first F-15E on 29 May 1991. 391st FS sole F-15E squadron in multitype 366th Wing at Mountain Home AFB, Idaho, received first aircraft (reallocated from early production) 6 November 1991. 492nd and 494th FS of 48th FW at Lakenheath, UK, received first aircraft on 21

February 1992 (46th arrival at Lakenheath, 16 June 1993, was 200th F-15E, 91-0335). Deliveries of Lot 7 began to 48th FW on 13 April 1994 and final USAF F-15E (92-0366) delivered to 57th Wing on 11 July 1994. Initial contract placed with McDonnell Douglas by US government on 18 December 1992 for 72 Saudi aircraft, project name, Peace Sun IX.

COSTS: $35 million, flyaway, $2.000 million for 21 F-15Is (1993), Israel.

DESIGN FEATURES: NACA 64A aerofoil section with conical camber on leading-edge; sweepback 38° 42′ at quarter-chord, thickness/chord ratio 6.6 per cent at root, 3 per cent at tip; anhedral 1°, incidence 0°. Twin fins positioned to receive vortex flow off wing and maintain directional stability at high angles of attack. Straight two-dimensional external compression engine air inlet each side of fuselage. Air inlet controllers by Hamilton Standard. Air inlet actuators by National Water Lift. Mission includes approach and attack at night and in all weather; main systems include new high resolution, synthetic aperture Hughes AN/APG-70 radar, wide field of view FLIR, Lockheed Martin LANTIRN navigation (AN/AAQ-13) and targeting (AN/AAQ-14) pods beneath starboard and port air intakes respectively; air-to-air capacity with AIM-7 Sparrow, AIM-9 Sidewinder and AIM-120 AMRAAM retained, rear cockpit has four multipurpose CRT displays for radar, weapon selection, and monitoring enemy tracking systems, front cockpit modifications include redesigned up-front controls, wide field of view HUD, colour CRT multifunction displays for navigation, weapon delivery, moving map, precision radar mapping and terrain-following. Engines have digital electronic control, engine trimming and monitoring, fuel tanks are foam-filled, more powerful generators, better environmental control.

FLYING CONTROLS: Plain ailerons and all moving tailplane with dog-tooth extensions, both powered by National Water Lift hydraulic actuators, rudders have Ronson Hydraulic Units actuators; no spoilers or trim tabs; Moog boost and pitch compensator for control column, plain flaps, upward-opening airbrake panel in upper fuselage between fins and cockpit. Digital triple-redundant Lear Astronics flight control system capable of automatic coupled terrain-following.

STRUCTURE: Wing based on torque box with integrally machined skins and ribs of light alloy and titanium; aluminium honeycomb wingtips, flaps and ailerons, airbrake panel of titanium, aluminium honeycomb and graphite/epoxy composites skin. Strike version of Eagle includes 60 per cent of normal F-15 structure redesigned to allow 9 g and 16,000 hours fatigue life; superplastic forming/diffusion bonding used for upper rear fuselage, rear fuselage keel, main landing gear doors, and some fuselage fairings, plus engine bay structure. New wing design that would provide 33 per cent range increase and give double the number of weapons stations of existing F-15E revealed in 1994. This could be incorporated in future production aircraft (including proposed United Arab Emirates F-15U) or installed on existing F-15s as retrofit programme.

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel on each unit. All units retract forward. Cleveland nose and main units, each incorporating an oleo-pneumatic shock-absorber. Bendix wheels and Michelin AIR X radial tyres on all units. Nosewheel tyre size 22 × 7.75-9, mainwheel tyres size 36 × 11-18, tyre pressure 21.03 bars (305 lb/sq in) on all units. Bendix five-rotor carbon disc brakes.

POWER PLANT: Initially, two Pratt & Whitney F100-PW-220 turbofans, each rated for take-off at 104.3 kN (23,450 lb st), installed, with afterburning. Later aircraft have option of Pratt & Whitney F100-PW-229s or 129.0 kW (29,000 lb st) General Electric F110-GE-129s. USAF aircraft 135 onwards (90-0233), built from August 1991, have 129.4 kN (29,100 lb st) Pratt & Whitney F100-PW-229s, which also ordered for Saudi F-15S. Internal fuel in foam filled structural wing tanks and six Goodyear fuselage tanks, total capacity 7,643 litres (2,019 US gallons; 1,681 Imp gallons). Simmonds fuel gauge system. Optional conformal fuel tanks (CFT) attached to side of engine air intakes, beneath wing, each containing 2,737 litres (723 US gallons; 602 Imp gallons). Provision for up to three additional 2,309 litre (610 US gallon, 508 Imp gallon) external fuel tanks. Maximum total internal and external fuel capacity 20,044 litres (5,295 US gallons, 4,409 Imp gallons).

ACCOMMODATION: Two crew, pilot and weapon systems officer, in tandem on McDonnell Douglas ACES II zero/zero ejection seats. Single-piece, upward-hinged, bird-resistant canopy.

SYSTEMS: Lucas Aerospace generating system for electrical power, with Sundstrand 60/75/90 kVA constant speed drive units. Litton molecular sieve oxygen generating system (MSOGS) introduced in 1991 to replace liquid oxygen system. AiResearch air conditioning system. Three independent hydraulic systems (each 207 bars, 3,000 lb/sq in) powered by Abex engine-driven pumps; modular hydraulic packages by Hydraulic Research and Manufacturing Company. AlliedSignal APU for engine starting, and for provision of limited electrical or hydraulic power on the ground independently of main engines.

AVIONICS: *Comms*: Magnavox AN/ARC-164 UHF transceiver and UHF auxiliary transceiver with cryptographic capability; Teledyne Electronics AN/APX-101 IFF transponder, Hazeltine AN/APX-76 IFF interrogator with Litton reply evaluator.

Radar: Hughes Aircraft AN/APG-70 I band pulse Doppler radar provides air-to-air capability equal to F-15C, plus high-resolution synthetic aperture mode for air-to-ground.

Flight: Triple redundant Lear Astronics digital flight control system with automatic terrain-following standard. IBM CP-1075C very high-speed integrated circuit (VHSIC) central computer introduced in 1992 (replacing CP-1075). Honeywell AN/ASK-6 air data computer, Honeywell AN/ASN-108 AHRS, Honeywell CN-1655A/ASN ring laser gyro INS providing basic navigation data and serving as primary attitude reference system, Collins AN/ARN-118 Tacan, Collins HSI presenting aircraft navigation information on a symbolic pictorial display, Collins AN/ARN-112 ILS receiver, Collins ADF receiver. Dorne & Margolin glide slope localiser antenna and Teledyne Avionics angle of attack sensors. Collins miniature airborne GPS receiver for installation from 1995.

Instrumentation: FLIR imagery displayed on Kaiser IR 2394/A wide field of view HUD; Honeywell vertical situation display set using CRT to present radar, electro-optical identification and attitude director indicator formats to pilot under all light conditions, moving map display by Bendix/King RP-341/A remote map reader. Honeywell digital map system intended to replace remote map reader from 1996.

Mission: Lockheed Martin LANTIRN externally mounted sensor package comprising AN/AAQ-13 navigation pod and AN/AAQ-14 targeting pod.

Self-defence: Northrop Grumman Enhanced AN/ALQ-135(V) internal countermeasures set provides automatic jamming of enemy radar signals, Loral AN/ALR-56C RWR, Magnavox AN/ALQ-128 EW warning set, Tracor AN/ALE-45 chaff dispenser.

ARMAMENT: 20 mm M61A1 six-barrel gun in starboard wing root, with 512 rounds. General Electric lead computing gyro. Provision on underwing (one per wing) and centreline pylons for air-to-air and air-to-ground weapons and external fuel tanks. Wing pylons use standard rail and launchers for AIM-9 Sidewinder and AIM-120 AMRAAM air-to-air missiles, AIM-7 Sparrow and AIM-120 AMRAAM can be carried on ejection launchers on the fuselage or on tangential stores carriers on CFTs. Maximum aircraft load (with or without CFTs) is four each AIM-7 or AIM-9, or up to eight AIM-120. Single or triple rail launchers for AGM-65 Maverick air-to-ground missiles can be fitted to wing stations only.

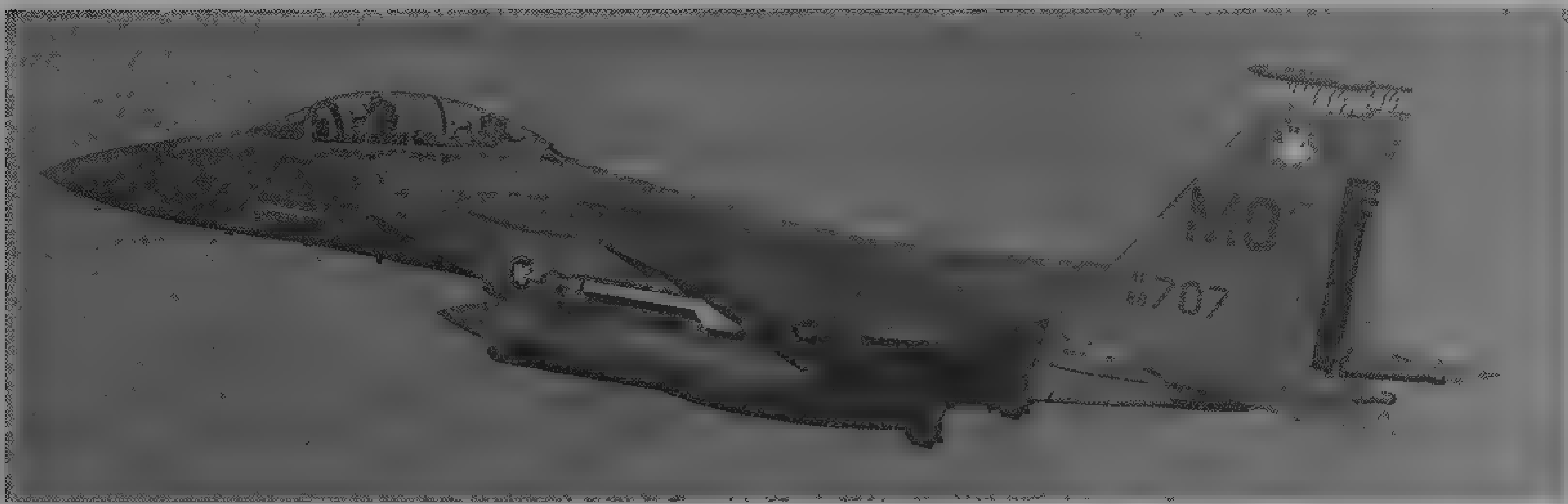
Tangential carriage on CFTs provides for up to six bomb racks on each tank, with provision for multiple ejector racks on wing and centreline stations. Edo BRU-46/A and BRU-47/A adaptors throughout, plus two LAU-106A/As

US F-15 PRODUCTION

Block	United States Air Force					Israel Defence Force				Japan ASDF		R Saudi AF	
	F-15A	F-15B	F-15C	F-15D	F-15E	F-15A	F-15B	F-15C	F-15D	F-15J	F-15DJ	F-15C	F-15D
1	2	—											
2	3	—											
3	2	1											
4	3	1[1]											
5	4	—											
6	4[2]	—											
7	5	3											
8	8	2											
9	10	2											
10	13	2											
11	18	2											
12	25	2											
13	31	5											
14	31	5											
15	39	6											
16	37	6				—	2						
17	30	5				10	—						
18	31	5				9	—						
19	35	6											
20	34	6											
21			28	5									
22			27	5									
23			28	4									
24			23	3						2	4K		
25			21	5						—	4K		
26			23	3						—	4		
27			22	2				3	2			—	4
28			15	2				3	4			6	2
29			15	4				3	—	—	2	7	2
30			12	2								11	3
31			9	3								14	2
32			16	—						—	2	8	3
33			15	2						—	2		
34			16	3									
35			25	3				2	2				
36			9	2				7	—	—	2		
37			15	3									
38			16	2									
39			15	3									
40			21	3									
41			20	2	2								
42			18	—	6								
43					21								
44					21								
45					21								
46					21								
47					18								
48					18								
49					18								
50					18				5			9	3
51					18								
52					18								
53					6								
54					3								
Sub-totals	365	59	409	61	209	19	2	18	13	2	20	55	19
			1,103					52			22		74
Total							1,251[3]						

Notes: Kits to Mitsubishi marked 'K'
Blocks 1-4 are YF-15s
[1]Converted to F-15E Strike Eagle prototype
[2]Including record breaking *Streak Eagle* 72-0119
[3]Production continues in Japan (see Mitsubishi)

UPDATED



McDonnell Douglas F-15E Eagle of composite 366th Wing which also includes B-1Bs, F-16Cs, F-15Cs and KC-135R tankers

1995

each side of lower fuselage. F-15E can carry a wide variety and quantity of guided and unguided air-to-ground weapons, including Mk 20 Rockeye (26), Mk 82 (26), Mk 84 (seven), BSU-49 (26), BSU-50 (seven), GBU-10 (seven), GBU-12 (15), GBU-15 (two), GBU 24 (five), CBU 52 (25), CBU-58 (25), CBU-71 (25), CBU-87 (25) or CBU-89 (25) bombs; SUU-20 training weapons (three), A/A-37 U-33 tow target (one), and B57 and B61 series nuclear weapons (five). An AN/AXQ-14 datalink pod is used in conjunction with the GBU-15, LANTIRN pod illumination is used to designate targets for laser-guided bombs. AGM-130 powered standoff bomb integrated in 1993. AGM-88 HARM capability in 1996. AN/AWG-27 armament control system

DIMENSIONS, EXTERNAL:

Wing span	13.05 m (42 ft 9¾ in)
Wing aspect ratio	3.01
Length overall	19.43 m (63 ft 9 in)
Height overall	5.63 m (18 ft 5½ in)
Tailplane span	8.61 m (28 ft 3 in)
Wheel track	2.75 m (9 ft 0¼ in)
Wheelbase	5.42 m (17 ft 9½ in)

AREAS:

Wings, gross	56.5 m² (608.0 sq ft)
Ailerons (total)	2.46 m² (26.48 sq ft)
Flaps (total)	3.33 m² (35.84 sq ft)
Fins (total)	9.78 m² (105.28 sq ft)
Rudders (total)	1.85 m² (19.94 sq ft)
Tailplanes (total)	10.34 m² (111.36 sq ft)

WEIGHTS AND LOADINGS (F100-PW-220 engines):

Operating weight empty (no fuel, ammunition, pylons or external stores)	14,515 kg (32,000 lb)
Max weapon load	11,113 kg (24,500 lb)
Max fuel weight: internal (JP4)	5,952 kg (13,123 lb)
CFTs (two, total)	4,265 kg (9,402 lb)
external tanks (three, total)	5,396 kg (11,895 lb)
max internal and external	15,613 kg (34,420 lb)
Max T-O weight	36,741 kg (81,000 lb)
Max zero-fuel weight	28,440 kg (62,700 lb)
Max landing weight: unrestricted	20,094 kg (44,300 lb)
at reduced sink rates	36,741 kg (81,000 lb)
Max wing loading	650.5 kg/m² (133.2 lb/sq ft)
Max power loading	176.13 kg/kN (1.73 lb/lb st)

PERFORMANCE:

Max level speed at height	Mach 2.5
Max combat radius	685 n miles (1,270 km, 790 miles)
Max range	2,400 n miles (4,445 km, 2,762 miles)

UPDATED

MCDONNELL DOUGLAS F-15S/MTD

TYPE: One-off F-15 STOL/manoeuvring technology demonstrator for USAF.

PROGRAMME: Ordered October 1984, first prototype F-15B (71-0290) modified, first flight 7 September 1988; first flight with two-dimensional vectoring nozzles 10 May 1989; reverse thrust applied in flight 22 March 1990; demonstrated deceleration from Mach 1.6 to Mach 0.7. From May 1991 participated in USAF/MDC integrated controls and avionics for air superiority (ICAAS) programme. Completed assigned programme 12 August 1991 (138th sortie) by demonstrating autonomous night landing capability. Stored for 22 months, reflown June 1993 at St Louis to NASA/Dryden for baseline performance assessment with conventional nozzles, fitted in November 1993 with F100-PW-229 engines for further calibration until April 1994; then fitted with pitch and yaw vectoring nozzles designed by Pratt & Whitney for ACTIVE (Advanced Control Technology for Integrated VEhicles) flight test programme, beginning September 1994; intention is to prove effectiveness of vectoring nozzles sufficiently to reduce area of both F-15's vertical fins by 50 per cent. Additional data in 1991-92 *Jane's*.

VERIFIED

MCDONNELL DOUGLAS F/A-18 HORNET

US Navy/Marine Corps designations: F/A-18A, B, C, D
Royal Australian Air Force designations: AF-18A and ATF-18A
Canadian Forces designations: CF-188A/B
Spanish Air Force designations: C.15 and CE.15

TYPE: Carrierborne and land-based attack/fighter.

PROGRAMME: US Navy study of VFAX low cost, lightweight multimission fighter accepted Spring 1974. VFAX study terminated August 1974 and replaced by derivative of either General Dynamics YF-16 or Northrop YF-17 lightweight fighter prototypes. McDonnell Douglas proposed F-17 derivative with Northrop as associate, resultant Navy Air Combat Fighter called Hornet accepted in two versions, F-18 fighter and A-18 attack aircraft; single F/A-18 selected to fill both roles. McDonnell Douglas prime contractor and Northrop principal subcontractor for all versions agreed 1985; first Hornet flight (160775) 18 November 1978, 11 development aircraft flying by March 1980; delivery of F/A-18A/B (TF-18A designation dropped) to US Navy and Marines began May 1980 and completed 1987, millionth flying hour achieved 10 April 1990 two millionth on 17 September 1993.

Enhancements to Hughes AN/APG-65 radar funded ($65.7 million) May 1990, new signal and data processors, upgraded receiver/exciter. Resultant AN/APG-73 received $257 million funding in June 1991 for initial production of 12 in FY92, first flight in trials Hornet at St Louis on 15 April 1992, installed in production F/A-18s from 1994 (first two F/A-18Cs with this radar delivered to VFA-146 and 147 at NAS Lemoore, California, on 25 and 26 May 1994).

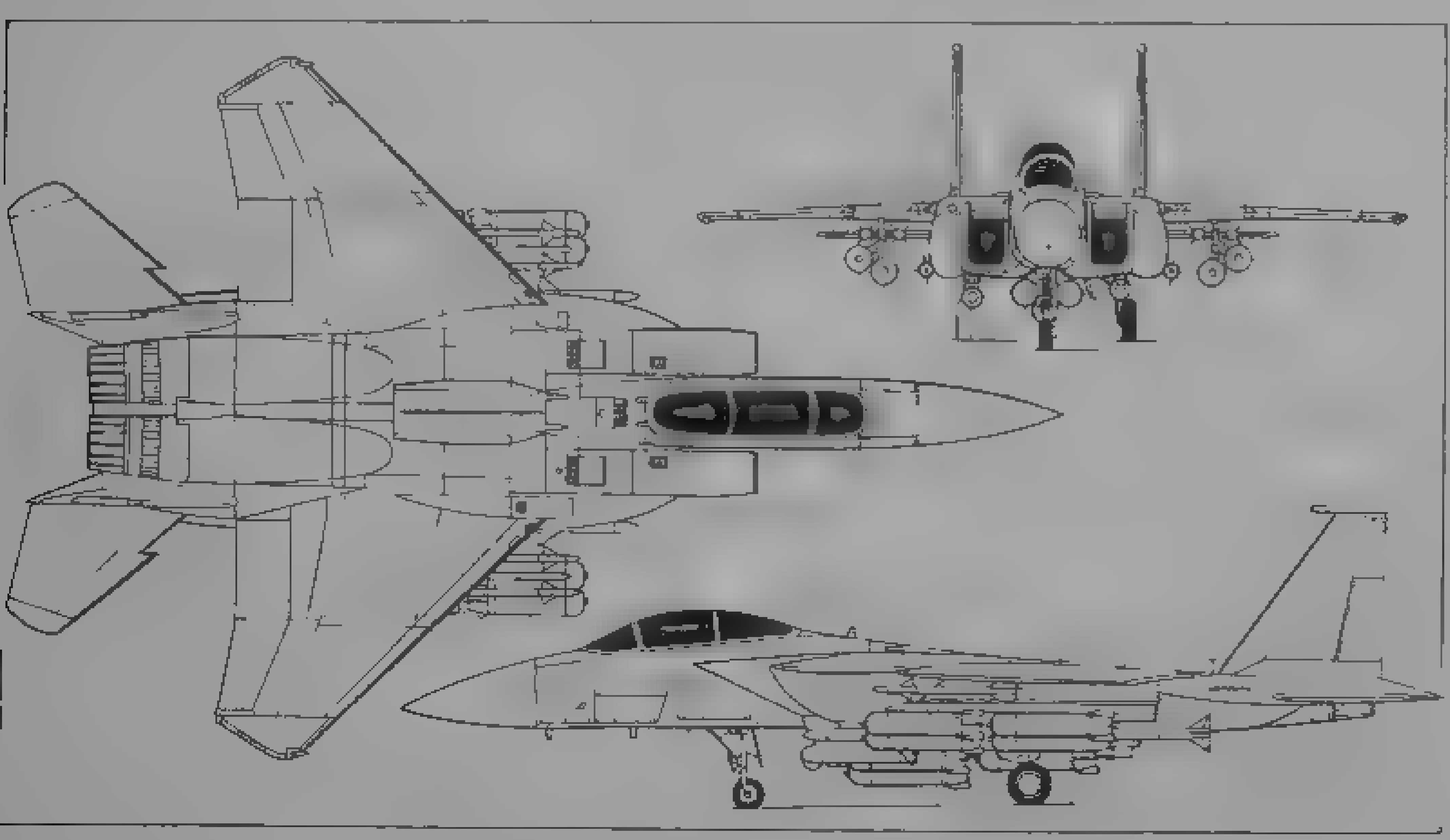
CURRENT VERSIONS: **F/A-18A**: Single-seater. Total of 371 F/A-18As and 39 two-seat F/A-18Bs (plus 11 prototypes, including two tandem-seat trainers) for USN and USMC as escort fighters to replace F-4s and as attack aircraft replacing A-7s under FY79 to FY85 contracts, first training squadron (VFA-125) formed at NAS Lemoore, California, November 1980; in service 7 January 1983 with Marine Fighter/Attack Squadron VMFA-314 at MCAS El Toro, California, first Navy squadron, VFA-113 of Pacific Fleet, October 1983, first Atlantic Fleet squadrons formed NAS Cecil Field, Florida, 1 February 1985, same month VFA-113 and VFA-25 embarked in USS *Constellation*.

US Navy and Marines squadrons with F/A-18A/Bs are tabulated. Electronic warfare training F/A-18A/Bs used AN/ALQ-167 jamming, AN/ALE-4 chaff and AN/AST-4/6 threat simulator pods. 'Aggressor' training aircraft of VFA-127 wear desert camouflage and Cuban/Iraqi/Libyan insignia. First combat experience by VFA-131, 132, VMFA-314 and 323 from USS *Coral Sea* attacking Libyan targets 1986.

F/A-18B: Combat capable two-seater, originally designated TF-18A, internal fuel capacity reduced by 6 per cent, production figures and US operating squadrons, see table and F/A-18A.

F/A-18C and F/A-18D: Single- and two-seat versions respectively. Purchased from FY86 onwards, 137 F/A-18Cs and 31 F/A-18Ds bought under FY86 and FY87 procurements are baseline non-night attack models; overall total of 558 F/A-18C/Ds (including Night Attack – see below) funded between FY86 and FY94 (batches of 84, 84, 84, 84, 66, 48, 36, 36 and 36), further 24 in FY95 and 12 in FY96 for completion of first-generation Hornet production, first flight of production F/A-18C (163427) 3 September 1987. *Main description applies to F/A-18C except where indicated.*

Modifications include provision for up to six AIM-120 AMRAAM missiles (two on fuselage and two on each outboard pylon), up to four imaging IR Maverick missiles (one on each wing pylon), provision for reconnaissance equipment, upgraded stores management set with 128 kbits memory, Intel 8086 processor, MIL-STD-1553B armament multiplex bus with MIL-STD-1760 weapons interface capability, flight incident recorder and monitoring set (FIRAMS) with integrated fuel/engine indicator, data storage set for recording maintenance and flight incidents data, signal data processor interfacing with fuel system to provide overall system control, enhanced built-in test capability and automatic CG adjustment as fuel is consumed, maintenance status panel isolating faults to card level; and new faster XN-6 mission computer with twice memory of previous XN-5, upgraded to XN-8 from FY91. Small rectangular fence retrofitted to US Navy aircraft above LEX strake just ahead of wing leading-edge broadens LEX vortexes, reduces fatigue and improves directional control at angles of attack higher than 45°. AIM-120A AMRAAM cleared for use by Hornet from September 1993, initially on aircraft of VFA-22, VFA-94 and VMFA-314 in Arabian Gulf.



McDonnell Douglas F-15E Eagle equipped for high ordnance payload air-to-ground mission *(Jane's/Dennis Punnett)*

1987

F/A-18D Night Attack Hornet of Marine Corps squadron VMFA(AW)-242 'Batmen' firing rockets
1994

F/A-18C/D Night Attack. First flight of prototype 6 May 1988, one Night Attack F/A-18C (163985) and one D (163986) delivered to Naval Air Test Center, Patuxent River, on 1 and 14 November 1989 respectively, all F/A-18Cs and Ds delivered subsequently (FY88 procurement) have all-weather night attack avionics. Hughes AN/APG-73 radar (first F/A-18 flight test 15 April 1992) standard from May 1994, initially on aircraft of VFA-146 and VFA-147. US Navy squadrons equipped with F/A-18C Night Attack, US Marine Corps 'VMFA-' squadrons also F/A 18C Night Attack, Marines 'VMFA(AW)-' squadrons with F/A-18D Night Attack, deliveries of night capable C versions to VMFA-312 began 5 August 1991, night-capable Ds to VMFA(AW)-121 from April 1990; third Night D squadron, VMFA(AW)-225, equipped from 1 July 1991, but later to adopt reconnaissance role. Marine Corps has replaced six squadrons of Grumman A-6Es, McDonnell Douglas OA-4s and RF-4Bs in attack, reconnaissance and forward air controller roles, with 96 Hornets, of which first 48 authorised in 1990; remainder in F/A 18D (RC) configuration (see below). Navy squadrons unchanged with two-seaters used as trainers only. 1,000th Hornet was F/A-18D 164237, delivered to VMFA (AW)-242 on 22 April 1991. USN/USMC operating squadron status in table.

Night Attack system includes GEC Cat's Eyes pilot's night vision goggles, Hughes AN/AAR-50 thermal imaging navigation set (TINS) presenting forward view in Kaiser AN/AVQ-28 raster HUD, colour multifunction displays and Smiths colour digital moving map, external sensor pods comprise Loral AN/AAS-38 NITE Hawk targeting FLIR and TINS. NITE Hawk added laser target designator/ranger subsystem from January 1993, initially for squadrons VFA 146 and -147, operating in Arabian Gulf. USMC version of F/A-18D has mission-capable rear cockpit with no control column, but two sidestick weapons controllers and two Kaiser 12.7 cm (5 in) colour MFDs in addition to Smiths Srs 2100 colour map display, may be converted to dual control, with stick and throttles, for pilot training.

F/A-18D(RC). Simple reconnaissance version, launched 1982 and first flown 1984, included a twin-sensor package replacing gun in nose; was to be fitted with Martin Marietta Advanced Tactical Airborne Reconnaissance System (ATARS) centreline pod, first sensor-capable aircraft delivered to El Toro, February 1992, ATARS development cancelled June 1993. As replacement, 31 F/A-18Ds of Marine Corps to receive partial ATARS fit, comprising electro-optical overflight sensors, long-range optical sensor and modified version of Hughes AN/APG-73 radar capable of producing high-resolution strip maps.

F/A-18E/F. Described separately.

AF-18A and ATF-18A. Royal Australian Air Force versions, decision to purchase 75 announced 20 October 1981, deliveries started 17 May 1985; first flight of ATF 18A assembled by AeroSpace Technologies of Australia (ASTA), 26 February 1985, first flight of Australian manufactured aircraft (ATF 18A, A21-104) 3 June 1985, last of 57 single-seat and 18 two-seat Hornets delivered 16 May 1990; Hornet replaced Dassault Mirage IIIO; units are No. 2 OCU, Williamtown, No. 3 Squadron (formed August 1986) and No. 77 Squadron at same base, and No. 75 Squadron, Tindal. Weapons include AIM-7M, AIM 9M, AGM 88 HARM, AGM-84 Harpoon, GBU-10/GBU-12/Paveway II LGBs, Mk 82 bombs and 70 mm rockets. From 1990, remaining 74 aircraft being fitted with F/A-18C/D type avionics and (from 1991) provision for Loral AN/AAS 38 IR tracking and laser designating pod.

CF-18A and B. Canada's purchase of 138 Hornets (finalised as 98 CF-18As and 40 two-seat CF-18Bs, known respectively as **CF-188A** and **CF-188B**) announced 10 April 1980; first flight of CF 18 29 July 1982; deliveries between 25 October 1982 and September 1988; CF units were No. 410 OCU and Nos. 416 and 441 Squadrons at CFB Cold Lake, Alberta, 425 and 433 at Bagotville, Quebec, and 439 and 421 Squadrons of No. 4 Fighter Wing/No. 1 Air Division at Baden Sollingen, Germany; last aircraft left Europe 26 January 1993. Currently active with Nos. 425 and 433 Squadrons at Bagotville and Nos. 411 (OCU), 416 and 441 at Cold Lake; defence reductions expected to reduce this to four, with up to a quarter of CF-18 fleet being placed in store. Differences from US Navy F/A-18A/B include ILS, in-flight identification spotlight in port side of fuselage, and provision for LAU-5003 19-tube pods for CRV 7 70 mm (2.75 in) high-velocity submunition rockets; other weapons are AIM 7M and AIM 9L air-to-air missiles, 500 lb Mk 82 bombs and Hunting BL755 CBUs. Pilot has comprehensive cold weather land survival kit. Upgrade planned for late 1990s.

EF-18A and B. Spanish versions, purchase of 60 single-seat Hornets and 12 two-seaters, known respectively as **C 15** and **CE 15**, under Futuro Avion de Combate y Ataque programme announced 30 May 1983; financial restrictions reduced number from 84 and deliveries then stretched from 36, 24 and 12 during 1986 to 1988 to 1., 26, 15, 12 and eight during 1986 to 1990; maintenance performed in Spain by CASA, which also works on USN Hornets with 6th Fleet in Mediterranean. First flight Spanish Hornet 4 December 1985, deliveries began 10 July 1986, all 12 trainers delivered by early 1987; armament includes AIM-7F and AIM-9L air-to-air missiles, AGM 84 Harpoon, AGM-88 HARM and free-fall bombs; AIM-120 AMRAAM ordered 1990. First 36 aircraft have Sanders AN/ALQ-126B deception jammers ordered in 1987, final 36 received Northrop Grumman AN/ALQ-162(V) systems.

Units equipped are Ala de Caza 15 (15th Fighter Wing) formed at Zaragoza December 1985 and operational December 1987, with 30 A and six B shared between Escuadrones 151 and 152, Ala de Caza 12 at Torrejon (Escuadrones 121 and 122) completed re-equipping in July 1990. One attrition replacement required. Agreement in 1992 to upgrade Spanish aircraft to **F-18A+/B+** standard close to F/A-18C/D, of 71 available, 46 to be converted by McDonnell Douglas between September 1992 and March 1994, final 25 by CASA by 1995. Engineering Change

HORNET PRODUCTION

FY	Block	US Navy/Marines F/A-18A/C	US Navy/Marines F/A-18B/D	Canada CF-18A	Canada CF-18B	Australia AF-18A	Australia AF-18B	Spain EF-18A	Spain EF-18B	Kuwait KAF-18C	Kuwait KAF-18D	Cum Total
76	1	3										3
	2	3	1									7
	3	3	1									1
79	4	7	2									20
80	5	3	4									27
	6	8	1									36
	7	9										45
81	8	11	4		4							64
	9	17	4	1	5							91
	10	22	3	5	3							124
82	11	17	3	7								151
	12	23	1	8	2							185
	13	19		6	1							2 .
83	14	18	3	7	1	3	7					250
	15	29	2	6	2	4						293
	16	32		7	1	4						337
84	17	24	3	7	2	7			2			382
	18	25	4	7	1		5	1	2			427
	19	27	1	7	1	3	2		4			472
85	20	24	3	6	2	6		3	1			5 7
	21	26	1	8		5		5	3			565
	22	30		8		4	2	9				6 8
86	23	23[1]	8[2]	8		4	2	9				672
	24	21	8		9	4		6				720
	25	17	7		6	5		2				757
87	26	25	3			4		5				794
	27	26	2			3		5				830
	28	25	3			1		7				866
88	29	20[3]	10[4]					2				898
	30	16	10					4				928
	31	18	10					2				958
89	32	17	7									982
	33	23	7									1,012
	34	24	6									1,042
90	35	22								5	3	1,072
	36	11	10							3	3	1,099
	37	13	10							2	2	1,126
91	38	12	4							8		1,150
	39	12	4							8		1,174
	40	12	4							6		1,196
92	41-43	24	12									1,232
Sub-totals		**741[5]**	**166[6]**	**98**	**40**	**57**	**18**	**60**	**12**	**32**	**8**	
93		36										1,268
94		36										1,304
95		24										1,328
96		12										1,340
Sub-totals		**1,015**		**138**		**75**		**72**		**40**		
Finland (64)												1,404
Switzerland (34)												1,438
Malaysia (8)												1,446
Total		**1,015**		**138**		**75**		**72**		**40**		**1,446**

Notes: Begins F/A-18C production
[2]Begins F/A 18D production
Begins F/A 18C Night Attack production
[4]Begins F/A 18D Night Attack production
[5]Nine prototypes, 371 As, 137 Cs and 224 C Nights
[6]Two prototypes, 39 Bs, 31 Ds and 94 D Nights

Proposal 287 includes later mission and armament computers, databuses, data-storage set, new wiring, pylon modifications and software

Spain decided in January 1995 to obtain 24 former USN F/A-18A Hornets, with six more on option. Aircraft will be subjected to update before delivery and will have late standard F404 engines plus other Spanish-specified modifications

CUSTOMERS: See table of production. Total 1,263 Hornets delivered by 21 April 1994, of which 938 to US forces, USN proposed procurement of 1,156 production Hornets first generation models total 1,015 including prototypes, with follow-on F/A-18E/F versions set to raise procurement to in excess of 2,000 for USN/MC by year 2015

In addition to US Navy/Marine Corps, Australia, Canada and Spain (see Current Versions), Switzerland selected 26 F/A-18Cs and eight F/A-18Ds powered by GE F404-GE-402 engines and with AN/APG-73 radar and night vision systems in October 1988, as its Neue Jagdflugzeug to replace front line F-5Es, purchase ratified by parliament 12 June 1992, confirmed by referendum 6 June 1993, deliveries planned from February 1996, with NITE Hawk FLIR pods

Kuwait contract signed September 1988 for 32 F/A-18Cs and eight F/A-18Ds together with AGM-65G Maverick, AGM-84 Harpoon, AIM-7F Sparrow and AIM-9L Sidewinder, first flight 19 September 1991, first three delivered to No. 25 Squadron 25 January 1992, 20 more before year end, final delivery to No. 9 Squadron 23 August 1993, but additional small purchases planned F404-GE-402 power plants

Finland selected seven F/A-18Ds (built by McAir) and 57 F/A-18Cs (for assembly from kits by Valmet), announcement 6 May 1992; letter of offer signed 5 June 1992, 402 engines and AN/APG-73 radar; initial procurement of four aircraft in 1993 first US built aircraft (F-18D HN-461) flown 21 April 1995 prior to formal roll-out on 7 June 1995; initial four F-18Ds for delivery in November 1995 Valmet production begins September 1995 for first delivery 12 months later

Malaysia confirmed order for eight USMC-standard F/A-18Ds (AN/APG-73 radar and -402 engines) 29 June 1993, FMS contract placed with manufacturer 7 April 1994, four to be delivered in January 1997, remainder four months later Malaysia later requested price/availability data for additional 10 or 16 F/A-18Ds for delivery in 1997-98, decision expected by Summer 1995. Singapore also interested began Hornet evaluation at NWC China Lake, 7 February 1994, eventually purchased more F-16s

Canadian No 441 Squadron CF-18A 188781 wearing 'Invasion Stripes' for 50th anniversary of D-Day *(Paul Jackson)*

1995

US HORNET OPERATING SQUADRONS

Unit	Base	Version	Remarks
Regular Navy			
VFA-15	Cecil Field	C Night	
VFA-22	Lemoore	C Night	
VFA-25	Lemoore	C Night	
VFA-27	Lemoore	A	
VFA-37	Cecil Field	C Night	
VF-45	Key West	A	Aggressor
VFA-81	Cecil Field	C	
VFA-82	Cecil Field	C	
VFA-83	Cecil Field	C	
VFA-86	Cecil Field	C	
VFA-87	Cecil Field	C Night	
VFA-94	Lemoore	C Night	
VFA-97	Lemoore	A	
VFA-105	Cecil Field	C Night	
VFA-106	Cecil Field	A, B, C Night, D Night	Training
VFA-113	Lemoore	C Night	
VFA-125	Lemoore	A, C, D Night	Training
VFA-127	Fallon	A, B	Aggressor
VFA-131	Cecil Field	C Night	
VFA-136	Cecil Field	C Night	
VFA-137	Lemoore	C Night	
VFA-146	Lemoore	C Night	
VFA-147	Lemoore	C Night	
VFA-151	Lemoore	C Night	
VFA-192	Atsugi, Japan	C	
VFA-195	Atsugi, Japan	C	
VX-9	Point Mugu/China Lake	A, C, D, D Night	
Blue Angels	Pensacola	A, B	
NAWC (AD)	Patuxent River	A, B, C, D	
NAWC (WD)	Point Mugu	A, B, C	
NAWC (WD)	China Lake	A, C, D	
NSWC	Fallon	A, B	
Marine Corps			
VMFAT-101	El Toro	A, B, C, D, D Night	Training
VMFA-115	Beaufort	A	
VMFA(AW)-121	Miramar	D Night	
VMFA-122	Beaufort	A	
VMFA-212	El Toro	C	
VMFA(AW)-224	Beaufort	D Night	
VMFA(AW)-225	El Toro	D Night	
VMFA-232	El Toro	C	
VMFA-235	El Toro	C	
VMFA(AW)-242	El Toro	D Night	
VMFA-251	Beaufort	C Night	
VMFA-312	Beaufort	C Night	
VMFA-314	El Toro	A	
VMFA-323	El Toro	C Night	
VMFA(AW)-332	Beaufort	D Night	
VMFA-451	Beaufort	A	
VMFA(AW)-533	Beaufort	D Night	
Naval Reserve			
VFC-12	Oceana	A, B	Aggressor
VFC-13	Miramar	A, B	Aggressor
VFA-203	Cecil Field	A	
VFA-204	New Orleans	A	
Marine Corps Reserve			
VMFA-112	Dallas	A, B	
VMFA-134	Miramar	A	
VMFA-142	Cecil Field	A	
VMFA-321	Washington	A, B	

Disbanded units are VFA-132 on 1 June 1992; VFA-303 and VFA-305 both October 1994; VMFA-333 and VMFA-531 both 31 March 1992; VAQ-34 on 1 October 1993, VX-4 and VX-5 both September 1994 (replaced by VX-9). All F/A-18A operators, except VX-4 and VX-5 which used several versions. VF-21 and VA-115 to convert from F-14 and A-6 respectively and will be redesignated as VFA-21/115 following transition to F/A-18. USMC squadrons at El Toro to relocate to Miramar

COSTS: $25 million, flyaway unit cost, 1991. $55.632 million (1991) US programme, 1,167 aircraft

DESIGN FEATURES: Sharp-edged, cambered leading-edge extensions (LEX), slots at fuselage junction and outward canted twin fins are designed to produce high agility and docile performance at angles of attack over 50°, wings have 20° sweepback at quarter-chord and fold up 90° at inboard end of ailerons, even on land-based F/A-18s, landing gear designed for unflared landings on runways as well as on carriers

FLYING CONTROLS: Full digital fly-by-wire controls using ailerons and tailerons for lateral control, plus flaps in flaperon form at low airspeeds, leading- and trailing-edge flaps scheduled automatically for high manoeuvrability, fast cruise and slow approach speed, both rudders turned in at take-off and landing to provide extra nose-up [illegible] fly-by-wire returns towards 1 g flight if pilot releases controls, lateral and then directional control progressively washed out as angle of attack reaches extreme values height, heading and airspeed holds provided in fly-by-wire system, US Navy aircraft can land automatically using carrier-based guidance system, airbrake panel located on top of fuselage, between fins. Bertea hydraulic actuators for trailing-edge flaps, Hydraulic Research actuators for ailerons, National Water Lift actuators for tailerons

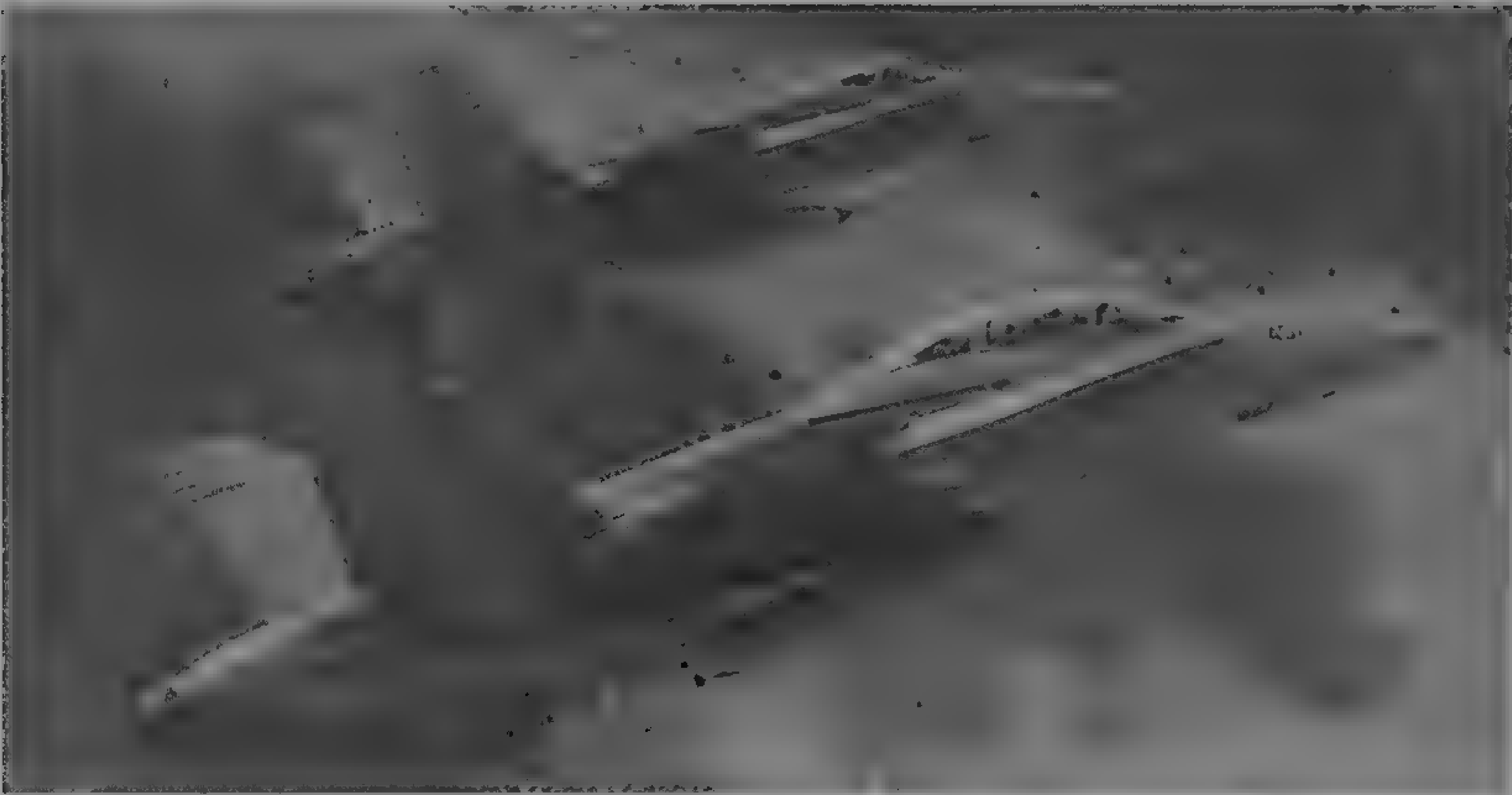
STRUCTURE: Multispar wing mainly of light alloy, with graphite/epoxy inter-spar skin panels and trailing-edge flaps, tail surfaces mainly graphite/epoxy skins over aluminium honeycomb core, graphite/epoxy fuselage panels and doors, titanium engine firewall. Northrop Grumman produces rear and centre fuselages: assembly and test at McDonnell Douglas St Louis factory; CASA produces horizontal tail surfaces, flaps, leading-edge extensions, speedbrakes, rudders and rear side panels for all F/A-18s

LANDING GEAR: Dowty retractable tricycle type, with twin-wheel nose and single-wheel main units. Nose unit retracts forward, mainwheels rearward, turning 90° to stow horizontally inside the lower surface of the engine air ducts Bendix wheels and brakes. Nosewheel tyres size 22 × 6.6-10, 20 ply pressure 24.13 bars (350 lb/sq in) for carrier operations, 10.34 bars (150 lb/sq in) for land operations Mainwheel tyres size 30 × 11.5-14.5, 24 ply, pressure 24.13 bars (350 lb/sq in) for carrier operations, 13.79 bars (200 lb/sq in) for land operations. Ozone nosewheel steering unit. Nose unit towbar for catapult launch. Arrester hook, for carrier landings, under rear fuselage

POWER PLANT: Two General Electric F404-GE-400 low bypass turbofans initially, each producing approximately 71.2 kN (16,000 lb st) with afterburning F404-GE-402 EPE (Enhanced Performance Engine) standard from early 1992, rated at approximately 78.3 kN (17,600 lb st). Self-sealing fuel tanks and fuel lines, foam in wing tanks and fuselage voids. Internal fuel capacity (JP5) approximately 6,061 litres (1,600 US gallons, 1,333 Imp gallons). Provision for up to three 1,250 litre (330 US gallon, 275 Imp gallon) external tanks. Canadian Hornets carry three 1,818 litre (480 US gallon, 400 Imp gallon) tanks. Flight refuelling probe retracts into upper starboard side of nose. Simmonds fuel gauging system. Fixed ramp air intakes

ACCOMMODATION: Pilot only, on Martin-Baker SJU-5/6 zero/zero ejection seat, in pressurised, heated and air conditioned cockpit. Upward opening canopy, with separate windscreen, on all versions. Two pilots in F/A-18B and USN F/A-18D; pilot and Naval Flight Officer in USMC F/A-18D

SYSTEMS: Two completely separate hydraulic systems, each at 207 bars (3,000 lb/sq in). Maximum flow rate 212 litres (56 US gallons, 46.6 Imp gallons)/min. Bootstrap type



Unusual formation of McDonnell Douglas F/A-18D (foreground) and F/A-18C both belonging to Marine Corps squadron VMFA(AW) 533, normally equipped only with the 'D' version

1995

reservoir, pressure 5.86 bars (85 lb/sq in). AiResearch air conditioning system. General Electric electrical power system. AlliedSignal GTC36-200 APU for engine starting and ground pneumatic, electric and hydraulic power. Oxygen system. Fire detection and extinguishing systems.

AVIONICS: *Comms*: AN/ARC-182 UHF/VHF. Conrac communications system control. Hazeltine AN/APX-111 IFF for Kuwait.

Radar: Hughes Aircraft AN/APG-65 multimode digital air-to-air and air-to-ground tracking radar, with air-to-air modes which include velocity search (VS), range while search (RWS), track while scan (TWS - track 10 targets and display eight to pilot) and raid assessment mode (RAM). Improved Hughes Aircraft AN/APG-73 replaced AN/APG-65 in F/A-18C/D for USN, USMC, Finland, Malaysia and Switzerland from May 1994.

Flight: Automatic carrier landing system (ACLS) for all-weather carrier operations; Collins AN/ARN-118 Tacan, DF-301E UHF/DF, Eaton AN/ARA-63 receiver/decoder, JET ID-1791/A flight director indicator, AlliedSignal HSI, General Electric quadruple redundant fly-by-wire flight control system, with direct electrical back-up to all surfaces and direct mechanical back-up to tailerons, Litton AN/ASN-130A inertial navigation system (plus GPS from FY93), being replaced by Litton AN/ASN-139 ring laser system (including retrofits), Normalair-Garrett digital data recorder for AlliedSignal maintenance recording system; flight incident recording and monitoring system (FIRAMS), Smiths standby altimeter, Kearflex standby airspeed indicator, standby vertical speed indicator, cockpit pressure altimeter. Night Attack F/A-18 has Hughes AN/AAR-50 thermal imaging navigation set (TINS).

Instrumentation: Smiths Industries multipurpose colour map display, two Kaiser monochrome MFDs (colour on Night Attack Hornets), central GEC-Marconi-AlliedSignal CRT, Kaiser AN/AVQ-28 HUD, GEC-Marconi FID 2035 horizontal situation display, plus provision for GEC-Marconi Cat's Eyes NVGs.

Mission: Two Control Data Corporation AN/AYK-14 digital computers, GEC-Marconi Type 117 laser designator, Harris AN/ASW-25 radio datalink and Loral AN/AAS-38 NITE Hawk targeting FLIR.

Self-defence: Magnavox AN/ALR-50 RWR, Litton AN/ALR-67 RWR, Goodyear AN/ALE-39 chaff dispenser (AN/ALE-47 from FY93 including exports to Finland, Malaysia and Switzerland), Sanders AN/ALQ-126B deception jammers (additionally, Northrop Grumman AN/ALQ-162(V) CW jammers in Canadian and later Spanish aircraft), ITT/Westinghouse AN/ALQ-165 jammer selected by Finland and Switzerland.

ARMAMENT: Nine external weapon stations, comprising two wingtip stations for AIM-9 Sidewinder air-to-air missiles; two outboard wing stations for an assortment of air-to-air or air-to-ground weapons, including AIM-7 Sparrows, AIM-9 Sidewinders, AIM-120 AMRAAMs (launch trials by VX-4 in 1992, cleared for squadron use mid-1993), AGM-84 Harpoons and AGM-65F Maverick missiles; two inboard wing stations for external fuel tanks, air-to-ground weapons or Brunswick ADM-141 TALD tactical air-launched decoys; two nacelle fuselage stations for Sparrows or Lockheed Martin AN/ASQ-173 laser spot tracker/strike camera (LST/SCAM) or AN/AAS-38 and AN/AAR-50 sensor pods (see Avionics); and a centreline fuselage station for external fuel or weapons. Air-to-ground weapons include GBU-10 and -12 laser-guided bombs, Mk 82 and Mk 84 general purpose bombs, and CBU-59 cluster bombs. An M61A1 20 mm six-barrel gun with 570 rounds, is mounted in the nose and has a McDonnell Douglas director gunsight, with a conventional sight as back-up.

DIMENSIONS, EXTERNAL:

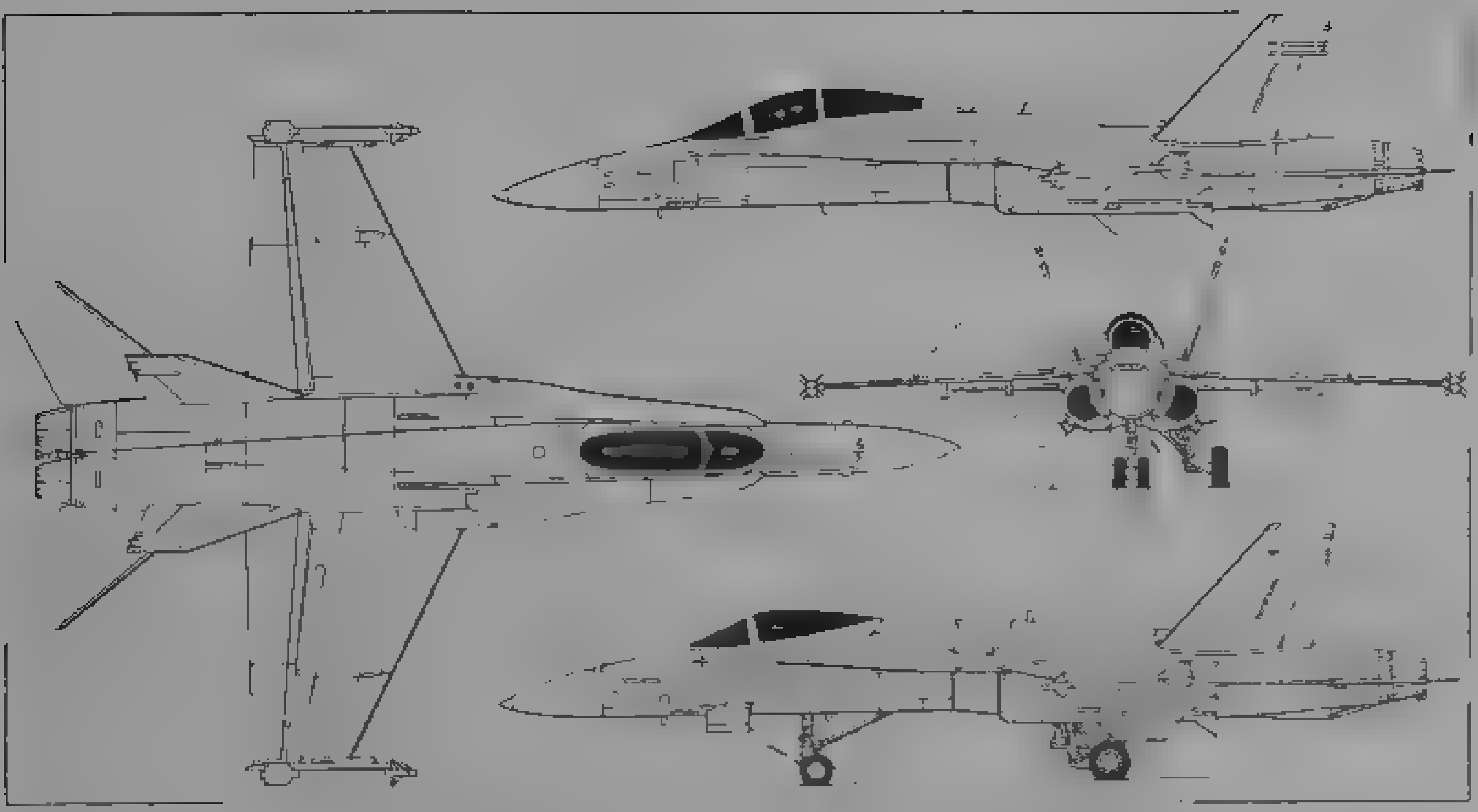
Wing span	11.43 m (37 ft 6 in)
Wing span over missiles	12.31 m (40 ft 4¾ in)
Wing chord: at root	4.04 m (13 ft 3 in)
at tip	1.68 m (5 ft 6 in)
Wing aspect ratio	3.52
Width, wings folded	8.38 m (27 ft 6 in)
Length overall	17.07 m (56 ft 0 in)
Height overall	4.66 m (15 ft 3½ in)
Tailplane span	6.58 m (21 ft 7¼ in)
Distance between fin tips	3.60 m (11 ft 9½ in)
Wheel track	[illegible]
Wheelbase	[illegible]

AREAS:

Wings, gross	37.16 m² (400.0 sq ft)
Ailerons (total)	2.27 m² (24.4 sq ft)
Leading-edge flaps (total)	4.50 m² (48.4 sq ft)
Trailing-edge flaps (total)	5.75 m² (61.9 sq ft)
Fins (total)	9.68 m² (104.2 sq ft)
Rudders (total)	1.45 m² (15.6 sq ft)
Tailerons (total)	8.18 m² (88.1 sq ft)

Hughes AN/APG-73 radar in the nose of an F/A-18C

1994



McDonnell Douglas F/A-18C Hornet with additional side view (top) of F/A-18D (*Jane's/Dennis Punnett*) *1991*

WEIGHTS AND LOADINGS:

Weight empty	10,810 kg (23,832 lb)
Max fuel weight: internal (JP5)	4,926 kg (10,860 lb)
external: F/A-18 (JP5)	3,053 kg (6,732 lb)
CF-18 (JP4)	4,246 kg (9,360 lb)
Max external stores load	7,031 kg (15,500 lb)
T-O weight: fighter mission	16,651 kg (36,710 lb)
attack mission	23,541 kg (51,900 lb)
max	approx 25,401 kg (56,000 lb)
Max wing loading (attack mission)	600.83 kg/m² (123.06 lb/sq ft)
Max power loading (attack mission)	156.80 kg/kN (1.54 lb/lb st)

PERFORMANCE:

Max level speed	more than Mach 1.8
Max speed, intermediate power	more than Mach 1.0
Approach speed	134 kts (248 km/h; 154 mph)
Acceleration from 460 kts (850 km/h; 530 mph) to 920 kts (1,705 km/h; 1,060 mph) at 10,670 m (35,000 ft)	under 2 min
Combat ceiling	approx 15,240 m (50,000 ft)
T-O run	less than 427 m (1,400 ft)
Min wind over deck: launching	35 kts (65 km/h; 40 mph)
recovery	19 kts (35 km/h; 22 mph)
Combat radius, interdiction, hi-lo-lo-hi	290 n miles (537 km; 340 miles)
Combat endurance, CAP 150 n miles (278 km; 173 miles) from aircraft carrier	1 h 45 min
Ferry range, unrefuelled	more than 1,800 n miles (3,333 km; 2,071 miles)

UPDATED

MCDONNELL DOUGLAS F/A-18E/F HORNET

TYPE: Single/two-seat carrier-based strike/attack and maritime air supremacy aircraft.

PROGRAMME: Proposed 1991 as replacement for cancelled GD/MDC A-12 and follow-on for early F/A-18As and other USN/MC tactical aircraft as they phase out; development funding approved by Congress for FY92; $4.88 billion engineering and manufacturing development contract awarded June 1992, covering seven flight test aircraft (five Es, two Fs) and three ground test articles, plus associated 7½ year test programme; $754 million award in 1992 to GE for F414 engine development.

Critical design review (CDR) undertaken 13 to 17 June 1994 at St Louis by team of independent government evaluators, successfully negotiated, with F/A-18E/F satisfying or surpassing all timescale, cost, technical, reliability and maintainability requirements.

Principal subcontractor Northrop Grumman launched assembly process of first aircraft (165164) 24 May 1994 with start of work on centre/aft fuselage section at Hawthorne, California. First forward fuselage section followed suit on new assembly line at St Louis, Missouri 23 September 1994, completed 12 January 1995, except for wiring; mating with centre/aft section from Hawthorne effected 8 May 1995. Roll-out due September 1995; first flight planned December 1995; assembly of first production article to begin 1998, service entry expected 2001.

CURRENT VERSIONS: **F/A-18E**: Single-seat.

F/A-18F: Two-seat combat-capable trainer.

F/A-18 C²W: See Addenda.

CUSTOMERS: US Navy. Seven prototypes, approval for 12 in FY97, with production rising incrementally to peak rate of 48 per annum during FY98 to FY01. Broad requirement identified for over 1,000 by FY15.

COSTS: Development estimated $4.8 billion (1992); $1,089 million in FY92 budget, $943 million in FY93; approximate $1,500 million in FY94 and $1,348 million requested for FY95. $2,200 million in provisional FY97 budget for first 12 aircraft. Navy plans 1,000 aircraft in $49,000 million programme.

DESIGN FEATURES: Stretched versions of F/A-18C/D, gross landing weight increased by 4,536 kg (10,000 lb); 0.86 m (2 ft 10 in) fuselage plug, wings photometrically increased in size to provide 9.29 m² (100.0 sq ft) extra area and 1.31 m (4 ft 3½ in) span increase; wings 2.5 cm (1 in) deeper at root, larger horizontal tail surfaces, LEX size substantially increased in early 1993 (from total 5.8 m²; 62.4 sq ft to 7.0 m²; 75.3 sq ft - compared with 5.2 m²; 56.0 sq ft on current F/A-18C/Ds), restoring F/A-18C manoeuvre capability at 30 to 35° AoA, additional 1,637 kg (3,600 lb) of internal and 1,406 kg (3,100 lb) of external fuel, 40 per cent extra range; further two (making 11) weapon hardpoints (Stations 2 and 10, inboard of wingtips, for AAMs and ASMs of up to 520 kg; 1,146 lb), additional survivability measures; air intakes redesigned and slewed to increase mass flow to more powerful F414-400 engines.

FLYING CONTROLS: As F/A-18C/D.

STRUCTURE: As F/A-18C/D.

LANDING GEAR: As F/A-18C/D.

POWER PLANT: Two General Electric F414-GE-400 turbofans, each rated at approximately 97.86 kN (22,000 lb st) with afterburning. Internal fuel capacity (JP5 fuel) 8,062 litres (2,130 US gallons; 1,774 Imp gallons). Provision for three 1,818 litre (480 US gallon; 400 Imp gallon) external tanks.

ACCOMMODATION: As F/A-18C/D.

SYSTEMS: High commonality with F/A-18C/D. Leland Electrosystems power generating system provides 60 per cent more electrical power than in F/A-18C. Hamilton Standard air conditioning, Vickers hydraulic pumps.

AVIONICS: Over 90 per cent commonality with F/A-18C, but differences include following.

Radar: Hughes AN/APG-73 multimode, digital air-to-air and air-to-ground radar as standard.

Instrumentation: Cockpit upgraded with 75 × 130 mm (3 × 5 in) touch-panel LCD upfront display and 160 mm (6¼ in) square colour LCD tactical situation display; retains two 130 mm (5 in) square monochrome displays and will have monochrome programmable LCD in place of existing F/A-18C engine/fuel display.

Self-defence: Raytheon AN/ALE-50 towed radar missile decoy stowed between jetpipes.

ARMAMENT: Full range of USN offensive and defensive ordnance. 'Bring back' load increased to 4,082 kg (9,000 lb).

DIMENSIONS, EXTERNAL (approx):

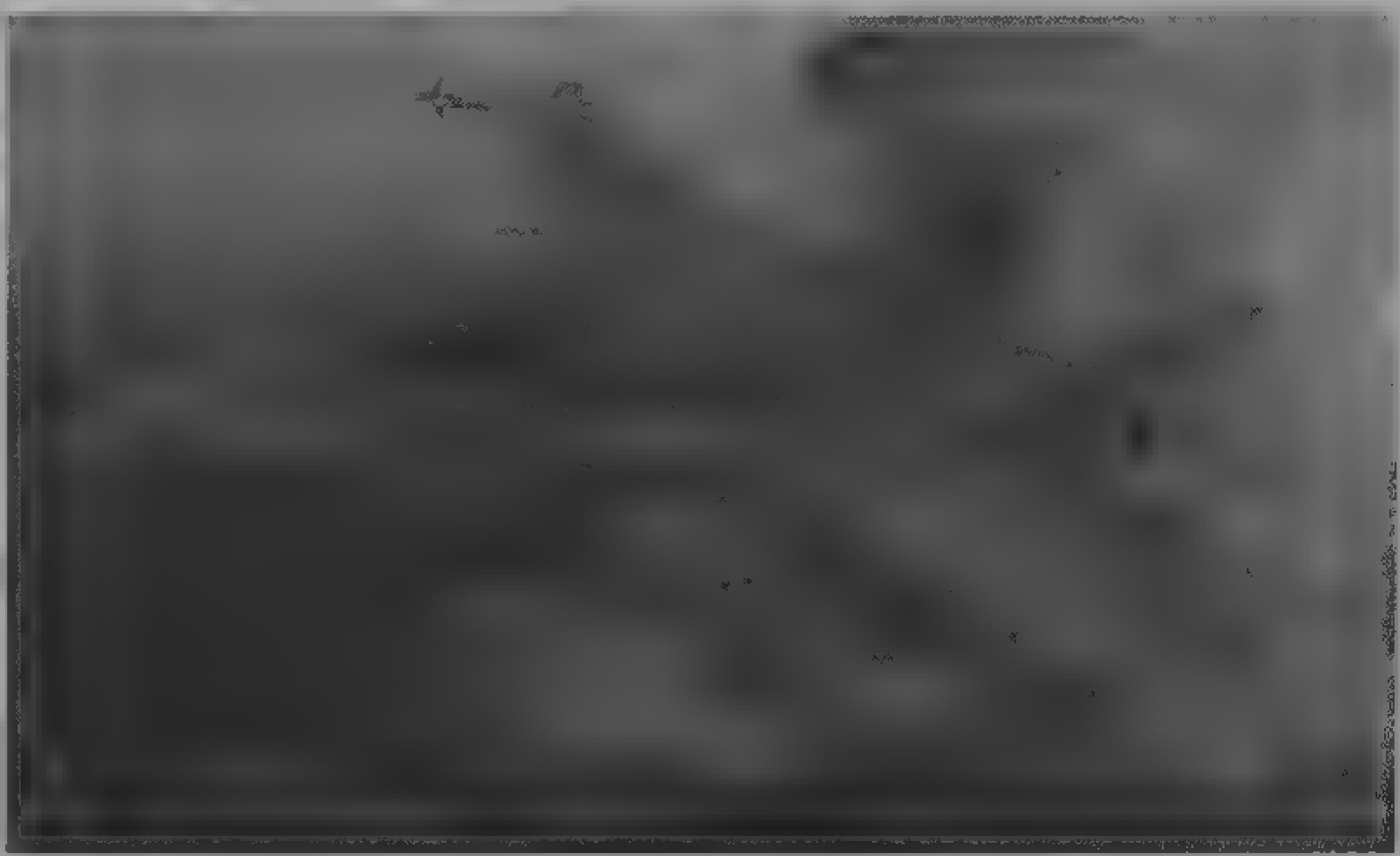
Wing span over missiles	13.62 m (44 ft 8½ in)
Wing aspect ratio	4.00
Width, wings folded	9.32 m (30 ft 7¼ in)
Length overall	18.31 m (60 ft 1¼ in)
Height overall	4.88 m (16 ft 0 in)

AREAS:

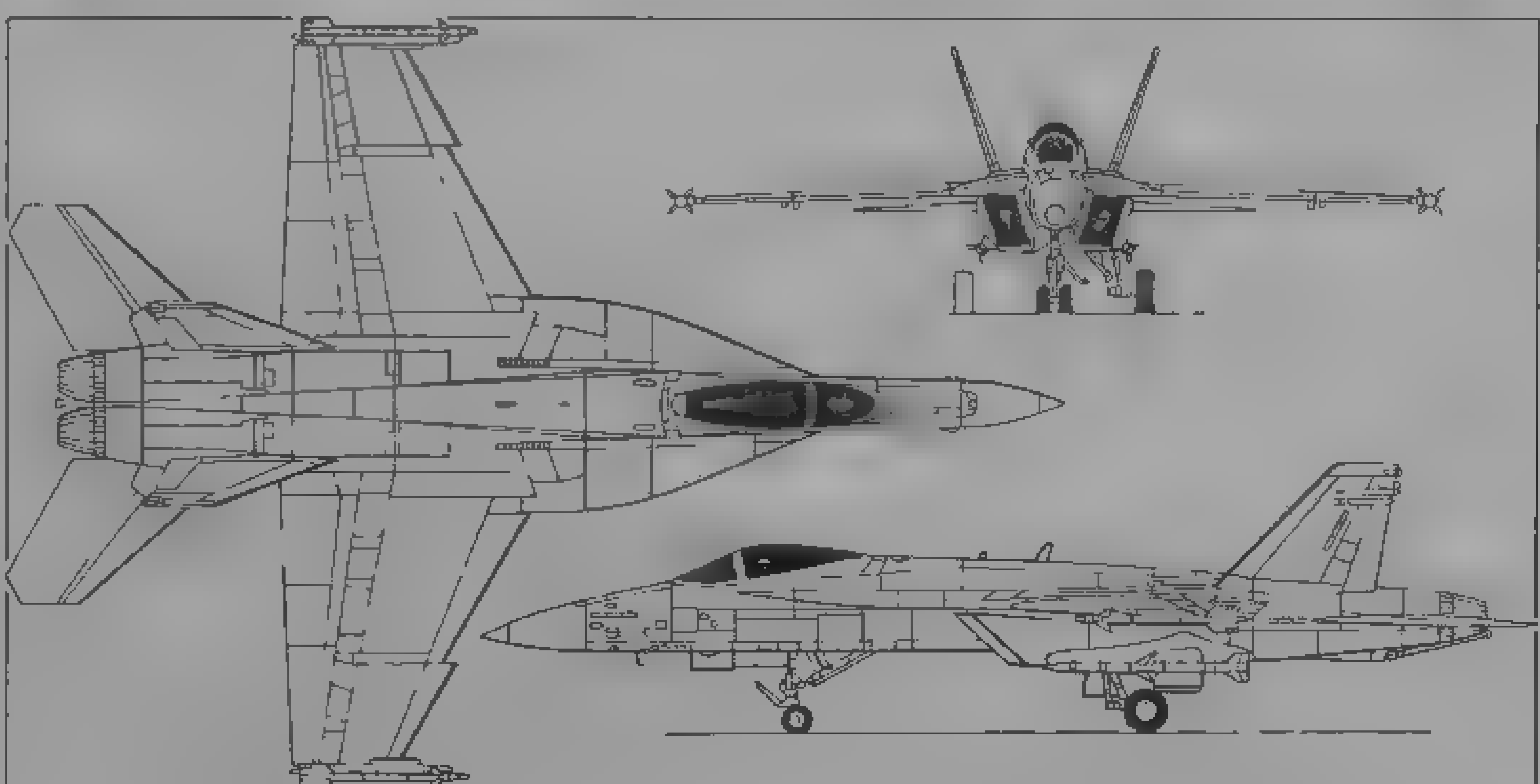
Wings, gross	46.45 m² (500.0 sq ft)

WEIGHTS AND LOADINGS:

Weight, empty: design target	13,387 kg (29,574 lb)
specification limit	13,864 kg (30,564 lb)
Max fuel weight: internal (JP5)	6,531 kg (14,400 lb)
external (JP5)	4,436 kg (9,780 lb)
Max external stores load	8,051 kg (17,750 lb)



Computer-generated image of McDonnell Douglas F/A-18E *1995*



McDonnell Douglas F/A-18E advanced version of the Hornet (*Jane's/Mike Keep*) *1992*

T-O weight, attack mission 29 937 kg (66 000 lb)
Max wing loading 620.0 kg/m² (127.0 lb/sq ft)
Max power loading 47.1 kg/kN (1.44 lb/lb st)

PERFORMANCE (estimated)
Max level speed at altitude more than Mach 1.8
Combat ceiling 15 240 m (50 000 ft)
Min wind over deck
launching 30 kts (56 km/h; 34.5 mph)
recovery 15 kts (28 km/h; 17.5 mph)
Combat radius specification, interdiction with four 1 000 lb bombs, two Sidewinders and two 1 818 litre (480 US gallon; 400 Imp gallon) external tanks, navigation FLIR and targeting FLIR
hi-lo-lo-hi 390 n miles (722 km; 449 miles)
fighter escort with two Sidewinders and two AMRAAM 410 n miles (760 km; 472 miles)
Combat endurance: maritime air superiority, six AAMs, three 1 818 litre (480 US gallon; 400 Imp gallon) external tanks, 150 n miles (278 km; 173 miles) from aircraft carrier 2 h 15 min

UPDATED

OTHER AIRCRAFT

See International section for description of **AV-8B Harrier II** and **T-45A Goshawk** programmes undertaken jointly with British Aerospace.

NEW ENTRY

MCDONNELL DOUGLAS AEROSPACE TRANSPORT AIRCRAFT (Division of McDonnell Douglas Aerospace)

VICE-PRESIDENT/GENERAL MANAGER, BUSINESS MANAGEMENT C-17: Michael Cave
PUBLIC RELATIONS: Jim Ramsey

UPDATED

MCDONNELL DOUGLAS C-17A GLOBEMASTER III

TYPE: Long-range and intra theatre heavy cargo transport.

PROGRAMME: US Air Force selected McDonnell Douglas to develop C-X cargo aircraft 28 August 1981; full-scale development called off January 1982 and replaced on 26 July 1982 by slow-paced preliminary development order; development and three prototypes (one flying) ordered 31 December 1985; fabrication of first C-17A (T1/87-0025) began 2 November 1987; first production C-17A contract 20 January 1988; assembly started at Long Beach 24 August 1988; assembly of prototype completed 21 December 1990. Programme transferred from Douglas Aircraft Company to McDonnell Douglas Aerospace in 1992.

First flight 15 September 1991 – also delivery to 6517th Test Squadron/6510th TW, Edwards AFB (unit renumbered 417th TS/412th TW on 2 October 1992); 100th hour/35th sortie 17 January 1992; first aerial refuelling 11 April 1992 during 51st sortie (155 hours 48 minutes); first stall testing 7 May 1992; 200th hour/65 sorties 8 May 1992; achieved VNE (Mach 0.875/510 knots) May 1992; first opening of cargo door in flight 17 June 1992; 300th hour/73 sorties 13 August 1992; 100th sortie/326 hours 29 August 1992; new software for expansion of flight envelope flown 5 January 1993; 400th sortie, 25 May 1993 (by P5/89-1191); first paratroop drop, 9 July 1993 (from T1/87-0025); two new payload-to-altitude records established by P1/88-0265) on 8 October 1993, increasing C-17's records to 21. First overseas service flight (P11/92-3291) to Mildenhall, UK, 25 May 1994. Development flight testing completed 15 December 1994, by which time 16 production aircraft delivered and 22nd record set. Initial AMC Squadron (17th AS) received its 12th and final C-17A 22 December 1994; achieved IOC 17 January 1995. Second squadron (14th AS) received its first aircraft 17 February 1995.

Two static test airframes (T2 and T3) commissioned 30 November 1991 and Spring 1992; development continued until 1995; named Globemaster III on 5 February 1993; peak production target 18 per year; assembly in new 102,200 m² (1.1 million sq ft) facility at Long Beach, California, dedicated 13 August 1987. Feasibility study for hose-drogue tanker/transport combi, Spring 1991.

CUSTOMERS: US Air Force original requirement 210; cut to 120 by 1991; capped at 40 in January 1994 for two year probationary period, during which contractor to achieve performance, cost and delivery targets; decision thereafter on balance of 80 C-17s or alternative modification of existing airliner. Settlement of 6 January 1994 extends flight trials from 80 to 152 aircraft-months and relaxes some performance specifications. Events for 1995 comprise 30 day reliability, maintainability and availability demonstration to take place in June/July, and 'Milestone 3B' review in November, when US DoD will assess programme status and determine whether to limit procurement to 40 aircraft or proceed with further orders.

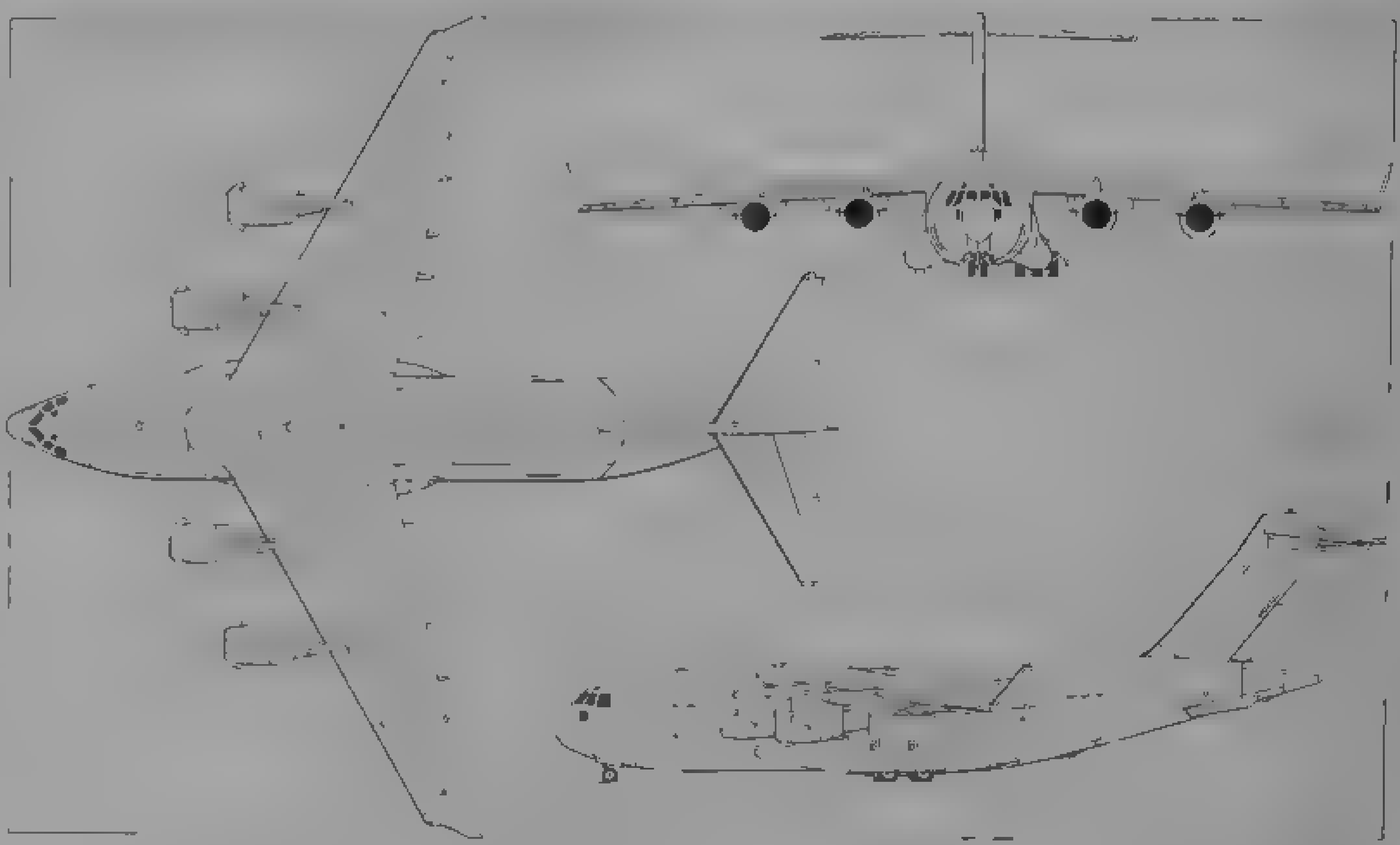
First operating squadron is 17th AS of 437th AW at Charleston AFB, North Carolina, supported by reservist personnel of 317th AS/315th AW; total 12 received.

C-17 PROCUREMENT

FY	Lot	Qty	First aircraft
—	Proto	1	87-0025
88	1	2	88-0265
89	2	4	89-1189
90	3	4	90-0532
91			
92	4	4	92-3291
93	5	6	93-0599
94	6	6	94-0065
95	7	6	
Total		**32 + 1**	

Note: Eight planned for funding in FY96

McDonnell Douglas C-17A Globemaster III of 17th Airlift Squadron
1995



McDonnell Douglas C-17A Globemaster III long-range heavy cargo transport *(Jane's/Dennis Punnett)*
1985

Initial assignments of production aircraft as below:

P1/88-0265: First flight/delivery 18 May 1992, 417th TS; structural, systems, acoustic, mission systems, unpaved field and air refuelling test aircraft; air load testing began October 1992 flying M60 tank (41 277 kg; 91,000 lb); first C-17 airdrop, 3 May 1993 (2,890 kg; 6,370 lb of ballast); trial of 40-pallet container delivery system; wing modifications, August 1993; load trials from October 1993; first LAPES delivery 3 May 1994. Currently engaged on follow-on flight test duty.

P2/88-0266: First flight/delivery 21 June 1992, 417th TS; range/payload trials and tests of additional avionics including global positioning system, communications/navigation equipment. Undergoing predelivery modification at McDonnell Douglas Tulsa early 1995.

P3/89-1189: First flight/delivery 7 September 1992; landed on desert strip at Edwards AFB, 417th TS; electromechanical systems and all weather trials; Eglin AFB, 2 November for six months of climatic trials; Edwards 30 May 1993; anti icing tests (behind KC-135 water sprayer) 28 and 30 June 1993; overseas deployments for 12 months, from September/October 1993; Eielson AFB, Alaska, for cold weather trials, from 15 January 1994; first North Pole flight 10 February 1994; Mitchell Field, Milwaukee, for adverse weather trials, from 7 March 1994. Modified at McDonnell Douglas Tulsa 1995, prior to joining AMC.

P4/89-1190: First flight 9 December 1992; delivery 20 January 1993 to 417th TS; first C-17 without test instrumentation; initial evaluation and airlift training with USAF Operational Test and Evaluation Center, Kirtland AFB, New Mexico; troop-dropping trials, including first C-17 night parachute drop, 24 August 1993; IOT&E testing continuing.

P5/89-1191: First flight 31 January 1993; production configuration; delivered for lightning and electromagnetic resistance evaluation at Patuxent River NAS 12 March 1993; returned to Edwards, 27 July 1993. After modification at McDonnell Douglas Tulsa was delivered to 437th AW 17 January 1995.

P6/89-1192: First flight 8 May 1993; first direct delivery to Charleston AFB 14 June 1993; maintenance familiarisation and crew training (first sortie, 29 June 1993) for 17th AS/437th AW, first for squadron.

Lot 3 completed on 8 February 1994 with delivery of

LEGEND

CODE	SUPPLIER
(1)	AEROSTRUCTURES HAMBLE
(2)	ALLIED BENDIX
3	ALLIED GARRETT
(4)	ALTO AIRE COMPOSITES
5	BEECHCRAFT
(6)	B F GOODRICH
[illegible]	BRUNSWICK
(8)	CLEVELAND PNEUMATIC COMPANY
9	CC INDUSTRIES
[illegible]	COMPOSITE STRUCTURES DIVISION
[illegible]	DAC
[illegible]	GRUMMAN
13	HEATH TECNA
14	KAMAN AEROSPACE CORP
15	LTV
16	MARTIN MARIETTA
(17)	MCAIR
18	MENASCO
[illegible]	MISC SUB/EQUIPMENT
[illegible]	NORTHWEST COMPOSITES
[illegible]	PRATT & WHITNEY
22	REYNOLDS METALS
[illegible]	WESTERN GEAR
24	WESTLAND

C-17A airframe suppliers

1993

P10/90-1535, Lot 4 completed 20 August 1994, with first from Lot 5 on 29 September 1994, final Lot 5 aircraft (P20/93-0604) delivered June 1995.

COSTS: Initial award $3,387 million for development, placed 31 December 1985. First production contract $603.6 million (1988) for two aircraft, second production contract $757 million for four aircraft (1989); originally expected unit cost $125 million. Programme unit cost now $294 million (1994), or $35,274 million for 120 aircraft. December 1992 estimate of costs for development, plus first six production aircraft, was $7,700 million ($2,000 million above target, $1,130 million over maximum price). Lot 3 ceiling price $1,200 million: estimated (1993) cost $1,000 million. Lot 6 fully funded at $1,600 million.

DESIGN FEATURES: Externally blown flap system based on McDonnell Douglas YC-15 medium STOL transport prototypes (see 1979-80 *Jane's*), with extended flaps in exhaust flow from engines during take-off and landing, combines load-carrying capacity of C-5 with STOL performance of C-130; required to operate routinely from 915 m (3,000 ft) long and 27.45 m (90 ft) wide runways, complete 180° three-point turn in 25 m (82 ft) and reverse up 1 in 50 gradient when fully loaded using thrust reversers. Structure designed to survive battle damage and protect crew, essential line-replaceable units (LRU) to be replaceable in flight; rear-loading ramp. Supercritical wing with 25° sweepback, 2.90 m (9.5 ft) high NASA winglets.

FLYING CONTROLS: First military transport with all-digital FBW control system and two-crew cockpit with central stick controllers, two full-time, all-function HUDs and four multifunction electronic displays; outboard ailerons and four spoilers per wing; four elevator sections, two-surface rudder split into upper and lower segments, full-span leading-edge slats; two-slot, fixed-vane, simple hinged flaps over about two-thirds of trailing-edge; small strakes under tail. Quadruple-redundant Lockheed Martin digital fly-by-wire flight control system, with mechanical back-up.

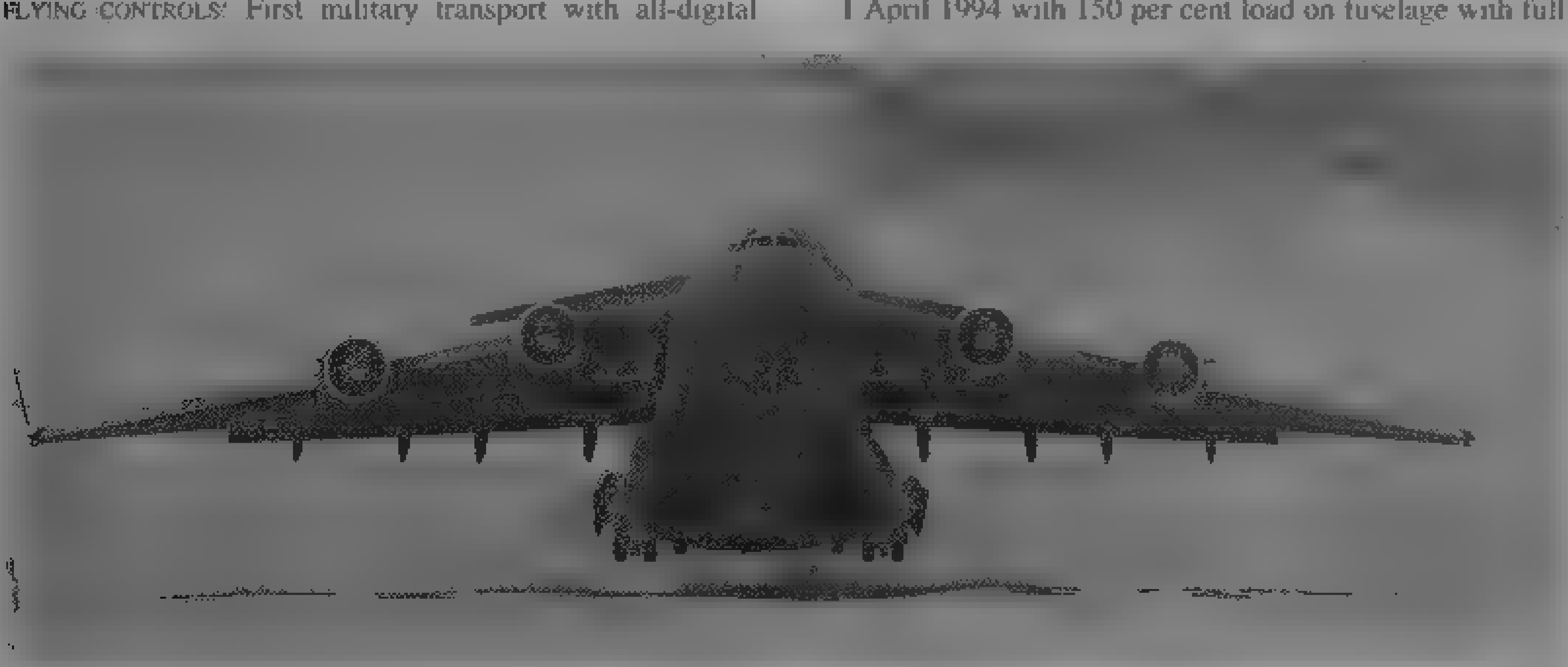
STRUCTURE: Major subassemblies produced in new factory at Macon, Georgia: some 50 subcontractors of which 21 for airframe; subcontractors include Raytheon (composites winglets), Northrop Grumman (composites ailerons, rudder and elevators), Vought (vertical and horizontal stabilisers, engine nacelles and thrust reversers), Reynolds Metals Company (wing skins), CC Industries (wing spars and stringers), Kaman Aerospace (wing ribs and bulkheads), Lockheed Martin (tailcone), Heath Tecna (wing-to-fuselage fillet), Aerostructures Hamble (composite flap hinge fairing and trailing-edge panels) and Northwest Composites (main landing gear pod panels). C-17A structure is 69.3 per cent aluminium, 12.3 per cent steel alloys, 10.3 per cent titanium and 8.1 per cent composites. Wings of P1-P10 undergoing local strengthening as consequence of load test of 1 October 1992: first rework to P8/90-0533 at McDonnell Douglas, Tulsa, between 3 January and 9 April 1994. Ground static qualification testing completed 1 April 1994 with 150 per cent load on fuselage with full fuel. Durability test fuselage completed simulated 1/4 service lifetime (45,000 hours 12,819 sorties/28,500 landings) on 23 November 1994, proceeding with second full life cycle. Proposal, early 1994, to design all-composites horizontal tail surfaces for weight-saving resulting in McDonnell Douglas securing a $40.7 million contract to build new unit, expected to be 50 per cent cheaper and 20 per cent lighter than existing tail.

LANDING GEAR: Hydraulically retractable tricycle type, with free-fall emergency extension, designed for sink rate of 4.57 m (15 ft)/s and suitable for operation from paved runways or unpaved strips. Mainwheel units, each consisting of two legs in tandem with three wheels on each leg, rotate 90° to retract into fairings on lower fuselage sides, tyre size 50 × 21-20, pressure 9.52 bars (138 lb/sq in). Menasco twin-wheel nose leg retracts forwards; tyre size 40 × 16-14, pressure 10.69 bars (155 lb/sq in). Bendix wheels and carbon brakes. Minimum ground turning radius at outside mainwheels 17.37 m (57 ft 0 in); minimum taxiway width for three-point turn 27.43 m (90 ft 0 in); wingtip/tailplane clearance 74.24 m (237 ft 0 in).

POWER PLANT: Aircraft have four Pratt & Whitney F117-PW-100 (PW2040) turbofans, with maximum flat rating of 181.0 kN (40,700 lb st), pylon-mounted in individual underwing pods and each fitted with a directed flow thrust reverser deployable both in flight and on the ground. Provision for in-flight refuelling. Two outboard wing fuel tanks of 21,210 litres (5,603 US gallons; 4,666 Imp gallons) each, two inboard wing fuel tanks of 30,056 litres (7,940 US gallons; 6,612 Imp gallons) each; total capacity 102,610 litres (27,086 US gallons; 22,572 Imp gallons). Plessey fuel pumps.

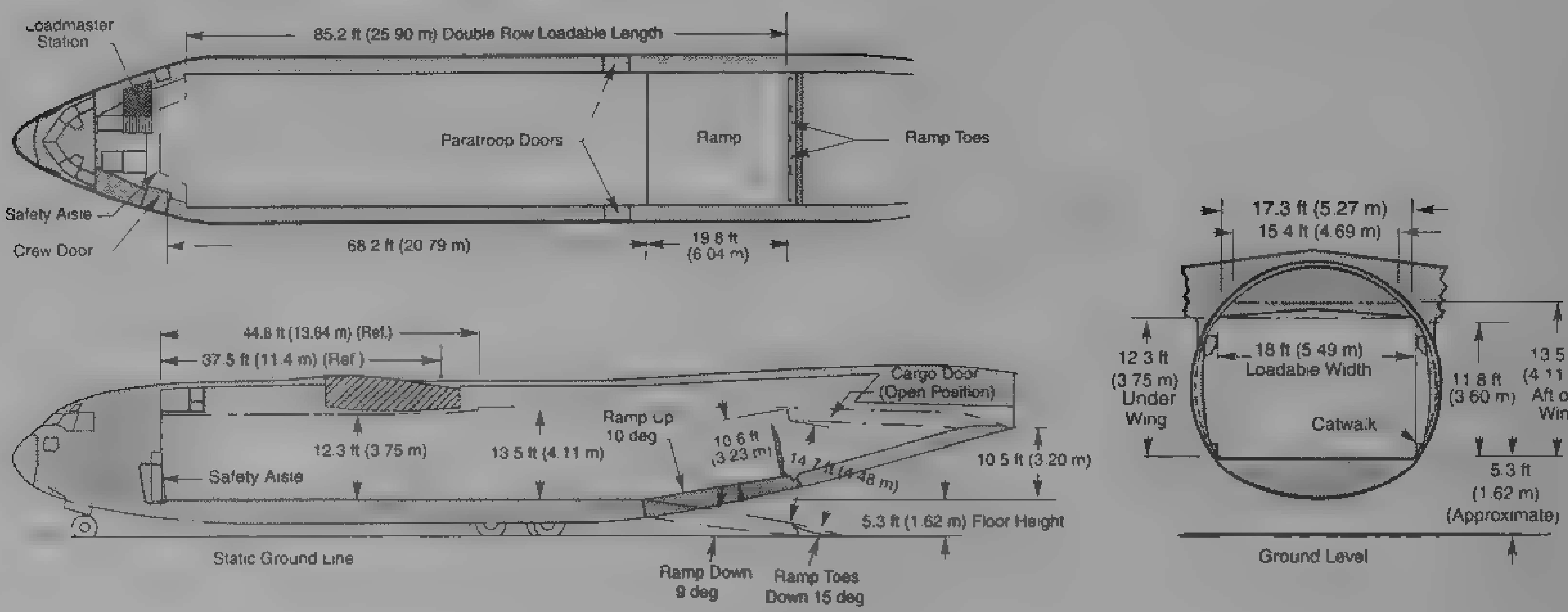
ACCOMMODATION: Normal flight crew of pilot and co-pilot, side by side and two observer positions on flight deck, plus loadmaster station at forward end of main floor, access to flight deck via downward opening airstair door on port side of lower forward fuselage. Bunks for crew immediately aft of flight deck area, crew comfort station at forward end of cargo hold.

Main cargo hold able to accommodate US Army wheeled and tracked vehicles, including 5 ton expandable vans in two rows, or three Jeeps side by side, or up to three AH-64A Apache attack helicopters, with loading via hydraulically actuated rear loading ramp which forms underside of rear fuselage when retracted. Aircraft fitted with 27 stowable tip-up seats along each sidewall and another 48 seats carried on board which can be erected along the centreline, optionally up to 48 litters for medical evacuation mission or up to 100 passengers on 10-passenger pallets in addition to 54 sidewall seats. Air



Bicycle Lake, California, was the scene of C-17A Globemaster III austere field trials

1993



C-17A cargo area dimensions

1994

delivery system capability for nine 463L pallets plus two on ramp in single row, or handling system for 18 463L pallets in double row. Airdrop capability includes single platforms of up to 27,215 kg (60,000 lb), multiple platforms of up to 49 895 kg (110,000 lb), or up to 102 paratroops Equipped for low-altitude parachute extraction system (LAPES) drops. The C-17A is only aircraft able to airdrop outsize firepower such as the US Army's M2 infantry fighting vehicle; also able to carry the M1 main battle tank in combination with other vehicles

Cargo handling system includes rails for airdrops and rails/rollers for normal cargo handling. Each row of rails/rollers can be converted quickly by a single loadmaster from one configuration to the other Total of 295 cargo tie-down rings, each stressed for 11,340 kg (25,000 lb), all over cargo floor forming grid averaging 74 cm (29 in) square. Three quick erecting litter stanchions, each supporting four litters, permanently carried. Main access to cargo hold is via rear-loading ramp, which is itself stressed for 18,145 kg (40,000 lb) of cargo in flight. Underfuselage door aft of ramp moves upward inside fuselage to facilitate loading and unloading Paratroop door at rear on each side, four overhead FEDS (flotation equipment deployment system) escape hatches and liferafts, two forward and two aft of wing

SYSTEMS Include AiResearch computer-controlled integrated environmental control system and cabin pressure control system, 2,440 m (8 000 ft) equivalent cabin pressure up to 11,280 m (37,000 ft), quad-redundant flight control and four independent 276 bar (4,000 lb/sq in) hydraulic systems, independent fuel feed systems, electrical system AlliedSignal GTCP331 APU (at front of starboard landing gear pod), provides auxiliary power for environmental control system, engine starting, and on-ground electronics requirements, onboard inert gas generating system (OBIGGS) for the explosion protection system, pressurised by engine bleed air at 4 1 bars (60 lb/sq in) to produce NEA (nitrogen-enriched air) and governed by a Gull Inc system controller; fire suppression system, Pyrotector (Graviner Inc) smoke detection systems. All phases of cargo operation and configuration change capable of being handled by one loadmaster

Electrical system includes single 90 kVA generator per engine and an APU, providing 115/200 V, three-phase, 400 Hz power; four 200 A transformer-rectifiers providing 28 V DC; single-phase, 1,000 VA inverter for ground refuelling and emergency AC; and two 40 Ah Ni/Cd batteries for APU starting and emergency DC. Aeromedical equipment provided with 60 Hz power

AVIONICS: *Comms.* Telephonic Corporation radio management system; UHF; Satcom, VHF-AM/FM, HF, secure voice and jam-resistant UHF/VHF/FM intercom, IFF/SIF; en route army/marine UHF LOS and Satcom hook-up; cockpit voice recorder; crash position indicator

Radar. Bendix/King AN/APS-133(V) weather/mapping radar

Flight. Delco Electronics mission computer with MDC software and electronic control system; Hamilton Standard aircraft and propulsion data management computer, Honeywell dual air data computers; Teledyne Controls warning and caution system; master warning system provides aural and voice alerts plus visual alerts on glare shields; General Dynamics automatic test equipment, and support equipment data acquisition and control system, four inertial reference units; VOR/DME, Tacan ILS/marker beacon; UHF-DF; ground proximity warning system; radar altimeter, flight data recorder; flight plan entry manually or by preprogrammed cassette

Instrumentation. Advanced digital avionics and four full-colour multifunction displays (MFDs); two GEC-Marconi full flight regime foldable head-up displays

Mission. Integrated mission and communications keyboards (MCKs) and displays (MCDs), Sierra Research station keeping equipment (SKE) displayed on MFD.

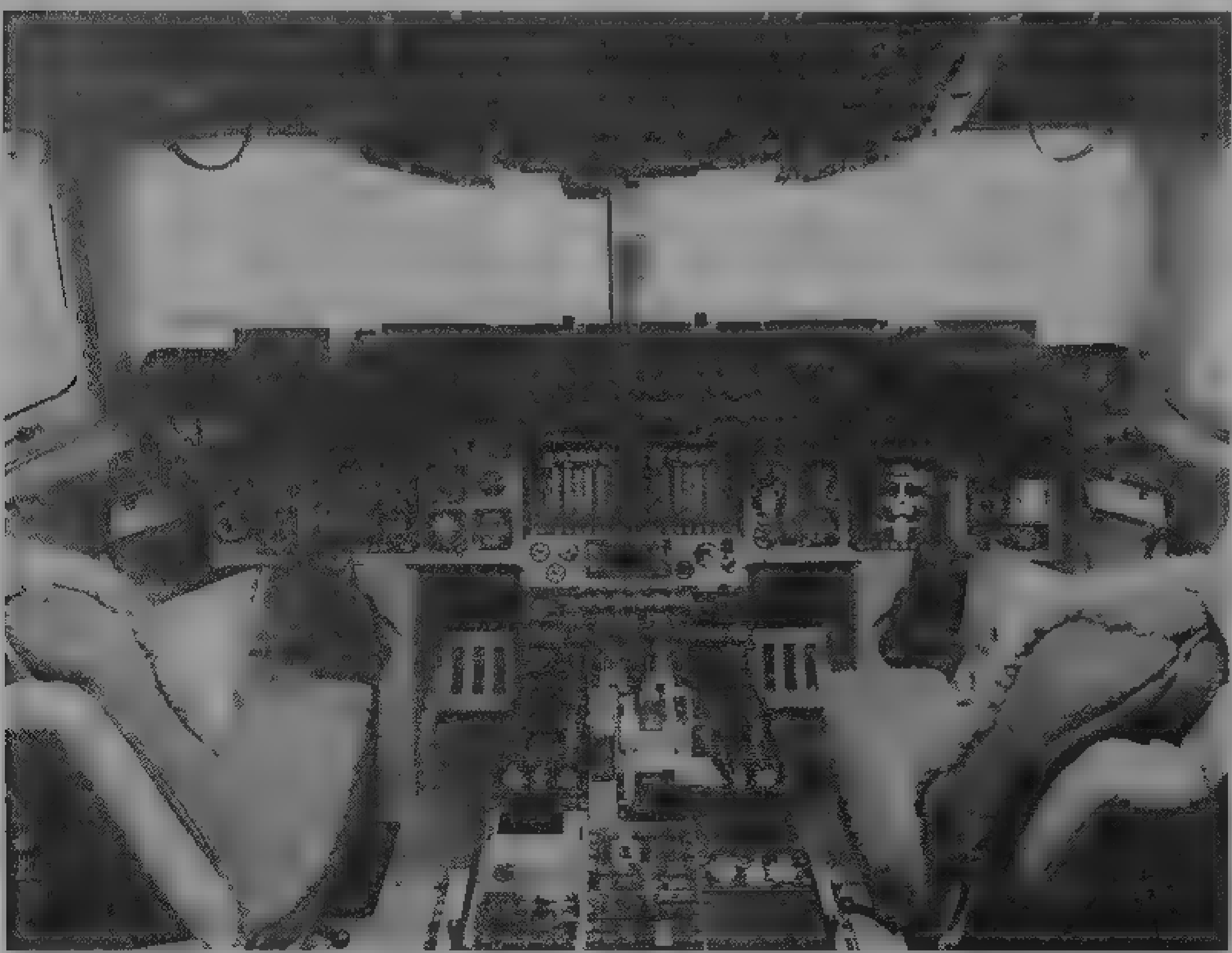
Self-defence. Development of defensive electronic systems completed in 1994. Missile approach warning system and associated automatic flare dispenser installed on five aircraft

DIMENSIONS, EXTERNAL

Wing span wings only	50.29 m (165 ft 0 in)
at winglet tips	51 76 m (169 ft 10 in)
Wing aspect ratio	7 16
Length, overall	53.04 m (174 ft 0 in)
fuselage	48 49 m (159 ft 1¼ in)
Height overall	16 79 m (55 ft 1 in)
Fuselage diameter	6 85 m (22 ft 6 in)
Tailplane span	19 81 m (65 ft 0 in)
Wheel track	10 27 m (33 ft 8½ in)
Wheelbase	20.05 m (65 ft 9½ in)
Height to sill	approx 1 62 m (5 ft 4 in)
Ground clearance under engine pods	
inboard	2.71 m (8 ft 10½ in)
outboard	2 35 m (7 ft 8½ in)

DIMENSIONS, INTERNAL

Cargo compartment	
Length, incl 6 05 m (19 ft 10 in) rear-loading ramp	26 82 m (88 ft 0 in)
Loadable width	5 49 m (18 ft 0 in)
Height under wing	3.76 m (12 ft 4 in)



Flight deck of the C-17A Globemaster III

1994

Paratroop door, port side, showing slipstream deflector and jumping 'balcony' ***(Paul Jackson)***

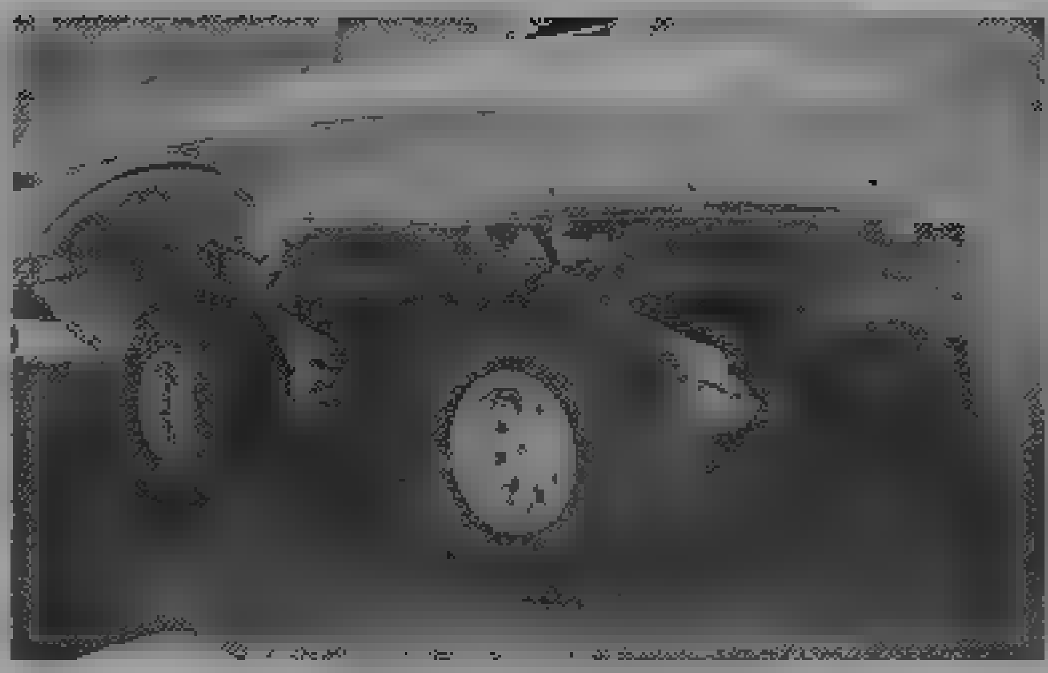
1995

Max height 4.11 m (13 ft 6 in)
Volume 592 m³ (20,900 cu ft)

AREAS
Wings, gross 353 m² (3,800 0 sq ft)
Ailerons (total) 11 83 m² (127 34 sq ft)
Tailplane 79 2 m² (845 0 sq ft)

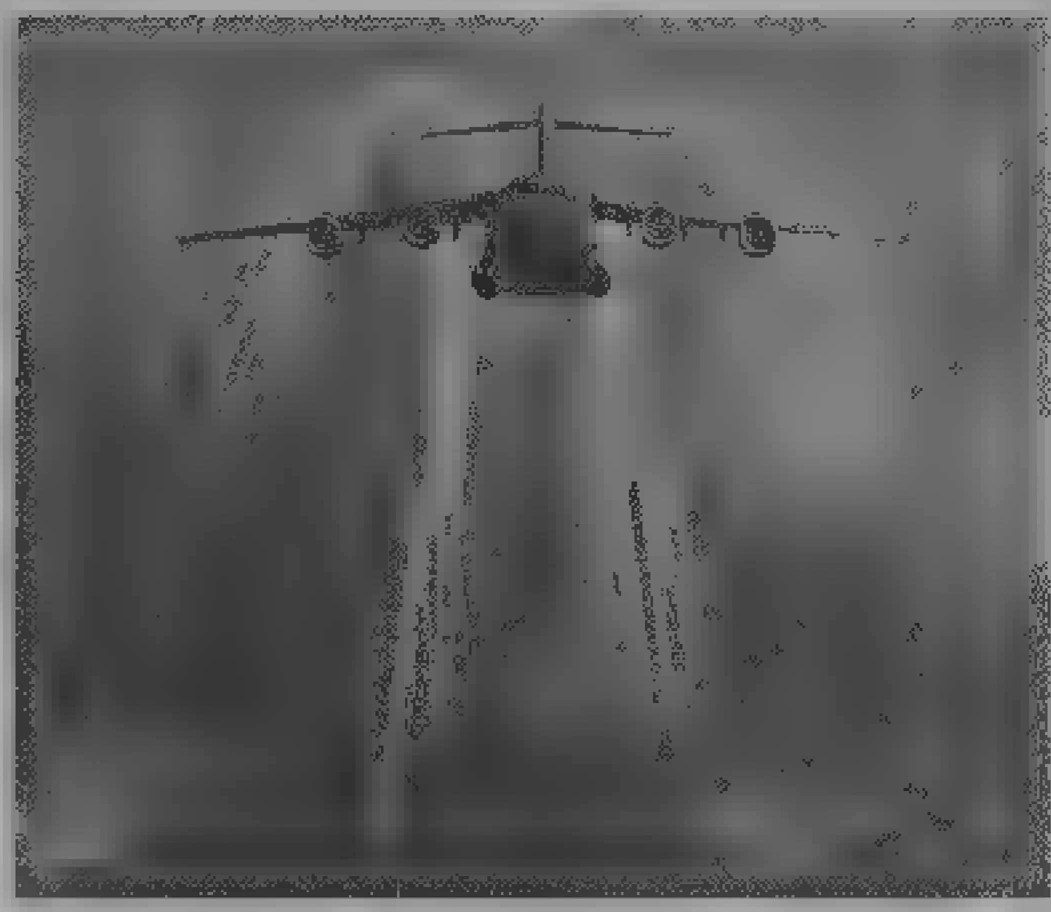
WEIGHTS AND LOADINGS
Operating weight empty 125,645 kg (277,000 lb)
Typical payload
inter-theatre logistics mission (2.5 *g* load factor) 54,421 kg (120,000 lb)
heavy logistics mission (2 25 *g* load factor) 68,039 kg (150,000 lb)
Max payload (2 25 *g*) 76,657 kg (169,000 lb)
Ramp capacity 18,143 kg (40,000 lb)
Max T-O weight 265,352 kg (585,000 lb)
Max wing loading 751 71 kg/m² (153 95 lb/sq ft)
Max power loading 366 51 kg/kN (3 59 lb/lb st)

PERFORMANCE (estimated, pending completion of flight test programme)
Normal cruising speed at 8,535 m (28,000 ft) Mach 0 74
Max cruising speed at low altitude 350 kts (648 km/h, 403 mph) CAS
Airdrop speed at S/L 115 250 kts (213-463 km/h, 132 288 mph) CAS
at 7,620 m (25,000 ft) 130-250 kts (241-463 km/h, 150-288 mph) CAS
Approach speed with max payload 115 kts (213 km/h; 132 mph) CAS
Service ceiling 13,715 m (45,000 ft)
Runway LCN (paved surface) better than 49
T-O field length with 72,575 kg (160,000 lb) payload and fuel for 2,400 n miles (4,445 km, 2,762 miles) 2,286 m (7,500 ft)
Landing field length with 76,655 kg (169 000 lb) payload, using thrust reversal 915 m (3,000 ft)



C-17A's main landing gear (*Paul Jackson*) 1995

Radius, T-O with 36,786 kg (81,100 lb) payload in 975 m (3 200 ft), land in 823 m (2,700 ft), T-O with similar payload in 853 m (2,800 ft) and land in 792 m (2,600 ft), all at load factor of 3 *g*, no in-flight refuelling 500 n miles (925 km, 575 miles)
Radius, T-O with 56,245 kg (124,000 lb) payload in 2 012 m (6,600 ft) at load factor of 2 25 *g*, land in 915 m (3,000 ft), T-O with zero payload (load factor of 3 *g*) in 671 m (2,200 ft) and land in 701 m (2,300 ft), no in-flight refuelling 1,900 n miles (3,519 km, 2,186 miles)
Range with payloads indicated, with no in-flight refuelling
72,575 kg (160,000 lb), T-O in 2,286 m (7,500 ft), land in 915 m (3,000 ft), load factor of 2 25 *g* 2 400 n miles (4,445 km, 2,762 miles)
68,039 kg (150,000 lb), T-O in 2,320 m (7,600 ft), land in 885 m (2 900 ft), load factor of 2 25 *g* 2,700 n miles (5,000 km, 3,107 miles)



An interim C-17A defensive system of IR flares was tested at Eglin AFB, Florida, in Summer 1994 1995

54,421 kg (120,000 lb), T-O in 1,830 m (6,000 ft), land in 853 m (2 800 ft), load factor of 2 5 *g* 2,800 n miles (5,185 km, 3,222 miles)
self ferry (zero payload), T-O in 1,128 m (3,700 ft), land in 701 m (2,300 ft) load factor of 2 5 *g* 4 700 n miles (8,704 km; 5,408 miles)

UPDATED

OTHER AIRCRAFT

Details of the **KDC-10** tanker conversion of an airline DC-10 for military use appear in *Jane's Aircraft Upgrades*

NEW ENTRY

MCDONNELL DOUGLAS HELICOPTER SYSTEMS (Division of McDonnell Douglas Aerospace)

5000 East McDowell Road, Mesa, Arizona 85215
Telephone 1 (602) 891 3000
Fax: 1 (602) 891 5599
Telex. 3719337 MD HC C MESA

SENIOR VICE-PRESIDENT AND GENERAL MANAGER
Dean C Borgman
SENIOR VICE-PRESIDENT OPERATIONS Chuck Sny
VICE-PRESIDENTS
Ervin J Hunter (Military Programmes)
Andrew H Logan (Commercial Programmes)
Al Winn (Engineering Division)
MANAGER COMMUNICATIONS. Ken Jensen

Hughes Helicopters Inc became subsidiary of McDonnell Douglas Corporation 6 January 1984, name changed to McDonnell Douglas Helicopter Company 27 August 1985, changed again to McDonnell Douglas Helicopter Systems in September 1993 In February 1994, alliance announced with Hunting Aviation of Singapore to represent McDonnell Douglas helicopters in nations of Pacific Rim and Middle East

Main company base at Mesa, Arizona, with 52,955 m² (570,000 sq ft) AH-64 Apache assembly and testing factory and another 123,980 m² (1,334,500 sq ft) completed in 1986; MD 500/530 production line transferred to Mesa 1986-87 workforce 3,400 in mid-1994. Chain Gun systems manufactured at Culver City

Model 300 helicopter design rights sold to Schweizer Aircraft Corporation (which see) at Elmira, New York, 1986, following licence production by Schweizer since 1983. McDonnell Douglas helicopters produced under licence by Kawasaki, Japan (civil and military 500D) Korean Airlines (civil and military 500D and 500E, and fuselages for all MD 500s sold worldwide); Agusta, Italy (500D, 500E and 530F civil variants), Agusta licence extended mid-1993 to include MD 520N

UPDATED

MCDONNELL DOUGLAS APACHE

US Army designations. AH-64A and D
Israel Defence Force name Pethen (Cobra)

TYPE. Day/night twin-engined attack helicopter

PROGRAMME. Original Hughes Model 77 entered for US Army advanced attack helicopter (AAH) competition, first flights of two development prototype YAH-64s 30 September and 22 November 1975, details of programme in 1984-85 and earlier *Jane's*, selected by US Army December 1976; named Apache late 1981

Deliveries started 26 January 1984, 800th delivered July 1993; 867 by December 1994, at which time US Army had ordered 821 (excluding prototypes) with export contracts totalling 104 AH-64As, latter total increased to 213 by July 1995. Self deployment capability shown by 14th Apache with four 871 litre (230 US gallon; 191 Imp gallon) external tanks, which flew 1,020 n miles (1,891 km 1 175 miles) Mesa - Santa Barbara - Mesa - Tucson - Mesa with 45 minutes fuel remaining on 4 April 1985; initial

Model of Longbow Apache to be ordered for British Army (*Paul Jackson*) 1994

operating capability achieved by 3rd Squadron, 6th Cavalry Regiment, July 1986, 33 of 35 planned AH-64A battalions, including seven National Guard and two Army Reserve, combat-ready by July 1994, first combat use (11 AH-64As) in operation Just Cause, Panama, December 1989, used extensively (288) during January/February 1991 Gulf War against Iraq, including first air strike of conflict First AH-64As issued to Army National Guard in 1987, fourth ArNG unit (1 211 AvRgt in Utah) established 1990; first overseas regiment 2/6 Cavalry Regiment, Illesheim, Germany, September 1987, eighth in Europe (3-4 AvRgt at Finthen) equipped 1990; battalion consists of 18 AH-64As and 13 Bell OH 58 Kiowas; more than 160 AH-64As based in Germany at peak strength, but force now reduced Deployed to South Korea March 1994, with 17th Aviation Brigade (5 501st AVN) at Camp Eagle

Eleven month programme to integrate air-to-air Stinger began October 1987; four missiles mounted in pairs on wingtips; five firings early 1989; air-to-air development programme included firing two AIM 9 Sidewinders in hover and at 80 knots (148 km/h, 92 mph) at White Sands, New Mexico, November 1987, laser ranging and tracking tests on Bell UH 1 and LTV A 7 flown in 1989; M230 Chain Gun being improved for air-to-air use, Matra Mistral captive carry tests completed. New missile control system by Base 10 Defense of Trenton, New Jersey, used for two more Stinger firings during 1990; Sidearm anti-radiation missile from AH-64A hit RF emitter on armoured vehicle at US Naval Weapons Center 25 April 1988 Total 800,000 hours flown by Apache to mid-1995

CURRENT VERSIONS **AH-64A**: Production for US Army and export. All to be upgraded to AH-64D; last in 2010. Retrofit from 1993 with SINCGARS secure radios and GPS, first installed in Apaches of 5-501 Aviation Regiment on deployment to Camp Eagle, South Korea *Detailed description applies to AH-64A except where indicated*

AH-64B. Cancelled in 1992. Was planned near-term upgrade of 254 AH-64As with improvements derived from operating experience in 1991 Gulf War, including GPS, SINCGARS radios, target handover capability, better navigation, and improved reliability including new rotor blades

AH-64C Previous designation for upgrade of AH-64As to near AH 64D standard, apart from omission of Longbow radar and retention of -701 engines provisions for optional fitment of both. Army requested draft proposal, August 1991, funding for two prototype conversions awarded in September 1992. With exception of AH 64Ds and re-sales, all remaining US Army AH 64As (approximately 540) to have been modified. Designation abandoned late 1993, all Apaches to become AH-64D, including those not fitted with radar

AH-64D Longbow Apache Current improvement programme based on Westinghouse mast-mounted Longbow millimetre-wave radar and Lockheed Martin Hellfire with RF seeker; includes more powerful GE T700-

McDonnell Douglas AH 64A Apache firing Hellfire ATM

1994

GE-701C engines, larger generators for 70 kVA peak loads, Plessey AN/ASN-157 Doppler navigation, MIL-STD 1553B databus allied to dual 1750A processors, and a vapour cycle cooling system for avionics, early user tests completed April 1990.

Full-scale development programme, lasting 51 months, authorised by Defense Acquisition Board August 1990 but airframe work extended in December 1990 to 70 months to coincide with missile development, supporting modifications being incorporated progressively, first flight of AH-64A (82-23356) with dummy Longbow radome 11 March 1991, first (89-0192) of six AH-64D prototypes flown 15 April 1992, second (89-0228) flew 13 November 1992, fitted with radar in mid 1993 and flown 20 August 1993, No 3 (85-25410) flown 30 June 1993; No 4 (90-0423) on 4 October 1993, No 5 (formerly AH-64C No 1) 19 January 1994 (first Apache with new Hamilton Standard lightweight flight management computer), No 6 flown 4 March 1994 (last two mentioned converted from 85-25408 and 85-25477 and lack radar. Six AH-64Ds to fly 3,300 hour test programme, production deliveries to start mid 1997 from planned first batch of 24. Following redesignation of AH-64C in late 1993, entire Army inventory to be known as AH-64D Longbow Apache, although only 227 (original AH-64D total) to carry Longbow radar.

Capability exists to convert any AH-64D to Longbow Apache configuration in 4 to 8 hours, this potential demonstrated June 1994 when Army personnel removed Longbow radar, associated equipment and T700-GE-701C engines from AH-64D prototype and installed them on second (non-radar) aircraft, which then test flown for 30 minutes. AH-64D to equip 26 battalions, company strength to be three with radar plus five without; three companies per battalion. Longbow can track flying targets and see through rain, fog and smoke that defeat FLIR and TV, RF Hellfire can operate at shorter ranges, it can lock-on before launch or launch on co-ordinates and lock-on in flight. Longbow scans through 360° for aerial targets or scans over 270° in 90° sectors for ground targets, mast-mounted rotating antenna weighs 113 kg (250 lb).

Further modifications include 'manprint' cockpit with large displays, air-to-air missiles, digital autostabiliser, integrated GPS/Doppler/INS/air data/laser/radar altimeter navigation system, digital communications, faster target handoff system and enhanced fault detection with data transfer and recording. AH-64D No 1 made first Hellfire launch on 21 May 1993; first RF Hellfire launch 4 June 1994, first demonstration of digital air-to-ground data communications with Symetrics Industries improved data modem, 8 December 1993.

Training of US Army instructors began Summer 1994 in anticipation of Force Development Test and Experimentation (FDT&E) trial, using three prototypes, starting October 1994, followed by Initial Operational Test and Evaluation (IOT&E) January to March 1995; 3,600 hours flown by AH-64D to June 1995. Successful completion of FDT&E and IOT&E precursor to start of modification programme in 1996; long-lead contract awarded to McDonnell Douglas December 1994 covering start up funds for initial batch of remanufactured Apaches.

Test successes of 1994 include June trial in which Longbow Apache tracked moving ground target with radar and scored direct hit with RF Hellfire, communication of digital data with Joint STARS and UH-60 Black Hawk via improved data modem in September; demonstration of new tri-service embedded GPS/INS in October; and RF Hellfire ripple-launch capability in November, when single Apache scored hits on three targets at close, medium and long range with three missiles, time of engagement, from detection to target impacts, less than 30 seconds.

GAH-64A. At least 17 AH-64As grounded for technical instruction.

JAH-64A. Seven AH-64As for special testing, of which one reverted to standard.

WAH-64D. Assembled by Westland, British Army version with Longbow radar and two Rolls-Royce/Turboméca RTM322 turboshafts, commitment to 67 announced 13 July 1995, Hellfire ATM as main armament, AAM choice expected 1997.

CUSTOMERS: US Army 827, of which 800th (including exports) delivered 1 September 1993, see Programme and Current Versions for details. Confirmed exports totalled 104 by December 1994, 213 orders and firm commitments by July 1995. Israel ordered 18 in March 1990, first two delivered 12 September 1990 to 113 Squadron, powered by T700-GE-701s, further 24 second-hand (including 18 US Army Europe AH-64As delivered September 1993 from 24 pledged in October 1992), also for 127 Squadron, first two units based at Ramon; deliveries to 190 Squadron at Ramat David, 1995.

Deliveries began in April 1993 to Saudi Arabia (12) and in 1995 to Egypt (24). Further orders from Greece (20) and United Arab Emirates (20), both in December 1991, six handed over to UAE on 30 October 1993, 14 followed in 1994. Greek deliveries from 1995. Ten more ordered for UAE in June 1994, 12 more to Egypt approved early 1995. Kuwait, Sweden and South Korea also known to be interested and version of AH-64D Longbow Apache offered to British Army by consortium of McDonnell Douglas, Westland, Lockheed Martin, Westinghouse and Shorts; UK announced proposed order for 67, July 1995. Netherlands signed contract on 24 May 1995 for 30 Apaches for 1998 service entry with Nos. 301 and 302 Squadrons at Gilze-Rijen, radar not required. US Army has offered 10 AH-64As on lease basis for period 1996-99. Production rate slowed from five to four per month in late 1993, reduced to three per month in February 1995.

COSTS: New $18 million Longbow radar costs $2 million (1990) without supporting modifications compared with $9.96 million flyaway cost of AH-64A. Longbow R&D contract (for four prototypes) $194.6 million. Programme cost (807 aircraft at 1991 values) $1,169 million. Latest Egyptian request costed at $318 million for 12 Apaches plus four spare Hellfire launchers, 34 70 mm (2.75 in) rocket launchers, six spare T700 engines, one spare TADS/PNVS system and miscellaneous spares.

DESIGN FEATURES: AH-64 is required to continue flying for 30 minutes after being hit by 12.7 mm bullets coming from anywhere in the lower hemisphere plus 20°; also survives 23 mm hits in many parts; target acquisition and designation system (TADS) and pilot night vision system (PNVS) sensors mounted in nose, low airspeed sensor above main rotor hub, avionics in lateral containers, chin-mounted Chain Gun fed from ammunition bay in centre-fuselage, four weapon pylons on stub wings (six when air-to-air capability is installed), engines widely separated, with integral particle separators and built-in exhaust cooling fittings; four-blade main rotor with lifting aerofoil blade section and swept tips, blades can be folded or easily removed, tail rotor consists of two teetering two-blade units crossed at 55° to reduce noise, airframe meets full

APACHE PROCUREMENT

		Qty		
US Army				
	FY73	3		
	FY79	3		
	FY82	11		
	FY83	48		
	FY84	112		
	FY85	138		
	FY86	116		
	FY87	101		
	FY88	77		
	FY89	54		
	FY90	154		
	FY95	10		
Sub-total		**827**		
Exports			**First aircraft and date**	
	Israel	18	801	September 1990
	Saudi Arabia	12	90 0291	April 1993
	Egypt (Lot 1)	24		1995
	(Lot 2)	12		1997
	Greece	20	ΕΣ-1001	1995
	UAE (Lot 1)	20	050	October 1993
	(Lot 2)	10		1996
	Netherlands	30		1998
	UK	67		1999
Sub-total		**213**		
Total		**1,040***		

APACHE CONVERSIONS (AH-64A to AH-64D)

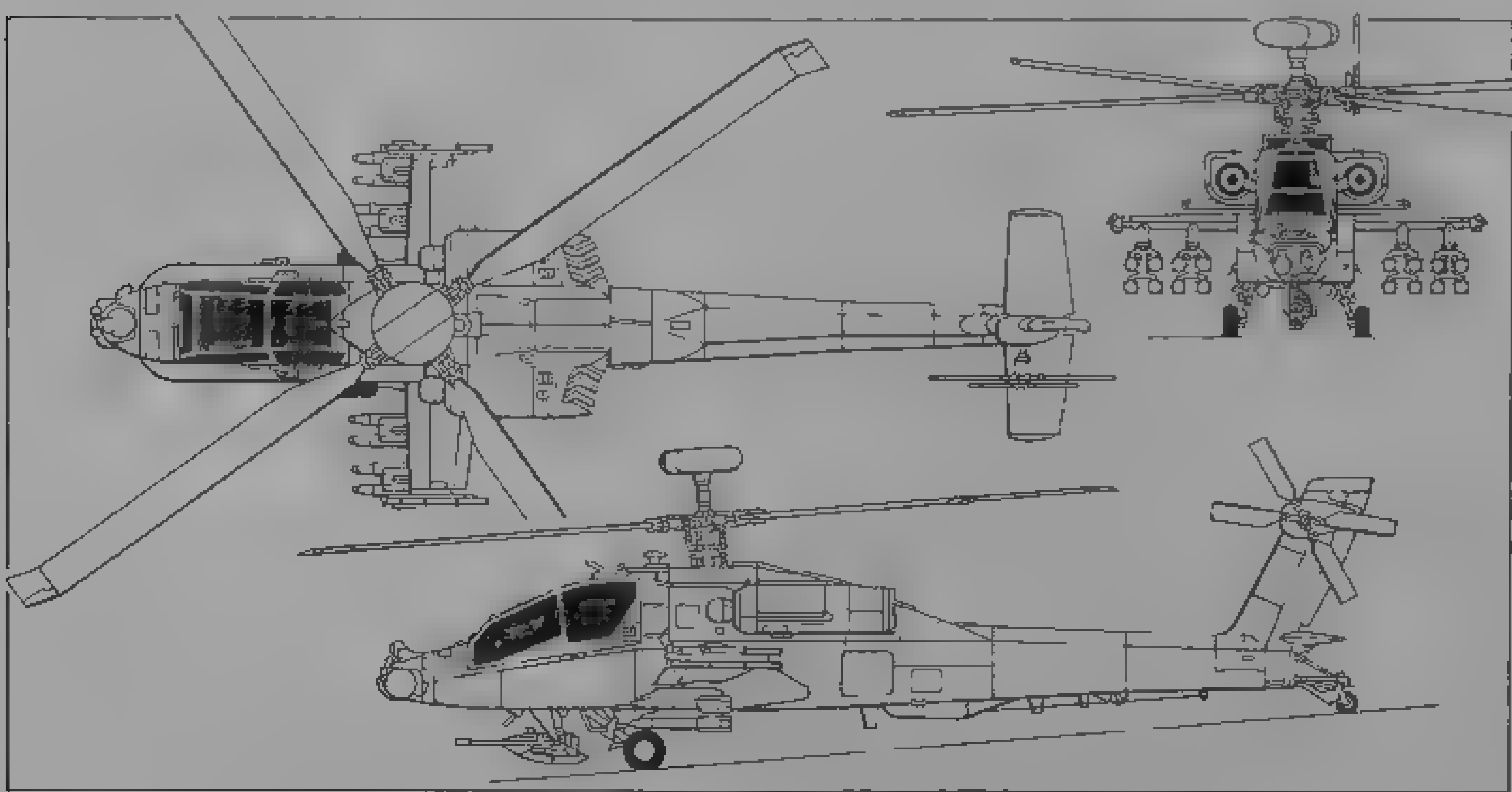
	FY	Qty
US Army	96	16*
Total		**16**

*Request

APACHE PRODUCTION

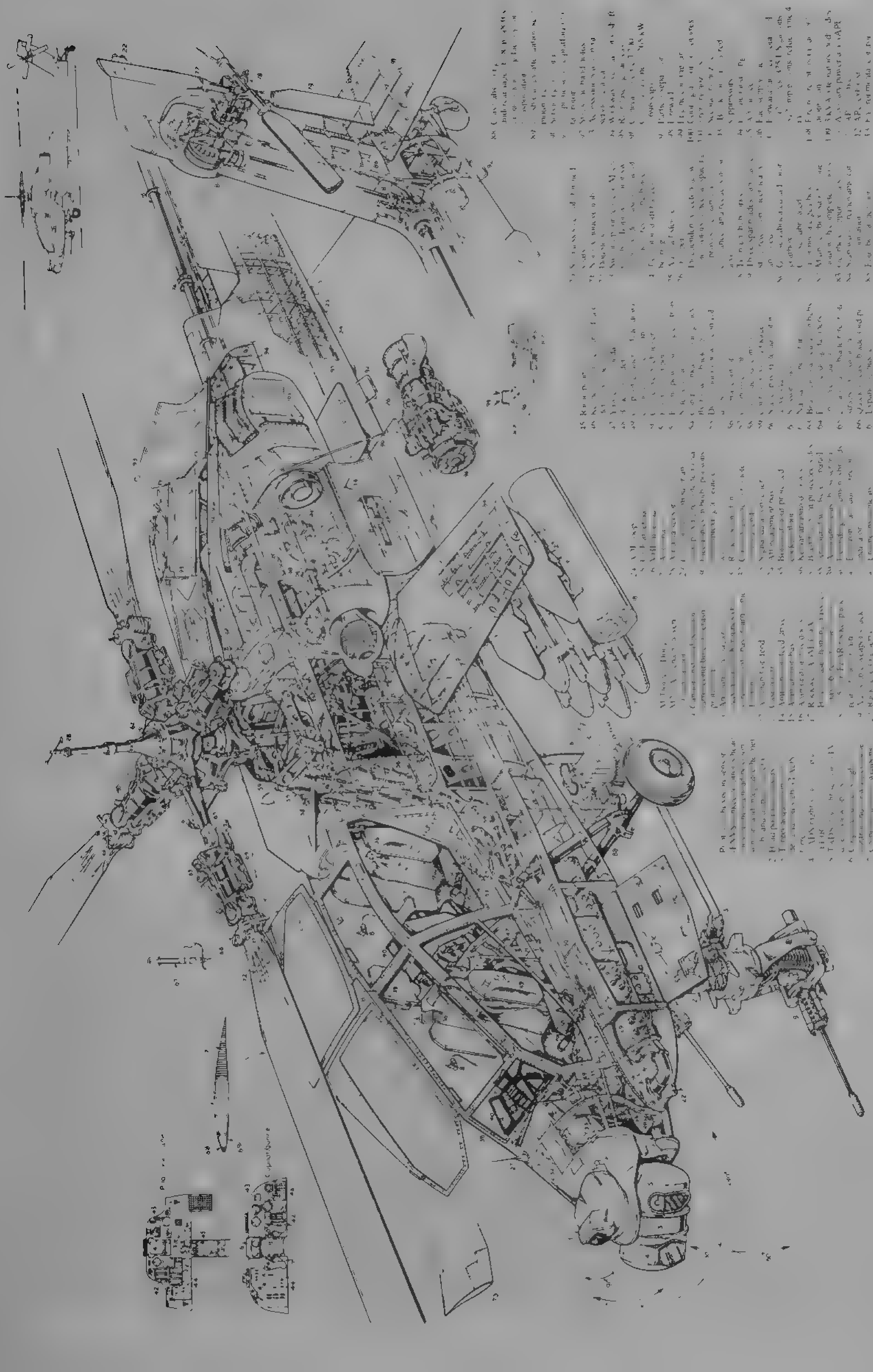
Lot	FY	Qty US	Qty Export	First aircraft
	73	3[1]		73-22247
	79	3[2]		79-23257
1	82	11		82-23355
2	83	48		83-23787
3	84	112		84-24200
4	85	138		85-25351
5	86	116		86-8940
6	87	101		87-0407
7	88	67		88-0197
		0		88-0275
8	89	54	18	89-0192
9	90	60	6	90-0280
		54	12	90-0415
10		40	2	90-0481
11	91		5	91-0112
	92		14	92-0498
			37	92
12	95	10[3]	10	95-
	95-96		109	95
Sub-totals		**827**	**213**	
Total		**1,040**		

Notes. [1]Prototypes, 73-22247 was static test airframe
[2]Preproduction
[3]Partial replacement for 24 transferred to Israel, 1993



McDonnell Douglas AH-64D Longbow Apache tandem-seat advanced attack helicopter *(Jane's/Mike Keep)*

1992



AH-64A Apache cutaway drawing

McDonnell Douglas AH-64D Longbow Apache prototype

1994

Close-up view of Longbow mast-mounted radome *(Paul Jackson)*

1995

crash-survival specifications. Two AH-64s will fit in C-141, six in C-5 and three in C-17A

Main transmission by Litton Precision Gear Division can operate for 1 hour without oil, tail rotor drive, by Aircraft Gear Corporation, has grease lubricated gearboxes with Bendix driveshafts and couplings, gearboxes and shafts can operate for 1 hour after ballistic damage; main rotor shaft runs within airframe-mounted sleeve, relieving transmission of flight loads and allowing removal of transmission without disturbing rotor. AH-64A has flown aerobatic manoeuvres and is capable of flying at 0.5 g

FLYING CONTROLS: Fully powered controls with stabilisation and automatic flight control system, automatic hover hold, tailplane incidence automatically adjusted by Hamilton Standard control to streamline with downwash during hover and to hold best fuselage attitude during climb, cruise, descent and transition

STRUCTURE: Main rotor blades (by Tool Research and Engineering Corporation, Composite Structures Divisions) tolerant to 23 mm cannon shells, have five U-sections forming spars and skins bonded with structural glassfibre tubes, laminated stainless steel skin and composites rear section, blades attached to hub by stack of laminated steel straps with elastomeric bearings. Teledyne Ryan produces all fuselages, wings, tail, engine cowlings, canopies and avionics containers

LANDING GEAR: Menasco trailing arm type, with single mainwheels and fully castoring, self-centring and lockable tailwheel. Mainwheel tyres size 8.50-10, tailwheel tyre size 5.00-4. Hydraulic brakes on main units. Main gear is non-retractable, but legs fold rearward to reduce overall height for storage and transportation. Energy absorbing main and tail gears are designed for normal descent rates of up to 3.05 m (10 ft)/s and heavy landings at up to 12.8 m (42 ft)/s. Take-offs and landings can be made at structural design gross weight on terrain slopes of up to 12° (head-on) and 10° (side-on)

POWER PLANT: Two 1,265 kW (1,696 shp) General Electric T700-GE-701 turboshafts, derated for normal operations to provide reserve power for combat emergencies, and with automatic OEI rating of 1,285 kW (1,723 shp); -701C engines from 604th (89-0192) AH-64A onward (1990) giving 1,409 kW (1,890 shp) maximum continuous and 1,447 kW (1,940 shp) OEI. Engines mounted one on each side of fuselage, above wings, with key components armour-protected. Upper cowlings let down to serve as maintenance platforms. Two crash-resistant fuel cells in fuselage, combined capacity 1,421 litres (375 US gallons, 312 Imp gallons). Modifications ordered September 1993 for carriage of four 871 litre (230 US gallon, 192 Imp gallon) Brunswick Corporation external tanks on 437 Apaches. Total internal and external fuel 4,910 litres (1,295 US gallons, 1,078 Imp gallons). 'Black Hole' IR suppression system protects aircraft from heat seeking missiles; this eliminates an engine bay cooling fan, by operating from engine exhaust gas through ejector nozzles to lower the gas plume and metal temperatures

ACCOMMODATION: Crew of two in tandem: co-pilot/gunner (CPG) in front, pilot behind on 48 cm (19 in) elevated seat. Crew seats, by Simula Inc, are of lightweight Kevlar. Teledyne Ryan canopy, with PPG transparencies and transparent acrylic blast barrier between cockpits, is designed to provide optimum field of view. Crew stations are protected by Ceradyne Inc lightweight boron armour shields in cockpit floor and sides, and between cockpits, offering protection against 12.7 mm armour-piercing rounds. Sierracin electric heating of windscreen. Seats and structure designed to give crew a 95 per cent chance of surviving ground impacts of up to 12.8 m (42 ft)/s

SYSTEMS: AiResearch totally integrated pneumatic system includes a shaft-driven compressor, air turbine starters, pneumatic valves, temperature control unit and environmental control unit. Parker Bertea dual hydraulic systems, operating at 207 bars (3,000 lb/sq in), with actuators ballistically tolerant to 12.7 mm direct hits. Redundant flight control system for both rotors. In the event of a flying control system failure, the system activates Honeywell secondary fly-by-wire control. Bendix electrical power system, with two 35 kVA fully redundant engine-driven AC generators, two 300 A transformer-rectifiers, and URDC standby DC battery. AlliedSignal GTP 36-55(H) 93 kW (125 shp) APU (36-155(BH) in AH-64D) for engine starting and maintenance checking. DASA (TST) electric blade de-icing

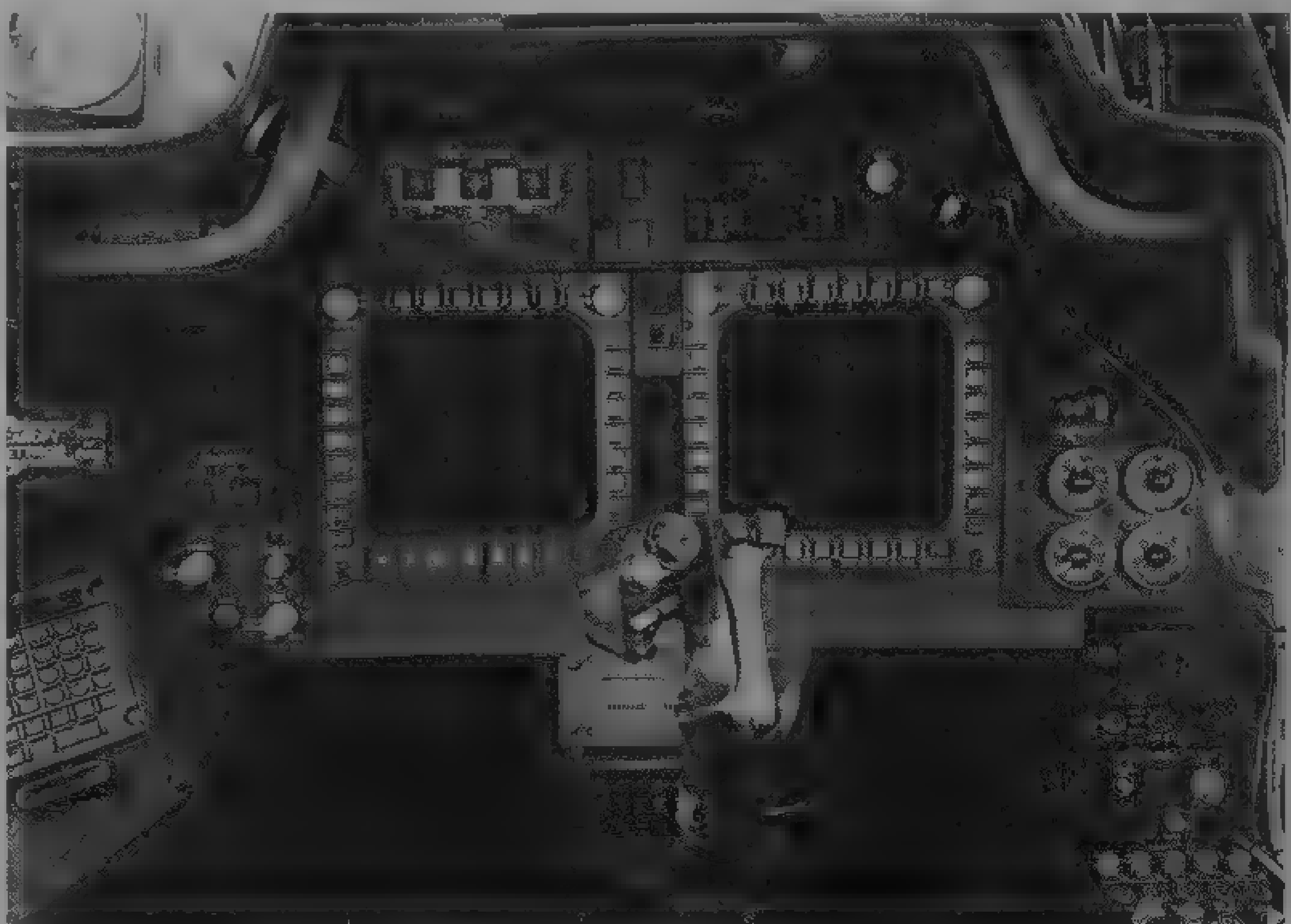
AVIONICS: *Comms:* AN/ARC-164 UHF, AN/ARC-186 UHF/VHF, retrofit of SINCGARS secure radio from 1993. KY-28/58/TSEC crypto secure voice, C 8157 secure voice control, AN/APX 100 IFF unit with KIT-1A secure encoding, Tempest C-10414 intercom

Radar: AH-64D Longbow Apache has Lockheed Martin Longbow mast-mounted 360° radar, presenting up to 256 targets on tactical situation display, detects air targets in air-to-ground mode; air-to-air mode for flying targets only

Flight: Plessey Electronic Systems AN/ASN-137 lightweight Doppler navigation system (upgrade to AN/ASN-157 on AH-64D), Litton LR 80 (AN/ASN 143) strapdown AHRS, AN/ARN-89B ADF, GPS retrofit from 1993, Honeywell digital automatic stabilisation equipment (DASE), Astronautics Corporation HSI, Pacer Systems omnidirectional, low-airspeed air data system, remote magnetic indicator, BITE fault detection and location. Doppler system, with AHRS, permits nap-of-the-earth navigation and provides data for storing target locations

Instrumentation: Honeywell all-raster symbology generator processes TV data from IR and other sensors, superimposes symbology, and distributes the combination to CRT and helmet-mounted displays. Honeywell AN/APN-209 radar altimeter video display unit, AH-64D with 'Manprint' (manpower integration) cockpit instrumentation including Litton Canada upfront display and two Bendix/King 15 × 15 cm (6 × 6 in) monochrome CRT displays. AH-64A's 1,200 cockpit switches reduced to approximately 200 on AH-64D

Mission: Lockheed Martin Orlando Aerospace target acquisition and designation sight and AN/AAQ-11 pilot's night vision sensor (TADS/PNVS) comprises two independently functioning, fully integrated systems mounted on nose



Pilot's cockpit on the AH-64D Apache

1995

TADS consists of a rotating turret (±120° in azimuth, ±30/-60° in elevation) housing sensor subsystems, optical relay tube in the CPG's cockpit, three electronic units in the avionics bay, and cockpit-mounted controls and displays, used principally for target search, detection and laser designation, with CPG as primary operator (can also provide back-up night vision to pilot in event of PNVS failure). Once acquired by TADS, targets can be tracked manually or automatically for autonomous attack with gun, rockets or Hellfire missiles. TADS daylight sensor consists of TV camera with narrow (0° 50′) and wide angle (4° 0′) fields of view, direct view optics (4° narrow and 18° wide angle), laser spot tracker, and International Laser Systems laser rangefinder/designator. Night sensor, in starboard half of turret, incorporates FLIR sight with narrow, medium and wide angle (3° 6′, 10° 6′ and 50°) fields of view.

PNVS consists of FLIR sensor (30 × 40° field of view) in rotating turret (±90° in azimuth, +20/−45° in elevation) mounted above TADS, electronic unit in the avionics bay, and pilot's display and controls, provides pilot with thermal imaging for nap-of-the-earth flight to, from and within battle area at night or in adverse daytime weather, at altitudes low enough to avoid detection. PNVS imagery displayed on monocle in front of one of pilot's eyes, flight information including airspeed, altitude and heading is superimposed on this imagery to simplify piloting. Monocle is part of Honeywell integrated helmet and display sighting system (HADSS) worn by both crew members. Retrofit of Rockwell Collins Automatic Target Handover System in AH-64A, transmits 1,200 bits/s. AH-64D to have Symetrics Industries improved data modem for transmission of target data (and eventually real time imagery) between helicopters, tactical jet, Joint-STARS airborne command posts, HQs and ground units at 16,000 bits/s, plus radio frequency interferometer beneath radome for identification of hostile transmitters.

Self defence: Aircraft survivability equipment (ASE) consists of Aerospace Avionics AN/APR-39 passive RWR, Sanders AN/ALQ-144 IR jammer, AN/AVR-2 laser warning receiver, AN/ALQ-136 radar jammer and chaff dispensers.

ARMAMENT: McDonnell Douglas M230 Chain Gun 30 mm automatic cannon, located between the mainwheel legs in an underfuselage mounting with Smiths Industries electronic controls. Normal rate of fire is 625 rds/min of HE or HEDP (high-explosive dual purpose) ammunition, which is interoperable with NATO Aden/DEFA 30 mm ammunition. Maximum ammunition load is 1,200 rounds. New 'Sideloader' system demonstrated June 1994, cuts normal loading time of 20 minutes by up to half and reduces number of personnel required from two to one; under US Army consideration for fleetwide adoption. Gun mounting is designed to collapse into fuselage between pilots in the event of a crash landing. Four underwing hardpoints, with Aircraft Hydro-Forming pylons and ejector units, on which can be carried up to 16 Hellfire anti-tank missiles or up to seventy-six 2.75 in FFAR (folding fin aerial rockets) in their launchers or a combination of Hellfires and FFAR. Planned modification adds two extra hardpoints for four Stinger, four Mistral or two Sidewinder (including Sidearm anti-radiation variant) missiles. Hellfire remote electronics by Rockwell, Bendix aerial rocket control system, multiplex (MUX) system units by Honeywell. Co-pilot/gunner (CPG) has primary responsibility for firing gun and missiles, but pilot can override his controls to fire gun or launch missiles.

AH-64A Apaches for the United Arab Emirates await delivery at Mesa

1995

DIMENSIONS, EXTERNAL:

Main rotor diameter	14.63 m (48 ft 0 in)
Main rotor blade chord	0.53 m (1 ft 9 in)
Tail rotor diameter	2.79 m (9 ft 2 in)
Length overall: tail rotor turning	15.54 m (51 ft 0 in)
both rotors turning	17.76 m (58 ft 3¼ in)
Wing span: clean	5.23 m (17 ft 2 in)
over empty weapon racks	5.82 m (19 ft 1 in)
Height: over tailfin	3.55 m (11 ft 7½ in)
over tail rotor	4.30 m (14 ft 1¼ in)
to top of rotor head	3.84 m (12 ft 7 in)
overall (top of air data sensor)	4.66 m (15 ft 3½ in)
overall, AH-64D	4.95 m (16 ft 3 in)
Main rotor ground clearance (turning)	3.59 m (11 ft 9¼ in)
Distance between c/l of pylons:	
inboard pair	3.20 m (10 ft 6 in)
outboard pair	4.72 m (15 ft 6 in)
Tailplane span	3.40 m (11 ft 2 in)
Wheel track	2.03 m (6 ft 8 in)
Wheelbase	10.59 m (34 ft 9 in)

AREAS:

Main rotor disc	168.11 m² (1,809.5 sq ft)
Tail rotor disc	6.13 m² (66.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: AH-64A	5,165 kg (11,387 lb)
AH-64D	5,352 kg (11,800 lb)
Max fuel weight: internal	1,108 kg (2,442 lb)
external (four Brunswick tanks)	2,712 kg (5,980 lb)
Structural design gross weight	6,650 kg (14,660 lb)
Primary mission gross weight	6,552 kg (14,445 lb)
Design mission gross weight	8,006 kg (17,650 lb)
Max T-O weight: -701 engine	9,525 kg (21,000 lb)
701C engine, ferry mission, full fuel	10,107 kg (22,283 lb)
Max disc loading	60.12 kg/m² (12.31 lb/sq ft)

PERFORMANCE (A: AH-64A at 6,552 kg, 14,445 lb AUW with 701 engines, B: AH-64A with -701C engines, L: Longbow Apache at 7,480 kg, 16,491 lb with -701C engines, ISA except where indicated):

Never exceed speed (VNE)	197 kts (365 km/h, 227 mph)
Max level and max cruising speed: A	158 kts (293 km/h, 182 mph)
L	141 kts (261 km/h, 162 mph)
Max rate of climb at S/L: B	990 m (3,240 ft)/min
L	942 m (3,090 ft)/min
Max vertical rate of climb at S/L:	
A	762 m (2,500 ft)/min
B	771 m (2,530 ft)/min
L	474 m (1,555 ft)/min
Service ceiling: A	6,400 m (21,000 ft)
Service ceiling, OEI: A	3,290 m (10,800 ft)
B	3,800 m (12,480 ft)
Hovering ceiling:	
IGE: A	4,570 m (15,000 ft)
B	5,245 m (17,210 ft)
L	4,115 m (13,500 ft)
OGE: A	3,505 m (11,500 ft)
B	4,125 m (13,530 ft)
L	2,990 m (9,810 ft)
Max range, internal fuel (30 min reserves):	
A	260 n miles (482 km, 300 miles)
B	220 n miles (407 km, 253 miles)
L	220 n miles (407 km, 253 miles)
Ferry range, max internal and external fuel, still air, 45 min reserves	1,024 n miles (1,899 km, 1,180 miles)
Endurance at 1,220 m (4,000 ft) at 35°C	1 h 50 min
Max endurance, internal fuel	3 h 9 min
g limits at low altitude and airspeeds up to 164 kts (304 km/h, 189 mph)	+3.5/−0.5

WEIGHTS FOR TYPICAL MISSION PERFORMANCE (A: anti-armour at 1,220 m/4,000 ft and 35°C, four Hellfire and 320 rounds of 30 mm ammunition, B: as A, but with 1,200 rounds, C: as A, but with six Hellfire and 540 rounds, D: anti-armour at 610 m/2,000 ft and 21°C, 16 Hellfire and 1,200 rounds, E: air cover at 1,220 m/4,000 ft and 35°C, four Hellfire and 1,200 rounds, F: as E but at 610 m/2,000 ft and 21°C, four Hellfire, 19 rockets, 1,200 rounds, G: escort at 1,220 m/4,000 ft and 35°C, 19 rockets and 1,200 rounds, H: escort at 610 m/2,000 ft and 21°C, 38 rockets and 1,200 rounds):

Mission fuel: A	727 kg (1,602 lb)
G	741 kg (1,633 lb)
E	745 kg (1,643 lb)
C	902 kg (1,989 lb)
B	1,029 kg (2,269 lb)
D	1,063 kg (2,344 lb)
H	1,077 kg (2,374 lb)
F	1,086 kg (2,394 lb)
Mission gross weight: A	6,552 kg (14,445 lb)
E	6,874 kg (15,154 lb)
G	6,932 kg (15,282 lb)
B, C	7,158 kg (15,780 lb)
D	7,728 kg (17,038 lb)
F	7,813 kg (17,225 lb)
H	7,867 kg (17,343 lb)

TYPICAL MISSION PERFORMANCE (A-H as above):

Cruising speed at intermediate rated power:	
C	147 kts (272 km/h, 169 mph)
D	148 kts (274 km/h; 170 mph)
F	150 kts (278 km/h, 173 mph)
B	151 kts (280 km/h, 174 mph)
E, H	153 kts (283 km/h; 176 mph)
A	154 kts (285 km/h; 177 mph)
G	155 kts (287 km/h, 178 mph)
Max vertical rate of climb at intermediate rated power:	
B, C	137 m (450 ft)/min
H	238 m (780 ft)/min
F, G	262 m (860 ft)/min
E	293 m (960 ft)/min
D	301 m (990 ft)/min
A	448 m (1,470 ft)/min
Mission endurance (no reserves): A, E, G	1 h 50 min
C	1 h 47 min
D, F, H	2 h 30 min
B	2 h 40 min

Co-pilot/gunner's cockpit on the AH-64D Apache

1995

UPDATED

McDonnell Douglas MD 530F Lifter of the Mexican Air Force

1995

MCDONNELL DOUGLAS MD 500/530

TYPE: Single-engined utility helicopter.

PROGRAMME: See earlier *Jane's* for MD 500D and previous versions. First flight MD 500E (N5294A) 28 January 1982, first flight MD 530F, 22 October 1982.

CURRENT VERSIONS: **MD 500E**: Replaced MD 500D in production 1982; deliveries started December 1982. Allison 250-C20R became optional replacement for standard 250-C20B in late 1988; window area of forward canopy increased in 1991 model. MD 500E introduced many cabin improvements including more space for front and rear seat occupants, lower bulkhead between front and rear seats, T tail and optional four-blade Quiet Knight tail rotor.

MD 530F Lifter: Powered by Allison 250-C30; transmission rating increased from 280 kW (375 shp) to 317 kW (425 shp) from 11 July 1985; diameter of main rotor increased by 0.3 m (1 ft 0 in) and of tail rotor by 5 cm (2 in); cargo hook kit for 907 kg (2,000 lb) external load available, certificated 29 July 1983; first delivery 20 January 1984. *Detailed description applies to MD 500E and 530F except where indicated.*

MD 500/530 Defender: Described separately.

CUSTOMERS: More than 4,630 MD 500/530 series produced by late 1994; 33 MD 500E/530F/520N series helicopters delivered in 1994.

COSTS: Typical MD 500E $700,000; MD 530F $968,000.

DESIGN FEATURES: Fully articulated five-blade main rotor with blades retained by stack of laminated steel straps; blades can be folded after removing retention pins; two-blade tail rotor with optional X pattern four-blade Quiet Knight tail rotor to reduce external noise; optional high skid landing gear to protect tail rotor in rough country; protective skid on base of lower fin; narrow-chord fin with high-set tailplane and endplate fins introduced with MD 500D. Main rotor rpm (500E/530F) 492/477 normal; main rotor tip speed 207 to 208 m (680 to 684 ft)/s; tail rotor rpm 2,933/2,848.

FLYING CONTROLS: Plain mechanical without hydraulic boost. Pilot sits on left instead of normal right-hand seating.

STRUCTURE: A-frame based on two A frames from rotor head to landing gear legs, enclosing rear seat occupants; front seat occupants protected within straight line joining rotor hub and forward tips of landing skids; engine mounted inclined in rear of fuselage pod, with access through clam shell doors; main rotor blades have extruded aluminium spar hot-bonded to wraparound aluminium skin; tail rotor blades have swaged tubular spar and metal skin.

LANDING GEAR: Tubular skids carried on McDonnell Douglas oleo-pneumatic shock absorbers. Utility floats, snow skis and emergency inflatable floats optional.

POWER PLANT: MD 500E powered by 313 kW (420 shp) Allison 250-C20B or 335.6 kW (450 shp) 250-C20R turboshaft, derated in both cases to 280 kW (375 shp) for T-O; maximum continuous rating 261 kW (350 shp). MD 530F has 485 kW (650 shp) Allison 250-C30 turboshaft, derated to 317 kW (425 shp) for take-off and 261 kW (350 shp) maximum continuous.

MCP transmission rating 261 kW (350 shp); improved, heavy-duty transmission, rating 447 kW (600 shp), derated to 280 kW (375 shp) on production aircraft from June 1995. Two interconnected bladder fuel tanks with combined usable capacity of 232 litres (61.3 US gallons, 51 Imp gallons). Self sealing fuel tank optional. Refuelling point on starboard side of fuselage. Auxiliary fuel system, with 79.5 litre (21 US gallon, 17.5 Imp gallon) internal tank, available optionally. Oil capacity 5.7 litres (1.5 US gallons, 1.2 Imp gallons). Greater capacity internal fuel tanks also available.

ACCOMMODATION: Forward bench seat for pilot and two passengers, with two or four passengers, or two litter patients and one medical attendant, in rear portion of cabin. Low-back front seats and individual rear seats with fabric or leather upholstery, optional. Baggage space capacity 0.3 m³ (... cu ft) under and behind rear seat in five-seat form. Clear space for 1.19 m³ (42 cu ft) of cargo or baggage with only three front seats in place. Two doors on each side. Interior soundproofing optional.

SYSTEMS: Aero Engineering Corporation air conditioning system or Fargo pod-mounted air conditioner optional.

AVIONICS (MD 500E): Optional avionics listed below.

Comms: Dual Bendix/King KY 195 or Collins VHF-251 transceivers, Bendix/King KT 76 or Collins TDR-950 transponder, intercom system, headsets, microphones, and public address system.

Flight: Dual Bendix/King KX 175 or Collins VHF-251/231 nav receivers, latter with IND-350 nav indicator. Bendix/King KR 85 or Collins ADF 650 ADF.

EQUIPMENT: Standard equipment includes basic VFR instruments and night flying lighting. Optional equipment includes shatterproof glass, heating/demisting system, radios and intercom, attitude and directional gyros, rate of climb indicator, nylon mesh seats, dual controls, cargo hook, cargo racks, underfuselage cargo pod, heated pitot tube, extended landing gear, blade storage rack, litter kit, emergency inflatable floats, inflated utility floats, FLIR radar and 30 Mcd Spectrolab SX-16 Nightsun searchlight.

DIMENSIONS, EXTERNAL:
Main rotor diameter: 500E 8.05 m (26 ft 5 in)
530F 8.33 m (27 ft 4 in)
Main rotor blade chord 0.171 m (6¾ in)
Tail rotor diameter: 500E 1.37 m (4 ft 6 in)
530F 1.42 m (4 ft 8 in)
Distance between rotor centres:
500E 4.67 m (15 ft 4 in)
530F 4.88 m (16 ft 0 in)
Length overall, rotors turning:
500E 8.61 m (28 ft 3 in)
530F 8.97 m (29 ft 5 in)
Length of fuselage 7.49 m (24 ft 7 in)
Height to top of rotor head (standard skids; for extended skids add 0.27 m, 11¼ in) 2.67 m (8 ft 9 in)
Tailplane span 1.65 m (5 ft 5 in)
Skid track (standard) 1.91 m (6 ft 3 in)
Cabin doors (each): Height 1.13 m (3 ft 8½ in)
Max width 0.76 m (2 ft 6 in)
Height to sill: 500E 0.79 m (2 ft 7 in)
530F 0.76 m (2 ft 6 in)
Cargo compartment doors (each):
Height 1.12 m (3 ft 8¼ in)
Width 0.88 m (2 ft 10½ in)
Height to sill: 500E 0.71 m (2 ft 4 in)
530F 0.66 m (2 ft 2 in)

DIMENSIONS, INTERNAL:
Cabin: Length 2.44 m (8 ft 0 in)
Max width 1.31 m (4 ft 3½ in)
Max height 1.52 m (5 ft 0 in)

AREAS:
Main rotor blades (each): 500E 0.62 m² (6.67 sq ft)
530F 0.65 m² (6.96 sq ft)
Tail rotor blades (each): 500E 0.063 m² (0.675 sq ft)
530F 0.066 m² (0.711 sq ft)
Main rotor disc: 500E 50.89 m² (547.81 sq ft)
530F 54.58 m² (587.50 sq ft)
Tail rotor disc: 500E 1.53 m² (16.47 sq ft)
530F 1.65 m² (17.72 sq ft)
Fin 0.56 m² (6.05 sq ft)
Tailplane 0.76 m² (8.18 sq ft)

WEIGHTS AND LOADINGS:
Weight empty: 500E 655 kg (1,445 lb)
530F 717 kg (1,580 lb)
Max normal T-O weight: 500E 1,361 kg (3,000 lb)
530F 1,406 kg (3,100 lb)
Max overload T-O weight:
500E, 530F 1,610 kg (3,550 lb)
Max T-O weight, external load:
530F 1,701 kg (3,750 lb)
Max normal T-O disc loading:
500E 26.76 kg/m² (5.48 lb/sq ft)
530F 25.78 kg/m² (5.28 lb/sq ft)
Max normal T-O power loading (from June 1995):
500E, 530F 4.87 kg/kW (8.00 lb/shp)

PERFORMANCE (at max normal T-O weight, ISA, except where indicated):
Never-exceed speed (VNE) at S/L:
500E, 530F 152 kts (282 km/h; 175 mph)
Max cruising speed at S/L:
500E 134 kts (248 km/h; 154 mph)
530F 133 kts (246 km/h; 153 mph)
Max cruising speed at 1,525 m (5,000 ft):
500E 132 kts (245 km/h; 152 mph)
530F 134 kts (248 km/h; 154 mph)

McDonnell Douglas MD 500E five/seven-seat utility and executive helicopter

1993

Econ cruising speed at S/L:
500 E 129 kts (239 km/h; 149 mph)
530 F 131 kts (243 km/h; 151 mph)
Econ cruising speed at 1,525 m (5,000 ft):
500E, 530F 123 kts (228 km/h; 142 mph)
Max rate of climb at S/L: 500E 536 m (1,760 ft)/min
530 F 631 m (2,070 ft)/min
Vertical rate of climb at S/L: 500E 248 m (813 ft)/min
530 F 446 m (1,462 ft)/min
Service ceiling: 500E 4,575 m (15,000 ft)
530 F 4,875 m (16,000 ft)
Hovering ceiling IGE: ISA: 500E 2,590 m (8,500 ft)
530 F 4,360 m (14,300 ft)
ISA+20°C: 500E 1,830 m (6,000 ft)
530 F 3,660 m (12,000 ft)
Hovering ceiling OGE: ISA: 500E 1,830 m (6,000 ft)
530 F 3,660 m (12,000 ft)
ISA+20°C: 500E 975 m (3,200 ft)
530 F 2,970 m (9,750 ft)
Range, 2 min warm-up, standard fuel, no reserves:
500 E at S/L 233 n miles (431 km; 268 miles)
530 F at S/L 202 n miles (374 km; 232 miles)
500 E at 1,525 m (5,000 ft)
258 n miles (478 km; 297 miles)
530 F at 1,525 m (5,000 ft)
228 n miles (422 km; 262 miles)

UPDATED

MCDONNELL DOUGLAS 500/530 DEFENDER

US Army designations: AH-6, EH-6, MH-6

TYPE: Military derivatives of MD 500/530.

PROGRAMME: Earlier 500MD Scout Defender, TOW Defender, 500MD/ASW Defender and 500MD Defender II described in 1987-88 and earlier *Jane's*. Except for TOW Defender, military Defenders have same airframe as current civil 500/530; versions available detailed below.

CURRENT VERSIONS: **500MG Defender:** As 530MG, but with 313 kW (420 shp) Allison 250-C20B and MD 500E rotor system.

TOW Defender: Retains round nose of earlier MD 500. M65 TOW sight in nose; carries four TOW missiles; available with Allison 250-C20B, 250-C20R or 250-C30.

Paramilitary MG Defender: Introduced July 1985 as low-cost helicopter suitable for police, border patrol, rescue, narcotics control and internal security use; available in either 500E or 530F configurations.

530MG Defender: Based on MD 530F Lifter, first flight of prototype/demonstrator (N530MG) 4 May 1984, designed mainly for point attack and anti-armour, but also suitable for scout, day and night surveillance, utility, cargo lift and light attack. Integrated crew station with multifunction display allows hands on lever and stick (HOLAS) control of weapon delivery, communications and flight control. HOLAS based on Racal RAMS 3000, designed for all-weather and NOE flight and connected to MIL-STD-1553B digital databus linking the processor interface unit (PIU), control and display unit (CDU) and data transfer unit (DTU). CDU used for flight planning, navigation, frequency selection and subsystem management and has its own monochrome display and keyboard; multifunction display is high-definition monochrome tube with symbolic and alphanumeric capability; data input to DTU using ground loader unit inserted in cockpit receptacle.

Other equipment includes Astronics Corporation autopilot, Decca Doppler navigator with Racal Doppler velocity sensor, GEC-Marconi FIN 1110 AHRS, twin Collins VHF/UHF AM/FM radios; Bendix/King HF radio, ADF/VOR, radar altimeter and transponder; Telephonics intercom; SFENA attitude indicator. Options include mast-mounted Hughes TOW sight, FLIR, RWR, IFF, GPWS and laser ranger.

McDonnell Douglas 530MG Defender equipped with TOW missile tubes and nose-mounted Hughes M65 sight

1995

One of two new-build McDonnell Douglas MH-6Hs of the US Army's 160th Special Operations Aviation Regiment

1995

Weapons qualified or tested include TOW 2, FN Herstal pods containing 7.62 mm or 0.50 in machine guns, and 2.75 in rockets in seven- or 12-tube launchers, stores attached by standard 14 in NATO racks. Future armament will include General Dynamics air-to-air Stinger and 7.62 mm McDonnell Douglas Chain Gun. Chaff and flare dispensers with automatic chaff discharge available. Both cyclic sticks have triggers for gun or rocket firing; co-pilot/gunner's visual image display has two handgrips for TOW/FLIR operation.

Nightfox: Introduced 1986 for low-cost night surveillance and military operations, equipment includes FLIR Systems Series 2000 thermal imager and night vision goggles, with same weapons as 530MG; available in both 500MG and 530MG forms.

Following versions of H-6 have been used by the US Army's 160th Special Operations Aviation Regiment at Fort Campbell, Kentucky:

EH-6B: Four conversions of OH-6A, two to AH-6C, two to MH-6B.

MH-6B: Twenty-four conversions of OH-6A, plus two from EH-6B, four to AH-6C, 10 survivors sold in 1991-92.

AH-6C: Eleven conversions of OH-6A, plus six from EH/MH-6. Six lost, others remain.

MH-6C: Three conversions of OH-6A, all remain.

EH-6E: Three new-build, all to MH-6H.

MH-6E: Fifteen new-build, 10 to MH-6H, two to MH-6J, one lost.

AH-6F: Eight new-build, six to AH-6G, two lost.

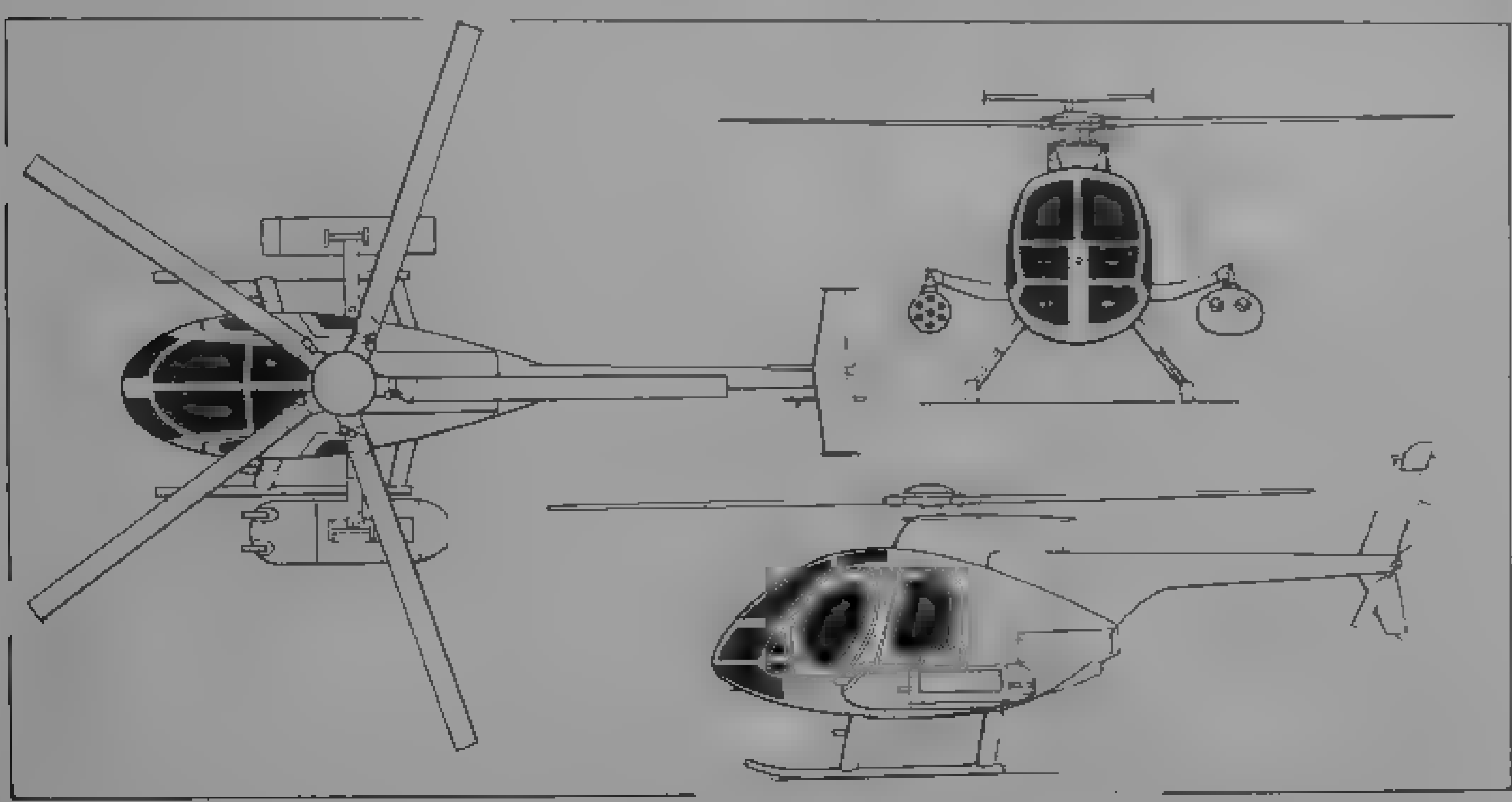
AH-6G: Four new-build, plus six from AH-6F.

MH-6H: Two new-build (FY85) equivalent of MD 530F, plus 13 conversions from EH/MH-6E; two to MH-6J, two lost.

AH-6J: Twenty or more new-build from FY88-91 procurement. In service by mid-1992, four or more converted from MH-6E/H, NOTAR tail configuration.

MH-6J: Small number funded in FY90-91, NOTAR tail configuration.

AH-6F and MH-6E based on MD 500MG; AH-6G and MH-6F/H based on MD 530MG, all can carry 7.62 mm



McDonnell Douglas 530MG Defender, with seven-tube rocket launcher and FN Herstal gun pod *(Jane's/Dennis Punnett)*

1985

Minigun, machine gun and rocket pods, with provision for air-to-air Stinger. MH-6E, MH-6F and MH-6H have multifunction displays and FLIR used in association with night vision goggles.

Re-equipment of 160th SOAR with NOTAR variant officially began with four conversions and two new AH-6/MH-6s, of which first pair formally delivered on 1 July 1992. Programme of 39 conversions cancelled soon afterwards. Meanwhile, up to 30 new-build H-6Js delivered in 1991-92 to unannounced orders; serial numbers include 88-25349 to '357, 89-25351 to '356, 90-25357 to '363 and 92-25364 to '366, all allegedly NOTAR; however 160th reportedly received only small number of NOTAR helicopters before returning these to manufacturer in early 1995 because improved acoustic signature outweighed by decrease in lift capability. AH-6J/MH-6J have common avionics and multirole capability with AH-6G armed version and MH-6H personnel transport. Folding tailboom for compact air transport. M134 7.62 mm Minigun; BEI Hydra 70 mm rocket pods, Aerocrafter 0.5 in machine gun pods. Optional Litton AIM-1 laser marker, Hughes AN/AAQ-16 FLIR. Optional cabin fuel tanks, capacity 110 litres (29 US gallons, 24 Imp gallons) or 236 litres (62.5 US gallons, 52 Imp gallons). Bendix/King KNS600 FMS, Omega/VLF, Tacan, VOR, GPS, Honeywell AN/APN-209 radar altimeter.

CUSTOMERS: Operated by US Army (as detailed above) and also by Colombia (six 500MG and three 530MG delivered from 1986) and Philippines (22 520MGs from October 1990, plus six in 1992 and five ordered in 1993). Earlier Model 500s in military service with Argentina (500D/M), Colombia (500D/E), Iraq (500D), Israel (500MD), Kenya (500D/M/MD/ME), North Korea (500D/E) and South Korea (500MD). OH-6 and civilian standard Model 500/530 in other air arms. See also Korean Airlines entry in 1994-95 *Jane's* for co-developed 520MK Black Tiger (non-NOTAR version of 500/530, despite designation).

AVIONICS: See Current Versions.

ARMAMENT: See Current Versions.

DIMENSIONS, EXTERNAL:

As for 500E/530F except:

Length of fuselage: 500MD/TOW	7.62 m (25 ft 0 in)
530MG	7.29 m (23 ft 11 in)
Height to top of rotor head:	
500MD/TOW	2.64 m (8 ft 8 in)
530MG	2.62 m (8 ft 7 in)
530MG with MMS	3.41 m (11 ft 2¼ in)
Height over tail (endplate fins):	
500MD/TOW	2.71 m (8 ft 10½ in)
530MG	2.59 m (8 ft 6 in)
Width over skids: 500MD/TOW	1.93 m (6 ft 4 in)
530MG	1.96 m (6 ft 5 in)
Width over TOW pods: 500MD/TOW, 530MG	3.23 m (10 ft 7¼ in)
Tailskid ground clearance:	
500MD/TOW	0.64 m (2 ft 1¼ in)
530MG	0.61 m (2 ft 0 in)

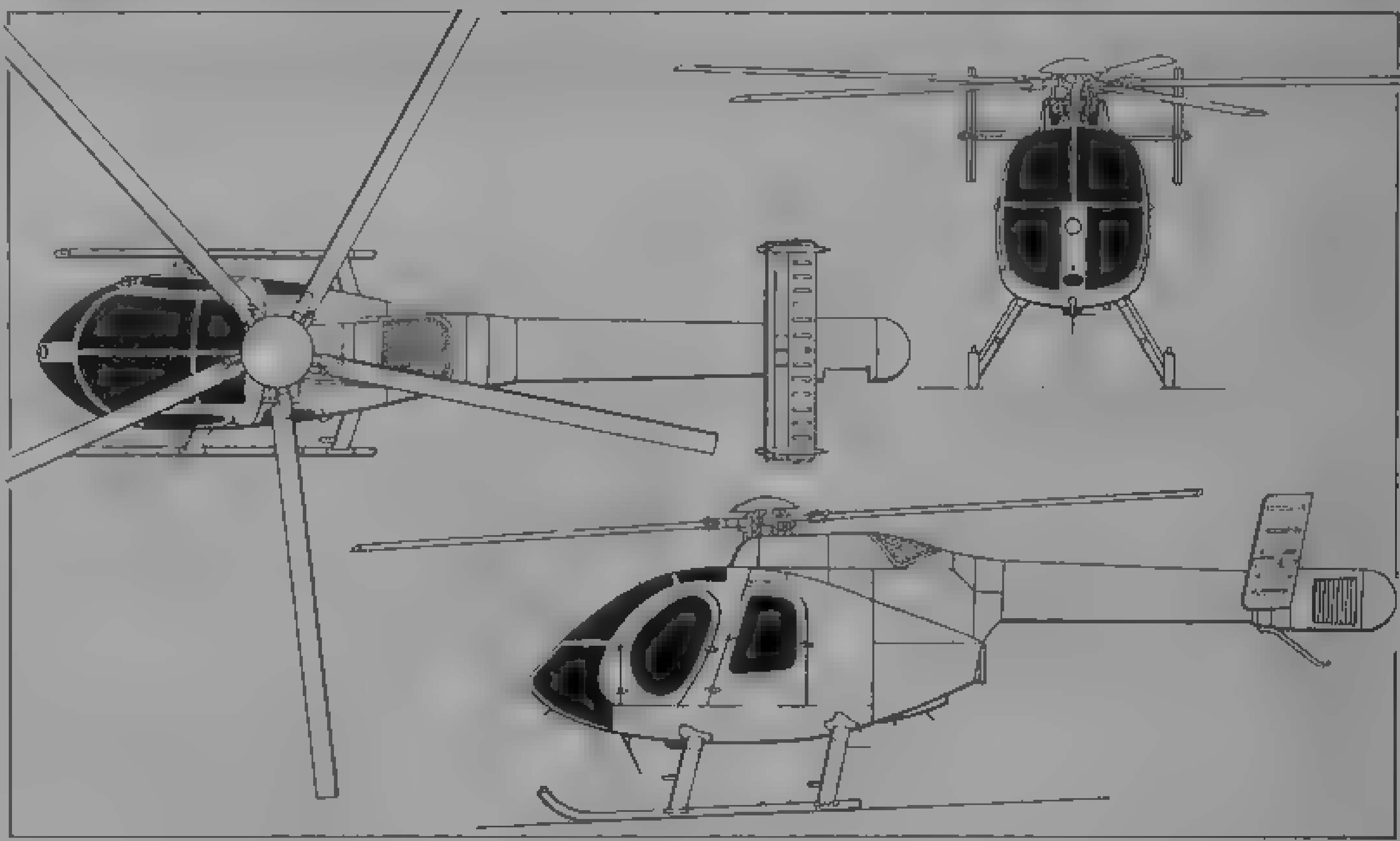
WEIGHTS AND LOADINGS:

Weight empty, equipped:	
500MD/TOW	849 kg (1,871 lb)
530MG	898 kg (1,979 lb)
Max T-O weight:	
500MD/TOW, normal	1,361 kg (3,000 lb)
500MD/TOW, max overload	1,610 kg (3,550 lb)
530MG, normal	1,406 kg (3,100 lb)
530MG, max overload	1,701 kg (3,750 lb)
Max disc loading:	
500MD/TOW	31.64 kg/m² (6.48 lb/sq ft)
530MG	31.16 kg/m² (6.38 lb/sq ft)

PERFORMANCE (at max normal T-O weight, except where indicated):

Never-exceed speed (VNE) at S/L:	
500MD/TOW, 530MG	130 kts (241 km/h; 150 mph)
Max cruising speed at S/L:	
500MD/TOW, 530MG	121 kts (224 km/h; 139 mph)
Max cruising speed at 1,525 m (5,000 ft):	
500MD/TOW	120 kts (222 km/h; 138 mph)
530MG	123 kts (228 km/h; 142 mph)
Max rate of climb at S/L, ISA:	
500MD/TOW	520 m (1,705 ft)/min
530MG	626 m (2,055 ft)/min
Vertical rate of climb at S/L:	
500MD/TOW	248 m (813 ft)/min
530MG	445 m (1,660 ft)/min
Service ceiling: 500MD/TOW	4,635 m (15,210 ft)
530MG	over 4,875 m (16,000 ft)
Hovering ceiling IGE:	
ISA: 500MD/TOW	2,590 m (8,500 ft)
530MG	4,360 m (14,300 ft)
ISA+20°C: 500MD/TOW	1,830 m (6,000 ft)
530MG	3,660 m (12,000 ft)
500MD/TOW, 35°C	1,340 m (4,400 ft)
530MG, 35°C	2,680 m (8,800 ft)
Hovering ceiling OGE:	
ISA: 500MD/TOW	1,830 m (6,000 ft)
530MG	3,660 m (12,000 ft)
ISA+20°C: 500MD/TOW	975 m (3,200 ft)
530MG	2,970 m (9,750 ft)
500MD/TOW, 35°C	732 m (2,400 ft)
530MG, 35°C	2,120 m (6,950 ft)

FLIR equipped McDonnell Douglas MD 520N in law enforcement configuration
1995



McDonnell Douglas MD 520N five-seat NOTAR helicopter *(Jane's/Mike Keep)*
1992

Range, 2 min warm-up, standard fuel, no reserves:	
500MD/TOW at S/L	203 n miles (376 km; 233 miles)
530MG at S/L	176 n miles (326 km; 202 miles)
500MD/TOW at 1,525 m (5,000 ft)	227 n miles (420 km; 261 miles)
530MG at 1,525 m (5,000 ft)	200 n miles (370 km; 230 miles)
Endurance with standard fuel, 2 min warm-up, no reserves:	
500MD/TOW at S/L	2 h 23 min
530MG at S/L	1 h 56 min
500MD/TOW at 1,525 m (5,000 ft)	2 h 35 min
530MG at 1,525 m (5,000 ft)	2 h 7 min

UPDATED

MCDONNELL DOUGLAS MD 520N

TYPE: Five-seat light utility helicopter with no tail rotor (NOTAR).

PROGRAMME: First flight OH-6A NOTAR testbed 17 December 1981; programme details in 1982-83 *Jane's*; extensive modifications during 1985 with second blowing slot, new fan, 250-C20B engine and MD 500E nose; flight testing resumed 12 March 1986 and completed in June, retired to US Army Aviation Museum, Fort Rucker, Alabama, October 1990. Commercial MD 520N and MD 530N NOTAR helicopters announced February 1988 and officially launched January 1989, to be powered by 335.6 kW (450 shp) 250-C20R-2 and 485 kW (650 shp) 250-C30 respectively; first flight of first MD 530N (N530NT) 29 December 1989, first flight 520N (N520NT) 1 May 1990 and first production 520N 28 June 1991; 520N certificated 13 September 1991, first production 520N (N521FB) delivered to Phoenix Police Department 31 October 1991. MD 520N set new Paris to London speed record in September 1992, at 1 hour 22 minutes 29 seconds. Now certificated in 21 countries. MD520N fleet had logged more than 45,000 flight hours by January 1995.

CURRENT VERSIONS: **MD 520N**: NOTAR version of MD 500, offering more power, higher operating altitude and greater maximum T-O weight than MD 500E. Transmission rating 280 kW (375 shp) for T-O, maximum continuous 261 kW (350 shp). Fuel capacity 235 litres (62 US gallons; 51.6 Imp gallons). *Description applies to this version.*

MD 530N: Company "has no plans" to certificate MD 530N; MD 520N fills most of its roles.

MD 600N: Stretched version, described separately.

MD 520N Defender: Military variant, being developed, including retrofit of some US Army AH/MH-6s as MH-6J (which see).

CUSTOMERS: Orders and options for more than 200 MD 520Ns, 70 delivered by January 1995. Recent customers include Los Angeles Country Sheriff's Department, which ordered nine in January 1995, three of which were delivered in June 1995, the remainder scheduled for delivery before end of 1996. By June 1995 more than 70 MD 520NS were in service with law enforcement agencies in Phoenix, Arizona, Burbank, Glendale, Huntington Beach, Ontario and San Jose, California, Hernando County, Florida, Hamilton County, Ohio, which has seven 520Ns; San Juan, Puerto Rico and Calgary, Alberta, Canada. Phoenix Police Department pioneered use of MD 520Ns for firefighting, using 341 litre (90 US gallon, 75 Imp gallon) 'Bambi' buckets to drop 151,416 litres (40,000 US gallons, 33,307 Imp gallons) of water on fires in remote desert and mountain areas.

COSTS: Original $2.2 million 24 month contract from US Army Applied Technology Laboratory and Defense Advanced Research Projects Agency (DARPA) for modification of OH-6A (65-12917). Typical cost of MD 520N $825,000.

DESIGN FEATURES: NOTAR (no tail rotor) system provides anti-torque and steering control without an external tail rotor, thus eliminating the danger of tail strikes; air emerging through Coanda slots and steering louvres is cool and at low velocity. Believed to be currently the quietest turbine helicopter, based on FAA certification test noise figures. Main rotor rpm 477, main rotor tip speed 208 m (684 ft)/s, NOTAR system fan rpm 5,388. Emergency floats among options.

McDonnell Douglas MD 530N Defender undergoing flight testing near Mesa, Arizona

1995

MD 520N of Phoenix (Arizona) Police carrying four members of a SWAT rapid reaction team

1995

FLYING CONTROLS: Unboosted mechanical, as in earlier models. Rotor downwash over tailboom deflected to port by two Coanda type slots fed with low pressure air from engine-driven variable-pitch fan in root of tailboom; this counters normal rotor torque, some of fan air is also vented at tail through variable-aperture louvres controlled by pilot's foot pedals, giving steering control in hover and forward flight. Port moving fin on tailplane connected to foot pedals, primarily to increase directional control during autorotation and allow touchdown at under 20 knots (37 km/h, 23 mph); starboard fin operated independently by yaw damper.

STRUCTURE: Same as for MD 500E/530F, except graphite composites tailboom; metal tailplane and fins, new high efficiency fan with composites blades fitted in production aircraft. NOTAR system components now have twice the lifespan of conventional tail rotor system assemblies. During 1993, NOTAR system components warranty increased from two to three years.

POWER PLANT: One Allison 250-C20R turboshaft, derated to 317 kW (425 shp) for T-O and 280 kW (375 shp) maximum continuous. Improved, heavy-duty transmission, rating 447 kW (600 shp), derated to 317 kW (425 shp) on production aircraft from June 1995.

DIMENSIONS, EXTERNAL:

Rotor diameter	8.33 m (27 ft 4 in)
Length overall, rotor turning	9.78 m (32 ft 1¼ in)
fuselage	7.77 m (25 ft 6 in)
Height to top of rotor head	
standard skids	2.74 m (9 ft 0 in)
extended skids	3.01 m (9 ft 10½ in)
Height to top of fins	2.83 m (9 ft 3½ in)
Tailplane span	2.01 m (6 ft 7¼ in)
Skid track	1.92 m (6 ft 3½ in)

AREAS:

Rotor disc	54.5 m² (586.8 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: standard	742 kg (1,636 lb)
Max fuel weight	183 kg (404 lb)
Max hook capacity	1,004 kg (2,214 lb)
Max T-O weight: normal	1,519 kg (3,350 lb)
with external load	1,746 kg (3,850 lb)
Max normal disc loading	27.87 kg/m² (5.71 lb/sq ft)
Max normal T-O power loading (from June 1995)	4.80 kg/kW (7.88 lb/shp)

PERFORMANCE (at normal max T-O weight, ISA, except where indicated):

Never-exceed speed (V_{NE})	152 kts (281 km/h, 175 mph)
Max cruising speed at S/L	135 kts (249 km/h, 155 mph)
Max rate of climb at S/L: ISA	564 m (1,850 ft)/min
ISA + 20°C	480 m (1,575 ft)/min
Service ceiling	4,320 m (14,175 ft)
Hovering ceiling IGE	2,753 m (9,034 ft)
Hovering ceiling OGE: ISA	1,537 m (5,043 ft)
ISA +20°C	1,292 m (4,241 ft)
Range at S/L	217 n miles (402 km; 250 miles)
Endurance at S/L	2 h 24 min

OPERATING NOISE LEVELS:

T-O	85.4 EPNdB
Approach	87.9 EPNdB
Flyover	80.2 EPNdB

UPDATED

McDONNELL DOUGLAS MD EXPLORER

TYPE: Eight-seat twin-engined light helicopter.

PROGRAMME: Formerly MDX and given engineering designations MD 900/901; now known simply as MD Explorer. Announced February 1988, launched January 1989. Hawker de Havilland Limited of Australia designed and manufactures airframe. Canadian Marconi tested initial version of integrated instrumentation display system (IIDS) early 1992, Kawasaki Heavy Industries completed 50 hour test of transmission early 1992. Other partners include Aim Aviation (interior), IAI (cowling and seats) and Lucas Aerospace (actuators). Ten prototypes and trials aircraft of which seven (Nos. 1, 3-7 and 9) for static tests, first flight (No.2/N900MD) 18 December 1992, followed by No.8/N900MH 17 September 1993 and No.10/N9208V 16 December 1993; first production/demonstrator Explorer (No.11/N9201I) flown 3 August 1994. FAA certification 2 December 1994, first delivery 16 December 1994.

CURRENT VERSIONS: **Explorer:** Civilian utility version, as described. **Combat Explorer:** Displayed at Paris Air Show, June 1995, demonstrator N9015P (No.15). Can be configured for utility, medevac or combat missions, armament may include seven- or 19-tube 70 mm rocket pods, 0.50 calibre machine gun pods, chin-mounted FLIR night pilotage system and roof-mounted NightHawk surveillance and targeting systems. Combat weight 3,130 kg (6,900 lb), two P&WC PW206A engines. *Details apply to civilian version with P&WC PW206A engines except where indicated.*

CUSTOMERS: Certificates of interest for about 200 by February 1995 from over 100 operators, representing planned production until 1999; market estimated at 800 to 1,000 in first decade; first delivery 16 December 1994 to Petroleum Helicopters Inc (PHI), which has ordered five Explorers; second delivery December 1995 to Rocky Mountain Helicopters for EMS duties with affiliate Care flight/REMSA in Reno, Nevada; recent customers (February 1995) include Aero Asahi of Japan (15), Japan Digital Laboratory (1) and McDonnell Douglas Helicopter Systems' Japanese distributor Tomen (1). Three built 1994, 20 intended in 1995, rising to planned annual production rate of 48 in 1997.

COSTS: Basic price about $3 million, typically equipped $3.5 million, target direct operating cost $375 (1994) per hour.

DESIGN FEATURES: NOTAR anti-torque system, all composites five-blade rotor with bearingless flexbeam retention and pitch case, tuned fixed rotor mast and mounting truss for vibration reduction, replaceable rotor tips, modified A frame construction from rotor mounting to landing skids protects passenger cabin, energy-absorbing seats absorb 20 *g* vertically and 16 *g* fore and aft, onboard health monitoring, exceedance recording and blade track/balance.

FLYING CONTROLS: NOTAR tailboom (see details under MD 520N), mechanical engine control from collective pitch lever is back up for electronic full authority digital engine control. Automatic stabilisation and autopilot offered for IFR operation.

STRUCTURE: Cockpit, cabin and tail largely carbonfibre; top fairings Kevlar composites; no magnesium, lightning strike protection embedded in composite skin. Transmission overhaul life 5,000 hours, glassfibre blades have titanium leading-edge abrasion strip and are attached to bearingless hub by carbonfibre encased glassfibre flexbeams; rotor blades and hub on condition.

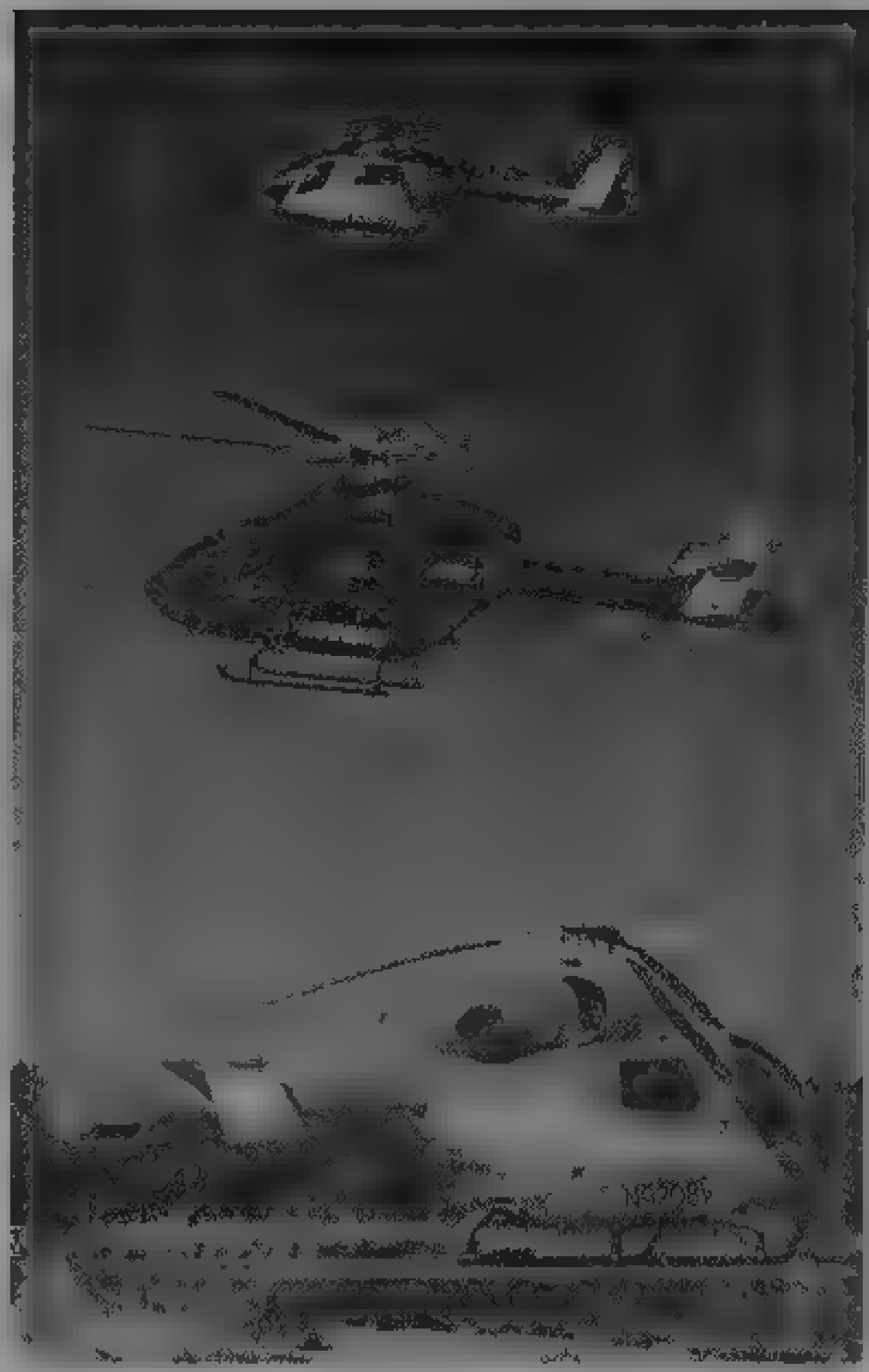
LANDING GEAR: Fixed skids with replaceable abrasion pads.

POWER PLANT: First 128 MD Explorers to be powered by two Pratt & Whitney Canada PW206Bs, each rated at 469 kW (629 shp) for 5 minutes for T-O, thereafter, will be available powered by two Turbomeca TM319 2 Arrius 2Cs, each rated at 478 kW (641 shp) for 5 minutes for T-O. Engines equipped with FADEC. Transmission rating 746 kW (1,000 shp) for 5 minutes for T-O, 671 kW (900 shp) maximum continuous, and 429 kW (575 shp) for 2½ minutes OEI.

Fuel contained in single tank under passenger cabin, useful capacity 602 litres (159 US gallons; 132.4 Imp gallons), optional 666 litres (176 US gallons; 146 Imp gallons); single-point refuelling, self-sealing fuel lines

Prototype Combat Explorer equipped with two sensors above and below cockpit and armament including rocket launcher

1995



Second (top), first and third prototypes of MD Explorer

1995

ACCOMMODATION: Two pilots or pilot/passenger in front on energy-absorbing adjustable crew seats with five-point shoulder harnesses/seat belts, six passengers in club-type energy-absorbing seating with three-point restraints, rear baggage compartment accessible through rear door; cabin can accept long loads reaching from flight deck to rear door; hinged, jettisonable door to cockpit on each side; sliding door to cabin on each side

AVIONICS: Full IFR capability for single- or two-pilot operation

Comms: Two headsets standard. Bendix/King Silver Crown VHF transceiver, audio control panel, ELT, cockpit voice recorder and Wulfsberg Flexcomm II optional

Radar: Weather radar optional

Flight: Optional equipment includes Bendix/King Silver Crown VOR/ILS, HSI, ADF, DME, marker beacon receiver, radar altimeter, Loran C and GPS. Coupled three-axis autopilot optional

Instrumentation: Single- or two-pilot instrument panels incorporate Canadian Marconi integrated instrumentation display system (IIDS) with high-resolution sunlight-readable LCD screen displaying engine and system information including engine condition trend monitoring, exceedance recording, caution annunciators, onboard track and balance of rotor and fan, weight on cargo hook, outside air temperature, digital clock, running time meter and RS-232 download modem interface for personal computer. Other standard instrumentation includes airspeed indicator, encoding altimeter, vertical speed indicator, turn and slip indicator, wet compass and clock. FFIS 40 electronic flight information system and parallel IIDS monitor for long-line hook operations from left seat optional

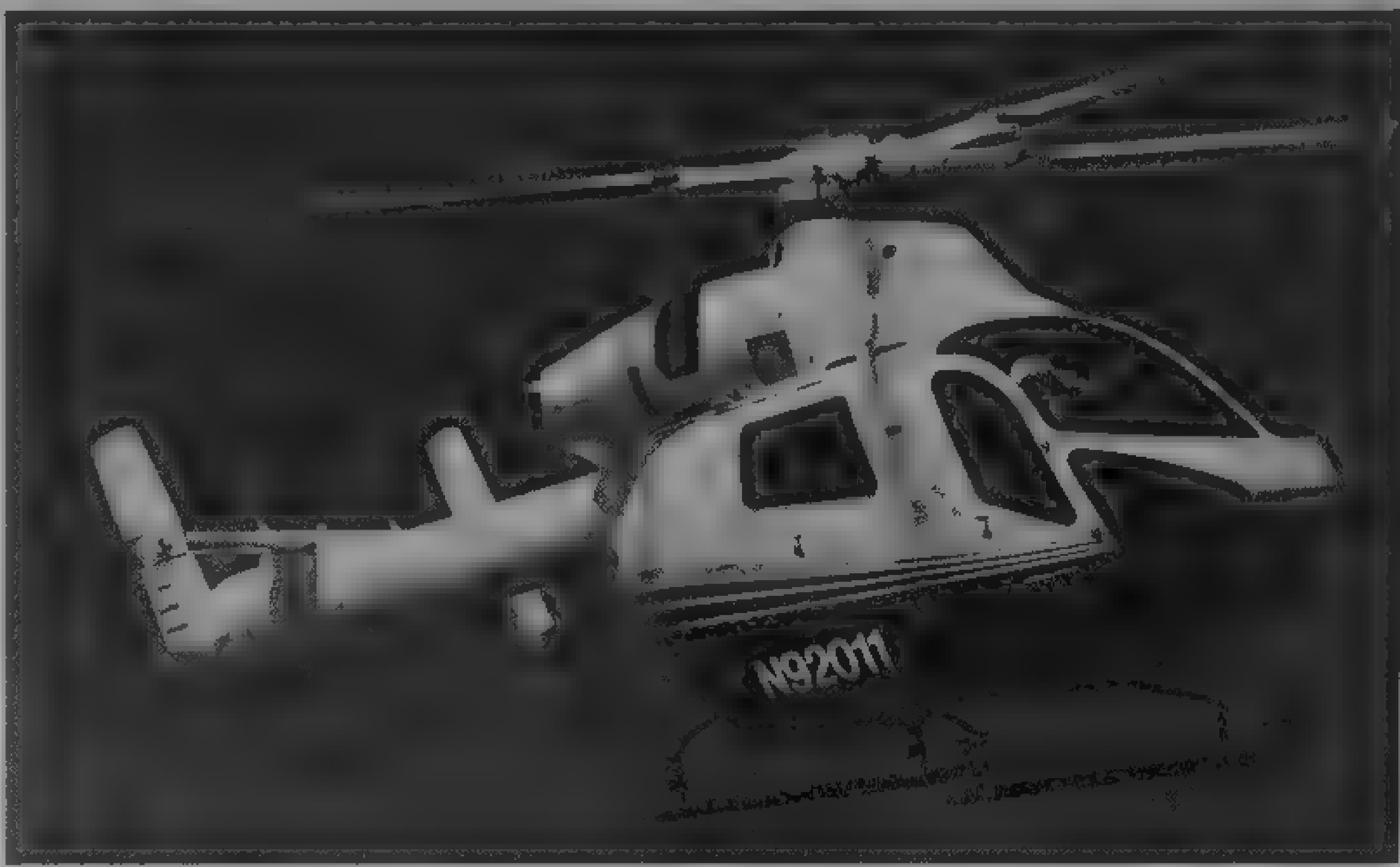
Mission: Law enforcement panel with space for FLIR screen available

EQUIPMENT: Standard equipment includes magnetic chip detectors on engines, tiedown fittings, flush-mounted cargo tiedowns, rotor blade tiedowns, right side passenger step, utility beige colour carpet, trim, wall and ceiling panels, soundproofing, tinted windows, map case, recessed hover and approach light, wander and white dome lights in cockpit, white dome light in cabin, utility light in baggage compartment, single 28 V DC power outlet each in cockpit and cabin, single colour external paint with two-colour accent stripes, FOD covers, pitot tube cover and cockpit fire extinguisher

Optional equipment includes dual controls, heated pitot head, rotor brake, pilot-activated engine fire extinguisher, engine air particle separator, maintenance hand pump for hydraulics, external cargo hook with 1,361 kg (3,000 lb) capacity, wire strike kit, emergency floats for skids, retractable landing light, left side cabin step, landing gear and rotor fairing canopy cover, heater/defogger, vapour-cycle air conditioner, upgraded soundproofing, passenger service unit with air gaspers and reading lights, window reveal panels, matching close-out panel for aft baggage area, upgraded passenger seats, smoke detector in baggage compartment, jack point fittings and ground handling wheels

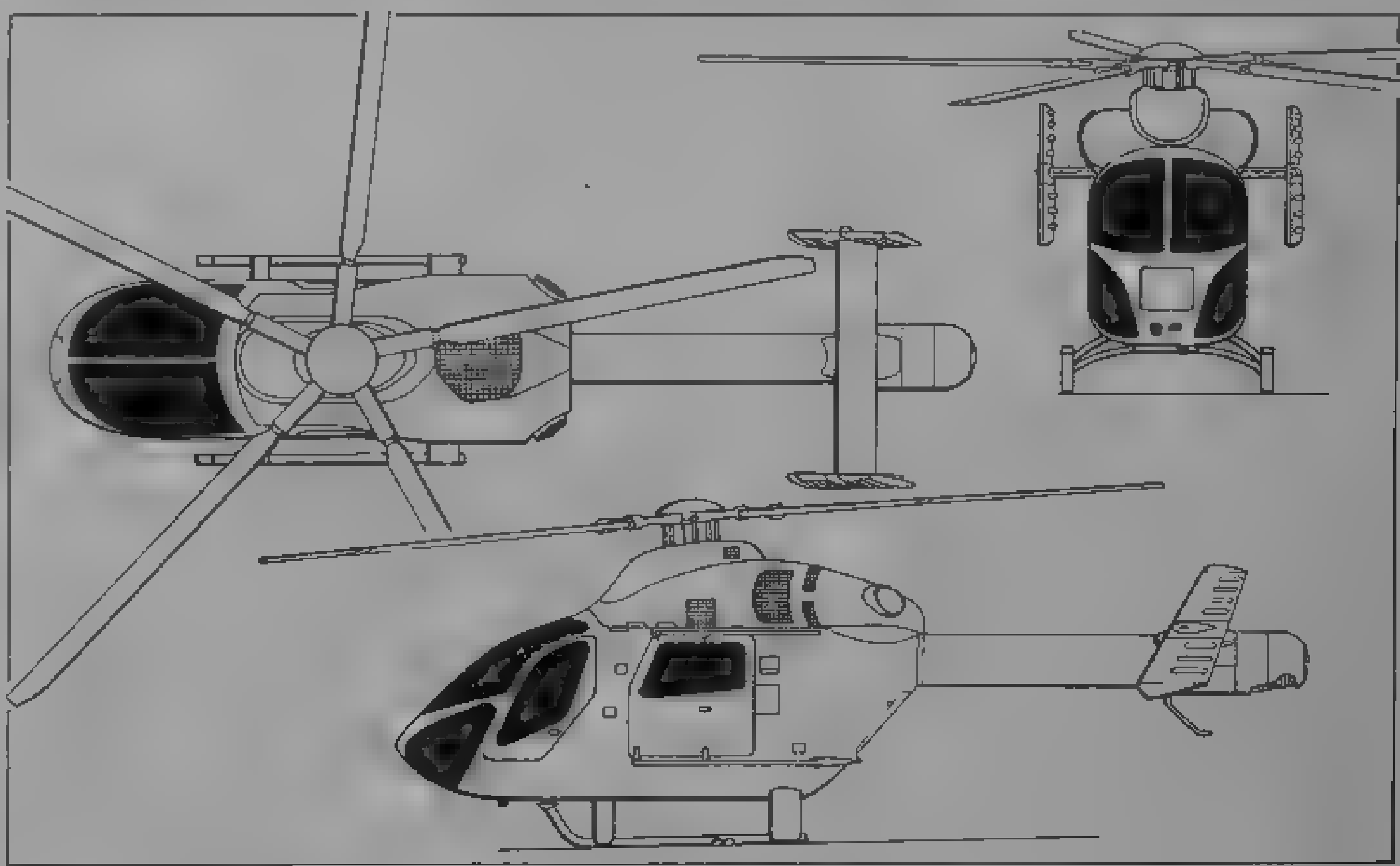
DIMENSIONS, EXTERNAL:

Rotor diameter	10.31 m (33 ft 10 in)
Length: overall, rotor turning	11.83 m (38 ft 10 in)
fuselage	9.85 m (32 ft 4 in)



Company demonstrator for McDonnell Douglas MD Explorer eight-seat twin-turboshaft helicopter

1995



McDonnell Douglas MD Explorer eight-seat commercial helicopter *(Jane's/Mike Keep)*

1995

Fuselage width at cabin	1.63 m (5 ft 4 in)
Height to top of rotor head	3.66 m (12 ft 0 in)
Height to top of fins	2.79 m (9 ft 2 in)
Min fuselage ground clearance	0.38 m (1 ft 3 in)
Tailplane span	2.84 m (9 ft 4 in)
Skid track	2.24 m (7 ft 4 in)
Cabin door width	1.27 m (4 ft 2 in)
DIMENSIONS, INTERNAL:	
Cabin: Length overall, incl baggage compartment	3.93 m (12 ft 10¾ in)
Length, passenger compartment only	1.90 m (6 ft 3 in)
Max height	1.24 m (4 ft 1 in)
Max width	1.45 m (4 ft 9 in)
Volume: Cabin	4.88 m³ (172.5 cu ft)
Baggage (if closed off)	1.46 m³ (51.4 cu ft)
AREAS:	
Rotor disc	83.52 m² (899.04 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, standard configuration	1,481 kg (3,265 lb)
Usable fuel load	438-472 kg (965-1,041 lb)
Max internal payload	1,163 kg (2,565 lb)
Max slung load	1,361 kg (3,000 lb)
Max T-O weight: internal load	2,722 kg (6,000 lb)
slung load	3,057 kg (6,740 lb)
Max disc loading:	
internal load	32.32 kg/m² (6.62 lb/sq ft)
slung load	36.33 kg/m² (7.44 lb/sq ft)
Max power loading:	
internal load	3.65 kg/kW (6.00 lb/shp)
slung load	4.10 kg/kW (6.74 lb/shp)

PERFORMANCE (at max T-O weight, ISA. A: PW206B, B: Arrius 2C):

Never-exceed speed (VNE) at S/L, ISA	160 kts (296 km/h; 184 mph)
Max cruising speed at S/L, 38°C (100°F)	145 kts (267 km/h; 167 mph)
Max rate of climb at S/L	853 m (2,800 ft)/min
Vertical rate of climb at S/L	411 m (1,350 ft)/min
Rate of climb at S/L, OEI	305 m (1,000 ft)/min
Service ceiling: both engines	
A	5,490 m (18,000 ft)
B	5,640 m (18,500 ft)
OEI	
A	3,200 m (10,500 ft)
B	3,350 m (11,000 ft)
Hovering ceiling:	
IGE, ISA	
A	3,900 m (12,800 ft)
B	4,130 m (13,550 ft)
IGE, ISA + 20°C	
A	2,910 m (9,550 ft)
B	2,970 m (9,750 ft)
OGE, ISA	
A	3,445 m (11,300 ft)
B	3,625 m (11,900 ft)
OGE, ISA + 20°C	
A	2,165 m (7,100 ft)
B	2,240 m (7,350 ft)
Hovering ceiling, OEI:	
IGE, ISA at 87% max T-O weight	1,220 m (4,000 ft)
Max range at 1,525 m (5,000 ft), ISA	286-315 n miles (529-584 km; 329-363 miles)
Max endurance	3 h 18 min-3 h 30 min
OPERATING NOISE LEVELS:	
T-O	84.1 EPNdB
Approach	88.9 EPNdB
Flyover	81.9 EPNdB

Prototype McDonnell Douglas MD 600N eight-seat helicopter *1995*

MD 600N prototype with MD 520N (of which it is a stretched derivative) above *1995*

MCDONNELL DOUGLAS MD 600N

TYPE: Single-turboshaft light helicopter, stretched version of MD 520N.

PROGRAMME: Announced as 'concept', 8 November 1994; prototype, then known as MD 630N, (N630N, converted from MD 530F demonstrator) first flight 22 November 1994, 138 days after project approval; public debut at Heli Expo in Las Vegas January 1995; production go-ahead 28 March 1995, at which time designation changed to MD 600N; prototype had flown 35 hours by June 1995; second prototype then under construction, to fly before end 1995. FAA certification and first customer deliveries in second half of 1996.

CUSTOMERS: Launch customer AirStar Helicopter of Arizona (two); orders for first year's production (total unspecified) received on day of public debut; Saab Helikopter AB of Sweden and Rotair Limited of Hong Kong ordered one each in June 1995, for 1997 delivery; market estimated at 150 to 180 by 2000.

COSTS: Target direct operating cost $234 (1995) per hour.

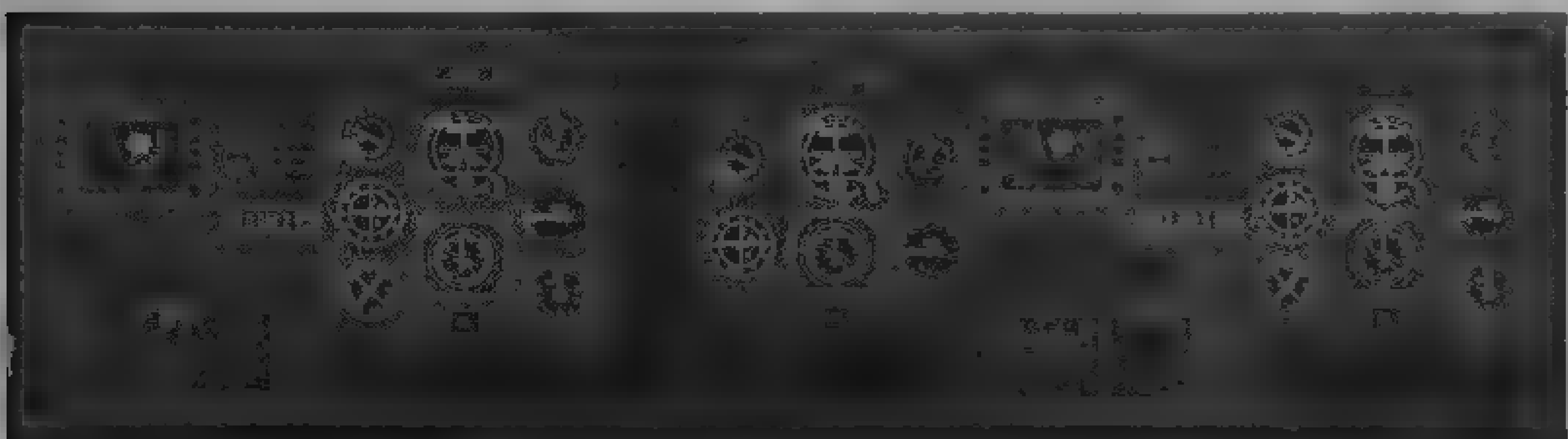
DESIGN FEATURES: Stretched MD 520N airframe (less than 1 per cent new parts) by means of 0.76 m (2 ft 6 in) plug aft of cockpit/cabin bulkhead and 0.71 m (2 ft 4 in) plug in tailboom, combined with more powerful engine, uprated transmission and six-blade main rotor. Cabin has flat floor to assist cargo handling, and will feature quick-change interior configurations to suit multiple-use operators. Intended for civil, utility, offshore, executive transport, medevac, touring, law enforcement and other noise-sensitive operations, also adaptable for armed scout, utility and other military missions.

Description generally as for MD 520N except as follows:

POWER PLANT: One 485 kW (650 shp) Allison 250-C47 turboshaft, derated to 447 kW (600 shp) for T-O and 429 kW (575 shp) maximum continuous, with FADEC. Transmission rating 447 kW (600 shp). Fuel capacity 454 litres (120 US gallons; 100 Imp gallons), in underfloor tank.

ACCOMMODATION: Seating capacity for eight persons including pilot. Two side-opening 'accordion' type doors to passenger cabin on each side, single door to cockpit on starboard side.

WEIGHTS AND LOADINGS:	
Weight empty	875 kg (1,930 lb)
Useful load: internal	984 kg (2,170 lb)
external	1,247 kg (2,750 lb)
Max hook capacity	1,361 kg (3,000 lb)
Max T-O weight: internal load	1,859 kg (4,100 lb)
slung load	2,204 kg (4,860 lb)



Alternative single- (left) and dual-pilot instrument panels available for MD Explorer *1995*

PERFORMANCE (provisional):
Never exceed speed (VNE) 152 kts (282 km/h; 175 mph)
Max cruising speed, S/L to 1,525 m (5,000 ft), ISA
134 kts (248 km/h; 154 mph)
Max rate of climb at S/L, ISA 518 m (1,700 ft)/min
Max operating altitude 6,100 m (20,000 ft)
Hovering ceiling, ISA: IGE 3,200 m (10,500 ft)
OGE 2,070 m (6,800 ft)
Max range 400 n miles (740 km; 460 miles)
Endurance 3 h 42 min

NEW ENTRY

OTHER AIRCRAFT

In March 1994, agreement reached with Anglo-Italian EHI (see International section) for McDonnell Douglas to define an **EHI EH 101** variant to meet US armed forces' medium-lift helicopter requirements. Available, if selected, from 1999; production at Mesa.

UPDATED

DOUGLAS AIRCRAFT COMPANY (Division of McDonnell Douglas Corporation)

HEADQUARTERS: 3855 Lakewood Boulevard, Long Beach, California 90846
Telephone: 1 (310) 593 5511
Fax: 1 (310) 496 8720
Telex: 674357
PRESIDENT: Robert H. Hood Jr
DEPUTY PRESIDENT: Ed Bavaria
EXECUTIVE VICE-PRESIDENT (OPERATIONS AND PRODUCTION): John J. Van Gels
EXECUTIVE VICE-PRESIDENT (DEVELOPMENT): John D. Wolf
VICE-PRESIDENTS:
Donald V. Black (Airline Financing)
Peter K. Chapman (President, DAC China)
John H. Feren (Marketing)
Allen C. Haggerty (Design and Technology)
Gary J. Hedges (Human Resources and Internal Communications)
James R. Jensen (Product Support)
Leroy A. Keith (Quality)
Ronald L. O'Kelley (Chief Financial Officer)
Thomas C. Moore (Contracts)
Walter J. Orlowski (Marketing and Business Development)
James R. Phillips (MD-95)
Stephen J. Pohl (Supplier Management)
Grace M. Robertson (MD-90)
GENERAL MANAGERS:
Doug Jacobsen (Customer Relations and External Communications)
Jody Martin (Human Resources and Internal Communications)

Douglas delivered 976 DC-9s up to 1982 and its 2,000th twin-jet airliner, an MD-80 to American Airlines, on 11 June 1992. Plan to sell up to 49 per cent of Douglas to Taiwan Aerospace during 1992 and jointly develop MD-12 did not materialise. Douglas still willing to consider an airliner manufacturing alliance, but airliner business is again profitable.

Douglas reduced workforce from between 40,000 and 43,000 in 1990, before military C-17 was reassigned, to around 11,000 by end of 1994; productivity increased so that man-hours to produce an MD-11 reduced from 300,000 in 1991 to 140,000 by end 1994, and for a twin-jet from 100,000 to 50,000; MD-90 modular manufacturing system applied also to MD-80 during 1993; company can therefore remain viable while producing fewer than 30 twin-jets a year, compared with 136 needed in 1989, and around 30 tri-jets a year. Company can fund own development of forthcoming derivatives MD-90-50 and MD-11ER, but development of MD-XX and MD-12 at a standstill, awaiting market upturn.

DOUGLAS AIRLINER ORDERS AND DELIVERIES

Order backlog at 1 January 1995

	Firm	Other*	Total
MD-11	45	85	130
MD-80 Series	48	55	103
MD-90	74	78	152

Order backlog at 1 January 1994

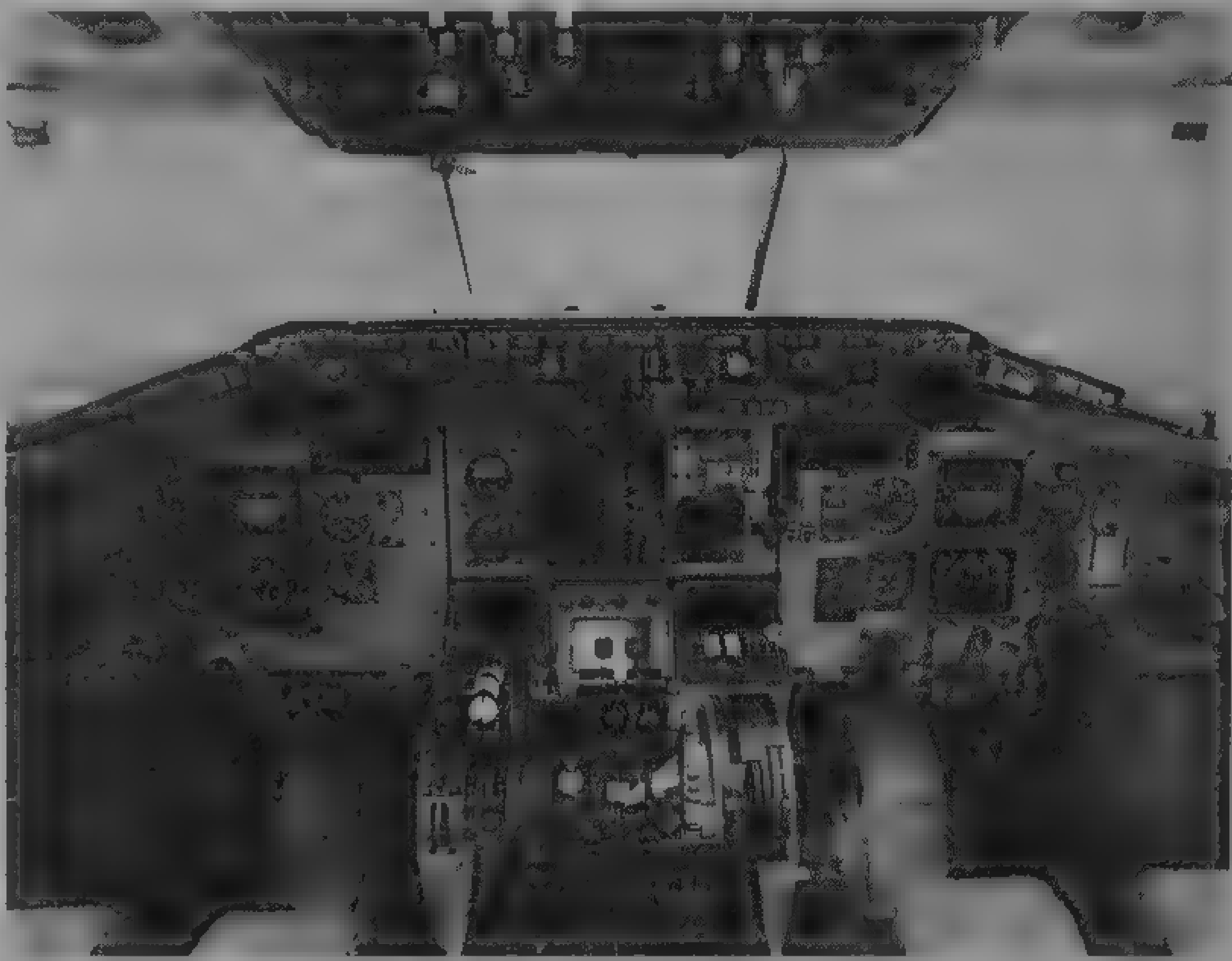
	Firm	Other*	Total
MD-11	60	101	161
MD-80 Series	66	81	147
MD-90	77	104	18

1994 Orders		Net after changes
MD-11	5	3
MD-80 Series	9	4
MD-90	9	(3)

1994 Deliveries		Cumulative Total
MD-11	17	129
MD-80 Series	22	1,111
MD-90	0	0

Notes: Including Trunkliner
*'Other' includes options and reserved positions

UPDATED



McDonnell Douglas MD-80 series modern flight deck with EFIS panels, two flight management system control displays on centre console, weather radar screen, LED engine indicators and autopilot controls in the glareshield

1994

MCDONNELL DOUGLAS MD-80 SERIES

TYPE: Twin-turbofan short/medium-range airliner.

PROGRAMME: Began as Super 80 higher capacity variant of DC-9; first flight 18 October 1979; first flight of second and third prototypes (N1002G and N1002W) 6 December 1979 and 29 February 1980 respectively; FAA certification 26 August 1980; first delivery, to Swissair, 12 September 1980.

CURRENT VERSIONS: **MD-81:** Basic version with maximum seating for 172 passengers; P&W JT8D-209 engines with automatic power reserve; two-man crew; maximum five-abreast passenger seating.

MD-82: Announced 16 April 1979; powered by P&W JT8D-217s for hot and high performance and increased payload/range; same size cabin as MD-81 and -83; first flight 8 January 1981, certificated 31 July 1981 at maximum T-O weight 66,680 kg (147,000 lb); in service August 1981; same fuel capacity and landing weight as MD-81. Second version, certificated mid-1982, has JT8D-217As and higher maximum T-O weight.

Chinese MD-82: Agreement signed 12 April 1985 for assembly by Shanghai Aviation Industrial Corporation (see SAMF in Chinese section) of 25 out of 26 MD-82s ordered by China, another five MD-82s and five MD-83s approved April 1990; US built first aircraft delivered 30 September 1985; first flight of SAMF assembled MD-82 2 July 1987, in service 4 August 1987; second aircraft delivered 18 December 1987. FAA certificate extended to Chinese built aircraft 9 November 1987; 27 MD-82s delivered by SAMF by end 1992 (plus five MD-83, see Trunkliner below). Douglas interests vested in McDonnell Douglas Pacific & Asia Ltd; SAMF assembles aircraft and makes tailplane and landing gear doors; Chengdu Aircraft Industrial Corporation is second source for nose sections for China and USA (see also Trunkliner variant).

MD-83: Extended-range version powered by JT8D-219s, announced 31 January 1983, 2 per cent lower fuel consumption than -217As, two extra fuel tanks in cargo compartment. Passenger capacity same as MD-81 and -82. First flight 17 December 1984, FAA certification 1985, in service Alaska Airlines and Finnair early 1986; on 14 November 1985, Finnair MD-83 made longest MD-80 flight covering 3,406 n miles (6,308 km; 3,920 miles) from Montreal to Helsinki in 7 hours 26 minutes; first revenue transatlantic service flown by Transwede between Stockholm and Fort Lauderdale, Florida, with stops at Oslo and Gander. Five MD-83s built in China by SAMF (see MD-82 entry above) completed first quarter 1993.

MD-87: Short fuselage version for maximum 139 single-class passengers, fin height increased, powered by JT8D-217Cs with 2 per cent lower fuel consumption than 217As, other -200 series engines available; first flight 4 December 1986, certificated 21 October 1987; first deliveries to Finnair and Austrian Airlines; optional front and rear cargo compartment auxiliary fuel tanks each hold 2,139 litres (565 US gallons; 470.5 Imp gallons). MD-87 has MD-80 cruise performance improvement package including fillet fairing between engine pylons and fuselage, fairing on APU, improved sealing on horizontal tail, low-drag flap hinge fairings, and extended low-drag tailcone. MD-87 also first of series with EFIS, AHRS and HUD as standard.

MD-88: Combines JT8D-219 power plant with EFIS cockpit displays, flight management system, onboard windshear detection system and increased use of composites in structure. Redesigned cabin interior for 142 passengers (14 first/128 coach class) five-abreast; wider aisle; redesigned overhead bins. First flight 15 August 1987, FAA certification 9 December 1987; entered service 5 January 1988 with principal customer Delta Air Lines (125 ordered).

MD-80/90 Trunkliner: Agreement worth $1,000 million signed 25 June 1992 to produce three MD-82, 17 MD-82T and 20 MD-90-30T Trunkliners in China (which see under SAMF heading), but renegotiated mid-1994, and amended $1,600 million contract signed 4 November 1994 for first 20 aircraft, a mix of MD-80s and MD-90s, to be built by Douglas. Chengdu Aircraft Industrial Corporation making nose sections, passenger and pilot doors and airstairs and airstair doors for Trunkliners and US built MD-80/90s, Shenyang will be responsible for assembly of tail surfaces, incorporating SAMF tailplanes and elevators, electrical wiring, radio racks and electrical power centres and Xian will make forward fuselages and wings, offset work to be offered on IAE V2500 engines. Further discussions planned for 1995 could lead to 130 additional MD-90Ts. MD-82/90Ts were to have dual tandem landing gear with four-wheel bogies designed jointly by Douglas and Shanghai Aircraft Research Institute of CATIC under separate contract signed in 1990, gear proved unnecessary and development discontinued; first MD-90 Trunkliner to be delivered in 1997.

MD-80 Executive Jets: Corporate and executive versions of MD-83 and MD-87 offered, typically seating 20 passengers, MD-83 maximum range 4,100 n miles (7,593 km; 4,718 miles), MD-87 maximum range 4,500 n miles (8,334 km; 5,178 miles).

McDonnell Douglas MD-81, MD-82, MD-83 and MD-88 are externally identical

1994

CUSTOMERS: For order backlogs and deliveries, see table on earlier page. 1,000th delivered 23 March 1992. Operators include, but are not limited to: Adria Airways, Aero Cancun, Aero Lloyd, Aerolineas Argentinas, Aeromexico, Aeropostal, Air Aruba, Air Liberté, Air Liberté Tunisia, Airtours, Alaska Airlines, Alitalia, ALM Antillean Airlines, American Airlines, AOM-Minerve, ATI, Austrian Airlines, Austral, Aviaco, Avianca, Balair, Beiya Airlines, Centennial Airlines, China Eastern, China Northern, Continental, CTA, Delta Air Lines, Eagle Airlines, Eurofly, Far Eastern Air Transport, Finnair, Great American Airways, Iberia, Japan Air System, Korean Air, Meridiana Italy, Midwest Express, National Airlines, Nordic East Airlines, North American Airlines, Northwest, Oasis, Reno Air, SAS, Spanair, Sun Jet International, Swissair, Transwede, Trinidad & Tobago, TWA, USAir, Venus Air and ZAS Airline of Egypt.

DESIGN FEATURES: MD-80 has DC-9 wing span increased by centre-section plugs and 0.61 m (2 ft 0 in) wingtip extensions; fuselage extended by plugs fore and aft of wing; larger wing holds more fuel, wingtip winglets tested and rejected in early 1994; systems improvements include digital integrated flight guidance and control system, 'dial a flap' control for more accurate flap settings, flow-through cooling of avionics compartment, larger capacity APU, recirculation of ventilating air, and advanced digital fuel gauging system. Performance management system similar to that of DC-10 standard from April 1983, optional flight management system giving horizontal and vertical guidance. Other features include increased use of composites such as Kevlar wing/fuselage fillets introduced 1983. Flight deck changes include advanced AHRS, optional Honeywell EFIS, flat LED displays, alternative flight management systems, and Honeywell windshear guidance system (certificated June 1989; now standard on all new MD-80s and retrofittable).

Wing sweepback at quarter-chord 24° 30', mean thickness/chord ratio 11.0 per cent, dihedral 3°, incidence 1° 15'.

FLYING CONTROLS: Manual ailerons, elevators with assister tabs, electrically actuated variable incidence tailplane; hydraulically actuated rudder with manual standby; automatic landing available; full-span, three-position leading-edge slats; three spoilers per wing, of which outboard two for flight and ground braking and one for lift dumping; hydraulically actuated double-slotted flaps cover 67 per cent of span; one underwing vortillon fence on each wing.

STRUCTURE: All metal two-spar wing with riveted spanwise stringers; glassfibre trailing edges on wings, ailerons, flaps, elevators and rudder; detachable wingtips, most of cabin floor made of balsa or Nomex core sandwich; engine pylons by Calcor and fuselage panels by Alenia.

LANDING GEAR: Retractable tricycle type of Cleveland Pneumatic manufacture, with steerable nosewheels (±27° on MD-81/82/87/88, ±25° on MD-83). Hydraulic retraction, nose unit forward, main units inward. Twin Goodyear wheels and tyres on each unit. Mainwheel tyres size 44.5 × 16.5-20, pressure 11.38 bars (165 lb/sq in). Nosewheel tyres size 26 × 6.6-14, pressure 10.34 bars (150 lb/sq in). Goodyear disc brakes. Hydro-Aire Mk IIIA anti-skid units. Douglas ram air brake cooling. Minimum ground turning radius, MD-81/82/83/88 about nosewheel 22.43 m (73 ft 7¼ in); MD-87 about nosewheel 19.54 m (64 ft 1¼ in), MD-81/82/83/88 about wingtip 20.04 m (65 ft 9 in), MD-87 about wingtip 19.63 m (64 ft 5 in).

POWER PLANT: Two Pratt & Whitney JT8D-209 turbofans in MD-81, pod mounted one each side of rear fuselage, and each rated at 82.3 kN (18,500 lb st), with emergency thrust reserve of 3.34 kN (750 lb). MD-82 has JT8D-217s, each rated at 89 kN (20,000 lb st), with emergency thrust reserve of 3.78 kN (850 lb), or -217As of similar rating. MD-83 has JT8D-219 engines of 93.4 kN (21,000 lb st) with thrust reserve of 3.11 kN (700 lb). MD-87 has JT8D-217C engines of 89 kN (20,000 lb st), with an emergency thrust reserve of 3.78 kN (850 lb). MD-88 has 93.4 kN (21,000 lb st) JT8D-219 turbofans with thrust reserve of 3.1 kN (700 lb). Target type thrust reversers.

Standard fuel capacity in MD-81/82/87/88 is 21,876 litres (5,779 US gallons, 4,812 Imp gallons), increased in MD-83 (and, optionally, MD-87) to 26,260 litres (6,939 US gallons, 5,778 Imp gallons) by two 2,195 litre (580 US gallon, 483 Imp gallon) auxiliary tanks in cargo compartment. Pressure refuelling point in starboard wing leading-edge. Overwing gravity refuelling points.

ACCOMMODATION: Crew of two and observer seat on flight deck, plus cabin attendants. Seating arrangements are optional to meet specific airline requirements, maximum optional seating capacity is for 172 passengers (130 in MD-87). Fully pressurised and air conditioned, one toilet forward on port side, two at rear of cabin, provisions for galley at each end of cabin. Passenger door at front of cabin on port side, with built-in electrically operated airstairs, and rear hydraulically operated ventral stairway, are standard; whole tailcone can be jettisoned to allow emergency exit over retracted rear ventral stairway. Servicing and emergency exit doors at starboard forward end and port rear end of cabin. Three cargo doors for underfloor holds on starboard side. Overwing emergency exits, two each side.

SYSTEMS: AiResearch dual air cycle air conditioning and pressurisation system utilising engine bleed air, maximum differential 0.54 bar (7.77 lb/sq in). Two separate 207 bar (3,000 lb/sq in) hydraulic systems for operation of spoilers, flaps, slats, rudder, landing gear, nosewheel steering, brakes, thrust reversers and ventral stairway. Maximum flow rate 30.3 litres (8 US gallons, 6.7 Imp gallons)/min. Airless bootstrap type reservoirs, output pressure 2.07 bars (30 lb/sq in). Pneumatic system, for air conditioning/pressurisation, engine starting and ice protection, utilises 8th or 13th stage engine bleed air and/or APU. Electrical system includes three 40 kVA 120/208 V three-phase 400 Hz alternators, two engine-driven, one driven by APU. Oxygen system of diluter demand type for crew on flight deck, continuous flow chemical canister type with automatic mask presentation for passengers. Anti-icing of wing, engine inlets and tailplane by engine bleed air. Electric windscreen de-icing. Thermal anti-icing of leading-edges. TDG Aerospace NOFOD heater panel certificated by FAA as means of preventing 'cold corner' in inner wing fuel tank from forming ice on wing skin and shedding it into engine intakes. APU provides pneumatic and electrical power on ground, and electrical power in flight.

AVIONICS: Dual Honeywell integrated digital flight systems.

Radar: Colour weather radar standard.

Flight: Dual Honeywell flight management systems (FMS), Cat IIIa autoland, autopilot and stability augmentation, performance management system, speed command with digital full-time autothrottles, thrust rating indicator, dual Honeywell air data systems, Sundstrand HUD optional.

DIMENSIONS, EXTERNAL (all versions, except as indicated):

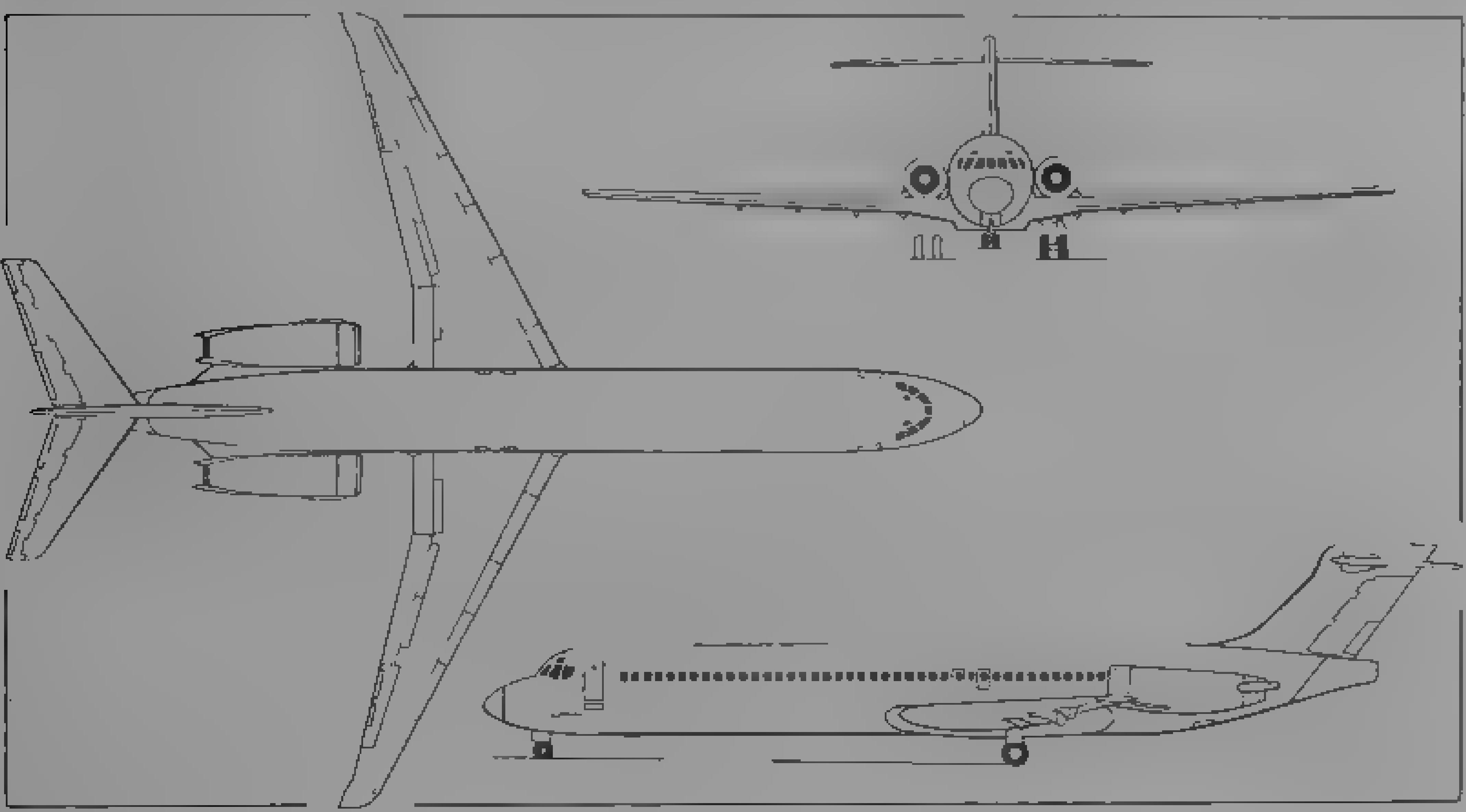
Wing span	32.87 m (107 ft 10¼ in)
Wing chord, at root	7.05 m (23 ft 1¼ in)
at tip	1.10 m (3 ft 7¼ in)
Wing aspect ratio	9.62
Length overall: except MD-87	45.06 m (147 ft 10 in)
MD-87	39.75 m (130 ft 5 in)
Length of fuselage:	
except MD-87	41.30 m (135 ft 6 in)
MD-87	36.30 m (119 ft 1 in)
Fuselage: max diameter	3.61 m (11 ft 10 in)
Height overall: except MD-87	9.19 m (30 ft 2 in)
MD-87	9.50 m (31 ft 2 in)
Tailplane span	12.24 m (40 ft 2 in)
Wheel track	5.08 m (16 ft 8 in)
Wheelbase: except MD-87	22.07 m (72 ft 5 in)
MD-87	19.18 m (62 ft 11 in)
Passenger door (port, fwd):	
Height	1.83 m (6 ft 0 in)
Width	0.86 m (2 ft 10 in)
Height to sill	2.36 m (7 ft 9 in)
Service door (stbd, fwd): Height	1.22 m (4 ft 0 in)
Width	0.69 m (2 ft 3 in)
Height to sill	2.36 m (7 ft 9 in)
Service door (port, rear): Height	1.52 m (5 ft 0 in)
Width	0.69 m (2 ft 3 in)
Height to sill	2.82 m (9 ft 3 in)
Freight and baggage hold doors:	
Height	1.27 m (4 ft 2 in)
Width	1.35 m (4 ft 5 in)
Height to sill: fwd	1.47 m (4 ft 10 in)
centre	1.42 m (4 ft 8 in)
rear	1.65 m (5 ft 5 in)
Rear cargo door (MD-87): Height	1.27 m (4 ft 2 in)
Width	0.91 m (3 ft 0 in)
Height to sill	1.65 m (5 ft 5 in)
Emergency exits (overwing, port and stbd):	
Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck, incl toilets:	
Length	30.78 m (101 ft 0 in)
Max width	3.14 m (10 ft 3¾ in)
Max height	2.06 m (6 ft 9 in)
Floor area	89.65 m² (965.0 sq ft)
Volume	191.9 m³ (6,778 cu ft)
Freight holds (underfloor, MD-81/82):	
fwd	12.29 m³ (434.0 cu ft)
centre	10.65 m³ (376.0 cu ft)
rear	12.54 m³ (443.0 cu ft)
Freight holds (underfloor, MD-83 with extra fuel tanks):	
total	28.7 m³ (1,013 cu ft)
Freight holds (underfloor MD-87):	
total	26.6 m³ (938 cu ft)
with extra fuel tanks	19.7 m³ (695 cu ft)

AREAS:

Wings, gross	115.1 m² (1,239 sq ft)
Ailerons (total)	3.53 m² (38.0 sq ft)



McDonnell Douglas MD-87, a short-fuselage variant of the MD-80 series airliners *(Jane's/Dennis Punnett)*

1993

Fin, excl dorsal fin (except -87) 9.51 m² (102.4 sq ft)
Rudder 6.07 m² (65.3 sq ft)
Tailplane 29.17 m² (314.0 sq ft)

WEIGHTS AND LOADINGS:
Operating weight empty: -81 35,329 kg (77,888 lb)
-82, -88 35,369 kg (77,976 lb)
-83 optional fuel 36,145 kg (79,686 lb)
-87 standard fuel 33,237 kg (73,274 lb)
-87 optional fuel 33,965 kg (74,880 lb)
Fuel load:
-81, -82, -87 standard 17,763 kg (39,162 lb)
-83, -87 optional 21,216 kg (46,773 lb)
Max structural payload:
-81 18,194 kg (40,112 lb)
-82, -88 19,969 kg (44,024 lb)
-83 optional fuel 19,193 kg (42,314 lb)
-87 standard 17,566 kg (38,726 lb)
-87 optional fuel 16,837 kg (37,120 lb)
Max T-O weight: -81 (-217 engines), -87 standard 63,505 kg (140,000 lb)
-81 (-217A engines), -82, -87 optional, -88 standard 67,810 kg (149,500 lb)
-83 optional 72,575 kg (160,000 lb)
Max zero-fuel weight: -81 53,525 kg (118,000 lb)
-82, -83 55,340 kg (122,000 lb)
-87 standard and optional 50,800 kg (112,000 lb)
Max landing weight:
-81, -87 standard 58,060 kg (128,000 lb)
-82, -87 optional, -88 58,965 kg (130,000 lb)
-83 optional 63,275 kg (139,500 lb)
Max wing loading:
-81, -87 standard 534.6 kg/m² (109.5 lb/sq ft)
-82, -87 optional, -88 standard 574.7 kg/m² (117.7 lb/sq ft)
-83, -88 optional 615.0 kg/m² (126.0 lb/sq ft)
Max power loading: -81 385.8 kg/kN (3.78 lb/lb st)
-82, -87 optional, -88 381.0 kg/kN (3.74 lb/lb st)
-83 optional 388.5 kg/kN (3.81 lb/lb st)
-87 standard 356.8 kg/kN (3.50 lb/lb st)

PERFORMANCE (at max T-O weight except where indicated):
Max level speed: all 500 knots (925 km/h; 575 mph)
Max cruising speed: all Mach 0.80
Normal cruising speed: all Mach 0.76
FAA T-O field length: -81 2,210 m (7,250 ft)
-82 2,270 m (7,450 ft)
-83 2,552 m (8,375 ft)
-87 1,859 m (6,100 ft)
FAA landing field length, at max landing weight:
-81 1,478 m (4,850 ft)
-82 1,500 m (4,920 ft)
-83 1,585 m (5,200 ft)
-87 1,429 m (4,690 ft)
Range with max fuel:
-87 standard 2,980 n miles (5,522 km; 3,431 miles)
-87 optional 3,650 n miles (6,764 km; 4,203 miles)
Range (-81, -82, -83 with 155 passengers, domestic reserves, -87 with 130 passengers, domestic reserves):
-81 1,564 n miles (2,897 km; 1,800 miles)
-82 2,050 n miles (3,798 km; 2,360 miles)
-83 2,502 n miles (4,635 km; 2,880 miles)
-87 standard 2,372 n miles (4,393 km; 2,730 miles)
-87 optional 2,833 n miles (5,248 km; 3,261 miles)

OPERATIONAL NOISE LEVELS (FAR Pt 36):
T-O: -81, -82, -83 90.4 EPNdB
-87 estimated 88.7 EPNdB
Sideline: -81, -82, -83 94.6 EPNdB
-87 estimated 92.8 EPNdB
Approach: -81, -82, -83 93.3 EPNdB
-87 estimated 93.3 EPNdB

UPDATED

McDONNELL DOUGLAS MD-90

TYPE: Stretched MD-80 follow-on, powered by IAE V2500 turbofans.

PROGRAMME: Launched 14 November 1989; first flight of T1 prototype (N901DC) 22 February 1993; second aircraft (N902DC) made first flight three weeks early on 27 August 1993 and was used for avionics and systems tests, including automatic landing; first production aircraft flown 20 September 1994, three days ahead of schedule; FAA certification achieved 16 November 1994, by which time three MD-90s had flown 1,906 flight tests hours in 1,450 flights; first delivery, N902DA (-30 version; 2,094th of DC-9/MD-80/MD-90 family) to Delta Air Lines, 24 February 1995; service entry 1 April 1995 on Dallas/Fort Worth - Newark, New Jersey route.

CURRENT VERSIONS: **MD-90-30**: Has MD-80 fuselage lengthened by 1.45 m (4 ft 9 in) ahead of wing, same enlarged tail surfaces as MD-87, powered elevators, 153 two-class passengers, five-abreast; maximum 172 passengers limited by exit doors and hatches, two IAE V2525-D5 turbofans.
Details below apply mainly to this version.

MD-90-30 Trunkliner: 20 ordered for assembly and delivery by Shanghai Aviation Industrial Corporation (SAIC) 25 June 1992; first delivery 1998 (see MD-80/90 Trunkliner entry).

MD-90-50: Provides 700 n miles (1,296 km; 805 miles) more range at same payload, maximum T-O weight increased to 78,245 kg (172,500 lb); wing, fuselage, tail surfaces, landing gear, wheels and brakes reinforced; provision for up to 6,738 litres (1,780 US gallons; 1,482 Imp gallons) of additional fuel; IAE V2528-D5 engines giving 124.5 kN (28,000 lb st) each.

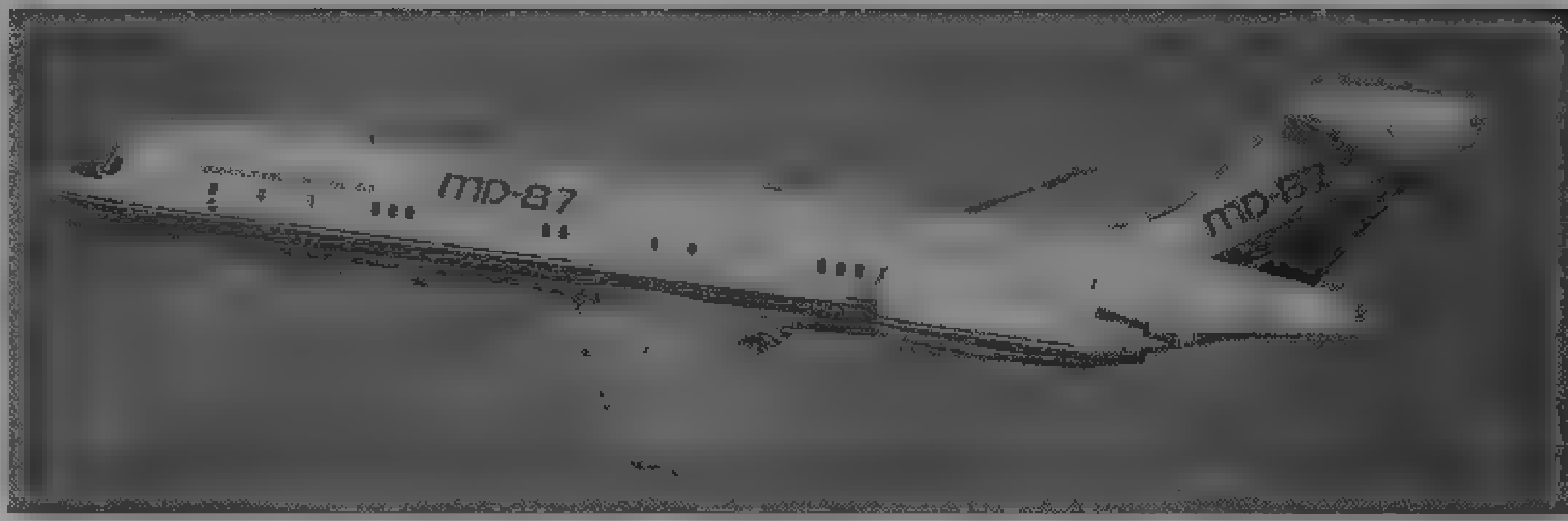
MD-90-55: Similar to MD-90-50 but with extra pair of doors in forward fuselage section to allow maximum 187 charter class passengers.

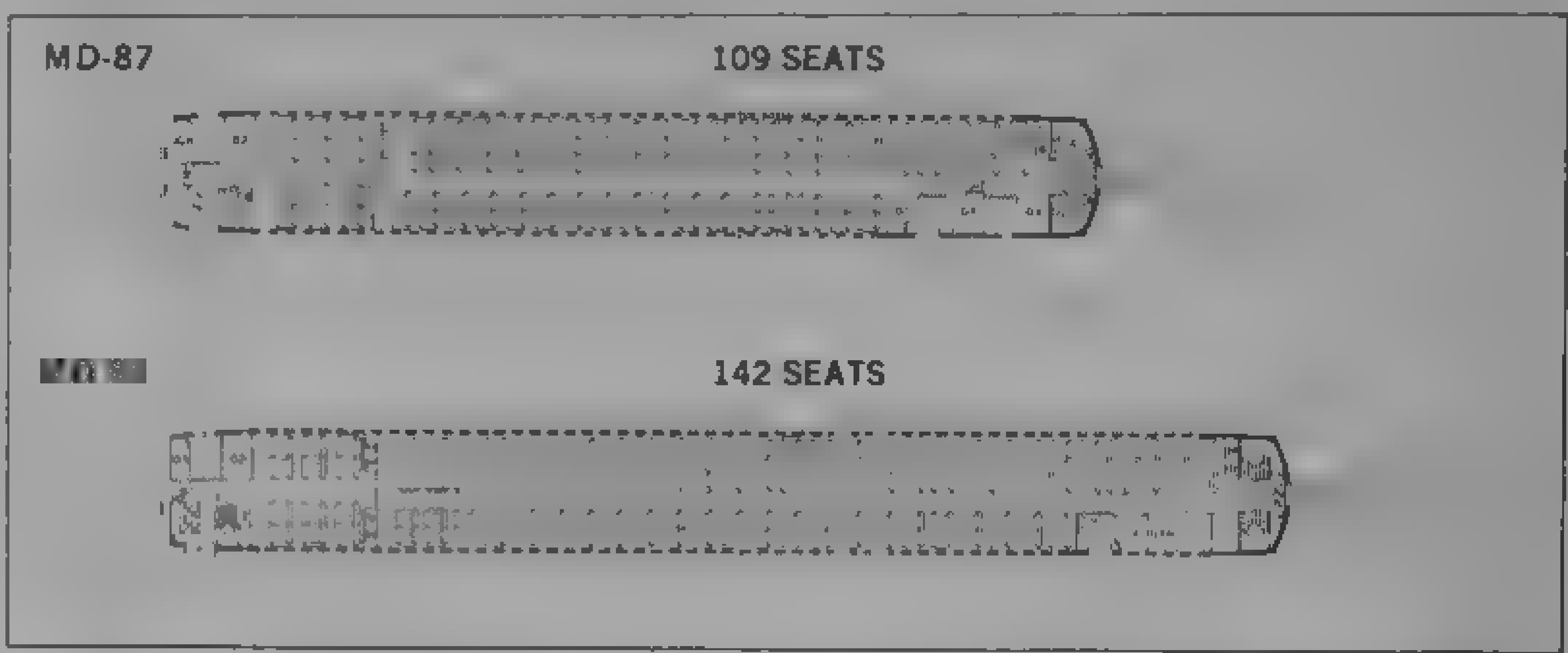
CUSTOMERS: Launch customer Delta Air Lines (50 ordered plus 115 on option, later reported as 31 firm and 106 options); other customers reported to include China (Trunkliner), Great China, SAS (six plus six converted from MD-80s) and Japan Air System. For totals, see table on first page of Douglas entry.

DESIGN FEATURES: Being built on MD-80 production line, powered by IAE V2500 engines rated by engine control system for power required by MD-90-30 and MD-90-50; 10 more two-class passengers than MD-80 accommodated by forward fuselage stretch of 1.37 m (4 ft 6 in) to compensate for higher engine weight, better power/weight ratio than MD-80; noise level expected to be 20 dB below Stage 3 and with very low emissions; improved cabin includes larger baggage bins, better lighting and hand rail at bin level. Wing sweep at quarter-chord, 24° 30'.

FLYING CONTROLS: Powered elevators with dual actuators, and manual reversion with servo tabs, to cope with increased pitch-axis inertia caused by heavier engines and longer forward fuselage; double-slotted flaps; three-position leading-edge slats, spoilers for airbrake and lift dumping; flight deck similar to MD-88, but Douglas planning new six-screen layout similar to that of MD-11. Three-position leading-edge slats.

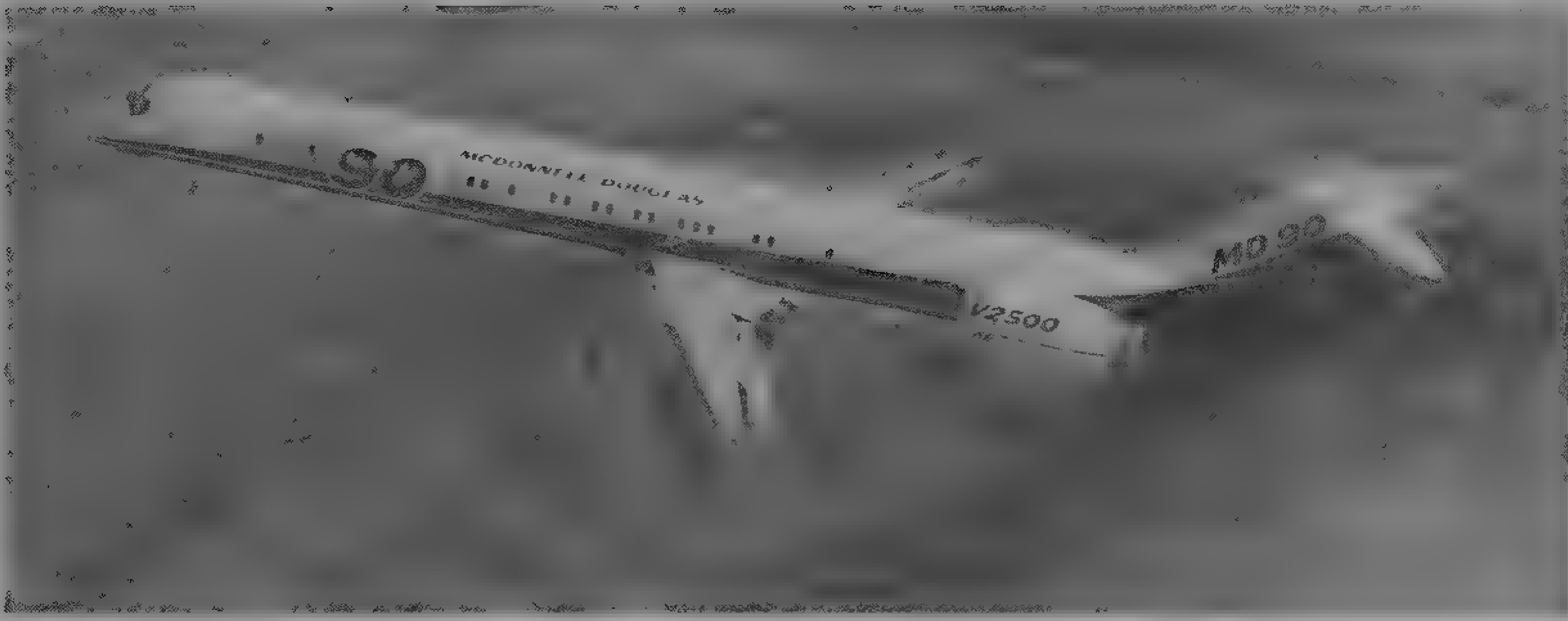
STRUCTURE: Structure broadly as late MD-80, but new modular manufacturing system, developed and tested on both prototypes, allows both types to be built on same production line and in about half the man-hours of earlier MD-80s; subassemblies contributed by Alenia, AeroSpace Technologies of Australia, Aerospatiale, CASA, Chengdu Aircraft Industrial Corporation, Shanghai Aviation Industrial Corporation (SAIC) and Shanghai Aircraft Manufacturing Factory (SAMF) are built up into fuselage modules in Salt Lake City.


MD-87 is short fuselage member of MD-80 family of jetliners
1995



Typical mixed class seating arrangement in MD-80 and MD-87
1995


Flight deck of MD-90 showing two two-screen EFIS, LED matrix engine indicators, full flight management system panels on centre console and autopilot controllers under the glareshield
1994



Prototype of MD-90-30, which will eventually succeed the MD-80

1994

LANDING GEAR: Retractable tricycle type with twin wheels on all units, as MD-80.

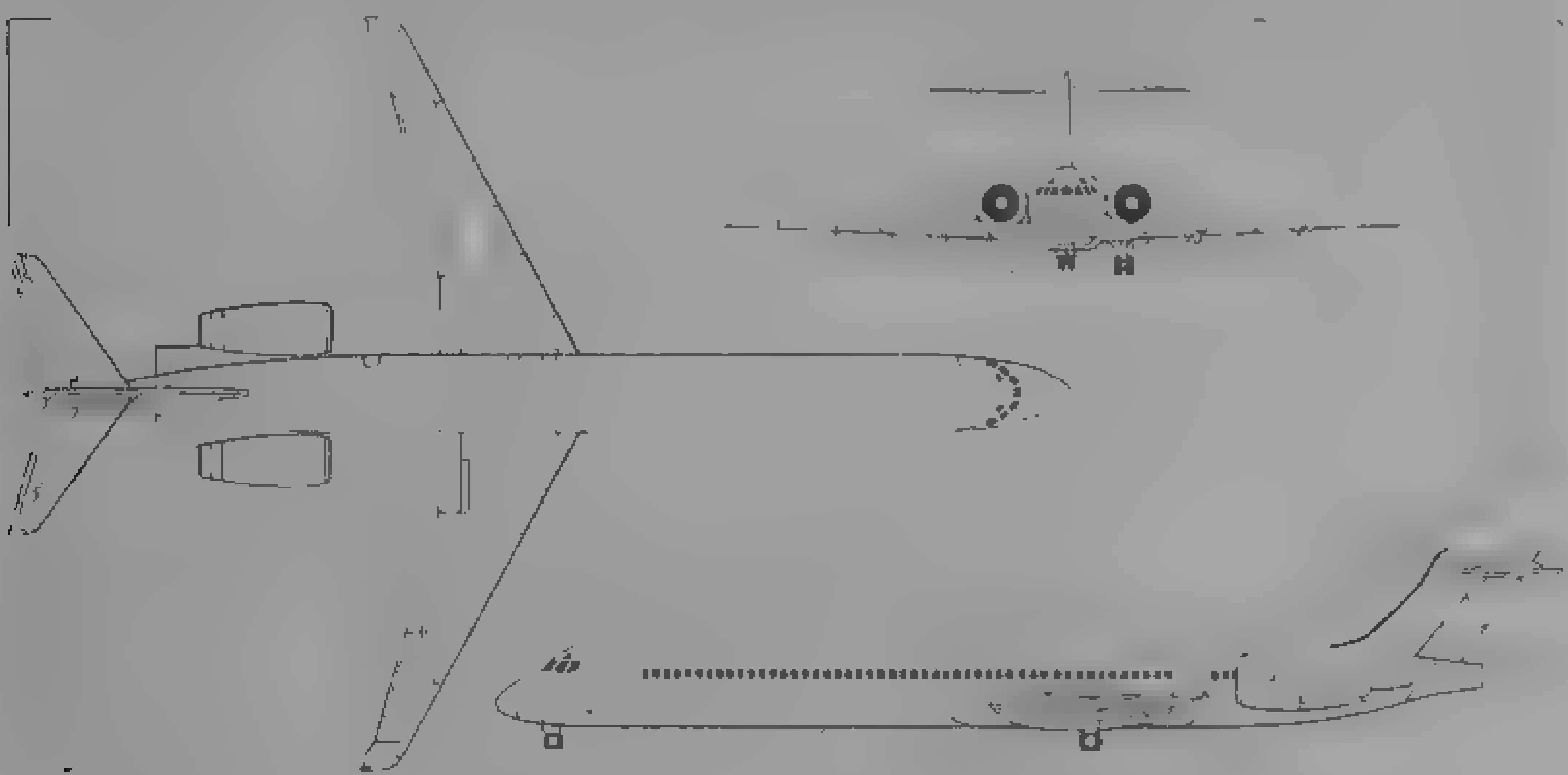
POWER PLANT: Two 111.2 kN (25,000 lb st) IAE V2525-D5 in MD-90-30, two 124.5 kN (28,000 lb st) V2528-D5 in MD-90-50 and -55, thrust maintained at S/L up to 30°C ambient temperature, power output determined by electronic engine control, cascade thrust reversers for use on ground only. MD-90-30 fuel tankage 22,107 litres (5,840 US gallons; 4,863 Imp gallons), MD-90-50 tankage 28,845 litres (7,620 US gallons; 6,345 Imp gallons) including 6,738 litres (1,780 US gallons; 1,482 Imp gallons) in extra tanks in baggage compartment.

ACCOMMODATION: Traditional Douglas five-abreast seating; two more seat rows than MD-80, larger and lighted overhead stowage bins, lighted full-grip handrail on stowage bins illuminates seat labels, new vacuum lavatories.

SYSTEMS: New system elements, compared with MD-80, include Bendix variable-speed, constant frequency electrical generation, new AlliedSignal 421 kW (565 shp) GTCP131-9D APU to provide greater engine-starting power and 8,000 hour life, carbon wheel brakes with digital anti-skid saving 181 kg (400 lb) weight, centre-wing de-icing system using warmed fuel from engine oil cooler circulated through inboard fuel tanks, and new environmental control system providing higher flow rates.

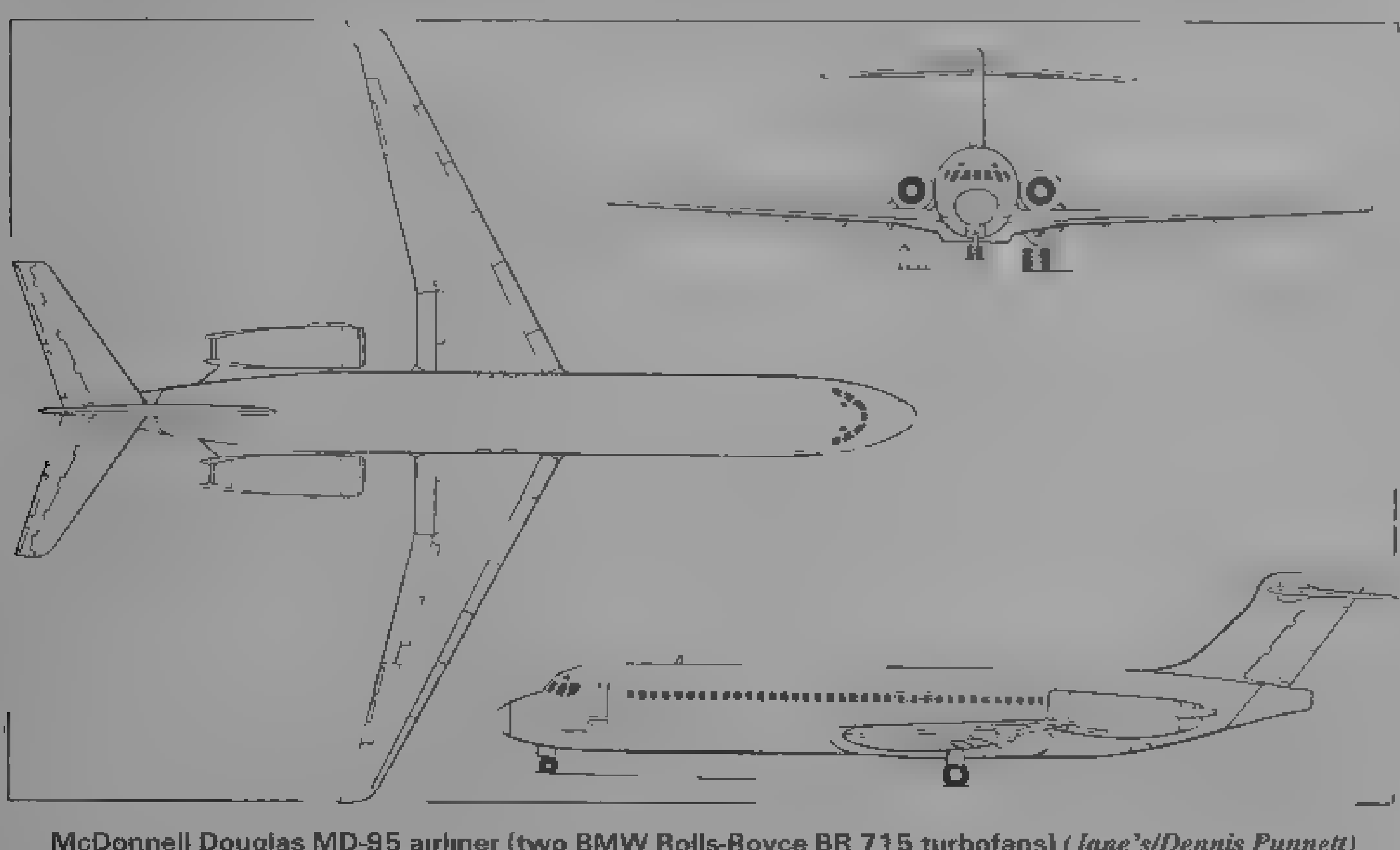
AVIONICS: *Flight*: Honeywell electronic flight instruments, flight management system (FMS), digital flight guidance system (DFGS) with auxiliary control system (ACS), new air data computer, and advanced inertial reference system based on ring laser gyro platform.

Instrumentation: LED displays for engine and system monitoring.



McDonnell Douglas MD-90-30 airliner (two IAE V2525-D5 turbofans) *(Jane's/Dennis Punnett)*

1994



McDonnell Douglas MD-95 airliner (two BMW Rolls-Royce BR 715 turbofans) *(Jane's/Dennis Punnett)*

1993

DIMENSIONS, EXTERNAL (all versions):

Wing span	32.87 m (107 ft 10 in)
Wing aspect ratio	9.62
Length overall	46.51 m (152 ft 7 in)
Height overall	9.33 m (30 ft 7¼ in)
Wheel track	5.09 m (16 ft 8½ in)
Wheelbase	23.52 m (77 ft 2 in)

DIMENSIONS, INTERNAL:

Baggage volume (total): -30	36.8 m³ (1,300 cu ft)
-50, -55 with optional fuel	23.3 m³ (822 cu ft)

AREAS:

Wings, gross: all	112.3 m² (1,209 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty: -30	39,916 kg (88,000 lb)
-50	41,685 kg (91,900 lb)
Space limited payload: -30	17,350 kg (38,250 lb)
-50, -55 with extra tanks	15,195 kg (33,500 lb)
Max T-O weight: -30	70,760 kg (156,000 lb)
-50, -55	78,245 kg (172,500 lb)
Max ramp weight: -30	71,215 kg (157,000 lb)
-50, -55	78,700 kg (173,500 lb)
Max zero-fuel weight: -30	58,965 kg (130,000 lb)
-50, -55	61,235 kg (135,000 lb)
Max landing weight: -30	64,410 kg (142,000 lb)
-50, -55	71,210 kg (156,000 lb)
Max wing loading: -30	614.75 kg/m² (125.91 lb/sq ft)
-50, -55	679.78 kg/m² (139.23 lb/sq ft)
Max power loading: -30	318.14 kg/kN (3.12 lb/lb st)
-50, -55	315.93 kg/kN (3.08 lb/lb st)

PERFORMANCE (estimated, at max T-O weight, ISA, except where indicated):

Cruising speed at 10,670 m (35,000 ft): all	437 kts (809 km/h, 503 mph) Mach 0.76
FAA T-O field length: -30	2,135 m (7,000 ft)
-50, -55	2,347 m (7,700 ft)
FAA landing field length, at max landing weight: -30	1,564 m (5,130 ft)
-50, -55	1,628 m (5,340 ft)
Range, with international reserves (-30 and -50 with 153 passengers, -55 with 187 passengers): -30	2,275 n miles (4,216 km; 2,620 miles)
-50	3,022 n miles (5,600 km; 3,480 miles)
-55	2,700 n miles (5,003 km; 3,109 miles)

UPDATED

MCDONNELL DOUGLAS MD-95

TYPE: 100-passenger twin-jet transport.

PROGRAMME: Announced at Paris Air Show 1991, potential airline customers briefed and manufacturing partners announced in Berlin, November 1994; modification of former Eastern Airlines DC-9-30 into first prototype began late 1994; this, and two further flight test aircraft, expected to fly in 1997; first flight of production aircraft January 1998, joint JAA/FAA certification anticipated in March 1998, first customer delivery August 1998.

CURRENT VERSIONS: **MD-95-30**: Initial production version.

MD-95-30ER: Extended range version with additional fuselage fuel tank, capacity 4,277 litres (1,130 US gallons; 941 Imp gallons). Other versions may be developed.

CUSTOMERS: Unlaunched by March 1995, but Scandinavian Airlines System and International Lease Finance Corporation unofficially reported to have received formal offers; about 70 commitments thought to be required for launch. McDonnell Douglas predicts requirements for more than 1,600 aircraft in this class over the next 20 years, with 300 to 500 MD-95 sales over life of programme.

DESIGN FEATURES: About 1 m (3 ft 3 in) longer than DC-9-30; DC-9/MD-80 fuselage cross-section, DC-9-34 wing planform, systems and avionics are blend of low cost and advanced technology.

Artist's impression of the McDonnell Douglas 100-passenger MD-95 airliner

1995

FLYING CONTROLS: Basically fully powered with manual reversion, as MD-90, double-slotted flaps, full span leading-edge slats with two settings, wing mounted spoilers for airbrakes. Flight deck technology based on MD-90.

STRUCTURE: Generally as MD-80/MD-90. Partners are Alenia (fuselage sections), Korean Airlines Aerospace Division (nose structure and main passenger door/entry area), Halla Engineering and Heavy Industry Ltd (wings, in conjunction with McDonnell Douglas Canada, which will build initial sets of wings for flight test aircraft and early production units), ShinMaywa Industries Ltd (horizontal tail surfaces and engine pylons), British Aerospace Chadderton Aerostructures Division (aft fuselage and fin), Israel Aircraft Industries SHL Servo Systems (landing gear), AlliedSignal Aerospace (AiResearch environmental control system), Honeywell Inc (flight guidance and avionics systems), Sundstrand Aerospace (electrical power generating system), and (in partnership with Sundstrand) Auxiliary Power International Corporation (APU). Final assembly of MD-95s will be undertaken by Dalfort Aviation at Love Field, Dallas, Texas, nominal production rate one aircraft per week. A new Douglas Delivery Center will be established alongside the Love Field assembly plant.

LANDING GEAR: Retractable tricycle with steerable nosewheel, twin wheels on all legs.

POWER PLANT: Two BMW Rolls-Royce BR 715 turbofans each giving 82.29 kN (18,500 lb st) at T-O at 30° ambient; 88.96 kN (20,000 lb st) thrust rating optional for MD-95-30ER, cascade thrust reversers for ground use only. Standard fuel capacity 13,927 litres (3,679 US gallons, 3,063 Imp gallons), ER 18,204 litres (4,809 US gallons, 4,004 Imp gallons).

ACCOMMODATION: Typical two-class seating for 100 passengers in five-abreast arrangement; cabin interior based on that of MD-90, including larger overhead baggage bins. Underfloor cargo volume standard 24.35 m³ (860 cu ft), ER 18.23 m³ (644 cu ft).

AVIONICS: *Flight:* Honeywell flight management system (FMS), inertial reference system (IRS), digital flight guidance system (DFGS), digital air data computer and wind shear detection system.

Instrumentation: EFIS cockpit.

DIMENSIONS, EXTERNAL:

Wing span	28.44 m (93 ft 3½ in)
Wing aspect ratio	8.70
Length overall	36.36 m (119 ft 3½ in)
Height overall	8.60 m (28 ft 2½ in)
Wheel track	4.88 m (16 ft 0 in)
Wheelbase	16.15 m (53 ft 0 in)

AREAS:

Wings, gross	92.97 m² (1,000.7 sq ft)

WEIGHTS AND LOADINGS (S: standard, ER: with extended-range tank):

Operating weight empty: S	30,073 kg (66,300 lb)
ER	30,844 kg (68,000 lb)
Max T-O weight: S	51,710 kg (114,000 lb)
ER	54,885 kg (121,000 lb)
Max ramp weight: S	52,165 kg (115,000 lb)
ER	55,340 kg (122,000 lb)
Space-limited payload: S, ER	10,700 kg (23,590 lb)
Max zero-fuel weight: S	43,545 kg (96,000 lb)
ER	44,679 kg (98,500 lb)
Max landing weight: S	46,265 kg (102,000 lb)
ER	49,895 kg (110,000 lb)
Max wing loading: S	556.2 kg/m² (113.9 lb/sq ft)
ER	590.4 kg/m² (120.9 lb/sq ft)
Max power loading: S	314.39 kg/kN (3.08 lb/lb st)
ER	333.70 kg/kN (3.27 lb/lb st)

PERFORMANCE (estimated):

Max level speed: S, ER
438 kts (811 km/h, 504 mph) (Mach 0.76)

FAA T-O field length at max T-O weight, S/L, 30°C:

S	1,951 m (6,400 ft)
ER	2,012 m (6,600 ft)

FAA landing field length at max landing weight, S/L:

S, ER	1,564 m (5,130 ft)

Range, international reserves:

S	1,500 n miles (2,778 km, 1,726 miles)
ER	1,900 n miles (3,518 km; 2,186 miles)

UPDATED

MCDONNELL DOUGLAS MD-XX

TYPE: Advanced technology medium-range airliner.

PROGRAMME: Preliminary studies begun May 1991. Possible launch 1997 or later, first deliveries before 2002.

CURRENT VERSIONS: Single-aircraft programme to replace existing narrow body aircraft through 6 per cent lower seat-mile costs, twin-aisle comfort and lower deck container capability features, and to replace early small wide-body aircraft through 10 per cent lower trip costs and wider aisles. Initial version to seat 222 passengers (equivalent to Boeing 757) and 204 passengers (equivalent to Boeing 767).

DESIGN FEATURES: Transcontinental, 200- to 220-passenger transport, later stretch up to 295 seats exceeds Boeing 767 capacity by at least 10 per cent, advanced aerofoil and high-aspect ratio wing technologies reduce drag by 14 per cent from current airliners; Mach 0.8 cruise; range 3,000 n miles (5,556 km, 3,452 miles); extended-range options up to 5,500 n miles (10,186 km, 6,329 miles), fuselage cross-section twin-aisle oval 5.18 m (17 ft 0 in) wide, 5.41 m (17 ft 9 in) high, two LD2 containers side by side in underfloor cargo compartments. Five-year NASA-Douglas study on advanced composite transport will produce an initial composite wing box element of MD-XX size in 1995, main objective is cost reduction, fly-by-wire signalling for control, sensor and data distribution.

POWER PLANT: Two wing-mounted advanced high bypass engines such as P & W Advanced Ducted Propeller (ADP).

DIMENSIONS, EXTERNAL (provisional):

Wing span	44.98 m (147 ft 7 in)
Wing aspect ratio	11.14
Length: fuselage	43.79 m (143 ft 8 in)
overall	44.96 m (147 ft 6 in)
Height overall	14.76 m (48 ft 5 in)
Tailplane span	13.36 m (43 ft 10 in)
Wheel track	7.92 m (26 ft 0 in)

AREAS (provisional):

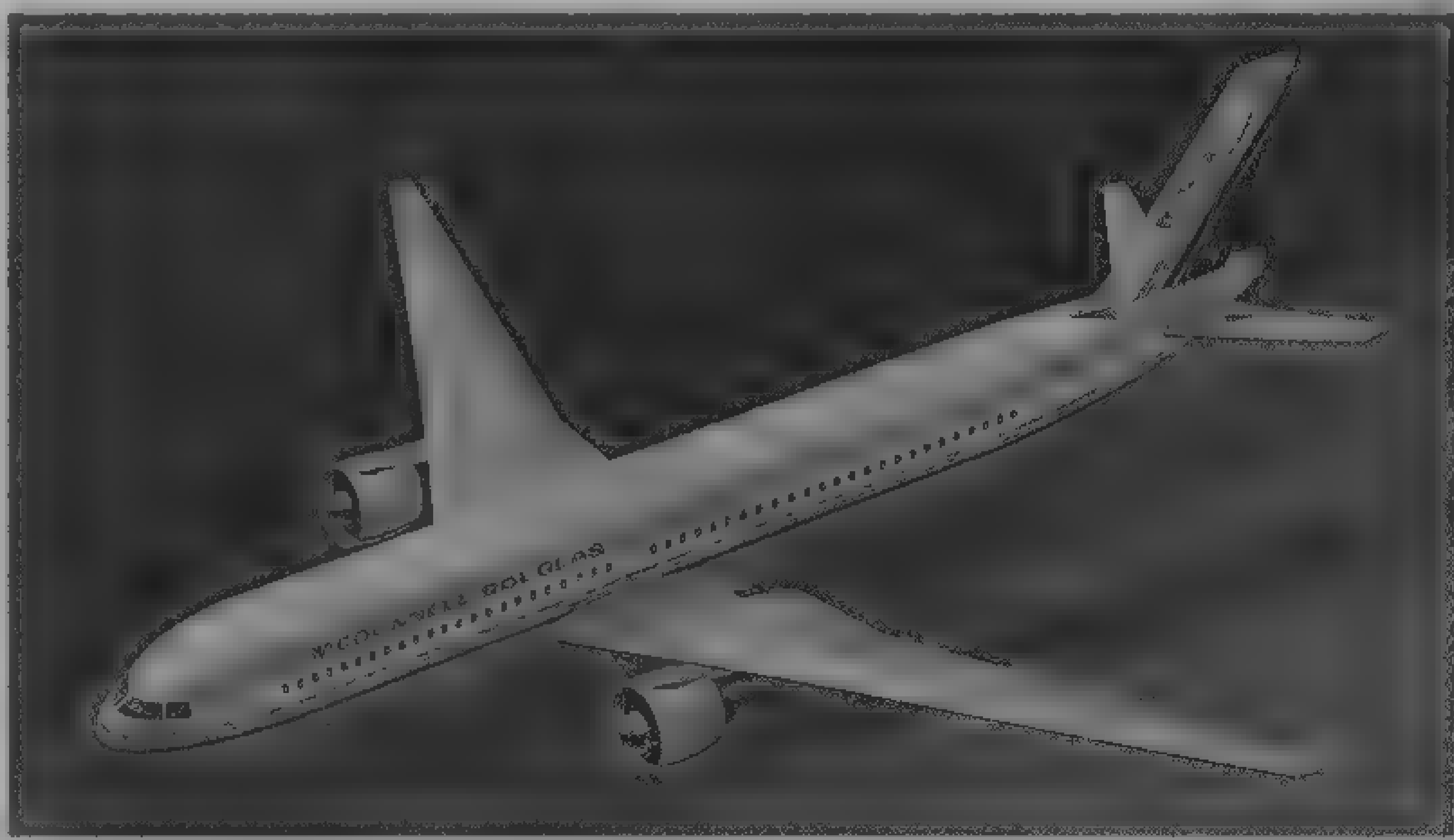
Wings, gross	181.6 m² (1,955.0 sq ft)
Vertical tail surfaces (total)	37.2 m² (400.0 sq ft)
Horizontal tail surfaces (total)	35.7 m² (384.0 sq ft)

UPDATED

MCDONNELL DOUGLAS MD-11

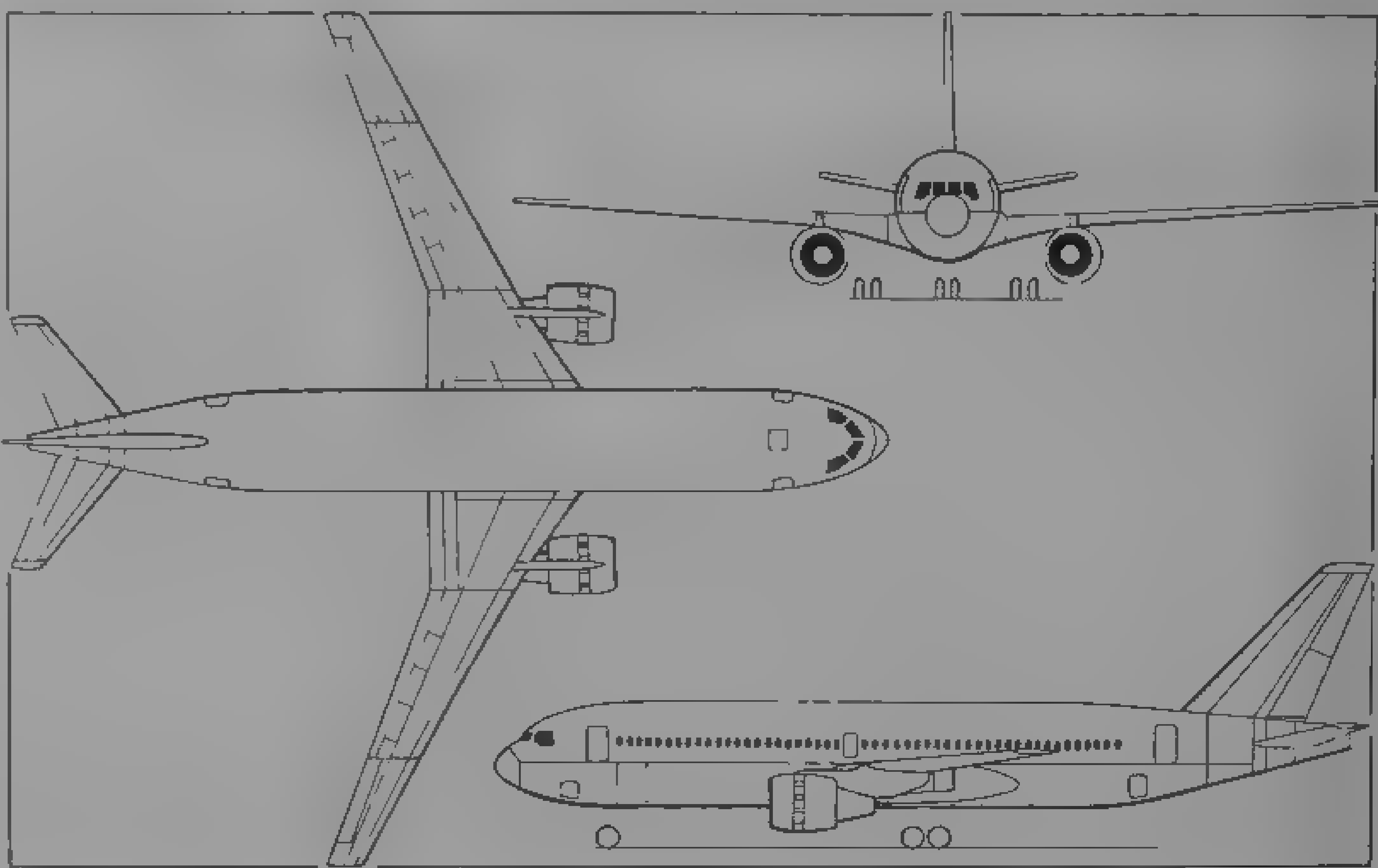
TYPE: Medium/long-range passenger and freight follow-on to DC-10.

PROGRAMME: Revealed at Paris Air Show 1985. British Caledonian ordered nine 3 December 1986; official programme launch 30 December 1986; five aircraft in flight test programme (four with GE engines, one with P&W), first flight (N111MD) 10 January 1990 powered by CF6s, first flight of third prototype powered by P&W PW4460s, 26 April 1990; certificated 8 November 1990; first delivery to Finnair 29 November 1990, entering service 20 December. Deliveries totalled three in 1990, 31 in 1991, 42 in 1992, 36



Artist's impression of McDonnell Douglas MD-XX advanced technology medium-range airliner

1995



McDonnell Douglas MD-XX provisional drawing (*Jane's/James Goulding*)

1995

in 1993 and 17 in 1994; 100th MD-11 delivered 30 June 1993.

Certification with R R Trent 650 discontinued.

CURRENT VERSIONS: **MD-11**: Standard passenger version for 298 passengers in three-class layout, maximum range 7,000 n miles (12,964 km; 8,055 miles) with maximum optional T-O weight. Planned production of all variants declined to about two per month in 1993; expected to increase again from 1995. *Detailed description applies to improved MD-11, MD-11F, MD-11 Combi and MD-11 convertible Freighter.*

MD-11 Performance Improvement Programme (PIP): Continuous improvement programme aimed at weight and drag reduction and extended range under way since 1990, resulting in recovery and extension of MD-11's design range. First delivery November 1990 with initial choice of gross weights between 273,289 kg (602,500 lb) and 276,691 kg (610,000 lb), range shortfall 440 n miles (815 km; 506 miles) with GE engines and 710 n miles (1,315 km; 817 miles) with P&W engines. Successive drag reduction, weight saving and fuel consumption and engine installation improvements, introduced in stages by December 1994, included the following.

Weight reduction: Airframe weight reduced progressively by 1,020 kg (2,250 lb) by changes in cargo handling system, tailplane structure, composites centre engine inlet, cargo hold changes and new flooring materials.

T-O weight increases: Maximum T-O weight increased to 280,320 kg (618,000 lb) in January 1991; further optional increase to 283,720 kg (625,500 lb) in July 1993.

Drag reduction: Phase I, introduced before first delivery, saved 0.7 per cent drag by means of splitter plate preventing turbulence forming behind blunt wing trailing-edge. Phase II drag reduction, available from January 1992, saved another 1.5 per cent drag by sealing outboard slat gaps and drooping outboard ailerons by 4°. Phase III, introduced September 1993, eliminated another 0.1 per cent drag by applying endplates on wing adjacent ailerons and adding fillet to wing-mounted engine pylons. Modification of windscreen wipers and windscreen introduced December 1994 cuts another 0.3 per cent. Phase IV, introduced February 1995, eliminates further 1.2 per cent drag by means of a re-rigged elevator (to reduce incidence and produce a more cambered aerofoil), a diverter fillet around base of the centre engine inlet structure, redesign of flap hinge-fairing and installation of wing and undercarriage door seals. Cumulative range improvement of all four phases extends range to more than 6,911 n miles (12,800 km; 7,953 miles) with 29,000 kg (63,934 lb) payload.

Added fuel: Auxiliary fuel tanks available from April 1992; one or two 7,472 litre (1,974 US gallon; 1,644 Imp gallon) tanks can be mounted in rear of forward underfloor cargo compartment, displacing two or four LD3 cargo containers; tanks can be removed through normal cargo door.

T-O distance: Reduced by up to 137 m (450 ft) in order to accommodate increased T-O weight by deflecting inboard and outboard ailerons with flaps at take-off.

Engine improvements: Internal improvements by General Electric in the CF6-80C2 engine, introduced by mid-1993, have saved some 1.5 per cent fuel consumption, equivalent to about 1,360 kg (3,000 lb) of payload.

P&W applied a three-phase engine and intake improvement sequence, introduced in June 1992 and November 1993, which together gave 2.7 per cent improvement; in addition, P&W has certificated an optional thrust increase to 275.8 kN (62,000 lb st). Total range increase for these improvements is 600 n miles (1,111 km; 690 miles) for GE powered aircraft and 690 n miles (1,278 km; 794 miles) for PW-powered aircraft.

MD-11 Combi: Mixed cargo/passenger version for four to 10 cargo pallets and 168 to 240 passengers; ranges from 5,180 n miles (9,593 km; 5,961 miles) to 6,860 n miles (12,705 km; 7,894 miles). Main deck cargo door at rear on port side. Certificated April 1992 to latest FAA Class C smoke and fire containment requirements.

MD-11CF: Convertible freighter; launched August 1991 with order from Martinair-Holland (four firm orders for delivery 1994 and 1995, one on option). Main deck cargo door at front on port side. Certification due 1994.

MD-11F: All-freight version.

MD-11ER: Extended-range version launched February 1994; maximum T-O weight increased to 285,989 kg (630,500 lb) and fuel capacity increased, offers either 480 n miles (889 km; 552 miles) greater range or 2,721 kg (6,000 lb) more payload, will be offered in passenger, Combi, convertible or all-freight versions; drag reduction and weight saving will reduce fuel burn by 1.5 per cent, intended to provide lower costs on very long routes with lower passenger traffic; Douglas claims MD-11ER costs 26 per cent less to operate than Boeing 747-400. MD-11ER extends MD-11 range with 298 passengers from 7,000 n miles (12,964 km; 8,055 miles) to 7,240 n miles (13,408 km; 8,331 miles), which is claimed to be very slightly greater than Boeing 747-400 with 421 passengers; first deliveries early 1996.

Three further potential variants were being studied in early 1995:

MD-11LR: Long-range version with 3.66 m (12 ft) wingtip extensions, new aileron segment, modified low-speed ailerons, revised trailing-edge, revised wheels, tyres, brakes and anti-skid system, four-wheel centre landing gear, uprated engines and tip extensions to horizontal and vertical tail surfaces; target range 7,900 to 8,000 n miles (14,631 to 14,816 km; 9,091 to 9,206 miles) with about 300 passengers in three-class arrangement.

MD-11 'Simple Stretch': 6.70 m (22 ft) fuselage stretch, maximum T-O weight 278,950 kg (615,000 lb), range 5,400 n miles (10,000 km; 6,213 miles) with 365 passengers.

MD-11 Twinjets: Twin-engined derivatives, could include medium-range, stretched medium-range and long-range versions. Medium-range version would have two 311.4 kN (70,000 lb st) class engines, wingtip extensions as for MD-11LR, fuselage shortened by about 4.87 m (16 ft) forward of wing, centre landing gear eliminated and vertical tail/centre engine nacelle structure replaced by new vertical tail surface of composites construction; empty weight 118,975 kg (262,300 lb), maximum T-O weight 227,700 kg (502,000 lb); design range 5,890 n miles (10,908 km; 6,778 miles) with 264 passengers in three-class arrangement. Long-range twin would have 422.6 kN (95,000 lb st) class engines and additional fuel capacity; empty weight 131,815 kg (290,600 lb), maximum T-O weight 277,600 kg (612,000 lb), design range 7,550 n miles (13,982 km; 8,688 miles). Stretched medium version would have 5.59 m (18 ft 4 in) plug forward of wing and 5.18 m (17 ft 0 in) plug aft of wing, design range 5,850 n miles (10,834 km; 6,732 miles) with 351 passengers.

CUSTOMERS: At 1 January 1995, 129 MD-11s had been delivered to 20 operators.

DESIGN FEATURES: Compared with DC-10, MD-11 has winglets above and below each wingtip, tailplane has advanced cambered aerofoil, modified trailing-edge camber, reduced sweepback and 7,571 litre (2,000 US gallon; 1,665 Imp gallon) fuel trim tank, extended tailcone of low-drag chisel profile; two-crew all-digital flight deck, restyled interior, choice of GE CF6-80C2D1F and P&W PW4460 engines.

Wing has Douglas aerofoil section; sweepback at quarter-chord 35°, dihedral 6°; incidence at root 5° 51′, tailplane sweepback 33°.

FLYING CONTROLS: Ailerons powered by Parker Hannifin actuators, electrohydraulically actuated variable incidence tailplane with slotted elevators in two sections each side powered by Parker Hannifin and Teijin Seiki actuators; inboard all-speed ailerons and outboard low-speed ailerons droop with flaps on take-off, dual section rudder split into vertical segments, near full-span leading-edge slats, double-slotted trailing-edge flaps with offset external hinges; five spoilers in groups of four and one on each wing. Cat. IIIb automatic landing with ground roll control (certificated April 1991) standard.

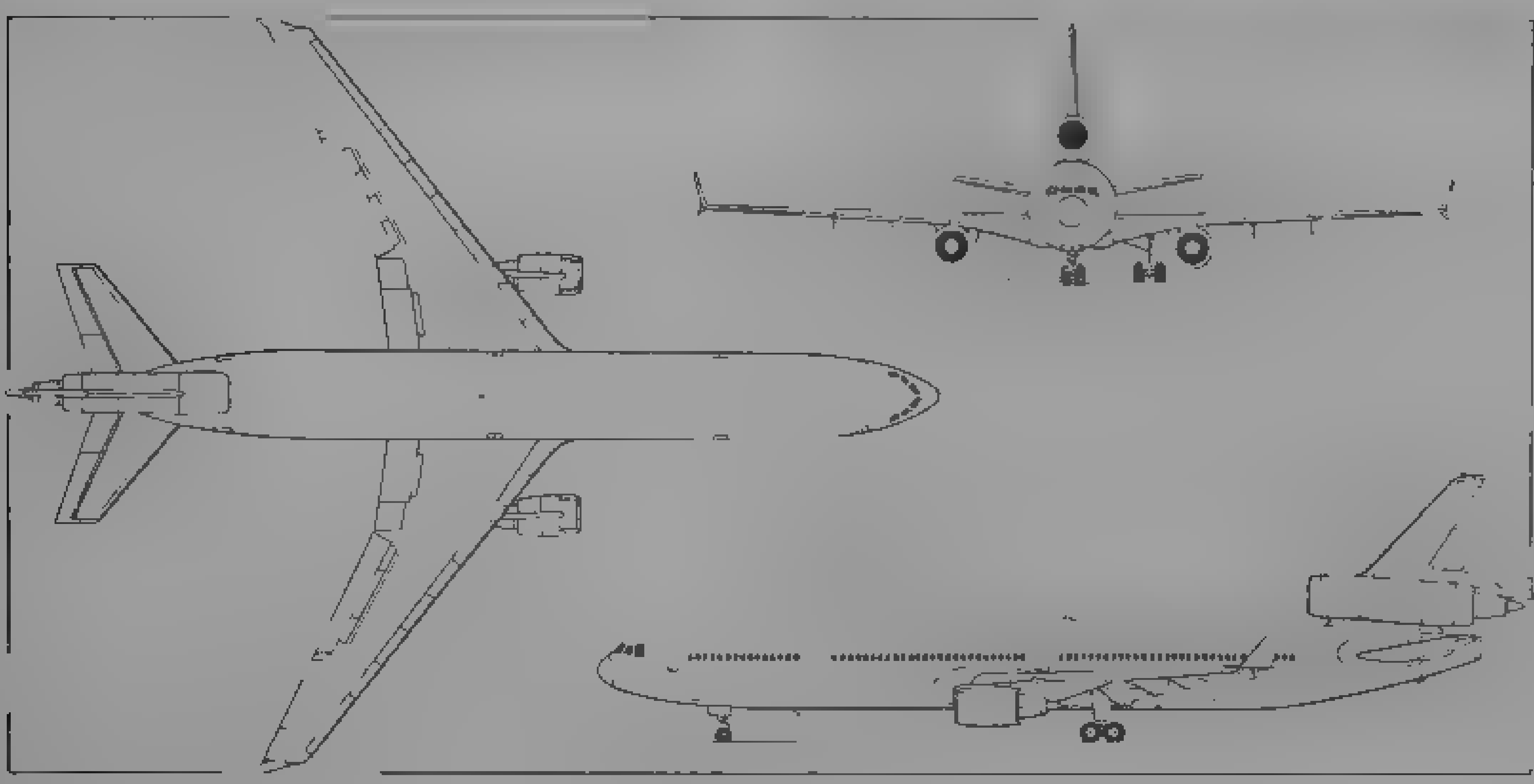
STRUCTURE: Composites used in virtually all control surfaces, engine inlets and cowlings, and wing/fuselage fillets; wing has two-spar structural box with chordwise ribs and skins with spanwise stiffeners; upper wing et of ribs, spars and stiffened aluminium alloy skin with carbonfibre trailing-edge; lower winglet carbonfibre, inboard ailerons have metal structure with composites skin; outboard ailerons all-composites, inboard flaps composites-skinned metal,

All-freight MD-11F version of McDonnell Douglas MD-11

1994

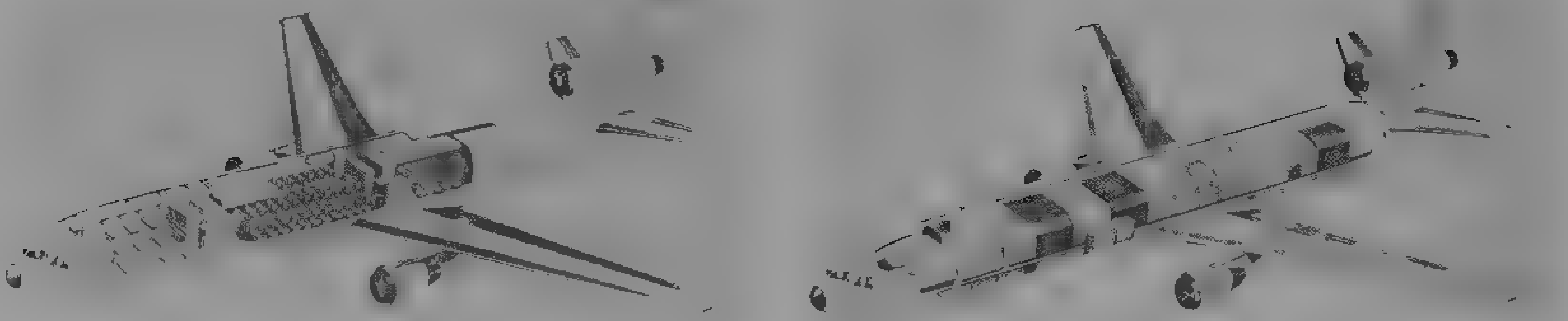
McDonnell Douglas MD-11 in take-off configuration

1994



McDonnell Douglas MD-11 medium/long-range transport *(Jane's/Dennis Punnett)*

1994



McDonnell Douglas MD-11 Combi with freight door and freight aft of passenger cabin and all-freight MD-11F (right) with full load of pallets and containers
1994

outboard flaps all composites, spoilers aluminium honeycomb and composites skin, tailplane has CFRP trailing-edge, elevators CFRP.

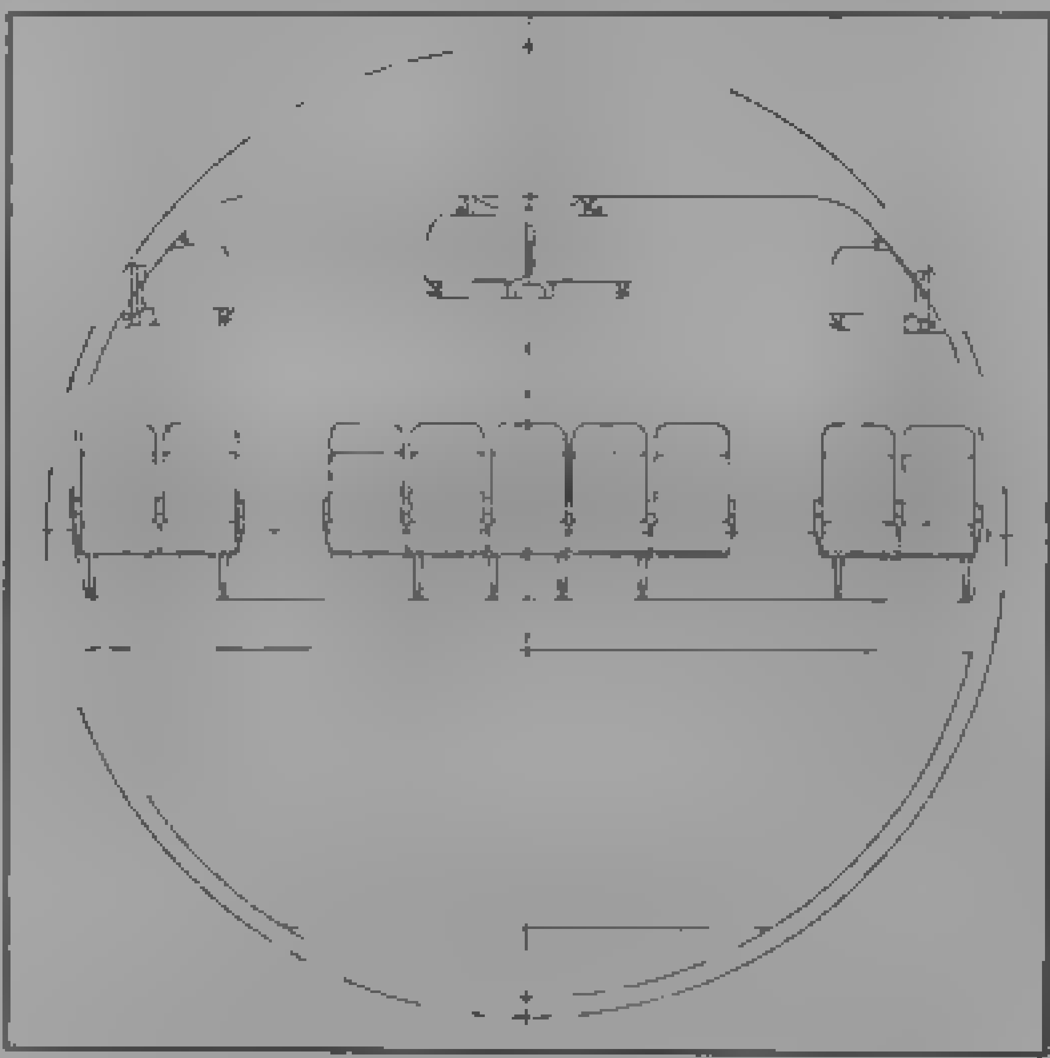
Rear engine inlet duct and fan cowl doors, and nose cowl outer barrels on wing-mounted engines, are of composites construction. Inner surfaces of engine nacelles are acoustically treated.

Suppliers include Aermacchi (fin, rudder, fuselage panels, winglets), AP Precision Hydraulics (centreline and nose landing gear), Bendix (mainwheels and carbon brakes), CASA (horizontal tail surfaces), General Dynamics Convair Division (fuselage sections until end 1995), Embraer (outboard flap sections), Fischer GmbH (composite flap hinge fairings), Pneumo Abex Corporation (main landing gear), Rohr Industries (engine pylons), Honeywell (advanced flight deck and avionics), and Westland Aerospace (flap vane and inlet duct extension rings).

LANDING GEAR: Hydraulically retractable tricycle type, with additional twin-wheel main unit mounted on the fuselage centreline; heaviest proposed variants might have four-wheel centreline bogie; nosewheel and centreline units retract forward, main units inward into fuselage. Twin-wheel steerable nose unit (±70°). Main gear has four-wheel bogies. Oleo-pneumatic shock-absorbers in all units. Loral nosewheels and Goodyear tyres size 40 × 15.5-16, pressure 13.44 bars (195 lb/sq in). Main and centreline units have Bendix wheels and Goodyear tyres size 54 × 21-24, pressure 13.79 bars (200 lb/sq in). Bendix carbon brakes with air convection cooling. Loral anti-skid system. Minimum ground turning radius about nosewheel 26.67 m (87 ft 6 in), about wingtip 35.90 m (117 ft 9½ in).

POWER PLANT: Three Pratt & Whitney PW4460 turbofans, each originally rated at 266.9 kN (60,000 lb st), or three General Electric CF6-80C2D1F turbofans, each rated at 273.57 kN (61,500 lb st). P&W thrust optionally increased to 275.8 kN (62,000 lb) to improve field performance; two engines mounted on underwing pylons, the third above the rear fuselage aft of the fin torsion box. Refuelling point in leading-edge of each wing. Standard fuel capacity: MD-11 152,108 litres (40,183 US gallons; 33,459 Imp gallons), MD-11F and Combi 146,305 litres (38,650 US gallons; 32,182 Imp gallons); one or two 7,472 litre (1,974 US gallon; 1,643 Imp gallon) tanks can be added in cargo hold.

ACCOMMODATION: Crew of two, plus two observer seats. Standard class seating for 250, two-class for 298 and



Cabin cross-section of MD-11 in economy layout. Aisle width 48.3 cm (1 ft 7 in); height 241.3 cm (7 ft 11 in); seat width 45.7 cm (1 ft 6 in), overall width, two seats 106.7 cm (3 ft 6 in), five seats 259.1 cm (8 ft 6 in). Exterior diameter 6.02 m (19 ft 9 in)
1994

all-economy for up to 410. Combi carries 214 passengers. Crew door and three passenger doors each side, all eight of which open sliding inward and upward. Two rear doors are deactivated in Combi configuration. Two freight holds in lower deck, forward and aft of wing, and one bulk cargo compartment in rear fuselage. Forward freight hold is heated and ventilated; rear freight hold heated only. MD-11 Combi has a lower deck cargo door in centre compartment on starboard side of fuselage for loading of pallets, an upward-opening main deck cargo door on port side at rear of cabin. MD-11F/CF have port side forward main deck cargo door.

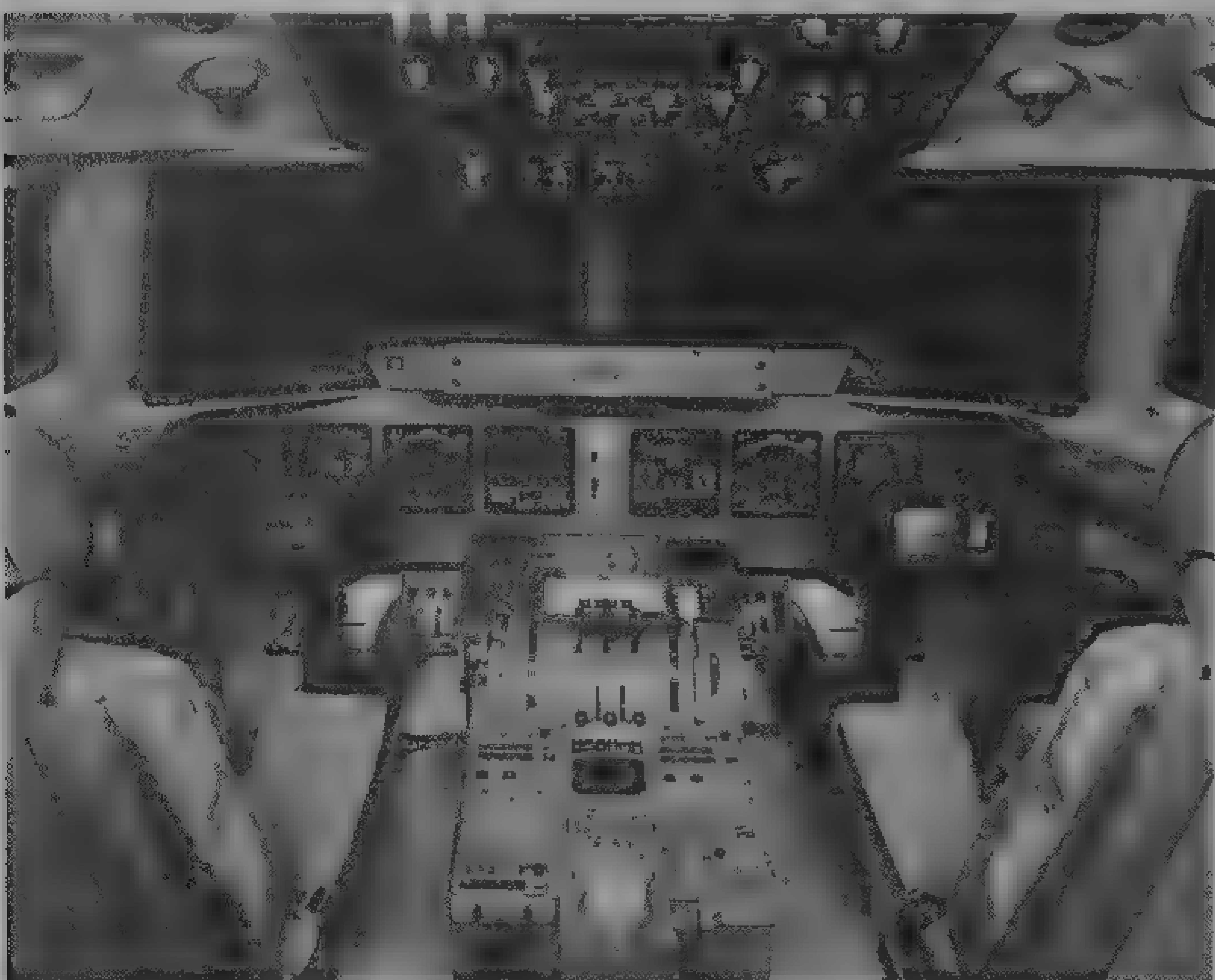
SYSTEMS: Air conditioning system includes three AiResearch air bearing air-cycle units with two automatic digital pressure controllers and electromanual back-up. Cabin maximum pressure differential 0.59 bar (8.6 lb/sq in). Three independent hydraulic systems for operation of flight controls and braking, with motor/pump interconnects to allow one system to power another. Electrical system comprises three 400 Hz, 100/120 kVA integrated drive generators, one per engine; one 90 kVA generator in APU, 50 Ah battery, four transformer-rectifiers to convert AC power to DC; and 25 kVA drop-out air-driven emergency generator. Pneumatic system, maximum controlled pressure 3.17 bars (46 lb/sq in) at 230°C, supplies air conditioning, engine bleed air anti-icing for wing (outer slats) and tailplane leading-edges, galley vent jet pump, and cargo compartment floor heating. EROS plumbed gaseous oxygen system for crew; chemical oxygen generators with automatically deploying masks for passengers. Portable oxygen cylinders for attendants and first aid. De-icing for windscreens, angle of attack sensors, TAT probe and static port plate. AlliedSignal TSCP700-4E APU.

AVIONICS: *Flight*: Avionics integrator, Honeywell, responsible for flight guidance/flight deck system consisting of 44 line-replaceable units. These include aircraft system controllers (ASC) that perform flight engineer control and monitoring functions, providing automated hydraulic, electrical, environmental and fuel systems, laser inertial reference system (IRS) for navigation, digital air data computer (DADC). Flight control computer includes autothrottle and longitudinal stability augmentation, windshear detection and guidance.

Instrumentation: Six-tube EFIS and systems displays, 'dark cockpit' philosophy with lights only showing to indicate abnormal states; no need to look on overhead panels to check systems status. hydraulic, electrical, environmental and fuel systems segregated and each system configured in normal and abnormal conditions by a pair of computers.

DIMENSIONS, EXTERNAL:

Wing span	51.77 m (169 ft 10 in)
Wing chord: at root	10.71 m (35 ft 1¾ in)
at tip	2.73 m (8 ft 11½ in)
Wing aspect ratio	7.91
Length overall: with PW4460	61.24 m (200 ft 11 in)
with CF6-80	61.37 m (201 ft 4 in)
Fuselage: Length	58.65 m (192 ft 5 in)
Max diameter	6.02 m (19 ft 9 in)
Height overall	17.60 m (57 ft 9 in)
Tailplane span	18.03 m (59 ft 2 in)
Wheel track	10.56 m (34 ft 8 in)
Wheelbase	24.61 m (80 ft 9 in)
Crew doors (two, each): Height	1.93 m (6 ft 4 in)
Width	0.81 m (2 ft 8 in)
Passenger doors	
Height: front pair	1.93 m (6 ft 4 in)
rear six doors	1.93 m (6 ft 4 in)
Width: front pair	0.81 m (2 ft 8 in)
rear six doors	1.07 m (3 ft 6 in)
* Lower deck forward freight door:	
Height	1.68 m (5 ft 6 in)
Width	2.64 m (8 ft 8 in)
Lower deck centre freight door (standard):	
Height	1.68 m (5 ft 6 in)
Width	1.78 m (5 ft 10 in)
Lower deck bulk cargo door: Height	0.91 m (3 ft 0 in)
Width	0.76 m (2 ft 6 in)
Combi main deck cargo door (port, rear):	
Height	2.59 m (8 ft 6 in)
Width	4.06 m (13 ft 4 in)



MD-11 two-crew flight deck with six large displays and two flight management system panels on console. The third FMS panel at rear is for groundcrew use when testing aircraft avionics
1993

CF main deck cargo door (port, forward):
  Height 2 59 m (8 ft 6 in)
  Width 3.56 m (11 ft 8 in)

Centre freight door of Combi also this size, available as an option on other models

DIMENSIONS, INTERNAL:
  Cabin
    Length, flight deck door to rear bulkhead 46.51 m (152 ft 7¼ in)
    Max width 5 71 m (18 ft 9 in)
    Max height 2 41 m (7 ft 11 in)
    Floor area, incl galleys and toilets 244.7 m² (2,634 0 sq ft)
    Volume, incl galleys and toilets 599 3 m³ (21,165 cu ft)
    Lower deck freight holds, volume 194 m³ (6,850 cu ft)

AREAS:
  Wings, gross 338 9 m² (3,648.0 sq ft)
  Winglets (total) 7 42 m² (80.0 sq ft)
  Vertical tail surfaces (total) 56 2 m² (605 0 sq ft)
  Horizontal tail surfaces (total) 85 5 m² (920 0 sq ft)

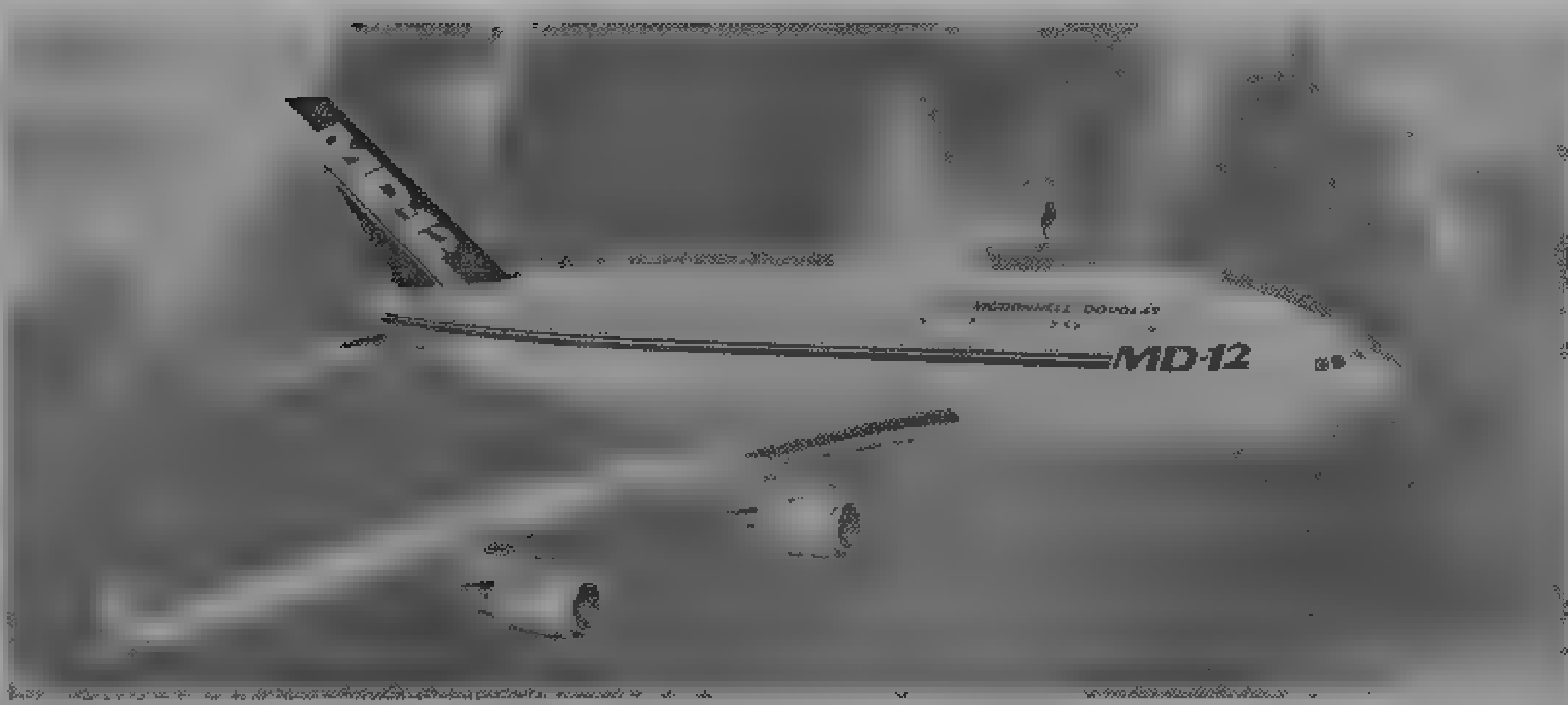
WEIGHTS AND LOADINGS:
  *Operating weight empty -11 131,035 kg (288,880 lb)
    -11F 113,630 kg (250,510 lb)
    -11 Combi 129,591 kg (285,700 lb)
  Weight limited payload: -11 51,058 kg (112,564 lb)
    -11F 91,078 kg (200,790 lb)
    -11 Combi 65 454 kg (144,300 lb)
  **Max T-O weight: standard 273,289 kg (602,500 lb)
    optional 280,320 kg (618 000 lb)
    ultimate 283,720 kg (625,500 lb)
  Max zero-fuel weight -11 181,435 kg (400,000 lb)
    -11F 204,700 kg (451,300 lb)
    -11 Combi 195,040 kg (430,000 lb)
  Max landing weight -11 195,040 kg (430,000 lb)
    -11F 213 870 kg (471,500 lb)
    -11 Combi 207,745 kg (458,000 lb)

** Empty weights with P&W engines about 317 kg (700 lb) lower than with GE engines*

*** All versions*

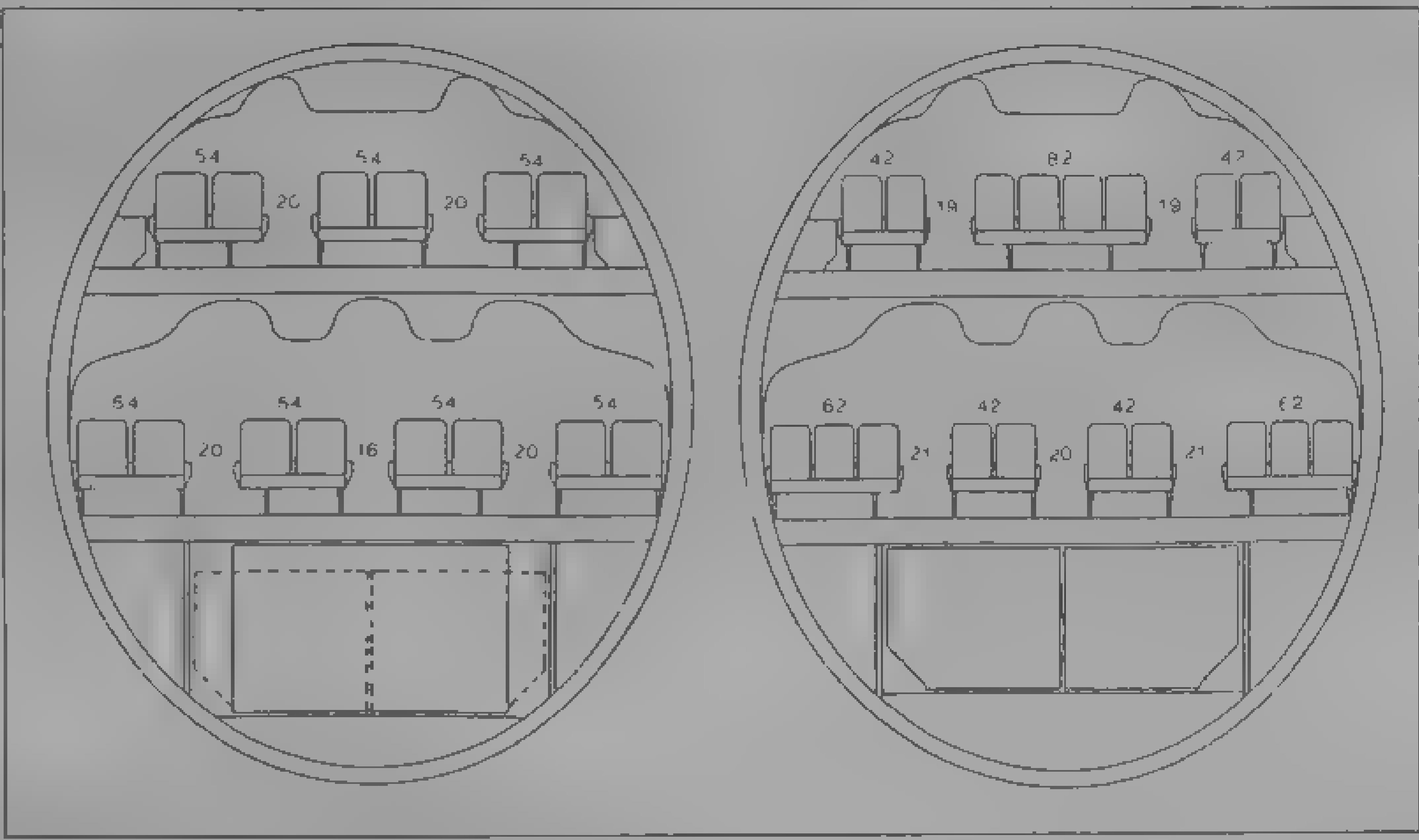
PERFORMANCE:
  Max operating Mach number (MMO): all 0 945
  Max level speed at 9,450 m (31,000 ft)
    all Mach 0.87 (511 kts, 945 km/h, 588 mph)
  FAA T-O field length MTOW, S/L, ISA +15°C
    -11 3 200 m (10,500 ft)
    -11F and Combi 3,127 m (10,260 ft)
  FAA landing field length, MLW, S/L
    -11 1,966 m (6,450 ft)
    -11F 2 131 m (6,990 ft)
    -11 Combi 2 027 m (6,650 ft)
  Design range, FAA international reserves
    -11, 323 passengers, two-class 6,787 n miles (12,569 km, 7,810 miles)
    -11F 3,623 n miles (6,711 km, 4,170 miles)
    -11 Combi, 214 passengers, six pallets 6,269 n miles (11,611 km, 7,215 miles)

UPDATED



Artist's impression of the McDonnell Douglas MD-12 with full-length upper deck

1992



Cabin cross sections of Douglas MD-12 showing all-business configuration (left) and all-economy (right), dimensions are inches, upper deck maximum height 2 18 m (7 ft 2 in), lower deck 2 54 m (8 ft 4 in) overall dimensions are 7.39 m (24 ft 3 in) wide and 8 5 m (27 ft 11 in) high

1995

McDONNELL DOUGLAS MD-12

TYPE: High-capacity long-range airliner

PROGRAMME: Definitive four-engined layout announced April 1992, development delayed following failure to conclude arrangement with Taiwan Aerospace and prolonged downturn profitability in airline industry; new risk-sharing partners or partner group being sought, low level of development activity by 1994.

CURRENT VERSIONS: Initially offered in Long-Range, High Capacity, Freight and Combi versions; later to be offered in Stretch Medium Range, Stretch Long Range and Twin Engined versions

CUSTOMERS: No firm customers announced by mid-1995

DESIGN FEATURES: Full length two-deck fuselage seating up to 579 passengers in three classes; range would allow New York to Taipei or Singapore to Zurich or Los Angeles to Bangkok non-stop. Wing of advanced technology with 35° sweep, wing span maintains operational clearance with current taxiway separation standards, seat mile costs to be 15 per cent less than those of current largest airliner

FLYING CONTROLS: Fly-by-wire control system with all-glass cockpit; normal ailerons assisted by outboard [illegible] panels, four elevator sections, rudders divided into fore and aft and upper and lower panels; total seven spoilers per wing for lateral control, airbrakes and lift dumping; six leading-edge slat and three flap sections per wing

LANDING GEAR: Five main legs each to carry one four-wheel bogie, inner legs retract into fuselage, outers into wing and [illegible], twin-wheel nose leg

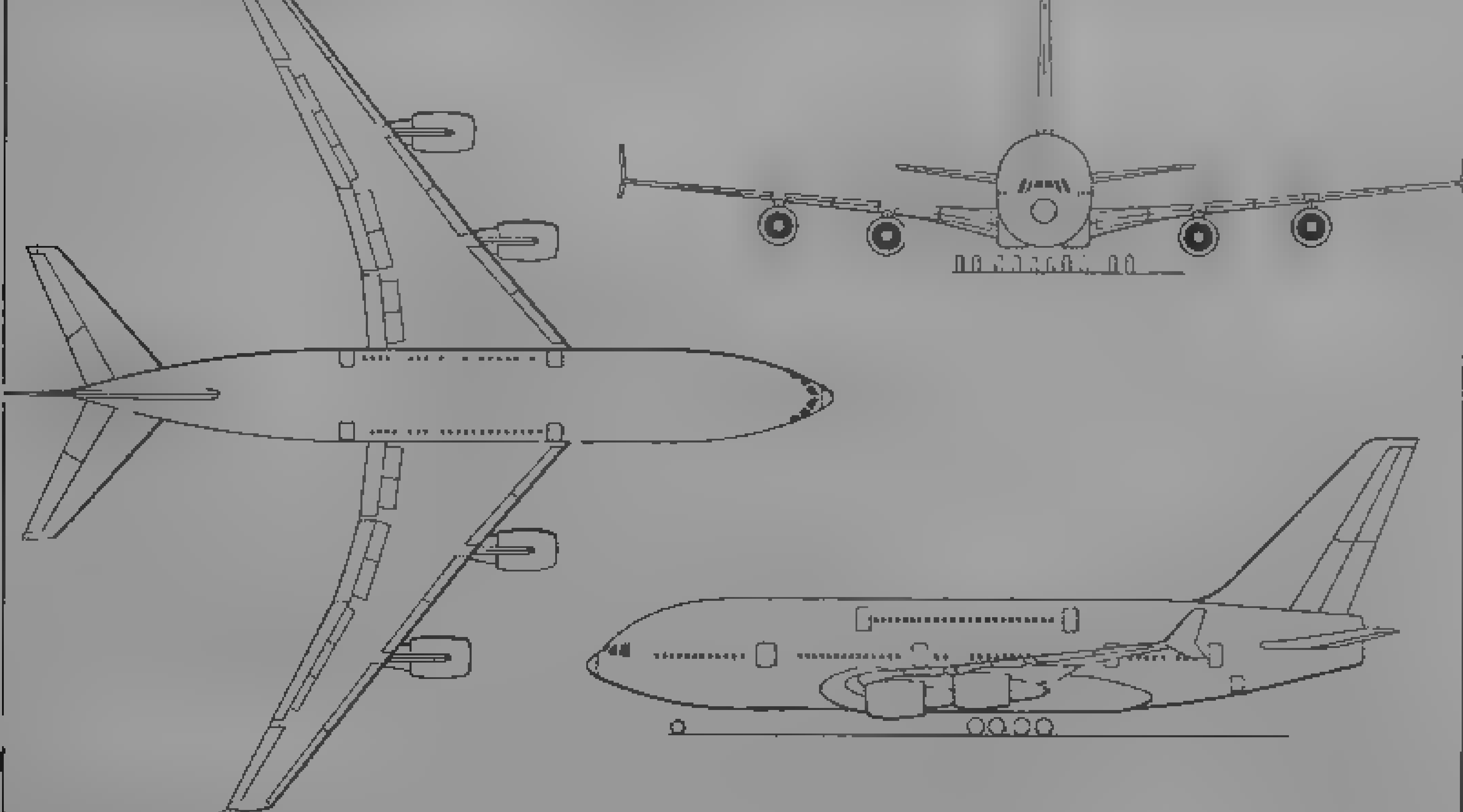
POWER PLANT: Four turbofans, choice of GE CF6-80C2D1F (273 6 kN, 61,500 lb st each) or Pratt & Whitney PW4462 (275 8 kN, 62,000 lb st each) or Rolls-Royce Trent 764 (284 7 kN, 64,000 lb st each)

ACCOMMODATION: Two-pilot flight deck on main deck level possible cross-qualifying with MD-11, crew rest compartment at front end of main upper decks, cabin crew rest area at aft end of upper deck, main deck has two or three aisles; upper deck has two aisles. Long Range interior seats 481 passengers in three-class layout, including 176 economy class on shortened upper deck plus 24 first class, 90 business class and 191 economy class on main deck; High Capacity version seats as many as 579 passengers with 107 business class and 93 economy class on full-length upper deck plus 30 first class and 349 economy class on main deck. Combi carries maximum of nine freight pallets on main deck and 428 passengers. Freighter accommodates cargo on both main and upper decks, underfloor freight compartments hold two LD3 containers abreast, eight passenger doors on main deck and four escape doors on upper deck, one stairway standard and second available for High Capacity.

DIMENSIONS, EXTERNAL:
  Wing span 69 80 m (229 ft 0 in)
  Wing aspect ratio 7 76
  Length: fuselage 61 32 m (201 ft 2 in)
    overall 63 93 m (209 ft 9 in)
  Height overall 23 32 m (76 ft 6 in)
  Tailplane span 25 12 m (82 ft 5 in)
  Wheel track 11 48 m (37 ft 8 in)
  Wheelbase 26 82 m (88 ft 0 in)

DIMENSIONS, INTERNAL:
  Cabin: Main deck width at floor 6 71 m (22 ft 0 in)
    Upper deck width at shoulder 5 33 m (17 ft 6 in)
  Underfloor freight volume 139 3 m³ (4,920 cu ft)
  Main deck freight volume 538 9 m³ (19,030 cu ft)
  Upper deck freight volume 198 2 m³ (7,000 cu ft)

AREAS:
  Wings, gross 628.1 m² (6,761 0 sq ft)
  Vertical tail surfaces (total) 108 7 m² (1,170 0 sq ft)
  Horizontal tail surfaces (total) 140.3 m² (1,510.0 sq ft)



Four-engined two-deck (short upper deck version) McDonnell Douglas MD-12, announced in April 1992 *(Jane's/Mike Keep)*

1993

WEIGHTS AND LOADINGS (LR Long Range, HC High Capacity, C Combi, F Freighter):

Operating weight empty: LR	200,490 kg (442,000 lb)
HC	208,655 kg (460,000 lb)
C	209,105 kg (461,000 lb)
F	191,870 kg (423,000 lb)
Weight limited payload: F only	143,790 kg (317,000 lb)
Max T-O weight: LR, HC, C, F	463,570 kg (1 022,000 lb)
Max zero-fuel weight: LR, HC	290,300 kg (640,000 lb)
C	297,100 kg (655,000 lb)
F	328,855 kg (725,000 lb)
Max landing weight: LR, HC	308,445 kg (680,000 lb)
C	315,245 kg (695,000 lb)
F	347,000 kg (765,000 lb)
Max wing loading	738 0 kg/m² (151 2 lb/sq ft)

PERFORMANCE (estimated):

Cruising Mach number	0 85
FAA T-O field length (ISA + 30°C)	3,170 m (10,400 ft)
FAA landing field length (S/L):	
LR, HC	2,683 m (8,800 ft)
C	2 744 m (9 000 ft)
F	2 926 m (9,600 ft)
Design range (FAA international reserves and full passenger payload; freight payload on C and F at 136 kg/m³, 8 5 lb/cu ft):	
LR	8 090 n miles (14 982 km, 9 309 miles)
HC	7,130 n miles (13,204 km, 8,205 miles)
C	6 360 n miles (11 778 km; 7,319 miles)
F	5 000 n miles (9,260 km, 5,753 miles)

UPDATED

MCDONNELL DOUGLAS HIGH-SPEED COMMERCIAL TRANSPORT

Douglas study suggests as much as 20 per cent of traffic demand in 2010 could be met by High Speed Commercial Transports. In-house and NASA contract research under way, $8 million five year NASA Langley study contract awarded 1991, certification not before 2005, potential sales, 500 to 1,500; main operating areas Pacific Rim and North Atlantic. Douglas also member of international SST study group (see Supersonic Airliner Studies in International section) formed March 1990. Current Douglas research focusing on Mach 2.4 aircraft with range of more than 5 500 n miles (10,186 km, 6,329 miles) carrying 300 passengers in three classes, would fly over land at Mach 0.95, target dates are first flight 2003, certification no earlier than 2005 and in service 2006. Each HSCT would probably cost two to three times as much as a 300-passenger subsonic airliner

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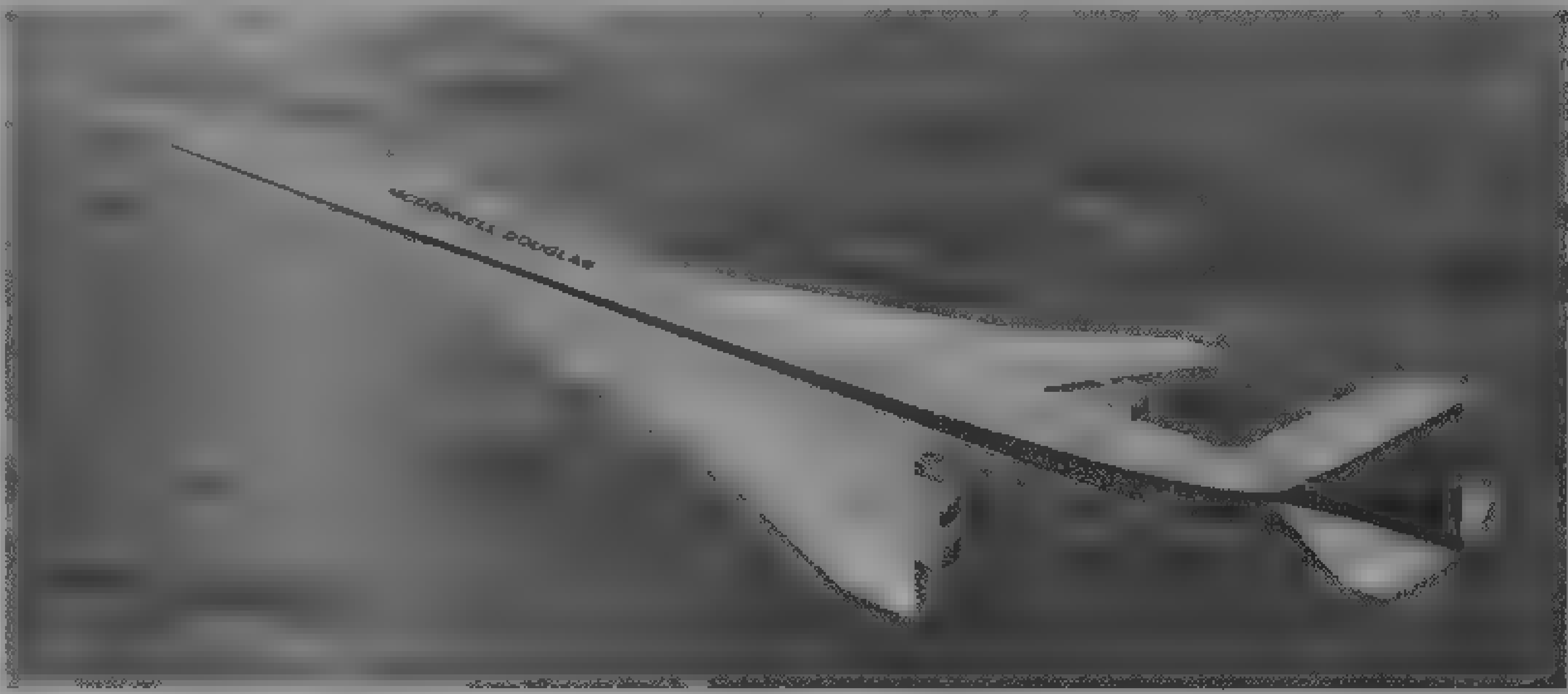

Artist's impression of 300-passenger Douglas High Speed Commercial Transport

1994

MELEX

MELEX USA INC

1221 Front Street, Raleigh, North Carolina 27609
Telephone: 1 (919) 828 7645
Fax: 1 (919) 834 7290
Telex: 825868 MELEX UI

VICE PRESIDENT: George Lundy

Subsidiary of Pezetel and PZL Mielec of Poland, responsible for sale and support of PZL Warszawa PZL-104 Wilga, PZL Mielec M-18 Dromader agricultural aircraft and M-26 Iskierka aerobatic aircraft in western hemisphere. Only M-26 has recently been imported into the USA. Details in Polish section of this edition and US section of 1994-95 and earlier *Jane's*

UPDATED

MERLIN

MERLIN AIRCRAFT INC

509 Airport Road, Muskegon, Michigan 49411
Telephone: 1 (616) 798 1622
Fax: 1 (616) 798 2376

GENERAL MANAGER: John W Burch

DIRECTOR, INTERNATIONAL SALES: Terry M Shepard

Merlin now produces a variant of the Macair Merlin light aircraft, previously produced by Macair Industries Inc of Baldwin, Ontario, Canada (which see in 1990-91 *Jane's*)

MERLIN MERLIN

TYPE: Side by side two-seat light aircraft

CURRENT VERSIONS: Available as floatplane, agricultural sprayer, or as light attack aircraft with two wing-mounted 5 56 mm machine guns and/or a fuselage-mounted pod with seven 70 mm rockets

CUSTOMERS: About 130 civil versions sold

DESIGN FEATURES: Strut-braced high wing full-span flaperons, tailplane with separate elevator

LANDING GEAR: Non-retractable mainwheels and tailwheel

POWER PLANT: One 74 6 kW (100 hp) Canadian Automotive (CAM) 100 engine, driving a two- or three-blade propeller

DIMENSIONS, EXTERNAL:

Wing span	9 75 m (32 ft 0 in)
Length overall	6 10 m (20 ft 0 in)
Height overall	1 85 m (6 ft 1 in)

PERFORMANCE:

Max level speed	104 kts (193 km/h, 120 mph)
Stalling speed	34 kts (63 km/h, 39 mph)
T-O distance	46 m (150 ft)
Landing distance	70 m (200 ft)
Max range	417 n miles (772 km, 480 miles)

UPDATED

Floatplane version of Merlin Merlin

1995

Proposed Merlin military version with underfuselage rocket pod and machine gun under wing

1995

MOLLER

MOLLER INTERNATIONAL

1222 Research Park Drive, Davis, California 95616
Telephone: 1 (916) 756 5086
Fax: 1 (916) 756 5179
PRESIDENT: Dr Paul S Moller
DIRECTOR OF MARKETING: Jack G Allison

VERIFIED

MOLLER M200/M400 SKYCAR

TYPE: Unorthodox fan-lift light aircraft.

PROGRAMME: Company formed 1983 to develop Volantor VTOL aircraft, including high power/weight ratio engines and three-axis stabilisation; prototypes called Discojet, XM-4 and 200X were saucer-shaped with multiple lift fans and centrally mounted cockpit, 200X made 150 flights from 1987 onwards, powered by eight 37.3 kW (50 hp) Wankel engines, design patented May 1992. Development in 1992-94 concentrated on own twin-rotor rotary engine weighing only 29.5 kg (65 lb); first flight of prototype scheduled for mid-1996 followed by FAA certification in 1997.

CURRENT VERSIONS: **M200**: Two-seat, five-fan version.

M400: Four-seat, four-fan version, *as described*.

CUSTOMERS: Total 88 expressions of interest.

COSTS: Development has cost $38 million, unit cost $995,000.

FLYING CONTROLS: Two sets of cascading vanes at rear of each duct vector thrust vertically for take-off, hover and landing; in horizontal flight, vanes move concurrently to act as elevators and differentially as ailerons; four servo motors power each set of vanes. Full time fly-by-wire provides stability augmentation, controlled by sensors and input from pilot's dual joysticks.

POWER PLANT: Eight 89.5 kW (120 hp) Moller MR 530 HT twin-rotor rotary engines mounted in pairs in four ducts and driving independent contrarotating fans.

AVIONICS: EFIS flight instrumentation.

DIMENSIONS, EXTERNAL:
Length overall: 5.49 m (18 ft 0 in)
Max width: 2.74 m (9 ft 0 in)
Height overall: 1.83 m (6 ft 0 in)

WEIGHTS AND LOADINGS:
Payload with max fuel: 335 kg (740 lb)
Design max T-O weight: 1,088 kg (2,400 lb)

PERFORMANCE (estimated):
Max level speed: 339 kts (627 km/h; 390 mph)
Cruising speed: 304 kts (563 km/h; 350 mph)
Max rate of climb at S/L: 2 377 m (7,800 ft)/min
Service ceiling: 9,140 m (30,000 ft)
T-O and landing area diameter: 10.7 m (35 ft)
Max range: 782 n miles (1,448 km; 900 miles)

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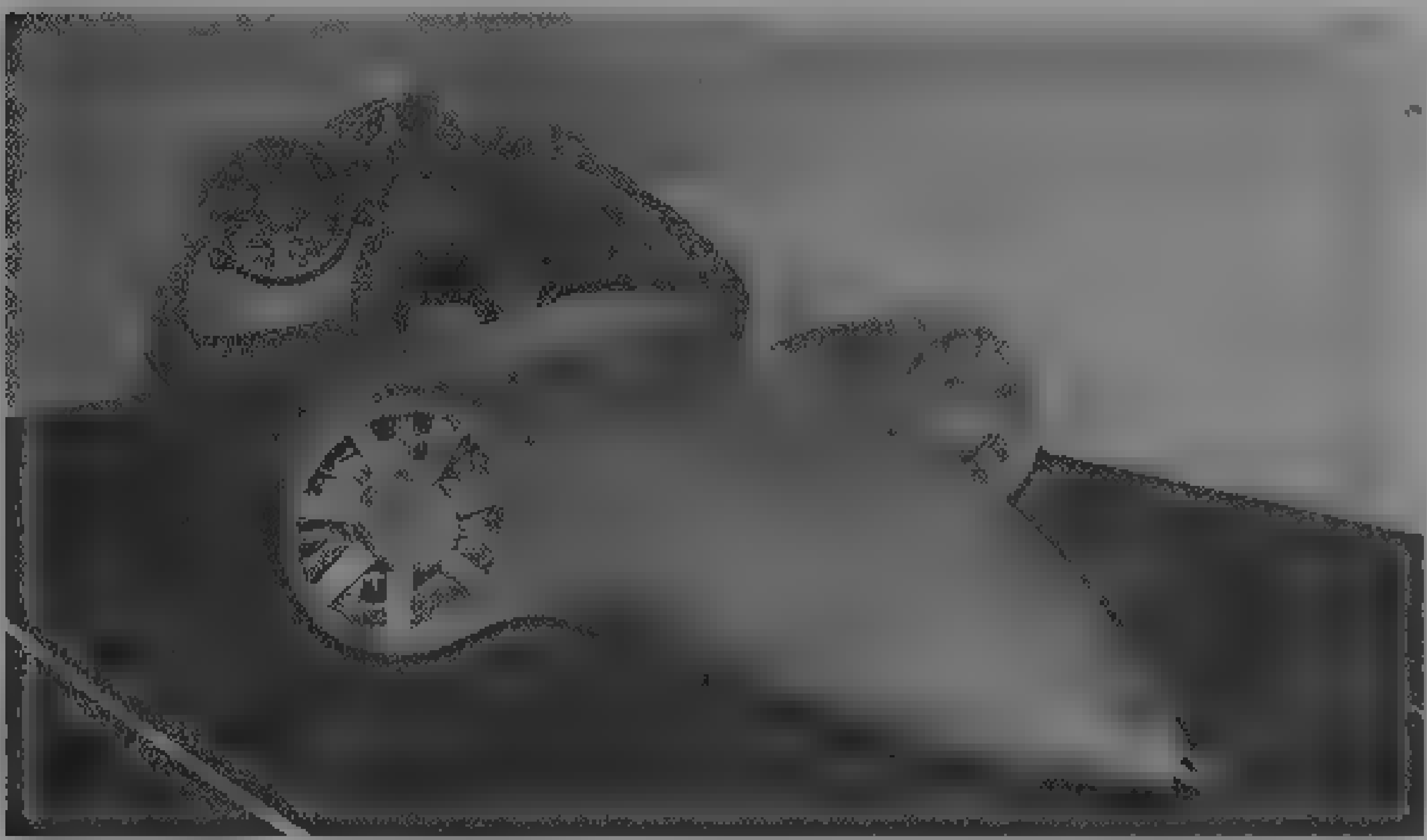


Model of two-seat M200 Skycar at 1995 Paris Air Show (*Paul Jackson*) *1995*

Moller M400X four-seat prototype, to fly in 1996 *1995*

MONTANA

MONTANA COYOTE INC

3302 Airport Road, PO Box 9272, Helena, Montana 59601
Telephone: 1 (406) 449 3556
Fax: 1 (406) 449 3570
EXECUTIVE VICE-PRESIDENT AND OPERATIONS MANAGER:
Kenneth D Probst

UPDATED

Montana Coyote two-seat STOL homebuilt *1993*

MONTANA COYOTE

TYPE: Two-seat STOL homebuilt.

PROGRAMME: First flown in Spring 1991, kits available since Summer 1991. Building time 600 to 800 hours.

COSTS: Kit $16,500, including basic VFR and engine instruments, prewelded components, fuel and brake systems, hardware and covering; does not include engine, propeller and paint.

STRUCTURE: Wooden wings, and 4130 steel tube fuselage, rudder and elevators, Dacron covered. Flaps and ailerons have aluminium alloy skins bonded to foam core. Wingtips, cowlings, seats, instrument panel, spinner and fuel tank of GFRP.

LANDING GEAR: Non-retractable tailwheel type, with brakes. Optional floats, amphibious floats and wheel/skis.

POWER PLANT: One engine of 74.5 to 149 kW (100 to 200 hp), weighing 159 kg (350 lb) or under. Fuel capacity 151 litres (40 US gallons; 33.3 Imp gallons).

DIMENSIONS, EXTERNAL:
Wing span: 11.58 m (38 ft 0 in)
Wing aspect ratio: 8.71
Length overall: 7.62 m (25 ft 0 in)
Height overall: 1.98 m (6 ft 6 in)
Propeller diameter: 1.88 m (6 ft 2 in)

AREAS:
Wings, gross: 5.40 m² (165.75 sq ft)

WEIGHTS AND LOADINGS:
Weight empty: 408-476 kg (900-1,050 lb)
Baggage capacity: 72.5 kg (160 lb)
Max T-O weight: 839 kg (1,850 lb)
Max wing loading: 54.49 kg/m² (11.16 lb/sq ft)

PERFORMANCE:
Max level speed: 104 kts (193 km/h; 120 mph)
Max cruising speed at 1,525 m (5,000 ft): 87 kts (161 km/h; 100 mph)
Econ cruising speed at 1,525 m (5,000 ft): 82 kts (153 km/h; 95 mph)
Stalling speed, power off: 31 kts (57 km/h; 35 mph)
Max rate of climb at S/L: 381 m (1,250 ft)/min
Service ceiling: 4,575 m (15,000 ft)
T-O and landing run: 107 m (350 ft)
Range: 434 n miles (804 km; 500 miles)
Endurance: 6 h
g limits: +5/−2

VERIFIED

MOONEY

MOONEY AIRCRAFT CORPORATION

PO Box 72, Louis Schreiner Field, Kerrville, Texas 78028
Telephone: 1 (210) 896 6000
Fax: 1 (210) 896 8180
CHAIRMAN AND PRESIDENT: Alexandre Couvelaire
CEO: Jacques Esculier
VICE-PRESIDENT, SALES: Jeffrey T Dunbar
VICE-PRESIDENT, MANUFACTURING: C. Keith Russey

Original Mooney company formed in Wichita, Kansas, 1948, produced single-seat M-18 Mite until 1952, later history recorded in 1987-88 *Jane's*. Alexandre Couvelaire, President of Euralair/Avialair Paris, France, and Michel Seydoux, President of MSC, jointly acquired Mooney in 1985. Mooney and Aerospatiale (Socata) announced joint development of TBM 700 June 1987 (see under Socata in French section), but Mooney withdrew in Spring 1991. Total of 10,039 aircraft of all models produced by end of 1994, 71 of which delivered in 1994.

UPDATED

MOONEY M20J MSE

TYPE: Four-seat touring aircraft.

PROGRAMME: First flight of original Mooney 201 June 1976, certificated September 1976; improved 201 SE (Special

Mooney MSE four-seat light aircraft (Textron Lycoming IO-360-A3B6D engine) *1995*

Edition) followed by modified 205; MSE version introduced August 1990

CURRENT VERSIONS: **MSE**: Standard version, *to which detailed description applies*

CUSTOMERS: Total of more than 1,850 Mooney 201/205s delivered by January 1995

COSTS: Basic $149,725; typically equipped with IFR avionics $211,135 (1995)

DESIGN FEATURES: High-efficiency touring aircraft, originally designed by Mooney brothers, wing section NACA $63_2$182-215 at root, 64$_1$181 412 at tip, dihedral 5° 30′, incidence 2° 30′ at root, 1° at tip; wing swept forward 2° 29′

FLYING CONTROLS: Manually operated, sealed gap, differentially operated ailerons, fin and tailplane integral so that both tilt, varying tailplane incidence for trimming, no trim tabs, electrically actuated single-slotted flaps.

STRUCTURE: Single-spar wing with auxiliary spar out to mid-position of flaps, wing and tail surfaces covered with stretch formed wraparound skins. Steel tube cabin section covered with light alloy skin, semi-monocoque rear fuselage with extruded stringers and sheet metal frames

LANDING GEAR: Electrically retractable levered suspension tricycle type with airspeed safety switch bypass. Nosewheel retracts rearward, main units inward into wings. Rubber disc shock absorbers in main units. Cleveland mainwheels, size 6.00-6, and steerable nosewheel, size 5.00-5. Tyre pressure, mainwheels 2.07 bars (30 lb/sq in), nosewheel 3.38 bars (49 lb/sq in). Cleveland hydraulic single-disc brakes on mainwheels. Parking brake

POWER PLANT: One 149 kW (200 hp) Textron Lycoming IO-360-A3B6D flat-four engine, driving a McCauley B2D34C214/90DHB-16 two-blade constant-speed metal propeller. Two integral fuel tanks in wings, with combined usable capacity of 242 litres (64 US gallons, 53.3 Imp gallons). Refuelling points in wing upper surface. Oil capacity 7.5 litres (2 US gallons, 1.7 Imp gallons)

ACCOMMODATION: Cabin accommodates four persons in pairs on individual vertically adjustable seats with reclining back, armrests, lumbar support and headrests. Dual controls standard. Overhead ventilation system. Cabin heating and cooling system, with adjustable outlets and illuminated control. One-piece wraparound windscreen. Tinted Plexiglas windows. Rear seats removable for freight stowage. Rear seats fold forward for carrying cargo. Single door on starboard side. Compartment for 54 kg (120 lb) baggage behind cabin, with access from cabin or through door on starboard side

SYSTEMS: Hydraulic system for brakes only. Electrical system includes 70 A alternator, 24 V 10 Ah battery, voltage regulator and warning lights, together with protective circuit breakers. Windscreen defrosting system standard

AVIONICS: Choice of four 'required option' Bendix/King IFR avionics packages available: K200 without DME, K 300 with DME, K 400 with RNav/DME and K 500 with EFIS/GPS/RNav/DME.

Flight: Optional avionics include Bendix/King KAP 100, KAP 150 or KFC 150 autopilot/flight control systems. KR 87-15 ADF with KI 227-00 indicator, KI 227-01 slaved ADF, KI 229 RMI, KRA-10A-00 radar altimeter and KT 71-00 Mode C digital transponder; B F Goodrich WX-900, WX-1000 or WX-1000+ Stormscope

Instrumentation: Standard blind-flying instruments

EQUIPMENT: Standard equipment includes FT101A fuel management system, fuel sight gauges in wings, two electric fuel quantity gauges, electric OAT gauge, CHT and EGT gauges, alternate static source, and panel/cabin lighting, navigation lights, landing/taxi light, three high-intensity strobe lights, grey tinted windscreen and cabin windows, seat belts and shoulder harnesses for all seats, assist straps and baggage straps, hatshelf and coat hook, multiple cabin fresh air vents, cargo tiedowns, wing jackpoints and external tiedowns, towbar, fuel tank quick drains and fuel sampler cup, auxiliary power plug, heated pitot tube, epoxy polyimide anti-corrosion treatment, and overall external polyurethane paint finish. Optional equipment includes electric trim system, leather seats, leather-wrapped control wheels, export altimeter with millibar subscale, co-pilot's toe brakes and custom paint

DIMENSIONS, EXTERNAL:

Wing span	11.00 m (36 ft 1 in)
Wing chord, mean	1.50 m (4 ft 11¼ in)
Wing aspect ratio	7.45
Length overall	7.52 m (24 ft 8 in)
Height overall	2.54 m (8 ft 4 in)
Tailplane span	3.58 m (11 ft 9 in)
Wheel track	2.79 m (9 ft 2 in)
Wheelbase	1.82 m (5 ft 11⅝ in)
Propeller diameter	1.88 m (6 ft 2 in)
Propeller ground clearance	0.24 m (9½ in)

DIMENSIONS, INTERNAL:

Cabin: Length	2.90 m (9 ft 6 in)
Max width	1.10 m (3 ft 7½ in)
Max height	1.13 m (3 ft 8½ in)
Baggage door: Width	0.53 m (1 ft 9 in)
Height	0.43 m (1 ft 5 in)
Baggage compartment volume	0.38 m³ (13.5 cu ft)

AREAS:

Wings, gross	16.24 m² (174.8 sq ft)
Ailerons (total)	1.06 m² (11.4 sq ft)
Trailing-edge flaps (total)	1.66 m² (17.9 sq ft)
Fin	0.73 m² (7.92 sq ft)
Rudder	0.58 m² (6.23 sq ft)
Tailplane	1.99 m² (21.45 sq ft)
Elevators (total)	1.11 m² (12.05 sq ft)

WEIGHTS AND LOADINGS:

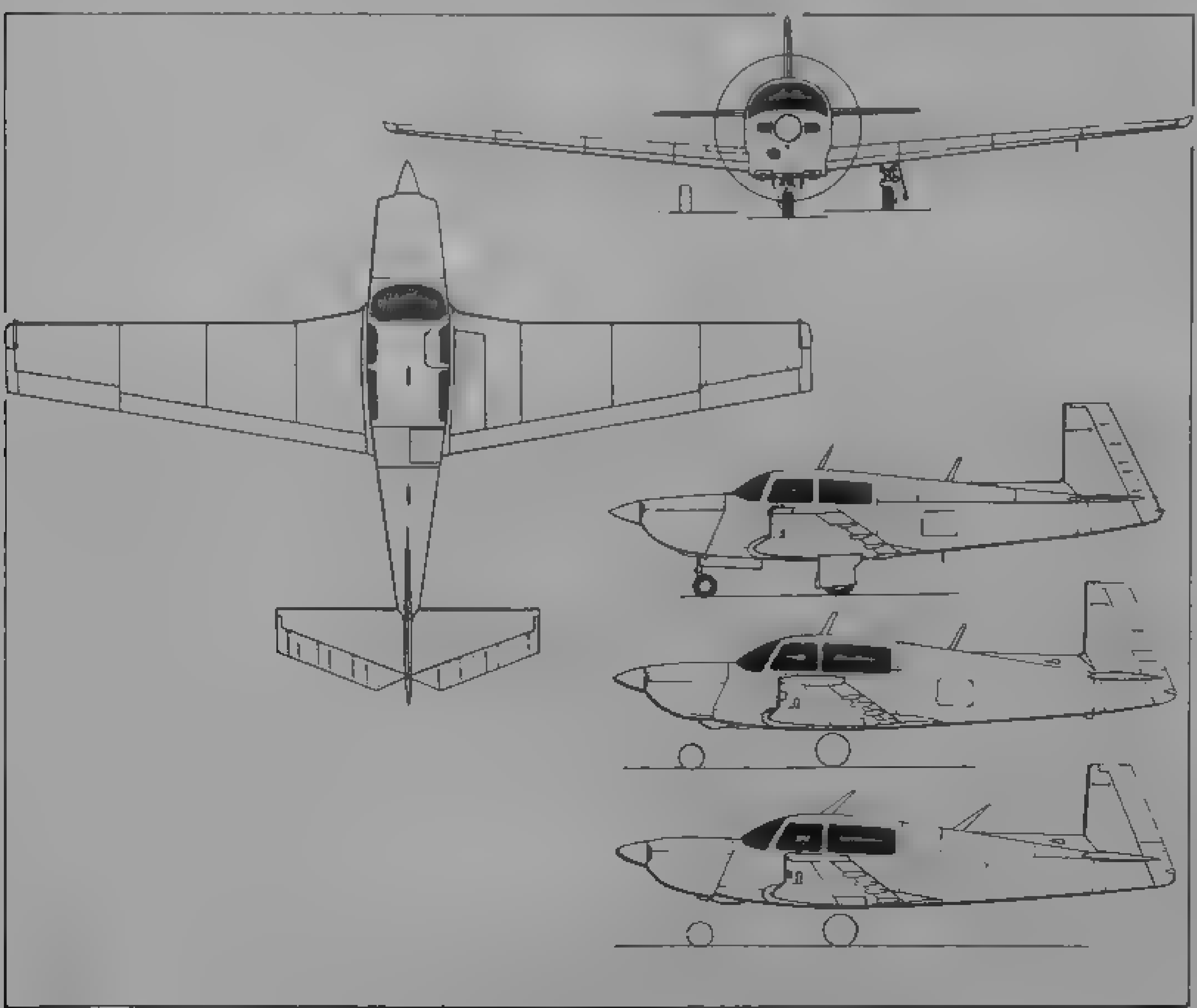
Weight empty	783 kg (1,726 lb)
Max T-O and landing weight	1,315 kg (2,900 lb)
Max wing loading	81.0 kg/m² (16.6 lb/sq ft)
Max power loading	8.83 kg/kW (14.50 lb/hp)

PERFORMANCE (at max T-O weight):

Never-exceed speed (VNE)	196 kts (364 km/h; 226 mph)
Max level speed at S/L	175 kts (325 km/h; 202 mph)
Max cruising speed, 75% power at 2,470 m (8,100 ft)	168 kts (311 km/h; 193 mph)
Econ cruising speed, 55% power at 2,470 m (8,100 ft)	152 kts (282 km/h; 175 mph)
Stalling speed: flaps up	62 kts (115 km/h; 72 mph) IAS
wheels and flaps down	58 kts (108 km/h; 67 mph) CAS
Max rate of climb at S/L	314 m (1,030 ft)/min
Service ceiling	5,670 m (18,600 ft)
T-O to 15 m (50 ft)	463 m (1,517 ft)
Landing from 15 m (50 ft)	491 m (1,610 ft)
Landing run	235 m (770 ft)
Range: 55% power, no reserves	1,059 n miles (1,961 km; 1,218 miles)
75% power, no reserves	951 n miles (1,761 km; 1,094 miles)

UPDATED

Mooney Ovation four-seat light aircraft (Teledyne Continental IO-550-G5B engine) *(Bob Grimstead)* 1995



Mooney MSE four-seat touring aircraft, with additional side views of TLS (centre) and Ovation (bottom) *(Jane's/Dennis Punnett)* 1995

MOONEY M20R OVATION

TYPE: Four-seat touring aircraft

PROGRAMME: Prototype (N20XR) rolled out April 1994; first flight May 1994, FAA certification July 1994

CUSTOMERS: Total 31 ordered by early November 1994, including 10 for export from customers in France, Germany, Paraguay, South Africa, Switzerland, Thailand and UK. 21 delivered by end of 1994, production rate 25 per year

COSTS: Basic $215,750 or $281,555, typically equipped with IFR avionics (1995)

DESIGN FEATURES: Combines airframe of TLS with normally aspirated flat six engine. Completely restyled instrument panel, seats and cabin interior with sandwich-core rigid trim/soundproofing panels and leather and wool fabric upholstery

POWER PLANT: One 224 kW (300 hp) Teledyne Continental IO-550-G5B flat-six engine, derated to 209 kW (280 hp), driving a McCauley three-blade constant-speed metal propeller. Usable fuel 337 litres (89 US gallons; 74 Imp gallons)

AVIONICS: As Mooney MSE

DIMENSIONS, EXTERNAL: As Mooney TLS except:

Length overall	8.17 m (26 ft 9¾ in)
Propeller diameter	1.85 m (6 ft 1 in)

WEIGHTS & LOADINGS:

Weight empty	1,029 kg (2,268 lb)
Max usable fuel	242 kg (534 lb)
Max T-O weight	1,528 kg (3,368 lb)
Max landing weight	1,451 kg (3,200 lb)
Max wing loading	94.1 kg/m² (19.26 lb/sq ft)
Max power loading	7.32 kg/kW (12.03 lb/hp)

PERFORMANCE (at max T-O weight, ISA, except where indicated)
Max cruising speed 190 kts (352 km/h; 219 mph)
Stalling speed
flaps and wheels up 66 kts (123 km/h; 76 mph)
flaps and wheels down 59 kts (110 km/h, 68 mph)
Max rate of climb at S/L 366 m (1,200 ft)/min
Service ceiling 6,100 m (20,000 ft)
Range, with reserves, at 2,745 m (9,000 ft)
1,130 n miles (2,092 km, 1,300 miles)

UPDATED

MOONEY M20M TLS

TYPE: Four-seat turbocharged light aircraft

PROGRAMME: Announced 2 February 1989 as TLS (Lycoming Sabre); certificated 1989

CUSTOMERS: 19 produced in 1994

COSTS: Basic $255,750, typically equipped with IFR avionics $334,830 (1995)

DESIGN FEATURES: Stretched fuselage; turbocharged and intercooled engine

POWER PLANT: One 201 kW (270 hp) turbocharged Textron Lycoming TIO-540-AF1A flat six engine, driving a McCauley three-blade metal propeller. Two integral fuel tanks in inboard wing leading-edges, with a combined capacity of 363 litres (96 US gallons, 80 Imp gallons), of which 337 litres (89 US gallons, 74 Imp gallons) are usable. Two-piece nose cowling is of composite glassfibre/graphite construction

ACCOMMODATION: All seats have centre and side armrests (removable in rear seats) and European-style headrests. Rear seats moved aft by 10 cm (4 in) to increase legroom. Pilot and co-pilot seats have inertia reel shoulder harnesses.

SYSTEMS: Dual 70 Ah 28 V alternators. 24 V 10 Ah batteries. oxygen system, capacity 3 26 m³ (115 cu ft), with masks and overhead outlets, standard

AVIONICS: As Mooney MSE

EQUIPMENT: Standard equipment includes attitude indicator, IFR directional gyro, fuel flow indicator, annunciator panel with press-to-test, electric/manual elevator trim and electric rudder trim with console- or panel-mounted LED indicators, avionics master switch, forward centre console, console-mounted chart holder, pilot's and co-pilot's map lights, high-speed electric starter, dual batteries console-mounted weight-and-balance computer, chrome-plated collapsible towbar, cigarette lighter and ashtrays, cabin, baggage door and ignition locks, and speedbrakes

Specifications as Mooney MSE except

Mooney TLS four-seat turbocharged light aircraft *1995*

DIMENSIONS, EXTERNAL
Length overall 8 15 m (26 ft 9 in)
Wheelbase 2 02 m (6 ft 7½ in)
Propeller diameter 1 91 m (6 ft 3 in)
Propeller ground clearance 0 28 m (11 in)

DIMENSIONS, INTERNAL
Cabin: Length 3 20 m (10 ft 6 in)
Floor area 3 53 m² (38 0 sq ft)
Volume 3 88 m³ (137 cu ft)
Baggage compartment volume 0 64 m³ (22 6 cu ft)

WEIGHTS AND LOADINGS
Weight empty 1,029 kg (2,268 lb)
Max T-O weight 1 528 kg (3 368 lb)
Max wing loading 94 07 kg/m² (19 27 lb/sq ft)
Max power loading 7 59 kg/kW (12 47 lb/hp)

PERFORMANCE (at max T-O weight, ISA, except where indicated)
Max cruising speed
at 3 960 m (13 000 ft) 200 kts (371 km/h, 230 mph)
at 7,620 m (25,000 ft) [illegible] kts (407 km/h; 253 mph)
Stalling speed
flaps and wheels up 66 kts (122 km/h, 76 mph)
flaps and wheels down 59 kts (109 km/h, 68 mph)
Max rate of climb at S/L 375 m (1,230 ft)/min
Certificated ceiling 7,620 m (25,000 ft)
Range with reserves, at 3,965 m (13,000 ft)
1 070 n miles (1,982 km, 1 231 miles)
Endurance 6 h 42 min

UPDATED

MUSTANG

MUSTANG AERONAUTICS INC

Construction of Mustang II continues by several hundred amateurs, aircraft last described in 1994 95 edition

UPDATED

NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (Office of Aeronautics)

600 Independence Avenue SW, Washington, DC 20546
Telephone: 1 (202) 453 2693
Fax: 1 (202) 426 4256
Telex: 89530 NASA WSH

ASSOCIATE ADMINISTRATOR: Dr Wesley Harris
DIRECTOR FOR AERONAUTICS: Cecil C Rosen

NASA budget request for FY96 is $14 260 million, however, $5 billion spending cut expected by end of FY00, at which time prime NASA concerns will be R&D rather than operationally driven, staff total of 24,731 to be reduced to 21,100 by 1999, operates fleet of about 110 aircraft, comprising 33 dedicated to research and 70 to programme support, flies typical 29,000 hours per year, including 24,600 for R&D and programme support; employs 137 pilots, including 45 astronauts. Most aircraft carry civilian registrations between N400NA and N999NA, assigned according to base. Main operating bases are

Ames Research Center, Moffett Field, California (N700-799NA)

Dryden Flight Research Facility, Edwards AFB, California (N800-899NA)

Langley Research Center, Hampton, Virginia (N500-599NA)

Lewis Research Center, Cleveland, Ohio (N600-699NA)

Other significant aircraft operations bases are

Johnson Space Center, Houston, Texas (N900-999NA)

Wallops Flight Facility, Wallops Island, Virginia (N400-499NA)

UPDATED

REUSABLE LAUNCH VEHICLE (X-33)

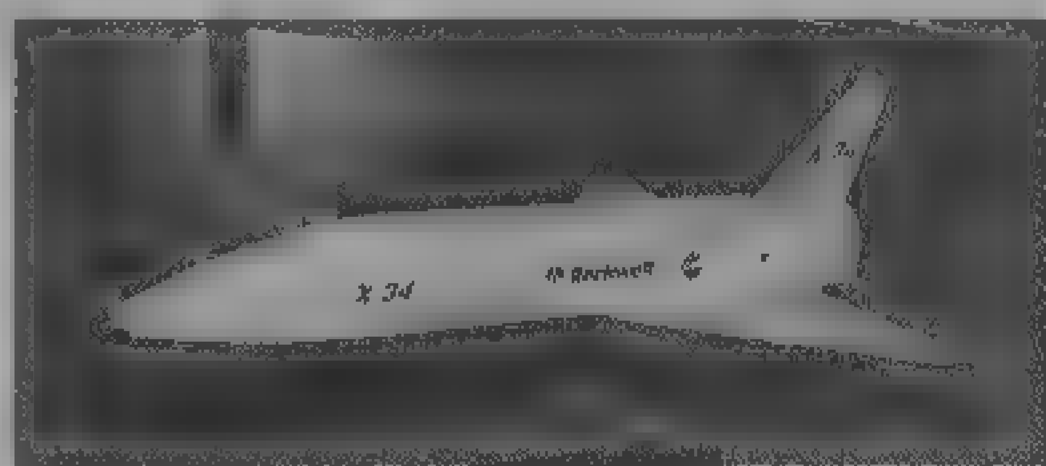
Joint NASA/industry project to develop single-stage-to-orbit technology demonstrator reusable launch vehicle (RLV), paving way for orbital RLV with capability to carry 18,000 kg (39,683 lb) payload. Industry briefed on funding by NASA at Marshall Space Flight Center on 19 October 1994, when Co-operative Agreement Notice (CAN) issued; deadline for initial response from interested agencies 2 November, with proposals due for submission on or by 6 January 1995. NASA to reduce initial three definition teams to one (possibly two) for development and flight test stage through 1999. During period FY95 to FY99 NASA plans to allocate $660 million to X 33 project, though intent is for any follow on RLV to be privately financed, with government commitment limited to guaranteeing to buy agreed number of launches

Three teams selected by NASA in March 1995 for 15 month concept definition and design phase. McDonnell Douglas and Boeing teamed to compete for work, with McDonnell drawing on VTOL experience gained with DC-X subscale flight demonstrator project tested in 1993-94, though X-33 effort starts with 'clean sheet of paper'. Lockheed Martin formed partnership arrangement with Rocketdyne and Rohr, design leadership vested in Lockheed Martin Skunk Works at Palmdale, California, which currently studying lifting-body design. Rockwell team includes Northrop Grumman and Orbital Sciences Corporation

NEW ENTRY

REUSABLE LAUNCH VEHICLE (X-34)

Joint NASA/industry project for small RLV with capability to deliver 544 to 1,134 kg (1,200 to 2,500 lb) payload into low Earth orbit. Co-operative Agreement Notice issued 19 October 1994, with target dates for response from industry identical to those of X 33 project. By late October 1994, at least 16 companies had developed concepts for X-34, with others expected. NASA has earmarked budget of $70 million for development and testing of system and chosen (in March 1995) Orbital Sciences Corporation/Rockwell consortium to participate in joint programme, industry contributing further $100 million. Studies in 1995 considering alternative approaches of 35,000 kg (77,162 lb) X 34A carried by specially modified Lockheed L 1011 TriStar, and larger, 50,000 kg (110,230 lb) X 34A fitted on top of Boeing 747. Targets include suborbital tests in late 1997; first orbital launch in 1998, and two test missions in 1998 and 1999



Model of X-34 proposed by OSC/Rockwell *(Paul Jackson)* *1995*

NEW ENTRY

NASA TRIALS PROGRAMMES

Recent developments summarised hereunder

Boeing 747SP: Engineering work under way to build Stratospheric Observatory For Infra-Red Astronomy (SOFIA) with 2 50 m (98 in) telescope, to replace Lockheed C-141A (NASA 714), partner is German Ministry of Science (BMFT); cruise altitude 12,500 to 13,700 m (41 000 to 45,000 ft) to fly 120 sorties (8 hours each) per year for 20 years

Boeing 757: Transport Systems Research Vehicle at Langley; being prepared for fly-by-light and power-by-wire systems trials in 1998-99; will also be used to evaluate aircraft safety, operating efficiency and compatibility with future air traffic control systems and participate in NASA's Advanced Subsonic Transport and High-Speed Research projects

Lockheed Martin C-130B Hercules: Earth Resources Aircraft Program operates C-130B (N707NA/58 0712) to

acquire data for Earth research, carries variety of sensors for Federal, state, university and industrial investigations.

Lockheed Martin EC 130Q Hercules. Two (including N427NA) ex-US Navy delivered to Wallops in December 1991 for modification to remote sensing platforms, replacing NP-3A Orion (NASA428).

Lockheed SR-71 Two SR 71As (NASA832/64 17971 and NASA844/64-17980) and one SR 71B (NASA831/64-17956) acquired in 1991 in support of high-speed research and support to X 30 NASP, one SR 71A (NASA832) since returned to USAF operational inventory. Flights include crew proficiency in NASA831; began series of high altitude ultraviolet spectronomy missions March 1993; available for hire by commercial customers at up to $200,000 per sortie. SR 71 under consideration as possible launch vehicle for HERA/M57A1 missile target for ABM proving trials.

Lockheed Martin F-16XL: Acquired two aircraft, 1991 92, for advanced research into laminar flow with applications in High-Speed Civil Transport (HSCT) programme (See Lockheed Martin entry, this edition.) First (single-seat) aircraft (NASA849/75-0749) flown at Dryden from 3 May 1990 before transfer to Langley in April 1993, to test high-lift devices for HSCT from 1995-96, smoke-generation device in wings, laser scanner; video cameras in fuselage spine. Second (two seat) (NASA848/75-0747) for trials 1992 96 at Dryden, first flight 29 September 1992 with passive (no suction) glove on starboard wing, due to begin trials with active titanium glove on port wing. Year-long laminar flow test project set to start by October 1995 as part of High Speed Research programme, between 45 and 60 flights anticipated, with laminar-flow demonstrations commencing one month after first flight of modified aircraft. First F-16XL recently engaged in supersonic-boom experiment, functioning as probe to fly in wake of SR-71 and study shockwave boundary.

McDonnell Douglas F-15A. (NASA835/71-0287) Used as testbed for integrated digital electronic engine and flight control systems, demonstrated first self-repairing flight control systems. Currently flown in programme to improve engine performance, fuel efficiency and lifetime (performance seeking controls), and for studies of engine-only control research. Goals include landing on engine controls only (aerodynamic surfaces locked); made first touch-and-go landing with aerodynamic controls locked and using thrust vectoring for pitch attitude and lateral control in April 1993.

McDonnell Douglas F/A-18: Includes F/A-18A High Angle of Attack Research Vehicle (HARV) (NASA840/161251) with thrust vectoring system, first flight 16 January 1991 at Dryden, first flight with vectoring 15 July 1991, reached 70° AoA in sustained flight 1992; trials continued to 1994, initially with inlet-mounted pressure sensor and new programmable Ada software for quadruplex digital FCS, addition of vortex-flow nose strakes, late 1994, strakes 1 22 m (4 ft 0 in) long and 0.15 m (6 in) wide, hinged on lower edges and rotated outwards in flight to control nose vortices. F/A-18B Systems Research Aircraft (SRA) N845NA began tests in late 1993 under Navy Fiber Optic Control System Integration (FOCSI) programme with fly-by-light control system duplicating existing wiring. Fresh series of fly-by-light control tests begun July 1994, based on experience gained with FOCSI programme, expected to lead to Fly-by-light Aircraft Closed-loop Tests (FACT) project in fourth quarter of 1995 with objective of bringing fibre optics into critical paths of flight control system.

Northrop Grumman YF-23: Initially for non-flying research at Dryden into loads calibration techniques, both prototypes received late 1993, minus engines, flight control computers and some avionics. First prototype (87 0800) expected to join trials fleet and was being restored to flight status in closing stages of 1994.

Rockwell OV-10A: Entered service at Langley April 1993 for wake vortex studies (N524NA/68-3799). Benchmark tests undertaken at Memphis International Airport from Autumn 1994 at start of expected year long assessment of wake vortex behaviour and decay in joint NASA/FAA study; futher tests to follow at other locations. NASA also intended to launch advanced studies by flying OV 10 in trail behind C-130 from January 1995.

Rockwell/DASA X-31 NASA acquired both aircraft, April 1992, based at Dryden in international test programme, achieved 74° AoA in sustained flight, 29 April 1993. Air combat trials against F A 18A Hornet began November 1993, introduced GEC-Marconi Viper symbology displaying pilot's helmet from 6 January 1994. Trials completed February 1994; in 94 close combats, demonstrated 9 6 1 kill ratio

One of the two X-31s was destroyed near Edwards AFB, California in January 1995

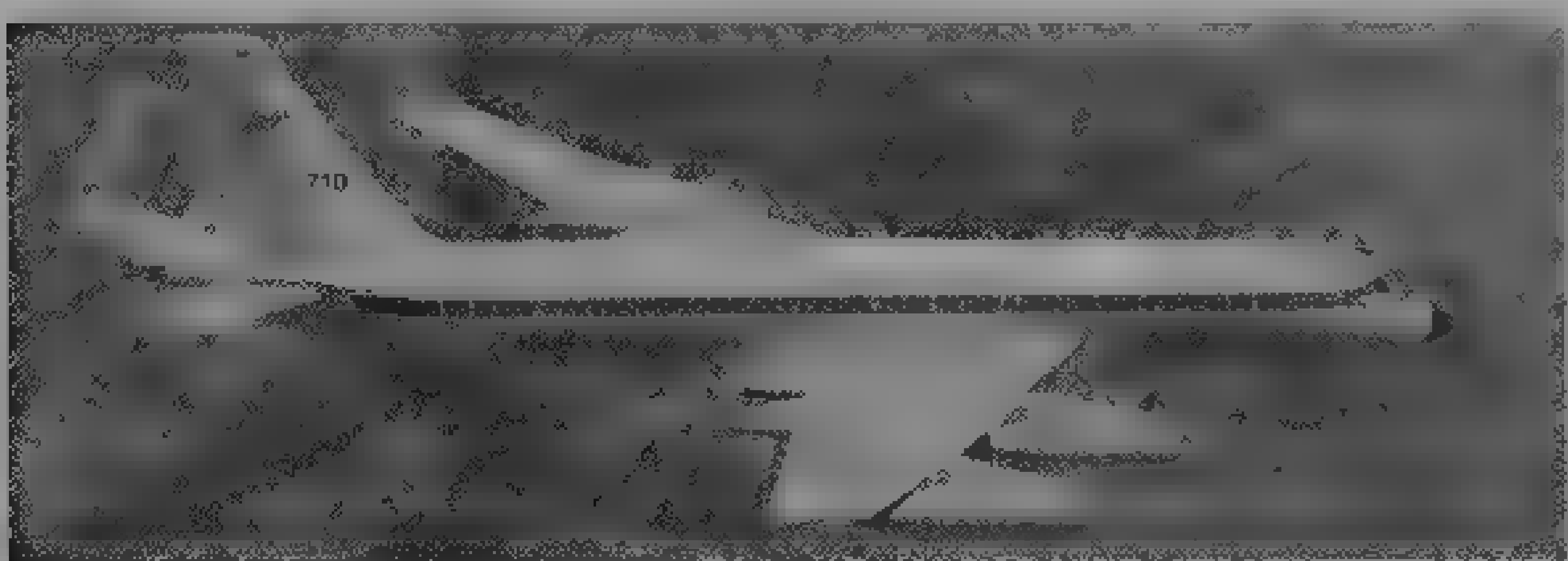
1995

HIGH AoA THRUST VECTORING COMPARISONS

Comparison of performances by NASA's X 31 and F/A 18 HARV and the USAF/Lockheed Martin F 16D MATV (which see under Lockheed Martin), compiled April 1994

Aircraft	F/A-18 HARV	X-31	F-16D MATV
First flight	16 January 1991	11 October 1990	2 July 1993
Registration	N840NA	164584/164585	86-0048
Typical gross weight	15,876 kg (35,000 lb)	6,622 kg (14,600 lb)	11,521 kg (25,400 lb)
Power plant	GE F404	GE F404	GE F110
Number, thrust	2 × 71 17 kN (16,000 lb st)	1 × 71 17 kN (16,000 lb st)	1 × 124.55 kN (28,000 lb st)
Wing reference area	37 16 m² (400.0 sq ft)	21.02 m² (226 3 sq ft)	27 87 M² (300.0 sq ft)
Thrust weight ratio[1]	0.48	0 57	0 46
Wing loading (typical)	427 2 kg/m² (87 5 lb/sq ft)	314 9 kg/m² (64.5 lb/sq ft)	413 5 kg/m² (8 47 lb/sq ft)
Max load factor	+5 4 *g*/+4 3 *g*	+6 *g*	+8 *g*
VMO/MMO	450 kts/M 0.9	485 kts/M 0.9-1 25	435 kts/M 0 95
Max speed for full AoA	n/a (g limited)	265 kts (491 km/h, 305 mph)	250 kts (463 km/h, 288 mph)
TV effective deflection	12.5°	12-15°	18°
TV side force[2]	1,633 kg (3 600 lb)	998 kg (2,200 lb)	1,633 kg (3,600 lb)[3]
TV moment arm	6.25 m (20 ft 6 in)	5 38 m (17 ft 8 in)	5 33 m (17 ft 6 in
TV moment[1]	10,203 kgm (73,800 ft-lb)	5,378 kgm (38,900 ft-lb)	8,710 kgm (63,000 ft-lb)
Elevator area	8 18 m² (88 0 sq ft)	2.93 m² (31.6 sq ft)	5 92 m² (63 7 sq ft)
Elevator moment arm	5.03 m (16 ft 6 in)	2.34 m (7 ft 8 in)	4 85 m (15 ft 11 in)
Canard area	n/a	1.00 m² (10.7 sq ft)	n/a
Canard moment arm	n/a	4 88 m (16 ft 0 in)	n/a
Tail volume coefficient[4]	0.31	0.15	0.30
Max AoA	unlimited	70°	unlimited
Max stabilised AoA	70°	70°	86°
Max AoA for Ps=0[5]	30°	45-50°	30-35°
Post stall pitch rate	≈40°/s	40°/s	45°/s
Roll rate at cruise	140°/s	240°/s	220°/s
Roll at post stall	40°/s	48°/s	50°/s

Notes: [1] At typical gross weight, M 0.2 at 6,100 m (20,000 ft)
[2] At 6,100 m (20,000 ft)
[3] Limited to 1,690 kg (3,725 lb) by engine mountings
[4] (Control surface area multiplied by moment arm) ÷ (wing area multiplied by MAC)
[5] At 6,100 m (20,000 ft), aircraft energy is constant



Convair 990-30 N810NA (ex N710NA) is a testbed for brakes and landing gear on both space shuttles and conventional aircraft

1994

NASA Dryden Research Facility F/A-18B fitted with fibre optic control system in FOCSI programme

1994

Engine and control system test F 15A Eagle NASA835 lands at Edwards AFB accompanied by chase F/A 18A Hornet

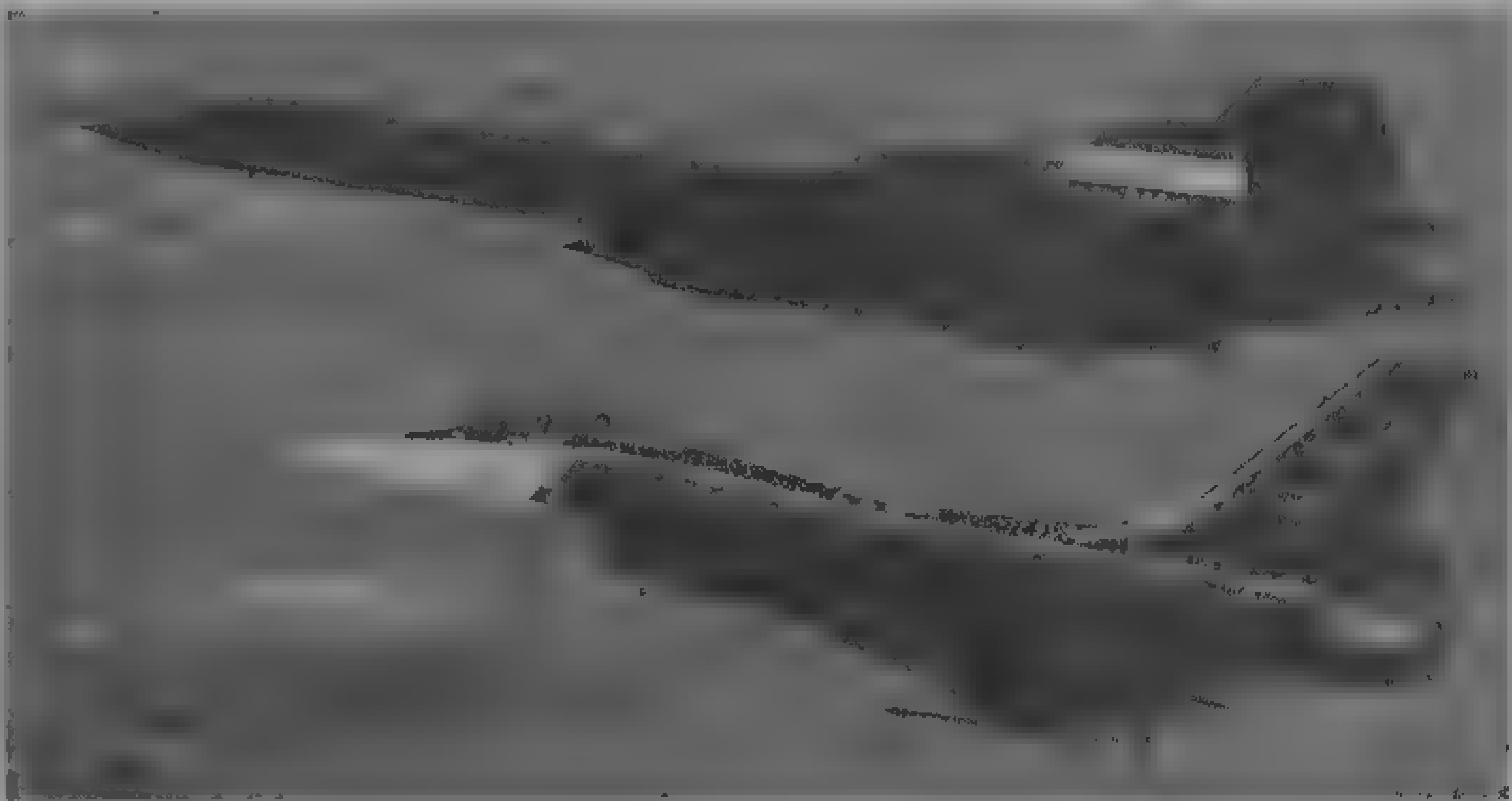
1995

against Hornet when using post-stall flight capability. Two sorties in March 1994 demonstrated thrust vectoring for yaw control after electronic flight control system modified to simulate removal of vertical tail. First aircraft destroyed near Edwards AFB 19 January 1995, suspected cause pilot icing. Prior to that, recent test activity had included use of tail-less flight capability to demonstrate thrust vectoring for power approach, carrier suitability and ground attack for JAST project, and further air combat evaluations against USAF F-15Ds and F-16Ds plus USN F-14s. Air combat tests due to end January 1995 and Rockwell/DASA seeking funds for follow-on test activity at time of accident.

Sikorsky JUH-60A: Acquired in 1991 as Rotorcraft Aircrew Systems Concept Airborne Laboratory (RASCAL NASA750); investigating increased agility for helicopters and improving automatic terrain-avoidance, heavily instrumented rotor blades. NASA won Boeing contract, January 1994, for three year test of fly-by-wire trials in RASCAL, intended to demonstrate technology for manoeuvrability exceeding RAH-66 Comanche capabilities.

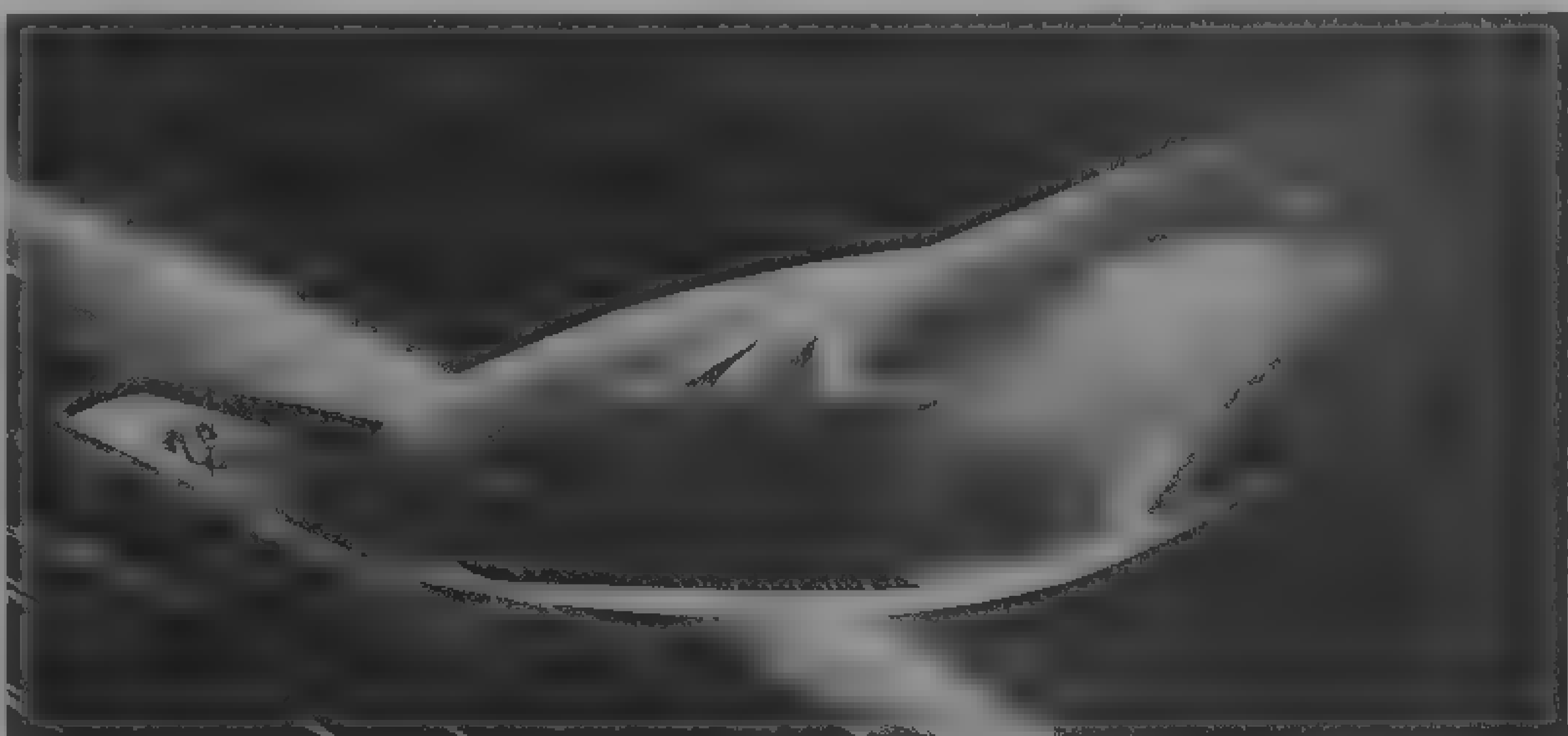
Tupolev Tu-144. Late model Tu-144D to be used by NASA as test vehicle for High-speed Research (HSR) programme, following adaptation by Tupolev under three year, $8 million contract with NASA and HSR team that includes Boeing, McDonnell Douglas, Rockwell, General Electric and Pratt & Whitney. Modification includes substitution of Kuibyshev KKBM NK 25 turbofan engines in place of original NK-144 power plants, plus fitment of airborne data sensor equipment. Langley Research Center responsible for management of programme, which initially calls for about 35 test flights commencing mid-1995 in Russia, later flights could be undertaken in USA. Project objectives include study of external and internal fuselage temperatures, thermal effects, noise levels, boundary-layer measurement, handling qualities and evaluation of close coupled inlet structures.

UPDATED



Supersonic transport trials have involved NASA's SR 71A generating sonic booms monitored by an F-16XL (nearest), as well as an F-18 Hornet, YO-3A and ground stations

1995



Lockheed Martin Skunk Works concept for reusable launch vehicle in X 33 class

1995

NORDAM

NORDAM MANUFACTURING DIVISION

Nordam's noise reducing measures for Boeing 737s are described in *Jane's Aircraft Upgrades*.

UPDATED

NORTHROP GRUMMAN

NORTHROP GRUMMAN CORPORATION

1840 Century Park East, Los Angeles, California 90067
Telephone: 1 (310) 553 6262
Fax: 1 (310) 552 3109/3104/4561
CHAIRMAN, PRESIDENT AND CEO: Kent Kresa

Acquisition of Grumman by Northrop completed 1 May 1994 and new corporation formed 18 May. Combined Northrop Grumman workforce more than 45 000 at time of takeover; reduced to about 41,000 by mid-1995. Northrop Grumman subsequently completed acquisition of Vought Aircraft Company, with $130 million purchase of Carlyle Group's 51 per cent interest, in August 1994. Vought workforce numbered 5,200 in Dallas area.

Northrop company formed 1939 to produce military aircraft; activities extended to missiles, target drones, electronics, space technology, communications, support services and commercial products; name changed from Northrop Aircraft Inc to Northrop Corporation in 1959. Reorganisation in wake of Grumman purchase resulted in creation of five divisions (B-2, Military Aircraft, Commercial Aircraft, Electronics and Systems Integration, and Data Systems and Services) plus Advanced Technology and Development Center.

Grumman Aircraft Engineering Corporation incorporated 6 December 1929; Grumman Corporation formed as small holding company 1969 for Grumman Aerospace Corporation, Grumman Allied Industries Inc and Grumman Data Systems Corporation. Ten operating divisions created February 1985 (see 1990-91 and earlier editions), followed by further reorganisations in 1987-88. Corporate structure consolidated into four operating groups in 1991, falling to three (Aerospace and Electronics, Data Systems and Services, and Allied: see 1993-94 edition) on 1 January 1993. Consolidation plan, finalised January 1994, required Grumman Corporation to shed one-third of worldwide capacity and abandon independent design and development of aircraft. Grumman Corporation employees totalled 16,700 at time of takeover.

Northrop Grumman divisional responsibilities allocated as follows.

Advanced Technology and Development Center intended to generate new military business, new non-traditional business and maintain technology base in support of core competencies.

B-2 Division is prime contractor for advanced technology stealth bomber and functions as depot for B-2 Spirit, plus centre for special projects.

Military Aircraft Division is responsible for ongoing military aircraft programmes and their derivatives; intercompany work orders for modification and assembly of aircraft (E-2C Hawkeye and E-8C Joint STARS); production of fuselage sections for McDonnell Douglas F/A-18, upgrade programmes for F-5 (Tiger IV) and T-38, and builds UAVs including BQM-74 and International Chukar III. Also responsible for Northrop Worldwide Aircraft Services Inc (NWASI), Lawton, Oklahoma, which provides technical assistance and support to US armed forces and customs service.

Commercial Aircraft Division produces commercial aircraft structures including major subassemblies and components for Boeing 747 (principal subcontractor), 757, 767, 777, Gulfstream IV/V, Raytheon Hawker 800, Airbus A340 and Fokker 100. Also manages residual ground transportation programmes.

Electronics and Systems Integration Division tasked with continuation of ongoing programmes, derivatives and upgrades to existing programmes (including EF-111A and EA-6B) as well as new electronic, battle management and system integration projects. Current work includes production of strategic and tactical navigation and guidance equipment, passive sensor and tracking systems, electronic countermeasures equipment (including AN/ALQ-135 internal countermeasures for USAF F-15 and AN/ALQ-162 for joint service use), rate and rate-integrating gyros and strapdown guidance systems. Also has overall programme responsibility for E-2C and E-8C.

Data Systems and Services Division, based in Bethpage, New York, continues existing Grumman activity and will incorporate the Northrop Information Services Center and services business of NWASI.

UPDATED

ADVANCED TECHNOLOGY AND DEVELOPMENT CENTER

8900 East Washington Boulevard, Pico Rivera, California 90660-3737
CORPORATE VICE-PRESIDENT AND GENERAL MANAGER:
Richard J. DeLust

Established 1991 to develop concepts and business for Military Aircraft and Electronic and Systems Divisions. Key centre for ASTOVL/CTOL design effort under Advanced Research Projects Agency X-32 programme and for Joint Advanced Strike Technology (JAST) project in concert with McDonnell Douglas and British Aerospace.

UPDATED

COMMON AFFORDABLE LIGHTWEIGHT FIGHTER (CALF) and JAST

TYPE: Strike-fighter technology demonstrator.

PROGRAMME: US Department of Defense designation X-32 allocated for technology demonstrator phase of Advanced Research Projects Agency (ARPA) programme. CALF initially launched as STOVL Strike Fighter (SSF) to provide US Navy/Marine Corps with replacement for F/A-18 Hornet and AV-8B Harrier II, later expanded to include USAF F-16 Fighting Falcon replacement candidate, with vertical lift system eliminated in favour of additional fuel to produce longer ranged, conventional take-off aircraft. Northrop Grumman last of four teams to emerge, entering X-32 programme in 1994, after securing ARPA agreement to participate at own expense, and offered lift-plus-lift/cruise propulsion concept; other teams headed by Boeing, Lockheed Martin and McDonnell Douglas. Northrop Grumman partnered by Pratt & Whitney and Rolls-Royce engine manufacturers. Congressional pressure in Autumn 1994 resulted in CALF project merging with Joint Advanced Strike Technology (JAST) programme (see US Navy entry). Northrop Grumman JAST study awards totalled $30 million by mid-1995.

NEW ENTRY

B-2 DIVISION

8900 East Washington Boulevard, Pico Rivera, California 90660-3737
Telephone: 1 (310) 942 3000
CORPORATE VICE-PRESIDENT AND GENERAL MANAGER:
Ralph D. Crosby Jr

Activities of B-2 Division continue unchanged under new corporate structure.

VERIFIED

NORTHROP GRUMMAN B-2 SPIRIT

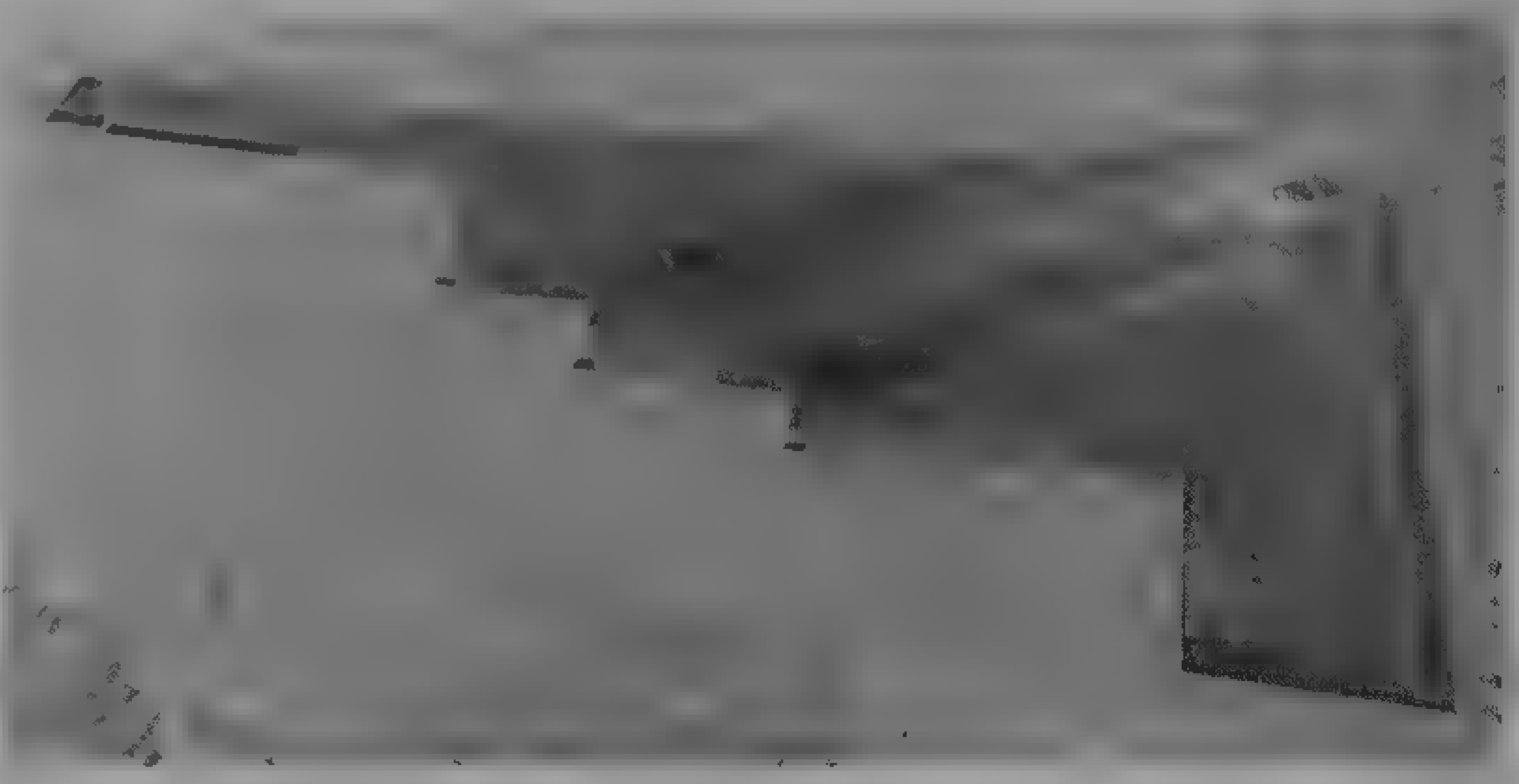
TYPE: Low-observable strategic penetration bomber.

PROGRAMME: Development of high level bomber started 1978, contract placed by USAF Aeronautical Systems Division October 1981, design modified for low-altitude operation 1983, KC-135 testbed for B-2 avionics flying at Edwards AFB since January 1987, six B-2s assigned to trials: all but first will be refurbished for operational service; two static airframes also funded, of which structural test airframe exceeded ultimate (150 per cent) load test before fracture at 161 per cent December 1992; by 1995, durability test airframe had completed second simulated lifetime of 20,000 hours/30 years; 4,000 hour test programme planned, of which 26 per cent concerned with low observables (LO) testing ends 1997.

Boeing completed work with delivery of outboard wing sections for 21st aircraft on 3 May 1994 and then began storage of tooling. Vought followed suit shortly after with completion of final intermediate section. However, follow-on procurement not ruled out, with Northrop Grumman submitting cost estimates to USAF for additional 20 B-2As, pending outcome of force requirement study presented to Congress at beginning of May 1995; study cost $125 million, including funds to preserve B-2 manufacturing facilities for 12 months.

Conventional weapons capability to be expanded following trials of GPS Aided Munition (GAM). Testing of 2,000 lb class weapon begun 23 November 1994 with F-4D of Tracor Flight Systems dropping first device at China Lake, California. Trials of associated GPS Aided Targeting System (GATS) stores management software on KC-135 began later in November. GATS/GAM package will bestow ability to deliver weapon to within 6 m (20 ft) of target. Total of 28 GAMs contracted for test programme, with further F-4 drops preceding B-2 trials in 1995 as prelude to start of full system testing with new software in August 1995.

GATS/GAM combination scheduled for deployment with 509th Bomb Wing by July 1996, with $25 million funding appropriated for purchase of 128 bombs, allowing



Northrop Grumman B-2A Spirit (four General Electric F118 turbofans)

1993

eight B-2As to be equipped with 16 GAMs each. Ultimately, GAM to be replaced by Joint Direct Attack Munition (JDAM). Production JDAM scheduled for release to service in 1999 and is key element in USAF proposals to use B-2A for long-range conventional bombing missions.

Duties and achievements of development batch B-2A Spirits are detailed below.

AV-1/82-1066: Rolled out USAF Plant 42 at Palmdale 22 November 1988, first flight (and delivery to Edwards AFB) 2 hours 20 minutes on 17 July 1989; first flight refuelling (from KC-10A) 8 November 1989. Block 1 of test programme, up to 13 June 1990, comprised 67 hours in 16 flights, covering aerodynamic performance and airworthiness. Block 2 LO testing began on 17th flight, 23 October 1990, after lay-up for preparation; further LO modifications late 1992, trials completed and placed in storage by March 1993, 81 sorties and 352.6 flying hours, to remain in trials configuration.

AV-2/82-1067: First flight, Palmdale to Edwards, 19 October 1990; envelope expansion; flutter, loads, landing gear and weapons bay door tests, 133 sorties and 686 hours to December 1994. Non-standard LO configuration plans for use as permanent testbed reversed in April 1993, and aircraft to be refurbished for USAF.

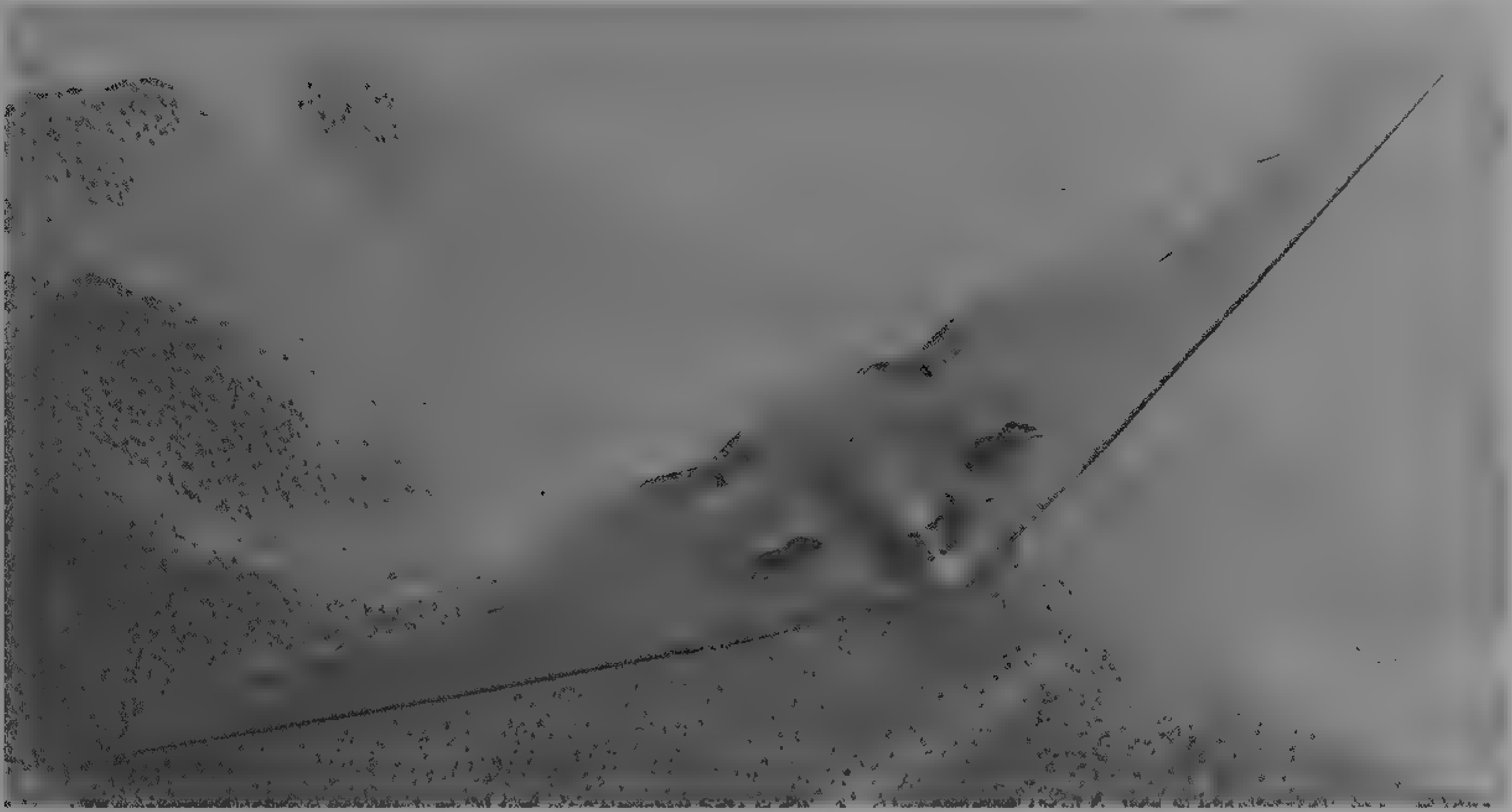
AV-3/82-1068: Flew 18 June 1991, first with full mission avionics, including AN/APQ-181 radar, navigation and, from February 1993, ZSR-63 defensive avionics; first B-2 terrain-following radar trials began November 1993, 120 sorties and 617 hours to December 1994.

AV-4/82-1069: Avionics, LO and weapon testing; flew 17 April 1992, made first B-2 bomb drop on 3 September 1992 (inert 2,000 lb Mk 84 from 6,100 m; 20,000 ft) and all subsequent bombing trials; 74 sorties and 293 hours to December 1994, avionics and armament trials.

AV-5/82-1070: Weapons, LO and climatic testing, flown 5 October 1992, received LO improvements in early 1993, 17 sorties and 71 hours to December 1994, including initial trials in 1994 of ZSR-63 defensive avionics system.

AV-6/82-1071: Flown 2 February 1993, for operational (avionics and weapons) testing (this first occasion on which new B-2 not delivered to Edwards on first flight), six months of ground testing, 58 sorties and 237 hours to December 1994.

Total 555 sorties/2,630 hours up to 1 June 1995 by Edwards-based B-2 fleet, including first night flight on 4 June 1992 and first night refuelling on 2 July 1992. All development aircraft operated by 6520th Test Squadron of 6510th TW, Edwards AFB (redesignated 420th TS/412th



Development batch B-2A Spirit during trials from Edwards AFB, California

1995

TW on 2 October 1992). First service delivery to 509th BW, 17 December 1993, named Spirit, February 1994, production ends 1998

CURRENT VERSIONS: **B-2A Block 10**: Nos 2 to 16: initial ability to carry B83 or Mk 84 weapons (see Armament paragraph of this entry) and deploy in two- or three-aircraft cells from Whiteman AFB, recover at post-strike base and return to Whiteman. Upgrading to Block 20 commencing 1996.

B-2A Block 20: Nos. 17 to 19 and retrofits; as above plus partial terrain-following, GATS (GPS-Aided Targeting System); limited AGM-137 capability, or up to 36 CBUs or 16 Joint Direct Attack Munitions (only four releasable per target), basic deployable mission planning capability for multi-aircraft deployments to forward bases. For upgrading to Block 30 at Northrop, Palmdale, from 1997, completion by mid 2000.

B-2A Block 30: Nos. 20 and 21 and retrofits, deliveries from late 1997 — first version with full LO features; weapons system as above, plus up to 80 Mk 82, 36 M117 or 80 Mk 62 bombs, full JDAM launch capability, completely automated mission planning, usable at Whiteman AFB, at forward bases or whilst airborne, Milstar satellite communications.

CUSTOMERS: USAF originally wanted 133 B-2s including first development aircraft, but budget cuts reduced this to 75 production articles by 1991. Six (five eventually for USAF) funded 1982, followed by further three whilst programme still 'black' (FY88), three in FY89, two in FY90 and two in FY91, for total of 16 (15 USAF); programme frozen by Congress October 1991, at 16 B-2s for delivery before end 1995. USAF continued to seek minimum of 20 operational bombers, including one with conditional FY92 funds and four requested for FY93, all 20 are now funded. 509th Bomb Wing formed 1 April 1993 at Whiteman AFB Missouri, where extensive, purpose designed facilities built. 393rd Bomb Squadron formed 27 August 1993 and received first aircraft, 88-0329 (eighth B-2), 17 December 1993, from 1996, second element to be 715th Bomb Squadron, each squadron with eight aircraft. (Wing also has 13 T-38 Talon jet trainers for proficiency flying.) Further three B-2s delivered in 1994. By June 1995 six B-2s at Whiteman had generated 600 hours, two more aircraft due by end of 1995.

First operational munitions delivered by 393rd Bomb Squadron instructor crew on Utah Test and Training Range during mission on 20 September 1994 when two inert Mk 84 2,000 lb bombs released manually from 30,000 ft. Four B-2As scheduled for delivery in 1995.

Production aircraft comprise:

AV-7/88-0328: *Spirit of Texas*. Leased from USAF by Northrop for electromagnetic compatibility and emissions testing (completed August 1993) prior to first flight, to 393rd BS/509th BW, 25 September 1994.

AV-8/88-0329: *Spirit of Missouri*; first delivery, 393rd BS/509th BW 17 December 1993.

AV-9/88-0330: *Spirit of California*; first flown 24 January 1994, accepted by USAF at Palmdale but held there pending resolution of low-observable anomaly concerning coating of tailpipes, eventually delivered to 393rd BS/509th BW 17 August 1994. First B-2A overseas mission, Whiteman-Paris/le Bourget-Whiteman, 10/11 June 1995.

AV-10/88-0331: *Spirit of South Carolina*, delivered in first half of 1995.

AV-11/88-0332: *Spirit of Washington*, to 393rd BS/509th BW 29 October 1994.

AV-12/88-0333: *Spirit of Kansas*; delivered in first half of 1995.

AV-13 to AV-16: Block 10.

AV-17 to AV-19: Block 20: delivery from July 1996.

AV-20 and AV-21: Block 30: delivery from late 1997.

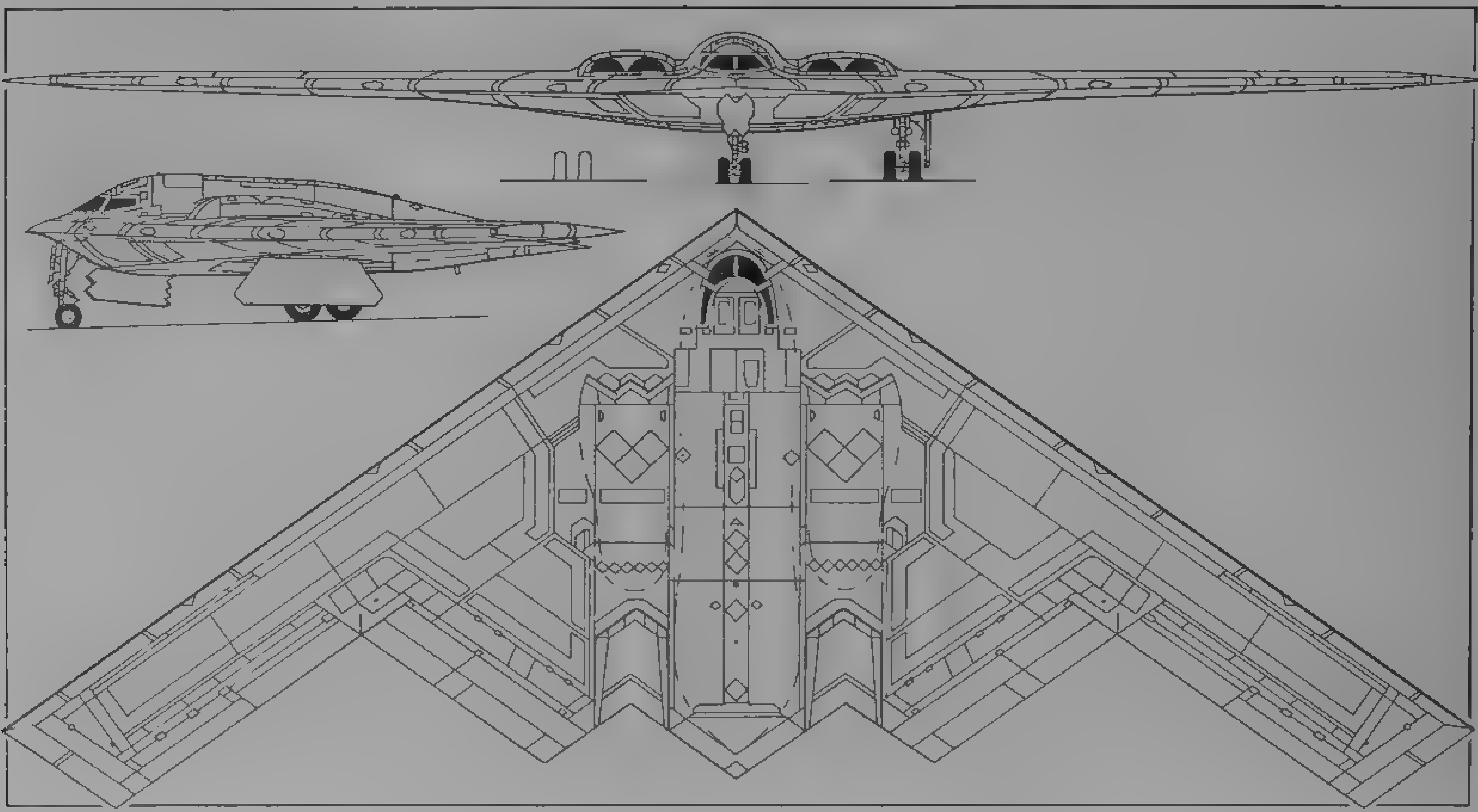
Accepted shortfalls in initial service aircraft include absence of terrain following radar and radar warning receiver. Oklahoma City Air Logistics Center is primary B-2 depot facility.

COSTS: $2 billion contract to start B-2 production 19 November 1987, programme cost $64,700 million (then-year prices) for 75 aircraft. By 1993, estimated $44,400 million for 20 B-2s, unit programme cost (21 aircraft) $2,114 million each, or flyaway, $837.5 million per aircraft. Programme capped at $45 billion, but overrun predicted in 1994 financial examination, by September 1994, disbursements totalled $39,639 million. For follow-on production (if ordered), Northrop Grumman offering 20 aircraft in $13.6 billion programme, or $570 million per unit.

DESIGN FEATURES: Blended flying wing, with straight leading-edges, swept at 33°, centre and tip sections have sharp strongly under-cambered fixed leading-edges; two dielectric panels underwing outboard of flight deck cover dual radar antennae, 'double-W' trailing-edge incorporating elevons and drag rudders outboard of engines, two side by side weapons bays in lower centrebody each have small drop-down spoiler panels ahead of doors, generating vortexes to ensure clean weapon release; engines fed by S-shaped air ducts; irregular-shaped air intakes feed engines, with three-pointed splitter plates ahead of inlets which remove boundary layer and provide secondary air flow for cooling and IR emissions control, upper lip of intake has single point; two auxiliary air inlet doors mounted on top of intake trunks remain open on ground

B-2A Spirit two-man flight deck

1994



Northrop Grumman B-2A Spirit strategic penetration bomber *(Jane's/Mike Keep)*

1991

and in slow-speed flight two V-shaped overwing exhausts set well forward of trailing-edge, titanium on wing surface behind engine outlet, wingtips and leading-edges have dielectric covering of aerofoil section to mask radar-dissipating sawtooth construction

Total 80,000 hours of testing aircraft's components include 24,000 hours wind tunnel tests, 44,000 hours avionics testing and 6,000 hours full-scale 'plastic bird' control system tests flight testing to total 4,000 hours with six aircraft; all locations in airframe stored in CAD/CAM three-dimensional database used for machine tool, robot and tooling reference, prototype built on production tooling to accuracy of ±6.3 mm (¼ in) from tip to tip, nearly 900 new materials and processes developed; currently over 4,000 subcontractors throughout USA

FLYING CONTROLS: Four control surfaces on each outer body/wing section, totalling approximately 15 per cent of wing area combining aileron, elevator, rudder and flap functions, two inner pairs act in unison as elevons for slow-speed flight control, outboard elevon pair employed in normal flight, outermost surfaces, split horizontally, function as fast-moving drag rudders and speed-brakes, remaining partly deployed at most times (latter set at ±45° on landing approach), for normal flight, lower halves of drag rudders deploy to 90°, followed by upper halves to extent required to execute manoeuvre, no high-lift devices, beaver tail behind centre fuselage acts as pitch-axis trimming surface and, with elevons, as gust alleviation system; elevons deflect at up to 100°/s, four groups of four pressure sensors around nose section indicate quadruplex full fly-by-wire flying control system

STRUCTURE: Mostly of composites (extensively graphite/epoxy), radar-absorbent honeycomb structure and skin, outer skin of materials and coatings designed to reduce radar reflection and heat radiation. Northrop Grumman builds forward centre-section including cockpit, integrates and assembles aircraft, Boeing Military Airplanes produces aft centre-section and outboard sections; Vought produces intermediate fuselage sections and aluminium and titanium structural components and composites parts, nationwide workforce is 15,000 directly involved with production, of whom 10,000 employed by Northrop Grumman

LANDING GEAR: Tricycle type, adapted from Boeing 757/767. Inward retracting four wheel main bogies have large trapezoidal door of thick cross-section. Rearward retracting two-wheel nose unit has small door with sawtooth edges and large rear door, also used for crew access. Two landing lights on nosewheel leg. Landing gear limiting speed 224 knots (415 km/h, 258 mph)

POWER PLANT: Four 84.5 kN (19,000 lb st) General Electric F118-GE-110 non-afterburning turbofans mounted in pairs within wing structure, each side of weapons bay. In-flight refuelling receptacle in centrebody spine. Initially fuelled by JP-4; conversion to JP-8 due by March 1996. Development of contrail management system due by December 1996, reportedly involving regulation of exhaust temperatures, rather than mixing chlorofluoro-sulfonic acid with exhaust gases, as previously understood

ACCOMMODATION: Two crew, with upward-firing ejection seats, pilot to port, mission commander/instructor pilot to starboard. Provision for third member. Both forward positions have conventional control columns. Flight, engine, sensor and systems information presented on nine-tube EFIS display. Either crew member capable of flying complete mission, although data entry panels biased towards weapon systems officer on starboard seat. Four flight deck windows.

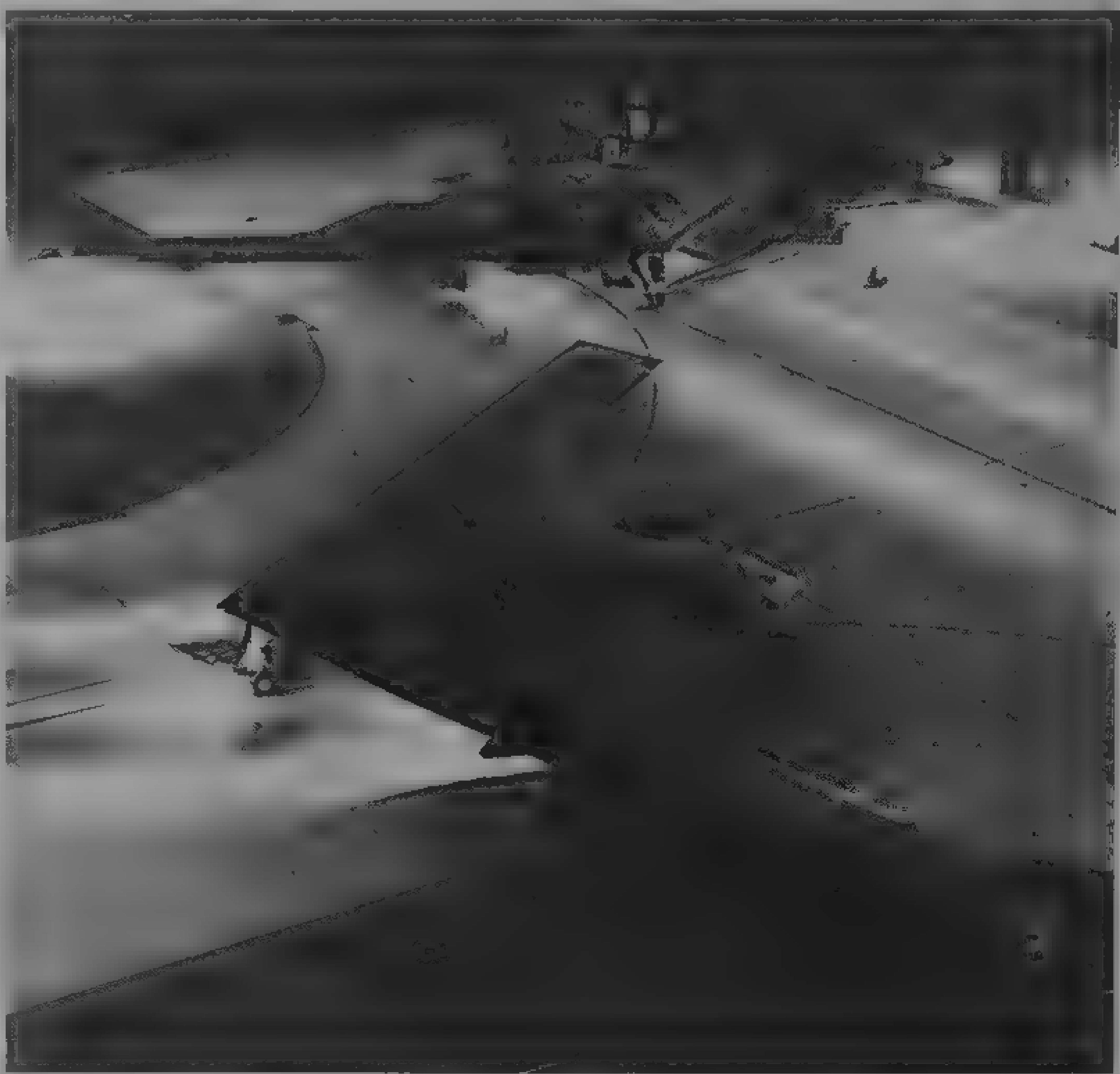
SYSTEMS: Hydraulic system for flying controls operates at 276 bars (4,000 lb/sq in). AlliedSignal APU outboard of port engine bay, covered by triangular door flush with wing surface

AVIONICS: *Comms:* Rockwell Collins VLF/LF receiver, ICS-150X intercom; Milstar satellite communications from Block 30

Radar: Hughes AN/APQ-181 low-probability-of-intercept (LPI) J-band covert strike radar, having 21 modes including terrain-following and terrain-avoidance

Flight: Rockwell Collins TCN-250 Tacan and VIR-130A ILS

Instrumentation: Hughes GPS-Aided Targeting System (GATS) from Block 20, involving synthetic aperture mode on radar to establish GPS positional error of target for accurate high-level bombing. 4× zoom magnification available on radar picture



Dawn mission launch by two development batch B-2As

1994

Mission: Unspecified, but crew workload eased by three-position selector switch in cockpit to activate/deactivate appropriate equipment for 'take-off' (transfer mission data tape, checklist and appropriate flight controls mode), 'go to war' (flight controls in stealthy mode, weapons ready and radio emitters switched off) and 'land' (reactivate systems and perform checklist).

Self defence: Loral Federal Systems AN/APR 50 RWR, Northrop Grumman ZSR 63 defensive aids equipment (role unspecified but reportedly involves active cancellation of radar returns).

ARMAMENT: Boeing rotary launcher assembly (RLA) in each of two side by side weapons bays in lower centrebody, detachable for loading at weapons dump with up to eight large stores each. Total capacity of 16 AGM-129 ACMs. Alternative weapons include 16 B61 tactical/strategic or 16 B83 strategic free-fall nuclear bombs, 80 Mk 82 500 lb bombs; 16 Joint Direct Attack Munitions; 16 Mk 84 2,000 lb bombs, 36 M117 750 lb fire bombs, 36 CBU-87/89/97/98 cluster bombs, and 80 Mk 36 560 lb or Mk 62 sea mines. Stores of 1,000 lb and below held in four (two per weapons bay) bomb rack assemblies (BRA).

DIMENSIONS, EXTERNAL

Wing span	52.43 m (172 ft 0 in)
Length overall	21.03 m (69 ft 0 in)
Height overall	5.18 m (17 ft 0 in)
Wheel track	12.20 m (40 ft 0 in)

AREAS (estimated)

Lower surface	over 464.5 m² (5,000 sq ft)

WEIGHTS AND LOADINGS

Weight empty	45,360-49,900 kg (100,000-110,000 lb)
Max weapon load	18,144 kg (40,000 lb)
Max internal fuel capacity	81,650-90,720 kg (180,000-200,000 lb)
Normal T-O weight	152,635 kg (336,500 lb)
Max T-O weight	170,550 kg (376,000 lb)
Max wing loading	367.2 kg/m² (75.2 lb/sq ft)
Max power loading	504.53 kg/kN (4.95 lb/lb st)

PERFORMANCE

Approach speed	140 kts (259 km/h; 161 mph)
Service ceiling	15,240 m (50,000 ft)

Range with eight AGM-129s and eight B83 bombs, totalling 16,919 kg (37,300 lb), at max T-O weight:

hi-hi-hi	6,300 n miles (11,667 km, 7,250 miles)
hi-lo-hi (1,000 n miles, 1,852 km, 1,151 miles at low level)	4,400 n miles (8,149 km, 5,063 miles)

Range with eight AGM-129s and eight B61 bombs, totalling 10,886 kg (24,000 lb), at 162,386 kg (358,000 lb) T-O weight:

hi-hi-hi	6,600 n miles (12,223 km, 7,595 miles)
hi-lo-hi (1,000 n miles, 1,852 km, 1,151 miles at low level)	4,500 n miles (8,334 km, 5,178 miles)

Range with one aerial refuelling: over 10,000 n miles (18,520 km, 11,508 miles)

UPDATED

MILITARY AIRCRAFT DIVISION

One Northrop Avenue, Hawthorne, California 90250
Telephone: 1 (310) 332 1000
Fax: 1 (310) 332 3396
CORPORATE VICE-PRESIDENT AND GENERAL MANAGER:
Wallace C. Solberg

Former Northrop Aircraft Division is principal subcontractor for F/A-18 (see McDonnell Douglas) and produced Boeing 747 main fuselage, upper deck, cargo door and passenger doors (over 1,000 shipsets since 1966). Boeing 747 and other civilian work assigned to separate operating division from 2 January 1993. Research projects involve advanced structure and manufacturing technologies. Under new combined structure, assumed responsibility for both JPATS candidates (Northrop/Embraer Super Tucano and Grumman/Agusta S.211A), F-14 Tomcat, unmanned vehicles (aerial targets) and aircraft work of Northrop Worldwide Aircraft Services. Also builds airframe for E-2C Hawkeye and remanufactures Boeing 707s selected for E-8C Joint-STARS conversion. Continues modification work and support of Northrop F-5, T-38, Grumman A-6 Intruder and Fairchild A-10, and is offering avionics and structural upgrades for the F-5 (Tiger IV) and T-38.

UPDATED

NORTHROP GRUMMAN/EMBRAER EMB-312HJ SUPER TUCANO

TYPE: Turboprop primary trainer

PROGRAMME: Northrop Grumman teamed with Embraer to offer latter's Super Tucano (see Brazilian section) as next-generation trainer for USAF (which see for programme details) and USN in JPATS competition. Basic Tucano considerably modified with fuselage stretch, uprated 1,193 kW (1,600 shp) P&WC PT6A-68/1 turboprop, five-blade propeller; pressurised cockpit with rear-hinged canopy, new avionics and systems; airbrake and other changes. Two prototypes under test. Rejected in favour of Raytheon/Pilatus PC-9.

UPDATED

NORTHROP GRUMMAN/AGUSTA S.211A

TYPE: Primary jet trainer

PROGRAMME: Northrop Grumman offered licence-built version of Italian Agusta S.211 (which see for further details) to meet JPATS requirement (see USAF entry). Missionisation changes include more powerful 14.19 kN (3,190 lb st) P&WC JT15D-5C; new, high-lift supercritical aerofoil, reinforced landing gear, lowered (5 cm, 2 in) cockpit floor and provision for wider range of crew sizes, new Rockwell Collins avionics, and Microtecnica (Hamilton Standard) environmental systems. Two production S.211A aircraft are flying. Rejected in favour of Raytheon/Pilatus PC-9.

UPDATED

ELECTRONICS AND SYSTEMS INTEGRATION DIVISION

South Oyster Bay Road, Bethpage, New York 11714
Telephone: 1 (516) 575 5119
Fax: 1 (516) 575 2164
SENIOR VICE-PRESIDENT AND GENERAL MANAGER:
John E. Harrison

This Division combines the activities of the former Northrop Electronics Systems Division with the Electronics and Space divisional activities of Grumman Aircraft programme responsibilities include the E-2C Hawkeye, E-8C Joint-STARS, and integrated electronic systems for the EA-6B Prowler and EF-111 Raven.

UPDATED

NORTHROP GRUMMAN HAWKEYE

US Navy designations: E-2C and TE-2C
Israel Defence Force name: Daya (Kite)

TYPE: Shipborne and land-based airborne early warning and control aircraft.

PROGRAMME: First flight of first of three prototypes 21 October 1960; total 59 production E-2As, of which 51 updated to E-2B by end 1971 apart from two TE-2A trainers and two converted to E-2C prototypes (see earlier *Jane's*); first flight of E-2C prototype 20 January 1971; production started mid-1971, first flight production aircraft 23 September 1972, total 177 ordered, of which 170 delivered at start of 1995, production rate, six per year. AN/APS-145 radar replaces AN/APS-120, AN/APS-125, AN/APS-138 and AN/APS-139 in new-built E-2Cs.

Evaluation of Grumman/Martin Marietta AN/APS-145 began 1986, radar tracks more than 2,000 targets and operates at longer ranges, has improved jamming resistance and sharper fully automated/optimised overland detection. AN/APS-145 radar and new main operator displays, IFF, mission computer processor, JTIDS tactical software and upgraded engines form core of current Update Development Program (Groups I and II), which fully developed and delivered in new production aircraft from October 1991. Second production Group I aircraft (163535 – 123rd E-2C; 102nd USN E-2C) set 20 (broke 14 and established six new) records for time-to-height, altitude and 100 km closed circuit, 17-19 December 1991.

USN previously considered Advanced Tactical Support (ATS) aircraft programme, including an AEW configuration, to replace E-2C; ATS plans cancelled 1991 and USN considering launch of E-X programme for follow-on AEW, although no funding apparently available in defence budgets prior to 2000.

CURRENT VERSIONS: **E-2B**: Withdrawn from USN service.

E-2C: Current service and production version (*as detailed*).

TE-2C: Training model, based on E-2C.

E-2T: Proposed conversion of E-2B for Taiwan with AN/APS-138 radar and electronic warfare upgrades was abandoned. Designation then allocated to new-build E-2C for Taiwan.

CUSTOMERS: US Navy orders for E-2C totalled 139 by FY92, of which all delivered by March 1994. Target of 175 cut to 145 in early 1991 and to 139 in January 1992 (excluding two prototypes). Further procurement authorised December 1994, when Northrop Grumman awarded $122.5 million contract for start-up of new assembly line at St Augustine, Florida. Initial orders for seven Group II aircraft (four with FY95 funds, three with FY96 funds) and further contracts expected. Current US Navy programme status as under:

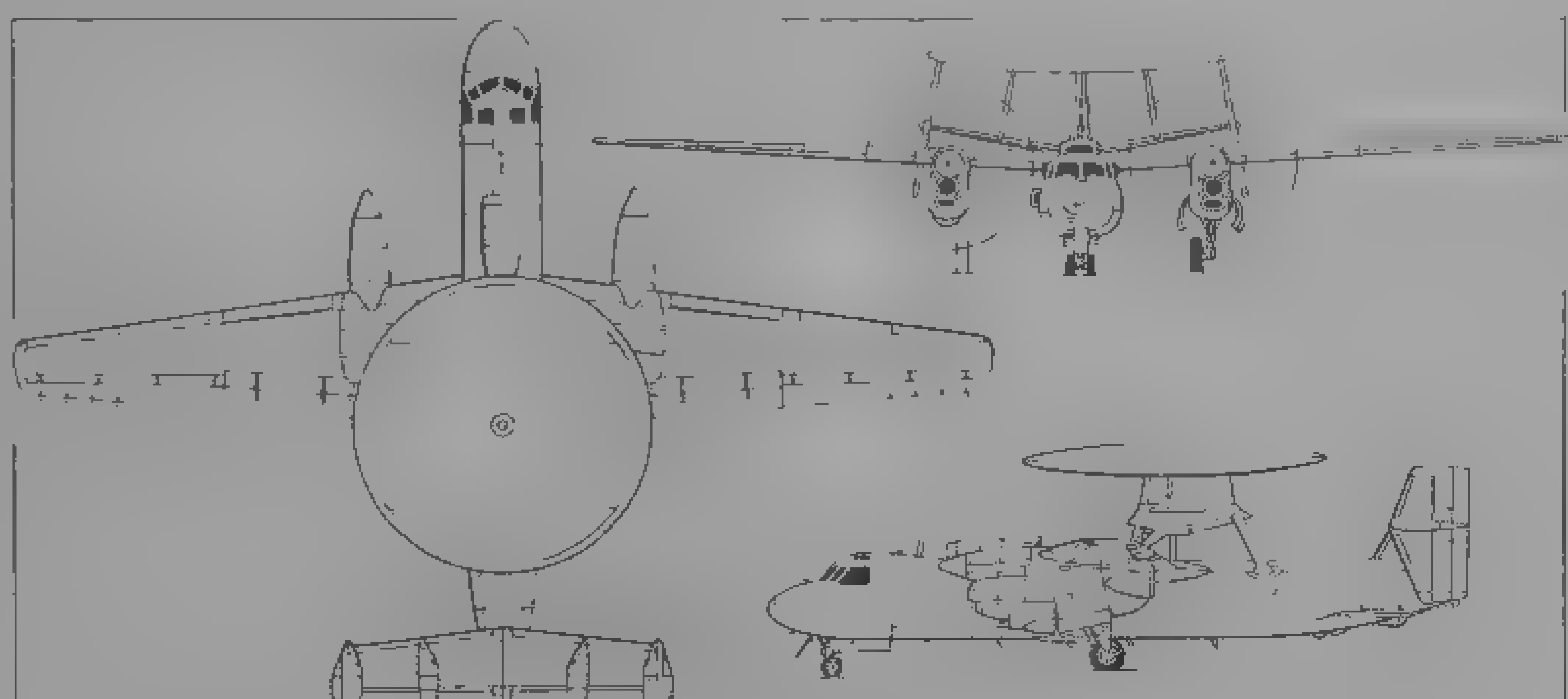
Variant	Qty	First aircraft
E-2C 'Group 0'	100	158638
E-2C Group I	18	163029
E-2C Group II	28	164108
Total	**146**	

Major retrofit programme for USN and FMS aircraft was planned, including upgrade of all 18 Group I and minimum of 36 older ('Group 0') aircraft to Group II standard from FY95. Instead, 1994 defence review established new E-2Cs more economical than retrofit.

In December 1994, company received $155 million contract to upgrade E-2C mission computer. New equipment to be based on Raytheon's Model 940, itself a modification of Digital Equipment Corporation 2100 Model A500MP processing system, which is same family of hardware used by E-8C Joint-STARS.

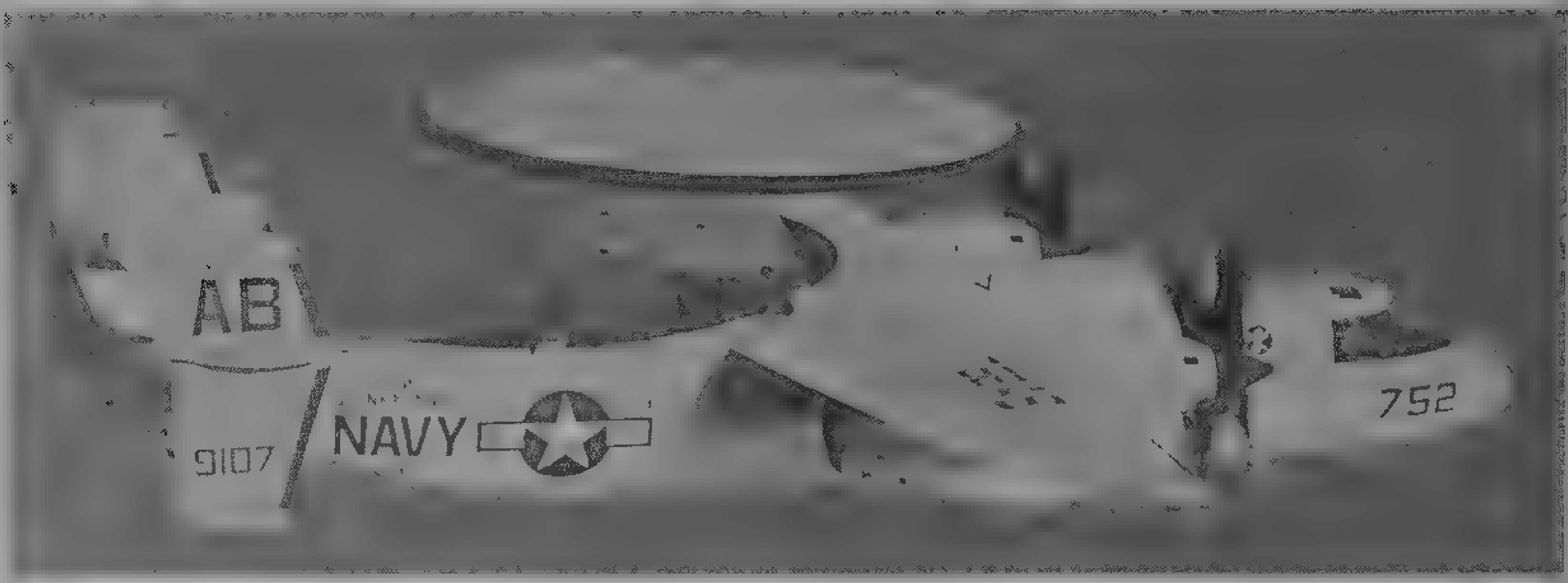
E-2C entered service with VAW-123 at NAS Norfolk, Virginia, November 1973 and went to sea on board USS *Saratoga* late 1974; E-2C issued to 18 other squadrons, including two of Naval Reserve, two TE-2C in service, including 158639 assigned to JTIDS development. Current squadrons are VAW-112, 113, 115 to 117 at Miramar, California, VAW-120 to 126 with VAW-78 of Reserves at Norfolk, Virginia. VAW-120 is training unit. Miramar is base of first Group II squadron, VAW-113, June 1992. VAW-113 first operational evaluation cruise on USS *Carl Vinson*, 1993. Group II aircraft also issued to VAW-110 (disbanded September 1994), 112, 116 and 117. Final two of original 139 E-2Cs delivered to USN in 1994. US Navy transferred two Group 0 aircraft to US Coast Guard (operations with CG Air Wing 1 at St Augustine, Florida, began January 1987) and two to US Customs Service for anti-narcotics operations; USCS aircraft to USCG in August 1989 and all returned to USN on 23 October 1991 (due to rotations, nine different aircraft used).

See table for exports. Singaporean aircraft with AN/APS-138 radar; Taiwan originally required E-2T (converted E-2B with AN/APS-138 radar) before confirming E-2C in 1993. France signed Letter of Offer and



Northrop Grumman E-2C Hawkeye twin-turboprop airborne early warning and control aircraft *(Jane's/Dennis Punnett)*

1983



Northrop Grumman E-2C Hawkeye early warning and control aircraft of the US Navy

1995

Acceptance (LOA) in June 1995 for two aircraft to be delivered for aircrew training in fourth quarter of 1997, eventually expected to obtain total of four. Fourth Taiwanese E-2C, completed in November 1994, is final Hawkeye built at Calverton, subsequent production at St Augustine.

COSTS: $59 million, flyaway, USN FY92. Total cost of French procurement of two aircraft approximately $562 million including logistics support. $122.5 million awarded December 1994 for production start-up for seven new E-2Cs.

DESIGN FEATURES: Details here apply to E-2C. Hawkeye can cover naval task force in all weathers flying at 9,150 m (30,000 ft) and can detect and assess approaching aircraft in excess of 300 n miles (556 km; 345 miles); AN/APS-145 has total radiation aperture control antenna (TRAC-A) to reduce sidelobes to offset jamming; radar sweeps six million cubic mile envelope and simultaneously monitors surface ships; long-range, automatic target track initiation and high-speed processing enable each E-2C to track more than 2,000 targets simultaneously and automatically and control more than 40 intercepts. Randtron Systems AN/APA-171 antenna housed in 7.32 m (24 ft) diameter radome, rotating at 5 to 6 rpm above the fuselage; antenna arrays in rotodome provide radar sum and difference signals and IFF.

AN/APS-139 and Allison T56-427 engines form **Group I** update; first operational aircraft (163538) delivered to VAW-112 on 8 August 1989; 18 built. AN/APS-139 can detect cruise missiles at ranges exceeding 100 n miles (185 km; 115 miles), also monitors maritime traffic; radar coverage extended by AN/ALR-73 passive detection system (PDS), detecting electronic emitters at twice radar detection range; more detailed description in 1979-80 *Jane's*. AN/APS-145 in **Group II** aircraft from December 1991; other enhancements give Group II 96 per cent expansion in radar volume, 400 per cent extra target tracking capability, 40 per cent more radar and identification range and 960 per cent increase in numbers of targets displayed. Group II added JTIDS in 1993-94, also has GPS.

Conventional airframe with nose-tow catapult attachment, arrester hook and tail bumper; parts of tail made of composites to reduce radar reflection; wings fold hydraulically on skewed hinges to lie parallel to fuselage; wing incidence 4° at root, 1° at tip.

FLYING CONTROLS: Fully powered with artificial feel; tailplane has 11° dihedral; four fins and three double-hinged rudders; long-span ailerons droop automatically when hydraulically operated Fowler flaps are extended; autopilot provides autostabilisation or full flight control.

STRUCTURE: Wing centre section has three beams, ribs and machined skins; hinged leading-edge provides access to flying and engine controls. Fuselage conventional light metal. Composites used in parts of tail.

LANDING GEAR: Hydraulically retractable tricycle type. Pneumatic emergency extension. Steerable nosewheel unit retracts rearward. Mainwheels retract forward and rotate to lie flat in bottom of nacelles. Twin wheels on nose unit only. Oleo-pneumatic shock absorbers. Mainwheel tyres size 36 × 11 Type VII 24 ply, pressure 17.9 bars (260 lb/sq in) on ship, 14.5 bars (210 lb/sq in) ashore. Hydraulic brakes. Hydraulically operated retractable tailskid. A frame arrester hook under tail.

POWER PLANT: Two 3,803 kW (5,100 ehp) Allison T56-A-427 turboprops, driving Hamilton Standard Type 54460-1 four-blade fully feathering reversible-pitch constant-speed propellers. These have foam filled blades which have a steel spar and glassfibre shell. T56-A-427 engines provide 15 per cent improvement in efficiency, compared with 425 installed prior to 1989. Israeli Hawkeyes fitted locally with fixed in-flight refuelling probes, first aircraft (941) seen 1993.

ACCOMMODATION: Normal crew of five, consisting of pilot and co-pilot on flight deck, plus ATDS Combat Information Center (CIC) staff of combat information centre officer, air control officer and radar operator. Downward hinged door with built in steps, on port side of centre-fuselage and three overhead escape hatches.

SYSTEMS: Pneumatic boot de-icing on wings, tailplane and fins. Spinners and blades incorporate electric anti-icing.

AVIONICS: *Comms:* AN/AIC-14A intercom.

Radar: Lockheed Martin AN/APS-145 advanced radar processing system (ARPS) with fully automatic overland/overwater detection capability, Randtron AN/APA-171 rotodome (radar and IFF antennae).

Flight: Litton AN/ASN-92 CAINS carrier aircraft inertial navigation system. GPS, AN/ASN-50 heading and attitude reference system, Collins AN/ARA-50 UHF ADF, AN/ASW-25B ACLS, GEC Marconi standard central air data computer, ASM-400 in-flight performance monitor, Honeywell AN/APN-171(V) radar altimeter.

Mission: Hazeltine AN/APA-172 control indicator group with Loral enhanced (colour) main display units, Litton OL-77/ASQ computer programmer (L-304) with Loral enhanced high-speed processor, Hazeltine IFF detector processor. Litton AN/ALR-73 passive detection system, AN/ARC-158 UHF datalink, AN/ARQ-34 HF datalink and JTIDS Class 2 HP terminal.

DIMENSIONS, EXTERNAL:

Wing span	24.56 m (80 ft 7 in)
Wing chord: at root	3.96 m (13 ft 0 in)
at tip	1.32 m (4 ft 4 in)
Wing aspect ratio	9.28
Width, wings folded	8.94 m (29 ft 4 in)
Length overall	17.60 m (57 ft 8¾ in)
Height overall	5.58 m (18 ft 3¾ in)
Diameter of rotodome	7.32 m (24 ft 0 in)
Tailplane span	7.99 m (26 ft 2½ in)
Wheel track	5.93 m (19 ft 5¼ in)
Wheelbase	7.06 m (23 ft 2 in)
Propeller diameter	4.11 m (13 ft 6 in)

AREAS:

Wings, gross	65.03 m² (700.0 sq ft)
Ailerons (total)	5.76 m² (62.0 sq ft)
Trailing-edge flaps (total)	11.03 m² (118.75 sq ft)
Fins, incl rudders and tabs	
outboard (total)	10.25 m² (110.36 sq ft)
inboard (total)	4.76 m² (51.26 sq ft)
Tailplane	11.62 m² (125.07 sq ft)
Elevators (total)	3.72 m² (40.06 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	18,363 kg (40,484 lb)
Max fuel (internal, usable)	5,624 kg (12,400 lb)
Max T-O weight	24,687 kg (54,426 lb)
Max wing loading	379.6 kg/m² (77.75 lb/sq ft)
Max power loading	3.25 kg/kW (5.34 lb/ehp)

PERFORMANCE (at max T-O weight):

Max level speed	338 kts (626 km/h; 389 mph)
Max cruising speed	325 kts (602 km/h; 374 mph)
Cruising speed (ferry)	259 kts (480 km/h; 298 mph)
Approach speed	103 kts (191 km/h; 119 mph)
Stalling speed (landing configuration)	75 kts (138 km/h; 86 mph)
Service ceiling	11,275 m (37,000 ft)
Min T-O run	564 m (1,850 ft)
T-O to 15 m (50 ft)	793 m (2,600 ft)
Min landing run	439 m (1,440 ft)
Ferry range	1,541 n miles (2,854 km; 1,773 miles)
Time on station, 175 n miles (320 km; 200 miles) from base	4 h 24 min
Endurance with max fuel	6 h 15 min

E-2C EXPORTS

Customer	Qty	Group	First aircraft	Delivery	Unit (or base)
Egypt	6	0	162791	1987-88 (5)	(Cairo West)
		0	164626	1993 (1)	
France	2	II		1997	
Israel	4	0	160771	1978	192 Sqdn
Japan	13	0	34-3451	1982 (4)	601 Sqdn
		0	34-3455	1984 (4)	
		0	34-3459	1992-93 (3)	
		0	34-3462	1993 (2)	
Singapore	4	0	162793	1987	111 Sqdn
Taiwan	4	II		1994	
Total	**33**				

UPDATED

NORTHROP GRUMMAN E-8 JOINT-STARS

TYPE: Long-range radar reconnaissance aircraft, programme name, Joint Surveillance Target Attack Radar System (Joint-STARS).

PROGRAMME: Full-scale development contract to Grumman, 27 September 1985; two Boeing 707-328Cs purchased from American Airlines and Qantas as EC-18C testbeds, later redesignated E-8A; first aircraft for modification reached Boeing Military Airplanes, Wichita, January 1986; delivered to Grumman Melbourne Systems Division, Florida, 31 July 1987; second aircraft to Wichita June 1986, for delivery to Grumman Autumn 1988; first flight in full Joint STARS configuration (86-0416, N770JS) 22 December 1988; first flight of second aircraft (86-0417/N8411) 31 August 1989; first instantaneous transmission to ground station August 1989; European trials February-March 1990 (N770JS) and September 1990 (86-0417); original requirement for 22 new build aircraft and 100 ground stations, amended to 20 second-hand Boeing 707s; IOC planned in 1997 with five aircraft, but emergency interim capability achieved for Gulf War against Iraq 1991. Low rate initial production advanced procurement contract signed by USAF 24 April 1992; progress review, May 1993, authorised first six production aircraft at two per year; further review then to consider outstanding 12.

Airframe modifications now at Northrop Grumman Lake Charles following Boeing's withdrawal from programme, avionics installation at Melbourne; first E-8C (90-0175/N526SJ) completed December 1993 and made first flight 25 March 1994, at which time four more with Grumman and three unmodified airframes in storage with USAF; further 10 conversion subjects to be sought after 1996. Deliveries to begin in 1996.

NATO considering integrated Joint-STARS force; planning group established December 1992, programme office established November 1994, short European tour by second E-8A in October 1994 for demonstration to Belgium, France, Germany and UK; requirement for up to 12 Joint-STARS to be based at Geilenkirchen, alongside E-3A

First production Northrop Grumman E-8C Joint-STARS aircraft, to be used as a permanent testbed

1994

Se.t.ty AWACS unit, may use Airbus or similar aircraft as avionics platform. Further interest expressed by Japan (possibly four aircraft), South Korea (four) and Saudi Arabia (up to six). Grumman teamed with BAe in 1993 to offer Joint-STARS to UK in satisfaction of SR(L/A) 925 (ASTOR) requirement

Multi-Stage Improvement Program (MSIP) formulated by 1994 and first phase funded, involves TADIL-J datalink with dedicated operator's position for monitoring of air threats, followed by 'End Game' radar- and IR countermeasures. Phase 2 options include satellite communications, improved data modem and automatic target recognition, to be launched in 1996

CURRENT VERSIONS: **E-8A**: Two development aircraft, as above. Fitted with consoles for 10 operators, Pratt & Whitney JT3D-3B engines. First operational mission, 14 January 1991 with 4411th J STARS Squadron (Provisional), USAF from Saudi Arabia, six ground station modules also deployed, flew 49 missions/534 6 hours up to end of conflict. Returned to Grumman for completion of performance testing in 100 sorties and several thousand hours of ground testing. Both accepted by USAF December 1993, for trials at Edwards AFB. To be eventually upgraded as E-8Cs

E-8B: Originally proposed production version, based on new-built airframe, F108 turbofan engines; 15 operator consoles. One prototype, 88-0322, flown 12 June 1990 in 'green' state (avionics not installed), overtaken by decision to use second-hand Boeing 707 airframes, delivered to USAF 3 October 1991 for storage at Davis-Monthan AFB, Arizona; bartered with Omega Air, 1993, for five used 707s and currently in civilian use as N707UM

JOINT STARS PROCUREMENT

FY	Type	Qty	First aircraft
86	E-8A	2	86-0416
88	E-8B*	(1)	88-03[illegible]
90	E-8C	1	90-01[illegible]
94	E-8C	1	
95	E-8C	2	
Total		**6 (+1*)**	

*New-build, not delivered

Operator stations aboard E-8 Joint STARS

1995

E-8C: Production version. 18 operator consoles (17 operations, one navigation/self-defence). Initial two aircraft to Lake Charles for conversion May-June 1992. First E-8C, completed in March 1994, is permanent testbed, not for delivery to USAF. *Data apply to this version.* Further details in 1994-95 *Jane's Battlefield Surveillance Systems*

CUSTOMERS: US Air Force and US Army (aircraft operated by USAF). First E-8C funded in FY90, second in FY94, two in FY95 and request for two in FY96, total 20 expected including two upgraded E-8As and one E-8C permanent testbed. To be based at Robins AFB, Georgia

COSTS: $657 million (1985) full-scale development, $523 million award to Grumman November 1990 for conversion of first E-8C. Estimated programme cost (1994) $8,560 million including ground stations. First (two aircraft) advance procurement contract $125 million (April 1992). Northrop Grumman secured $254 million contract in July 1994 for completion of second pair, with $440 million appropriation for two more in FY95 budget

DESIGN FEATURES: Boeing 707-320C airliner converted with 7.32 m (24 ft) antenna covered by a 'canoe' fairing under forward fuselage, immediately behind nosewheel, for phased-array SLAR

STRUCTURE, FLYING CONTROLS, LANDING GEAR: As, or similar to commercial Boeing 707, last described in 1980-81 *Jane's*

POWER PLANT: Four 80.1 kN (18,000 lb st) Pratt & Whitney JT3D-3B turbojets. See Weights and Loadings for fuel

SYSTEMS: As Boeing 707, additional electronic generating capacity. World Auxiliary Power Company APU

AVIONICS: *Comms*: Telephonics multiple intercom net control system

Radar: Norden AN/APY-3 multimode side-looking phased-array I-band radar, scanned electronically in azimuth and steered mechanically in elevation from either side of aircraft. Synthetic aperture (SAR) mode used to detect stationary objects, such as parked tanks, up to 81 to 95 n miles (150 to 175 km; 93 to 109 miles) behind front line. Can interleaf Doppler mode to detect moving targets. Coverage, 1 million km² (386,100 sq miles) in 8 hour sortie, cruising at 9,145 to 12,200 m (30,000 to 40,000 ft)

Flight: Litton INS, Collins flight management system

Mission: Five Raytheon Model 920/866 supermini computers per aircraft, Ceridian Data Inc programmable signal processors (three), Interstate Electronics graphic displays, Raytheon Model AXP 3000/500 workstations, Orbit International workstation keyboards, Miltope message printers, Cubic Defense Systems surveillance and control datalink, JTIDS for Tacan operation and TADIL-J generation and processing. Satellite communications link, Magnavox encrypted UHF radios (12), two encrypted HF radios, three encrypted VHF radios with SINCGARS (Single Channel Ground and Airborne Radio System) provision. Radar data can be transmitted instantaneously to ground stations, or attacks by aircraft and ground forces directed via JTIDS datalink

ARMAMENT: Nil

DIMENSIONS, EXTERNAL (abbreviated):

Wing span	44.42 m (145 ft 9 in)
Length overall	46.61 m (152 ft 11 in)
Height overall	12.95 m (42 ft 6 in)

WEIGHTS AND LOADINGS:

Weight empty	[illegible]564 kg (171,000 lb)
Max fuel load	70,307 kg (155,000 lb)
Max T-O weight	152,407 kg (336,000 lb)

PERFORMANCE:

Max operating Mach number (M_{MO})	0.84
Service ceiling	12,800 m (42,000 ft)
Endurance: internal fuel	11 h
with one in-flight refuelling	20 h

UPDATED

COMMERCIAL AIRCRAFT DIVISION

PO Box 655907, Dallas, Texas 75265-5907
Telephone: 1 (214) 266 2011
Fax: 1 (214) 266 576

Division activities include commercial aircraft and ground transportation. Programmes include subassemblies and/or component manufacture for Boeing 747 (fuselages), Boeing 757, 767, 777, McDonnell Douglas C-17A (ailerons, elevators and rudders), Tay turbofan nacelles and thrust reversers for Gulfstream IV, development and manufacture of wings for Gulfstream V, engine nacelles and thrust reversers for Fokker 100, and former Grumman/Piaggio partnership of March 1994 to promote and possibly manufacture P.180 Avanti in North America.

Commercial Aircraft Division also includes Vought Aircraft Company which was acquired by Northrop Grumman on 31 August 1994. Vought had teamed with FMA of Argentina to offer IA 63 Pampa 2000 for USAF/USN JPATS programme, but this contender eliminated from competition in November 1994.

UPDATED

PEMCO

PEMCO AEROPLEX INC (Subsidiary of Precision Standard Inc)

Pemco conversions of BAe 146, Boeing 737/747/757, L-1011 TriStar, DC-8, DC-9 and Tu-204 are detailed in *Jane's Aircraft Upgrades*.

[redacted]

PEREGRINE

PEREGRINE FLIGHT INTERNATIONAL

Minden Airport, Minden, Nevada

Peregrine has acquired design, manufacture and marketing rights for the civilian version of Bede BD-10; military market continues to be pursued by Bede (which see). Fox Aircraft, a subsidiary of Peregrine, assists home constructors to complete their BD-10s, one completed and two more being assembled by early 1995.

NEW ENTRY

PEREGRINE FALCON

TYPE: Tandem two-seat supersonic aircraft, factory or homebuilt.

PROGRAMME: Design began as Bede BD-10 in 1983; construction of prototype started 1989 and first flight 8 July 1992 (N2BD); construction of production kits/aircraft began 1992, initial kit deliveries began August 1993. Peregrine International was carrying out flight envelope trials on development aircraft at high airspeed/high Mach when fatal crash occurred on 30 December 1994, reportedly due to flutter of port horizontal stabiliser at nearly 400 knots (740 km/h; 460 mph) IAS. Stabiliser redesigned.

CURRENT VERSIONS: **PJ-1**: Original aircraft, lost in accident.

PJ-2: Factory built upgraded version for certification in Experimental category, tail section strengthened and fins toed out 2°. Flown 21 June 1995, but crashed fatally 4 August 1995.

PJ-3: Projected version certified to FAR Pt 23.

CUSTOMERS: Total 45 ordered by early 1995, nine aircraft being constructed at March 1995, including five for projected Peregrine Falcon Jet Demonstration Team.

COSTS: $1.4 to 1.6 million (1995).

DESIGN FEATURES: Supersonic flight. Wings with leading-edge sweepback, twin fins.

FLYING CONTROLS: Non-boosted controls, using push-pull rods; sidestick controller for low-speed flying and centre floor-mounted stick for high-speed flight; dual controls, tailplane and elevators, twin rudders, double-slotted flaps.

STRUCTURE: 60 per cent metal, 40 per cent composites, aluminium alloy and aluminium honeycomb/aluminium or GFRP skin sandwich construction.

LANDING GEAR: Retractable tricycle type, electrical/mechanical actuation; all wheels retract aft, oleo-pneumatic shock absorbers in all units. Cleveland wheels and brakes.

POWER PLANT: One 13.12 kN (2,950 lb st) General Electric CJ610 turbojet; alternative GE J85 engine. Eventually to be available with Williams Rolls FJ44 turbofan. Fuel in five centre-fuselage cells, total capacity 1,132 litres (299 US gallons; 249 Imp gallons). Single refuelling point in top of fuselage. Oil capacity 7.6 litres (2 US gallons; 1.7 Imp gallons).

ACCOMMODATION: Two persons in tandem.

SYSTEMS: No hydraulics. Electrically de-iced engine inlets. Cockpit pressurisation system.

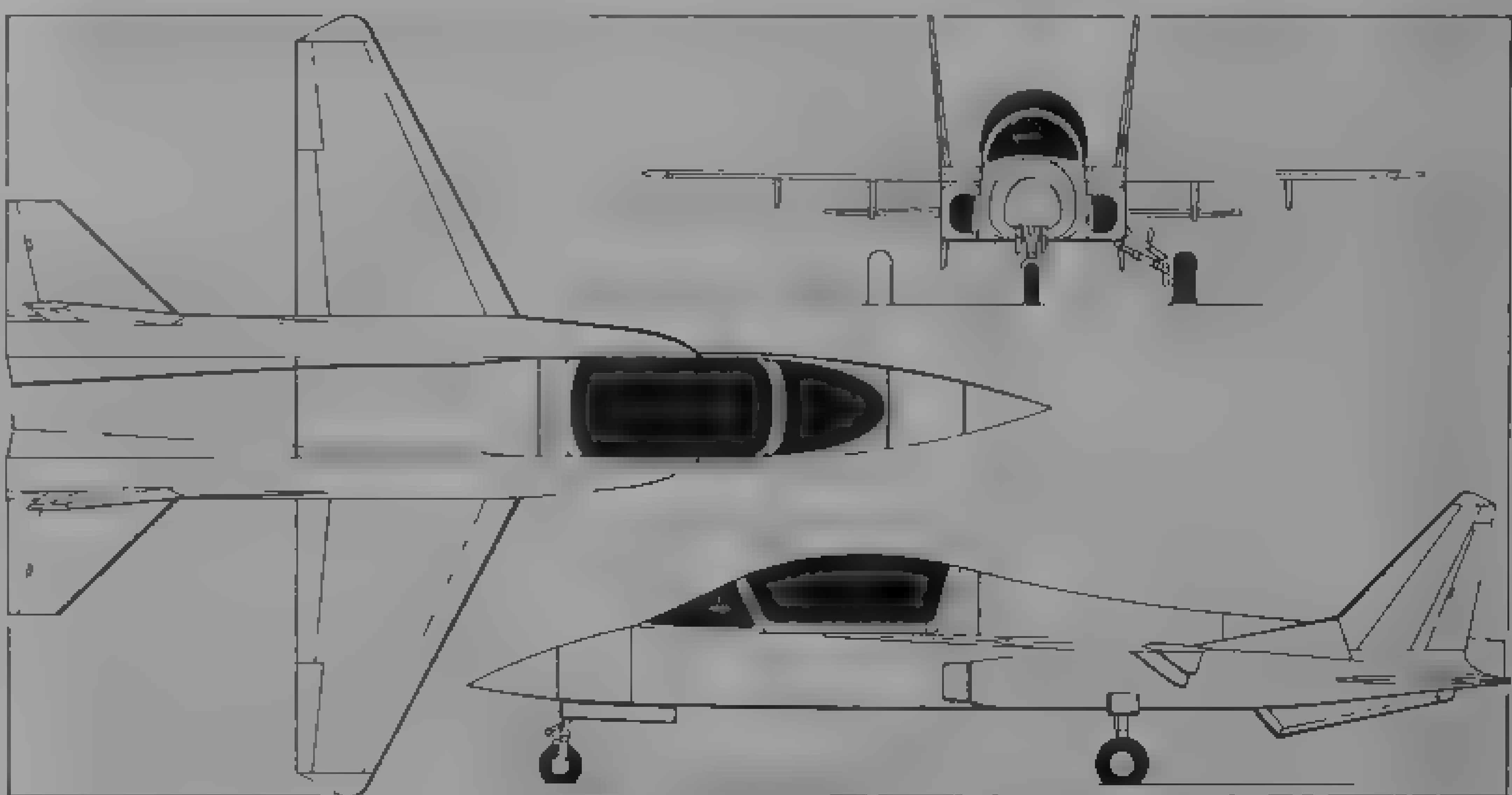
AVIONICS: Weather radar; EFIS.

DIMENSIONS, EXTERNAL:	
Wing span	6.55 m (21 ft 6 in)
Wing aspect ratio	4.72
Length overall	8.79 m (28 ft 10 in)
Height overall	2.46 m (8 ft 1 in)
AREAS:	
Wings, gross	9.10 m² (98.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty	1,021 kg (2,250 lb)
Max T-O weight	2,014 kg (4,440 lb)
Max wing loading	221.2 kg/m² (45.3 lb/sq ft)
Max power loading (CJ610)	153.6 kg/kN (1.50 lb/lb st)
PERFORMANCE (estimated, at max T-O weight except where indicated):	
Max level speed	Mach 1.4
Max cruising speed at 13,715 m (45,000 ft)	Mach 0.91
(Tested in 1994 to Mach 0.86 at 9,150 m, 30,000 ft)	
Stalling speed	53-98 kts (97-181 km/h; 60-112 mph)
Max rate of climb at S/L	9,150 m (30,000 ft)/min
Service ceiling	13,715 m (45,000 ft)
T-O at 1,270 kg (2,800 lb) AUW	183 m (600 ft)
Landing run at 953 kg (2,100 lb) AUW	458 m (1,500 ft)
g limit	+8

UPDATED

Peregrine (Bede) Falcon (General Electric CJ610 turbojet)

1995



Falcon version of Bede BD-10 supersonic light aircraft (*Jane's/Mike Keep*)

1994

PIASECKI

PIASECKI AIRCRAFT CORPORATION

Second Street West, Essington Pennsylvania 19029-0360
Telephone 1 (215) 521 5700
Fax 1 (215) 521 5935

PRESIDENT Frank N Piasecki
VICE-PRESIDENTS
Donald N Meyers (Engineering)
Frederick W Piasecki (Technology)
John W Piasecki (Contracts)
DIRECTOR, MILITARY REQUIREMENTS: Joseph P Cosgrove

Formed in 1955 by Frank Piasecki, former Chairman of the Board and President of Piasecki Helicopter Corporation, now Helicopters Division, Boeing Defense and Space Group

Piasecki vectored thrust combat agility demonstrator (VTCAD): US Army has awarded modifications to initial contract to develop further a compound helicopter incorporating Piasecki Vectored Thrust Ducted Propeller (VTDP) concept. Follow-on activities include airframe interface design, pilot controls simulation, and cost-effectiveness analysis for both AH-64 Apache and AH-1W SuperCobra attack helicopters. Design, fabrication and ground test of a full scale VTDP are included. Programme objectives are increased maximum level flight speed to over 200 knots (370 km/h, 230 mph), 50 per cent improvement in longitudinal acceleration and deceleration capability in level flight, 50 per cent decrease in turn and pull-up radii at speeds in excess of 95 knots (176 km/h, 109 mph), and handling qualities at least as good as those of the baseline AH-64A/AH-1W. Additional AH-1W design activities are part of a separate USN contract

PZL Świdnik W-3A Sokół Piasecki assisted Świdnik in FAA certification, awarded in May 1993. Piasecki has exclusive sales agreement for W-3A in the Americas and Pacific Rim countries. W-3A Sokół complies with FAR Pt 29 and is certificated for full IFR operations; it is equipped with a rotor monofilar vibration absorber, turbine inlet particle separator, dual batteries, US instrumentation, and PZL Rzeszów turboshaft engines rated at 746 kW (1,000 shp) maximum continuous and 857 kW (1,150 shp) OEI for 2½ minutes. It has been tested for high-intensity electromagnetic field effects and flight into known icing. See Polish section for full description

UPDATED

Model of AH-1W SuperCobra VTCAD with PiAC vectored thrust ducted propeller and stub wings
1995

PIPER

PIPER AIRCRAFT CORPORATION

2926 Piper Drive, Vero Beach, Florida 32960
Telephone: 1 (407) 567 4361
Fax: 1 (407) 778 2144

PRESIDENT AND CHIEF EXECUTIVE OFFICER
Charles (Chuck) M Suma
VICE-PRESIDENT, PRODUCT SERVICES: Werner Hartlieb
VICE-PRESIDENT, MANUFACTURING: George (Buddy) Watson
DIRECTOR OF ENGINEERING: Elliott Nichols
MARKETING MANAGER: Kimberley Von Hagen

Piper purchased by Lear Siegler Inc effective 1 March 1984; Lock Haven and Piper facilities in Pennsylvania closed second half 1984; Lakeland, Florida, plant phased out October 1985. Activities concentrated at Vero Beach and new 12,075 m² (130,000 sq ft) plant completed October 1986 for Cheyenne IIIA and 400 production (transferred from Lakeland)

Company acquired by M Stuart Millar 12 May 1987 and became subsidiary of Romeo Charlie Inc; LoPresti Piper Advanced Engineering Group set up as subsidiary December 1987; Piper North Corporation subsidiary formed November 1989 at Lock Haven to re-establish aircraft manufacturing at former headquarters under loan guarantee agreement with Commonwealth of Pennsylvania. Increasing cash flow problems in second half of 1990 resulted in closure of both subsidiaries and reduced production. Sale of type certificates and manufacturing rights for number of out-of-production models were negotiated August 1990 and March 1991. Aerospatiale (Socata) negotiations to buy Piper finally broken off 22 March 1991, reportedly because of product liability uncertainties

Voluntarily filed for protection under Chapter 11 of US Bankruptcy Code July 1991, after several abortive bids from would-be purchasers; in July 1995, US Bankruptcy Court approved new reorganisation plan under which Piper's assets were bought for $95 million by Newco Pac Inc, a new company jointly owned by Philadelphia-based investment firm Dimeling, Schreiber and Park, Teledyne Continental Motors (which was Piper's largest creditor) and the remaining creditors.

During 1994, Piper delivered 132 aircraft, a substantial increase over previous year; estimates for 1995 were for 174 aircraft and for 1996, 202 aircraft. Workforce increased to 410 by end of 1994, with total of 540 expected by December 1995

UPDATED

Piper PA-28-161 Warrior III four-seat tourer/trainer
1995

PIPER PA-28-161 WARRIOR III

TYPE: Four-seat light aircraft and trainer

PROGRAMME: Design began June 1972, as replacement for Cherokee 140 series; first flight of prototype PA 28-151 17 October 1972; FAA certification 9 August 1973. PA 28-161 Warrior II first flown 27 August 1976; two-four-seat Cadet trainer version introduced April 1988, but no longer in production. Warrior III introduced late 1994

CUSTOMERS: Eight Warrior IIs and one Warrior III delivered in 1994; total of 23 planned for production in 1995

COSTS: Standard equipped price $128,500 (1995)

DESIGN FEATURES: NACA 65_2-415 wing section on inboard panels, Mod No. 5 of NACA TN 2228 on leading-edge of outboard panels; dihedral 7°, incidence 2° at root, -1° at tip; sweepback at quarter-chord 5°

FLYING CONTROLS: Mechanical, combined anti-servo and trim tab on all-moving tailplane; four-position manually operated flaps.

STRUCTURE: Conventional light alloy, with semi-monocoque fuselage, single-spar wings and ribbed light alloy skins on fin and tailplane; glassfibre nose cowl and wing/tailplane/fin tips.

LANDING GEAR: Non-retractable tricycle type. Steerable nosewheel. Piper oleo-pneumatic shock absorbers; single wheel on each unit. Cleveland wheels with 4 ply tyres size 6.00-6 on main units, pressure 1.65 bars (24 lb sq in). Cleveland nosewheel and 4 ply tyre size 5.00-5, pressure 1.65 bars (24 lb sq in). Cleveland disc brakes. Parking brake. Glassfibre wheel fairings standard

POWER PLANT: One 119 kW (160 hp) Textron Lycoming O-320-D3G flat-four engine, driving a Sensenich 74DM6-0-60 two-blade fixed-pitch metal propeller. Fuel in two wing tanks, with total capacity of 189 litres (50 US gallons, 41.6 Imp gallons), of which 181.5 litres (48 US gallons, 40 Imp gallons) are usable. Refuelling point on upper surface of each wing. Oil capacity 7.5 litres (2 US gallons, 1.7 Imp gallons)

ACCOMMODATION: Four persons in pairs in enclosed cabin. Individual adjustable front seats with seat belts and shoulder harnesses; bench type rear seat with seat belts and shoulder harnesses. Dual controls standard. Large door on starboard side. Baggage compartment at rear of cabin, with volume of 0.68 m³ (24 cu ft) and capacity of 91 kg (200 lb). External baggage door on starboard side. Heating, ventilation and windscreen defrosting standard.

SYSTEMS: Hydraulic system for brakes only. Electrical system powered by 28 V 60 A engine-driven alternator. 24 V 10 Ah battery standard

AVIONICS: Standard Bendix/King package as described below; Advanced Training Group IFR package optional.

Comms: Single Bendix/King KX-155-39 transceiver with audio amplifier and broadband antenna; KT 76A transponder; avionics master switch, Telex 100T noise-cancelling microphone, headset and intercom with microphone buttons; cabin speaker and microphone jacks, ELT

Flight: Single KX-155-39 nav receiver with VOR antenna. KI-203 VOR/LOC indicator/converter; Narco AR 850 altitude reporter

Instrumentation: Piper true airspeed indicator, magnetic compass, sensitive altimeter, directional gyro, rate of turn indicator, rate of climb indicator, OAT gauge, digital ammeter, annunciator panel with push-to-test, recording tachometer, three-way oil temperature/pressure and fuel quantity gauges and vacuum gauge

EQUIPMENT: Standard equipment includes engine hour recorder, alternate static source, colour co-ordinated control wheels, internally lit rocker switches, external power receptacle, electrical engine primer system, instrument panel lighting package, cabin dome light, navigation lights, landing/taxi light, wingtip strobe lights, pilot's and co-pilot's vertically adjustable seats in fabric and vinyl with magazine storage pockets on backs, rear bench seat, four floor-mounted cabin fresh air vents, vinyl cabin side panels, wall-to-wall carpet and headliner, crew armrests, pilot's storm window, two sun visors, two map pockets, 'Quietised' soundproofing, carpeted baggage

compartment with security straps, tiedown points, jack pads, static discharge wicks, and Du Pont Imron polyurethane exterior paint in base colour with two contrasting trim stripes, heated pitot head with annunciator, foreign certification gross weight kit and rpm reduction kit optional.

DIMENSIONS, EXTERNAL

Wing span	10.67 m (35 ft 0 in)
Wing chord: at root	1.60 m (5 ft 3 in)
at tip	1.07 m (3 ft 6¼ in)
Wing aspect ratio	7.21
Length overall	7.25 m (23 ft 9⅜ in)
Height overall	2.22 m (7 ft 3½ in)
Tailplane span	3.96 m (12 ft 11¾ in)
Wheel track	3.05 m (10 ft 0 in)
Wheelbase	2.03 m (6 ft 8 in)
Propeller diameter	1.88 m (6 ft 2 in)
Propeller ground clearance	0.21 m (8¼ in)
Cabin door: Height	0.89 m (2 ft 11 in)
Width	0.91 m (3 ft 0 in)
Baggage door: Height	0.51 m (1 ft 8 in)
Max width	0.56 m (1 ft 10 in)
Height to sill	0.71 m (2 ft 4 in)

DIMENSIONS, INTERNAL

Cabin: Length (instrument panel to rear bulkhead)	2.49 m (8 ft 2 in)
Max width	1.05 m (3 ft 5¼ in)
Max height	1.14 m (3 ft 8¾ in)
Floor area	2.28 m² (24.5 sq ft)
Volume (incl baggage area)	3.00 m³ (106.0 cu ft)

AREAS

Wings, gross	15.8 m² (170.0 sq ft)
Ailerons (total)	1.23 m² (13.2 sq ft)
Trailing-edge flaps (total)	1.36 m² (14.6 sq ft)
Fin	0.69 m² (7.4 sq ft)
Rudder	0.38 m² (4.1 sq ft)
Tailplane, incl tab	2.46 m² (26.5 sq ft)

WEIGHTS AND LOADINGS

Weight empty	676 kg (1,491 lb)
Max T-O weight	1,110 kg (2,447 lb)
Max wing loading	70.28 kg/m² (14.39 lb/sq ft)
Max power loading	9.31 kg/kW (15.29 lb/hp)

PERFORMANCE (at max T-O weight, ISA, except where indicated):

Max level speed	127 kts (235 km/h; 146 mph)
Max cruising speed	126 kts (233 km/h; 145 mph)
Econ cruising speed	118 kts (218 km/h; 136 mph)
Stalling speed:	
flaps up	50 kts (93 km/h; 58 mph)
flaps down	44 kts (82 km/h; 51 mph)
Max rate of climb at S/L	196 m (644 ft)/min
Service ceiling	3,355 m (11,000 ft)
T-O to 15 m (50 ft)	503 m (1,650 ft)
Landing from 15 m (50 ft)	354 m (1,160 ft)

NEW ENTRY

PIPER PA-28-181 ARCHER III

TYPE: Four-seat light aircraft.

PROGRAMME: Introduced (as Cherokee Challenger) 9 October 1972 as successor to Cherokee 180; Archer introduced 1974; PA-28-181 Archer II launched 1976, and in 1978 introduced the tapered wings of Warrior II; Archer III 1994 with axisymmetric engine inlets, redesigned windscreen and cabin side windows, and interior restyling and improvements.

CUSTOMERS: 19 Archer IIs delivered in 1993, nine Archer IIs and 10 Archer IIIs in 1994; total of 40 planned for 1995.

COSTS: Standard, equipped $149,600 (1995).

Description of the Warrior III applies also to Archer III except as follows:

LANDING GEAR: Tyres size 6.00-6, 4 ply rating, on all three wheels. Mainwheel tyre pressure 1.65 bars (24 lb/sq in), nosewheel 1.24 bars (18 lb/sq in). Cleveland high-capacity disc brakes. Parking brake. Wheel speed fairings standard.

POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-A4M flat-four engine, driving a Sensenich 76EM8S5-0-62 two-blade fixed-pitch metal propeller. Fuel in two tanks in wing leading-edges, with total capacity of 189 litres (50 US gallons; 41.6 Imp gallons), of which 181.5 litres (48 US gallons; 40 Imp gallons) are usable. Oil capacity 7.5 litres (2 US gallons; 1.7 Imp gallons).

ACCOMMODATION: Four persons in pairs in enclosed cabin. Individual adjustable front seats, with dual controls; individual rear seats. Large door on starboard side. Baggage compartment at rear of cabin, with volume of 0.74 m³ (26 cu ft) and capacity of 90 kg (200 lb); door on starboard side. Rear seats removable to provide 1.25 m³ (44 cu ft) cargo space. Accommodation heated and ventilated. Windscreen defrosting.

SYSTEMS: 28 V 60 A alternator.

EQUIPMENT: Standard equipment generally as for Warrior III except polished propeller spinner, illuminated side-mounted OAT gauge, overhead switch panel, EGT gauge, flush locking fuel caps, overhead vent fan system, restyled windscreen and window lines with tinted transparencies, full chemical corrosion protection, choice of four interior colours with suede cloth headliner, wool carpeting and Hobnail side panels, passenger armrests and headrests. Additional options include Piper Aire air conditioning, carburettor ice detector, second altimeter and leather seats.

Piper PA-28-181 Archer III, showing new axisymmetric engine inlets *1995*

DIMENSIONS, EXTERNAL AND INTERNAL:

As for Warrior III except:	
Tailplane span	3.92 m (12 ft 10¼ in)
Wheelbase	2.00 m (6 ft 7 in)
Propeller diameter	1.93 m (6 ft 4 in)
Cabin: Width	1.06 m (3 ft 5¾ in)
Height	1.14 m (3 ft 9 in)
Baggage compartment volume, incl hatshelf	0.74 m³ (26.0 cu ft)

AREAS: As for Warrior III

WEIGHTS AND LOADINGS:

Weight empty	743 kg (1,639 lb)
Max T-O weight	1,156 kg (2,550 lb)
Max ramp weight	1,160 kg (2,558 lb)
Max wing loading	73.23 kg/m² (15.00 lb/sq ft)
Max power loading	8.62 kg/kW (14.17 lb/hp)

PERFORMANCE (at max T-O weight):

Max level speed	129 kts (239 km/h; 148 mph)
Cruising speed:	
75% power at 2,440 m (8,000 ft)	129 kts (239 km/h; 148 mph)
65% power at 3,660 m (12,000 ft)	125 kts (231 km/h; 144 mph)
55% power at 3,810 m (12,500 ft)	111 kts (206 km/h; 128 mph)
Stalling speed:	
flaps up	57 kts (106 km/h; 66 mph) CAS
flaps down	52 kts (97 km/h; 60 mph) CAS
Max rate of climb	203 m (667 ft)/min
Service ceiling	4,035 m (13,240 ft)
T-O run	266 m (870 ft)
T-O to 15 m (50 ft)	369 m (1,210 ft)
Landing from 15 m (50 ft)	424 m (1,390 ft)
Landing run	282 m (925 ft)
Range, allowances for taxi, T-O, climb and descent, and 45 min reserves at max range power:	
75% power at 2,440 m (8,000 ft)	520 n miles (963 km; 598 miles)
65% power at 3,660 m (12,000 ft)	565 n miles (1,046 km; 650 miles)
55% power at 3,810 m (12,500 ft)	580 n miles (1,074 km; 667 miles)

NEW ENTRY

PIPER PA-28R-201 ARROW

TYPE: Four-seat light aircraft.

PROGRAMME: Derived from Cherokee Archer II, but with retractable landing gear, more powerful engine and untapered wings of 1975 PA-28-180 Archer; PA-28R-201 Arrow III with tapered wings first flown 16 September 1975, first production aircraft 7 January 1977; new Arrow IV and Turbo Arrow IV models introduced 1979 with all-moving T tails, these subsequently discontinued and earlier low tail model restored to production.

CUSTOMERS: One Arrow delivered during 1994; total of three planned for 1995.

Description of Archer III applies also to Arrow except as follows:

COSTS: Standard, equipped $186,900 (1995).

LANDING GEAR: Tricycle type, retracted hydraulically with an electrically operated pump supplying the hydraulic pressure. Main units retract inward into wings, nose unit rearward. All units fitted with oleo-pneumatic shock-absorbers. Mainwheels and tyres size 6.00-6, 6 ply rating, pressure 2.07 bars (30 lb/sq in). Nosewheel and tyre size 5.00-5, 4 ply rating, pressure 1.86 bars (27 lb/sq in). High-capacity dual hydraulic disc brakes and parking brake.

POWER PLANT: Arrow: One 149 kW (200 hp) Textron Lycoming IO-360-C1C6 flat-four engine, driving a McCauley two-blade constant-speed metal propeller. Fuel tanks in wing leading-edges with total capacity of 291 litres (77 US gallons; 64 Imp gallons), of which 273 litres (72 US gallons; 60 Imp gallons) are usable. Oil capacity 7.5 litres (2 US gallons; 1.7 Imp gallons).

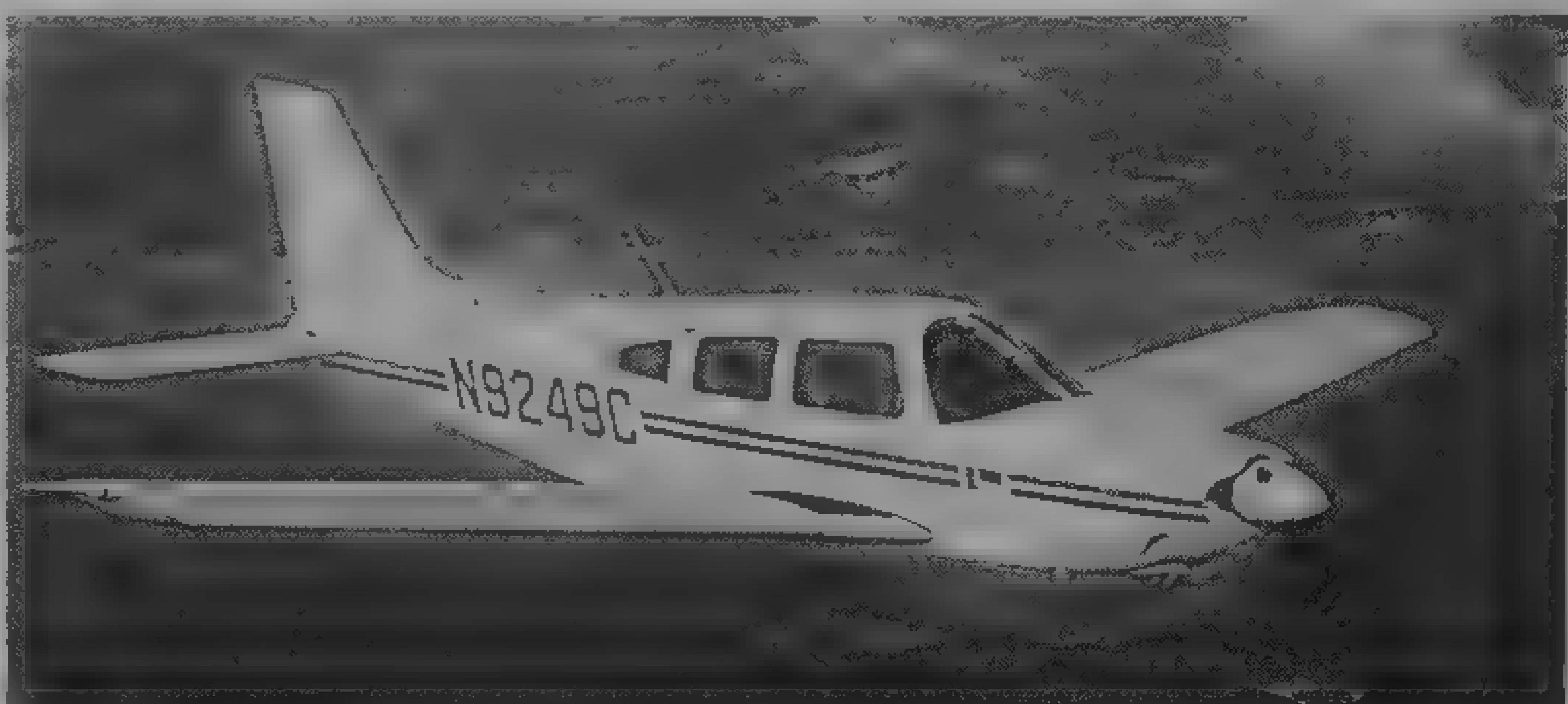
SYSTEMS: Generally as for Archer III and Warrior III except for electrohydraulic system for landing gear actuation.

DIMENSIONS, EXTERNAL:

Wing span	10.80 m (35 ft 5 in)
Wing aspect ratio	7.38
Length overall	7.52 m (24 ft 8 in)
Height overall	2.39 m (7 ft 10¼ in)
Wheel track	3.19 m (10 ft 5½ in)
Wheelbase	2.39 m (7 ft 10¼ in)

WEIGHTS AND LOADINGS:

Weight empty	816 kg (1,798 lb)
Max T-O weight	1,247 kg (2,750 lb)
Max wing loading	78.98 kg/m² (16.18 lb/sq ft)
Max power loading	8.37 kg/kW (13.75 lb/hp)



Piper PA-28R-201 Arrow *1995*

PERFORMANCE

Max level speed	152 kts (282 km/h, 175 mph)
Cruising speed at optimum altitude	
75% power	143 kts (265 km/h, 165 mph)
65% power	138 kts (256 km/h, 159 mph)
Stalling speed	
flaps up	60 kts (112 km/h, 69 mph)
flaps down	55 kts (102 km/h, 64 mph)
Max rate of climb at S/L	253 m (831 ft)/min
Service ceiling	4,935 m (16,200 ft)
T-O to 15 m (50 ft)	488 m (1,600 ft)
Landing from 15 m (50 ft)	465 m (1,525 ft)
Range, allowances for start, T-O, climb and descent, and 45 min reserves	
75% power	725 n miles (1,342 km, 834 miles)
65% power	770 n miles (1,426 km, 886 miles)

NEW ENTRY

PIPER PA-32R-301 SARATOGA IIHP

TYPE: Six-seat light tourer/business aircraft.

PROGRAMME: Saratoga family of fixed and retractable landing gear light aircraft announced 17 December 1979 to replace earlier PA-32 Cherokee SIX 300 and T-tail Lance series; fixed gear models now out of production. Saratoga IIHP introduced in Autumn 1993, featuring axisymmetric engine inlets, aerodynamic clean-up and interior improvements and restyling.

CUSTOMERS: 28 delivered in 1993, and 20 in 1994; total of 27 planned for 1995.

COSTS: Standard, equipped $314,200 (1995).

FLYING CONTROLS: Mechanical; combined anti-servo and trim tab on all-moving tailplane; rudder trim; four-position electrically actuated flaps with preselect.

STRUCTURE: Conventional light alloy, with semi-monocoque fuselage, single-spar wings and ribbed light alloy skins on fin and tailplane; glassfibre nose cowl and wing/tailplane/fin tips.

LANDING GEAR: Hydraulically retractable tricycle type with single wheel on each unit. Main units retract inward, nosewheel aft. Emergency free-fall extension system. Piper oleo-pneumatic shock-absorbers. Steerable nosewheel. Mainwheels and tyres size 6.00-6, 8 ply rating, pressure 2.62 bars (38 lb/sq in). Nosewheel and tyre size 5.00-5, 6 ply rating, pressure 2.41 bars (35 lb/sq in).

POWER PLANT: One 224 kW (300 hp) Textron Lycoming IO-540-K1G5 flat-six engine, driving a Hartzell blade constant-speed metal propeller. Two fuel tanks in each wing with combined capacity of 405 litres (107 US gallons, 89 Imp gallons), of which 386 litres (102 US gallons, 85 Imp gallons) are usable. Refuelling points on wing upper surface. Oil capacity 11.5 litres (3 US gallons, 2.5 Imp gallons).

ACCOMMODATION: Enclosed cabin seating six people, rear four in club arrangement. Two forward-hinged doors, one on starboard side forward, overwing, and one on port side at rear end of cabin. Space for 45 kg (100 lb) baggage at rear of cabin, with external baggage/utility door on port side. Additional baggage space, capacity 45 kg (100 lb), between engine fireproof bulkhead and instrument panel, with external door on starboard side. Pilot's storm window. Accommodation heated and ventilated. Windscreen defroster standard.

SYSTEMS: Electrically driven hydraulic pump for landing gear actuation. Electrical system includes 14 V 90 A engine-driven alternator and 12 V 35 Ah battery. Standby vacuum system standard.

AVIONICS: Standard Bendix/King IFR package.

Comms: Dual KX-165-21 combined nav/com transceivers with broadband antennas, KMA-24-03 audio selector panel with lights, KT-71 digital transponder, Nav 1/GPS switching/ground clearance system, avionics master switch, Telex 100T headset, cabin speaker with microphone jacks, pilot's and co-pilot's control wheel microphone buttons, and ELT.

Flight: Dual KX 165-21 combined nav/com receivers with dual glide slope receivers and VOR/LOC converters, marker beacon receiver; KI-525A-01 VOR/LOC/GS/HSI, KI 206 VOR/LOC indicator, KN-62A DME, KR-87 digital ADF with KI 227-01 slaved indicator and KA 44B antenna, KLN 90A GPS, KFC-150 autopilot/flight director with KI 256 flight command indicator, HSI-525A-01 flight computer, KC-192 annunciator/controller and KCS-55A slaved compass system; and Narco AR 850 altitude reporter.

Instrumentation: Piper true airspeed indicator, illuminated magnetic compass, sensitive altimeter (with second optional) ADI, HSI, rate of turn indicator, rate of climb indicator, OAT gauge, digital ammeter, annunciator panel with push-to-test, recording tachometer, manifold pressure/fuel flow gauge, oil pressure gauge, oil temperature gauge, dual fuel quantity gauges, fuel quantity sight gauges, CHT gauge, EGT gauge and vacuum gauge.

EQUIPMENT: Standard equipment includes engine hour recorder, alternate static source, electric clock, dual control wheels, heavy duty brake system with dual toe brakes, internally lit rocker switches, heated pitot head, resettable circuit breakers in CB panel, standby electric vacuum pump, electric emergency fuel pump, external power receptacle, instrument panel lighting package, avionics dimming, map lights, four cabin reading lights, forward baggage compartment light, two cabin door lights, navigation lights, landing/taxi light, wingtip strobe lights, wingtip recognition lights, pilot's and co-pilot's vertically adjustable all-leather seats, pilot's vent window, sun visors, two map pockets, four all-leather passenger seats with headrests, shoulder harnesses, seat belts, and quick-release facility, fold-down armrests (fifth and sixth seats), refreshment console, executive writing table, six overhead and four floor-mounted cabin fresh air vents, cabin air exhaust vents, tinted windscreen and cabin windows, folding shades on passenger windows, choice of four interior colours with suede cloth headliner, Hobnail fabric side panels, wool carpeting, super 'Quietised' soundproofing, lockable baggage compartments with security straps, utility door for rear baggage access and cargo loading, tie-down points, jack pads, stowable towbar, static discharge wicks, and Du Pont Imron polyurethane exterior paint in single or two-tone base colour with choice of trim colours. Piper Aire air conditioning system optional.

Piper PA-32R-301 Saratoga IIHP *1995*

DIMENSIONS, EXTERNAL

Wing span	11.02 m (36 ft 2 in)
Wing aspect ratio	7.34
Length overall	8.23 m (27 ft 0 in)
Height overall	2.59 m (8 ft 6 in)
Tailplane span	3.94 m (12 ft 11 in)
Wheel track	3.39 m (11 ft 1½ in)
Wheelbase	2.43 m (7 ft 11½ in)
Cabin door (fwd, stbd): Height	0.89 m (2 ft 11 in)
Width	0.91 m (3 ft 0 in)
Cabin door (rear, port): Height	0.72 m (2 ft 4½ in)
Width	0.71 m (2 ft 4 in)
Baggage door (fwd): Height	0.41 m (1 ft 4 in)
Width	0.56 m (1 ft 10 in)
Baggage/utility door (fwd): Height	0.52 m (1 ft 8½ in)
Width	0.66 m (2 ft 2 in)

DIMENSIONS, INTERNAL

Cabin	
Length (instrument panel to rear bulkhead)	3.16 m (10 ft 4¼ in)
Max width	1.24 m (4 ft 0¾ in)
Max height	1.07 m (3 ft 6 in)
Volume (include rear baggage area)	5.53 m³ (195.3 cu ft)
Baggage compartment volume	
forward	0.20 m³ (7.0 cu ft)
rear	0.49 m³ (17.3 cu ft)

AREAS

Wings, gross	16.56 m² (178.3 sq ft)

WEIGHTS AND LOADINGS

Weight empty, equipped	1,072 kg (2,364 lb)
Max T-O weight	1,633 kg (3,600 lb)
Max ramp weight	1,639 kg (3,615 lb)
Max wing loading	98.58 kg/m² (20.19 lb/sq ft)
Max power loading	7.30 kg/kW (12.00 lb/hp)

PERFORMANCE

Max level speed at optimum altitude	166 kts (307 km/h, 191 mph)
Cruising speed at mid-cruise weight	
High-speed cruise power	166 kts (307 km/h, 191 mph)
Normal cruise power	163 kts (302 km/h; 188 mph)
Econ cruise power	159 kts (294 km/h, 183 mph)
Long-range cruise power	152 kts (282 km/h, 175 mph)
Stalling speed	
flaps up	65 kts (121 km/h, 75 mph) CAS
flaps down	60 kts (112 km/h, 69 mph)
Max rate of climb at S/L	340 m (1,116 ft)/min
Service ceiling	4,750 m (15,590 ft)
T-O run	365 m (1,196 ft)
T-O run to 15 m (50 ft)	539 m (1,768 ft)
Landing from 15 m (50 ft)	464 m (1,520 ft)
Landing run	197 m (645 ft)
Range, allowances for start, taxi, T-O, climb and descent, and 45 min reserves:	
High-speed cruise power	450 n miles (833 km, 517 miles)
Normal cruise power	740 n miles (1,370 km, 851 miles)
Econ cruise power	800 n miles (1,481 km, 920 miles)
Long-range cruise power	860 n miles (1,592 km, 989 miles)

NEW ENTRY

PIPER PA-34-220T SENECA IV

TYPE: Six-seat twin-engined light aircraft and multi-engine trainer.

PROGRAMME: Original PA-34 Seneca announced 23 September 1971; redesignated Seneca II from 1975; improved Seneca III with more powerful counter-rotating (C/R) engines introduced 15 February 1981; Seneca IV with axisymmetric engine inlets, aerodynamic refinements and interior improvements and restyling introduced in 1994.

CUSTOMERS: Five Seneca IIIs delivered in 1993, and 24 Seneca IVs in 1994; total of 32 planned for production in 1995.

COSTS: Standard equipped price $439,900 (1995).

DESIGN FEATURES: Cantilever low-wing monoplane; dihedral 7°. Frise ailerons.

FLYING CONTROLS: Mechanical; one-piece all-moving horizontal tail with combined anti-balance and trim tab; anti-servo tab in rudder; wide-span electrically operated slotted flaps.

STRUCTURE: Conventional light alloy, with semi-monocoque fuselage, single-spar wings; glassfibre wingtips.

LANDING GEAR: Hydraulically retractable tricycle type. Main units retract inward, nose unit forward. Oleo-pneumatic shock-absorbers. Steerable nosewheel. Emergency free-fall extension system. Mainwheels and tyres size 6.00-6, 8 ply rating, pressure 3.79 bars (55 lb/sq in); nosewheel and tyre size 6.00-6, 6 ply rating, pressure 2.76 bars (40 lb/sq in). Nosewheel safety mirror. High-capacity disc brakes. Parking brake.

POWER PLANT: One 164 kW (220 hp) Teledyne Continental TSIO-360-KB and one 164 kW (220 hp) LTSIO-360-KB flat-six turbocharged counter-rotating engine, each driving a McCauley three-blade constant-speed fully feathering metal propeller. Propeller synchrophasers standard. Fuel in four tanks in wings, with a total capacity of 485 litres (128 US gallons, 106.6 Imp gallons), of which 466 litres (123 US gallons; 102.4 Imp gallons) are usable. Oil capacity 7.5 litres (2 US gallons, 1.7 Imp gallons). Glassfibre engine cowlings.

ACCOMMODATION: Enclosed cabin, seating six people in pairs on individual seats with 0.25 m (10 in) centre aisle. Dual controls standard. Pilot's storm window. Two forward-hinged doors, one on starboard side at front, the other on port side at rear. Large utility door adjacent rear cabin door provides an extra wide opening for loading bulky items. Passenger seats easily removable to provide different seating/baggage/cargo combinations. Space for 45 kg (100 lb) baggage at rear of cabin, and for 45 kg (100 lb) in nose compartment with external door on port side. Cabin heated and ventilated. Windscreen defrosters standard.

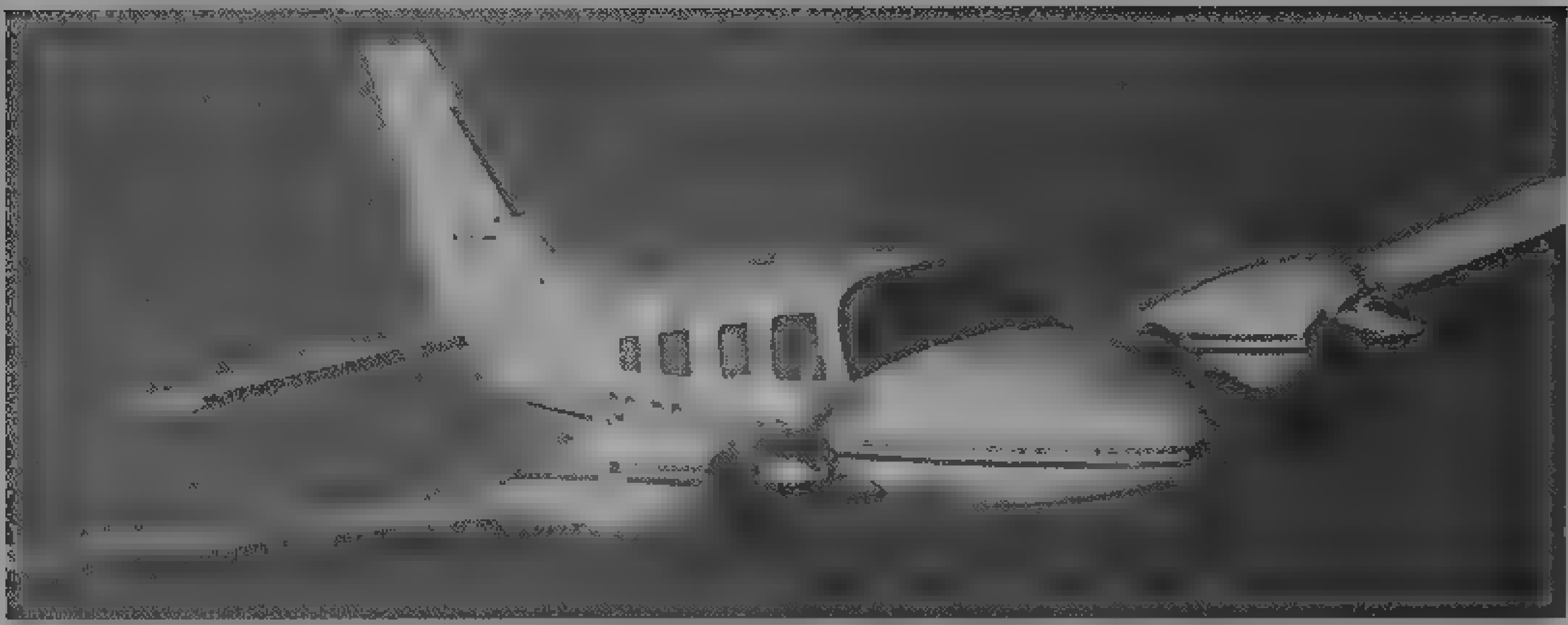
SYSTEMS: Electrohydraulic system for landing gear actuation. Electrical system powered by two 28 V 90 A alternators, 24 V 35 Ah battery. Pneumatic de-icing boots on wing, tailplane and fin leading edges.

AVIONICS: Standard Bendix/King IFR package.

Comms: Dual KX-165-25 combined nav/com transceivers with broadband antennae, KMA-24-03 audio selector panel with lights, KT-17 digital transponder, Nav 1/GPS switching/ground clearance system, Telex 100T headset, cabin speaker with microphone jacks, pilot's and co-pilot's control wheel microphone buttons, pilot's transponder ident button, and ELT.

Radar: Provision in nose and on instrument panel for weather radar installation; Bendix/King RDR 2000 vertical profile radar optional.

Flight: Dual KX 165-25 combined nav/com receivers with dual glide slope receivers and VOR/LOC converters, marker beacon receiver; KI-525A-07 VOR/LOC/GS indicator, KN-62A DME, KR 87 digital ADF with KI-227-01 slaved indicator and KA 44B antenna, KLN 90A GPS, KFC 150 autopilot/flight director with KI 256 flight



Piper PA-34-220T Seneca IV

1995

command indicator KI-525A-07 flight computer, KC 192 annunciator/controller and KCS-55A slaved compass system, and Narco AR-850 altitude reporter

Instrumentation Piper true airspeed indicator, magnetic compass, sensitive altimeter, ADI, HSI, rate of turn indicator, rate of climb indicator, illuminated OAT gauge digital ammeter annunciator panel with push-to-test recording tachometer, dual manifold pressure gauges three way oil pressure temperature and CHT gauge, dual fuel quantity gauges and vacuum gauge with warning indicator. Pilot's 7.5 cm (3 in) instrument pane optional

EQUIPMENT: Standard equipment as listed for Saratoga HP, plus emergency landing gear extension system, cabin dome light, pilot's storm window, sun visors with power setting table and checklist, chemical corrosion protection flush fuel caps and nose gear safety mirror. Piper Aire air conditioning system, built in oxygen system and foreign certification gross weight kit optional

DIMENSIONS, EXTERNAL

Wing span	11.85 m (38 ft 10¾ in)
Wing aspect ratio	7.25
Wing chord, constant	1.60 m (5 ft 3 in)
Length overall	8.72 m (28 ft 7½ in)
Height overall	3.02 m (9 ft 10¾ in)
Tailplane span	4.14 m (13 ft 6¾ in)
Wheel track	3.38 m (11 ft 1 in)
Wheelbase	2.13 m (7 ft 0 in)
Propeller diameter	1.93 m (6 ft 4 in)
Distance between propeller centres	3.80 m (12 ft 5½ in)
Cabin door (stbd, fwd): Height	0.89 m (2 ft 11 in)
Width	0.91 m (3 ft 0 in)
Cabin door (port, rear): Height	0.72 m (2 ft 4½ in)
Width	0.71 m (2 ft 4 in)
Baggage door (stbd, rear): Height	0.52 m (1 ft 8½ in)
Width	0.66 m (2 ft 2 in)
Baggage door (port, fwd): Height	0.53 m (1 ft 9 in)
Width	0.61 m (2 ft 0 in)

DIMENSIONS, INTERNAL

Cabin (incl flight deck): Length	3.15 m (10 ft 4½ in)
Max width	1.24 m (4 ft 0¾ in)
Max height	1.07 m (3 ft 6 in)
Volume	5.53 m³ (195.3 cu ft)
Forward baggage compartment	0.43 m³ (15.3 cu ft)
Rear baggage compartment	0.49 m³ (17.3 cu ft)

AREAS

Wings, gross	19.39 m² (208.7 sq ft)
Ailerons, incl tab (total)	1.17 m² (12.60 sq ft)
Trailing-edge flaps (total)	1.94 m² (20.84 sq ft)
Fin	1.14 m² (12.32 sq ft)
Rudder, incl tab	0.71 m² (7.62 sq ft)
Horizontal tail surfaces (total)	3.60 m² (38.74 sq ft)

WEIGHTS AND LOADINGS

Weight empty, equipped	1,503 kg (3,314 lb)
Max T-O weight	2,154 kg (4,750 lb)
Max ramp weight	2,165 kg (4,773 lb)
Max zero-fuel weight	2,028 kg (4,470 lb)
Max landing weight	2,047 kg (4,513 lb)
Max wing loading	111.12 kg/m² (22.76 lb/sq ft)
Max power loading	6.57 kg/kW (10.80 lb/hp)

PERFORMANCE

Max level speed	196 kts (363 km/h, 226 mph)
Cruise speed at optimum altitude, mid-cruise weight	
75% power	193 kts (357 km/h, 222 mph)
65% power	191 kts (354 km/h, 220 mph)
45% power	168 kts (311 km/h, 193 mph)
Cruising speed at 3,050 m (10,000 ft), mid-cruise weight	
75% power	179 kts (332 km/h, 206 mph)
65% power	175 kts (324 km/h, 201 mph)
45% power	143 kts (265 km/h, 165 mph)
Stalling speed	
flaps up	66 kts (123 km/h, 76 mph) CAS
flaps down	62 kts (115 km/h, 72 mph) CAS
Max rate of climb at S/L	427 m (1,400 ft)/min
Rate of climb at S/L, OEI	73 m (240 ft)/min
Max certificated ceiling	7,620 m (25,000 ft)
Service ceiling, OEI	3,660 m (12,000 ft)
T-O run	280 m (920 ft)
T-O run to 15 m (50 ft)	369 m (1,210 ft)
Landing from 15 m (50 ft)	603 m (1,978 ft)
Landing run	372 m (1,218 ft)
Accelerate/stop distance	637 m (2,088 ft)
Range, allowances for start, taxi, T-O, climb and descent, and 45 min reserves	
at optimum altitude	
75% power	665 n miles (1,231 km, 765 miles)
65% power	785 n miles (1,453 km, 903 miles)
45% power	990 n miles (1,833 km, 1,139 miles)
at 3,050 m (10,000 ft)	
75% power	640 n miles (1,185 km, 736 miles)
65% power	758 n miles (1,403 km, 872 miles)
45% power	903 n miles (1,672 km, 1,039 miles)

NEW ENTRY

PIPER PA-44-180 SEMINOLE

TYPE: Twin-engined four-seat light aircraft and multi-engine trainer

PROGRAMME: Prototype first flown May 1976, production version announced 21 February 1978, two versions Seminole and Turbo Seminole, produced until 1982, normally aspirated Seminole restored to production in 1988, suspended in 1990 and restored again in 1995

COSTS: Standard, equipped $288,900 (1995)

DESIGN FEATURES: Cantilever low-wing monoplane; T tail

FLYING CONTROLS: Mechanical, all-moving tailplane with full-span tab, rudder anti-servo tab, plain ailerons and four position manually operated flaps

STRUCTURE: Conventional light alloy, with semi-monocoque fuselage, single-spar wings

LANDING GEAR: Hydraulically retractable tricycle type. Free-fall emergency extension system. Piper oleo-pneumatic shock-absorbers. Mainwheels and tyres size 6.00-6, 8 ply with tubes. Steerable nosewheel with tyre size 5.00-5, 6 ply, with tube. Dual toe-operated high-capacity disc brakes. Heavy-duty brakes and tyres optional

POWER PLANT: Two 134 kW (180 hp) Textron Lycoming flat-four counter-rotating engines (one O-360-A1H6 and one LO-360-A1H6), each driving a Hartzell two-blade constant-speed fully feathering metal propeller. One bladder-type fuel tank in each engine nacelle, with total capacity of 416 litres (110 US gallons; 91.5 Imp gallons), of which 409 litres (108 US gallons; 90 Imp gallons) are usable. Refuelling point on upper surface of each nacelle. Oil capacity 11.5 litres (3 US gallons, 2.5 Imp gallons)

ACCOMMODATION: Cabin seats four in two pairs of individual seats. Dual controls standard. Emergency exit on port side. Pilot's storm window. Baggage compartment at rear of cabin, capacity 91 kg (200 lb). Accommodation heated and ventilated. Windscreen defrosters

SYSTEMS: Electrohydraulic system for landing gear actuation and brakes. Electrical system includes two engine-driven 14 V 70 A alternators and 12 V 35 Ah battery. Janitrol combustion heater of 45,000 BTU capacity. Dual vacuum systems standard

AVIONICS: Standard Bendix/King package as described below; De luxe IFR avionics package optional

Comms: Single Bendix/King KX 155 transceiver with broadband antenna, KT 76A transponder, avionics master switch, Telex 100T microphone and headset; Telex Procom passenger intercom with microphone buttons; cabin speaker and microphone jacks.

Flight: Single KX 155 nav receiver with VOR antenna, KI 203 VOR/LOC indicator/converter, Narco AR 850 altitude reporter

Instrumentation: Artificial horizon, directional gyro, Piper true airspeed indicator, illuminated magnetic compass, sensitive altimeter, rate of turn indicator, rate of climb indicator, OAT gauge, dual ammeters, annunciator panel with push-to-test and dual tachometers, dual manifold pressure/oil temperature/oil pressure/CHT and EGT gauges, dual fuel/pressure quantity gauges

EQUIPMENT: Metal instrument panel, engine hour recorders, alternate static source, heated pitot head, dual control wheels, instrument panel lights and overhead blue lighting, avionics dimming, dome light, navigation lights, landing/taxi light, wingtip strobe lights, pilot's and co-pilot's vertically adjustable seats in fabric and vinyl, two reclining rear passenger seats, four floor mounted cabin fresh air vents, vinyl cabin side panels, wall-to-wall carpet and headliner, crew armrests, pilot's storm window, two sun visors, two map pockets, 'Quietised' soundproofing, baggage compartment with security straps, tiedown points, jack pads, nose gear safety mirror, static discharge wicks, and Du Pont Imron polyurethane exterior paint in white base colour with two contrasting trim stripes

DIMENSIONS, EXTERNAL

Wing span	11.7 m (38 ft 7¼ in)
Wing aspect ratio	8.11
Length overall	8.41 m (27 ft 7¼ in)
Height overall	2.59 m (8 ft 6 in)
Wheel track	3.20 m (10 ft 6 in)
Wheelbase	2.56 m (8 ft 4¾ in)
Propeller diameter	1.88 m (6 ft 2 in)
Cabin door (stbd): Height	0.89 m (2 ft 11 in)
Width	0.91 m (3 ft 0 in)
Baggage door: Height	0.51 m (1 ft 8 in)
Width	0.56 m (1 ft 10 in)

DIMENSIONS, INTERNAL

Cabin, instrument panel to rear bulkhead	
Length	2.46 m (8 ft 1 in)
Max width	1.05 m (3 ft 5½ in)
Max height	1.25 m (4 ft 1 in)
Volume	3.00 m³ (106.0 cu ft)
Baggage compartment volume	0.74 m³ (26.0 cu ft)

AREAS

Wings, gross	17.08 m² (183.8 sq ft)

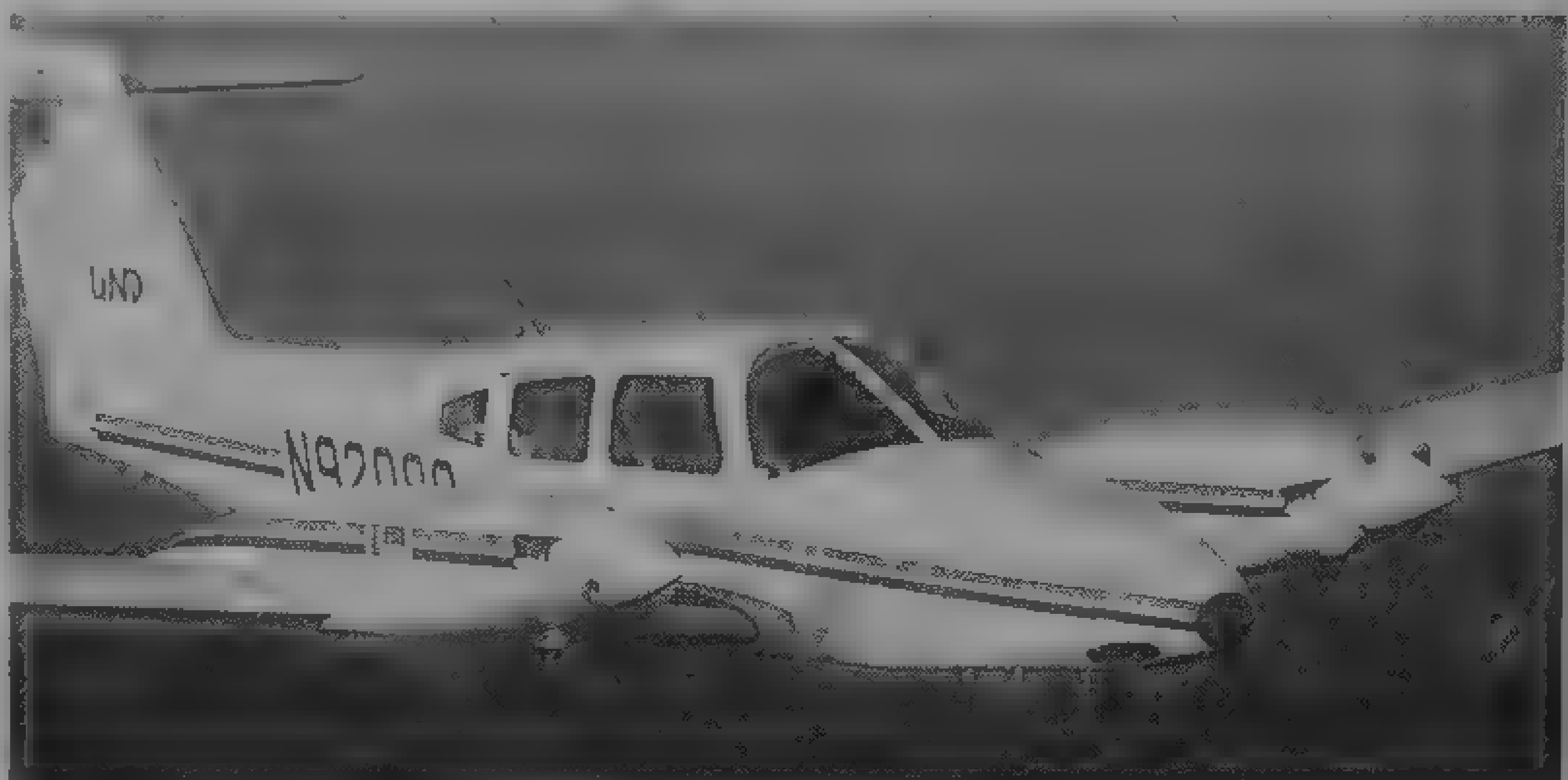
WEIGHTS AND LOADINGS

Weight empty, equipped	1,176 kg (2,593 lb)
Max T-O weight	1,723 kg (3,800 lb)
Max wing loading	100.94 kg/m² (20.67 lb/sq ft)
Max power loading	6.42 kg/kW (10.55 lb/hp)

PERFORMANCE

Max level speed	202 kts (374 km/h, 232 mph)
Cruising speed	
75% power	162 kts (300 km/h, 186 mph)
65% power	157 kts (291 km/h, 181 mph)
Stalling speed	
flaps up	57 kts (106 km/h; 66 mph) IAS
flaps down	55 kts (102 km/h, 63 mph) IAS
Max rate of climb at S/L	408 m (1,340 ft)/min
Rate of climb at S/L, OEI	65 m (212 ft)/min
Service ceiling	4,575 m (15,000 ft)
Service ceiling, OEI	1,155 m (3,800 ft)
T-O run to 15 m (50 ft)	464 m (1,520 ft)
Landing from 15 m (50 ft)	378 m (1,238 ft)
Cruising range	751 n miles (1,390 km, 864 miles)

NEW ENTRY



Piper PA-44-180 Seminole

1995

PIPER PA-46-350P MALIBU MIRAGE

TYPE: Six-seat light business transport

PROGRAMME: Announced November 1982. FAA certification of original PA-46-310P Malibu received September 1988, production deliveries began November 1983; 402 built before replaced by PA-46-350P Malibu Mirage October 1988, combined deliveries in excess of 550 by early 1995

CUSTOMERS: 28 delivered in 1994

COSTS: Standard, equipped $679,900 (1995)

DESIGN FEATURES: Textron Lycoming TIO-540-AE2A introduced on Malibu Mirage, other changes include dual 70 A 28 V alternators, split bus electrical system, redesigned flight deck, additional options include computerised fuel management system and pilot's electrically heated windscreen. Wing dihedral 4° 30'. Improvements introduced on 1995 model include pilot's heated glass windscreen, inflatable lumbar support on pilot/co-pilot's seats, colour co-ordinated control wheels and restyled interior trim, cabinetry and seats.

FLYING CONTROLS: Conventional ailerons, horn balanced elevators and rudder, trim tab in elevator, electrically operated trailing-edge flaps

STRUCTURE: Cantilever high aspect ratio all metal wings, light alloy fuselage, fail-safe construction in pressurised area, light alloy tail surfaces

LANDING GEAR: Hydraulically retractable tricycle type with single wheel on each unit, main units retract inward into wingroots, nosewheel rearward, rotating 90° to lie flat under baggage compartment

POWER PLANT: One 261 kW (350 hp) Textron Lycoming TIO-540-AE2A turbocharged and intercooled flat-six engine, driving a Hartzell two-blade constant-speed propeller. Fuel system capacity 462 litres (122 US gallons; 101.6 Imp gallons), of which 454 litres (120 US gallons; 100 Imp gallons) are usable. Oil capacity 11.5 litres (3 US gallons, 2.5 Imp gallons)

ACCOMMODATION: Pilot and five passengers in pressurised, heated and ventilated cabin, unpressurised baggage compartment in nose, and pressurised space at rear of cabin, each with capacity of 45 kg (100 lb)

SYSTEMS: Pressurisation maximum differential 0.38 bar (5.5 lb/sq in), to provide a cabin altitude of 2,400 m (7,900 ft) to a height of 7,620 m (25,000 ft). Hydraulic system pressure 107 bars (1,550 lb/sq in). Dual engine driven vacuum pumps standard. Standard electrical system has two 70 A/28 V alternators, 24 V 10 Ah battery; full icing protection optional

Piper PA-46-350P Malibu Mirage pressurised, single piston-engined aircraft *1994*

AVIONICS: Standard Bendix/King IFR avionics package

DIMENSIONS, EXTERNAL

Wing span	13.11 m (43 ft 0 in)
Wing aspect ratio	10.57
Length overall	8.72 m (28 ft 7¼ in)
Height overall	3.51 m (11 ft 6 in)
Tailplane span	4.42 m (14 ft 6 in)
Wheel track	3.75 m (12 ft 3½ in)
Wheelbase	2.44 m (8 ft 0 in)
Propeller diameter	2.03 m (6 ft 8 in)
Passenger door (port, rear):	
Height	1.17 m (3 ft 10 in)
Width	0.61 m (2 ft 0 in)
Baggage door (port, nose):	
Height	0.58 m (1 ft 11 in)
Width	0.48 m (1 ft 7 in)

DIMENSIONS, INTERNAL

Cabin: Length, instrument panel to rear pressure bulkhead	3.76 m (12 ft 4 in)
Max width	1.26 m (4 ft 1½ in)
Max height	1.19 m (3 ft 11 in)
Baggage compartment volume:	
nose	0.37 m³ (13.0 cu ft)
rear cabin	0.57 m³ (20.0 cu ft)

AREAS

Wings, gross	16.26 m² (175.0 sq ft)

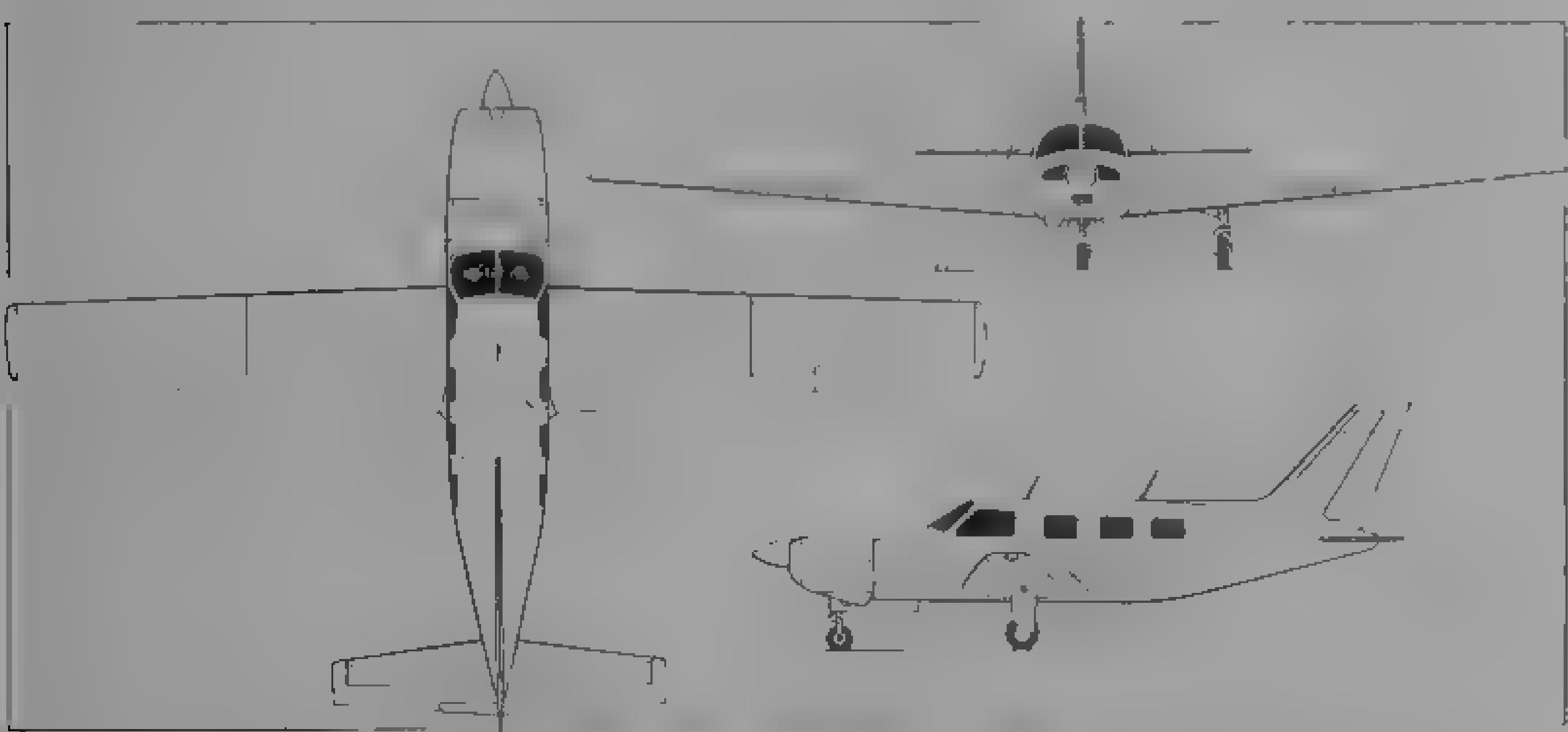
WEIGHTS AND LOADINGS

Weight empty, standard	1,382 kg (3,048 lb)
Useful load	576 kg (1,270 lb)
Max T-O weight	1,950 kg (4,300 lb)
Max ramp weight	1,958 kg (4,318 lb)
Max zero-fuel weight	1,860 kg (4,100 lb)
Max landing weight	1,860 kg (4,100 lb)
Max wing loading	119.9 kg/m² (24.6 lb/sq ft)
Max power loading	7.47 kg/kW (12.3 lb/hp)

PERFORMANCE

Max level speed at mid-cruise weight	232 kts (430 km/h, 267 mph)
Cruising speed at optimum altitude, mid-cruise weight:	
high-speed cruise power	225 kts (417 km/h, 259 mph)
normal cruise power	215 kts (398 km/h, 247 mph)
econ cruise power	199 kts (369 km/h, 229 mph)
long-range cruise power	168 kts (311 km/h, 193 mph)
Stalling speed:	
flaps and wheels up	71 kts (132 km/h, 82 mph)
flaps and wheels down	60 kts (111 km/h, 69 mph)
Max rate of climb at S/L	371 m (1,218 ft)/min
Max certificated ceiling	7,620 m (25,000 ft)
T-O run	467 m (1,530 ft)
T-O to 15 m (50 ft)	724 m (2,375 ft)
Landing from 15 m (50 ft)	599 m (1,964 ft)
Landing run	311 m (1,018 ft)
Range with max fuel, allowances for start, T-O, climb and descent, plus 45 min reserves, at optimum altitude:	
high-speed cruise power	990 n miles (1,833 km, 1,139 miles)
normal cruise power	1,056 n miles (1,956 km; 1,215 miles)
econ cruise power	1,184 n miles (2,193 km, 1,362 miles)
long-range cruise power	1,450 n miles (2,685 km, 1,668 miles)

UPDATED



Piper PA-46-350P Malibu Mirage (Textron Lycoming TIO-540-AE2A) *(Jane's/Dennis Punnett)* *1990*

OTHER AIRCRAFT

Piper delivered final batch of 24 **PA-18-150 Super Cubs** during 1994, and has announced that no further production will take place. See 1990-91 and earlier editions of *Jane's* for a full description. No examples of the **PA-42-720 Cheyenne IIIA** and **PA-42-1000 Cheyenne 400** twin-turboprop business aircraft have been manufactured for several years, and none is planned for 1995. Descriptions of both aircraft in 1994-95 and earlier editions of *Jane's*.

NEW ENTRY

QUESTAIR

QUESTAIR INC

7700 Airline Road, PO Box 18946, Greensboro, North Carolina 27419
Telephone: 1 (919) 668 7890 or (800) 852 3889
Fax: 1 (919) 668 7960
CEO: Mark Chambers
DIRECTOR, SALES AND MARKETING: Charles S. Haupt

UPDATED

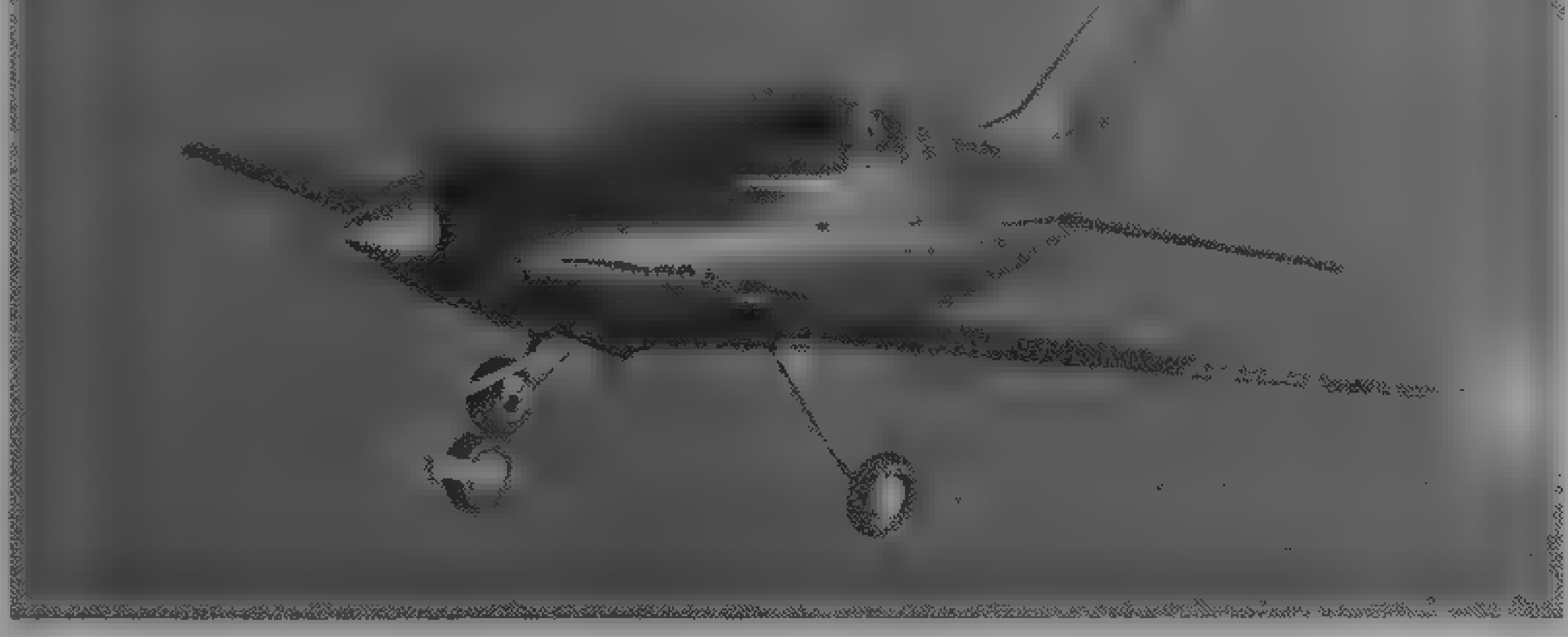
QUESTAIR SPIRIT

TYPE: Side by side two-seat or 2+1 three-seat sporting and cross-country homebuilt

PROGRAMME: Construction of prototype began in 1990; first flight February 1991. Claimed as "fastest fixed-gear aircraft in the world" in Spring 1994 after flight by prototype at TAS of 230 knots (426 km/h; 264 mph) at 7,620 m (25,000 ft). Kits are available, with engine included at customer's request

COSTS: Kit: $29,900 (1995).

DESIGN FEATURES: Non-retractable landing gear derivative of Venture, powered by Teledyne Continental IO-360 engine but with Textron Lycoming O-360 as optional power plant.



Questair Spirit two/three-seat sporting and cross-country monoplane *1993*

LANDING GEAR: Non-retractable tricycle type
POWER PLANT: One 156.6 kW (210 hp) Teledyne Continental IO-360-ES flat-six engine, driving a McCauley three-blade propeller. Alternatively 134 kW (180 hp) Textron Lycoming O-360. Fuel capacity 212 litres (56 US gallons; 46.6 Imp gallons)

DIMENSIONS, EXTERNAL:

Wing span	8.38 m (27 ft 6 in)
Wing aspect ratio	10.43
Length overall	4.95 m (16 ft 3 in)
Height overall	2.34 m (7 ft 8 in)
Propeller diameter	1.73 m (5 ft 8 in)

AREAS:

Wings, gross	6.74 m² (72.50 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	465 kg (1,025 lb)
Max T-O weight	771 kg (1,700 lb)
Max wing loading	114.5 kg/m² (23.45 lb/sq ft)
Max power loading	4.92 kg/kW (8.10 lb/hp)

PERFORMANCE:

Max level speed at 2,135 m (7,000 ft)	195 kts (361 km/h, 225 mph)
Max cruising speed at 2,135 m (7,000 ft)	185-195 kts (343-361 km/h, 213-225 mph)
Stalling speed	56 kts (104 km/h, 65 mph)
Max rate of climb at S/L	457-610 m (1,500-2,000 ft)/min
Range, with reserves	1,030 n miles (1,907 km, 1,185 miles)
Endurance	6 h 10 min
g limits	+6/-3

UPDATED

RAISBECK

RAISBECK ENGINEERING INC

Enhancements marketed by Raisbeck for a number of general aviation aircraft are described in *Jane's Aircraft Upgrades*

UPDATED

RAM

RAM AIRCRAFT CORPORATION

Specialist modifications to Beech, Cessna and Piper aircraft provided by RAM are now described in *Jane's Aircraft Upgrades*

UPDATED

RANS

RANS INC

4600 Highway 183 Alternate, Hays, Kansas 67601
Telephone: 1 (913) 625 6346
Fax: 1 (913) 625 2795
PRESIDENT: Randy J Schlitter

Details of S-4 Coyote, S-6 Coyote II, S-9 Chaos, S-10 Sakota, S-11 Pursuit, S-12 Airaile and S-14 Airaile can be found in 1992-93 *Jane's*

VERIFIED

RANS S-7 COURIER

TYPE: Two-seat STOL homebuilt
PROGRAMME: Offering standard kits (300 to 500 working hours to assemble) or a quick-build kit (150 working hours approximately). Prototype first flew October 1985. Estimated building time from kit is 500 to 700 working hours. Type certification by FAA April 1995
CUSTOMERS: 147 built by 1995
COSTS: Kit: $12,600; production aircraft, $24,000
DESIGN FEATURES: Follows general configuration of Coyote (see 1992-93 *Jane's*), fitted with dual controls and suited to training, recreational flying, agricultural spraying and similar duties. Wings fold rearwards for stowage
FLYING CONTROLS: Conventional control, with four-position flaps
STRUCTURE: Fabric covered, with aluminium alloy wings, and welded 4130 steel fuselage and tail unit. Glassfibre engine cowling
LANDING GEAR: Non-retractable tailwheel type. Optional floats and skis
POWER PLANT: One 48.5 kW (65 hp) Rotax 582, with 2.58:1 reduction gear. Optional 67 kW (90 hp) AMW 636 or 58.2 kW (78 hp) Rotax 912. Fuel capacity 56.8 litres (15 US gallons; 12.5 Imp gallons) in two wing tanks

DIMENSIONS, EXTERNAL:

Wing span	8.92 m (29 ft 3 in)
Wing aspect ratio	5.67
Length overall	6.40 m (21 ft 0 in)
Height overall	1.91 m (6 ft 3 in)
Propeller diameter	1.73 m (5 ft 8 in)

AREAS:

Wings, gross	14.03 m² (151.0 sq ft)

WEIGHTS AND LOADINGS:

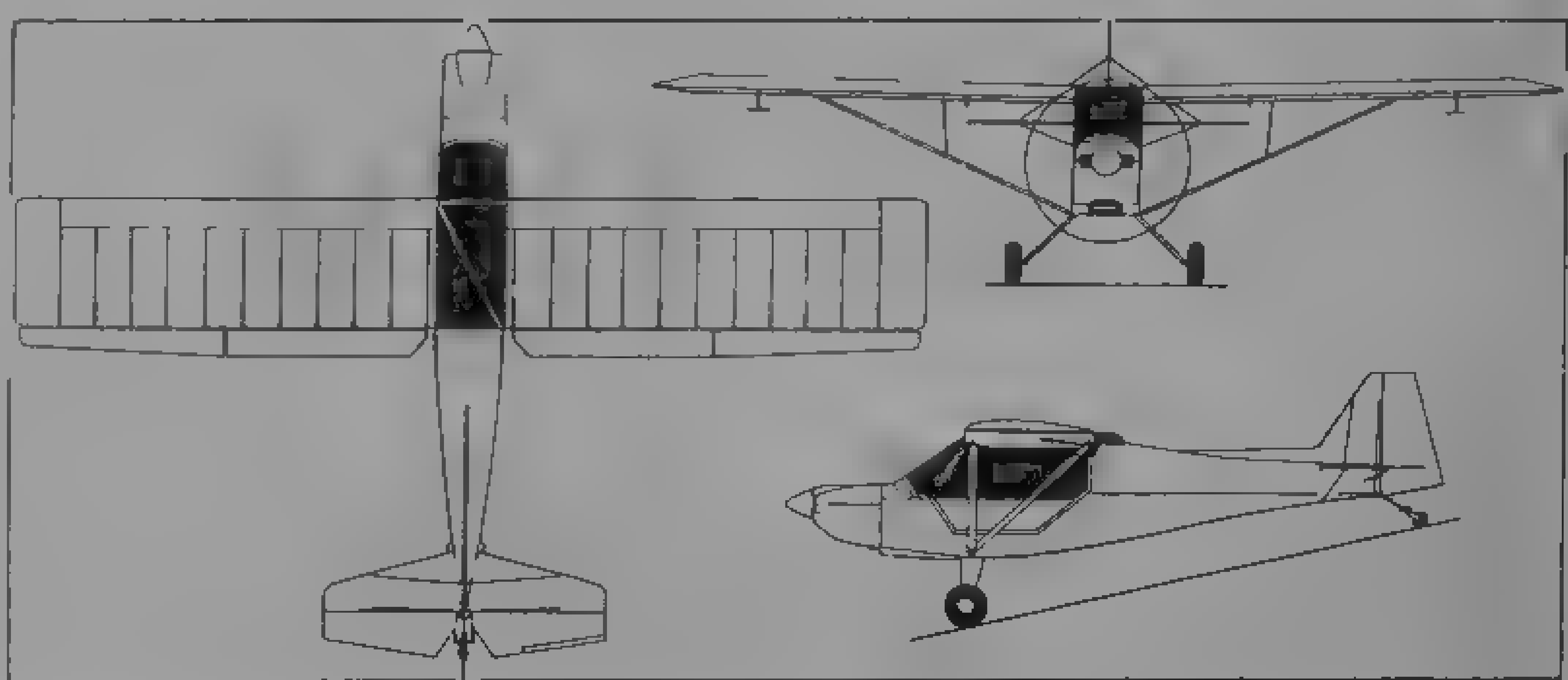
Weight empty, equipped (approx): Rotax 582	236 kg (520 lb)
Rotax 912	272 kg (600 lb)
Max T-O weight: Rotax 582	465 kg (1,025 lb)
Rotax 912	544 kg (1,200 lb)
Max wing loading	38.80 kg/m² (7.95 lb/sq ft)
Max power loading: Rotax 582	11.24 kg/kW (18.46 lb/hp)
Rotax 912	9.36 kg/kW (15.38 lb/hp)

PERFORMANCE (two persons, at 420 kg, 925 lb):

Never-exceed speed (VNE)	104 kts (193 km/h, 120 mph)
Cruising speed: Rotax 582	69 kts (129 km/h; 80 mph)
Rotax 912	91 kts (169 km/h, 105 mph)
Stalling speed, power off: flaps up	31 kts (57 km/h, 35 mph)
flaps down	26 kts (49 km/h; 30 mph)
Max rate of climb at S/L: Rotax 582	229 m (750 ft)/min
Rotax 912	366 m (1,200 ft)/min
Service ceiling: Rotax 582	4,115 m (13,500 ft)
Rotax 912	5,180 m (17,000 ft)

Rans S-7 Courier kit-built aircraft

1995



Rans S-7 Courier (Rotax or AMW engine)

1995

T-O run	54 m (175 ft)
Landing run to safe turn speed	93 m (303 ft)
Range	434 n miles (804 km; 500 miles)
Endurance: Rotax 582	2 h 30 min
Rotax 912	3 h 50 min
g limits	+6/–3

UPDATED

RANS S-15 PURSUIT II

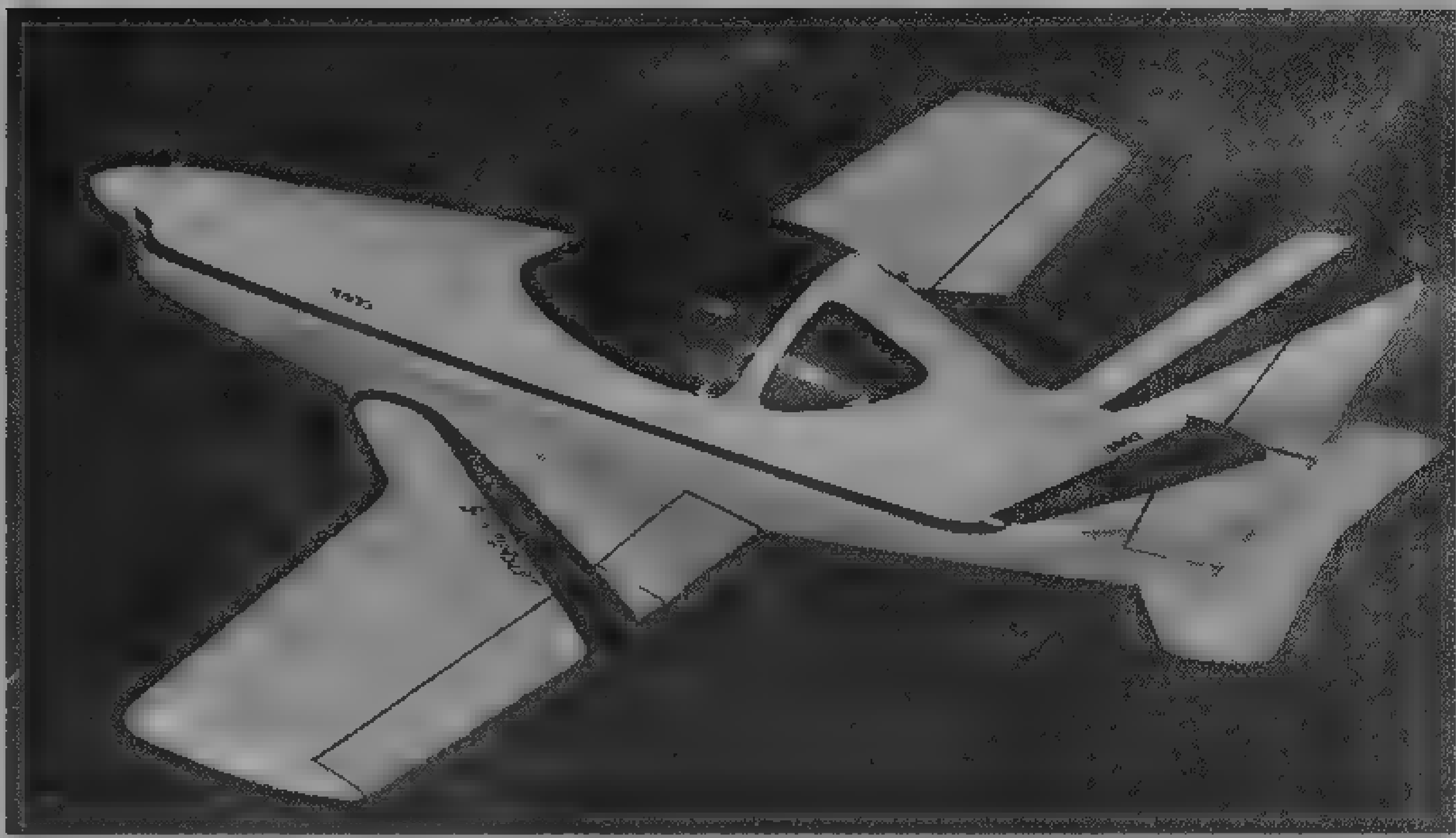
TYPE: Four-seat kit built.
PROGRAMME: Prototype under construction in 1995.
DESIGN FEATURES: Composites construction; retractable tricycle landing gear; twin tailfins.
POWER PLANT: One 59.7 kW (80 hp) Rotax 912 or 145.5 kW (195 hp) Textron Lycoming IO-360 piston engine.
DIMENSIONS, EXTERNAL:

Wing span	6.76 m (22 ft 2 in)
Length overall	5.49 m (18 ft 0 in)
Height overall	1.76 m (5 ft 9¼ in)

NEW ENTRY

RANS S-16

TYPE: Two-seat kit-built.
PROGRAMME: First flight and initial deliveries due 1995.
CUSTOMERS: Deposits received in 1995 for some of initial batch of 50 aircraft.
COSTS: $23,000 per kit, including Rotax engine (1995).
DESIGN FEATURES: Composites construction; conventional configuration low-wing monoplane.



Model of Rans S-15 Pursuit II *1995*

POWER PLANT: One 59.7 kW (80 hp) Rotax 912 piston engine, alternative power plants under consideration.

NEW ENTRY

RAYTHEON

RAYTHEON AIRCRAFT COMPANY (Subsidiary of Raytheon Company)

9709 East Central, Wichita, Kansas 67201-0085
Telephone: 1 (316) 676 7111
Fax: 1 (316) 676 8286
BRANCH DIVISIONS: Salina, Kansas, and Little Rock, Arkansas
PRESIDENT: Roy H. Norris III
CHAIRMAN AND CEO: Arthur E. Wegner
SENIOR VICE-PRESIDENT, GOVERNMENT AND COMMERCIAL MARKETING: Renso L. Caporali
VICE-PRESIDENT, AEROSPACE: Dr William A. Edgington
VICE-PRESIDENT, ENGINEERING: Steve Hanney
VICE-PRESIDENT, MANUFACTURING: John Booth
VICE-PRESIDENT, MARKETING: Doug Mahin
VICE-PRESIDENT, CUSTOMER SUPPORT: A. John Diebold
VICE-PRESIDENT, JPATS: David Riemer
VICE-PRESIDENT, DOMESTIC BUSINESS JET SALES: Karl Childs
VICE-PRESIDENT, DOMESTIC BEECH SALES: Keith Nadolski
VICE-PRESIDENT, INTERNATIONAL SALES: Jim Link
VICE-PRESIDENT, PROGRAM MANAGEMENT: Robert Brill
VICE-PRESIDENT, QUALITY ASSURANCE: Bill Wise
DIRECTOR, AIRLINE MARKETING: Mike Scheldt
DIRECTOR, CORPORATE AFFAIRS: James M. Gregory
MANAGER, PUBLIC RELATIONS: Pat Zerbe

Raytheon Aircraft Company (RAC) formed 15 September 1994, combining Raytheon Company subsidiaries Beech Aircraft Corporation and Raytheon Corporate Jets Inc. Beech Aircraft Corporation founded 1932 by Walter and Olive Ann Beech, became wholly owned subsidiary of Raytheon 8 February 1980. Raytheon acquired British Aerospace's Corporate Jets division 6 August 1993, founded Raytheon Corporate Jets, headquartered in Little Rock, Arkansas, with responsibility for design, development, production, marketing and support of Hawker family of corporate jets. RAC builds civil and military aircraft, missile targets, and components for aircraft and missiles; Salina division supplies all wings, nonmetallic interior components, ventral fins, nosecones and tailcones used in Wichita piston-engined and turboprop Beechcraft production and builds major subassemblies for the Beechjet. Additional Wichita products include subcontracted composites and metal winglets and composite landing gear doors for McDonnell Douglas C-17.

Second prototype Beech Mk II, as selected for JPATS programme *1995*

Completion work on British Aerospace Airbus manufactured Hawker 800 and 1000 business jets performed by Little Rock division but being transferred to Wichita, final assembly of these models also due to be transferred from UK to new 17,190 m² (185,000 sq ft) plant at Wichita beginning last quarter of 1995 and finalised by 1997, Little Rock will continue to provide custom interiors, avionics, sales and customer support services for Hawker models, aircraft painting services for Hawkers and Beechcraft 1900Ds and Beechjets, and refurbishment and depot service work on military aircraft formerly performed by Beech Aerospace Services Inc in Selma, Alabama. Beechcraft and Hawker product names are retained.

Wholly owned subsidiaries include Beech Aerospace Services Inc (BASI) of Madison, Mississippi (worldwide logistic support for US Army/Air Force/Navy C-12s, Army U-21s and Beech MQM-107 targets, and of US Navy T-34C and T-44 trainers in the USA); Beech Acceptance Corporation Inc (business aircraft retail financing and leasing), Travel Air Insurance Company Ltd, Bermuda (aircraft liability insurance), and United Beechcraft Inc (marketing support to parent company).

In early 1995 RAC had 10,645 employees worldwide and occupied 380,902 m² (4,100,000 sq ft) of plant area at its two major facilities in Wichita, production rate adjustments and consolidation of facilities, announced in late 1994, resulted in personnel reduction of 940 at RAC divisions in the UK and USA during 1995.

Total production by RAC exceeded 51,000 at start of 1995. Deliveries during 1994 totalled 361, valued at $1.72 billion, comprising 103 Bonanzas, 31 Barons, 35 King Airs, 59 Super King Airs (including RC-12s), 50 1900Ds, three Starships, 22 Beechjet 400As, 37 Jayhawks, 16 Hawker 800s and five Hawker 1000s.

UPDATED

BEECHCRAFT FIVE-YEAR PRODUCTION DELIVERIES

Type	1990	1991	1992	1993	1994	5-yr total
Bonanza	207	205	172	120	103	807
Baron	33	36	28	34	31	162
Beech 1300	4	-	-	—		4
King Air/Super King Air	121	83	98[1]	100[2]	94[5]	496
Beech 1900	48	34	34	45	50	211
Starship	11	2	7	2[3]	3	25
Beechjet (civil)	8[4]	29	31	18	22	108
Jayhawk	—	—	28	33	37	98
Annual total	**432**	**389**	**398**	**352**	**340**	**1 911**

Notes [1]Includes 12 RC-12N/P
[2]Includes five RC-12P
[3]Six others leased to customers
[4]Includes first four 400As
[5]Includes 4 RC-12N

HAWKER

Hawker 800 and 1000 business jets built in UK: refer to Raytheon entry in UK section.

NEW ENTRY

BEECH

Beech name continues to be used to market aircraft detailed below.

NEW ENTRY

BEECH Mk II

TYPE: Primary trainer (modified Pilatus PC-9).
PROGRAMME: For participation in USAF/USN Joint Primary Aircraft Training System competition (see USAF entry, this section), Beech received two standard PC-9s from Pilatus, one of which (N26BA) converted as engineering

development prototype and completed more than 260 hours' flight testing to reduce programme risk and develop engineering design baseline Followed by two Beech built production prototypes (Beech designation PD373), first flights December 1992 (N8284M) and July 1993 (N209BA). PT 2 used to complete flight test programme and evaluate systems performance, PT-3 incorporated several improvements and was principal aircraft for USAF/USN flight evaluation, three aircraft had completed 500 hours of flight testing by February 1995

Main changes from standard PC-9 are upgraded engine, pressurised cockpit, zero/zero seats, birdproof canopy, single-point refuelling and Bendix/King customised avionics, further details under Pilatus entry in Swiss section Selection as JPATS winner announced 22 June 1995, subject to Defense Acquisition Board approval in August, initial contract expected for 141 aircraft, first flight in December 1998, IOC with USAF 1999, IOC with USN 2002

UPDATED

Beechcraft F33 Bonanza four/five-seat executive aircraft of Ivory Coast Air Force; aerobatic F33C version recently discontinued *(SIRPA-Air)*

1995

BEECHCRAFT BONANZA F33A

TYPE: Four/five-seat single-engined executive and training aircraft.

PROGRAMME: First flight 14 September 1959, known as Debonair until 1967, 1985 model introduced cargo door, three-blade propeller, super soundproofing and full IFR avionics F33C aerobatic version (see 1994-95 *Jane's*) discontinued for 1995

CURRENT VERSIONS: **F33A**: Similar to V35B Bonanza (1984-85 *Jane's*), but with conventional vertical fin and tailplane. Certificated in Utility category

CUSTOMERS: F33A special order trainers include Lufthansa (three), Singapore International Airlines (four) and Airline Training Centre Total 3,338 Bonanza 33s built by early 1995, including 50 in 1993 and 17 in 1994

DESIGN FEATURES: Beech modified NACA 23016.5 wing section at root, modified 23012 at tip; dihedral 6°, incidence 4° at root and 1° at tip

FLYING CONTROLS: Mechanical, electrically actuated trim tab in each elevator; ground adjustable tabs in ailerons and rudder, single-slotted, three-position light alloy flaps

STRUCTURE: Conventional light alloy, with two-spar wing torsion box and stressed-skin tail surfaces

LANDING GEAR: Electrically retractable tricycle type, with steerable nosewheel. Mainwheels retract inward into wings, nosewheel rearward Beech oleo-pneumatic shock absorbers in all units. Cleveland mainwheels, size 6.00-6, and tyres, size 7.00-6, pressure 2.28 to 2.76 bars (33 to 40 lb/sq in) Cleveland nosewheel and tyre, size 5.00-5, pressure 2.76 bars (40 lb/sq in) Cleveland ring disc hydraulic brakes. Parking brake. Magic Hand landing gear system optional

POWER PLANT: One 212.5 kW (285 hp) Teledyne Continental IO-520-BB flat-six engine, driving a McCauley three-blade constant-speed metal propeller. Manually adjustable engine cowl flaps Two standard fuel tanks in wing leading-edges, with total usable capacity of 280 litres (74 US gallons; 61.6 Imp gallons) Refuelling points above tanks. Oil capacity 11.5 litres (3 US gallons, 2.5 Imp gallons)

ACCOMMODATION: Enclosed cabin with four individual seats in pairs as standard, plus optional forward-facing fifth seat Baggage compartment and hatshelf aft of seats. Passenger door and baggage compartment door on starboard side Heater standard Large cargo door, on starboard side of fuselage

SYSTEMS: Optional 12,000 BTU refrigeration type air conditioning system comprises evaporator located beneath pilot's seat, condenser on lower fuselage, and engine-mounted compressor. Air outlets on centre console, with two-speed blower Electrical system supplied by 28 V 60 A alternator, 24 V 15.5 Ah battery, a 100 A alternator is available as an option, as is a standby generator Hydraulic system for brakes only Pneumatic system for instrument gyros and refrigeration type air conditioning system optional Oxygen system and electric propeller de-icing optional

AVIONICS: *Comms* Bendix/King KX 155 760-channel com transceiver, KT 70 Mode S transponder; microphone, headset and cabin speaker

Flight Bendix/King KX 155 200-channel nav/glide slope receiver/converter with KI 209 VOR/ILS indicator, KI 208 VOR/LOC indicator, KR 87 ADF with 227 00 indicator, KN 63 DME with KDI 572 indicator. DME hold and nav 1/nav 2 switching, KEA 130A encoding altimeter, KMA 24 03 audio control/marker beacon receiver Bendix/King KLN 88 Loran C and BFGoodrich WX-1000 Stormscope optional. Bendix/King KFC 150 autopilot and yaw damper optional

A wide range of optional avionics is available, including Bendix/King KFC 150 autopilot, yaw damper, KLN 88 Loran C and Foster WX-1000 Stormscope

EQUIPMENT: Standard equipment includes LCD digital chronometer, EGT and OAT gauges, rate of climb indicator, turn co-ordinator, 3 in horizon and directional gyros, four fore and aft adjustable and reclining seats, armrests, headrests, single diagonal strap shoulder harness with inertia reel for all occupants, pilot's storm window, sun visors, ultraviolet-proof windscreen and windows, large cargo door, emergency locator transmitter, stall warning device, alternate static source, heated pitot, rotating beacon, three light strobe system, carpeted floor, super soundproofing, control wheel map lights, electroluminescent subpanel lighting, landing light, taxi light, full flow oil filter, three-colour polyurethane exterior paint, external power socket, static wicks and towbar

Optional equipment includes dual controls, co-pilot's wheel brakes, air conditioning, fifth seat, fresh air vent blower and ground com switch

DIMENSIONS, EXTERNAL

Wing span	10.21 m (33 ft 6 in)
Wing chord: at root	2.13 m (7 ft 0 in)
at tip	1.07 m (3 ft 6 in)
Wing aspect ratio	6.20
Length overall	8.13 m (26 ft 8 in)
Height overall	2.51 m (8 ft 3 in)
Tailplane span	3.71 m (12 ft 2 in)
Wheel track	2.92 m (9 ft 7 in)
Wheelbase	2.13 m (7 ft 0 in)
Propeller diameter	2.13 m (7 ft 0 in)
Passenger door: Height	0.91 m (3 ft 0 in)
Width	0.94 m (3 ft 1 in)
Baggage compartment door:	
Height	0.61 m (2 ft 0 in)
Width	0.99 m (3 ft 3 in)

DIMENSIONS, INTERNAL

Cabin, aft of firewall: Length	3.07 m (10 ft 1 in)
Max width	1.07 m (3 ft 6 in)
Max height	1.27 m (4 ft 2 in)
Volume	3.31 m³ (117.0 cu ft)
Baggage space	0.99 m³ (35.0 cu ft)

AREAS

Wings, gross	16.80 m² (181.0 sq ft)
Ailerons (total)	1.06 m² (11.4 sq ft)
Trailing-edge flaps (total)	1.98 m² (21.3 sq ft)
Fin	0.93 m² (10.0 sq ft)
Rudder, incl tab	0.52 m² (5.6 sq ft)
Tailplane	1.75 m² (18.82 sq ft)
Elevators, incl tabs	1.67 m² (18.0 sq ft)

WEIGHTS AND LOADINGS

Weight empty	1,017 kg (2,242 lb)
Max T-O and landing weight	1,542 kg (3,400 lb)
Max ramp weight	1,548 kg (3,412 lb)
Max wing loading	91.8 kg/m² (18.8 lb/sq ft)
Max power loading	7.26 kg/kW (11.93 lb/hp)

PERFORMANCE (at max T-O weight, ISA, except cruising speeds at mid-cruise weight):

Max level speed at S/L	182 kts (338 km/h, 209 mph)
Cruising speed: 75% power at 1,830 m (6,000 ft)	172 kts (319 km/h, 198 mph)
65% power at 3,050 m (10,000 ft)	160 kts (297 km/h, 184 mph)
55% power at 3,660 m (12,000 ft)	145 kts (269 km/h, 167 mph)
45% power at 2,440 m (8,000 ft)	136 kts (253 km/h, 157 mph)
Stalling speed, power off:	
flaps up	64 kts (118 km/h, 74 mph) IAS
30° flap	51 kts (94 km/h, 59 mph) IAS
Max rate of climb at S/L	353 m (1,157 ft)/min
Service ceiling	5,440 m (17,850 ft)
T-O run	305 m (1,000 ft)
T-O to 15 m (50 ft)	530 m (1,740 ft)
Landing from 15 m (50 ft)	396 m (1,300 ft)
Landing run	232 m (760 ft)
Range with max usable fuel, allowances for engine start, taxi, T-O, climb and 45 min reserves at 45% power:	
75% power at 1,830 m (6,000 ft)	715 n miles (1,325 km, 823 miles)
65% power at 3,050 m (10,000 ft)	810 n miles (1,501 km, 932 miles)
55% power at 3,660 m (12,000 ft)	860 n miles (1,593 km, 990 miles)
45% power at 2,440 m (8,000 ft)	889 n miles (1,648 km, 1,023 miles)

UPDATED

BEECHCRAFT BONANZA A36

TYPE: Four/six-seat, single-engined business and utility aircraft

PROGRAMME: Developed from Bonanza V35B, but with vertical fin, current A36 introduced 3 October 1983, succeeding model powered by 212.5 kW (285 hp) Continental IO-520-BB, certificated in FAA Utility category

CURRENT VERSIONS: **Bonanza A36**: Standard version, *as described in detail*

Bonanza A36AT (Airline Trainer): Certificated 1991 for use in Europe, modifications to propeller, engine and exhaust systems to reduce external noise; flyover sound level 71.8 dBA; Teledyne Continental IO-550-B, limited to 216 kW (290 hp) at 2,550 rpm, driving Hartzell three-blade constant-speed propeller; special exhaust silencers, additional engine cooling louvres, four seats

CUSTOMERS: Include Saudi Arabian Airlines (four in April 1985 for pilot training, Finnair Training Centre at Pori, Finland (three), in 1987, Japan Air Lines (five) in 1990, Lufthansa (12 A36ATs, to replace F33As) in 1991, Japan Air Lines (23); RLS Netherlands (eight A36ATs) in 1991, and All Nippon Airways (20, delivered 1992-94). Total 3,337 Bonanza 36s delivered by early 1995, including 60 in 1993 and 72 in 1994

DESIGN FEATURES: Structure as for F33A, but fuselage 0.25 m (10 in) longer; cabin volume increased by 0.54 m³ (18.9 cu ft); baggage volume increased by 0.28 m³ (10 cu ft); large double freight doors starboard side aft of wing, current model has improved instrument panel controls, lighting and systems; options same as for F33A, plus instrument post lights or internal instrument lighting, courtesy lights for entrance and step; co-pilot's vertically adjusting seat, refrigeration-type air conditioning

FLYING CONTROLS: As for F33A Dual controls standard

STRUCTURE: As for F33A, with addition of two vortex generators on wings

LANDING GEAR: As for F33A, new landing gear warning system introduced in 1989

POWER PLANT: One 224 kW (300 hp) Teledyne Continental IO-550-B flat-six engine, driving a McCauley three-blade constant speed propeller (Lufthansa aircraft derated to 212.5 kW; 285 hp and have smaller propeller). The engine is equipped with an altitude-compensating fuel pump which automatically makes the fuel/air mixture leaner and richer during climb and descent respectively Fuel capacity as for F33A

ACCOMMODATION: Enclosed cabin seating four to six persons on individual seats. Pilot's seat is vertically adjustable. Dual controls standard Two rear removable seats and two folding seats permit rapid conversion to utility configuration. Optional club seating with rear-facing third and fourth seats, executive writing desk, refreshment cabinet, headrests for third and fourth seats, reading lights and fresh air outlets for fifth and sixth seats. Double doors of bonded aluminium honeycomb construction on starboard side facilitate loading of cargo. As an air ambulance, one stretcher can be accommodated with ample room for a medical attendant and/or other passengers Extra windows provide improved view for passengers. Stowage for 181 kg (400 lb) of baggage.

SYSTEMS: Electrical system as for F33A Hydraulic system for brakes only Pneumatic system for instrument gyros, and refrigeration type air conditioning system, optional

AVIONICS: Standard equipment generally as for F33A, but wide range of optional avionics available. Optional ground communication switch permitting use of one com radio without turning on battery master switch

EQUIPMENT: Optional equipment as detailed for F33A Bonanza

DIMENSIONS, EXTERNAL: As for F33A except

Length overall	8.38 m (27 ft 6 in)
Height overall	2.62 m (8 ft 7 in)
Wheelbase	2.39 m (7 ft 10½ in)

Beechcraft A36 Bonanza four/six-seat cabin monoplane

1995

Propeller diameter: A36 — 2.03 m (6 ft 8 in)
A36AT — 1.93 m (6 ft 4 in)
Rear passenger/cargo door: Height — 0.89 m (2 ft 11 in)
Width — 1.14 m (3 ft 9 in)

DIMENSIONS, INTERNAL:
Cabin, aft of firewall:
Length, incl extended baggage compartment — 3.84 m (12 ft 7 in)
Max width — 1.07 m (3 ft 6 in)
Max height — 1.27 m (4 ft 2 in)
Volume — 3.85 m³ (135.9 cu ft)

AREAS: As for F33A

WEIGHTS AND LOADINGS:
Weight empty, standard:
A36, A36AT — 1,041 kg (2,295 lb)
Max T-O weight: A36 — 1,655 kg (3,650 lb)
A36AT — 1,633 kg (3,600 lb)
Max ramp weight: A36 — 1,661 kg (3,663 lb)
A36AT — 1,639 kg (3,613 lb)
Max wing loading: A36 — 98.6 kg/m² (20.2 lb/sq ft)
A36AT — 97.16 kg/m² (19.9 lb/sq ft)
Max power loading: A36 — 7.40 kg/kW (12.17 lb/hp)
A36AT — 7.59 kg/kW (12.46 lb/hp)

PERFORMANCE (at max T-O weight, ISA, unless specified otherwise):
Max level speed (min weight) — 184 kts (340 km/h, 212 mph)
Max cruising speed (mid-cruise weight):
2,500 rpm at 1,830 m (6,000 ft) — 176 kts (326 km/h, 202 mph)
2,300 rpm at 2,440 m (8,000 ft) — 167 kts (309 km/h, 192 mph)
2,100 rpm at 1,830 m (6,000 ft) — 160 kts (296 km/h, 184 mph)
2,100 rpm at 3,050 m (10,000 ft) — 153 kts (283 km/h, 176 mph)
Stalling speed, power off:
flaps up — 68 kts (126 km/h; 78 mph) IAS
30° flap — 59 kts (109 km/h, 68 mph) IAS
Max rate of climb at S/L — 368 m (1,208 ft)/min
Service ceiling — 5,640 m (18,500 ft)
T-O run: flaps up: A36 — 360 m (1,182 ft)
A36AT — 450 m (1,476 ft)
12° flap: A36 — 296 m (971 ft)
A36AT — 402 m (1,316 ft)
T-O to 15 m (50 ft):
flaps up: A36 — 640 m (2,100 ft)
A36AT — 662 m (2,170 ft)
12° flap: A36 — 583 m (1,913 ft)
A36AT — 618 m (2,025 ft)
Landing from 15 m (50 ft) — 442 m (1,450 ft)
Landing run — 280 m (920 ft)
Range with max usable fuel, with allowances for engine start, taxi, T-O, climb and 45 min reserves at econ cruise power: 2,500 rpm at 3,660 m (12,000 ft) — 875 n miles (1,621 km, 1,008 miles)
2,300 rpm at 3,660 m (12,000 ft) — 903 n miles (1,672 km, 1,039 miles)
2,100 rpm at 1,830 m (6,000 ft) — 914 n miles (1,694 km; 1,052 miles)

UPDATED

BEECHCRAFT TURBO BONANZA B36TC

TYPE: Turbocharged version of A36 Bonanza

PROGRAMME: Certificated as A36TC 7 December 1978, 271 A36TCs delivered, improved B36TC introduced 1982

CUSTOMERS: Total of 555 delivered by early 1995, including 10 in 1993 and 14 in 1994

DESIGN FEATURES: Compared with A36TC, B36TC has greater span, wing section NACA 23010.5 at tip, 0° incidence at tip; greater fuel capacity

Data below summarise differences from A36TC

POWER PLANT: One 223.7 kW (300 hp) Teledyne Continental TSIO-520-UB turbocharged flat-six engine, driving a three-blade constant-speed metal propeller. Fixed engine cowl flaps. Two fuel tanks in each wing leading-edge, with total usable capacity of 386 litres (102 US gallons, 85 Imp gallons). Refuelling points above tanks. Oil capacity 11.5 litres (3 US gallons; 2.5 Imp gallons)

SYSTEMS: Air conditioning optional

AVIONICS: As for A36

EQUIPMENT: As for A36, except EGT gauge not available. Turbine inlet temperature gauge is standard

DIMENSIONS, EXTERNAL: As for A36, except:
Wing span — 11.53 m (37 ft 10 in)
Wing chord at tip — 0.91 m (3 ft 0 in)
Wing aspect ratio — 7.61
Propeller diameter — 1.98 m (6 ft 6 in)

DIMENSIONS, INTERNAL: As for A36

AREAS:
Wings, gross — 17.47 m² (188.1 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, standard — 1,104 kg (2,433 lb)
Max T-O and landing weight — 1,746 kg (3,850 lb)
Max ramp weight — 1,753 kg (3,866 lb)
Max wing loading — 100.1 kg/m² (20.5 lb/sq ft)
Max power loading — 7.81 kg/kW (12.8 lb/hp)

PERFORMANCE (at max T-O weight, ISA, except speeds are at mid-cruise weight):
Max level speed at 6,700 m (22,000 ft) — 213 kts (394 km/h, 245 mph)
Cruising speed at 7,620 m (25,000 ft):
79% power — 200 kts (370 km/h, 230 mph)
75% power — 195 kts (361 km/h, 224 mph)
69% power — 188 kts (348 km/h, 216 mph)
56% power — 173 kts (320 km/h, 199 mph)
Stalling speed, power off:
flaps up — 65 kts (120 km/h, 75 mph) IAS
30° flap — 57 kts (106 km/h, 66 mph) IAS
Max rate of climb at S/L — 321 m (1,053 ft)/min
Service ceiling — over 7,620 m (25,000 ft)
T-O run, 15° flap — 311 m (1,020 ft)
T-O to 15 m (50 ft), 15° flap — 649 m (2,130 ft)
Landing run — 298 m (976 ft)
Range at 7,620 m (25,000 ft) with max fuel, allowances for engine start, taxi, T-O, cruise climb, descent, and 45 min reserves at 50% power:
79% power — 956 n miles (1,770 km, 1,100 miles)
75% power — 984 n miles (1,822 km, 1,132 miles)
69% power — 1,022 n miles (1,893 km, 1,176 miles)
56% power at 6,100 m (20,000 ft) — 1,092 n miles (2,022 km, 1,256 miles)

UPDATED

BEECHCRAFT BARON 58

TYPE: Four/six seat, dual control, twin-engined business aircraft

PROGRAMME: Developed from Baron D55, certificated in FAA Normal category 19 November 1969

CUSTOMERS: Include All Nippon Airways (12 ordered 1992, six for delivery 1993 and six for 1994), Indonesian Civil Flying Academy, Java (four), Centre National de Formation Aviation Civile of M'Vengue, Gabon (three), US FAA staff pilot proficiency training programme (eight), Lufthansa pilot training (19), Air France (three), Japan Air Lines (three), Singapore Airlines (two), and Seneca College, Toronto, Canada (two), all for pilot training. 1992 deliveries totalled 28 (21 domestic and seven international). Total 2,375 Baron 58s delivered by early 1995 including 34 in 1993 and 31 in 1994

DESIGN FEATURES: Changes from Baron 55 include forward cabin extended by 25.4 cm (10 in), wheelbase extended forward, double passenger/cargo doors starboard side, extended propeller hubs, redesigned nacelles for better cooling, and fourth window on each side.

Wing section NACA 23015.5 at root, 23010.5 at tip, dihedral 6°; incidence 4° at root and 0° at tip

FLYING CONTROLS: Manually operated trim tabs in elevators, rudder and port aileron, electrically operated single-slotted flaps

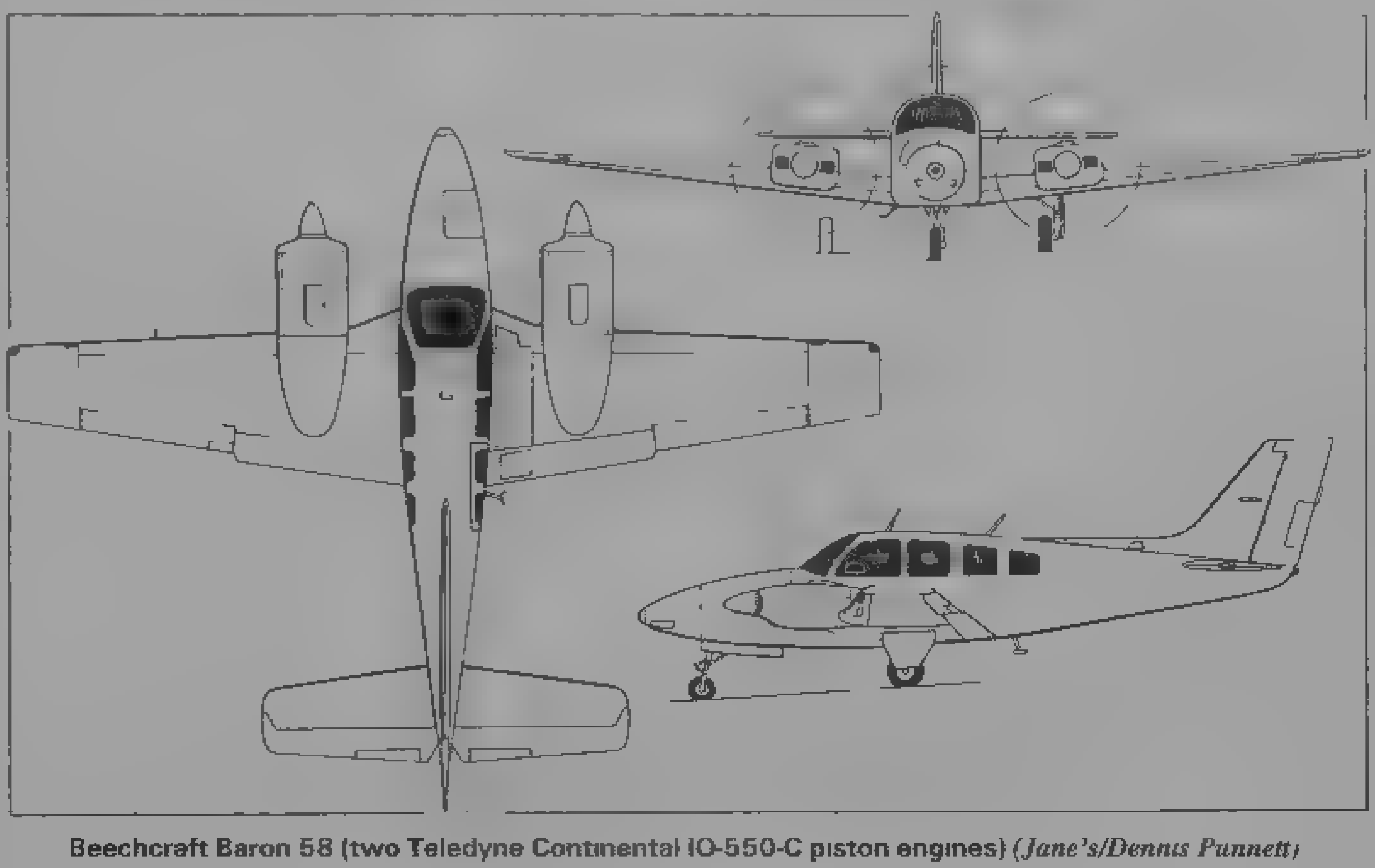
STRUCTURE: Light alloy with two-spar wing box, elevators have smooth magnesium alloy skins

LANDING GEAR: Electrically retractable tricycle type. Main units retract inward into wings, nosewheel aft. Beech oleo-pneumatic shock-absorbers in all units. Steerable nosewheel with shimmy damper. Cleveland wheels, with mainwheel tyres size 6.50-8, pressure 3.59 to 3.96 bars (52 to 56 lb/sq in). Nosewheel tyre size 5.00-5, pressure 3.79 to 4.14 bars (55 to 60 lb/sq in). Cleveland ring disc hydraulic brakes. Heavy-duty brakes optional. Parking brake. New warning system introduced in 1989

POWER PLANT: Two 224 kW (300 hp) Teledyne Continental IO-550-C flat-six engines, each driving a McCauley three-blade constant-speed fully feathering metal propeller. The standard fuel system has a usable capacity of 514 litres (136 US gallons, 113 Imp gallons), with optional usable capacity of 628 litres (166 US gallons, 138 Imp gallons). Optional 'wet wingtip' installation also available increasing usable capacity to 734 litres (194 US gallons, 161.5 Imp gallons)

ACCOMMODATION: Standard model has four individual seats in pairs in enclosed, soundproofed, heated and ventilated cabin, with door on starboard side. Single diagonal strap shoulder harness with inertia reel standard on all seats. Pilot's vertically adjusting seat is standard. Co-pilot's vertically adjusting seat, folding fifth and sixth seats, or club seating comprising folding fifth and sixth seats and aft facing third and fourth seats, are optional. Executive writing desk available as option with club seating. Baggage compartment in nose, capacity 136 kg (300 lb). Double passenger/cargo doors on starboard side of cabin provide access to space for 181 kg (400 lb) of baggage or cargo behind the third and fourth seats. Pilot's storm window. Openable windows adjacent the third and fourth seats are used for ground ventilation and as emergency exits. Windscreen defrosting standard

SYSTEMS: Cabin heated by Janitrol 50,000 BTU heater, which serves also for windscreen defrosting. Oxygen system of



Beechcraft Baron 58 (two Teledyne Continental IO-550-C piston engines) *(Jane's/Dennis Punnett)*

1993

Beechcraft Baron 58 four/six-seat cabin monoplane

1995

1.41 m³ (49.8 cu ft) or 1.87 m³ (66 cu ft) capacity optional. Electrical system includes two 28 V 60 A engine-driven alternators with alternator failure lights and two 12 V 25 Ah batteries. Two 100 A alternators optional. Hydraulic system for brakes only. Pneumatic pressure system for air-driven instruments, and optional wing and tail unit de-icing system. Oxygen system, cabin air conditioning and windscreen electric anti-icing optional.

AVIONICS: *Comms*: Bendix/King KX 155-09 760-channel com transceiver with audio amplifier, microphone, headset and cabin speaker. Optional avionics by Bendix/King or Collins to customer requirements. Emergency locator transmitter.

Radar: Bendix/King weather radar optional.

Flight: Bendix/King KX 155 200-channel nav receiver with KI 208 VOR/LOC converter/indicator, KR 87 ADF with KI 227-00 indicator, combined loop/sense antenna, nav and com antennae. Goodrich Stormscope optional.

Instrumentation: Blind-flying instruments, outside air temperature gauge, sensitive altimeter, turn co-ordinator, EGT and CHT gauges and synchroscope. Optional true airspeed indicator, engine and flight hour recorders and instantaneous vertical speed indicator.

EQUIPMENT: Standard equipment includes pilot's storm window, sun visors, ultraviolet-proof windscreen and cabin windows, armrests, adjustable rudder pedals (retractable on starboard side), heated pitot head, instrument panel floodlights, map light, lighted trim tab position indicator, navigation and position lights, steerable taxi light, dual landing lights, heated fuel vents, heated fuel and stall warning vanes and external power socket.

Options include alternate static source, internally illuminated instruments, digital beacon, strobe lights, electric windscreen anti-icing, wing ice detection light, static wicks, cabin club seating, cabin fire extinguisher, ventilation blower and super soundproofing.

DIMENSIONS, EXTERNAL:

Wing span	11.53 m (37 ft 10 in)
Wing chord: at root	2.13 m (7 ft 0 in)
at tip	0.90 m (2 ft 11½ in)
Wing aspect ratio	7.19
Length overall	9.09 m (29 ft 10 in)
Height overall	2.97 m (9 ft 9 in)
Tailplane span	4.85 m (15 ft 11 in)
Wheel track	2.92 m (9 ft 7 in)
Wheelbase	2.72 m (8 ft 11 in)
Propeller diameter	1.98 m (6 ft 6 in)
Rear passenger/cargo doors:	
Max height	0.89 m (2 ft 11 in)
Width	1.14 m (3 ft 9 in)
Baggage door (fwd): Height	0.56 m (1 ft 10 in)
Width	0.64 m (2 ft 1 in)

DIMENSIONS, INTERNAL:

Cabin, incl rear baggage area:	
Length	3.84 m (12 ft 7 in)
Max width	1.07 m (3 ft 6 in)
Max height	1.27 m (4 ft 2 in)
Floor area	3.72 m² (40.0 sq ft)
Volume	3.85 m³ (135.9 cu ft)
Baggage compartment: fwd	0.51 m³ (18.0 cu ft)

AREAS:

Wings, gross	18.51 m² (199.2 sq ft)
Ailerons (total)	1.06 m² (11.40 sq ft)
Trailing-edge flaps (total)	1.98 m² (21.30 sq ft)
Fin	1.46 m² (15.67 sq ft)
Rudder, incl tab	0.81 m² (8.75 sq ft)
Tailplane	4.95 m² (53.30 sq ft)
Elevators, incl tabs	1.84 m² (19.80 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	1,619 kg (3,570 lb)
Max T-O weight	2,495 kg (5,500 lb)
Max landing weight	2,449 kg (5,400 lb)
Max ramp weight	2,506 kg (5,524 lb)
Max wing loading	143.4 kg/m² (27.6 lb/sq ft)
Max power loading	5.60 kg/kW (9.2 lb/hp)

PERFORMANCE (at max T-O weight, ISA, except cruising speeds at average cruise weight):

Max level speed at S/L	208 kts (386 km/h; 239 mph)
Max cruising speed, 2,500 rpm at 1,525 m (5,000 ft)	203 kts (376 km/h; 234 mph)
Cruising speed, 2,500 rpm at 3,050 m (10,000 ft)	198 kts (367 km/h; 228 mph)
Econ cruising speed, 2,100 rpm at 3,660 m (12,000 ft)	163 kts (302 km/h; 188 mph)
Stalling speed, power off:	
flaps up	84 kts (156 km/h; 97 mph) IAS
flaps down	75 kts (139 km/h; 86 mph) IAS
Max rate of climb at S/L	529 m (1,735 ft)/min
Rate of climb at S/L, OEI	119 m (390 ft)/min
Service ceiling	6,306 m (20,688 ft)
Service ceiling, OEI	2,220 m (7,284 ft)
T-O run	427 m (1,400 ft)
T-O to 15 m (50 ft)	701 m (2,300 ft)
Landing from 15 m (50 ft)	747 m (2,450 ft)
Landing run	434 m (1,425 ft)

Range with 734 l (194 US gallons; 161.5 Imp gallons) usable fuel, with allowances for engine start, taxi, T-O, climb and 45 min reserves at econ cruise power:

max cruising speed (power/altitude settings as above)	1,150 n miles (2,130 km; 1,323 miles)
cruising speed (power/altitude settings as above)	1,411 n miles (2,613 km; 1,624 miles)
econ cruising speed (power/altitude settings as above)	1,575 n miles (2,917 km; 1,812 miles)

UPDATED

BEECHCRAFT KING AIR C90B and C90SE

TYPE: Six/10-seat turboprop pressurised business twin.

PROGRAMME: C90B announced at NBAA show at Houston October 1991; superseded King Air 90, A90, B90, C90, C90-1, C90A; introduced four-blade McCauley propellers, special interior soundproofing, updated and redesigned interior, updated cockpit features and interior noise and vibration levels substantially reduced.

CURRENT VERSIONS: **C90B**: Standard version from 1991; *detailed description applies to this version*.

C90SE (Special Edition): Announced 18 February 1994; Hartzell three-blade propellers, standard Bendix/King CNI-5000 avionics package; first flight (N15599, 1,367th 90/A90/B90/C90) mid-July 1994; first delivery, TG-RWC to Guatemalan customer, October 1994. Weight empty 2,914 kg (6,425 lb). T-O run 574 m (1,885 ft), T-O to 15 m (50 ft) 785 m (2,577 ft), landing from 15 m (50 ft) 745 m (2,443 ft); landing run 427 m (1,401 ft).

CUSTOMERS: 35 C90Bs and C90SEs delivered during 1994; total 1,386 commercial and 226 military King Air 90/A90/B90/C90/C90-1/C90A/C90B/C90SE delivered by end of 1994. Recent customers include former World Motor Racing Champion Alain Prost, who took delivery of a C90B in Spring 1995.

COSTS: C90SE $1.696 million (1994).

DESIGN FEATURES: Wing section NACA 23014.1 (modified) at root, 23016.22 (modified) at outer end of centre-section, 23012 at tip; dihedral 7°, incidence 4° 48′ at root, 0° at tip; tailplane 7° dihedral.

FLYING CONTROLS: Trim tabs on port aileron, in both elevators and rudders, single-slotted aluminium flaps.

STRUCTURE: Generally light alloy; magnesium ailerons.

LANDING GEAR: Hydraulically retractable tricycle type. Nosewheel retracts rearward, mainwheels forward into engine nacelles. Mainwheels protrude slightly beneath nacelles when retracted, for safety in a wheels-up emergency landing. Fully castoring steerable nosewheel with shimmy damper. Beech oleo-pneumatic shock absorbers. Goodrich mainwheels with tyres size 8.50-10, pressure 3.79 bars (55 lb/sq in). Goodrich nosewheel with tyre size 6.50-10, pressure 3.59 bars (52 lb/sq in). Goodrich heat-sink and air cooled multidisc hydraulic brakes. Parking brake. Minimum ground turning radius 10.82 m (35 ft 6 in).

POWER PLANT: Two 410 kW (550 shp) Pratt & Whitney Canada PT6A-21 turboprops, each driving a McCauley four-blade constant-speed fully feathering propeller. Propeller auto ignition system, environmental fuel drain collection system, magnetic chip detector, automatic propeller feathering and propeller synchrophaser standard. Fuel in two tanks in engine nacelles, each with usable capacity of 231 litres (61 US gallons; 50.8 Imp gallons), and auxiliary bladder tanks in outer wings, each with capacity of 496 litres (131 US gallons; 109 Imp gallons). Total usable fuel capacity 1,454 litres (384 US gallons; 320 Imp gallons). Refuelling points in top of each engine nacelle and in wing leading edge outboard of each nacelle. Oil capacity 13.2 litres (3.5 US gallons; 2.9 Imp gallons) per engine.

ACCOMMODATION: Two seats side by side in cockpit with dual controls standard. Normally, four reclining seats in main cabin, in two pairs facing each other fore and aft. Standard furnishings include cabin forward partition, with fore and aft partition curtain and coat rack, hinged nose baggage compartment door seat belts and inertia reel shoulder harness for all seats. Optional arrangements seat up to eight persons, with lateral tracking chairs, and refreshment cabinets. Baggage racks at rear of cabin on starboard side, with optional toilet on port side. Door on port side aft of wing with built in airstairs. Emergency exit on starboard side of cabin. Entire accommodation pressurised, heated and air conditioned. Electrically heated windscreen, windscreen defroster and windscreen wipers standard

SYSTEMS: Pressurisation by dual engine bleed air system with pressure differential of 0 34 bar (5 0 lb/sq in). Cabin heated by 45,000 BTU dual engine bleed air system and auxiliary electrical heating system. Hydraulic system for landing gear actuation. Electrical system includes two 28 V 250 A starter/generators, 24 V 45 Ah air cooled Ni/Cd battery with failure detector. Oxygen system, 0.62 m³ (22 cu ft), 1 39 m³ (49 cu ft) or 1 81 m³ (64 cu ft) capacity, optional. Vacuum system for flight instruments. Automatic pneumatic de-icing of wing/fin/tailplane leading-edges standard. Engine and propeller anti icing systems standard. Engine fire detection and extinguishing system optional

AVIONICS: Standard Collins Pro Line II package in sectional instrument panel. Bendix/King Silver Crown and Gold Crown packages optional

Comms: Dual VHF 22A transceivers with CTL-22 controls; dual TDR-90 transponders, dual DB systems Model 415 audio systems; dual Flite-Tronics PC-250 inverters edgelight radio panel, ELT, avionics master switch gnd and clearance switch on com 1, control wheel push-to talk switches; dual hand microphones, dual Telex headsets

Radar: WXR-270 colour weather radar

Flight: Dual VIR-32 VOR/LOC/GLS/MKR receivers with CTL-32 controls, ADF-60A with CTL 62 control, DME-42 with IND-42 indicator, RMI-30 dual MCS-65 compass systems. Goodrich WX-1000+ Stormscope optional. APS-65 autopilot/flight director with ADI-84 FDI and EFD-74 EHSI

Instrumentation: ALT-50A radio altimeter; pilot's United 5506-S encoding altimeter; dual 2 in electric turn and bank indicator's; co-pilot's 7 5 cm (3 in) horizon indicator, co-pilot's HSI. Bendix King KFC 150 autopilot and yaw damper optional.

Dual blind-flying instrumentation with dual instantaneous VSIs, standby magnetic compass, OAT gauge, LCD digital chronometer clock, vacuum gauge, de-icing pressure gauge, cabin rate of climb indicator; cabin altitude and differential pressure indicator, flight hour recorder, automatic solid-state warning and annunciator panel

EQUIPMENT: Standard equipment includes pilot and co-pilot's four-way adjustable seats with shoulder harness and lap belts, dual cockpit speakers, adjustable sun visors; map pocket; fresh air outlets; oxygen outlets with overhead mounted diluter demand masks with microphones; four fully adjustable cabin seats in club arrangement with removable headrests; removable low-profile toilet with shoulder harness, lap belt, two cabin tables, cabin fire extinguisher, internal corrosionproofing, wing ice lights, dual landing lights, nosewheel taxi light, flush position lights, dual rotating beacons, primary and secondary instrument lighting systems, rheostat-controlled white cockpit lighting; wingtip recognition lights, wingtip and tail strobe lights, and vertical tail illumination lights

Optional equipment includes electric flushing toilet, engine fire detection system, 1 81 m³ (64 cu ft) oxygen bottle, cabinet with three drawers and stereo tape deck storage; pilot to-cabin paging with four stereo speakers, and passenger stereo headsets

DIMENSIONS, EXTERNAL:

Wing span	15 32 m (50 ft 3 in)
Wing chord, at root	2 15 m (7 ft 0½ in)
at tip	1 07 m (3 ft 6 in)
Wing aspect ratio	8 59
Length overall	10 82 m (35 ft 6 in)
Height overall	4 34 m (14 ft 3 in)
Tailplane span	5 26 m (17 ft 3 in)
Wheel track	3 89 m (12 ft 9 in)
Wheelbase	3 73 m (12 ft 3 in)
Propeller diameter	2 29 m (7 ft 6 in)
Propeller ground clearance	0 34 m (1 ft 1½ in)
Passenger door: Height	1 30 m (4 ft 3½ in)
Width	0 69 m (2 ft 3 in)
Height to sill	1 22 m (4 ft 0 in)

DIMENSIONS, INTERNAL:

Total pressurised length	5 43 m (17 ft 10 in)
Cabin: Length	3 86 m (12 ft 8 in)
Max width	1 37 m (4 ft 6 in)
Max height	1 45 m (4 ft 9 in)
Floor area	6 50 m² (70 0 sq ft)
Volume	8 88 m³ (313 6 cu ft)
Baggage compartment, rear	1 51 m³ (53 5 cu ft)

AREAS:

Wings, gross	27 3. m² (293 94 sq ft)
Ailerons (total)	1 29 m² (13 90 sq ft)
Trailing-edge flaps (total)	2.72 m² (29 30 sq ft)
Fin	2.20 m² (23.67 sq ft)
Rudder, incl tab	1.30 m² (14 00 sq ft)
Tailplane	4 39 m² (47 25 sq ft)
Elevators, incl tabs (total)	1 66 m² (17 87 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	3,028 kg (6,675 lb)
Max T-O weight	4,581 kg (10,100 lb)
Max ramp weight	4,608 kg (10,160 lb)
Max landing weight	4,354 kg (9,600 lb)
Max wing loading	167 7 kg/m² (34 4 lb/sq ft)
Max power loading	5 59 kg/kW (9 2 lb/shp)

PERFORMANCE (at max T-O weight except where indicated):

Max cruising speed at AUW of 3,855 kg (8,500 lb)

at 3,660 m (12,000 ft)	242 kts (448 km/h, 278 mph)
at 4,880 m (16,000 ft)	247 kts (457 km/h, 284 mph)
at 6,400 m (21,000 ft)	243 kts (450 km/h, 280 mph)

Stalling speed, power off

wheels and flaps up	88 kts (163 km/h, 101 mph) IAS
wheels and flaps down	78 kts (144 km/h, 90 mph) IAS
Max rate of climb at S/L	610 m (2,003 ft)/min
Rate of climb at S/L, OEI	151 m (494 ft)/min
Service ceiling	8 810 m (28,900 ft)
Service ceiling, OEI	3,990 m (13,100 ft)
T-O run	620 m (2 033 ft)
T-O to 15 m (50 ft)	826 m (2,710 ft)
Accelerate/stop distance	1,113 m (3,650 ft)
Landing from 15 m (50 ft) at max landing weight, with propeller reversal	698 m (2,290 ft)
Landing run at max landing weight, with propeller reversal	384 m (1 260 ft)

Range with max fuel at max cruising speed, incl allowance for starting, taxi, take-off, climb, descent and 45 min reserves at max range power, ISA, at

6,400 m (21,000 ft)	1 075 n miles (1,991 km, 1,237 miles)
4,875 m (16,000 ft)	933 n miles (1,728 km; 1,074 miles)
7,315 m (24,000 ft)	1,165 n miles (2,158 km, 1,341 miles)

Max range at econ cruising power, allowances as above, at

6,400 m (21 000 ft)	1,277 n miles (2,365 km, 1,470 miles)
4,875 m (16,000 ft)	1 155 n miles (2,139 km, 1,329 miles)
7,315 m (24 000 ft)	1 340 n miles (2,482 km, 1,542 miles)

UPDATED

Beechcraft King Air C90SE

1995

BEECHCRAFT SUPER KING AIR B200

Swedish Air Force designation: Tp 101

TYPE: Twin turboprop pressurised passenger, cargo or business light transport

PROGRAMME: Design of Super King Air 200 began October 1970; first flight (c/n BB1) 27 October 1972, certificated FAR Pt 23 plus icing requirements of FAR Pt 25, 14 December 1973, design of B200 (prototype c/n BB343) began March 1980; production started May 1980; FAA certification 13 February 1981; on sale March 1981

CURRENT VERSIONS: **Super King Air B200**: Basic version *detailed description applies to B200*

Super King Air B200C: As B200 but with 1 32 × 1.32 m (4 ft 4 in × 4 ft 4 in) cargo door

Super King Air B200SE (Special Edition) Announced October 1994, certification scheduled for mid 1995, three blade propellers, standard Collins EFIS-84 avionics package with APS-65H autopilot

Super King Air B200T: Standard provision for removable tip tanks, adding total 401 litres (106 US gallons; 88.25 Imp gallons), making total 2,460 litres (650 US gallons, 541 Imp gallons) Span without tip tanks 16 92 m (55 ft 6 in)

Super King Air B200CT: Combines tip tanks and cargo door as standard

Maritime patrol B200T: Described separately

C/RC/UC-12: Military versions; described separately

Super King Air 300LW: Described separately

Super King Air 350: Described separately

CUSTOMERS: French Institut Géographique National acquired two B200T fitted with twin Wild RC-10 Superaviogon camera installations and Doppler navigation in February 1977, maximum endurance 10 3 hours, high flotation landing gear; special French certification for maximum T-O weight 6,350 kg (14,000 lb) and maximum landing weight 6,123 kg (13,500 lb). Egyptian government acquired one Super King Air in 1978 for water, uranium and other natural resources exploration over Sinai and Egyptian deserts as follow-up to satellite surveys, fitted with remote sensing gear, specialised avionics and special cameras. Navaid checking versions of Super King Air used by Taiwan government (one) and Malaysian government (two). Special missions Super King Air delivered to Taiwan Ministry of Interior May 1979; Royal Hong Kong Auxiliary Air Force (now Government Air Service) (two) 1986 and 1987, four Super King Air 200s operated by Swedish Air Force since 1989 as **Tp 101**. Total of 35 Super King Air B200s delivered in 1993, 23 in 1994. Deliveries by early 1995 totalled more than 1,590 for commercial and private orders, plus 345 military versions (described separately) to US armed forces and foreign customers. 1 500th commercial model 200 flown February 1995

COSTS: B200 SE $2.995 million (1995); B200 $3 57 million (1995)

DESIGN FEATURES: Pratt & Whitney Canada PT6A-41 turboprops of Super King Air 200 replaced by 634 kW (850 shp) P&WC PT6A-42s for better cruise and altitude performance, maximum zero-fuel weight raised by 272 kg (600 lb); cabin pressure differential increased from 0 41 bar (6.0 lb/sq in) to 0 44 bar (6.5 lb/sq in). Wing aerofoil NACA 23018 to 23016.5 over inner wing, 23012 at tip dihedral 6°; incidence 3° 48′ at root, −1° 7′ at tip, swept vertical and horizontal tail

FLYING CONTROLS: Trim tabs in port aileron and both elevators, anti-servo tab in rudder; single slotted trailing edge flaps, fixed tailplane

STRUCTURE: Two-spar light alloy wing safe-life semi-monocoque fuselage

LANDING GEAR: Hydraulically retractable tricycle type, with twin wheels on each main unit. Single wheel on steerable nose unit, with shimmy damper. Main units retract forward, nosewheel rearward. Beech oleo-pneumatic shock absorbers. Goodrich mainwheels and tyres size 18 × 5 5, pressure 7 25 bars (105 lb/sq in). Oversize and/or 10 ply mainwheel tyres optional. Goodrich nosewheel size 6 50 × 10, with tyre size 22 × 6.75 10, pressure 3 93 bars (57 lb/sq in). Goodrich hydraulic multiple-disc brakes. Parking brake

POWER PLANT: Two 634 kW (850 shp) Pratt & Whitney Canada PT6A-42 turboprops, each driving a Hartzell three-blade constant-speed reversible-pitch metal propeller with autofeathering and synchrophasing. Bladder fuel cells in each wing, with main system capacity of 1 461 litres (386 US gallons; 321 5 Imp gallons) and auxiliary system capacity of 598 litres (158 US gallons; 131 5 Imp gallons). Total usable fuel capacity 2,059 litres (544 US gallons; 453 Imp gallons). Two refuelling points in upper surface of each wing. Wingtip tanks optional, providing an additional 401 litres (106 US gallons; 88.25 Imp gallons) and raising maximum usable capacity to 2,460 litres (650 US gallons,

Beechcraft Super King Air B200 14-passenger pressurised transport

1995

541 Imp gallons). Oil capacity 29.5 litres (7.8 US gallons, 6.5 Imp gallons).

ACCOMMODATION: Pilot only, or crew of two side by side, on flight deck, with full dual controls and instruments as standard. Six cabin seats standard, each equipped with seat belts and inertia reel shoulder harness; alternative layouts for a maximum of 13 passengers in cabin and 14th beside pilot. Partition with sliding door between cabin and flight deck, and partition at rear of cabin. Door at rear of cabin on port side, with integral airstair. Large cargo door optional. Inward-opening emergency exit on starboard side over wing. Lavatory and stowage for up to 249 kg (550 lb) baggage in rear fuselage. Maintenance access door in rear fuselage, radio compartment access doors in nose. Cabin is air conditioned and pressurised, with radiant heat panels to warm cabin before engine starting.

SYSTEMS: Cabin pressurisation by engine bleed air, with a maximum differential of 0.44 bar (6.5 lb/sq in). Cabin air conditioner of 34,000 BTU capacity. Auxiliary cabin heating by radiant panels standard. Oxygen system for flight deck, and 0.62 m^3 (22 cu ft) oxygen system for cabin, with automatic drop down face masks; standard system of 1.39 m^3 (49 cu ft), 1.81 m^3 (64 cu ft) or 2.15 m^3 (76 cu ft) optional. Dual vacuum system for instruments. Hydraulic system for landing gear retraction and extension, pressurised to 171 to 191 bars (2,475 to 2,775 lb/sq in). Separate hydraulic system for brakes. Electrical system has two 250 A 28 V starter/generators and a 24 V 45 Ah air-cooled Ni/Cd battery with failure detector. AC power provided by dual 250 VA inverters. Engine fire detection system standard, engine fire extinguishing system optional. Pneumatic de-icing of wings and tailplane standard. Anti-icing of engine air intakes by hot air from engine exhaust; electrothermal anti-icing for propellers.

AVIONICS: Standard Collins Pro Line II and optional Bendix/King Gold Crown packages generally as for King Air C90B except:

Comms: Cockpit-to-cabin paging standard. Bendix/King KHF 950 or Collins HF 230 HF transceiver, Fairchild A 100A cockpit voice recorder and Wulfsberg Flitefone optional.

Radar: Bendix/King RDS 84VP colour weather radar optional.

Flight: Dual DME-30; dual RMI 30 standard. Options include Foster LNS 616B RNAV/Loran C and Bendix/King KNS 660 RNAV/VLF/Omega. Collins 12.5 cm (5 in) FCS, Honeywell SPZ-4000 autopilot with 10 or 12.5 cm (4 or 5 in) flight director systems and Fairchild 17M-700-274 flight data recorder optional.

Instrumentation: Pilot's ALT 80A encoding altimeter, dual maximum allowable airspeed indicators, and flight director standard. Options include Collins EFIS-85B or Honeywell EDZ-605 three-tube EFIS, and Bendix/King CC-2024C or Collins DCP-270 radar checklist.

EQUIPMENT: Standard/optional equipment generally as for King Air C90B except fluorescent cabin lighting, one-place couch with storage drawers, flushing toilet (B200) or chemical toilet (B200C), cabin radiant heating, cockpit/cabin partition with sliding doors, and airstair door with hydraulic snubber and courtesy light, standard. FAR Pt 135 operational configuration includes cockpit fire extinguisher and 2.15 m^3 (76 cu ft) oxygen bottle with cockpit oxygen pressure indicator as standard. A range of optional cabin seating and cabinetry configuration is available, including quick-removable fold-up seats.

DIMENSIONS, EXTERNAL:

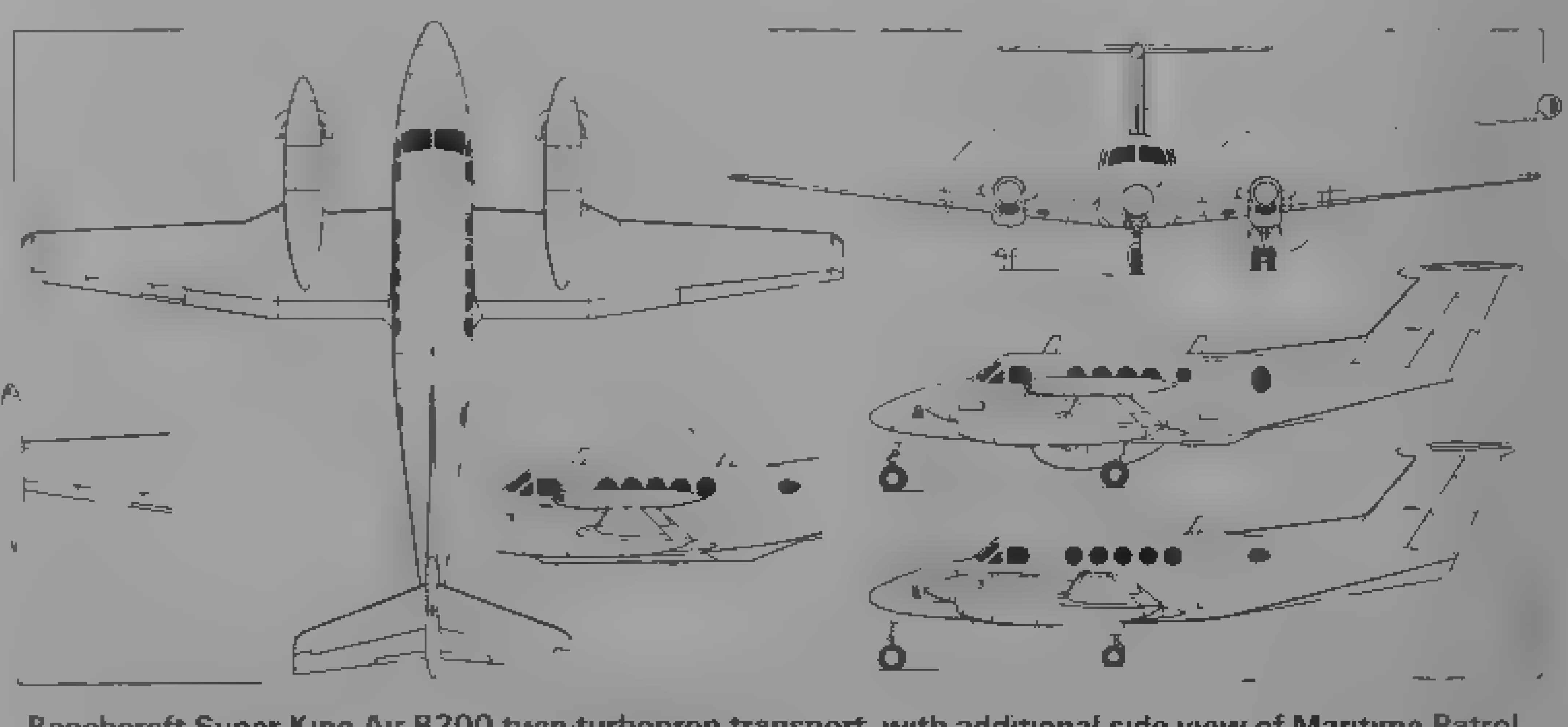
Wing span	16.61 m (54 ft 6 in)
Wing chord, at root	2.18 m (7 ft 1¼ in)
at tip	0.90 m (2 ft 11⅜ in)
Wing aspect ratio	9.80
Length overall	13.34 m (43 ft 9 in)
Height overall	4.57 m (15 ft 0 in)
Tailplane span	5.61 m (18 ft 5 in)
Wheel track	5.23 m (17 ft 2 in)
Wheelbase	4.56 m (14 ft 11½ in)
Propeller diameter	2.50 m (8 ft 2½ in)
Propeller ground clearance	0.37 m (1 ft 2½ in)
Distance between propeller centres	5.23 m (17 ft 2 in)
Passenger door: Height	1.31 m (4 ft 3½ in)
Width	0.68 m (2 ft 2¾ in)
Height to sill	1.17 m (3 ft 10 in)
Cargo door (optional): Height	1.32 m (4 ft 4 in)
Width	1.24 m (4 ft 1 in)
Nose avionics service doors (port and stbd)	
Max height	0.57 m (1 ft 10½ in)
Width	0.63 m (2 ft 1 in)
Height to sill	1.37 m (4 ft 6 in)
Emergency exit (stbd): Height	0.66 m (2 ft 2 in)
Width	0.50 m (1 ft 7¾ in)

DIMENSIONS, INTERNAL:

Cabin (from forward to rear pressure bulkhead)	
Length	6.71 m (22 ft 0 in)
Max width	1.37 m (4 ft 6 in)
Max height	1.45 m (4 ft 9 in)
Floor area	7.80 m^2 (84 sq ft)
Volume	11.10 m^3 (392 cu ft)
Baggage hold, rear of cabin	
Volume	1.51 m^3 (53.5 cu ft)

AREAS:

Wings, gross	28.15 m^2 (303.0 sq ft)
Ailerons (total)	1.67 m^2 (18.0 sq ft)
Trailing-edge flaps (total)	4.17 m^2 (44.9 sq ft)
Fin	3.46 m^2 (37.2 sq ft)
Rudder, incl tab	1.40 m^2 (15.1 sq ft)



Beechcraft Super King Air B200 twin-turboprop transport, with additional side view of Maritime Patrol B200T (centre right); scrap views of wingtip tanks and centre-fuselage of photo survey aircraft for IGN *(Jane's/Dennis Punnett)*

1993

Tailplane	4.52 m² (48.7 sq ft)
Elevators, incl tabs (total)	1.79 m² (19.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	3,675 kg (8,102 lb)
Max fuel	1,653 kg (3,645 lb)
Max T-O and landing weight	5,670 kg (12,500 lb)
Max ramp weight	5,710 kg (12,590 lb)
Max zero-fuel weight	4,990 kg (11,000 lb)
Max wing loading	201.6 kg/m² (41.3 lb/sq ft)
Max power loading	4.47 kg/kW (7.35 lb/shp)

PERFORMANCE (at max T-O weight ISA, except where indicated):

Never-exceed speed (VNE) 259 kts (480 km/h, 298 mph) IAS
Max operating Mach number 0.52
Max level speed at 7,620 m (25,000 ft), average cruise weight 294 kts (545 km/h, 339 mph)
Max cruising speed at 7,620 m (25,000 ft), average cruise weight 289 kts (536 km/h; 333 mph)
Econ cruising speed at 7,620 m (25 000 ft), average cruise weight. normal cruise power 282 kts (523 km/h, 325 mph)
Stalling speed:
flaps up 99 kts (183 km/h, 114 mph) IAS
flaps down 75 kts (139 km/h, 86 mph) IAS
Max rate of climb at S/L 747 m (2,450 ft)/min
Rate of climb at S/L, OEI 226 m (740 ft)/min
Service ceiling over 10,670 m (35,000 ft)
Service ceiling, OEI 6,675 m (21,900 ft)
T-O run, 40% flap 566 m (1,856 ft)
T-O to 15 m (50 ft), 40% flap 786 m (2,579 ft)
Landing from 15 m (50 ft):
without propeller reversal 867 m (2,845 ft)
with propeller reversal 632 m (2,074 ft)
Landing run 536 m (1,760 ft)
Range with max fuel, allowances for start, taxi, climb, descent, and 45 min reserves at max range power, ISA
max cruise power at:
5,485 m (18,000 ft) 1,190 n miles (2,204 km; 1,369 miles)
8,230 m (27,000 ft) 1,550 n miles (2,871 km, 1,784 miles)
9,450 m (31,000 ft) 1,750 n miles (3,241 km, 2,014 miles)
10,670 m (35,000 ft) 1,965 n miles (3,639 km, 2,261 miles)
econ cruise power at:
5,485 m (18 000 ft) 1,517 n miles (2,809 km; 1,746 miles)
8,230 m (27,000 ft) 1,860 n miles (3,445 km; 2,140 miles)
9,450 m (31 000 ft) 1,974 n miles (3,656 km, 2,272 miles)

UPDATED

BEECHCRAFT MARITIME PATROL B200T

TYPE: Maritime patrol or multimission aircraft.

PROGRAMME: Maritime Patrol 200T announced 9 April 1979; current version B200T for surface and subsurface monitoring of exclusive economic zones, pollution detection, inspecting offshore installations, search and rescue, special missions include aerial photography, environmental and ecological research, airways and ground-based navaid checking, target towing, ambulance flying.

CUSTOMERS: Japan Maritime Safety Agency (17), Algerian Ministry of Defence (two), Peruvian Navy (five), Puerto Rico (one), Uruguayan Navy (one), Germany (one), France (three), University of Wyoming (one). Malaysian Air Force (four), replacing Lockheed Martin C-130H-MPs with No. 16 Squadron at Subang.

DESIGN FEATURES: Modifications from standard Super King Air B200 include new outboard wings with provision for tip tanks, strengthened landing gear two bubble observation windows at rear, hatch for dropping survival equipment, 360° radome under fuselage, standard avionics include VLF/GPS coupled to autopilot to allow programmed search patterns integrated avionics, displays and controls, optional wingtip ESM antennae and FLIR.

LANDING GEAR: Strengthened to cater for higher operating weights.

POWER PLANT: As for Super King Air B200, including removable wingtip tanks which increase maximum usable fuel capacity by 401 litres (106 US gallons, 88.25 Imp gallons) to a total of 2,460 litres (650 US gallons, 541 Imp gallons).

AVIONICS: Standard items as listed under Design Features. Optional avionics include ESM integrated with GPS, VHF-AM/FM com, HF and UHF com, LLLTV, sonobuoys and processor, OTPI, multispectral scanner, tactical navigation computer, and three alternative search radar systems, all with 360° scan and weather avoidance capability and integrated with nav.

DIMENSIONS, EXTERNAL: As for Super King Air B200, except:

Wing span over tip tanks	17.25 m (56 ft 7 in)
Wing aspect ratio	10.35

DIMENSIONS, INTERNAL: As for Super King Air B200, except:

Cabin: Length (excl flight deck)	5.08 m (16 ft 8 in)

WEIGHTS AND LOADINGS (N: Normal category, R: Restricted category):

Weight empty: N, R	3,744 kg (8,255 lb)
Max T-O weight: N	5,670 kg (12,500 lb)
R	6,804 kg (15,000 lb)
Max landing weight: N	5,670 kg (12,500 lb)
R	6,123 kg (13,500 lb)

PERFORMANCE (at max Normal T-O weight, except where indicated):

Max cruising speed, AUW of 4,990 kg (11,000 lb) at 4,265 m (14,000 ft) 265 kts (491 km/h; 305 mph)
Typical patrol speed 140 kts (259 km/h; 161 mph)
Range with max fuel, patrolling at 227 kts (420 km/h, 261 mph) at 825 m (2,700 ft), 45 min reserves 1,790 n miles (3,317 km; 2,061 miles)
Typical endurance at 140 kts (259 km/h; 161 mph), at 610 m (2,000 ft), 45 min reserves 6 h 36 min
Max time on station, with wingtip fuel tanks 9 h

UPDATED

BEECHCRAFT SUPER KING AIR 200/B200 (MILITARY VERSIONS)

US basic military designation: C-12

TYPE: Military versions of Super King Air 200/B200.

PROGRAMME: US Army procured first three Super King Airs designated RU-21Js in 1971; US Army ordered 60 military passenger-carrying Super King Airs designated C-12A beginning FY73, worldwide deployment began July 1975.

CUSTOMERS: Total of 358 ordered by US armed forces by early 1994, of which 345 delivered. Further eight exports (16) and Israel (five in early 1985). Wing span (over tip tanks) 16.92 m (55 ft 6 in).

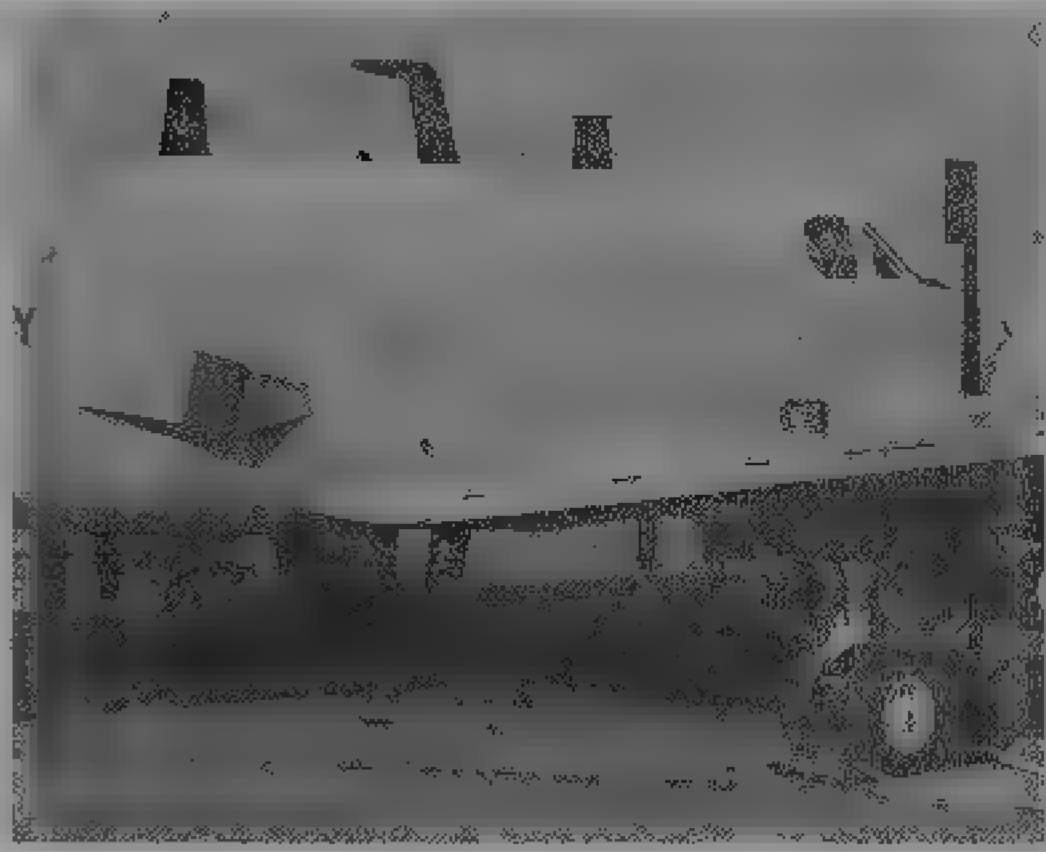
CURRENT VERSIONS: **C-12A**: Initial A200 version, powered by 559 kW (750 shp) P&WC PT6A-38 turboprops with Hartzell three-blade fully feathering reversible-pitch propellers, auxiliary tanks. Total 91 delivered (US Army 60; US Air Force 30; Greek Air Force one); entered service July 1975, details in 1980-81 *Jane's*. See C-12C and C-12E for C-12A re-engining.

UC-12B: US Navy/Marine Corps version (Model A200C) with 634 kW (850 shp) PT6A-41 turboprops, cargo door, high flotation landing gear. US Navy (49), US Marines (17), delivered by May 1982 for various base communications flights.

C-12C: As C-12A, but with PT6A-41 turboprops. Deliveries (US Army 14) complete. US Army C-12A fleet re-engined as C-12Cs: five civilianised 1989 for covert operations.

C-12D: Model A200CT. As US Army C-12C but cargo door, high flotation landing gear and provision for tip tanks. US Army (24), US Air Force (six); additional 21 built but converted to RC-12 before delivery to US Army

RC-12D Improved Guardrail V: Model A200CT. US Army special mission version, carries AN/USD-9 Improved Guardrail remote-controlled communications intercept and direction finding system with direct reporting to tactical commanders at corps level and below, aircraft survivability equipment (ASE) system, Carousel IV-E INS and Tacan system, radio datalink, AN/ARW-83(V)5 airborne relay with antennae above and below wings, wingtip ECM pods, associated equipment includes AN/TSQ-105(V)4 integrated processing facility, AN/ARM-63(V)4 AGE flightline van and AN/TSC-87 tactical commander's terminal. System prime contractor ESL Inc. US Army had 13 RC-12D Improved Guardrail Vs converted from C-12Ds, with deliveries starting in Summer 1983, one to HQ Forces Command at Fort McPherson, Georgia, remainder to 1st Military Intelligence Battalion, Wiesbaden, Germany, and 2nd MIB at Stuttgart, Germany. German based aircraft reassigned to US based units in late 1991, currently with 15th MIB at Robert Grey AAF, Texas, 304th MIB, Libby AAF, Arizona, MIB (LI), Panama; and AAESA Lakehurst, New Jersey. Five new-build aircraft to Israel. Wing span (over ECM pods) 17.63 m (57 ft 10 in).



Self-protection measures on Beechcraft RC-12K include flare dispenser at rear of engine cowling (above wing) and chaff dispenser on fuselage side *(Paul Jackson)* 1995

US MILITARY C-12s

Model	Type	USAF	Army	USN	First Aircraft
A200	C-12A	30			73-1205
			60		73-22250
A200C	UC-12B			66	161185
A200	C-12C		14		78-23126
A200CT	C-12D	6			83-0494
			24		78-23140
A200CT	RC-12D		13		78-23141
—	C-12E	(29[1])			—
B200	C-12F	46			84-0143
			35[2]		85-1261
B200C	UC-12F			10	163553
B200C	RC-12F			2	163563
A200CT	RC-12G		3[3]		80-23372
A200CT	RC-12H		6		83-24313
A200CT	RC-12K/N/P/Q		32		85-0147
200	C-12L		3		71-21058
B200C	UC-12M			10	163836
B200C	RC-12M			2	163846
Totals		**82**	**190**	**90**	

Notes. [1]Conversions
[2]Plus 14 options, 29 delivered by January 1995
[3]Previously RU-21J
List excludes C-12J, which is Beech 1900 variant

Beechcraft UC-12M operational support aircraft of the US Navy *(Paul Jackson)* 1995

Beechcraft RC-12N Guardrail Common Sensor of the US Army

1993

C-12E Designation of 29 US Air Force C-12As retrofitted with PT6A-42 turboprops, two crew plus nine passengers. Assigned to various embassies

C-12F: Operational support aircraft (OSA), similar to Model B200C with PT6A-42 engines, payload choices include two crew and eight passengers, more than 1,043 kg (2,300 lb) freight, two litter patients plus attendants, cargo floor standard. First delivery May 1984. US Air Force purchased 40 after initial five-year lease; US Army National Guard (20 ordered FY85-87), Air National Guard (six ordered FY84). US Army Reserve (15 ordered FY94, with options for up to 14 more)

UC-12F: US Navy equivalent of USAF C-12F with PT6A-42 turboprops. US Navy received first of 12 in 1986; two modified with surface search radar and operator's console to **RC-12F** Range Surveillance Aircraft (RANSAC) for Pacific Missile Range Facilities, Barking Sands, Hawaii

RC-12G: US Army special mission aircraft, based on A200CT, similar to RC-12D but maximum T-O weight increased to 6,804 kg (15,000 lb). Provides real-time intelligence support to field commanders; two crew. Mission equipment contractor Sanders Associates. Three delivered in 1985 after conversion from C-12D; currently with MIB (LI), in Panama

RC-12H Guardrail Common Sensor (Minus): US Army special mission aircraft, similar to RC-12D but maximum T-O weight increased to 6,804 kg (15,000 lb); system contractor ESL Inc. Six delivered in 1988 to 3rd Military Intelligence Battalion, Pyongtaek, South Korea

C-12J: Variant of Beechcraft 1900C (see 1991–92 *Jane's*)

RC-12K Guardrail Common Sensor: Similar to RC-12D except 820 kW (1,100 shp) PT6A-67 turboprops and maximum T-O weight 7,257 kg (16,000 lb). US Army ordered nine in October 1985, of which eight replaced RC-12Ds in 1st MIB, May 1991, one retained by Beech for RC-12N conversion; further two (4X-FSF and FSG) delivered to Israel in May-June 1991

C-12L: Three RU-21Js (71-21058 to 21060) stripped of Guardrail equipment in 1979 for transport duties but not redesignated until mid-1980s

UC-12M: US Navy designation of C-12F but with unique cockpit instruments, lighting and voice communications. Twelve delivered from 1987; two conversions with surface search radar and operator's console to **RC-12M** RANSAC, ordered 1988 for Pacific Missile Test Center, Point Mugu

RC-12N Guardrail Common Sensor: Generally similar to RC-12K, but equipped with dual EFIS and aircraft survivability equipment/avionics control system (ASE/ACS). ASE suite includes AN/APR-39 radar warning receiver, AN/APR-44 radar warning system, AN/ALQ-136, AN/ALQ-156 and AN/ALQ-162 countermeasure sets chaff/flare and M130 dispensers. Avionics suite includes AN/ARC-186 or AN/ARC-201 VHF-FM radio, AN/ARC-164 Have Quick II UHF-AM radio; AN/APX-100 IFF transponder; three KY-58 and one KIT-1A secure communications systems, Carousel IV INS, AN/ASN-149 GPS receiver. Prototype converted from RC-12K, 15 converted by ESL Inc delivered 1992-93 to 224th MIB and 304th MIB, further 12 being converted for later delivery as RC-12P (which see)

RC-12P Guardrail Common Sensor: Raytheon is modifying 12 RC-12Ns to RC-12P configuration. RC-12P has identical avionics and power plant but different mission equipment (including datalink capability), fibre optic cabling, smaller, lighter wing pods and increased T-O weight of 7,484 kg (16,500 lb). First batch of seven modified under subcontract from ESL Inc. for delivery late 1994 and 1995, but none yet reported in service; second batch of five will be converted under direct contract from US Army and will be delivered between September 1995 and June 1996

RC-12Q Direct Air Satellite Relay: Three RC-12Ps to be modified by ESL Inc and Loral during 1995-96, for delivery in 1997

CUSTOMERS: See table and under Current Versions above

UPDATED

BEECHCRAFT SUPER KING AIR 300LW

TYPE: Lightweight version of Super King Air 300 (1991-92 *Jane's*)

PROGRAMME: Announced September 1988 for European market; became sole 300 series aircraft on offer from October 1991, when production certificate for basic Super King Air 300 expired

CURRENT VERSIONS: **Super King Air 300LW**: Basic version, special European certification maximum T-O weight of 5,670 kg (12,500 lb) to limit airways user fees, maximum ramp weight 5,715 kg (12,600 lb); otherwise similar to 300

CUSTOMERS: 35 delivered by end of 1994, including eight in 1993 and five in 1994

DESIGN FEATURES: Two PT6A-60A turboprops, 'pitot cowl' engine intakes, aerodynamically faired exhausts; wing leading-edges extended 12.7 cm (5 in) forward, propellers moved forward 13.2 cm (5.2 in); hydraulically actuated landing gear, interior equipment changes

LANDING GEAR: Hydraulically retractable tricycle type. Goodrich mainwheels and tyres size 19 × 6.75-8, pressure 6.20 bars (90 lb/sq in) at maximum T-O weight. Goodrich nosewheel and tyre size 22 × 6.75-10, pressure 3.79 to 4.13 bars (55 to 60 lb/sq in)

POWER PLANT: Two 783 kW (1,050 shp) Pratt & Whitney Canada PT6A-60A turboprops, each driving a Hartzell four-blade constant-speed fully feathering reversible-pitch metal propeller. Bladder cells and integral tanks in each wing, with total capacity of 1,438 litres (380 US gallons; 316.5 Imp gallons), auxiliary tanks inboard of engine nacelles, capacity 601 litres (159 US gallons; 132.5 Imp gallons). Total fuel capacity 2,039 litres (539 US gallons; 449 Imp gallons). No provision for wingtip tanks. Oil capacity 30.2 litres (8 US gallons; 6.66 Imp gallons)

ACCOMMODATION: As for B200, except for additional emergency exit on port side, opposite starboard emergency exit and of the same dimensions. Pilot and co-pilot storm windows standard. Cabin features single-piece upper sidewall panels, indirect overhead lighting system with rheostat controls, stereo system with graphic equaliser and overhead speakers, larger executive tables incorporating magnetic game boards, seats with inflatable lumbar support adjustment, fore and aft, reclining and lateral tracking movement as standard. Crew seats have 2.5 or 5° tilt positions. Emergency exit lighting standard. Electric heating on ground standard. Optional radiant heat panels of B200 not available

SYSTEMS: As for B200, except for automatic bleed air type heating and 22,000 BTU cooling system with high-capacity ventilation system, 2.18 m³ (77 cu ft) oxygen system standard, hydraulic landing gear retraction and extension, two 300 A 28 V starter/generators with triple bus electrical distribution system

AVIONICS: Generally as for B200

EQUIPMENT: Generally as for B200

DIMENSIONS, EXTERNAL: As for B200 except:

Length overall	13.36 m (43 ft 10 in)
Height overall	4.37 m (14 ft 4 in)
Propeller diameter	2.67 m (8 ft 9 in)
Propeller ground clearance	0.25 m (10 in)
Emergency exit (each side of cabin, above wing):	
Height	0.66 m (2 ft 2 in)
Width	0.50 m (1 ft 7¾ in)

WEIGHTS AND LOADINGS:

Weight empty	3,878 kg (8,550 lb)
Max baggage weight	249 kg (550 lb)
Max T-O and landing weight	5,670 kg (12,500 lb)
Max ramp weight	5,715 kg (12,600 lb)
Max zero-fuel weight	5,216 kg (11,500 lb)
Max wing loading	201.6 kg/m² (41.3 lb/sq ft)
Max power loading	3.62 kg/kW (5.95 lb/shp)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (V_{NE})	259 kts (480 km/h; 298 mph) IAS
Max operating Mach number (M_{MO})	0.58
Max level and max cruising speed	317 kts (587 km/h; 365 mph)
Econ cruising speed	309 kts (573 km/h; 356 mph)
Stalling speed: flaps up	95 kts (176 km/h; 110 mph)
flaps down	78 kts (145 km/h; 90 mph)
Max rate of climb at S/L	999 m (3,277 ft)/min
Rate of climb at S/L, OEI	327 m (1,074 ft)/min
Max certificated ceiling	10,670 m (35,000 ft)
Service ceiling, OEI	7,882 m (25,855 ft)
T-O run, 40% flap	421 m (1,381 ft)
T-O to 15 m (50 ft), 40% flap	514 m (1,686 ft)
Accelerate/stop distance, 40% flap	1,067 m (3,500 ft)
Landing from 15 m (50 ft)	784 m (2,570 ft)
Landing run, without propeller reversal	393 m (1,289 ft)

Range with max fuel, allowances for start, taxi, T-O, climb, descent and 45 min reserves at max range power:

max cruise power at:	
5,485 m (18,000 ft)	960 n miles (1,778 km; 1,105 miles)
7,315 m (24,000 ft)	1,156 n miles (2,141 km; 1,330 miles)
8,535 m (28,000 ft)	1,333 n miles (2,469 km; 1,534 miles)
10,670 m (35,000 ft)	1,744 n miles (3,230 km; 2,007 miles)
max range power at:	
5,485 m (18,000 ft)	1,335 n miles (2,472 km; 1,536 miles)
8,535 m (28,000 ft)	1,780 n miles (3,297 km; 2,048 miles)
10,670 m (35,000 ft)	2,086 n miles (3,863 km; 2,400 miles)

UPDATED

Beechcraft C-12D of US Army in low-profile civilian-type colour scheme *(Paul Jackson)*

1995

BEECHCRAFT SUPER KING AIR 350

TYPE: Eight/12-passenger turboprop business aircraft.

PROGRAMME: Replaced Super King Air 300 (1991-92 *Jane's*); first flight (N120SK) September 1988, introduced at NBAA Convention 1989; certificated to FAR Pt 23 (commuter category), first delivery 6 March 1990.

CURRENT VERSIONS: **Super King Air 350**: Basic version, *as described in detail*.

Super King Air 350C: Has 132 × 132 cm (52 × 52 in) freight door with built-in airstair passenger door.

Super King Air 350 Special Missions: Versions available for aerial photography and airways and ground-based navaid checking.

RC-350 Guardian: Elint version, converted from 350 prototype 1991 by Beech Aircraft Corporation; mission avionics include Raytheon AN/ALQ-142 ESM, Watkins-Johnson 9195C communications interceptor, Honeywell laser INS, GPS receiver and Cubic secure digital datalink; can loiter on station at 10 670 m (35,000 ft) for more than 6 hours; can locate/monitor radar emitters in 20 MHz to 18 GHz range, and intercept communications within 20 to 1,400 MHz bandwidths. Wingtip pods house AN/ALQ-142 antennae; underfuselage bulge contains antenna for comint system.

CUSTOMERS: Total 130 Super King Air 350s and 350Cs delivered by end of 1994; first 350C delivery in 1990 to Rossing Uranium, Namibia; 14 Super King Air 350 deliveries 1993, 24 in 1994. Recent customers include DFS Deutsche Flugsicherung GmbH, which operates two Super King Air 350s equipped with automatic flight inspection systems for en route and precision navaid inspections throughout Germany, and Civil Aeronautics Administration of the Republic of China, with one aircraft on similar duties.

DESIGN FEATURES: Compared with Super King Air 300, fuselage stretched 0.86 m (2 ft 10 in) by plugs 0.37 m (1 ft 2½ in) forward of main spar and 0.49 m (1 ft 7½ in) aft; wing span increased by 0.46 m (1 ft 6 in) with NASA winglets 0.61 m (2 ft 0 in) high; two additional cabin windows each side; double club seating for eight passengers, optionally two more seats in rear of cabin, one passenger on toilet seat and one in co-pilot seat if operating single-crew, making maximum 12 passengers, certified for maximum 17 occupants including crew. Can depart with full payload and full tanks.

FLYING CONTROLS: Automatic cable tensioner in aileron circuit and larger elevator bobweight, larger rudder anti-servo tab, ailerons and rudder cleaned up.

POWER PLANT: As for 300LW.

DIMENSIONS, EXTERNAL: As for 300LW except:
Wing span over winglets 17.65 m (57 ft 11 in)
Wing aspect ratio 10.79
Length overall 14.22 m (46 ft 8 in)

DIMENSIONS, INTERNAL:
Cabin, excl cockpit: Length 5.94 m (19 ft 6 in)
Max width 1.37 m (4 ft 6 in)
Height 1.45 m (4 ft 9 in)

AREAS:
Wings, gross 28.80 m² (310.0 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 4,111 kg (9,062 lb)
Max fuel weight 1,638 kg (3,611 lb)
Max T-O and landing weight 6,804 kg (15,000 lb)
Max ramp weight 6,849 kg (15,100 lb)
Max zero-fuel weight 5,670 kg (12,500 lb)
Max wing loading 236.3 kg/m² (48.4 lb/sq ft)
Max power loading 4.34 kg/kW (7.14 lb/shp)

PERFORMANCE (at max T-O weight, ISA, except where indicated):
Max level speed 315 kts (584 km/h; 363 mph)
Max cruising speed, AUW of 5,896 kg (13,000 lb) at:
7,315 m (24,000 ft) 311 kts (576 km/h; 358 mph)
10,670 m (35,000 ft) 290 kts (537 km/h; 334 mph)
Cruising speed, normal cruising power, AUW of 5,896 kg (13,000 lb) at:
7,315 m (24,000 ft) 301 kts (558 km/h; 347 mph)
10,670 m (35,000 ft) 281 kts (521 km/h; 324 mph)
Cruising speed, max range power, AUW of 5,896 kg (13,000 lb) at:
5,485 m (18,000 ft) 210 kts (389 km/h; 242 mph)
10,670 m (35,000 ft) 240 kts (445 km/h; 276 mph)
Stalling speed at max landing weight, flaps and wheels down 81 kts (150 km/h; 94 mph)
Max rate of climb at S/L 832 m (2,731 ft)/min
Rate of climb at S/L, OEI, AUW of 6,350 kg (14,000 lb) 236 m (775 ft)/min
Service ceiling above 10,670 m (35,000 ft)
Service ceiling, OEI 6,555 m (21,500 ft)
T-O balanced field length 1,006 m (3,300 ft)
Landing from 15 m (50 ft) 802 m (2,631 ft)
Landing run 408 m (1,338 ft)
Range with 2,040 l (539 US gallons; 449 Imp gallons) usable fuel, allowances for start, T-O, climb and descent plus 45 min reserves:
max cruising power at:
5,485 m (18,000 ft) 1,067 n miles (1,976 km; 1,228 miles)
7,315 m (24,000 ft) 1,252 n miles (2,319 km; 1,441 miles)
8,535 m (28,000 ft) 1,407 n miles (2,606 km; 1,619 miles)
10,670 m (35,000 ft) 1,724 n miles (3,193 km; 1,984 miles)
normal cruising power, allowances as above:
5,485 m (18,000 ft) 1,085 n miles (2,009 km; 1,249 miles)
7,315 m (24,000 ft) 1,308 n miles (2,422 km; 1,505 miles)
8,535 m (28,000 ft) 1,474 n miles (2,730 km; 1,696 miles)
10,670 m (35,000 ft) 1,771 n miles (3,280 km; 2,038 miles)
max range power, allowances as above:
5,485 m (18,000 ft) 1,421 n miles (2,632 km; 1,635 miles)
8,535 m (28,000 ft) 1,756 n miles (3,252 km; 2,021 miles)
10,670 m (35,000 ft) 1,894 n miles (3,508 km; 2,180 miles)
NBAA VFR range, four passengers, 30 min reserves 2,030 n miles (3,761 km; 2,337 miles)

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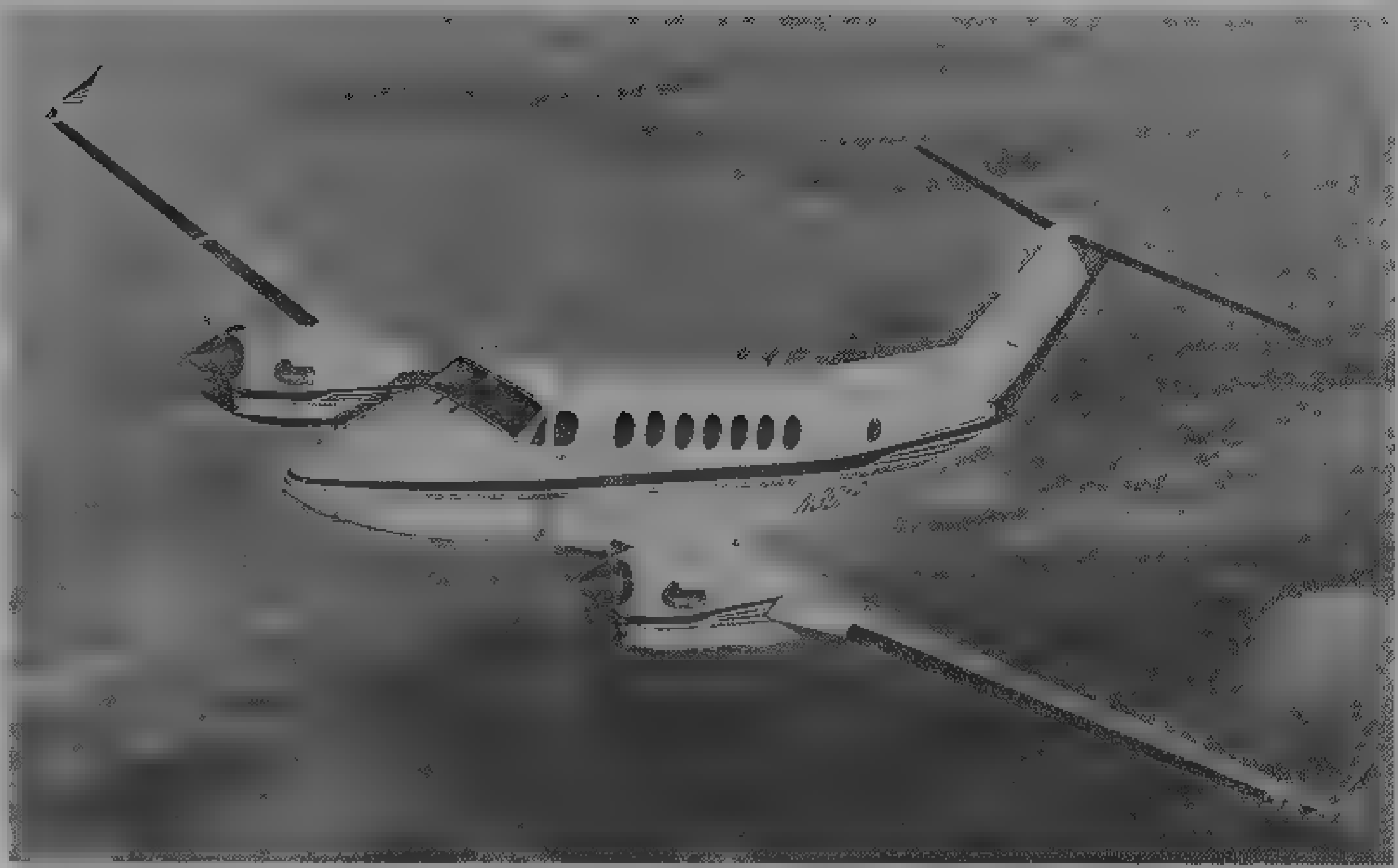
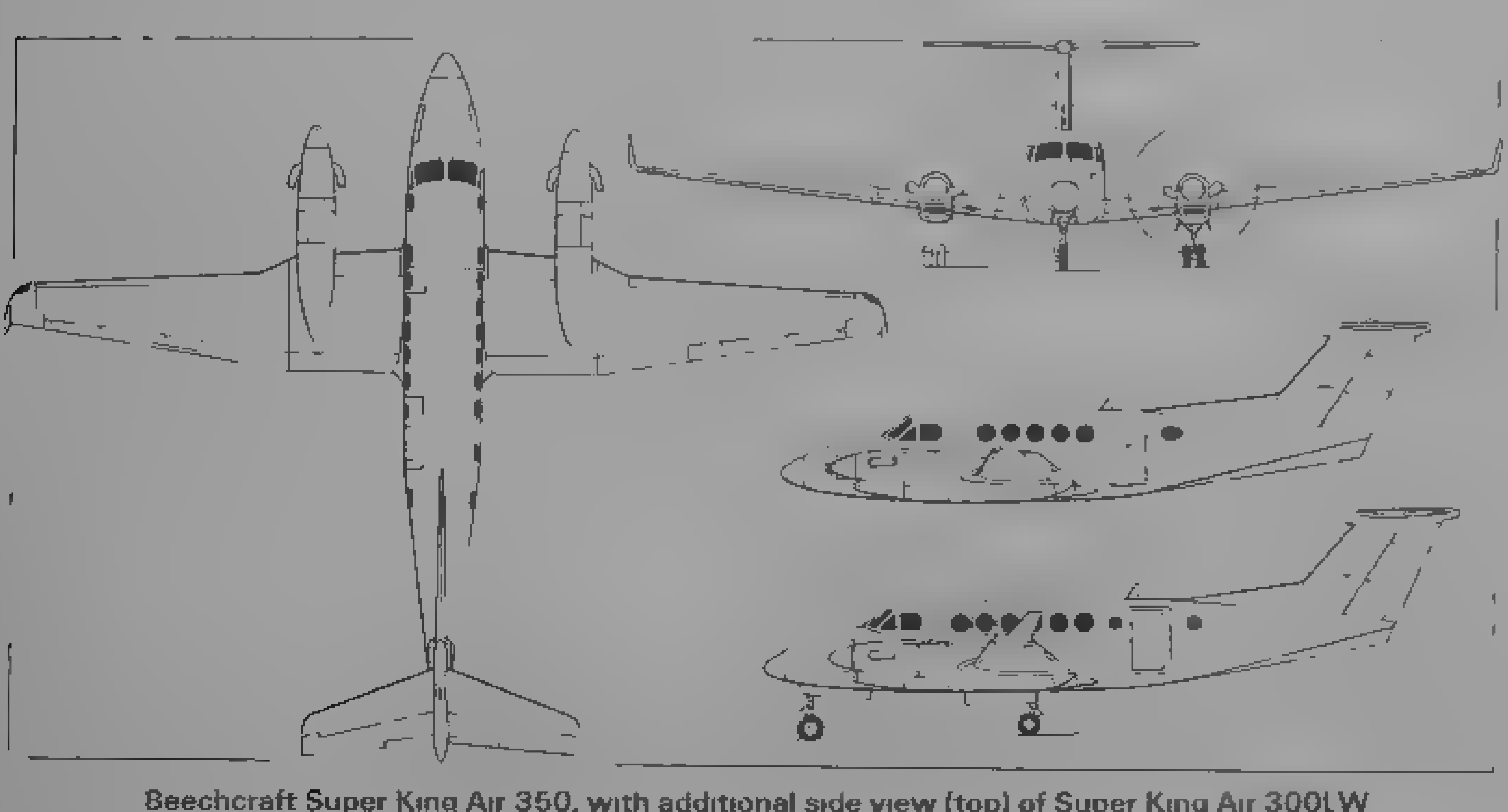


Beechcraft Super King Air 350 eight/12-passenger turboprop business aircraft

1995



Beechcraft Super King Air 350, with additional side view (top) of Super King Air 300LW (*Jane's/Dennis Punnett*)

1992

BEECHCRAFT 1900D

TYPE: Twin-turboprop regional transport, development of 1900C (1991-92 *Jane's*).

PROGRAMME: Announced at US Regional Airlines Association meeting 1989; prototype (N5584B) first flight 1 March 1990; certification to FAR Pt 23 Amendment 34 received March 1991, full certification with supplements received and deliveries (to Mesa Airlines) began, November 1991; replaced earlier 1900C in current product line.

CUSTOMERS: Total 45 delivered in 1993, 50 in 1994. 87 ordered during 1994, including Mesa Airlines (40 in November 1994 in addition to 78 previously ordered, for delivery during 1996-97); two delivered to Air Creebec of Canada in January 1995. Total 145 of D version delivered by April 1995.

COSTS: $4.775 million (1995).

DESIGN FEATURES: Flat floor with stand-up headroom; cabin volume increased by 28.5 per cent compared to 1900C; winglets add better hot and high performance; tailplane and fin swept, each tailplane carries small fin (tailet) on underside near tip; auxiliary horizontal fixed tail surface (stabilon) each side of rear fuselage improve centre of gravity range; twin ventral strakes improve directional stability and turbulence penetration; small horizontal vortex generator on fuselage ahead of wingroots.

Wing aerofoil NACA 23018 (modified) at root, 23012 (modified) at tip; dihedral 6°; incidence 3° 29′ at root, −1° 4′ at tip; no sweepback at quarter-chord.

FLYING CONTROLS: Mechanical, with automatic cable tensioner in aileron circuit; trim tabs in elevators, rudder and port aileron; primary and secondary controls routed separately to improve protection from possible engine-failure damage; single-slotted trailing-edge flaps in two sections on each wing.

STRUCTURE: Wing has continuous main spar with fail-safe structure riveted and bonded; fuselage pressurised and mainly bonded.

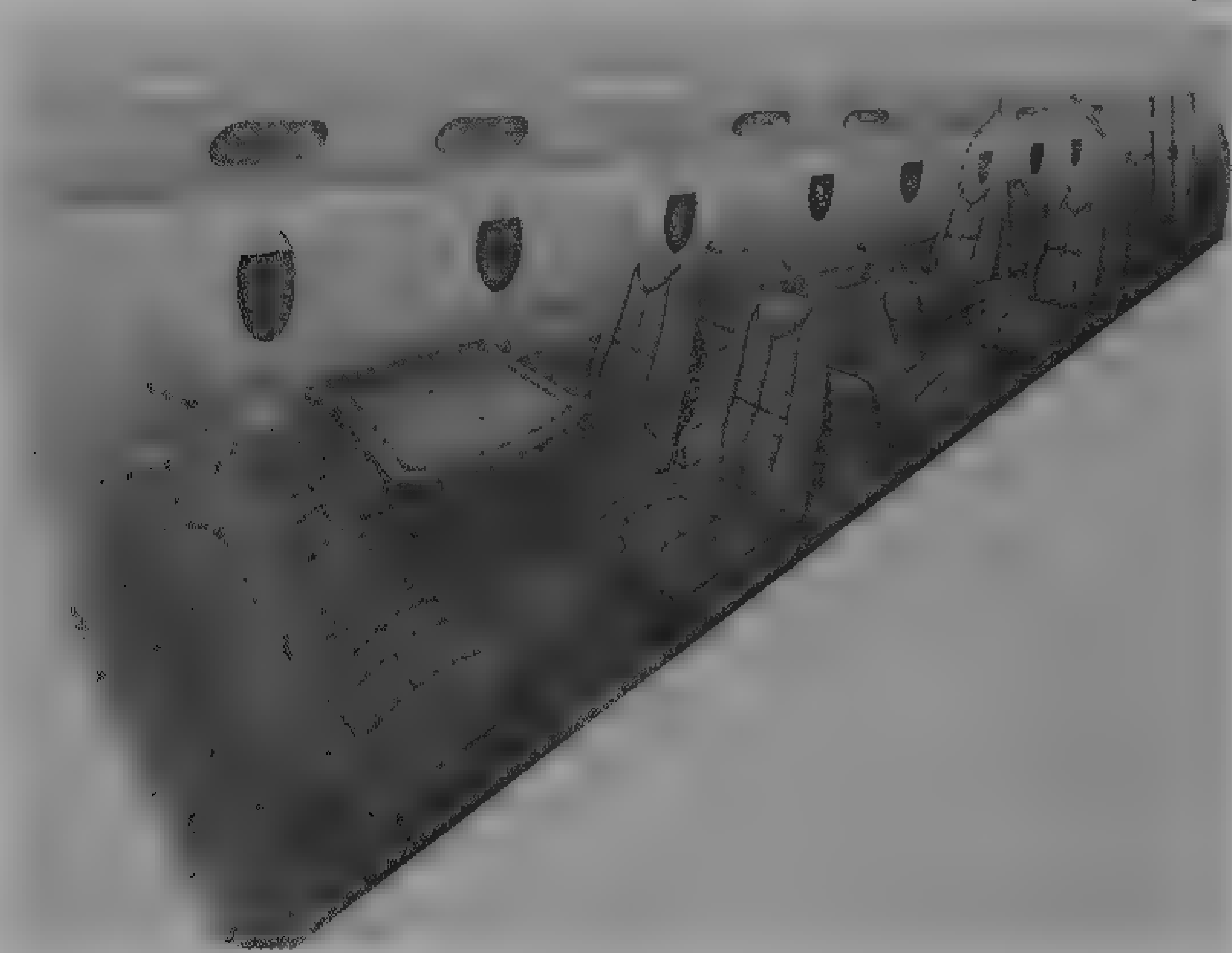
LANDING GEAR: Hydraulically retractable tricycle type; main units retract forward and nose unit rearward. Beech oleo-pneumatic shock-absorber in each unit. Twin Goodyear wheels on each main unit, size 6.50 × 10, with Goodyear tyres size 22 × 6.75-10 (tubeless, 10 ply rating), pressure 6.07 bars (88 lb/sq in). Goodyear steerable nosewheel size 6.60 × 8, with Goodyear tyres size 22 × 6.75-8 (tubeless, 10 ply rating), pressure 6.07 bars (88 lb/sq in). Multiple-disc hydraulic brakes. Optional Beech Hydro-Aire anti-skid units, power steering and brake de-icing. Ground turning radius based on wingtip clearance 12.55 m (41 ft 2 in).

POWER PLANT: Two Pratt & Whitney Canada PT6A-67D turboprops, each flat rated at 954 kW (1,279 shp) and driving a Hartzell four-blade constant-speed fully feathering reversible-pitch composite propeller. Wet wing fuel storage with a total capacity of 2,528 litres (668 US gallons; 556 Imp gallons), of which 2,519 litres (665 US gallons; 554 Imp gallons) usable. Refuelling point in each wing leading-edge, inboard of engine nacelle. Oil capacity (total) 29.5 litres (7.8 US gallons; 6.5 Imp gallons).

ACCOMMODATION: Crew of one (FAR Pt 91) or two (FAR Pt 135) on flight deck, with standard accommodation in cabin of commuter version for 19 passengers in single airline-standard seats on each side of centre aisle. Forward

Beechcraft 1900D of Canadian operator Air Creebec

1995



Optional executive interior for Beech 1900D

1995

carry-on baggage lockers, underseat baggage stowage, rear baggage compartment. Forward door, incorporating airstairs, on port side. Upward-hinged rear cargo door, also on port side. Three emergency exits over wing (two starboard, one port). Accommodation air conditioned, heated, ventilated and pressurised. Executive and corporate shuttle options seat between 10 and 18 passengers with options for forward and rear compartments, combination lavatory/passenger seat and two beverage bars at cabin compartment division. Club, double club and triple club seating optional. Customised interiors to customer's choice.

SYSTEMS: Bleed air cabin heating and pressurisation, maximum differential 0.35 bar (5.1 lb/sq in). Air cycle and vapour cycle air conditioning. Hydraulic system, pressure 207 bars (3,000 lb/sq in), for landing gear actuation. Electrical system includes two 300 A engine-driven starter/generators and one 34 Ah Ni/Cd battery. Constant flow oxygen system of 4.3 m³ (152 cu ft) capacity standard. Engine inlet screen anti-ice protection, exhaust heated engine inlet lips, fuel vent heating, electric propeller and windscreen de-icing systems standard. Brake de-icing optional. Pneumatic de-icing boots on wings, tailplane, tailets and stabilons.

AVIONICS: *Comms:* Collins Pro Line II digital technology radios, cabin briefer, cockpit voice recorder.

Flight: Dual flight directors, flight data recorder. Dual Loran optional.

Instrumentation: Collins EFIS-84 four-tube EFIS. Primary display consists of multicolour CRT panels, remote display processor unit and system control units. CRT displays provide conventional electronic attitude director indicator (EADI) and electronic horizontal situation indicator (EHSI) functions.

DIMENSIONS, EXTERNAL:

Wing span over winglets	17.67 m (57 ft 11⅝ in)
Wing chord: at root	2.18 m (7 ft 1⅝ in)
at tip	0.91 m (2 ft 11⅞ in)
Wing aspect ratio	10.85
Length overall	17.63 m (57 ft 10 in)
Height overall	4.72 m (15 ft 6 in)
Tailplane span	5.63 m (18 ft 5¾ in)
Wheel track	5.23 m (17 ft 2 in)
Wheelbase	7.25 m (23 ft 9⅖ in)
Propeller diameter	2.78 m (9 ft 1½ in)
Propeller ground clearance	0.35 m (1 ft 1⅜ in)
Distance between propeller centres	5.23 m (17 ft 2 in)
Passenger door: Height	1.63 m (5 ft 4⅕ in)
Width	0.64 m (2 ft 1⅕ in)
Cargo door: Height	1.45 m (4 ft 9 in)
Width	1.32 m (4 ft 4 in)
Emergency exits (each): Height	0.80 m (2 ft 7⅖ in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin, incl flight deck and rear baggage compartment:

Length	12.03 m (39 ft 5⅔ in)
Max width	1.37 m (4 ft 6 in)
Max height	1.80 m (5 ft 10¾ in)
Floor area	15.28 m² (164.5 sq ft)
Pressurised volume	26.0 m³ (918 cu ft)
Volume of passenger cabin	18.12 m³ (640 cu ft)
Baggage space, cabin: forward	0.48 m³ (17.0 cu ft)
underseat	0.91 m³ (32.0 cu ft)
rear	4.95 m³ (175 cu ft)

AREAS:

Wings, gross	28.80 m² (310.0 sq ft)
Ailerons (total)	1.67 m² (18.0 sq ft)
Trailing-edge flaps (total)	4.17 m² (44.9 sq ft)
Fin	4.86 m² (52.3 sq ft)
Rudder (incl tab)	1.40 m² (15.1 sq ft)
Tailets (total)	0.63 m² (6.8 sq ft)
Tailplane	6.32 m² (68.0 sq ft)
Elevator (incl tab)	1.79 m² (19.3 sq ft)
Stabilons (total)	1.44 m² (15.5 sq ft)

WEIGHTS AND LOADINGS:

Weight empty (typical)	4,815 kg (10,615 lb)
Max fuel (usable)	2,022 kg (4,458 lb)
Max baggage	939 kg (2,070 lb)
Max ramp weight	7,738 kg (17,060 lb)
Max T-O weight	7,688 kg (16,950 lb)
Max landing weight	7,530 kg (16,600 lb)
Max zero-fuel weight	6,804 kg (15,000 lb)
Max wing loading	266.9 kg/m² (54.68 lb/sq ft)
Max power loading	4.03 kg/kW (6.63 lb/shp)

PERFORMANCE (at max T-O weight except where indicated):

Max cruising speed at AUW of 6,804 kg (15,000 lb):

at 2,440 m (8,000 ft)	276 kts (511 km/h; 318 mph)
at 4,875 m (16,000 ft)	288 kts (533 km/h; 331 mph)
at 7,620 m (25,000 ft)	278 kts (515 km/h; 320 mph)

T-O speed, T-O flap setting: 105 kts (195 km/h; 121 mph) IAS

Approach speed at max landing weight: 117 kts (217 km/h; 135 mph)

Stalling speed at max T-O weight:

wheels and flaps up: 101 kts (187 km/h; 116 mph)

wheels down, T-O flap setting: 90 kts (167 km/h; 104 mph)

Stalling speed at max landing weight, wheels and flaps down: 84 kts (156 km/h; 97 mph)

Max rate of climb at S/L	800 m (2,625 ft)/min
Rate of climb at S/L, OEI	192 m (630 ft)/min
Service ceiling	10,058 m (33,000 ft)
Service ceiling, OEI	5,181 m (17,000 ft)
T-O field length, T-O flap setting	1,139 m (3,737 ft)

Landing from 15 m (50 ft) at max landing weight: 844 m (2,770 ft)

Range with 10 passengers, at long-range cruise power, with allowances for starting, taxi, T-O, climb and descent, with reserves (45 min hold at 1,525 m; 5,000 ft): 1,500 n miles (2,778 km; 1,726 miles)

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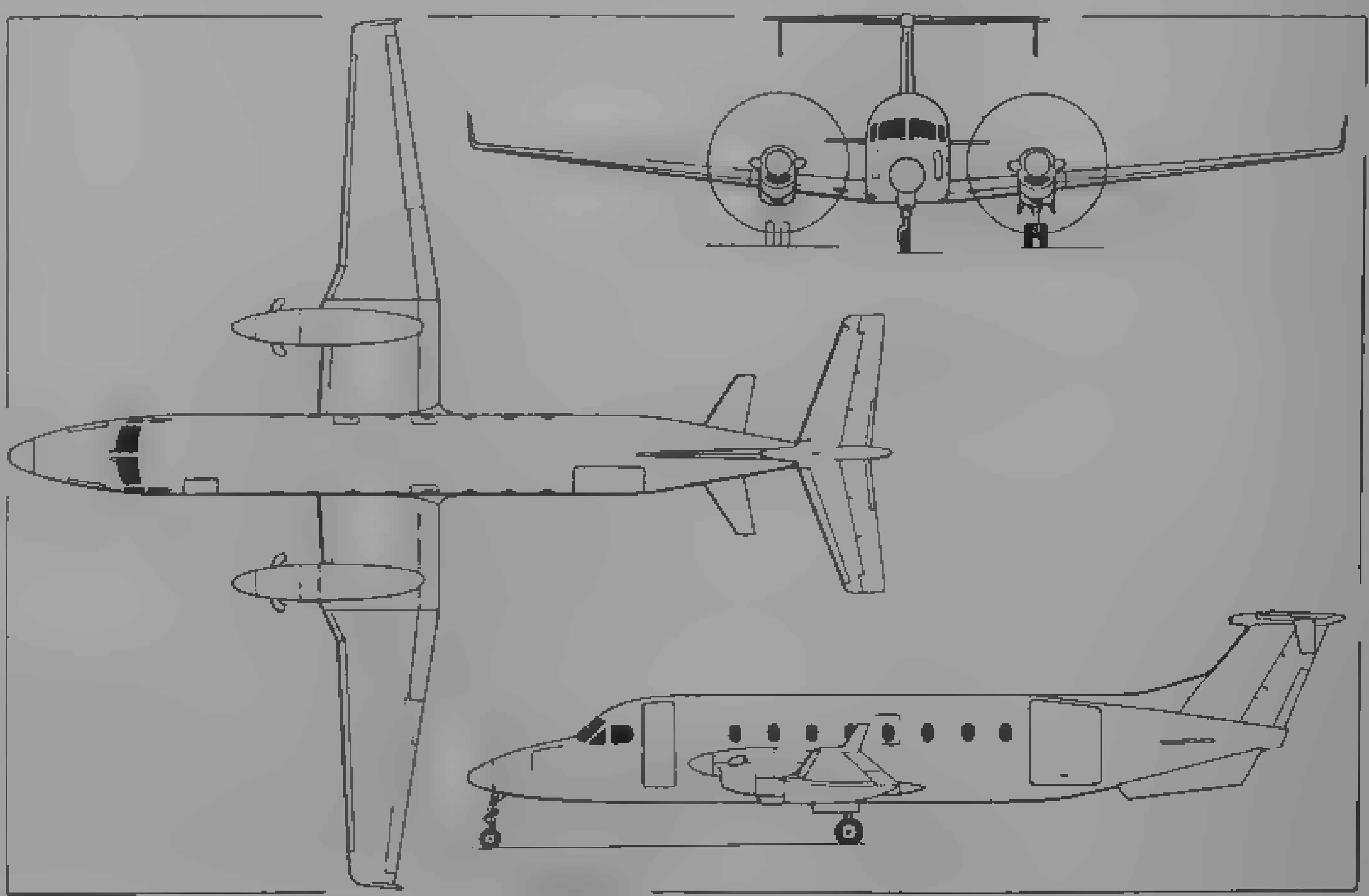

Beechcraft 1900D regional transport *(Jane's/Dennis Punnett)*

1992

BEECHCRAFT 2000 STARSHIP 1

TYPE: Twin-turboprop business aircraft.

PROGRAMME: Basic certification granted 14 June 1988, full certification for two-crew operation gained December 1989, followed by FAA crew determination study, single-pilot certification requiring functioning autopilot and flight management system granted May 1990; first flight of first full production aircraft (N2000S c/n NC 4) 25 April 1989, used for demonstration flights. Starship 2000A version announced at NBAA Convention October 1991, certificated by FAA April 1992. Production ceased early 1995 with 53rd aircraft; sales have not matched production. *Abbreviated entry follows, full details in 1994-95 and earlier Jane's.*

CURRENT VERSIONS: **Starship 2000.** Initial production model.

Starship 2000A. Improved version from c/n NC-21, six-passenger interior with increased passenger/baggage space and roomier aft toilet.

CUSTOMERS: Total of 31 in use by customers, including one in Europe, by early 1995, three delivered in 1994.

COSTS: $4.3 million (1995).

DESIGN FEATURES: Pusher turboprops with propellers aft of wing, almost cylindrical cabin section mounted far forward of engines and propellers to reduce cabin noise, engines mounted close together reduce yaw moment under asymmetric thrust.

FLYING CONTROLS: Pitch axis control by elevators on foreplane and elevons on main wing, directional control and yaw stabilisation through wingtip fins, called tipsails, and rudders, electrically actuated foreplane moved from 30° cruise sweep setting to 4° forward sweep as centre of lift moves when wing-mounted Fowler trailing-edge flaps are extended.

STRUCTURE: Wing is continuous tip to tip structure of Nomex honeycomb and graphite epoxy monocoque, semi-monocoque and honeycomb sandwich with spars bonded to upper and lower skin assemblies.

LANDING GEAR: Retractable tricycle type, hydraulically operated with emergency extension.

POWER PLANT: Two Pratt & Whitney Canada PT6A-67A turboprops, each flat rated at 895 kW (1,200 shp) and driving a McCauley five-blade fully feathering and reversible-pitch metal pusher propeller. Fuel, total usable capacity 2,139 litres (565 US gallons, 470 Imp gallons), contained in integral wing tanks with flush refuelling point in upper surface of each wing; optional tank, capacity 322 litres (85 US gallons, 71 Imp gallons) in each engine nacelle.

AVIONICS: Collins integrated avionics package comprising 12 colour and two monochrome CRT displays in 'all glass' cockpit.

DIMENSIONS, EXTERNAL:

Wing span (reference)	16.60 m (54 ft 4¾ in)
Wing aspect ratio	10.53
Foreplane span: sweptforward	7.82 m (25 ft 8 in)
sweptback	6.69 m (21 ft 11½ in)
Length overall	14.05 m (46 ft 1 in)
Fuselage: Length	13.67 m (44 ft 10 in)
Diameter (constant section)	1.78 m (5 ft 10 in)
Height overall	3.94 m (12 ft 11 in)

DIMENSIONS, INTERNAL:

Cabin, excl flight deck: Length	5.08 m (16 ft 8 in)
Max width	1.68 m (5 ft 6 in)
Max height	1.61 m (5 ft 3½ in)
Floor area	5.94 m² (64.0 sq ft)
Volume (between pressure bulkheads)	13.08 m³ (462 cu ft)

AREAS:

Wings, gross	26.09 m² (280.9 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, equipped	4,590 kg (10,120 lb)
Max baggage weight	311 kg (685 lb)
Max payload	1,125 kg (2,480 lb)
Max T-O weight	6,758 kg (14,900 lb)
Max zero-fuel weight	5,715 kg (12,600 lb)

PERFORMANCE (at max T-O weight, ISA, except where indicated):

Max limiting Mach number	0.60
Max cruising speed:	
at 7,620 m (25,000 ft)	335 kts (620 km/h, 385 mph)
at 10,670 m (35,000 ft)	318 kts (589 km/h, 366 mph)
Econ cruising speed at 11,280 m (37,000 ft)	279 kts (517 km/h, 321 mph)
Max rate of climb at S/L	838 m (2,748 ft)/min
Service ceiling	10,910 m (35,800 ft)
Range at 10,670 m (35,000 ft), max usable fuel, with reserves, econ cruise power	1,514 n miles (2,804 km, 1,742 miles)

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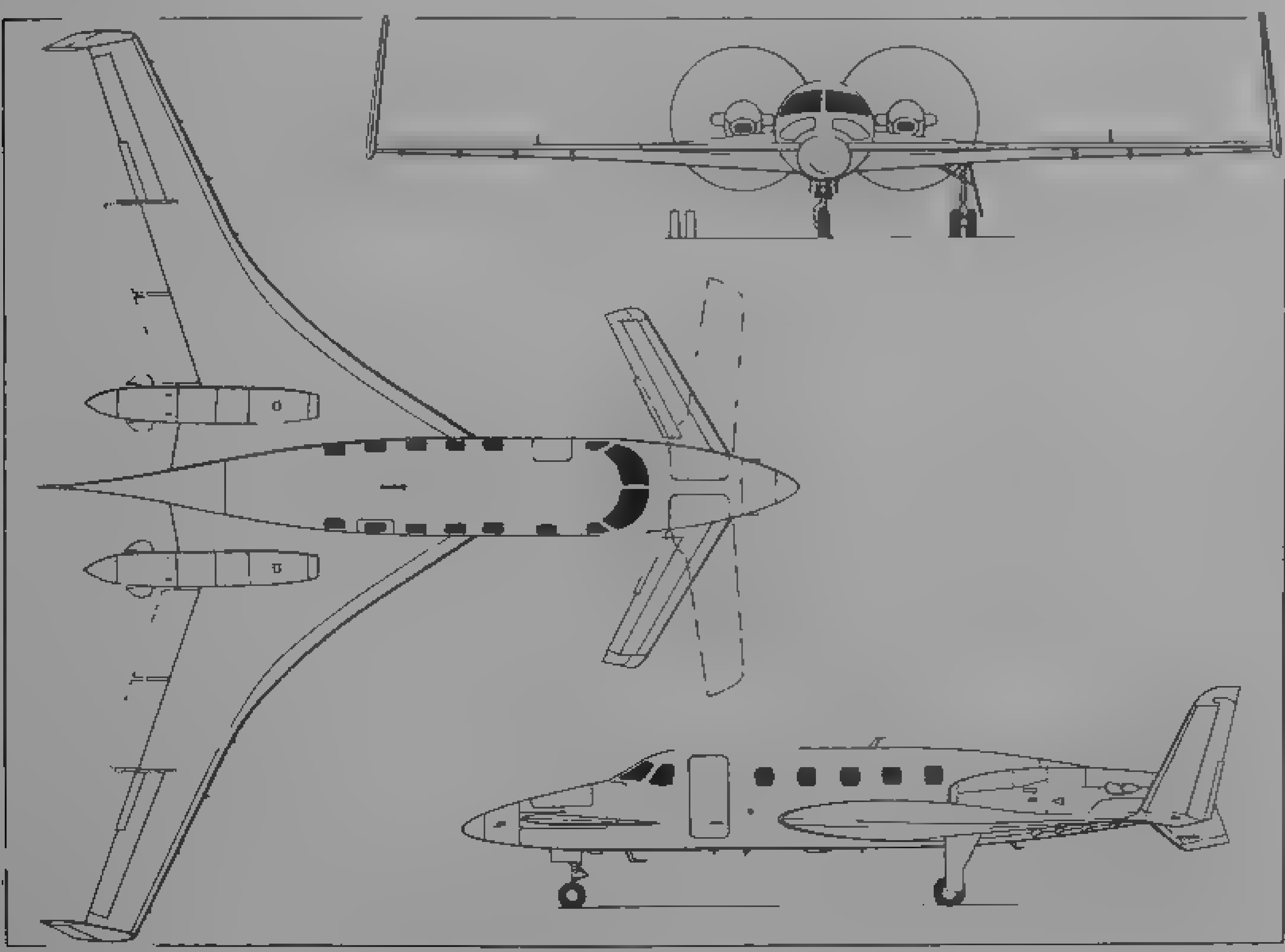
Beechcraft 2000A Starship (two 1,200 shp PT6A-67A turboprops) 1995



Beechcraft 2000A Starship 1 six/seven-passenger business aircraft (*Jane's/Dennis Punnett*) 1985

BEECHCRAFT 400A BEECHJET

US Air Force designation: T-1A Jayhawk

JASDF designation: T-400

TYPE: Twin-turbofan business aircraft and military trainer.

PROGRAMME: Beech acquired rights to Diamond II from Mitsubishi Heavy Industries and Mitsubishi Aircraft International, December 1985, made improvements to aircraft and renamed it Beechjet 400. First Beech assembled Beechjet rolled out 19 May 1986. During 1989, Beech moved entire manufacturing operation to Wichita. Announced new Beechjet 400A November 1989, featuring certification to 13,715 m (45,000 ft), larger and more comfortable cabin, all Collins avionics with digital EFIS, customer deliveries began November 1990.

CURRENT VERSIONS: **Beechjet 400:** Initial production version (64 built, see earlier *Jane's*), superseded by 400A.

Beechjet 400A. Announced at 1989 NBAA show, production 400A first flight 22 September 1989, FAA certification received 20 June 1990; deliveries began November 1990. Also certificated by July 1993 in Australia, Canada, France, Germany, Italy and UK; Brazilian and Pakistani type approval April 1994.

Beechjet T-1A Jayhawk. US Air Force selected McDonnell Douglas, Beechcraft and Quintron to supply Tanker Transport Training System (TTTS) on 21 February 1990, including requirement for 180 Beechjet 400Ts, valued at $755 million and designated T-1A Jayhawk, represents missionised version of 400A, sharing many components and characteristics with commercial counterpart; differences include cabin-mounted avionics, increased air conditioning capability, greater fuel capacity with single-point refuelling and strengthened windscreen and leading-edges for low-level birdstrike protection. First production aircraft (90-0400) delivered 17 January 1992; deliveries scheduled at approximately three per month until May 1997.

IOC for USAF Jayhawks January 1993, for Air Education and Training Command Specialised Undergraduate Pilot Training (SUPT) programme at Reese AFB (52nd FTS/64th FTW) where establishment of 41 received by October 1993. Second recipient was 99th FTS/12th FTW at Randolph AFB, Texas, where 16 delivered for instructor training in 1993, third unit was 86th FTS/47th FTW at Loughlin AFB, Texas, from late 1993 with training courses beginning May 1994; further two operators to be 71st FTW at Vance AFB, Oklahoma, (first aircraft December 1994) and 14th FTW at Columbus AFB, Mississippi, where training scheduled to begin in September 1995 and September 1996, respectively. T-1A used for training crews for KC-10, KC-135, C-5 and C-17. Jayhawk fleet had accumulated more than 52,000 flight hours by September 1994.

Beechjet 400T T-400: JASDF version, featuring thrust reversers, long-range inertial navigation and direction-finding systems, interior changes. Meets TC-X trainer requirement; three, three, two and one ordered in 1992-95, first (41-5051) delivered 31 January 1994.

CUSTOMERS: Total 104 civil 400A delivered by end of 1994. US Air Force 180 T-1As ordered, of which 28 delivered in 1992, 33 in 1993 and cumulative total of 100 by January 1995, 113 by June 1995. JASDF (nine ordered; six delivered in 1994, two in 1995 and one in 1996).

BEECHCRAFT T-1A JAYHAWK FUNDING

FY	Lot	Qty	First Aircraft	Delivery
89	—	1	89-0284	1991
90	1	14	90-0400	1992
91	2	28	91-0075	1992-93
92	3	34	92-0330	1993-94
93	4	36	93-0621	1994-95
94	5	35	94-0114	1995-96
95	6	32		1996-97
Total		180		

COSTS: Jayhawk programme cost $1.3 billion, Beech contracts for 180 aircraft, $755 million. Civil 400A quoted at $5.4 million in early 1995.

DESIGN FEATURES: Swept wing has computer designed three-dimensional Mitsubishi MAC510 aerofoil thickness/chord ratio 13.2 per cent at root, 11.3 per cent at tip; dihedral 2° 30'; incidence 3° at root, -3° 30' at tip; sweepback 20° at quarter-chord. Features of Beechjet 400A include increased payload and certificated ceiling, greater cabin volume achieved by moving rear-fuselage fuel tank forward under floor (balanced by moving toilet to rear of cabin), improved soundproofing, and emergency door moved one window forward to facilitate forward club seating.

Beechcraft T-1A Jayhawk Tanker Transport Training System aircraft

1995

T-1A Jayhawk features include student pilot in left seat, instructor on right and pupil/observer behind instructor, more bird-resistant windscreen and leading-edges, fewer cabin windows, strengthened wing carry-through structure and engine attachment points to meet low-level flight stresses, rails for four passenger seats in cabin for personnel transport, avionics relocated from nose to rack in cabin to facilitate nose installation of air conditioning, emergency door moved forward to position opposite main cabin door to allow straight-through egress, improved brakes, additional fuel tank, single-point pressure refuelling, Rockwell Collins five-tube EFIS, digital autopilot, weather radar, central diagnostic and maintenance system, Tacan with air-to-air capability.

FLYING CONTROLS: Variable incidence tailplane and elevators for pitch axis, lateral control by small ailerons and almost full semi-span, narrow chord spoilers used also as airbrakes and lift dumpers, narrow chord Fowler type flaps, double-slotted inboard and single-slotted outboard, occupy most of trailing-edges and are hydraulically actuated, mid-span leading-edge fences on wing, small horizontal strakes on fuselage at base of fin, small ventral fin.

STRUCTURE: Wings include integrally machined metal upper and lower skins joined to two box spars forming integral fuel tank, tailplane and fin similar. Wing, fuselage and tail unit certificated fail-safe for unlimited life (with periodic inspections and maintenance).

LANDING GEAR: Retractable tricycle type, with single wheel and oleo-pneumatic shock-absorber on each unit. Hydraulic actuation, controlled electrically. Emergency free-fall extension. Nosewheel, which is steerable by rudder pedals, retracts forward, mainwheels retract inward into fuselage. Goodyear wheels and tyres, Aircraft Braking Systems brakes.

POWER PLANT: Two Pratt & Whitney Canada JT15D-5 turbofans, each rated at 13.19 kN (2,965 lb st) for take-off. Rohr thrust reversers optional on 400A, but not fitted to T-1A. Total usable fuel capacity: 400A 2,775 litres (733 US gallons, 610.3 Imp gallons); 400T 2,998 litres (792 US gallons, 656 Imp gallons). One refuelling point in top of each wing, and one in rear fuselage for fuselage tank, capacity 1,158 litres (305.8 US gallons, 254.6 Imp gallons). (T-1A, single-point refuelling.) Oil capacity 7.7 litres (2 US gallons; 1.7 Imp gallons).

ACCOMMODATION: Crew of two on flight deck of 400A, T-1A has seats for trainee pilot, co-pilot/instructor and observer. Standard double club layout of 400A seats eight passengers in pressurised cabin, with eight tracking, reclining seats in facing pairs, each with integral headrest, armrest and shoulder harness. Fold-out writing table between each pair of seats. Private flushing lavatory at rear with sliding doors and optional lighted vanity unit and hot water supply. With seat belts, this compartment can serve as an additional passenger seat. Interior options include substitution of carry-on baggage compartment, volume 0.34 m³ (12.0 cu ft), for one of the forward club seats, and hot and cold service refreshment centre with integral stereo entertainment system. Independent temperature control for flight deck and cabin heating systems standard. In-flight telephone optional. Rear baggage compartment with external access; capacity 204 kg (450 lb). Optional four passenger seats in main cabin of T-1A. The 400T has an aft club arrangement with swivel chairs.

SYSTEMS: Pressurisation system, with normal differential of 0.63 bar (9.1 lb/sq in). Back-up pressurisation system, using engine bleed air, for use in emergency. Hydraulic system, pressure 103.5 bars (1,500 lb/sq in), for actuation of flaps, landing gear and other services. Each variable volume output engine-driven pump has a maximum flow rate of 14.76 litres (3.9 US gallons, 3.25 Imp gallons)/min and one pump can actuate all hydraulic systems. Reservoirs capacity 4.16 litres (1.1 US gallons, 0.9 Imp gallon), pressurised by filtered engine bleed air at 1.03 bars (15 lb/sq in). All systems are, wherever possible, of modular conception; for example, entire hydraulic installation can be removed as a single unit. Stick shaker as back-up stall warning device.

AVIONICS: *Instrumentation:* Standard avionics include pilot's integrated Collins Pro Line 4 EFIS featuring three-tube (optional four-tube) colour CRT primary flight display (PFD) and multifunction display (MFD) units mounted side by side, and control/display unit. PFD displays airspeed, altitude, vertical speed, flight director, attitude and horizontal situation information, while MFD displays navigation, radar, map, checklist and fault annunciation information. Smaller, single or dual CRTs mounted on central console function as independent navigation sensor displays or back-up displays for main CRTs. EFIS installation features strapdown attitude/heading referencing system, electronic map navigation display, airspeed trend information and V-speeds on Mach airspeed display, and solid state Doppler turbulence detection radar.

DIMENSIONS, EXTERNAL:

Wing span	13.25 m (43 ft 6 in)
Wing aspect ratio	7.83
Length overall	14.75 m (48 ft 5 in)
Fuselage: Length	13.15 m (43 ft 2 in)
Max width	1.68 m (5 ft 6 in)
Max depth	1.85 m (6 ft 1 in)
Height overall	4.24 m (13 ft 11 in)
Tailplane span	5.00 m (16 ft 5 in)
Wheel track	2.84 m (9 ft 4 in)
Wheelbase	5.86 m (19 ft 3 in)
Crew/passenger door: Height	1.27 m (4 ft 2 in)
Width	0.71 m (2 ft 4 in)

DIMENSIONS, INTERNAL:

Cabin:	
Max length, incl flight deck	6.37 m (20 ft 11 in)
Length, excl flight deck	4.78 m (15 ft 8 in)
Max width	1.50 m (4 ft 11 in)
Max height	1.45 m (4 ft 9 in)
Volume: incl flight deck	11.32 m³ (400 cu ft)
excl flight deck	8.64 m³ (305 cu ft)
Baggage compartment volume	0.75 m³ (26.4 cu ft)

AREAS:

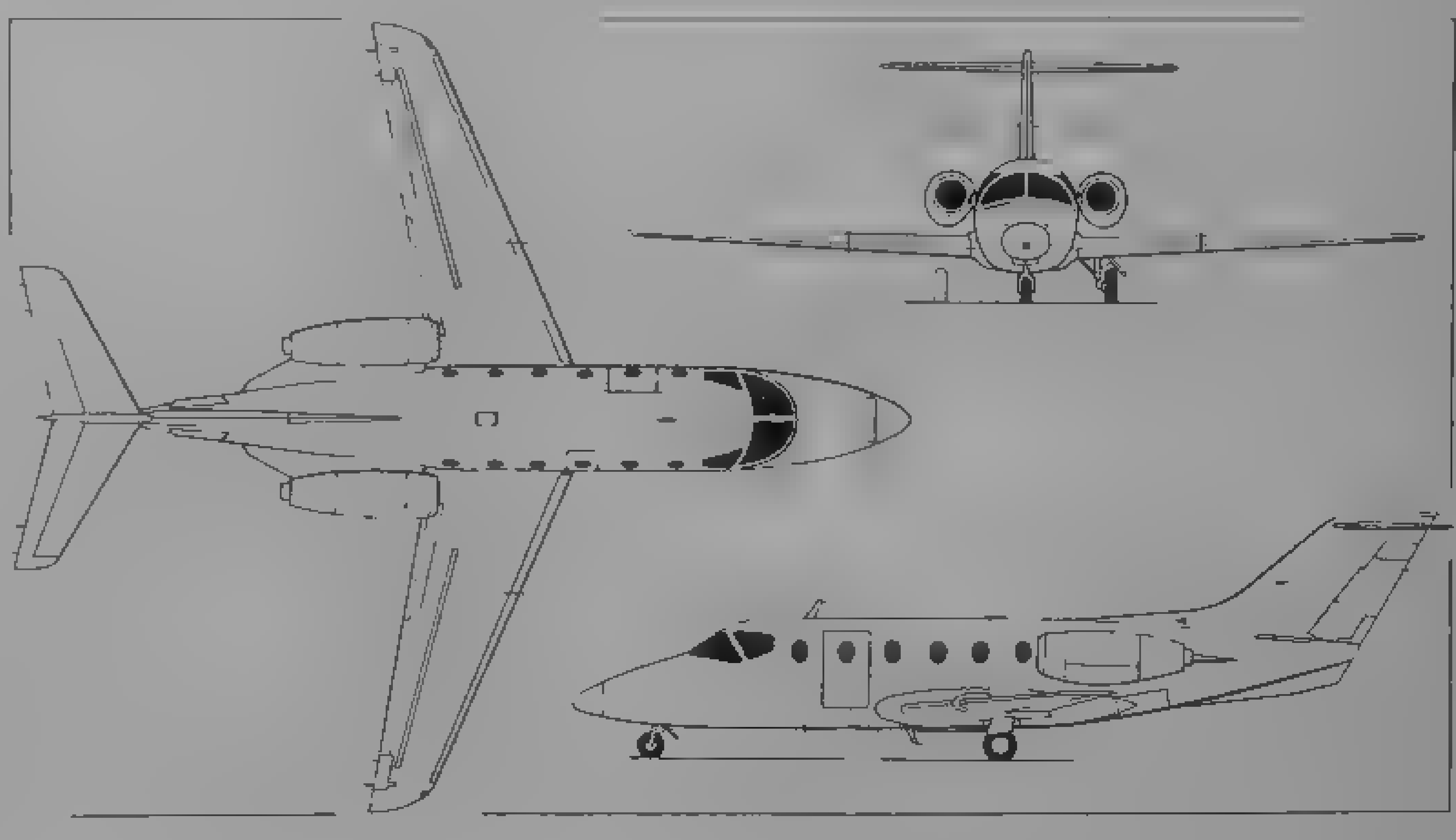
Wings, net	22.43 m² (241.4 sq ft)
Trailing-edge flaps (total)	4.22 m² (45.4 sq ft)
Spoilers (total)	0.57 m² (6.2 sq ft)
Fin, incl dorsal fin	5.91 m² (63.6 sq ft)
Rudder, incl yaw damper	0.99 m² (10.7 sq ft)
Tailplane	5.25 m² (56.5 sq ft)
Elevators, incl tab	1.55 m² (16.7 sq ft)

WEIGHTS AND LOADINGS:

Basic operating weight, incl crew, avionics and interior fittings	4,833 kg (10,655 lb)
Max fuel weight	2,228 kg (4,912 lb)
Max T-O weight	7,303 kg (16,100 lb)
Max ramp weight	7,393 kg (16,300 lb)
Max zero-fuel weight	5,896 kg (13,000 lb)
Max landing weight	7,121 kg (15,700 lb)
Max power loading	284.26 kg/kN (2.78 lb/lb st)

PERFORMANCE (at max T-O weight, ISA, except where indicated):

Max limiting Mach number	0.78
Max level speed at 8,230 m (27,000 ft)	468 kts (867 km/h, 539 mph)
Typical cruising speed at 12,500 m (41,000 ft)	450 kts (834 km/h, 518 mph)



Beechcraft Beechjet 400A (two P&WC JT15D-5 turbofans) *(Jane's/Dennis Punnett)*

1989

Long-range cruising speed at 12,500 m (41,000 ft)
392 kts (726 km/h, 451 mph)
Stalling speed, flaps down, idling power
93 kts (173 km/h; 107 mph) CAS
Max operating altitude: 400A 13,715 m (45,000 ft)
T-1A/T400 12,500 m (41,000 ft)
FAA (FAR 25) T-O to 10.7 m (35 ft), at S/L, ISA
1,159 m (3,802 ft)
FAA landing distance from 15 m (50 ft) at S/L, ISA, max landing weight 1,072 m (3,514 ft)
Range with four passengers, max fuel, ISA, zero wind, with allowance for climb and descent, long range cruise power, NBAA VFR reserves
1,805 n miles (3,343 km, 2,077 miles)

UPDATED

RAYTHEON PD 374

TYPE: Six-seat twin-turbofan business aircraft.

PROGRAMME: Design started early 1994 and approved early 1995; brief details revealed June 1995; to be launched at NBAA convention September 1995 to compete with Cessna CitationJet. First type to have Raytheon brand name.

DESIGN FEATURES: Sweptback low wing, rear-mounted engines; T tail.

FLYING CONTROLS: Fly-by-light system with fibre optic signalling.

STRUCTURE: Composites fuselage, all-metal wing.

LANDING GEAR: Retractable tricycle type.

POWER PLANT: Two 10.23 kN (2,300 lb st) class Williams International FJ44-2 turbofans, pylon mounted on sides of rear fuselage.

Beechjet 400As used by UND Aerospace for training China Airlines pilots

1995

AVIONICS: Collins EFIS suite, including flat panel displays.

NEW ENTRY

ROBINSON

ROBINSON HELICOPTER COMPANY

2901 Airport Drive, Torrance, California 90505
Telephone: 1 (310) 539 0508
Fax: 1 (310) 539 5198
Telex: 18 2554

PRESIDENT: Franklin D. Robinson

MARKETING DIRECTOR: Tim Goetz

New 24,620 m² (265,000 sq ft) plant for R44 production completed 1994; planned to work up to 800 employees when R44 in full production.

UPDATED

ROBINSON R22 BETA

TYPE: Two-seat light helicopter.

PROGRAMME: Design began 1973, first flight 28 August 1975, first flight of second R22 early 1977, FAA certification 16 March 1979, UK certification June 1981, deliveries began October 1979; R22 Alpha certificated October 1983, R22 Beta 5 August 1985.

CURRENT VERSIONS: **R22 Beta**: Standard version from c/n 501 onwards; increased horsepower; 89 delivered in 1994. *Main description applies to this version except where indicated.*

R22 Mariner: Has floats and ground wheels; first delivered for operation from tuna fishing boats off Mexico and Venezuela; 18 delivered in 1994.

R22 Police: Special communications and other equipment including removable port-side controls, 70 A alternator, searchlight, loudspeaker, siren and transponder.

R22 IFR: Equipped with flight instruments and radio to allow training for helicopter IFR flying (see under Avionics); four delivered in 1994.

External load R22: Hook kit certificated for 181 kg (400 lb) produced by Classic Helicopter Corporation, Boeing Field, Seattle, Washington; weighs 2.3 kg (5 lb); used for slung load training; never-exceed speed with load in place limited to 75 knots (139 km/h, 86 mph).

R22 Agricultural: Equipped with Apollo Helicopter Services DTM 3 spray system, FAA approved December 1991. Low-drag belly tank contains 151 litres (40 US gallons; 33.3 Imp gallons); boom length 7.31 m (24 ft 0 in); tank frame attached to landing gear mounting points with four bolts and wing nuts; installation of entire system requires no tools and can be completed by one person in approximately 5 minutes. System cost $6,000 (1992) including installation kit.

CUSTOMERS: Total production 2,506 by early 1995, including 222 delivered in 1992, 135 in 1993 and 111 (89 Betas, 18 Mariners and four IFRs) in 1994. Further 31 ordered January 1995.

COSTS: $115,850 for basic R22 Beta.

DESIGN FEATURES: Horizontally mounted piston engine drives transmission through multiple V belts and sprag-type overrunning clutch; main and tail gearboxes use spiral bevel gears; maintenance-free flexible couplings of proprietary manufacture used in both main and tail rotor drives. Two-blade semi-articulated main rotor, with tri-hinged underslung rotor head to reduce blade flexing, rotor vibration and control force feedback, and an elastic teeter hinge stop to prevent blade-boom contact when starting or stopping rotor in high winds; blade section NACA 63-015 (modified); two-blade tail rotor on port side; rotor brake standard.

FLYING CONTROLS: All mechanical; cyclic stick mounted between pilots with handgrips on swing arm for comfortable access from either seat.

STRUCTURE: All-metal bonded blades with stainless steel spar and leading-edge, light alloy skin and light alloy honeycomb filling; cabin section of steel tube with metal and plastics skinning; fail monocoque tailboom.

LANDING GEAR: Welded steel tube and light alloy skid landing gear, with energy absorbing crosstubes. Twin float/skid gear on Mariner with additional tailplane surface on lower tip of fin.

POWER PLANT: One 119 kW (160 hp) Textron Lycoming O-320-B2C flat-four engine (derated to 97.5 kW, 131 hp for T-O), mounted in the lower rear section of the main fuselage, with cooling fan. Light alloy main fuel tank in upper rear section of the fuselage on port side, usable capacity 72.5 litres (19.2 US gallons; 16 Imp gallons). Optional auxiliary fuel tank, capacity 39.75 litres (10.5 US gallons, 8.7 Imp gallons). Oil capacity 5.7 litres (1.5 US gallons, 1.25 Imp gallons).

ACCOMMODATION: Two seats side by side in enclosed cabin, with inertia reel shoulder harness. Curved two-panel windscreen. Removable door, with window, on each side. Police version has observation doors with bubble windows, which are also available as options on other models. Baggage space beneath each seat. Cabin heated and ventilated.

SYSTEMS: Electrical system, powered by 12 V DC alternator, includes navigation, panel and map lights, dual landing lights, anti-collision light and battery. Second battery optional.

AVIONICS: *Comms*: Bendix/King KY 197 VHF com radio, Bendix/King KCS 55A HSI, KR 87 ADF, KX 165 nav/com digital display radio, KT 76A transponder.

Flight: KR 22 marker beacon receiver, KN 53 nav receiver, Apollo II Bendix/King or Northstar Loran C, and KR 87 ADF. IFR trainer avionics include Bendix/King KN 63 DME.

Instrumentation: AIM 305-1 ALD VF artificial horizon, Bendix/King KEA 129 encoding altimeter, Astronautics DC turn indicator, rate of climb indicator, sensitive altimeter, quartz clock, hour meter, low rotor rpm warning horn, temperature and chip warning lights for main gearbox and chip warning light for tail gearbox.

DIMENSIONS, EXTERNAL:

Main rotor diameter	7.67 m (25 ft 2 in)
Tail rotor diameter	1.07 m (3 ft 6 in)
Main rotor blade chord	0.18 m (7.2 in)
Distance between rotor centres	4.39 m (14 ft 5 in)

Robinson R22 Mariner

1995

Robinson R22 Beta two-seat helicopter

1995

Length overall (rotors turning) 8.76 m (28 ft 9 in)
Fuselage: Length 6.30 m (20 ft 8 in)
Max width 1.12 m (3 ft 8 in)
Height overall 2.67 m (8 ft 9 in)
Skid track 1.93 m (6 ft 4 in)

DIMENSIONS, INTERNAL:
Cabin: Max width 1.12 m (3 ft 8 in)

AREAS:
Main rotor blades (each) 0.70 m² (7.55 sq ft)
Tail rotor blades (each) 0.037 m² (0.40 sq ft)
Main rotor disc 46.21 m² (497.4 sq ft)
Tail rotor disc 0.89 m² (9.63 sq ft)
Fin 0.21 m² (2.28 sq ft)
Stabiliser 0.14 m² (1.53 sq ft)

WEIGHTS AND LOADINGS:
Weight empty (without auxiliary fuel tank) 379 kg (835 lb)
Fuel weight: standard 52 kg (115 lb)
auxiliary 28.6 kg (63 lb)
Max T-O and landing weight 621 kg (1,370 lb)
Max zero-fuel weight 569 kg (1,255 lb)
Max disc loading 13.43 kg/m² (2.75 lb/sq ft)

PERFORMANCE (at max T-O weight, ISA):
Never-exceed speed (VNE) without sling load 102 kts (190 km/h, 118 mph)
Max level speed 97 kts (180 km/h, 112 mph)
Cruising speed, 75% power at 2,440 m (8,000 ft) 96 kts (177 km/h, 110 mph)
Econ cruising speed 82 kts (153 km/h, 95 mph)
Max rate of climb at S/L 366 m (1,200 ft)/min
Rate of climb at 1,525 m (5,000 ft) 323 m (1,060 ft)/min
Service ceiling 4,265 m (14,000 ft)
Hovering ceiling IGE 2,125 m (6,970 ft)
Range with auxiliary fuel and max payload, no reserves 319 n miles (592 km; 368 miles)
Endurance at 65% power, auxiliary fuel, no reserves 3 h 20 min

UPDATED

ROBINSON R44 ASTRO

TYPE: Four-seat light helicopter.

PROGRAMME: Development began 1986; first flight 31 March 1990; prototype (N44RH) and second aircraft had flown more than 200 hours by end January 1992, first flight of third R44 March 1992, certification completed 10 December 1992.

CUSTOMERS: $15,000 deposits for 36 taken on first day of sales 22 March 1992, orders 180 in early 1994; 31 delivered in 1993, 106 in 1994. Further 24 ordered in January 1995.

COSTS: Standard price $255,000 (1995).

DESIGN FEATURES: New design incorporating some proven concepts of R22, designed to requirements of FAR Pt 27; features for comfort and safety include electronic throttle governor to reduce pilot workload by controlling rotor and engine rpm during normal operations, rotor brake, advanced warning devices, automatic clutch engagement to simplify and reduce start-up procedure and reduce chance of overspeed, T-bar cyclic control, and crashworthy features including energy-absorbing landing gear and lap/shoulder strap restraints designed for high forward g loads. High reliability and low maintenance, patented rotor design with tri-hinge (see R22), low noise levels.

FLYING CONTROLS: Conventional, with Robinson central cyclic stick; rpm governor; rotor brake standard; left-hand collective lever and pedals removable.

LANDING GEAR: Fixed skids.

POWER PLANT: One 194 kW (260 hp) Textron Lycoming O-540 flat-six engine, derated to 165 kW (225 hp) at T-O, 153 kW (205 hp) continuous.

ACCOMMODATION: Four persons seated 2 + 2. Concealed baggage compartments. Dual controls.

SYSTEMS: Heating and ventilation.

AVIONICS: Wide selection of optional avionics and instruments.

Comms: Bendix/King KY 197 VHF radio with intercom for all four occupants.

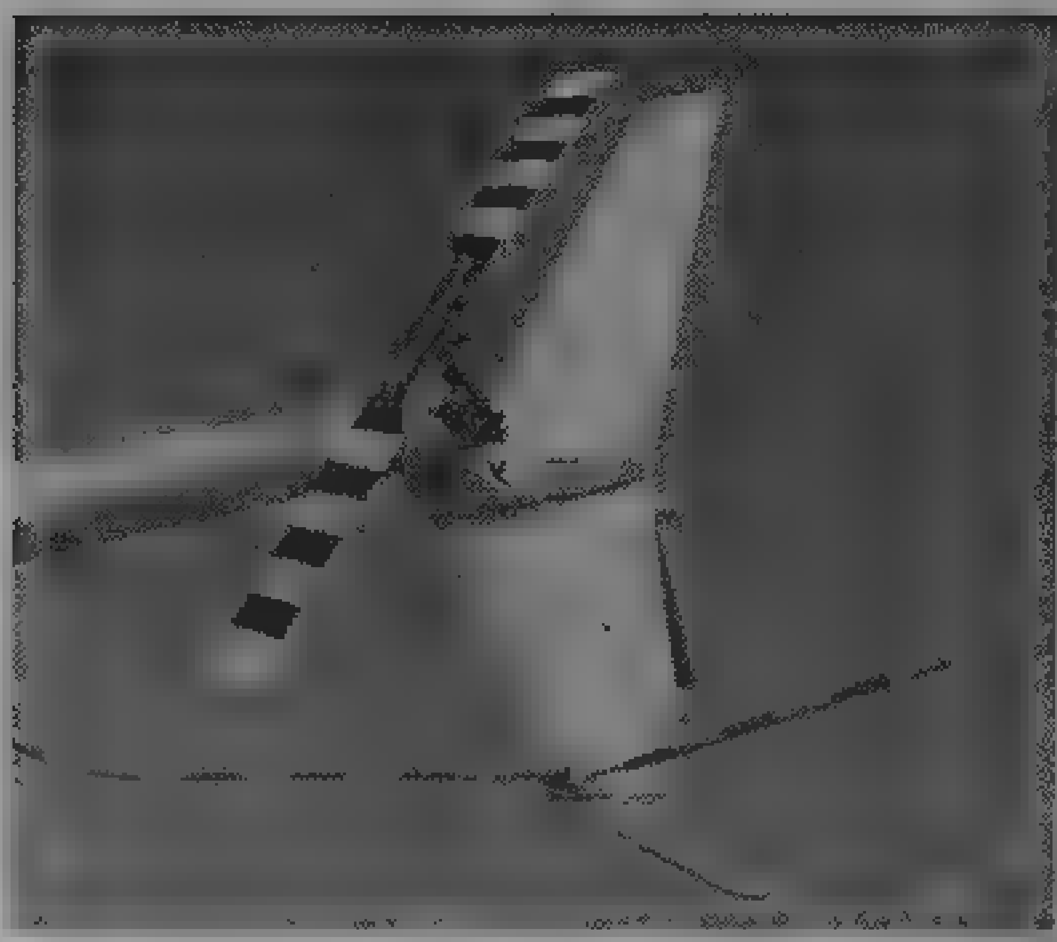
EQUIPMENT: Standard equipment includes auxiliary fuel system, heater.

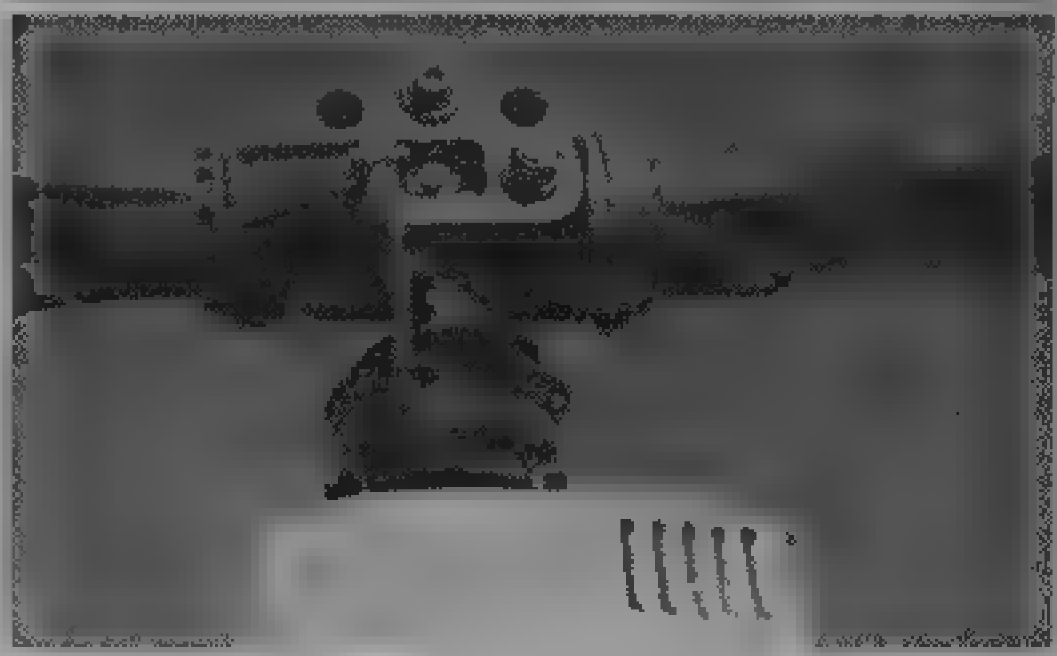
DIMENSIONS, EXTERNAL:
Main rotor diameter 10.06 m (33 ft 0 in)
Tail rotor diameter 1.47 m (4 ft 10 in)
Height overall 3.28 m (10 ft 9 in)
Skid track 2.18 m (7 ft 2 in)

DIMENSIONS, INTERNAL:
Cabin: Max width 1.28 m (4 ft 2½ in)

AREAS:
Main rotor disc 79.46 m² (855.3 sq ft)
Tail rotor disc 1.70 m² (18.35 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, standard 635 kg (1,400 lb)
Fuel weight: standard 86 kg (190 lb)
auxiliary 50 kg (110 lb)
Max T-O and landing weight 1,088 kg (2,400 lb)
Max disc loading 13.70 kg/m² (2.81 lb/sq ft)



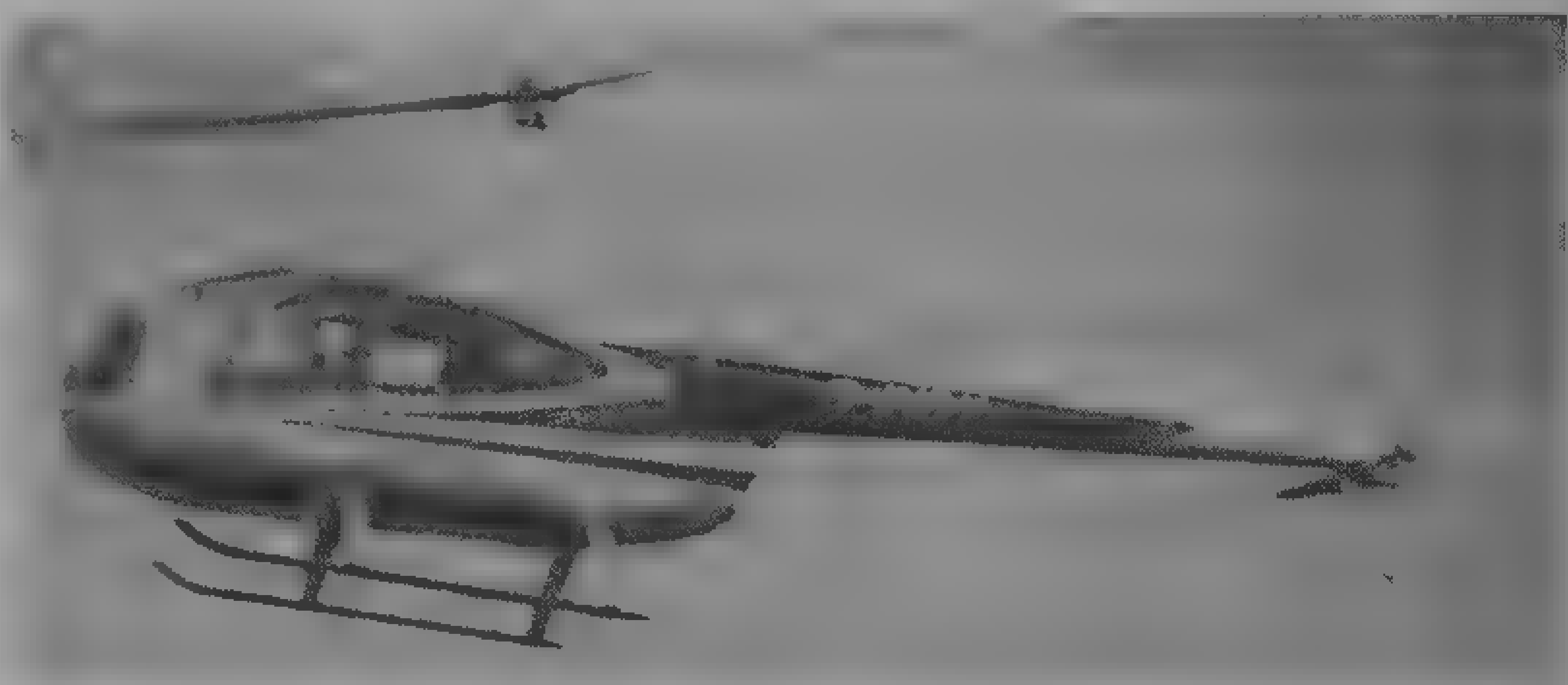


Robinson R44 main and tail rotors. Tri-hinged main rotor eliminates lag hinges, dampers and hydraulic struts

1994

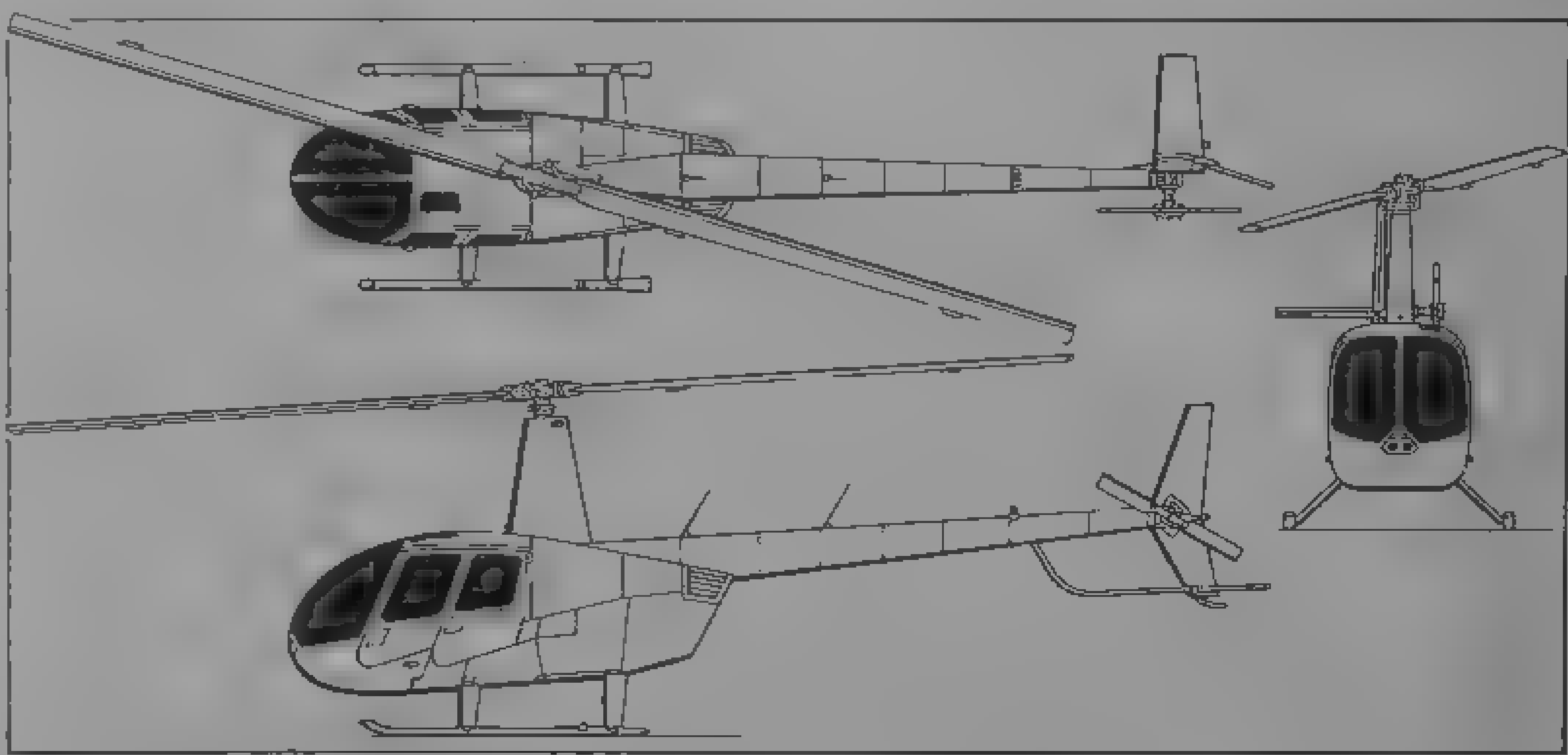
PERFORMANCE (at max T-O weight, ISA, except where indicated):
Cruising speed, 75% power 113 kts (209 km/h, 130 mph)
Max rate of climb at S/L 305 m (1,000 ft)/min
Service ceiling 4,270 m (14,000 ft)
Hovering ceiling: IGE 1,860 m (6,100 ft)
OGE 1,370 m (4,500 ft)
Max range, no reserves approx 347 n miles (643 km, 400 miles)

UPDATED



Robinson R44 four-seat light helicopter

1995



Robinson R44 light helicopter (one Textron Lycoming O-540 flat-six) *(Jane's/Mike Keep)*

1993

ROCKWELL

ROCKWELL CORPORATION

2201 Seal Beach Boulevard, PO Box 4250, Seal Beach, California 90740-8250
Telephone: 1 (310) 797 3311
CHAIRMAN AND CEO: Donald R. Beall
PRESIDENTS AND COO: Donald Davis
EXECUTIVE VICE-PRESIDENTS:
Kent M. Black
Sam F. Iacobellis

North American Aviation founded 1928 and manufactured aircraft from 1934, merged with Rockwell Standard Corporation of Pittsburgh, Pennsylvania (which manufactured Aero Commander aircraft), 22 September 1967, forming North American Rockwell Corporation, became Rockwell International Corporation in 1973, present name adopted March 1994. Four major businesses comprise aerospace, automotive, electronics and graphics. Aerospace includes production of military aircraft, manned and unmanned space systems, rocket engines, advanced space-based surveillance systems, and high-energy laser and other directed energy programmes. Electronics includes industrial automation equipment and systems, avionics products and systems, and related communications technologies primarily used in commercial and military aircraft; commercial telecommunications systems and products, and defence electronics systems and products for precision guidance and control, for tactical weapons and for command, control, communications and intelligence.

VERIFIED

ROCKWELL NORTH AMERICAN AIRCRAFT MODIFICATION DIVISION

3370 Miraloma Avenue, Anaheim, California 92803-4921
Telephone: 1 (714) 762 3327
Fax: 1 (714) 762 4200
PRESIDENT: John J. Pierro
VICE-PRESIDENT AND GENERAL MANAGER: John Vaswani

Palmdale Facility
2825 East Avenue P, Palmdale, California 93550
Telephone: 1 (805) 273 6000
VICE-PRESIDENT AND GENERAL MANAGER: C. W. Bright

Tulsa Facility
2000 North Memorial Drive, Tulsa, Oklahoma 74158
Telephone: 1 (918) 835 3111
VICE-PRESIDENT AND GENERAL MANAGER:
William P. Swiech

In addition to programmes detailed, Rockwell teamed with DASA in X-31A programme (see NASA entry, this section and Rockwell/DASA entry in International section) and to offer Ranger 2000 for JPATS training aircraft requirement (see International section).

Modification work includes upgrade of Australian F/RF-111C avionics, with functional flight test phase of prototype conversion commencing at Palmdale late 1994 and was due for completion early 1995, to be followed by 12 month performance evaluation flight test programme at McClellan AFB, California under RAAF management. Total of 17 F-111C and four RF-111C to be involved in modification project (see *Jane's Aircraft Upgrades*).

Rockwell's North American Aircraft Modification Division also selected by Czech Republic Ministry of Defence to undertake design and integration of avionics system for L-159 single-seat light fighter/attack derivative of Aero Vodochody Albatros. Value of prototype programme estimated at about \$20 million, with 33 month initial test effort to be followed by production of up to 72 L-159s for Czech Air Force. Further details of L-159 in Aero Vodochody entry in Addenda.

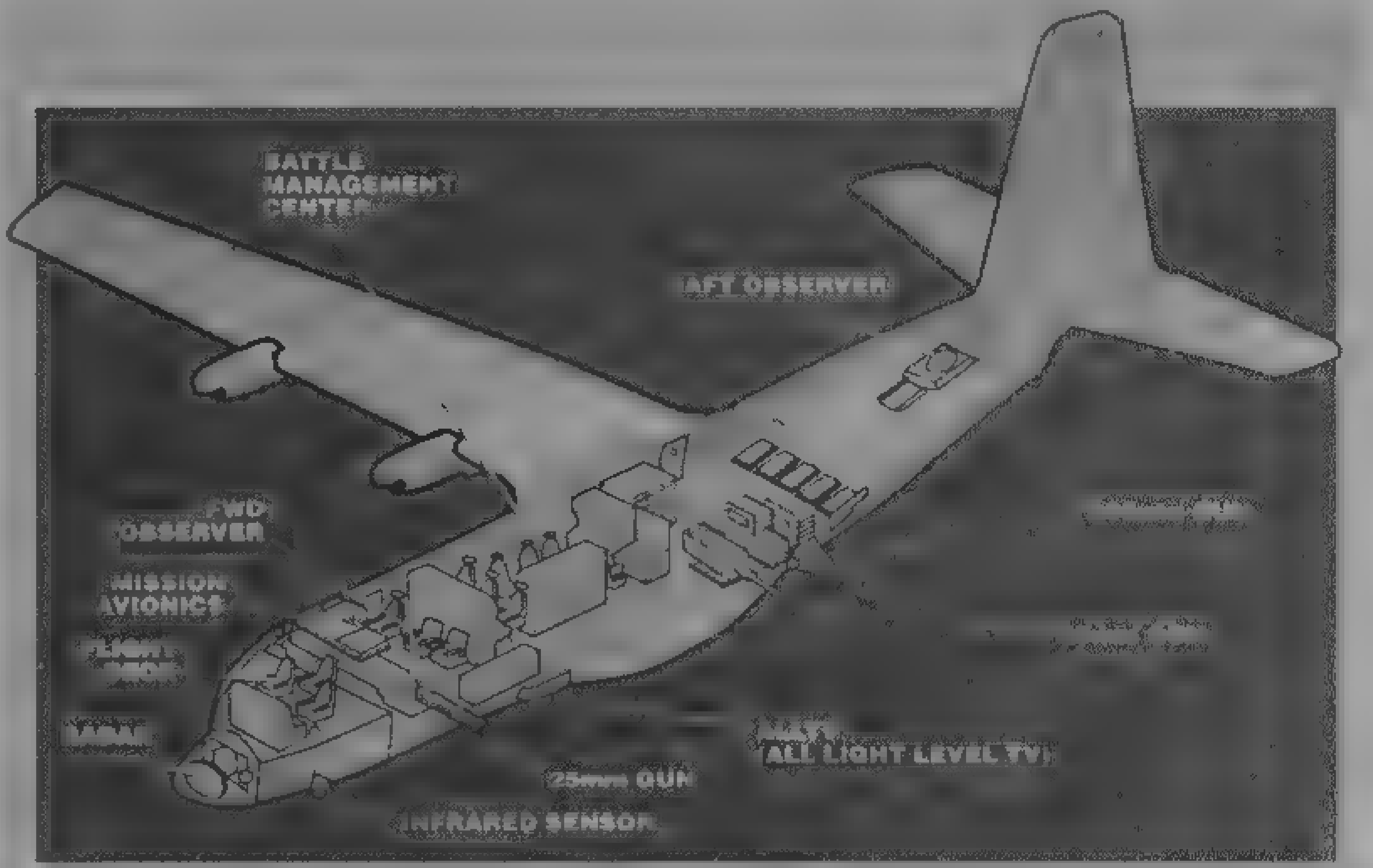
UPDATED

ROCKWELL (LOCKHEED MARTIN) AC-130U SPECTRE

TYPE: Aerial gunship.

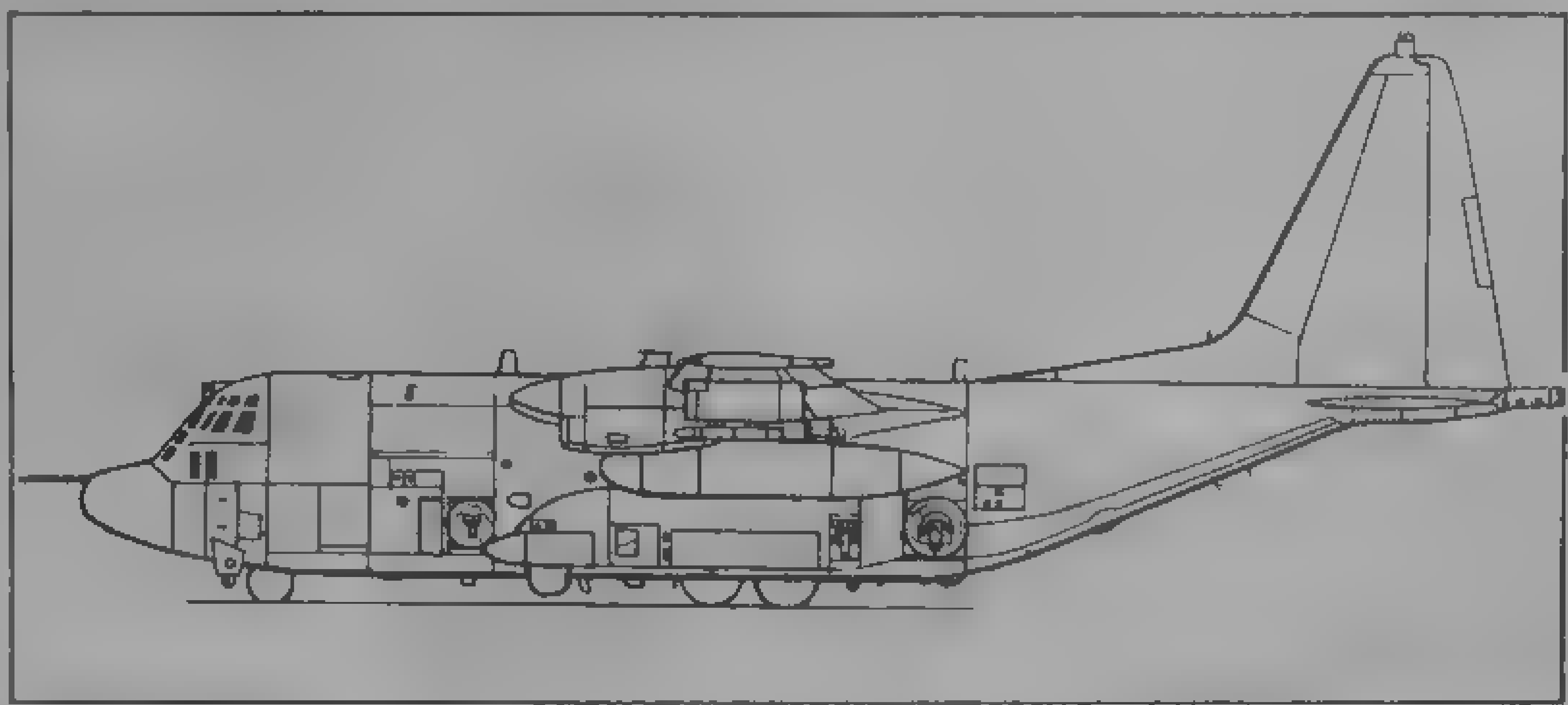
PROGRAMME: Development of new gunship version of Lockheed Martin C-130 Hercules launched 6 July 1987 with \$155,233,489 contract to North American Aircraft Operations; last contract awarded 31 December 1992; total value \$523.9 million.

Prototype delivered to Rockwell as standard C-130H transport, 28 July 1988, first post-conversion flight on 20 December 1990 was also ferry to Edwards AFB, California, for trials with 6510th Test Wing; work on remaining AC-130Us began January 1991, by January 1993, six aircraft complete, of which three with 418th Test Squadron/412th TW (ex-6510th TW) at Edwards AFB, operational unit 4th Special Operations Squadron at Hurlburt



Weapon and sensor locations in the AC-130U gunship

1993



Profile of AC-130U gunship *(Jane's/Dennis Punnett)*

1995

Third production Lockheed Martin Hercules conversion by Rockwell to AC-130U Spectre gunship

1995

Field, Florida, deliveries delayed by software and other changes; completion of FSD slipped from June 1991 to mid-1995, first aircraft delivered in June 1994, balance to follow by August 1995. Armament, firing to port, consists of (front to rear) trainable General Electric GAU-12/U

AC-130U PROCUREMENT

FY	Batch	Qty	First aircraft
87	—	1	87 0128
89	Lot 1	6	89 0509
90	Lot 2	5	90 0163
92	Lot 3	1	92-0167
Total		**13**	

25 mm six-barrel Gatling gun with 3,000 rounds, Bofors 40 mm gun, and a 105 mm gun based on US Army howitzer; addition of Rockwell Hellfire ASMs under consideration 1992; guns can be slaved to Hughes AN/APG-180 (modified AN/APG-70) digital fire control radar, Texas Instruments AN/AAQ-17 FLIR or GEC Marconi all light level television (ALLTV), for night and adverse weather attack on ground targets; sideways-facing HUD for visual aiming. Attack method was originally to circle target at altitude firing into apex of turn on ground, but guns can now be trained, relieving pilot of absolute precision flying. flight path is also less predictable; can fire on two targets simultaneously. AC-130U can refuel in flight and fly escort, surveillance, armed reconnaissance/interdiction, rescue and search missions.

Prone observer's position on rear ramp; starboard-side observer's window aft of flight deck, and battle management centre in cabin with five positions at monitoring consoles and four IBM AP-102 computers; crew totals 13, including flight crew and loaders. Defensive aids believed similar to those in MC-130H, modified fuel tank pylons contain IR countermeasures, total of 300 chaff bundles and 90 MJU7 or 180 M206 flares in three AN/ALE-40 launchers under fuselage, two ITT Avionics AN/ALQ-172 jammers in base of fin and on forward fuselage, Loral AN/ALR-56M RWR, AN/AAR-44 IR warner, QRC-84-02 IRCM and AN/APR-46 threat avoidance system, other equipment includes INS and GPS, triple MIL-STD-1553B digital databuses and Spectra ceramic armour protection.

Full details of C-130H in Lockheed Martin entry in this section

UPDATED

AEROSPACE BUSINESSES

2201 Seal Beach Boulevard, PO Box 4250, Seal Beach California 90740-8250
Telephone 1 (310) 797 3311
EXECUTIVE VICE-PRESIDENT AND COO: Sam F Iacobellis

Rocketdyne Division
6633 Canoga Avenue, Canoga Park, California 91303
Telephone 1 (818) 710 6300
PRESIDENT: Robert D Paster

Space Systems Division
12214 Lakewood Boulevard, Downey, California 90241
Telephone 1 (810) 922 2111
PRESIDENT: Robert G Minor
MANAGER, EXTERNAL COMMUNICATIONS AND MEDIA RELATIONS: Janet L Dean

Group includes Downey, Seal Beach and Palmdale facilities and contractual support groups in main national space centres; work includes development and fabrication of manned and unmanned space systems; Rockwell group produced five Shuttle Orbiter spacecraft for NASA, last described fully in 1992-93 *Jane's*

VERIFIED

ROTORWAY

ROTORWAY INTERNATIONAL

4141 West Chandler Boulevard, Chandler, Arizona 85226
Telephone 1 (602) 961 1001
Fax 1 (602) 961 1514
PRESIDENT: John Netherwood

Assets of former RotorWay Aircraft Inc purchased by John Netherwood, and new company established on 1 June 1990, now trading as RotorWay International. Original product was Exec 90, the former Exec with some 23 modifications. In August 1994, Exec 162F introduced and replaced the Exec 90; 162F improvements can be retrofitted to Exec 90.

RotorWay currently manufactures Exec 162F helicopter kits for final assembly by amateur builders, powered by the company's own R 1 2.66 litre (162 cu in) liquid-cooled engine; kit comes complete and only requires paint and avionics.

Some foreign distributors also sell helicopter fully assembled and test flown for delivery. RotorWay offers flight orientation and maintenance training, and customer service programme. RotorWay has a 3,440 m² (37,000 sq ft) facility on an Air Park outside Phoenix, Arizona. The facility incorporates all of RotorWay's departments including manufacturing, sales and flight school.

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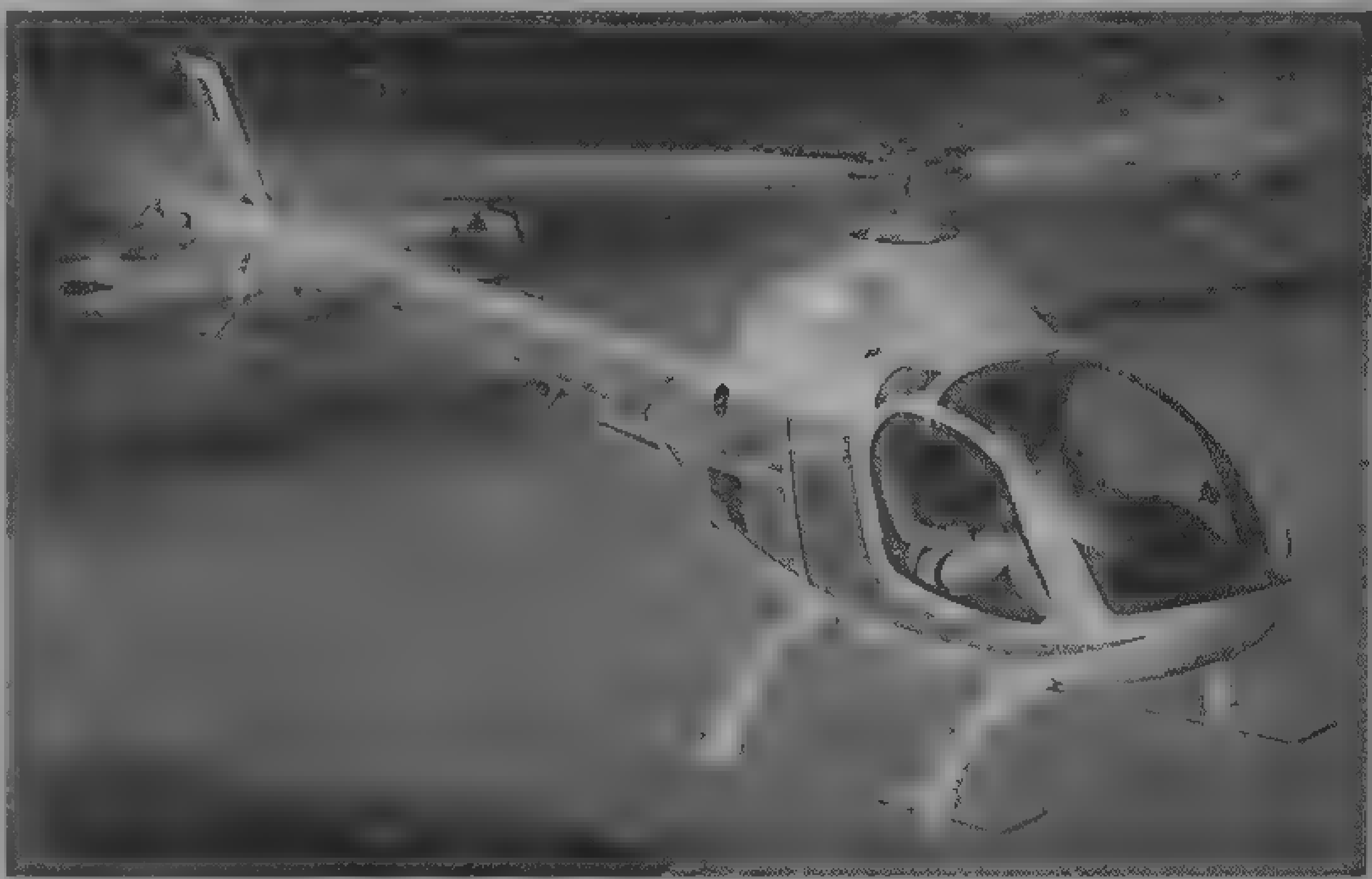

RotorWay International Exec 162F two-seat homebuilt helicopter *1995*

ROTORWAY INTERNATIONAL EXEC 162F

TYPE: Side by side two-seat homebuilt helicopter

PROGRAMME: RotorWay International manufactures Exec 162F helicopter kits for final assembly by amateur builders. Currently marketed in USA and 33 other countries. Being assembled in China from imported kits by Jingzhou Aircraft Company as Jingzhou No. 1

CUSTOMERS: Including earlier Exec 90 model, 260 kits sold and 140 flying by 1994. First Jingzhou version flew in China in 1993

COSTS: Kit $56,000

DESIGN FEATURES: Asymmetrical aerofoil section two-blade main rotor. All-metal aluminium alloy blades attached to aluminium alloy teetering rotor hub by retention straps. Teetering tail rotor, with two blades each comprising steel spar and aluminium alloy skin. Elastomeric bearing rotor hub system with dual push/pull cable controlled swash plate for cyclic pitch control

STRUCTURE: Blades as detailed under Design Features. Basic 4130 steel tube airframe structure, with wraparound glassfibre fuselage/cabin enclosure. Aluminium alloy monocoque tailboom

LANDING GEAR: Twin skid type

POWER PLANT: One 113.3 kW (152 hp) RotorWay International R 1 engine with dual electronic ignition. Standard fuel capacity 64.4 litres (17 US gallons, 14.2 Imp gallons)

DIMENSIONS, EXTERNAL:

Main rotor diameter	7.62 m (25 ft 0 in)
Length of fuselage	6.71 m (22 ft 0 in)
Height to top of main rotor	2.44 m (8 ft 0 in)

WEIGHTS AND LOADINGS:

Weight empty	420 kg (925 lb)
Crew weight	181 kg (400 lb)
Max T-O weight	646 kg (1,425 lb)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed (V_{NE}) and max level speed	100 kts (185 km/h; 115 mph)
Normal cruising speed	82 kts (153 km/h; 95 mph)
Max rate of climb at S/L	305 m (1,000 ft)/min
Service ceiling	3,050 m (10,000 ft)
Hovering ceiling, with two persons: IGE	2,135 m (7,000 ft)
OGE	1,525 m (5,000 ft)
Range with max fuel at optimum cruising power	156 n miles (290 km; 180 miles)
Endurance with max fuel at optimum cruising power	2 h

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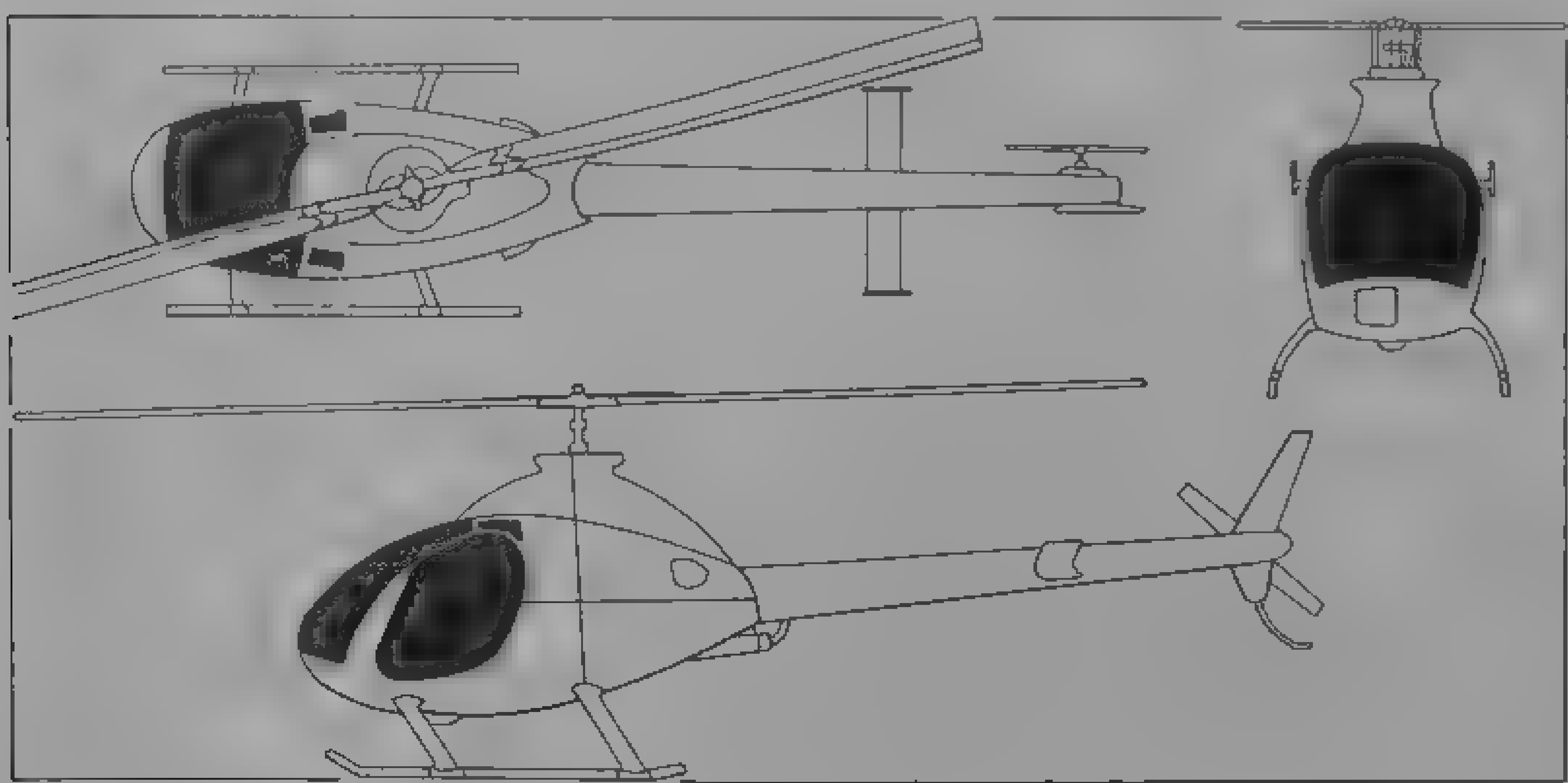

RotorWay 162F homebuilt (RotorWay International engine) *(Jane's/Paul Jackson)* *1995*

SABRELINER

SABRELINER CORPORATION

Information on Sabreliner executive jet and trainer will be found in *Jane's Aircraft Upgrades*

UPDATED

SADLER

SADLER AIRCRAFT CORPORATION

Development of the A-22 LASA and related aircraft (see 1994-95 and earlier *Jane's*) is understood to have been terminated

UPDATED

SCALED

SCALED COMPOSITES INC

1624 Flight Line, Mojave, California 93501-1663
Telephone 1 (805) 824 4541
Fax 1 (805) 824 4174
PRESIDENT: Burt (Elbert L.) Rutan
VICE-PRESIDENT AND GENERAL MANAGER
Michael W Melvill

Scaled Composites Inc bought by Beech Aircraft Corporation June 1985, sold back to Burt Rutan November 1988 and integrated in joint venture with Wyman-Gordon Company of Worcester, Massachusetts. Scaled produces composite aerospace structures for Wyman-Gordon and continues to provide R&D facilities to individuals and companies; several projects developed for Beech retained by Scaled

Past projects summarised in 1994-95 *Jane's* and detailed in earlier editions, company also active in UAV field (refer *Jane's Unmanned Aerial Vehicles and Targets*) Current programmes include Freewing Scorpion and RAPTOR UAVs Company plans to relocate to Montrose, Colorado

UPDATED

RUTAN 151 ARES

TYPE Agile Response Effective Support (ARES) low-cost military and paramilitary aircraft

PROGRAMME Rutan made design study of US Army Low-Cost Battlefield Attack Aircraft (LCBAA) 1981, ARES design began 1985; first flight (N151SC) 19 February 1990; live firing tests with GAU-12/U cannon November 1991, funded by US Air Force. Scaled Composites intended selling complete programme with ultimate goal of production, no purchaser acquired by 1995, fuller details in 1994-95 and earlier *Jane's*

STRUCTURE Extensive use of carbonfibre/epoxy over foam/PVC cores

LANDING GEAR Hydraulically retractable tricycle type, with single wheel on each unit

POWER PLANT One 13.12 kN (2,950 lb st) Pratt & Whitney JT15D-5 turbofan with electronic fuel control unit, offset 8° to port of centreline, with thrust line corrected by curved jetpipe. Curved air intake on port side of centre-fuselage only

ACCOMMODATION Pilot only, on UPC SIIS-3ER ejection seat

ARMAMENT One internal 25 mm General Electric GAU-12/U five-barrel rapid-firing cannon on starboard side of fuselage, with 220 rounds Provision for carriage of two AIM-9L Sidewinder or four AIM-92 Stinger air-to-air missiles on external stores hardpoints

DIMENSIONS, EXTERNAL

Wing span	10.67 m (35 ft 0 in)
Length overall	8.97 m (25 ft 5¼ in)
Height overall	3.00 m (9 ft 10 in)

WEIGHTS AND LOADINGS

Weight empty, unarmed	1,308 kg (2,884 lb)
Max T-O weight unarmed	2,179 kg (4,804 lb)
with GAU-12/U and 220 rds	2,767 kg (6,100 lb)

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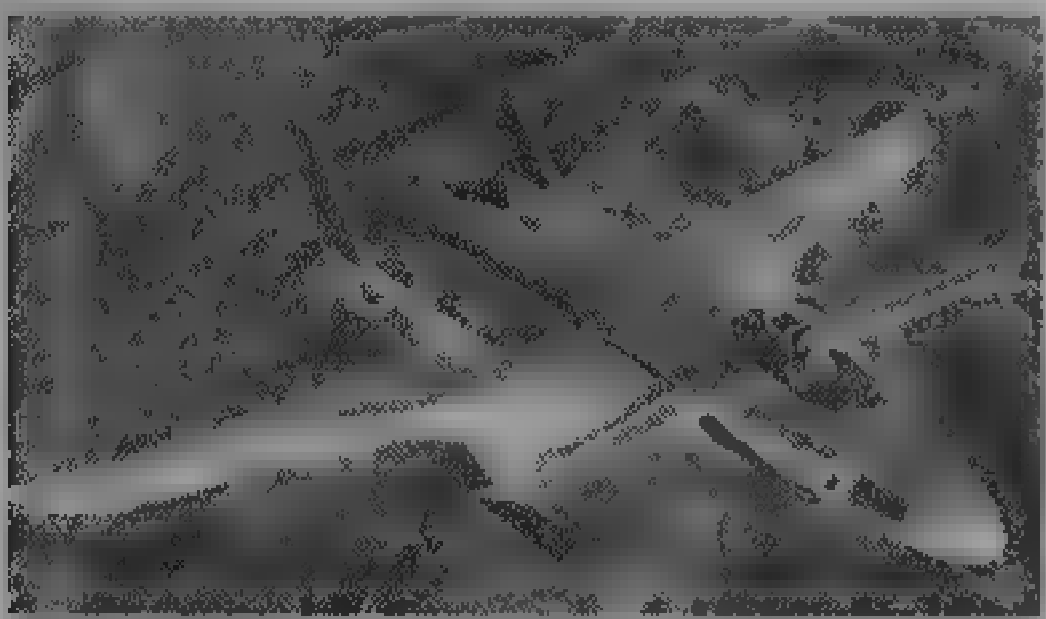


Photograph and three-view drawing (*Jane's/Mike Keep*) of the Rutan 151 ARES turbofan powered agile combat aircraft

1993/1996

RUTAN 202-11 BOOMERANG

TYPE Five-seat twin-engined development prototype with potential as light transport

PROGRAMME Prototype built 1993, no evidence of flight testing. Aircraft is Burt Rutan's personal project, not part of Scaled Composites, Inc. Full description in 1994-95 *Jane's*

UPDATED

SCHWEIZER

SCHWEIZER AIRCRAFT CORPORATION

PO Box 147, Elmira, New York 14902
Telephone 1 (607) 739 3821
Fax: 1 (607) 796 2488
Telex 932459 SCHWEIZER BIGF
PRESIDENT Paul H Schweizer
EXECUTIVE VICE-PRESIDENTS
Leslie E Schweizer
W Stuart Schweizer
VICE-PRESIDENT Michael D Oakley
DIRECTOR, MARKETING Cole Hedden
SALES MANAGERS
David Savage
Rocky Peters
MANAGER, MARKETING AND COMMUNICATIONS
Barbara J Tweedt

Established 1939 to produce sailplanes, which remain as element of current business, from mid-1957 to 1979 Schweizer also made Grumman (later Gulfstream American) Ag-Cat under subcontract, all rights to Ag-Cat purchased January 1981, delivery of Ag-Cat Super-B, since supplemented by turboprop version, started October 1981, Ag-Cat marketing and support based at Elmira factory until disposal of manufacturing rights in 1995 to Ag-Cat Corporation (which see) of Malden, Missouri

Schweizer acquired rights for sole US manufacture of Hughes 300 light helicopter 13 July 1983, Schweizer supporting earlier Hughes 300s, first Elmira built 300C completed June 1984, Schweizer purchased US rights for whole 300C programme from McDonnell Douglas Helicopter Company (formerly Hughes Helicopters) 21 November 1986.

Schweizer subcontracts include work for Bell Helicopter, Boeing, Sikorsky and others, company is involved in design and prototyping, and in projects to develop heavy lift vehicles, aerial applicators for pheromones, centrifuges, and spatial disorientation trainers.

UPDATED

SCHWEIZER SA 2-37A

US military designation: RG-8A

TYPE: Two-seat quiet special missions surveillance aircraft.

PROGRAMME First flight of SA 2-37A in 1986 prototype fitted with Hughes AN/AAQ-16 and other manufacturers' thermal imaging systems. Full description in 1991-92 and earlier *Jane's*

CUSTOMERS Nine built by mid-1994, including demonstrator N9237A (third produced). Three for US Army (85-0047, 85-0048 and 86-0404) of which 0048 lost in accident, remaining two transferred in 1987 to US Coast Guard at Opa Locka for anti-narcotics operations (serials 8101-8102) both converted to SA 2-38A (see next entry)

Fifth, sixth and seventh 2-37As built for Central Intelligence Agency late 1989/early 1990 as N7508U, N7508W and N7508Y, employed as airborne communications relay platforms for long-range reconnaissance UAVs; believed used over former Yugoslavia in 1994, supporting General Atomics Gnat 750 vehicles

Eighth 2-37A to Colombian Air Force as FAC-2406 aircraft No 7 delivered to Mexican Air Force early 1994 as [illegible]

DESIGN FEATURES Modification of Schweizer SGM 2-37 motor glider, but with slightly greater wing span drooped leading edge and leading-edge fences on outer wing panels to improve stall, much more powerful engine with large exhaust silencers on fuselage sides, three-blade quiet propeller, fuselage modified to accept bulged canopy and larger engine, streamlined fairings and hydraulic parking brake on mainwheels, more than treble standard fuel capacity, but optional extra tank also available; removable underfuselage skin and hatches give access to 1.84 m³ (65 cu ft) payload bay behind cockpit, in which pallets holding LLLTV, FLIR or camera payloads can be quickly removed and installed, other engines and larger payloads available for surveillance, basic and advanced training, operator training, glider and banner towing, and priority cargo delivery. Certificated to FAR Pt 23 for day and night IFR

Schweizer RG-8A of US Coast Guard (*Peter J Cooper*)

1995

inaudible when overflying at 'quiet mode' speed at about 610 m (2,000 ft) using 38.8 kW (52 hp) from its 175 kW (235 hp) Textron Lycoming IO-540 engine

Wing section Wortmann FX 61-163 at root and FX-60-126 (modified) at tip; outer wing panels and horizontal tail can be removed for transport

POWER PLANT: One 175 kW (235 hp) Textron Lycoming IO-540-W3A5D flat six engine, driving a McCauley three-blade constant-speed propeller. Standard fuel capacity of 196.8 litres (52 US gallons; 43.3 Imp gallons), increasable optionally to 253.6 litres (67 US gallons; 55.8 Imp gallons). Shadin fuel flow system

ACCOMMODATION: Seats for two persons side by side under two-piece upward-opening canopy, hinged on centreline. Dual controls, seat belts and inertia reel harnesses standard. Compartment aft of seats enlarged to accommodate pallet containing up to 340 kg (750 lb) of sensors or other equipment

DIMENSIONS, EXTERNAL:

Wing span	18.745 m (61 ft 6 in)
Wing aspect ratio	18.97
Fuselage length	8.46 m (27 ft 9 in)
Height overall (tail down)	2.36 m (7 ft 9 in)
Wheel track	2.79 m (9 ft 2 in)
Wheelbase	5.99 m (19 ft 8 in)
Propeller diameter	2.18 m (7 ft 2 in)

AREAS:

Wings, gross	8.52 m² (199.4 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	918 kg (2,025 lb)
Max mission payload	340 kg (750 lb)
Max T-O weight	1,587 kg (3,500 lb)
Max wing loading	85.65 kg/m² (17.55 lb/sq ft)
Max power loading	9.06 kg/kW (14.89 lb/hp)

PERFORMANCE (at max T-O weight):

Max permissible diving speed (VD)	176 kts (326 km/h; 202 mph) CAS
Cruising speed at 1,525 m (5,000 ft):	
75% power	138 kts (256 km/h; 159 mph)
65% power	129 kts (239 km/h; 148 mph)
Approach speed	117 kts (217 km/h; 135 mph) CAS
Quiet mode speed	70-80 kts (130-148 km/h; 80-92 mph)
Optimum climbing speed	77 kts (142 km/h; 88 mph) CAS
Stalling speed:	
airbrakes open	71 kts (132 km/h; 82 mph)
airbrakes closed	67 kts (124 km/h; 77 mph)
Max rate of climb at S/L	292 m (960 ft)/min
Service ceiling	5,490 m (18,000 ft)
T-O run (S/L, ISA): hard surface	387 m (1,270 ft)
grass	533 m (1,750 ft)
T-O to 15 m (50 ft) (S/L, ISA):	
hard surface	612 m (2,010 ft)
grass	759 m (2,490 ft)
Landing from 15 m (50 ft) (S/L, ISA):	
hard surface	680 m (2,230 ft)
grass	732 m (2,400 ft)
Best glide ratio	20
g limits	+6.6/-3.3

UPDATED

SCHWEIZER SA 2-38A

Unofficial name: RU-38A Twin Condor

TYPE: Special missions surveillance aircraft (converted SA 2-37A).

PROGRAMME: Development and redesign started 1993, first aircraft returned to Schweizer 24 January 1994 for conversion beginning in April; first flight (N61428) 31 May 1995, next aircraft due end 1995; further one (first 'new' build but with wing taken from stock) in February 1996; all three for USCG. Type publicly revealed 20 July 1995.

CURRENT VERSIONS: **Two-seat** version, *as described*, for USCG; **three-seat** version reportedly under design for an export customer; turbocharged version also under development, to increase operating altitude to 9,150 m (30,000 ft).

CUSTOMERS: US Coast Guard (three); second US customer, and one overseas, also reported. USCG aircraft expected to be deployed mainly over Caribbean and Gulf of Mexico from bases in south eastern USA.

COSTS: $450,000 (1993) for initial redesign; $3.5 million (1994) USAF contract to convert existing two aircraft, approximately $1 million each (excluding sensors) for any additional procurement.

DESIGN FEATURES: Main objectives were to increase night patrol capability and reduce engine coking problems compared with SA 2-37A; additional engine also increases safety factor for overwater operation, though normal mode will be single-engine cruise with second engine shut down.

Utilises wings and cockpit forward section of SA 2-37A; principal design changes are adoption of pod and twin tailboom configuration with twin engines in push-pull layout, cabin slightly widened.

LANDING GEAR: Retractable tricycle type, single wheel on each unit.

POWER PLANT: Two heavily muffled Teledyne Continental GIO-550A flat-six engines, each rated at 261 kW (350 hp) at 3,400 rpm, with reduction gear to limit propeller speed to 2,267 rpm. One engine in nose and one in rear of fuselage pod, respectively driving a tractor and pusher three-blade propeller. Usable fuel capacity 375 litres (99 US gallons; 82.5 Imp gallons).

ACCOMMODATION: Pilot and sensor operator.

AVIONICS: Bendix/King AN/APN-215(V) colour weather radar with search and mapping modes in nose of port tail boom and FLIR in nose of starboard boom, but sensors interchangeable if required.

DIMENSIONS, EXTERNAL:

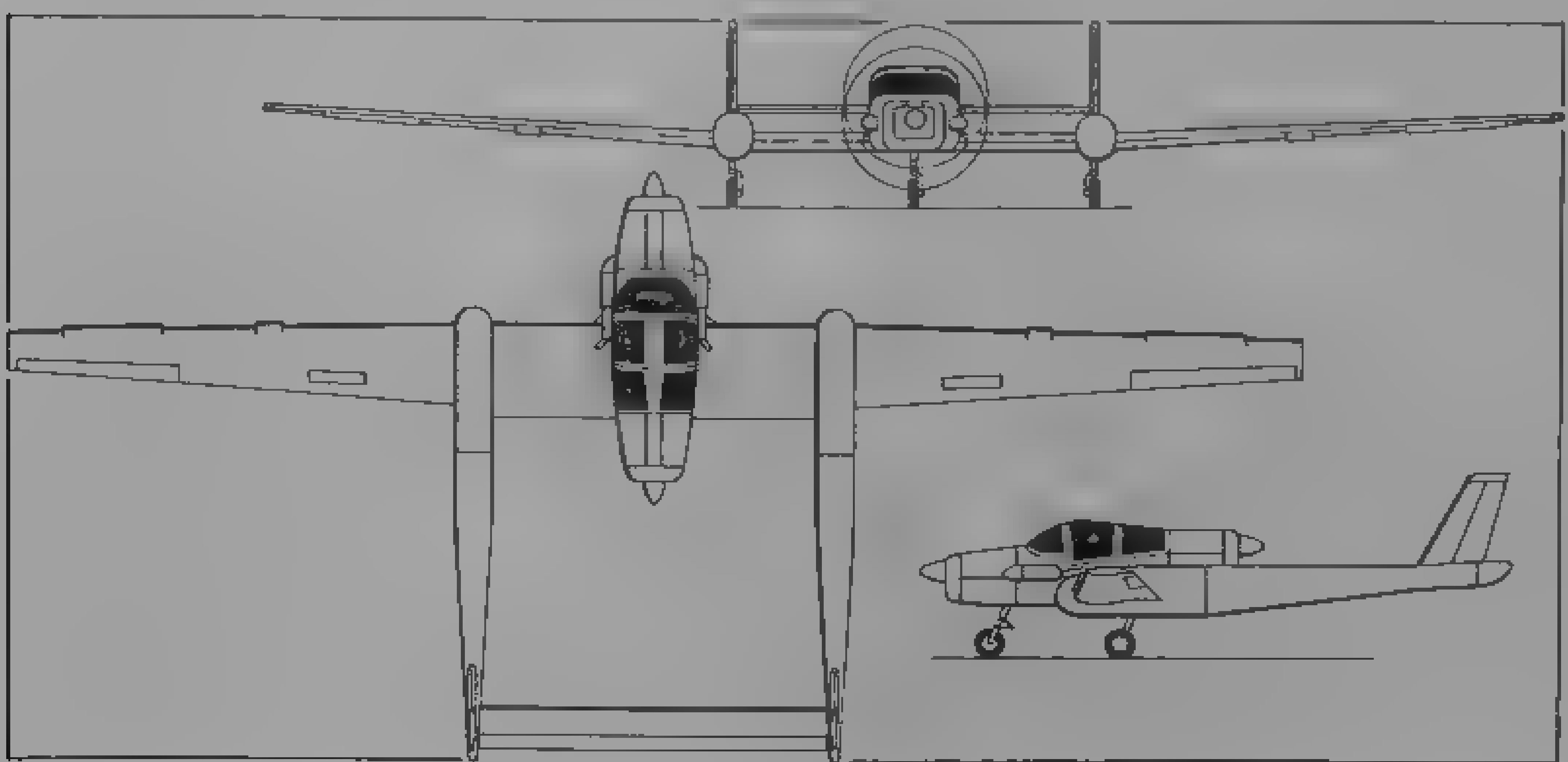
Wing span	19.51 m (64 ft 0 in)

WEIGHTS AND LOADINGS:

Max payload	408 kg (900 lb)
Max T-O weight	2,404 kg (5,300 lb)

PERFORMANCE (estimated):

Typical mission speed	85-95 kts (157-176 km/h; 98-109 mph)
Typical operating altitude	below 3,050 m (10,000 ft)
Max endurance	6 h



Schweizer SA 38A twin-engined surveillance aircraft *(Jane's/Mike Keep)* *1994*

Schweizer Ag-Cat Super-B Turbine agricultural aircraft *1993*

SCHWEIZER AG-CAT SERIES

TYPE: Agricultural biplane.

PROGRAMME: First flight of original Grumman Ag-Cat 27 May 1957, first deliveries 1959, production resumed in October 1981 with improved G-164B designated Ag-Cat Super-B, later joined by Ag-Cat Super-B Turbine. Production again suspended, December 1992, with manufacture of 833rd G-164B (N75099). Ag-Cat specification appears under EAL in Ethiopian section, but US production will resume following transfer of production rights to Ag-Cat Corporation of Malden, Missouri.

UPDATED

SCHWEIZER 300C

TYPE: Three-seat light utility helicopter.

PROGRAMME: First flight August 1969, first flight Hughes production model December 1969, FAA certification May 1970 (basic Hughes 300 described in 1976-77 *Jane's*). Production of 300C transferred from Hughes Helicopters to Schweizer July 1983; first flight Schweizer 300C June 1984. Schweizer bought entire programme November 1986. Model 300C is marketing title; engineering model number is 269C.

CURRENT VERSIONS: **300C**: Standard civil version, *to which main description applies*.

300C Sky Knight: Special police version, options include safety mesh seats with inertia reel shoulder harnesses, public address/siren system, searchlight, integrated communications, infra-red sensor, heavy-duty 28 V 100 A electrical system, cabin heater, night lights with strobe beacons, cabin utility light, fire extinguisher, first aid kit and map case.

TH-300C: Military training version.

300CB: 'Bare' version of 300C for training role, 134 kW (180 hp) Textron Lycoming HO-360 engine and 2,000 hour TBO; claimed to be cheaper to operate than 300C.

CUSTOMERS: Hughes produced 2,800 of all versions, including TH-55A Osage for US Army, before transfer to Schweizer. US Army $4.9 million order for 30 300Cs and spares placed in late 1985; two batches of 24 TH-300C training helicopters delivered to Royal Thai Army between March 1986 and mid-1989. 500th Schweizer manufactured 300C delivered at Heli Expo 1994. Recent Sky Knight customers include police departments of Baltimore, Maryland, Columbus, Ohio, and Allen County, Ohio.

DESIGN FEATURES: Fully articulated three-blade main rotor; fully interchangeable blades, blade section NACA 0015, elastomeric dampers, two-blade teetering tail rotor; limited blade folding; no rotor brake; multiple V-belt and pulley reduction gear/drive system between horizontally mounted engine and transmission, with electrically controlled belt-tensioning system instead of clutch; braced tubular tailboom.

FLYING CONTROLS: Mechanical, with first pilot on left, electric cyclic trim, separate dihedral tailplane and fin.

STRUCTURE: Main rotor blades bonded with constant section extruded aluminium spar, wraparound skin and trailing edge, tail rotor blades have steel tube spar and glassfibre skin; steel tube cabin section with light alloy, stainless steel and Plexiglas skin.

LANDING GEAR: Skids carried on oleo-pneumatic shock-absorbers. Replaceable skid shoes. Two ground handling wheels with 0.25 m (10 in) balloon tyres, pressure 4.14 to 5.17 bars (60 to 75 lb/sq in). Available optionally on floats made of polyurethane coated nylon fabric, 4.70 m (15 ft 5 in) long and with a total installed weight of 27.2 kg (60 lb).

POWER PLANT: One 168 kW (225 hp) Textron Lycoming HIO-360-D1A flat-four engine, derated to 142 kW (190 hp), mounted horizontally aft of seats. Two aluminium fuel tanks, total capacity 185.5 litres (49 US gallons; 40.8 Imp gallons), mounted externally aft of cockpit. Crash resistant fuel tank optional. Oil capacity 9.5 litres (2.5 US gallons; 2.1 Imp gallons).

ACCOMMODATION: Three persons side by side on sculptured and cushioned bench seat, with shoulder harness, in Plexiglas enclosed cabin. Carpet and tinted canopy standard. Forward hinged, removable door on each side. Dual controls optional. Baggage capacity 45 kg (100 lb). Exhaust muff heating and ventilation kits available.

SYSTEMS: Standard electrical system includes 24 V 70 A alternator, 24 V battery, starter and external power socket.

First Schweizer 330 in Europe is demonstrator for Saab Helikopter

1995

AVIONICS: *Comms*: Optional avionics include Bendix/King KY 196A com transceiver and headsets, KR 86 ADF and KT 76A transponders.

EQUIPMENT: Standard equipment includes map case, first aid kit, fire extinguisher, engine hour meter and main rotor blade tiedown kit. Optional equipment includes amphibious floats, litter kits, cargo racks with combined capacity of 91 kg (200 lb), external load sling of 408 kg (900 lb) capacity, Simplex Model 5200 agricultural spray or dry powder dispersal kits, Sky Knight law enforcement package, instrument training package, throttle governor start-up overspeed control unit, night flying kit, dual controls, all weather cover, heavy-duty skid plates, single or dual exhaust mufflers, door lock and dual oil coolers.

DIMENSIONS, EXTERNAL:

Main rotor diameter	8.18 m (26 ft 10 in)
Main rotor blade chord	0.171 m (6¾ in)
Tail rotor diameter	1.30 m (4 ft 3 in)
Distance between rotor centres	4.66 m (15 ft 3½ in)
Length overall, rotors turning	9.40 m (30 ft 10 in)
Height: to top of rotor head	2.66 m (8 ft 8¾ in)
to top of cabin	2.19 m (7 ft 2 in)
Width: rotor partially folded	2.44 m (8 ft 0 in)
[illegible]	1.30 m (4 ft 3 in)
Skid track	1.99 m (6 ft 6½ in)
Length of skids	2.51 m (8 ft 3 in)
Passenger doors (each): Height	1.09 m (3 ft 7 in)
Width	0.97 m (3 ft 2 in)
Height to sill	0.91 m (3 ft 0 in)

AREAS:

Main rotor blades (each)	0.70 m² (7.55 sq ft)
Tail rotor blades (each)	0.08 m² (0.86 sq ft)
Main rotor disc	52.5 m² (565.5 sq ft)
Tail rotor disc	1.32 m² (14.2 sq ft)
Fin	0.23 m² (2.5 sq ft)
Horizontal stabiliser	0.246 m² (2.65 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	474 kg (1,046 lb)
Max T-O weight: Normal category	930 kg (2,050 lb)
external load	975 kg (2,150 lb)
Max disc loading:	
Normal category	[illegible] kg/m² (3.62 lb/sq ft)
Max power loading:	
Normal category	6.55 kg/kW (10.8 lb/hp)

PERFORMANCE (at max Normal T-O weight, ISA):

Never-exceed speed (V_{NE}) at S/L	91 kts (169 km/h; 105 mph)
Max cruising speed	82 kts (153 km/h; 95 mph)
Speed for max range, at 1,220 m (4,000 ft)	[illegible] mph)
Max rate of climb at S/L	229 m (750 ft)/min
Service ceiling	3,110 m (10,200 ft)
Hovering [illegible]: IGE	1,800 m (5,900 ft)
OGE	840 m (2,750 ft)
Range at 1,220 m (4,000 ft), 2 min warm-up, max fuel, no reserves	194 n miles (360 km; 224 miles)
Max endurance at S/L	3 h 24 min

UPDATED


Schweizer 300C light utility helicopter

1995

SCHWEIZER 330

TYPE: Turbine-powered three/four-seat light helicopter.

PROGRAMME: Announced 1987, first flight in public (N330ST) 14 June 1988. FAA certification September 1992. Deliveries started mid-1993. A version with three sets of controls is being studied for student training. Model 330 is marketing designation; type is 269D.

CUSTOMERS: Customers include Kawanda Industries, Saab Helikopter, AER of Bladensburg, Maryland, and Venezuelan Army. Three aircraft delivered in 1993, five in 1994, plus one prototype and one demonstrator; total 10 by January 1995.

COSTS: $433,[illegible]5 for basic civil aircraft (1994).

DESIGN FEATURES: Civil roles include law enforcement, scout/observation, aerial photography, light utility, agricultural spraying and personal transport; uses turbine fuel rather than scarcer Avgas; extremely low flat rating of engine promises outstanding hot and high performance; third

occupant seat allows second student to observe instruction, three sets of flying controls can be fitted, streamlined external envelope and large tailplane with endplate fins added during development, rotor rpm 471

FLYING CONTROLS: Similar to 300C; see Design Features

STRUCTURE: Generally similar to 300C

POWER PLANT: One 313.2 kW (420 shp) Allison 250-C20 turboshaft. Maximum fuel capacity 227 litres (60 US gallons, 50 Imp gallons)

DIMENSIONS, EXTERNAL:
- Main and tail rotor diameters: as for Model 300C
- Length overall, rotors turning: 9.40 m (30 ft 10 in)
- Height overall: 2.89 m (9 ft 5¾ in)
- Skid track: 2.08 m (6 ft 10 in)

DIMENSIONS, INTERNAL:
- Cabin: Width at seat: 1.72 m (5 ft 7¾ in)
- Height at seat: 1.35 m (4 ft 5 ¼ in)

WEIGHTS AND LOADINGS:
- Weight empty: 508 kg (1,120 lb)
- Normal T-O weight: 1,012 kg (2,230 lb)

PERFORMANCE (at Normal T-O weight, ISA):
- Max cruising speed: 108 kts (200 km/h, 124 mph)
- Normal cruising speed: 100 kts (185 km/h, 115 mph)
- Hovering ceiling: IGE: 4,300 m (14,100 ft)
- OGE: 3,080 m (10,100 ft)
- Max range at 1,220 m (4,000 ft), no reserves: 269 n miles (498 km, 309 miles)
- Max endurance, no reserves: 4 h 12 min

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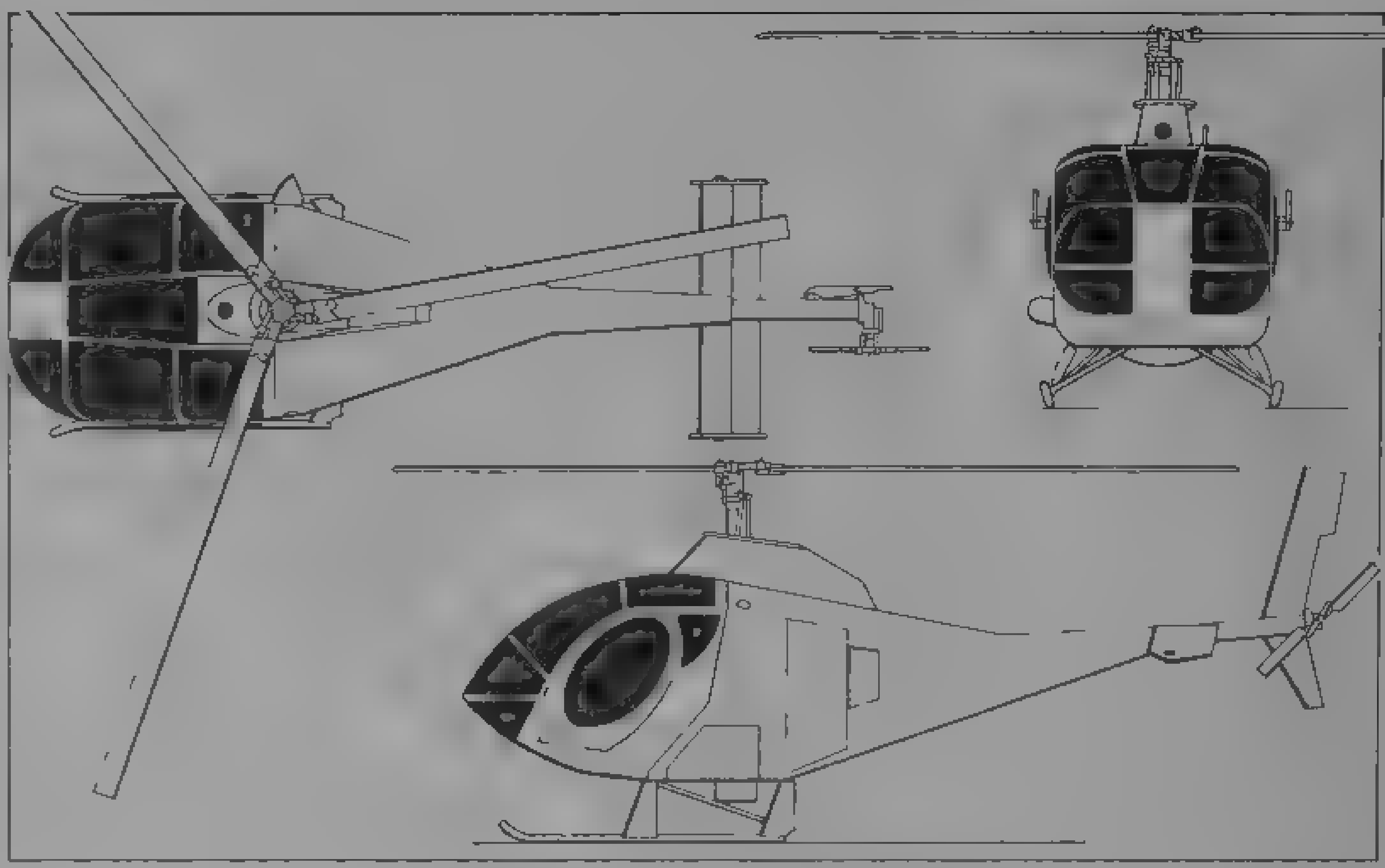


Schweizer 330 three/four seat light helicopter (*Jane's/Mike Keep*)

1993

SEQUOIA

SEQUOIA AIRCRAFT CORPORATION

2000 Tomlynn Street, PO Box 6861, Richmond, Virginia 23230
Telephone: 1 (804) 353 1713
Fax: 1 (804) 359 2618
PRESIDENT: Alfred P. Scott

VERIFIED

SEQUOIA 300 SEQUOIA

TYPE: Side by side two-seat utility and aerobatic aircraft

PROGRAMME: First flown 26 April 1992, single prototype, programme was offered for sale during 1993, no buyer found by early 1995

STRUCTURE: Wings, ailerons, slotted flaps and tail unit of flush riveted aluminium alloy construction. Welded steel tube fuselage, covered entirely with lightweight shell of glassfibre/PVC foam/glassfibre sandwich, attached to tubing with glassfibre and epoxy resin

LANDING GEAR: Retractable tricycle type

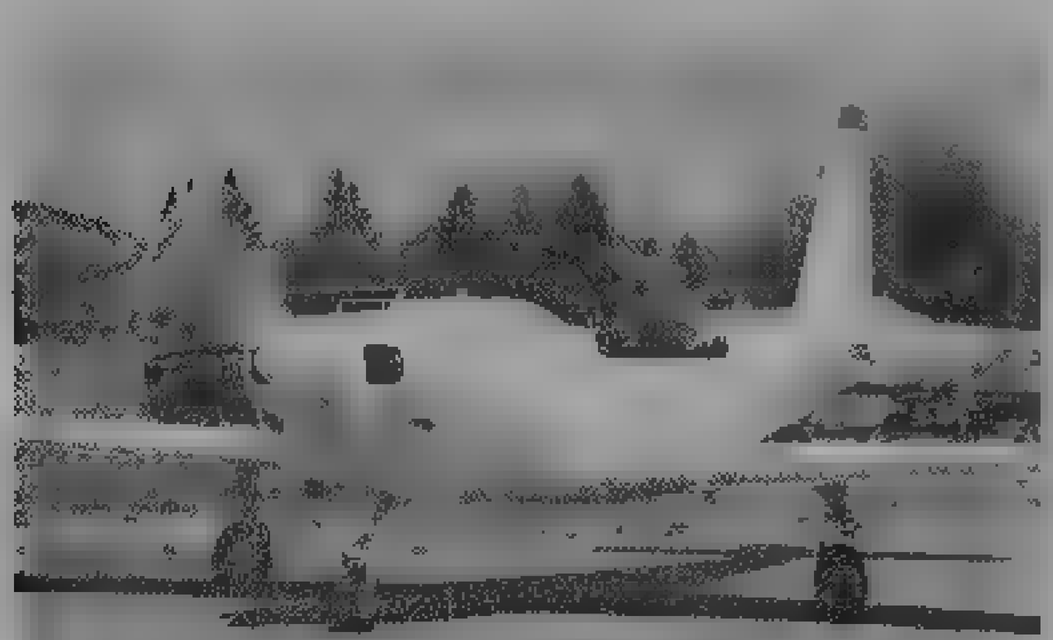
POWER PLANT: One 224 kW (300 hp) Textron Lycoming TIO-540-S1AD turbocharged engine in prototype

DIMENSIONS, EXTERNAL:
- Wing span: 9.14 m (30 ft 0 in)
- Length overall: 7.62 m (25 ft 0 in)
- Height overall: 2.90 m (9 ft 6 in)

WEIGHTS AND LOADINGS:
- Weight empty: 816 kg (1,800 lb)
- Baggage capacity: 45 kg (100 lb)
- Max T-O weight: Utility: 1,270 kg (2,800 lb)
- Aerobatic: 1,088 kg (2,400 lb)

PERFORMANCE (at max T-O weight, ISA):
- Max level speed at S/L: 195 kts (362 km/h, 225 mph)
- Max cruising speed at 2,440 m (8,000 ft): 185 kts (343 km/h, 213 mph)
- Service ceiling: 7,620 m (25,000 ft)
- T-O run: 457 m (1,500 ft)
- Landing run: 548 m (1,800 ft)
- Range at max cruising speed, 45 min reserves: 868 n miles (1,609 km, 1,000 miles)

UPDATED



Sequoia 300 Sequoia

1993

SEQUOIA FALCO F 8L

TYPE: Side by side two-seat, dual control aircraft, provision for child's seat in baggage space

PROGRAMME: Sequoia Aircraft markets plans and kits to build improved version of Falco F 8L high-performance monoplane, designed in Italy by Ing Stelio Frati of General Avia (which see) and first flown on 15 June 1955

CUSTOMERS: 45 aircraft flying in early 1995

COSTS: Kit: $60,000. Plans: $400

DESIGN FEATURES: NACA $64_2$212.5 wing section at root, NACA $64_2$210 at tip

STRUCTURE: Entire airframe has plywood covered wood structure, with overall fabric covering and glassfibre wing fillets. Optional metal control surfaces

LANDING GEAR: Retractable tricycle type

POWER PLANT: One 119 kW (160 hp) Textron Lycoming IO-320-B1A is standard for kit built aircraft. Optional engines for which Sequoia offers installation kits are the 112 kW (150 hp) IO-320-A1A and 134 kW (180 hp) IO-360-B1E. Fuel capacity 151 litres (40 US gallons, 33.3 Imp gallons). Optional 7.6 litre (2 US gallon, 1.7 Imp gallon) header tank to permit inverted flight

DIMENSIONS, EXTERNAL:
- Wing span: 8.00 m (26 ft 3 in)
- Wing aspect ratio: 6.40
- Length overall: 6.50 m (21 ft 4 in)
- Height overall: 2.29 m (7 ft 6 in)

AREAS:
- Wings, gross: 10.00 m² (107.6 sq ft)

WEIGHTS AND LOADINGS (119 kW, 160 hp engine):
- Weight empty: 550 kg (1,212 lb)
- Payload with max fuel: 194 kg (428 lb)
- Baggage capacity: 40 kg (88 lb)
- Max aerobatic weight: 748 kg (1,650 lb)
- Max T-O weight: 853 kg (1,880 lb)
- Max wing loading: 85.31 kg/m² (17.47 lb/sq ft)
- Max power loading: 7.17 kg/kW (11.75 lb/hp)

PERFORMANCE (at max T-O weight, ISA, 119 kW, 160 hp engine):
- Max level speed at S/L: 184 kts (341 km/h, 212 mph)
- Cruising speed: more than 174 kts (322 km/h, 200 mph)
- Stalling speed, flaps and wheels down: 54 kts (100 km/h, 62 mph)
- Max rate of climb at S/L: 347 m (1,140 ft)/min
- Service ceiling: 5,790 m (19,000 ft)
- Range at econ cruising speed: 868 n miles (1,609 km, 1,000 miles)

UPDATED

Sequoia Falco F 8L and builder/owner Dave MacMurray

1995

SHADIN

SHADIN CO INC

14280 23rd Avenue North, Minneapolis, Minnesota 55447-4910
Telephone: 1 (612) 544 6422
PRESIDENT: M S Reda

NEW ENTRY

SHADIN S-10 AEROPONY

TYPE: Side by side, two-seat trainer

PROGRAMME: Bucker Bü 181 Bestmann entered production in 1939; built under licence in Sweden, Czechoslovakia (Zlin Z-281 and Z-381) and Egypt (Helwan Gomhouria); various power plants. Production re-launched by Shadin, 1994

DESIGN FEATURES: Similar to Bü 181D, but has four cockpit transparencies instead of 15, Continental engine, as Gomhouria Mk 6, modern avionics

FLYING CONTROLS: Manually operated; narrow chord ailerons over half of wing trailing-edge; split flaps between ailerons and fuselage. Elevators with trim tabs, rudder with fixed tab

STRUCTURE: Forward and centre fuselage of steel tubing coated with duralumin, rear of wooden monocoque. Wooden fin constructed on two longerons, metal control surfaces throughout

LANDING GEAR: Fixed, tricycle

POWER PLANT: One 108 kW (145 hp) Teledyne Continental O-300D driving a two-blade propeller. Fuel capacity 125 litres (33 US gallons, 27.5 Imp gallons)

ACCOMMODATION: Two persons, side by side in enclosed cockpit

AVIONICS: *Flight*: Bendix/King KN 75 VOR/ILS and KLX 135 GPS

DIMENSIONS, EXTERNAL:

Wing span	10.60 m (34 ft 9¼ in)
Wing aspect ratio	8.78
Length overall	7.90 m (25 ft 11 in)
Height overall	2.05 m (6 ft 8¾ in)

AREAS:

Wings, gross	12.80 m² (137.78 sq ft)

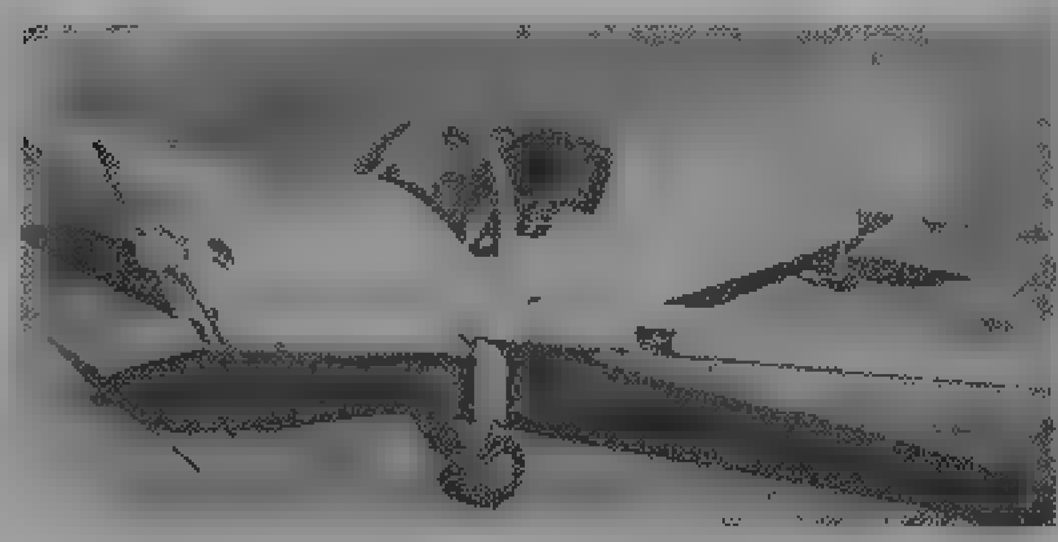
WEIGHTS AND LOADINGS:

Operating weight empty	544 kg (1,200 lb)
Max T-O weight	828 kg (1,825 lb)
Max wing loading	64.68 kg/m² (13.25 lb/sq ft)
Max power loading	7.66 kg/kW (12.58 lb/hp)

PERFORMANCE:

Max level speed	119 kts (220 km/h, 136.7 mph)
Cruising speed	100 kts (185 km/h, 115 mph)
Time to 3,000 m (9,840 ft)	20 min
Service ceiling	4,200 m (13,780 ft)
Range	432 n miles (800 km, 497 miles)

NEW ENTRY



Shadin S-10 Aeropony, evolved from Bü 181 via Gomhouria

1995

SIKORSKY

SIKORSKY AIRCRAFT (Subsidiary of United Technologies Corporation)

6900 Main Street, Stratford, Connecticut 06601-138
Telephone: 1 (203) 386 4000
Fax: 1 (203) 386 7300
Telex: 96 4372

OTHER WORKS: Troy, Alabama; South Avenue, Bridgeport, Connecticut; Shelton, Connecticut; West Haven, Connecticut; Development Flight Test Center, West Palm Beach Florida

PRESIDENT: Eugene Buckley

SENIOR VICE-PRESIDENTS:
G. C. Kay (Administration)
Robert R. Moore (Production Operations)

VICE-PRESIDENT, PROGRAMMES:
Merrick W. Hellyar

VICE-PRESIDENT, INTERNATIONAL BUSINESS:
James J. Satterwhite

VICE-PRESIDENT, RESEARCH AND ENGINEERING:
Dr Kenneth M. Rosen

VICE-PRESIDENT, GOVERNMENT BUSINESS DEVELOPMENT:
Gary F. Rast

MANAGER OF PUBLIC RELATIONS: William S. Tuttle

Founded as Sikorsky Aero Engineering Corporation by late Igor I. Sikorsky, has been division of United Technologies Corporation since 1929, but established as a subsidiary with effect 1 January 1995, began helicopter production in 1940s, has produced more than 7,800 rotary-wing aircraft; further 1,800 Sikorsky helicopters built by foreign licensees. Workforce 10,500 in 1994.

Headquarters and main plant at Stratford, Connecticut; main current programmes include UH-60 Black Hawk and derivatives, CH-53E Super Stallion and S-76 series. Sikorsky and Boeing Helicopters won US Army RAH-66 Comanche light helicopter demonstration/validation order on 5 April 1991 (see under Boeing Sikorsky in this section).

Sikorsky licensees include Agusta of Italy, Eurocopter of France and Germany, Mitsubishi of Japan, Pratt & Whitney Canada Ltd and Westland of the UK. Sikorsky and Embraer of Brazil signed agreement in Summer 1983 to transfer technology covering design and manufacture of composites components. Sikorsky and CASA of Spain signed MoU in June 1984 covering long-term helicopter industrial co-operation programme; CASA builds tail rotor pylon, tailcone and stabiliser components for H-60 and S-70, with first CASA S-70 components delivered to Sikorsky January 1986.

Westland plc (see UK section) shareholders approved joint Fiat/Sikorsky plan involving financial and technical support and minor equity participation in Westland on 12 February 1986. Westland then licensed to manufacture S-70 series.

Licence to manufacture S-70 in Japan granted to Mitsubishi Heavy Industries in 1988.

UPDATED

SIKORSKY S-80/H-53E

US Marine Corps and Navy designations: CH-53E Super Stallion and MH-53E Sea Dragon

TYPE: Three-engined heavy-lift helicopter.

PROGRAMME: Phase I development funding for CH-53E Super Stallion allocated 1973; first flight of first of two prototypes 1 March 1974; first flight of first production prototype 8 December 1975, first flight of second production prototype March 1976; deliveries to US Marine Corps started 16 June 1981; 158 CH-53Es and 50 MH-53Es funded up to and including FY93, 12 CHs funded in FY94, followed by an option for two examples in FY95, but programme future still uncertain.

CURRENT VERSIONS: **CH-53E Super Stallion**: Used by US Marine Corps for amphibious assault, carrying heavy equipment and armament, and recovering disabled aircraft; also used by US Navy for vertical onboard delivery and recovery of damaged aircraft from aircraft carriers; went into operation in Mediterranean area Summer 1983 with HC-4 at Sigonella, Italy; also serves as part of HC-2 at Norfolk, Virginia, and with Marines squadrons HMH-361, HMH-465 and HMH-466 at Tustin, California, and HMH-461 and HMH-464 at New River, North Carolina, plus HMT-302 for training at Tustin. *Detailed description applies to CH-53E, but applicable also to MH-53E, except where indicated.*

Sikorsky CH-53E Super Stallion heavy lift helicopter of the US Navy's HC-4 'Black Stallions' *(Paul Jackson)*

1995

Planned improvements for CH-53E include composites tail rotor blades, uprated GE T64-GE-416 engines, Omega navigation system, ground proximity warning system, flight crew night vision system, improved internal cargo handling system, missile alerting system, chaff/flare dispensers, nitrogen fuel inerting system, and facility for refilling hydraulic system inside cargo compartment. CH-53E will possibly be equipped with self-defence air-to-air missiles; initial trials of AIM-9 Sidewinder conducted at Naval Air Test Center, Patuxent River, Maryland.

Full-scale development of helicopter night vision system (HNVS) for CH-53E began June 1986, in co-operation with Northrop Electro-Mechanical Division. HNVS includes Lockheed Martin pilot night vision system (PNVS) and Honeywell integrated helmet and display sighting system (IHADSS) from Bell AH-1S surrogate trainer; HNVS will allow low-level operations in night and adverse weather; HNVS ground testing began 1988, operational evaluation began August 1989. Smaller scale capability authorised 1993, with contract to EER Systems for installation of Hughes AN/AAQ-16B FLIR, Teledyne Ryan Electronics AN/APN-217 Doppler and Rockwell Collins GPS 3A, total 24 upgrades to follow.

MH-53E Sea Dragon: Airborne mine countermeasures helicopter able to tow through water hydrofoil sledge carrying mechanical, acoustic and magnetic sensors; early history in 1982-83 *Jane's*; nearly 3,785 litres (1,000 US gallons; 833 Imp gallons) extra fuel carried in enlarged sponsons made of composites, improved hydraulic and electrical systems; minefield, navigation and automatic flight control system with automatic towing and approach and departure from hover modes. First flight of first pre-production MH-53E, 1 September 1983, first delivery to US Navy 26 June 1986, in operational service with HM-14 at Norfolk, Virginia, 1 April 1987, another MH-53E delivered to HM-12 (now AMCM training unit) in Spring 1987 was 100th H-53E, 32 delivered to USN by December 1991, including some with HM-15 at Alameda, California, for Pacific Fleet, none delivered in 1992; first carrier deployment by HM-15 on board USS *Tripoli*, 9 December 1989. HM-18 at Norfolk, Virginia, and HM-19 (USN Reserve) at Alameda both re-equipped from RH-53Ds in 1993 but due to integrate with regular force units HM-14 and HM-15 respectively, also partly equips Marines squadron HMH-461 at New River, North Carolina. Total requirement was 56. Delivery effected 1994 of MH-53E retrofitted with upgraded avionics package by EER Systems, comprising two 15.2 cm (6 in) horizontal situation display colour screens, Fairchild mission data loader and Rockwell Collins GPS 3A, USN developmental testing began June 1994 and to continue until end September, when month-long operational evaluation scheduled; upgrade of entire MH-53E fleet planned but may be reduced to around 30 as result of defence budget trimming. One MH-53E to West Palm Beach, Florida, for installation of T64-GE-419 engines, late 1993. Trials during 1994 verified performance gains, including recovery and flyaway capability in event of engine failure during hover; plans in hand to retrofit entire MH-53E fleet, with Sikorsky under contract to deliver first eight engine kits in October 1996, proposal for 11 more submitted.

CUSTOMERS: US Navy and Marine Corps (see Programme and Current Versions). Japan has acquired helicopters similar to MH-53E (see S-80M entry). Over 700 of Sikorsky S-65/S-80/H-53 series built by 1993.

SEA DRAGON and SUPER STALLION DELIVERIES

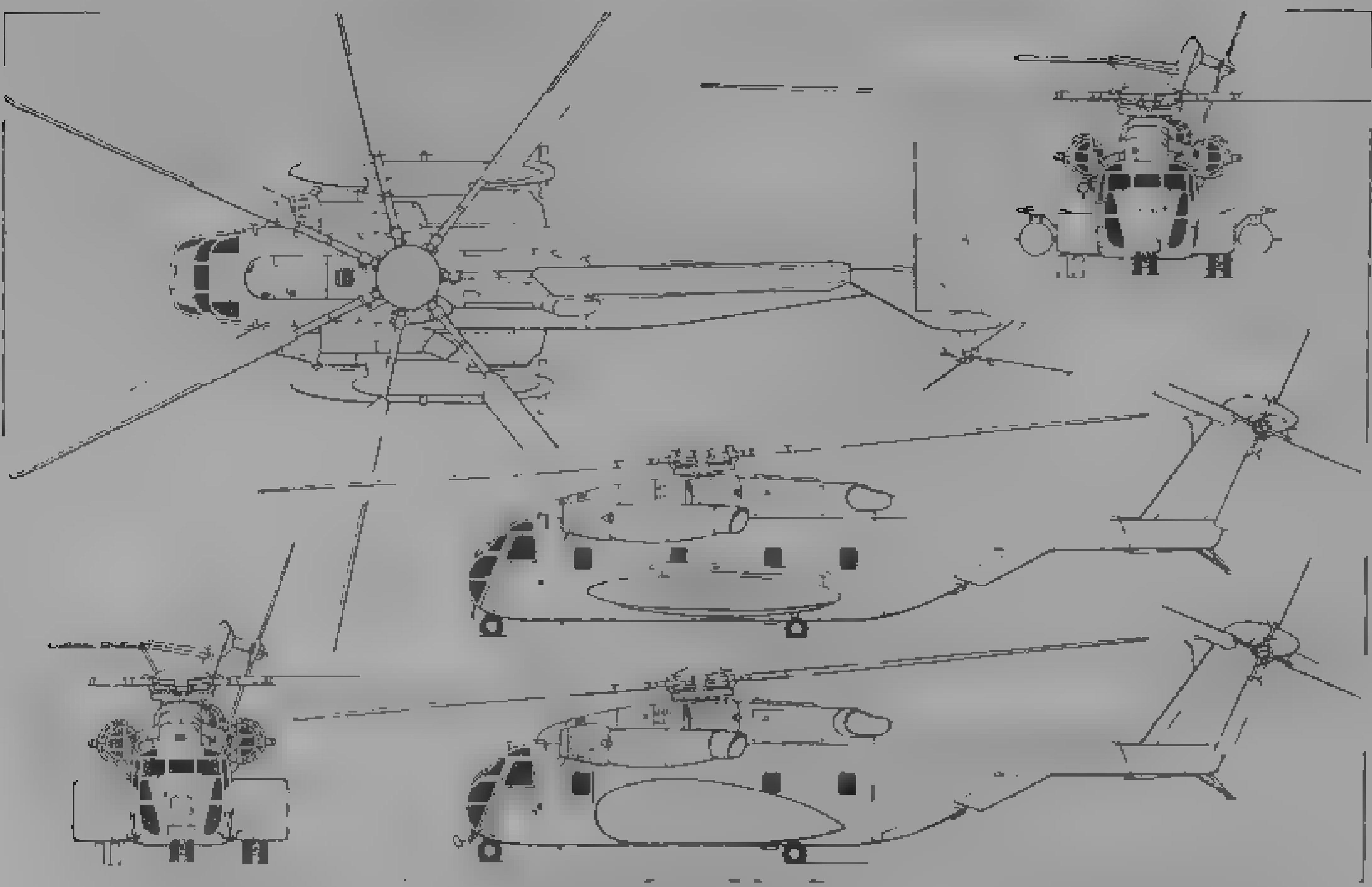
Year	USN/USMC	Japan
1980	2	
1981	14	
1982	24	
1983	20	
1984	18	
1985	10	
1986	9	
1987	12	
1988	13	1
1989	12	3
1990	14	2
1991	6	
1992	8	4
1993	14	
1994	17	1
Totals	**193**	**11**

COSTS: $24.36 million (1992) projected average unit cost.

DESIGN FEATURES: Fully articulated seven-blade main rotor; blade twist 14°; hydraulic powered blade folding for main rotor; tail pylon folds hydraulically to starboard; four-blade tail rotor on pylon canted 20° to port to derive some lift from tail rotor and extend CG range; cranked, strut-braced tailplane; rotor brake standard; fuselage stressed for 20 g vertical and 10 g lateral crash loads.

FLYING CONTROLS: Fully powered, with autostabilisation and autopilot. See also Current Versions and Avionics.

STRUCTURE: Fuselage has watertight primary structure of light alloy, steel and titanium; glassfibre/epoxy cockpit section, extensive use of Kevlar in transmission fairing and engine cowlings; main rotor blades have titanium spar, Nomex honeycomb core and glassfibre/epoxy composites skin; titanium and steel rotor head; Sikorsky blade inspection method (BIM) sensors detect blade spar cracks occurring in service; tail rotor of aluminium, pylon and tailplane of Kevlar composites.



Sikorsky CH-53E Super Stallion, with additional lower side view and lower front view of MH-53E Sea Dragon (*Jane's/Dennis Punnett*)

1995

LANDING GEAR: Retractable tricycle type, with twin wheels on each unit. Main units retract into rear of sponsons on each side of fuselage. Fully castoring nosewheels.

POWER PLANT: Three General Electric T64-GE-416 turboshafts, each with a maximum rating of 3,266 kW (4,380 shp) for 10 minutes, intermediate rating of 3,091 kW (4,145 shp) for 30 minutes and maximum continuous power rating of 2,756 kW (3,696 shp). Retrofit planned with T64-GE-419s. Transmission rated at 10,067 kW (13,500 shp) for take-off.

Self-sealing bladder fuel cell in forward part of each sponson, each with capacity of 1,192 litres (315 US gallons; 262 Imp gallons). Additional two-cell unit, with capacity of 1,465 litres (387 US gallons, 322 Imp gallons) brings total standard internal capacity to 3,849 litres (1,017 US gallons, 847 Imp gallons). (Total internal capacity of MH-53E is 12,113 litres, 3,200 US gallons, 2,664 Imp gallons.)

Optional drop tank outboard of each sponson of CH-53E, total capacity 4,921 litres (1,300 US gallons, 1,082 Imp gallons). (MH-53E can carry seven internal range extension tanks, total capacity 7,949 litres, 2,100 US gallons; 1,748 Imp gallons.) Forward extendable probe for in-flight refuelling. Alternatively, aircraft can refuel by hoisting hose from surface vessel while hovering.

ACCOMMODATION: Crew of three. Main cabin of CH-53E will accommodate up to 55 troops on folding canvas seats along walls and in centre of cabin. Door on forward starboard side of main cabin. Hydraulically operated rear loading ramp. Typical freight loads include seven standard 1.02 × 1.22 m (3 ft 4 in × 4 ft) pallets. Single-point central hook for slung cargo, capacity 16,330 kg (36,000 lb).

SYSTEMS: Hydraulic system, with four pumps, for collective/cyclic pitch/roll, yaw and feel augmentation flight control servo mechanisms; engine starters, landing gear actuation, cargo winches, loading ramp; and blade and tail pylon folding. System pressure 207 bars (3,000 lb/sq in), except for engine starter system which is rated at 276 bars (4,000 lb/sq in). (Separate hydraulic system in MH-53E to power AMCM equipment.) Electrical system includes three 115 V 400 Hz 40 to 60 kVA AC alternators, and two 28 V 200 A transformer-rectifiers for DC power. Solar APU.

AVIONICS: *Flight:* Hamilton Standard automatic flight control system, using two digital onboard computers and a four axis autopilot. Retrofit test flown late 1993, comprising four Canadian Marconi CM A-2082 15.2 cm (6 in) square colour displays, tied with GPS, Doppler and AHRS, installation by Teledyne Ryan.

EQUIPMENT: MH-53E equipment includes Westinghouse AN/AQS-14 towed sonar, AN/AQS-17 mine neutralisation device, AN/ALQ-141 electronic sweep, and Edo AN/ALQ-166 towed hydrofoil sled for detonating magnetic mines.

DIMENSIONS, EXTERNAL (CH-53E and MH-53E):

Main rotor diameter	24.08 m (79 ft 0 in)
Main rotor blade chord	0.76 m (2 ft 6 in)
Tail rotor diameter	6.10 m (20 ft 0 in)
Length overall: rotors turning	30.19 m (99 ft 0½ in)
rotor and tail pylon folded	18.44 m (60 ft 6 in)
Length of fuselage	22.35 m (73 ft 4 in)
Width of fuselage	2.69 m (8 ft 10 in)
Width overall, rotor and tail pylon folded	
CH-53E	8.66 m (28 ft 5 in)
MH-53E	8.41 m (27 ft 7 in)
Height: to top of main rotor head	5.32 m (17 ft 5½ in)
tail rotor turning	8.97 m (29 ft 5 in)
rotor and tail pylon folded	5.66 m (18 ft 7 in)
Wheel track (c/l of shock struts)	3.96 m (13 ft 0 in)
Wheelbase	8.31 m (27 ft 3 in)

DIMENSIONS, INTERNAL (CH-53E and MH-53E):

Cabin:	
Length (rear ramp/door hinge to fwd bulkhead)	9.14 m (30 ft 0 in)
Max width	2.29 m (7 ft 6 in)
Max height	1.98 m (6 ft 6 in)

AREAS (CH-53E and MH-53E):

Main rotor disc	455.38 m² (4,901.7 sq ft)
Tail rotor disc	29.19 m² (314.2 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: CH-53E	15,072 kg (33,228 lb)
MH-53E	16,482 kg (36,336 lb)
Internal payload (100 n miles; 185 km; 115 miles radius)	
CH-53E	13,607 kg (30,000 lb)
External payload (50 n miles, 92.5 km, 57.5 miles radius)	
CH-53E	14,515 kg (32,000 lb)
Max external payload: CH-53E	16,330 kg (36,000 lb)
Useful load, influence sweep mission	
MH-53E	11,793 kg (26,000 lb)
Max T-O weight (CH-53E and MH-53E):	
internal payload	31,640 kg (69,750 lb)
external payload	33,340 kg (73,500 lb)
Max disc loading:	
internal payload	69.47 kg/m² (14.23 lb/sq ft)
external payload	73.21 kg/m² (14.99 lb/sq ft)
Max power loading:	
internal payload	3.14 kg/kW (5.17 lb/shp)
external payload	3.31 kg/kW (5.44 lb/shp)

PERFORMANCE (CH-53E and MH-53E, ISA, at T-O weight of 25,400 kg, 56,000 lb):

Max level speed at S/L	170 kts (315 km/h, 196 mph)
Cruising speed at S/L	150 kts (278 km/h, 173 mph)
Max rate of climb at S/L, 11,340 kg (25,000 lb) payload	762 m (2,500 ft)/min
Service ceiling at max continuous power	5,640 m (18,500 ft)
Hovering ceiling at max power:	
IGE	3,520 m (11,550 ft)
OGE	2,895 m (9,500 ft)
Self-ferry range, unrefuelled, at optimum cruise condition for best range:	
CH-53E	1,120 n miles (2,074 km, 1,289 miles)

UPDATED

SIKORSKY S-80E and S-80M

Export versions of CH/MH-53E, available as **S-80E** basic heavy transport helicopter and **S-80M** mine countermeasures helicopter; S-80E has single-point cargo hook and VFR equipment; options include troop seats, cabin soundproofing, internal cargo winch, 272 kg (600 lb) external hoist, two-point external cargo attachment, automatic blade and tail folding, two 2,460.5 litre (650 US gallon, 541 Imp gallon) external tanks, ground-to-air or in-flight refuelling equipment, engine air particle separators, and wide selection of com/nav equipment.

Japan allocated funding for 11 S-80Ms (four in FY86, two in FY87, four in FY89 and one in FY91; further one required); first S-80M-1 (8623) completed 13 January 1989 and handed over to Japan Defence Agency 30 November 1989, initially to 51 Squadron at Atsugi for trials, 10 delivered by January 1993, 11th followed in May 1994.

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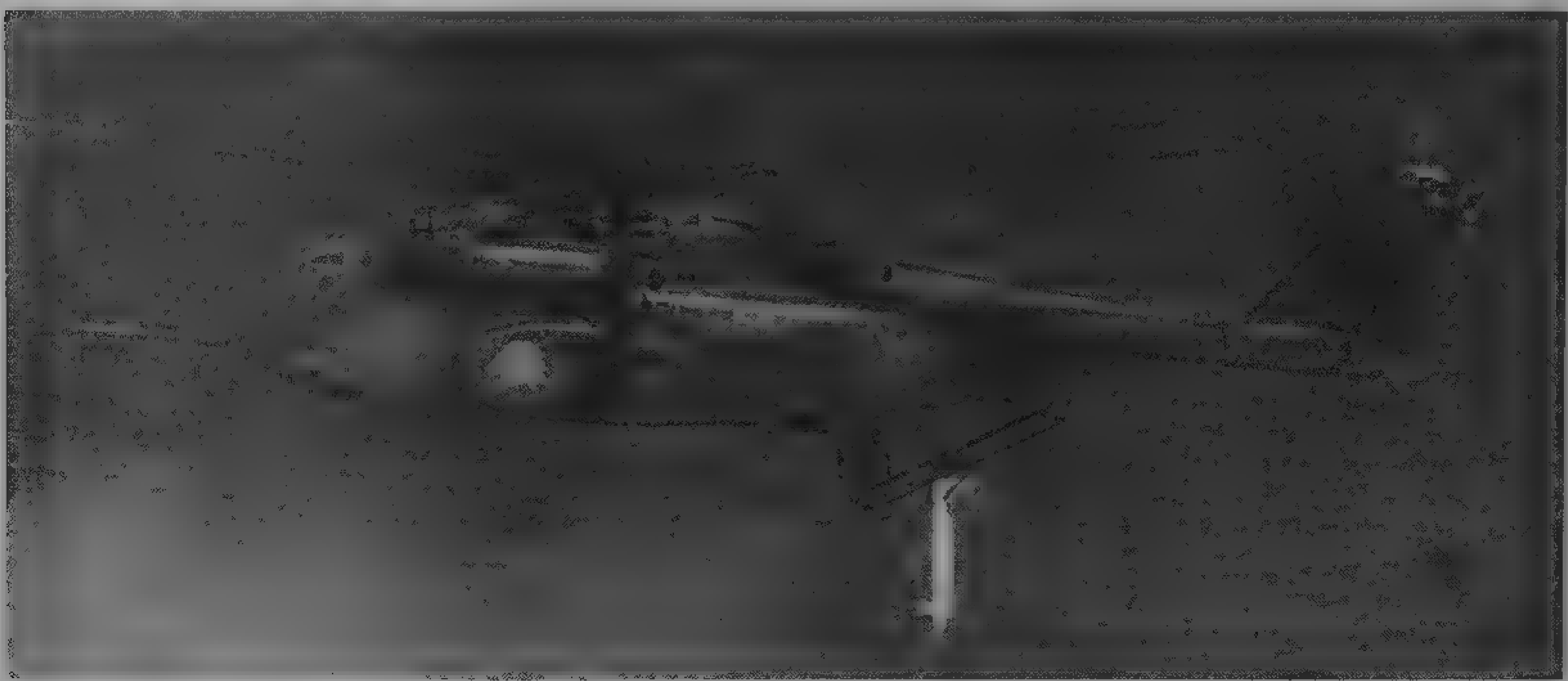


MH-53E of HM-14 deploys its side-scanning sonar device

1995

SIKORSKY S-70A

US Army designations: UH-60A, UH-60L and UH-60Q Black Hawk, AH-60L, EH-60A, MH-60A, MH-60K and MH-60L

US Air Force designations: UH-60A, HH-60G, MH-60G Pave Hawk

US Marine Corps designation: VH-60N

Israel Defence Force name: Yanshuf (Owl)

TYPE: Infantry squad transport helicopter; also adapted for other roles.

PROGRAMME: UH-60A declared winner of US Army Utility Tactical Transport Aircraft System (UTTAS) competition against Boeing Vertol YUH-61A 23 December 1976; first flight of first of three YUH-60A competitive prototypes 17 October 1974; early development history recorded in 1982-83 and earlier *Jane's*; 2,000th H-60 delivered May 1994. For retrofitted improvements, see UH-60L below.

CURRENT VERSIONS: **UH-60A Black Hawk**: Initial production version, designed to carry crew of three and 11 troops; also can be used without modification for medevac, reconnaissance, command and control, and troop supply; cargo hook capacity 3,630 kg (8,000 lb); one UH-60A can be carried in C-130, two in C-141 and six in C-5.

Medevac kits delivered from 1981; missile qualification completed June 1987, with day and night firing of Hellfire in various flight conditions, airborne target handover system (ATHS) qualified; cockpit lighting suitable for night vision goggles fitted to production UH-60s since November 1985 and retrofitted to those built earlier; US Army began testing Honeywell Volcano mine dispensing system July 1987; Volcano container is disposable and dispenses 960 Gator anti-tank and anti-personnel mines; usage monitor to measure certain rotor loads installed in 30 UH-60As; wire strike protection added to UH-60s and EH-60s during 1987; accident data recorders also fitted. Total 1,049 built for US Army (including 66 conversions to EH-60A) before production change to UH-60L in 1989. *Detailed description applies to UH-60A/L except where indicated.*

Enhanced Black Hawk: Incorporates active and passive self-defence systems, retrofitted by Corpus Christi Army Depot, Texas, to new build UH-60A/Ls, first 15 delivered to US Army in South Korea November 1989. Equipment includes Tracor AN/ARN-148 Omega navigation receiver, Motorola AN/LST-5B satellite UHF communications transceiver, Bendix/King AN/ARC-199 HF-SSB, and AEL AN/APR-44(V)3 specific threat RWR complementing existing AN/APR-39 general threat RWR. M134 Minigun can be fitted on each of two pintle mounts, replacing M60 machine gun.

JUH-60A: At least seven used temporarily for trials.

GUH-60A: At least 20 grounded airframes for technical training.

HH-60D Night Hawk: One prototype (82-23718) completed for abandoned USAF combat rescue variant.

EH-60A: (Designation **EH-60C** reserved, but not adopted by US Army.) Prototype YEH-60A (79-23301) ordered in October 1980 to carry 816 kg (800 lb) Quick Fix IIB battlefield ECM detection and jamming system. TRW Electronic Systems Laboratories was prime contractor for AN/ALQ-151(V)2 ECM kit, with installation by Tracor Aerospace; four dipole antennae on fuselage and deployable whip antenna, hover infra-red suppressor subsystem (HIRSS) standard. YEH-60A first flight 24 September 1981; order for Tracor Aerospace to modify 40 UH-60As to EH-60A standard under $51 million contract placed October 1984; first delivery July 1987 as part of US Army Special Electronics Mission Aircraft (SEMA) programme; 66 funded by FY87 excluding prototype; programme completed 1989.

Intercepts/locates AM, FM, CW and SSB radio emissions from upper HF to mid-VHF ranges over bandwidths of 8, 30 or 50 kHz; jams VHF communications with Fairchild AN/TLQ-17A; jams radar with ITT AN/ALQ-136(V)2 pulsed and Northrop Grumman AN/ALQ-162(V)2 CW transmitters. Protective systems of UH-60A/L (M-130 chaff/flare and AN/ALQ-144 IR jammer) augmented by Sanders AN/ALQ-156(V)2 missile plume detector and Litton AN/APR-39(V)2 RWR. Used by regular Army and Guard (D Coy, 135th Aviation of Kansas ArNG). Contract for conversion of 32 EH-60s to Advanced Quick Fix due 1995 for 1997 deployment; improvements to include AN/APR-39A(V)2 RWR, new PRC 118 wideband datalink, AEL/Sanders TACJAM-A ECM subsystem, IBM Communications High-Accuracy Locating System - Exploitable (CHALS-X) and UH-60L engines and gearbox for increase in maximum weight from 7,845 kg (17,295 lb) to 10,206 kg (22,500 lb).

MH-60A: About 30 modified for Army 160th Special Operations Aviation Regiment (SOAR), fitted with Hughes AN/AAQ-16 FLIR, Tracor AN/ARN-148 Omega/VLF navigation, M-130 chaff/flare dispensers, AN/ALQ-144 IR jammer, night vision equipment, multifunction displays, auxiliary fuel tanks and door-mounted Minigun; interim equipment, pending MH-60K, but replaced by MH-60L in late 1990 and passed to 1-245 Aviation Regiment, Oklahoma ArNG.

EH-60C: Original ECM/jamming Black Hawk redesignated EH-60A (see above). Designation now reserved for projected command and control version, not yet funded.

HH/MH-60G Pave Hawk: Replaced US Air Force HH-60D Night Hawk rescue helicopters, which were not funded (see 1987-88 *Jane's*), converted from UH-60A/L, including 10 originally delivered to 55th Aerospace Rescue and Recovery Squadron (now Special Operations Squadron) at Eglin AFB, Florida, in 1982-83, initially remaining as UH-60As, all progressively fitted by Sikorsky Support Services at Troy, Alabama, with aerial refuelling probe, 443 litre (117 US gallon; 97.5 Imp gallon) internal auxiliary fuel tank and fuel management panel, then to Pensacola NAD for mission avionics and modified instrument panel; some retrofitted with replacement internal tank of 700 litres (185 US gallons; 154 Imp gallons); most standardised on -701C engines by 1993.

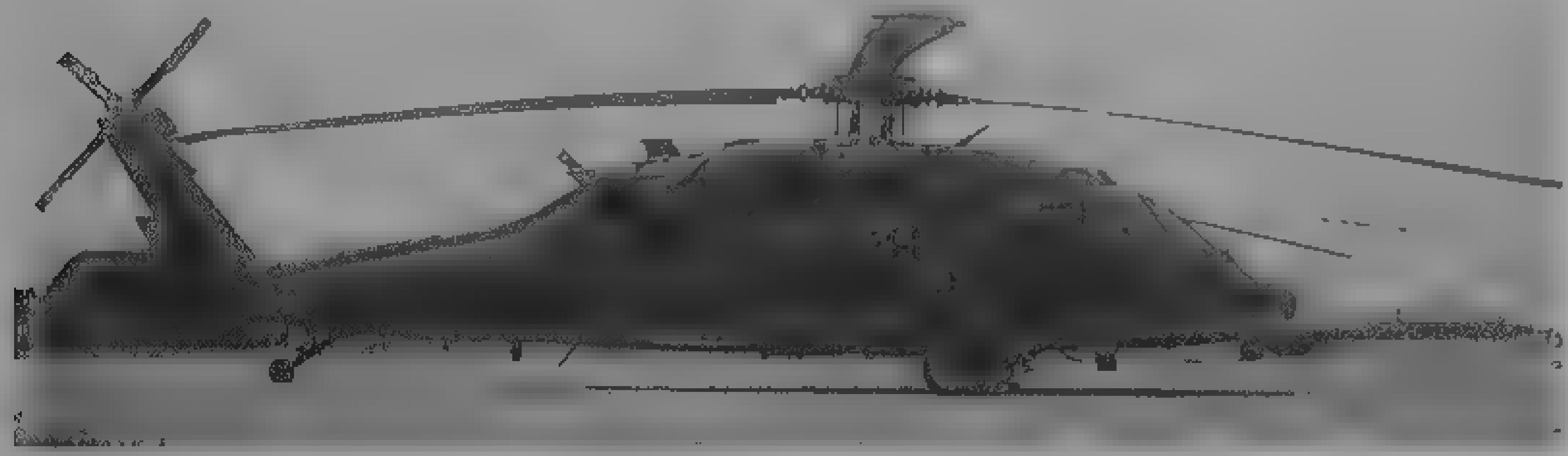
Further procurement began with batch of nine in FY87, followed by purchases of 16, 18, 22, 15 and 8 in FY88-92 with more since, all designated MH-60G until 1 January 1992, when 82 in combat rescue role redesignated HH-60G, balance of 16 remaining as MH-60G for special operations units. All have rescue hoist, Doppler/INS, electronic map display, Tacan, Bendix/King AN/APN-239 lightweight weather/ground-mapping radar, secure HF, and Satcom. MH-60G additionally has ESSS (see Armament paragraph) for weapons and additional fuel carrying capability plus door-mounted 0.50 in machine guns and Hughes AN/AAQ-16 Pave Low III FLIR as fitted in MH-53H/J; individual aircraft configurations vary, as only 10 per cent of fleet is to full 'G' standard.

Issued to 55th SOS at Eglin AFB, Florida (first operational MH-60G unit, March 1992, later to Hurlburt Field, Florida); 512th SOS, Kirtland AFB, New Mexico; 38th RQS (Rescue Squadron), Osan, South Korea; 66th RQS, Nellis AFB, Nevada (formed 1 March 1991); 56th RQS, Keflavik, Iceland (from December 1991), plus 304th RQS, Portland, Oregon (AFRes), 102nd RQS, Suffolk County, New York ANG, 129th RQS, Moffett Field NAS, California ANG; 210th RQS, Kulis, Alaska ANG; 33rd RQS, Kadena, Okinawa; 39th RQS, Misawa, Japan (1992); 48th RQS, Holloman AFB, New Mexico (1993); 305th RQS (ex-71st SOS), Davis-Monthan AFB, Arizona (1992), AFRes; 301st RQS, Homestead AFB (temporarily Patrick AFB), Florida (1992), AFRes, and 41st RQS, Patrick AFB, Florida (October 1992). Equipment planned of Combat Rescue School at Nellis AFB in 1994.

MH-60K: US Army special operations aircraft (SOA); prototype (88-26194) ordered in January 1988, first flight 10 August 1990. US Army funded two batches of 11 with options for another 38, first production aircraft (91-26368) complete, February 1992; trials at Patuxent River and Edwards AFB before intended first deliveries in June 1992

Sikorsky MH-60K special operations helicopter

1995



Sikorsky MH-60G Pave Hawk air rescue helicopter

1995

US BLACK HAWK PROCUREMENT

FY	Lot	Army	USAF	FMS	First aircraft*	Remarks
73	—	6			73-21650	RDT&E
77	1	15			77-22714	
78	2	56			78-22960	Includes YEH-60B (78-23013)
79	3	92			79-23265	
80	4	94			80-23416	
81	5	80	5		81-23547	
82	6	96	6		82-23660	MYP1, 18 December 1981
83	7	96			83-23837	
84	8	96			84-23933	
85	9	104			85-24387	MYP2, 31 October 1984
86	10	96			86-24483	
87	11	102	9	5[2]	87-24579	
88	12	72	16	15[3]	88-26015	MYP3, 11 January 1988
89	13	72	18	5[4]	89-26123	
90	14	76	22	1[5]	90-26218	
91	15	67	15	8[6]	91-26318	
92	16	60	8		92-26408	MYP4, 28 April 1992
93	17	60				
94	18	60				
95	19	60				
96	20	60				
Total		**1,520**	**99**	**34**		

Notes: Procurement to terminate with FY96 batch
[1]Includes 22 MH-60K for special operations
[2]For Colombia
[3]For Saudi Arabia (13) and Egypt (2)
[4]For Colombia
[5]For Bahrain
[6]For Saudi Arabia
*Serial numbers not always consecutive; batches include transfers to USAF and Foreign Military Sales programme

Sikorsky UH-60Q 'Dustoff' medical evacuation helicopter during trials 1995

Sikorsky AH-60L special forces' helicopter first revealed in 1995 1995

to 160th Special Operations Aviation Group (part of 160 SOA Regiment). Planned assignments to 'C' and 'D' Companies of 1 Battalion/160 SOA Group at Fort Campbell, Kentucky; 3-160 Avn at Hunter AAF, Georgia, and 1-245 Avn, Oklahoma ArNG. Deliveries delayed by software problems with special operations equipment, first 10 accepted in 1992 in non-operational state; remaining 12 initially stored, then delivered with new software installed October to December 1993 to permit start of training by 160 SOA Group, February 1994.

Features include provision for additional 3,141 litres (829 US gallons; 691 Imp gallons) of internal and external fuel (see Power Plant), plus flight refuelling capability, integrated avionics system with electronic displays, Hughes AN/AAQ-16 FLIR, Texas Instruments AN/APQ-174B terrain following, ground-mapping and air-to-ground ranging radar, T700-GE-701C engines and uprated transmission, external hoist, wire-strike protection, rotor brake, tiedown points, folding tailplane, AFCS similar to that of SH-60B, strengthened pintle mounts for 0.50 in machine guns, provision for Stinger missiles, missile warning receiver, pulse radio frequency jammer, CW radio jammer, laser detector, chaff/flare dispensers, and IR jammer.

SH-60B Seahawk: US Navy ASW/ASST helicopter, described separately.

SH-60F Seahawk: US Navy carrierborne inner-zone ASW helicopter to replace SH-3D Sea King. See Seahawk entry.

HH-60H and HH-60J Jayhawk: Search and rescue/special warfare helicopters, see Seahawk entry.

UH-60J: Designation of Japanese built S-70A-12 for Air Self Defence Force.

UH-60JA: Japanese Ground Self Defence Force to obtain 80 Mitsubishi built combat/utility Black Hawks in $2.67 billion acquisition programme announced early 1995. FY95 budget includes $66.8 million appropriation for first two; plans to deploy 50 with five district helicopter units alongside UH-1J, with balance assigned to VIP/training duties.

UH-60L: Replaced UH-60A in production for US Army from October 1989 (aircraft 89-26179 onwards); prototype (84-23953) first flight 22 March 1988, two preseries aircraft (89-26149 and 26154), first delivery 7 November 1989 to Texas ArNG. Powered by T700-GE-701C engines with uprated 2,535 kW (3,400 shp) transmission. Current production aircraft fitted with hover infra-red suppression system (HIRSS) to cool exhaust in hover as well as forward flight; older UH-60s retrofitted. Composites wide-chord main rotor blades of improved design flight tested at West Palm Beach, beginning 8 December 1993; new blade 16 per cent wider than current titanium rotor and has anhedral tip angled down at 20°; testing reveals much lower vibration plus anticipated benefits in payload, speed and manoeuvrability; projected retrofit from 1997.

MH-60L: Similar to MH-60A, for 160th SOAR, US Army, further modified as below.

AH-60L: 'Direct Action Penetrator'. Upgrade of MH-60L in 1990 with FLIR, radar and standard UH-60 external stores support system; two Black Hawk companies of 160th SOAR each have MH-60K platoon and AH-60L platoon.

UH-60M: Proposed enhanced version for US Army. Cancelled early 1989 in favour of UH-60L.

VH-60N: Nine for US Marine Corps Executive Flight Detachment of squadron HMX-1 at Quantico, Virginia, to replace UH-1Ns; deliveries started November 1988; known as VH-60A until redesignated 3 November 1989. Additional equipment includes more durable gearbox, weather radar, SH-60B-type flight control system and ASE, cabin soundproofing, VIP interior, cabin radio operator station, EMP hardening, 473 litre (125 US gallon; 104 Imp gallon) internal fuel tank and extensive avionics upgrading.

UH-60P: South Korean Army version of UH-60L (S-70A-18) with minor avionics modifications to meet local requirements; first (KA-1602) of three UH-60Ls delivered by Sikorsky 10 December 1990; balance of 80 UH-60Ps being assembled locally by Korean Airlines with increasing indigenous content, in $500 million, five-year programme.

UH-60Q: 'Dustoff' medical evacuation/armed search and rescue version for US Army; includes OBOGS, patient monitoring equipment, cabin lighting/air conditioning, personnel locator system, FLIR, weather radar, rescue hoist, dual mode IR/white searchlight, navigation (GPS, Tacan, Doppler and INS), communications (HF, multiband and satellite) and survivability (RWR/LWR) upgrades and improved litter arrangement. Prototype flown 31 January 1993 (conversion of UH-60A 86-24560 by Serv-Air Inc at Richmond, Kentucky). Delivered to Tennessee ArNG at Lovell Field, Chattanooga, on 12 March 1993. Evaluation for 12 months from September 1993; conversion programme anticipated but final decision awaited from US Army; requirement for 120.

UH-60V: Command and control version fitted with Symetrics Industries improved data modem allowing helicopters, armoured fighting vehicles and troops to communicate digitally; this capability successfully demonstrated in September 1994 during field exercise with development example of AH-64D Apache. Not yet deployed operationally but Army intent to use digital communications likely to lead to acquisition of further examples.

Exports comprise: S-70A-1: FMS deal for Royal Saudi Land Forces Army Aviation Command; 12 delivered January to April 1990 to squadron based at King Khaled Military City, modified to **Desert Hawk** and one (delivered December 1990) fitted with VIP interior. Desert Hawk has 15 troop seats, blade erosion protection using polyurethane tape and spray-on coating, Racal Jaguar 5 frequency-hopping radio, provision for searchlights, internal auxiliary fuel tanks, and external hoist.

S-70A-1L: Medical evacuation version for Saudi Arabia, infra-red filtered searchlight, rescue hoist, improved AN/ARC 217 HF com, AN/ARN-147 VOR/ILS, AN/ARN-149 ADF, air conditioning and provision for six stretchers; eight delivered from December 1991, further eight required.

S-70A-5: Two for Philippine Air Force, delivered March 1984.

S-70A-9: Royal Australian Air Force; 39 to replace Bell UH-1s; deliveries ran from October 1987 to 1 February 1991; first completed by Sikorsky, remainder assembled by Hawker de Havilland in Australia; aircraft transferred to Australian Army in February 1989, but RAAF continues to maintain them.

S-70A-11: Three to Jordan in 1986-87.

S-70A-12: Japan Self-Defence Forces acquiring

BLACK HAWK DELIVERIES

Year	US Army	USAF	Philippines	SOA	China	Taiwan	Jordan	Brunei	Westland	Australia	Saudi Arabia	Colombia	Turkey	Korea Co-prod	Korea FMS	Korea RoKAF	Japan	Egypt	Bahrain	Mexico	DEA	Morocco	Hong Kong	Argentina
1978	2																							
1979	36																							
1980	67																							
1981	1.9																							
1982	126																							
1983	126																							
1984	123		2		9																			
1985	120				15	11																		
1986	102					3	1	2	1												1			
1987	99	11					2			1+(13)											4			
1988	82	16								7+(11)	2	5	6											
1989	72	18								13+(14)	10	5												
1990	72	26								17	1		6	3+(13)			1+(2)	2	1					
1991	49			1						1	4			4	3	3				2				
1992	40	7		10							4			(24)								2	2	
1993	60			8									40	(24)										
1994	63	5		4									5	(16)										1
Totals	**1,358**	**83**	**2**	**23**	**24**	**14**	**3**	**2**	**1**	**39**	**21**	**10**	**57**	**7**	**3**	**3**	**1**	**2**	**1**	**2**	**5**	**2**	**2**	**1**

Notes: Kits in parentheses, NOT to be included in totals (appear also under year of completion)
DEA, Drug Enforcement Agency (USA)
SOA, Special Operations Aircraft

UH-60J version of Mitsubishi SH-60J for search and rescue. Sikorsky built prototype (N7267D), plus two CKD kits, delivered late 1990. JASDF and JMSDF require 70; 18 JASDF funded up to FY95, 12 funded for JMSDF to FY95.

S-70A-14: Two VIP for Brunei, delivered November and December 1986.

S-70A-16: Reserved for Westland Helicopters (see UK section).

S-70A-17: Turkish Jandarma ordered six in September 1988, deliveries completed December 1988, further six (including two VIP) delivered from late 1990 to Turkish National Police. See also S-70A-28.

S-70A-18: Korea (see UH-60P).

S-70A-19: Reserved for Westland of UK.

S-70A-21: Two VIP versions to Egypt, 1990.

S-70A-22: Korean VIP version. Three aircraft built by Sikorsky.

S-70A-24: Two UH-60Ls for Mexico. Delivered 1991.

S-70A-25/26: Moroccan Gendarmerie ordered two Black Hawks with different seating arrangements in 1991; delivered October 1992; began operations 11 November 1992, fitted with colour weather radar.

S-70A-27: Hong Kong. Two delivered 16 December 1992 to Royal Hong Kong Auxiliary Air Force, unit became Government Flying Service 1 April 1993. Fitted with FLIR and searchlight. Requirement for further four in 1995.

S-70A-28: Turkish follow-on batch, 95 ordered 8 December 1992, of which first five to Jandarma on 4 January 1993, followed by 40 to armed forces during 1993-94; balance of 50 co-produced in Turkey by TAI (which see).

S-70A-30: One VIP transport ordered for Argentine Air Force, January 1994, delivered 4 September 1994.

Direct transfers include one UH-60L to Bahrain, early 1991; five UH-60As delivered to Colombian Air Force in July 1988 for anti-narcotics operations, five more sold February 1989 and six in 1990; 10 delivered to Israel, August 1994, for 124 Squadron at Palmachim, under local name of Yanshuf (Owl); further deliveries planned.

Reserved designations as yet not ordered comprise S-70A-2 for Germany, -3 Spain, -4 Switzerland; -6 Thailand (transport); -7 Peru, -8 Brazil; -10 Israel, -13 not used, -15 Sweden, -20 Thailand (VIP), -23 Algeria, -29 unknown.

S-70C: Commercial version, described separately and under SH-60B Seahawk.

CUSTOMERS: Total 1,653 planned by US Army to end of FY96, including EH-60As and diversions to USAF, Bahrain, Colombia, Egypt and Saudi Arabia: see table; 1,000th accepted 17 October 1988 and 2,000th May 1994. US Army Black Hawks in service in Germany, Hawaii, South Korea, Panama and with Army National Guard and Army Reserve.

US Army loaned 12 UH-60As to the US Drug Enforcement Agency, augmenting five bought direct from Sikorsky.

See Current Versions for export models and details.

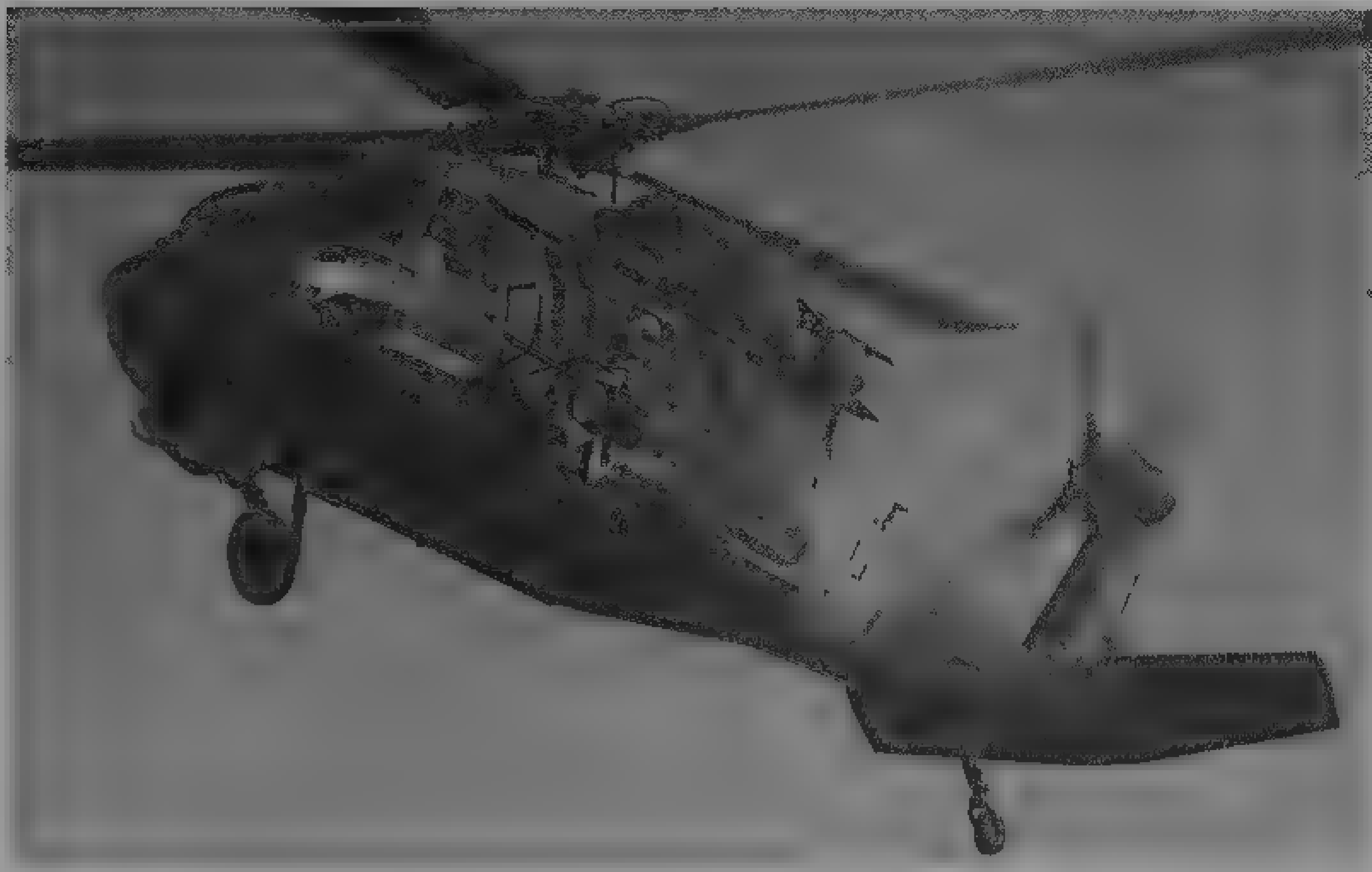
COSTS: UH-60L $5.87 million (1992) US Army unit cost; MH-60G $10.2 million.

DESIGN FEATURES: Represented new generation in technology for performance, survivability and ease of operation when introduced to replace UH-1 as US Army's main squad-carrying helicopter, adapted to wide variety of other roles, including several maritime applications. Four-blade main rotor: one-piece forged titanium rotor head with elastomeric blade retention bearings providing all movement and requiring no lubrication, hydraulic drag dampers; bifilar self-tuning vibration absorber above head, blades have 18° twist, and tips swept at 20°, thickness and camber vary over the length of blades, based on Sikorsky SC-1095 aerofoil, blades tolerant up to 23 mm hits and spar tubes pressurised with gauges to indicate loss of pressure following structural degradation.

Two pairs of tail rotor blades fastened in cross beam arrangement, mounted to starboard, tail rotor pylon tilted to port to produce lift as well as anti-torque thrust and to extend permissible CG range, fixed fin large enough to allow controlled run-on landing following loss of tail rotor.

FLYING CONTROLS: Rotor pitch control powered by two independent hydraulic systems; Hamilton Standard AFCS with digital three-axis autopilot provides speed and height control and coupled modes. Full-time autostabilisation includes feet-off heading hold cancelling torque-induced yaw at all airspeeds and during hover; positive fuselage attitude control provided by electrically driven variable incidence tailplane moving from +34° in hover to −6° during autorotation, angle is controlled by combined sensing of airspeed, collective-lever position, pitch attitude rate and lateral acceleration.

STRUCTURE: Main blade spar is formed and welded into oval titanium tube, with Nomex core, graphite trailing-edge and covered by glassfibre/epoxy skin; titanium leading-edge abrasion strip and Kevlar tip. New main blades, with modified tips and 16 per cent increase in chord, under development for UH-60L, available for retrofit from 1997. Cross-beam composites tail rotor, eliminating all rotor head bearings. Light alloy airframe designed to retain 85 per cent of its flight deck and passenger space intact after vertical impact at 11.5 m (38 ft)/s, lateral impact at 9.1 m (30 ft)/s, and longitudinal impact at 12.2 m (40 ft)/s, also withstands simultaneous 20 g forward and 10 g downward impact; glassfibre and Kevlar used for cockpit doors, canopy, fairings and engine cowlings; glassfibre/Nomex floors, tailboom folds to starboard and main rotor mast can be lowered for transport/storage.



Sikorsky S-70A-27 Black Hawk of Hong Kong Government Flying Service

1995

LANDING GEAR: Non-retractable tailwheel type with single wheel on each unit. Energy absorbing main gear with a tailwheel which gives protection for the tail rotor in taxying over rough terrain or during a high-flare landing. Axle assembly and main gear oleo shock-absorbers by General Mechatronics. Mainwheel tyres size 26 × 10.00-11, pressure 8.96 to 9.65 bars (130 to 140 lb/sq in), tailwheel tyre size 15 × 6.00-6, pressure 6.21 to 6.55 bars (90 to 95 lb/sq in). Alaskan based H-60s have Airglass Engineering ski undercarriage.

POWER PLANT: Two 1,210 kW (1,622 shp) intermediate rating General Electric T700-GE-700 turboshafts initially. From late 1989 (UH-60L), two T700-GE-701C engines, each developing intermediate 1,342 kW (1,800 shp). (T700-GE-701A engines with maximum T-O rating of 1,285 kW (1,723 shp) optional in export models.) Transmission rating 2,109 kW (2,828 shp) in UH-60A, uprated to 2,535 kW (3,400 shp) in models with T700-GE-701C engines. Two crashworthy, bulletproof fuel cells, with combined usable capacity of 1,361 litres (360 US gallons; 299.5 Imp gallons), aft of cabin. Single-point pressure refuelling, or gravity refuelling via point on each tank. Auxiliary fuel can be carried internally in one of several optional arrangements, or externally by the ESSS system. Two external tanks each of 870.5 litres (230 US gallons; 191.5 Imp gallons), up to two internal tanks, each of 700 litres (185 US gallons, 154 Imp gallons).

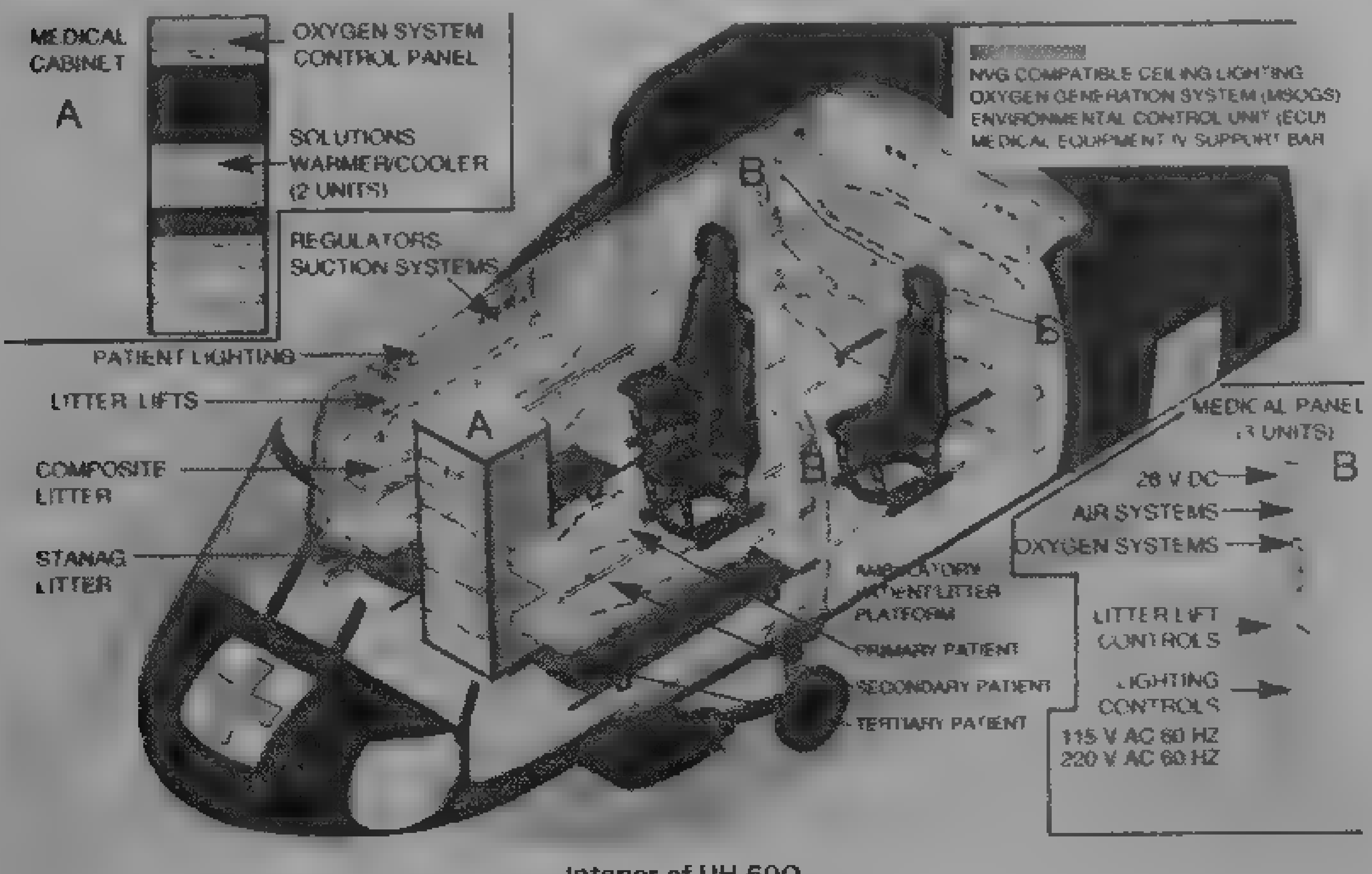
ACCOMMODATION: Two-man flight deck, with pilot and co-pilot on armour protected seats. A third crew member is stationed in the cabin at the gunner's position adjacent forward cabin windows. Forward-hinged jettisonable door on each side for access to flight deck area. Main cabin open to cockpit to provide good communication with flight crew and forward view for squad commander. Accommodation for 11 fully equipped troops, or 14 in high-density configuration. Eight troop seats can be removed and replaced by four litters for medevac missions, or to make room for internal cargo. An optional layout is available to accommodate a maximum of six litter patients. Cabin heated and ventilated. External cargo hook, having a 3,630 kg (8,000 lb) lift capability, enables UH-60A to transport a 105 mm howitzer, its crew of five and 50 rounds of ammunition. Rescue hoist of 272 kg (600 lb) capacity optional. Large rearward sliding door on each side of fuselage for rapid entry and exit. (Executive interiors for seven to 12 passengers available for the S-70A.)

SYSTEMS: Solar 67 kW (90 hp) T-62T-40-1, AlliedSignal or Sundstrand APU. An optional winterisation kit provides a second hydraulic accumulator installed in parallel with the APU hydraulic start accumulator, maintaining engine start capability at low ambient temperatures. Bendix 30 to 40 kVA and 20 to 30 kVA electrical power generators, 17 Ah Ni/Cd battery. Engine fire extinguishing system. Rotor blade de-icing system standard on US Army aircraft, optional for export. Electric windscreen de-icing.

AVIONICS: Configurations vary between aircraft, particularly on HH/MH-60G versions. Additional avionics and self protection equipment installed in Enhanced Black Hawk as described under Current Versions.

Comms: E-Systems AN/ARC-186 VHF-FM, GTE Sylvania AN/ARC-115 VHF-AM, Magnavox AN/ARC-164 UHF-AM, Collins AN/ARC-186(V) VHF-AM/FM, Bendix/King AN/APX-100 IFF transponder, Magnavox TSEC/KT-28 voice security set, and intercom. HH/MH-60G has AN/URC-108 Satcom.

Radar: MH-60K has Texas Instruments AN/APQ-147A terrain following/terrain-avoidance radar. HH/MH-60G has Bendix/King AN/APN-239 (RDR-1400C) radar. AH-60L and some export S-70s also equipped with radar

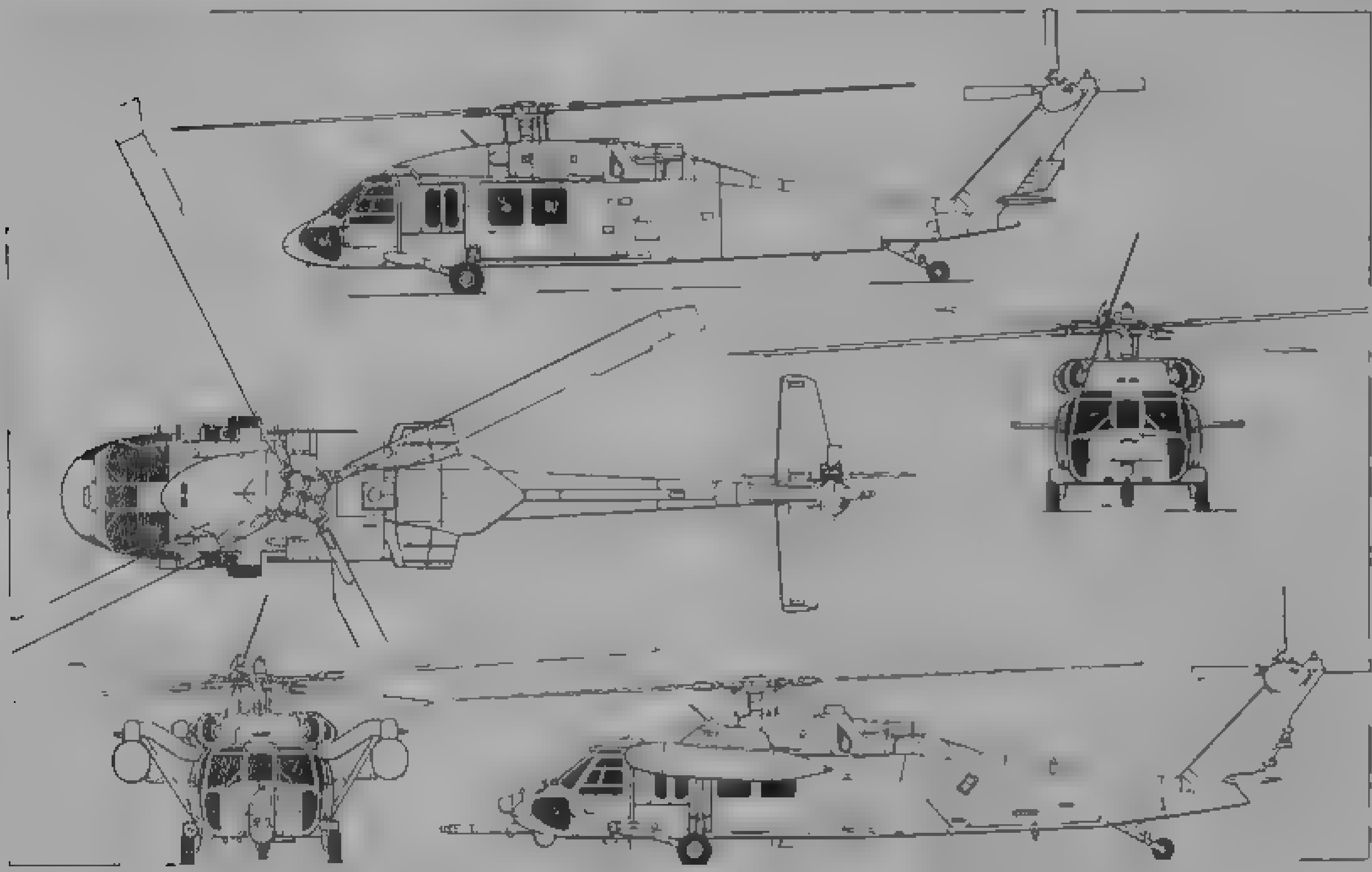


Interior of UH-60Q

1995

Moroccan Gendarmerie S-70A Black Hawk with nose-mounted colour weather radar

1995



Sikorsky UH-60L Black Hawk combat assault helicopter, with additional lower side view and lower front view of MH-60K special operations variant *(Jane's/Dennis Punnett)*

1995

Flight: Hamilton Standard AFCS with digital three-axis autopilot, Bendix/King AN/ARN-123(V)1 VOR/marker beacon/glide slope receiver, Emerson AN/ARN-89 ADF, Honeywell Plessey Electronic Systems AN/ASN-128 Doppler, AN/ASN-43 gyrocompass, Honeywell AN/APN-209(V)2 radar altimeter. HH/MH-60G has GEC-Marconi AN/ASN-137 Doppler, Rockwell Collins AN/ASN-149 GPS and Litton ring laser gyro INS (replacing Carousel IV).

Instrumentation: HH/MH-60G has Teldix KG-10 map display.

Mission: HH/MH-60G has Hughes AN/AAQ-16 FLIR.

Self-defence: Baseline UH-60 Black Hawk has E-Systems Melpar/Memcor AN/APR-39(V)1 RWR, Sanders AN/ALQ-144 IR countermeasures set and Tracor M-130 chaff/flare dispenser. MH-60K has Honeywell AN/AAR-47 missile warning system, Northrop Grumman AN/ALQ-136 pulse radio frequency jammer, Northrop Grumman AN/ALQ-162 CW radio jammer, E-Systems AN/APR-39A and AN/APR-44 pulse/CW warning receivers, Perkin Elmer AN/AVR-2 laser detector, Tracor M-130 chaff/flare dispenser and Sanders AN/ALQ-144 IR countermeasures set. HH/MH-60G has chaff/flare dispenser (Tracor M-130 being replaced by AN/ALE-40, but AN/ALE-47 to follow) and Sanders AN/ALQ-144 IR countermeasures set.

EQUIPMENT: HH/MH-60 have Lucas Western internal rescue hoist with 76 m (250 ft) of cable.

ARMAMENT: New production UH-60As and Ls from c/n 431 onward incorporate hardpoints for an external stores support system (ESSS). This consists of a combination of fixed provisions built into the airframe and four removable external pylons from which fuel tanks and a variety of weapons can be suspended. Able to carry more than 2,268 kg (5,000 lb) on each side of the helicopter, the ESSS can accommodate two 870 litre (230 US gallon; 191.5 Imp gallon) fuel tanks outboard, and two 1,703 litre (450 US gallon; 375 Imp gallon) tanks inboard. This allows the UH-60A to self-deploy 1,200 n miles (2,222 km; 1,381 miles) without refuelling. The ESSS also enables the Black Hawk to carry Hellfire laser-guided anti-armour missiles, gun or M56 mine dispensing pods, ECM packs, rockets and motorcycles. Up to 16 Hellfires can be carried externally on the ESSS, with another 16 in the cabin to provide the capability to land and reload. (Laser designation provided by Bell OH-58 helicopter or ground troops.) Two pintle mounts in cabin, adjacent forward cabin windows on each side, can each accommodate a 0.50 in calibre General Electric GECAL 50 or 7.62 mm six-barrel Minigun.

DIMENSIONS, EXTERNAL:
Main rotor diameter 16.36 m (53 ft 8 in)
Main rotor blade chord 0.53 m (1 ft 8¾ in)
Tail rotor diameter 3.35 m (11 ft 0 in)
Length overall: rotors turning 19.76 m (64 ft 10 in)
rotors and tail pylon folded 12.60 m (41 ft 4 in)
Length of fuselage:
UH-60A/MH-60G, excl flight refuelling probe 15.26 m (50 ft 0¾ in)
MH-60G, incl retracted refuelling probe 17.38 m (57 ft 0¼ in)
Width: UH-60A fuselage 2.36 m (7 ft 9 in)
MH-60G with auxiliary tanks 5.46 m (17 ft 11 in)
Max depth of fuselage 1.75 m (5 ft 9 in)
Height: overall, tail rotor turning 5.13 m (16 ft 10 in)
to top of rotor head 3.76 m (12 ft 4 in)
in air-transportable configuration 2.67 m (8 ft 9 in)
Tailplane span 4.38 m (14 ft 4½ in)
Wheel track 2.705 m (8 ft 10½ in)
Wheelbase 8.83 m (28 ft 11¾ in)
Tail rotor ground clearance 1.98 m (6 ft 6 in)
Cabin doors (each): Height 1.37 m (4 ft 6 in)
Width 1.75 m (5 ft 9 in)

DIMENSIONS, INTERNAL:
Cabin: Volume 11.61 m³ (410.0 cu ft)

AREAS:
Main rotor blades (each) 4.34 m² (46.70 sq ft)
Tail rotor blades (each) 0.41 m² (4.45 sq ft)
Main rotor disc 210.15 m² (2,262 sq ft)
Tail rotor disc 8.83 m² (95.03 sq ft)
Fin 3.00 m² (32.3 sq ft)
Tailplane 4.18 m² (45.0 sq ft)

WEIGHTS AND LOADINGS:
Weight empty: UH-60A 5,118 kg (11,284 lb)
UH-60L 5,216 kg (11,500 lb)
Payload: internal, UH-60A/L 1,197 kg (2,640 lb)
underslung, UH-60A/L 3,629 kg (8,000 lb)
Mission T-O weight: UH-60A 7,484 kg (16,500 lb)
UH-60L 7,711 kg (17,000 lb)
HH-60G 8,119 kg (17,900 lb)
MH-60K 11,113 kg (24,500 lb)
Max alternative T-O weight:
UH-60A 9,185 kg (20,250 lb)
UH-60L 10,659 kg (23,500 lb)
Max disc loading:
UH-60L at mission T-O weight 36.69 kg/m² (7.52 lb/sq ft)
UH-60L at max alternative T-O weight 50.72 kg/m² (10.39 lb/sq ft)
Max power loading:
UH-60L at mission T-O weight 3.04 kg/kW (5.00 lb/shp)
UH-60L at max alternative T-O weight 4.20 kg/kW (6.91 lb/shp)

PERFORMANCE (UH-60A at mission T-O weight, except where indicated):
Max level speed at S/L 160 kts (296 km/h; 184 mph)
Max level speed at max T-O weight 158 kts (293 km/h; 182 mph)
Max cruising speed:
UH-60A 139 kts (257 km/h; 160 mph)
UH-60L 150 kts (278 km/h; 173 mph)
Single-engine cruising speed at 1,220 m (4,000 ft) and 35°C (95°F) 105 kts (195 km/h; 121 mph)
Vertical rate of climb at 1,220 m (4,000 ft) and 35°C (95°F): UH-60A 125 m (411 ft)/min
UH-60L 239 m (785 ft)/min
Service ceiling 5,790 m (19,000 ft)
Hovering ceiling: IGE at 35°C 2,895 m (9,500 ft)
OGE, ISA 3,170 m (10,400 ft)
OGE at 35°C 1,705 m (5,600 ft)
Range with max internal fuel at max T-O weight, 30 min reserves: UH-60A 319 n miles (592 km; 368 miles)
UH-60L 315 n miles (584 km; 363 miles)
Range with external fuel tanks on ESSS pylons:
with two 870 litre (230 US gallon; 191.5 Imp gallon) tanks 880 n miles (1,630 km; 1,012 miles)
with two 870 litre (230 US gallon; 191.5 Imp gallon) and two 1,703 litre (450 US gallon; 375 Imp gallon) tanks 1,200 n miles (2,222 km; 1,381 miles)
Endurance: UH-60A 2 h 18 min
UH-60L 2 h 6 min
MH-60G with max fuel 4 h 51 min

UPDATED

SIKORSKY S-70B

US Navy designations: SH-60B Seahawk, SH-60F and HH-60H

US Coast Guard designation: HH-60J Jayhawk

Spanish Navy designation: HS.23

TYPE: ASW, and anti-ship surveillance and targeting helicopter.

PROGRAMME: Naval development of Sikorsky UTTAS (UH-60A Black Hawk) utility helicopter; won US Navy LAMPS Mk III competition for shipboard helicopter in 1977; first flight of first of five prototypes (161169) 12 December 1979; development details in 1982-83 *Jane's*; first 18 SH-60Bs authorised FY82. Changed USN planning in 1993 resulted in premature end to SH-60B/F production, SH-60F to be withdrawn from aircraft carriers, remanufacture of SH-60B/Fs as SH-60R to begin in 1998.

CURRENT VERSIONS: **SH-60B:** Initial production version for ASW/ASST, *as detailed under main description*.

XSH-60J: Japan Maritime Self-Defence Force (JMSDF) placed $27 million order for two **S-70B-3**s for installation of Japanese avionics and mission equipment, first flights 31 August and early October 1987, 1,007 hour test programme by Japan Defence Agency Technical Research and Development Institute between 1 June 1989 and 7 April 1991 to evaluate largely Japanese avionics for SH-60J but AN/APS-124 radar.

SH-60J: Mitsubishi (which see) is manufacturing SH-60J Seahawk for JMSDF to replace Sikorsky SH-3 Sea Kings by mid-1990s; total 90 required, 64 funded up to FY95, including two US built development aircraft. Japan Defence Agency's Technical Research and Development Institute to assemble prototype advanced rotor system for SH-60J in 1995, with full-scale version to be tested 1996-97. Will incorporate all-composite blades with redesigned cross-sections, planforms and tips and is expected to offer 5 per cent increase in hover efficiency and 30 per cent reduction in vibration levels, fleetwide retrofit probable if trials successful.

UH-60J/UH-60JA: Japanese variants of Black Hawk (see previous entry).

S-70B: Royal Australian Navy selected Seahawk, designated **S-70B-2**, for role adaptable weapon system (RAWS) full spectrum ASW helicopter with autonomous

First S-70B-6 Seahawk was delivered to Greece in 1994

1995

operating capability, order for eight confirmed 9 October 1984, eight more ordered May 1986, operates from RAN 'Adelaide' class (FFG-7) guided missile frigates; first flight (N7265H, now N24-001) at West Palm Beach 4 December 1987; 14 originally planned to be assembled in Australia, but announced late 1988 Sikorsky would assemble first eight, ASTA in Australia (which see) designated to assemble remainder in early 1989, first S-70B-2 handed over in USA 12 September 1989; formal acceptance at Nowra, NSW, 4 October 1989, Seahawk Introduction and Transition Unit became HS 816 at Nowra, 1 June 1991, formed first ship's flight, September 1991, squadron formally commissioned 23 July 1992. S-70B-2 has substantially different avionics to USN version Thomson Thorn Super Searcher radar (capable of tracking 32 surface targets) and Rockwell Collins advanced integrated avionics including cockpit controls and displays, navigation receivers, communications radios, airborne target hand-off datalink and tactical data system (TDS), final delivery 11 September 1991.

Spanish Navy received six **S-70B-1**s from December 1988 (designated **HS 23**) for operation from four FFG-7 frigates by Escuadrilla 010 at Rota, similar to USN SH-60B, but with Bendix/King AN/AQS-13F dipping sonar; further six ordered 1991

SH-60F. CV Inner Zone ASW helicopter, known as **CV-Helo**, for close-in ASW protection of aircraft carrier groups; $50.9 million initial US Navy contract for full-scale development and production options placed 6 March 1985, replacing SH-3H Sea King; Seahawk prototype modified as SH-60F test aircraft, first flight 19 March 1987, initial fleet deployment with USS *Nimitz* in 1991 Production terminated with delivery of final example 1 December 1994. To be phased out of carrier operations, conversions planned to SH-60R.

SH-60F has all LAMPS Mk III avionics, fairings and equipment removed, including cargo hook and RAST system main and tail probes, but installation provisions retained. Replaced by integrated ASW mission avionics including Bendix AN/AQS-13F dipping sonar, MIL-STD-1553B databus, dual Teledyne Systems AN/ASN-150 tactical navigation computers and AN/ASM-614 avionics support equipment, automatic flight control system with quicker automatic transition and both cable and Doppler autohover, tactical datalink with other aircraft, communications control system, multifunction keypads and displays for each of four crew members, internal/external fuel system and extra weapon station to port allowing carriage of three Mk 50 homing torpedoes, provision for surface search radar, FLIR, night vision equipment, passive ECM, MAD, air-to-surface missile capability, sonobuoy datalink, chaff/sonobuoy dispenser, attitude and heading reference system (AHRS), Navstar GPS, fatigue monitoring system and increase of maximum T-O weight to 10,659 kg (23 500 lb), secondary missions include SAR and plane guard

HH-60H: US Navy procurement of planned 42 to be achieved following resumption of deliveries on 1 December 1994, when first example of follow-on batch of 24 handed over at Stratford, Connecticut, used for strike-rescue/special warfare support (HCS), designated HH-60H, in September 1986; first flight (163783) 17 August 1988, accepted by USN 30 March 1989, in service with HCS-4 at Norfolk, Virginia, January 1990, initial procurement ended with 18th delivery July 1991, completing HCS-5 at Point Mugu, California, both squadrons are Reserves. Regular SH-60F squadrons later added pairs of HH-60Hs (HS-2, 3, 4, 6, 8, 14 and 15); missions are to recover four man crew at 250 n miles (463 km, 288 miles) from launch point or fly 200 n miles (371 km, 230 miles) and drop eight SEALs from 915 m (3,000 ft).

Close derivative of SH-60F, with same T700-GE-401C engines and HIRSS as SH-60B/F; equipment includes General Instrument AN/APR-39A(XE)2 RWR, Hughes AN/AVR-2 laser warning receiver, Honeywell AN/AAR-47 missile plume detector, Loral AN/ALE-47 chaff/flare dispenser, Sanders AN/ALQ-144 IR jammer, night vision goggle cockpit and two cabin-mounted M60D 7.62 mm machine guns; provision for weapon pylons, required to operate from decks of FFG-7, DD-963, CG-47 and larger vessels, as well as unprepared sites. Cubic AN/ARS-6 personnel locator system installed from FY91 Some equipped with Seahawk-type Indal RAST (recovery assist, secure and traverse) equipment. Armament development authorised October 1991 for installation of Hellfire ASM, 70 mm (2.75 in) rockets and forward-firing guns

HH-60J Jayhawk. Ordered in parallel with HH-60H, adapted for US Coast Guard medium-range recovery (MRR) role; 42 funded, including six in FY91, one each in FY92-93 and two in FY94, five more required. First flight (USCG 6001) 8 August 1989; first delivery to USCG (6002 at Elizabeth City CGAS) 16 June 1990; subsequently to Mobile, Traverse City, San Francisco, Cape Cod, Sitka, Kodiak and (December 1992) Clearwater CGAS When carrying three 455 litre (120 US gallon, 100 Imp gallon) external tanks, HH-60J can fly out 300 n miles (556 km, 345 miles) and return with six survivors in addition to four-man crew, or loiter for 1 hour 30 minutes when investigating possible smugglers; other duties include law enforcement, drug interdiction, logistics, aids to navigation, environmental protection and military readiness; compatible with decks of 'Hamilton' and 'Bear' class USCG cutters Equipment includes Bendix/King RDR-1300C search/weather radar, AN/ARN-147 VOR/ILS, KDF 806 direction-finder, GPS, Tacan, VHF/UHF-DF, TacNav, dual U/VHF-FM radios, HF radio, IFF V/U/HF IFF crypto computers, NVG-compatible cockpit, rescue hoist and external cargo hook

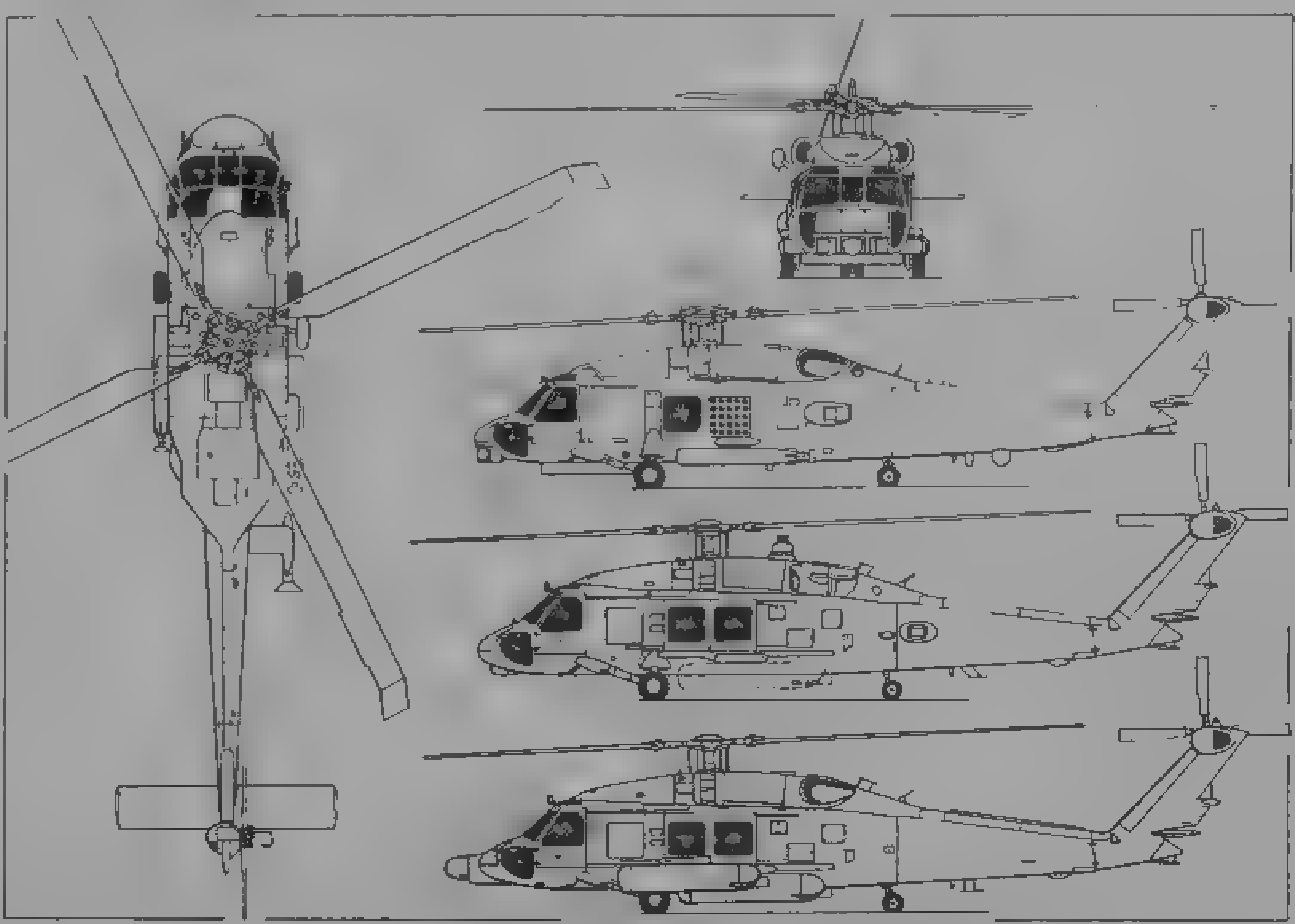
SH-60R: Remanufactured SH-60B/F combines SH-60B capabilities with dipping sonar of SH-60F; original plan anticipated first two conversions to be funded in FY98, 15 in FY99 and more thereafter, however, concerns over cost have led to one year delay in launch of remanufacture programme

S-70B-6. Hybrid SH-60B/F for Greece; five (plus three options) selected December 1991 and ordered 17 August 1992 for MEKO 200 frigates, armament includes NFT Penguin ASMs; avionics include AN/AQS-18(V)-3 dipping sonar, AN/APS-143(V)3 radar and AN/ALR-66(V)-2 ESM first two delivered fourth quarter of 1994

S-70B-7: Anticipated designation for six Seahawks ordered by Royal Thai Navy in October 1993, equipped for coastal surveillance maritime patrol and SAR from helicopter carrier, deliveries from 1997

S-70C(M)-1 Thunderhawk: Delivery began July 1990 to Taiwanese Navy of 10 SH-60B Seahawks, given S-70C designation, shipboard deployment from 1993 aboard six FFG-7 frigates. Equipment includes Bendix AN/AQS-18(V) dipping sonar, Telephonics AN/APS-128PC radar and Litton AN/ALR-606(V)-2 ESM integrated with radar antenna, no MAD

CUSTOMERS: Total US Navy requirement originally 260 SH-60Bs, plus five prototypes, 188 on order, including 12 in FY93 and seven in FY94, procurement then prematurely suspended. First flight production Seahawk 11 February 1983, deliveries at two a month; first squadron was HSL-41 at NAS North Island, San Diego, California, operational deployment began 1984, 10 US Navy squadrons operating by March 1991 (HSLs 41, 43, 45, 47 and 49 at



Sikorsky SH-60B Seahawk twin-turbine ASW/ASST helicopter, with additional side views of HH-60H (centre) and HH-60J Jayhawk (bottom) *(Jane's/Dennis Punnett)*

1995

Sikorsky SH-60B Seahawk LAMPS Mk III helicopter *(Paul Jackson)* 1995

Sikorsky HH-60J Jayhawk rescue and law enforcement helicopter for US Coast Guard 1995

NAS North Island, 40, 42, 44, 46 and 48 at NAS Mayport Florida), subsequently HSL-51 formed at Atsugi, Japan, 1 October 1991, and HSL-37 at NAS Barbers Point, Hawaii began converting from SH-2Fs on 6 February 1992. SH-60Bs deployed in 'Oliver Hazard Perry' (FFG-7) class frigates, 'Spruance' class and Aegis equipped destroyers and 'Ticonderoga' class guided missile cruisers. US Navy originally required 150 SH-60Fs; total 82 completed, comprising seven preseries plus 18 each in FY88, 89 and 91, 12 in FY92 and nine in FY93, procurement then prematurely halted, two used for operational evaluation; five more delivered by September 1989; in West Coast service with HS-2, 4, 6, 8, 10 and 14 squadrons NAS North Island, California. HS-3 at Jacksonville, Florida equipped from 27 August 1991 as first East Coast squadron, followed by HS-1, 11 and 15.

Exported to Australia, Greece, Japan and Spain (see Current Versions). S-70B-4 and -5 are derivatives of SH-60F and HH-60H, respectively; not taken up.

COSTS: $20.25 million (1992) USN programme unit cost.

DESIGN FEATURES: SH-60B Seahawk designed to provide all weather detection, classification, localisation and interdiction of surface ships and submarines, either controlled through datalink from mother ship or operating independently; secondary missions include SAR, vertical replenishment, medevac, fleet support and communications relay.

New features include more powerful navalised GE T700-GE-401 engines, additional fuel, sensor operator's station, port-side internal launchers for 25 sonobuoys, pylon on starboard side of tailboom for MAD bird, lateral pylons for two torpedoes or external tanks, chin-mounted ESM pods, sliding cabin door, rescue hoist, electrically actuated blade folding, rotor brake, folding tail, short wheelbase tailwheel landing gear with twin tailwheels stressed for lower crash impact, DAF Indal RAST recovery assist, secure and traversing for haul-down landings on small decks and moving into hangar, hovering in-flight refuelling system, and emergency flotation system; pilots' seats not armoured. SH-60B gives 57 minutes more listening time on station and 45 minutes more ship surveillance and targeting time than LAMPS Mk I.

For operation in Gulf during Iran-Iraq war, 25 SH-60Bs fitted with upper and lower Sanders AN/ALQ-144 IR jammers, Tracor AN/ALE-39 chaff/flare dispensers, Honeywell AN/AAR 47 electro-optical missile warning, and a single 7.62 mm machine gun in door, for a weight penalty of 169 kg (369.5 lb); seven Seahawks fitted with Ford Aerospace AN/AAS-38 FLIR on port weapon pylon with instantaneous relay to parent ship.

First Block I SH-60B update, introduced in production Lot 9, delivered from October 1991, includes provision for NFT AGM 119 Penguin anti-ship missile, Mk 50 advanced lightweight torpedo, Rospatch AN/ARR-84 99-channel sonobuoy receiver (replacing ARR 75), Chelton AN/ARC 182 V/UHF FM radio and Rockwell Collins Class 3A Navstar GPS, prior to production cutbacks, 115 Penguin-capable Seahawks to come from retrofitting back to Lot 5. Block II development, including airborne low frequency sonar and inverse synthetic aperture radar began 1991 with preliminary design contract award to IBM, EMD contract August 1993; for retrofitting from 1999, new sonar decision announced December 1991 in favour of Hughes/Thomson Sintra FLASH (folding light acoustic sonar for helicopters), 158 to replace AN/AQS-13F in SH-60F, plus 185 for installation in SH-60B, associated AT&T AN/UYS 2 enhanced modular signal processor; Telephonics multimode radar; improved version of AN/AYK 14 mission computer; improved ESM, maximum weight increased to 10,659 kg (23,500 lb).

FLYING CONTROLS: As for UH-60.

STRUCTURE: Basically as for UH-60 plus marine corrosion protection, single cabin door, starboard side, narrower than on UH-60.

POWER PLANT: Two 1,260 kW (1,690 shp) intermediate rating General Electric T700-GE-401 turboshafts in early aircraft, 1,342 kW (1,800 shp) T700-GE-401C turboshafts introduced in 1988 and on HH-60H/J. Transmission rating 2,535 kW (3,400 shp). Internal fuel capacity 2,233 litres (590 US gallons; 491 Imp gallons). Hovering in-flight refuelling capability. Two 455 litre (120 US gallon; 100 Imp gallon) auxiliary fuel tanks on fuselage pylons optional (three on HH-60J). Hover infra-red suppressor subsystem (HIRSS) exhaust cowling fitted to HH-60H.

ACCOMMODATION: Pilot and airborne tactical officer/back-up pilot in cockpit, sensor operator in specially equipped station in cabin. Dual controls standard. Sliding door with jettisonable window on starboard side. Accommodation heated, ventilated and air conditioned.

SYSTEMS: Generally as for UH-60A.

AVIONICS: Refer also to Current Versions for variants other than SH-60B.

Comms: Collins AN/ARC-159(V)2 UHF, Collins AN/ARC-174(V)2 HF, Hazeltine AN/APX-76A (V) and Bendix/King AN/APX-100(V)1 IFF transponders, TSEC/KG-45(E-1) communications security set, TSEC/KY-75 voice security set, Telephonics OK-374/ASC communications system control group.

Radar: Texas Instruments AN/APS-124 search radar (Thomson Thorn SuperSearcher for Australia, Telephonics AN/APS-128PC for Taiwan).

Flight: Collins AN/ARN-118(V) Tacan, Teledyne Ryan AN/APN-127 Doppler, Collins AN/ARA-50 UHF DF, Honeywell AN/APN-194(V) radar altimeter.

Mission: Sikorsky sonobuoy launcher, Edmac AN/ARR-75 and R-1651/ARA sonobuoy receiving sets (AN/ARR 84 receiver in Australian Seahawks and for USN Block 1 upgrade), Texas Instruments AN/ASQ-81(V)2 towed-MAD (CAE AN/ASQ-504(V) internal MAD in Australian Seahawks), Raymond MU-670/ASQ magnetic tape memory unit, Astronautics IO-2177/ASQ altitude indicator, Fairchild AN/ASQ-164 control indicator set, Fairchild AN/ASQ-165 armament control indicator set, IBM AN/UYS-1(V)2 Proteus acoustic processor (Computing Devices UYS-503 for Australia) and CV-3252/A converter display, Control Data AN/AYK-14 (XN 1A) digital computer, Raytheon AN/ALQ 142 ESM, Sierra Research AN/ARQ-44 datalink and telemetry (Rockwell Collins DHS-901 in Australian Seahawks). SH-60F has Bendix AN/AQS-13F dipping sonar (AN/AQS-18 in Taiwanese S-70s). During 1991 Gulf War, pod-mounted Hughes AN/AAQ-16 FLIR fitted to five SH-60Bs and Texas Instruments AN/AAQ-17 FLIR deployed on one SH-60B. GEC Marconi Sea Owl IR turret evaluated later in 1991; Texas Instruments FLIR/laser designator under test on SH-60B in early 1994, option to procure 90 systems by 1997. Australian examples also acquired AN/AAQ-16 FLIR for Gulf War.

Self-defence: Australian Seahawks fitted with AN/ALE-47 chaff/flare dispensers and AN/AAR-47 missile detectors for Gulf War.

EQUIPMENT: External cargo hook (capacity 2,722 kg, 6,000 lb) and rescue hoist (272 kg, 600 lb) standard.

ARMAMENT: Includes two Mk 46 torpedoes and (IOC 1993) NFT AGM-119B Penguin Mk 2 Mod 7 anti-shipping missiles. Block I upgrade integrates Penguin and Honeywell Mk 50 Advanced Lightweight Torpedo from 1993. HH-60H has two pintle-mounted M60D machine guns but to receive Rockwell AGM 114 Hellfire ASMs, 70 mm (2.75 in) rocket pods and forward-firing guns. Hellfire additionally considered as SH-60B/F armament for attacking small ships.

DIMENSIONS, EXTERNAL: As UH-60A except

Length overall, rotors and tail pylon folded:	
SH-60B	12.47 m (40 ft 11 in)
HH-60H	12.51 m (41 ft 0⅝ in)
HH-60J	13.13 m (43 ft 0⅞ in)
Length of fuselage: HH-60J	15.87 m (52 ft 1 in)
Width, rotors folded	3.26 m (10 ft 8¼ in)
Height: to top of rotor head	3.79 m (12 ft 5⅛ in)
overall, tail rotor turning	5.18 m (17 ft 0 in)
overall, pylon folded	4.04 m (13 ft 3¼ in)
Wheelbase	4.83 m (15 ft 10 in)
Tail rotor ground clearance	1.83 m (6 ft 0 in)
Main/tail rotor clearance	6.6 cm (2⅝ in)

SEAHAWK DELIVERIES

	SH-60B series					SH-60F series		HH-60H	HH-60J
Year	USN	Spain	Japan	Australia	Greece	USN	Taiwan		
1983	9								
1984	27								
1985	24		2						
1986	24								
1987	22					2			
1988	16	6		(14)					
1989	8			4		9		8	
1990	6			6		19	2	4	6
1991	6			6		18	8	6	10
1992	6					17			12
1993	9					9			7
1994	14				2	7		2	4
Totals	171	6	2	16	2	81	10	20	39

Notes: Kits in parentheses, NOT to be included in totals (appear also under year of completion)

AREAS: as UH-60A

WEIGHTS AND LOADINGS:

Weight empty: SH-60B ASW	6,191 kg (13,648 lb)
HH-60H	6,114 kg (13,480 lb)
HH-60J	6,086 kg (13,417 lb)
Useful load: HH-60J	3,551 kg (7,829 lb)
Internal payload: HH-60H	1,860 kg (4,100 lb)
Mission gross weight:	
SH-60B ASW	9,182 kg (20,244 lb)
SH-60B ASST	8,334 kg (18,373 lb)
Max gross weight:	
SH-60B Utility, HH-60H	9,926 kg (21,884 lb)
HH-60J	9,637 kg (21,246 lb)
Max disc loading:	
SH-60B Utility, HH-60H	47.24 kg/m² (9.67 lb/sq ft)
HH-60J	45.86 kg/m² (9.39 lb/sq ft)
Max power loading:	
SH-60B Utility, HH-60H	3.92 kg/kW (6.44 lb/shp)
HH-60J	3.80 kg/kW (6.25 lb/shp)

PERFORMANCE:

Cruising speed at S/L:	
HH-60H	147 kts (272 km/h; 169 mph)
HH-60J	146 kts (271 km/h; 168 mph)
Dash speed at 1,525 m (5,000 ft), tropical day:	
SH-60B	126 kts (234 km/h; 145 mph)
Vertical rate of climb at S/L, 32.2°C (90°F):	
SH-60B	213 m (700 ft)/min
Vertical rate of climb at S/L, 32.2°C (90°F), OEI:	
SH-60B	137 m (450 ft)/min

UPDATED

SIKORSKY S-70C

TYPE: Commercial or military H-60 for non-FMS customers.

PROGRAMME: See Customers below.

CUSTOMERS: Delivery of 24, designated **S-70C-2**, with undernose radar to People's Republic of China completed December 1985 but offered for sale in 1992 due to spares embargo; 14 supplied to Republic of China Air Force, Taiwan, one each for Westland plc (designated Westland **WS-70L**) and Rolls-Royce in UK, R-R aircraft used as testbed for R-R Turbomeca RTM 322 turboshafts; all based on Black Hawk. **S-70C(M)-1** designation assigned to 10 Seahawks for Taiwan (see SH-60B entry). No recent purchases.

DESIGN FEATURES: Certificated to FAR Pt 21.25; roles include utility transport, external lift, maritime and environmental survey, forestry and conservation, mineral exploration and heavy construction support, powered by General Electric CT7-2C or -2D engines; options include de-icing kit for main and tail rotors, cargo hook for 3,630 kg (8,000 lb) loads, rescue hoist, aeromedical evacuation kit, and winterisation kit. Combined transmission rating (continuous) 2,334 kW (3,130 shp).

FLYING CONTROLS: As for UH-60.

STRUCTURE: As for UH-60.

POWER PLANT: Two 1,212 kW (1,625 shp) General Electric CT7-2C or 1,285 kW (1,723 shp) CT7-2D turboshafts, or equivalent military T700s. Rolls-Royce Turbomeca RTM 322 in demonstrator G-RRTM. Maximum fuel capacity 1,370 litres (362 US gallons; 301 Imp gallons).

ACCOMMODATION: Flight deck crew of two, with provision for 12 passengers in standard cabin configuration and up to 19 passengers in high-density layout. Forward-hinged door on each side of flight deck for access to cockpit area. Large rearward-sliding door on each side of main cabin.

DIMENSIONS, INTERNAL:

Cabin: Length	3.84 m (12 ft 7 in)
Max width	2.34 m (7 ft 8 in)
Max height	1.37 m (4 ft 6 in)
Floor area	8.18 m² (88.0 sq ft)
Volume	10.96 m³ (387.0 cu ft)
Baggage compartment volume	0.52 m³ (18.5 cu ft)

WEIGHTS AND LOADINGS:

Weight empty	4,607 kg (10,158 lb)
Max external load	3,630 kg (8,000 lb)
Max T-O weight	9,185 kg (20,250 lb)
Max disc loading	43.73 kg/m² (8.96 lb/sq ft)
Max power loading	3.94 kg/kW (6.47 lb/shp)

PERFORMANCE (ISA, at max T-O weight):

Never-exceed speed (V_{NE})	195 kts (361 km/h; 224 mph)
Max level speed at S/L	157 kts (290 km/h; 180 mph)
Cruising speed at S/L	145 kts (268 km/h; 167 mph)
Max rate of climb at S/L	615 m (2,020 ft)/min
Service ceiling	4,360 m (14,300 ft)
Service ceiling, OEI	1,095 m (3,600 ft)
Hovering ceiling OGE	1,204 m (3,950 ft)
Range at 135 kts (250 km/h; 155 mph) at 915 m (3,000 ft) with max standard fuel, 30 min reserves	255 n miles (473 km; 294 miles)
Range, max fuel, no reserves	297 n miles (550 km; 342 miles)

VERIFIED

SIKORSKY S-76

TYPE: Twin-turbine helicopter.

PROGRAMME: Announced 19 January 1975; four prototypes begun May 1976; first flight (N762SA) 13 March 1977; certification to FAR Pt 29 in November 1978; deliveries started early 1979; delivery of Mk II began 1 March 1982; Mk II modification kits available for earlier S-76s.

CURRENT VERSIONS: **S-76**: Original transport version delivered before 1 March 1982 (see earlier editions).

S-76A+: Retrofit of Turbomeca Arriel 1S to S-76A.

S-76 Mark II: Standard version from March 1982, no longer current. Details in 1991-92 and earlier *Jane's*.

S-76 Utility: More basic version of S-76 Mk II with sliding doors (one each side), dual controls, and floors stressed for 976 kg/m² (200 lb/sq ft); options include fixed landing gear with low-pressure tyres, crash-resistant fuel tanks, baggage compartment auxiliary tank for 416 litres (100 US gallons; 91.5 Imp gallons), armoured crew seats, cargo hook, rescue hoist, engine air particle separators, and provision for stretchers. Philippine Air Force received 17 military S-76 Utility, of which 12 AUH-76s fitted for counter-insurgency, troop/logistic support and medevac, two others for SAR, and three as 12- or eight-passenger transports.

S-76B: Powered by P&W PT6B-36 engines, described separately; current production model. One S-76B flown with Fantail anti-torque system as part of RAH-66 Comanche development programme; see H-76 Eagle.

S-76C: Powered by Turbomeca Arriel 1S1 engines, described separately; current production model.

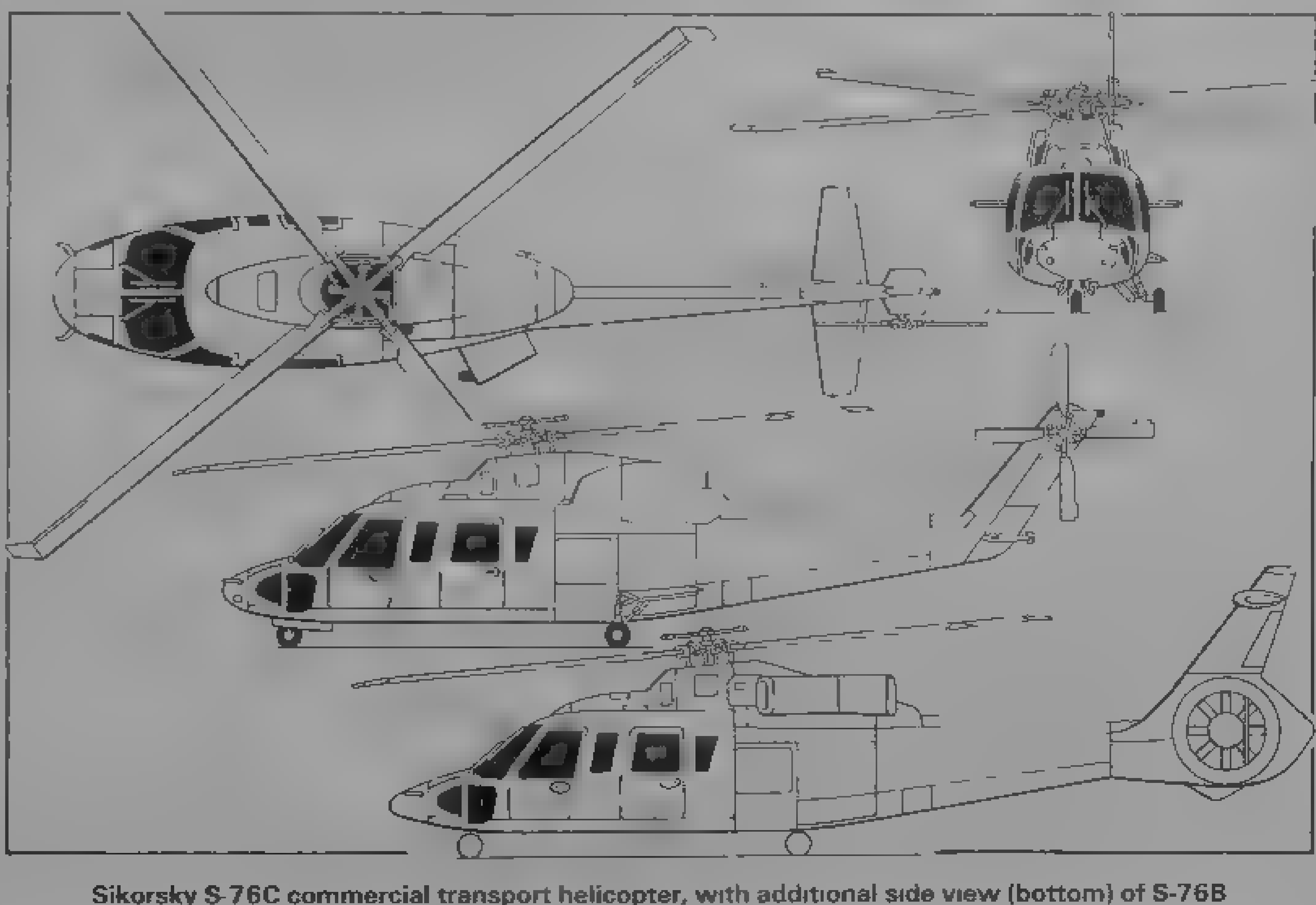
S-76C+: Powered by Turbomeca Arriel 2S1 engines, in development 1995.

H-76 and H-76N Eagle: Military and naval developments of S-76B, described separately.

Shadow: One-off modification (N765SA) of S-76,

SH-60F of HS-3 crosses in front of USS *Theodore Roosevelt* *1995*

Sikorsky S-70C(M)-1 Thunderhawk operated by Taiwanese Navy *1995*



Sikorsky S-76C commercial transport helicopter, with additional side view (bottom) of S-76B experimentally fitted with fan-in-fin tail of the RAH-66 Comanche (*Jane's/Mike Keep*) *1993*

Sikorsky S-76 of Helijet Airways, Vancouver, Canada

1995

Sikorsky Helicopter Advanced Demonstrator and Operator Workload fitted with nose-mounted single-seat cockpit for US Army Rotorcraft Technology Integration (ARTI) programme, main cabin used for safety pilots and test operators, first flight 24 June 1985, trials of full cockpit began Spring 1986; now has fly-by wire side-mounted control stick, voice interactive system, remote map reader, FLIR, HUD with programmable symbol generator, visually coupled helmet mounted display and dual CRT displays with touch-sensitive screens. Later modifications include upgraded engines and dynamic components, NVG compatible cockpit and cabin, reconfigurable evaluation cockpit, and high-visibility paint for night and NOE flying.

Partners in programme include Bendix/King, Kaiser Litton, Northrop Grumman, Pacer Systems, Rockwell Collins, Plessey Electronic Systems and Hamilton Standard.

Used 1990 in Boeing/Sikorsky LH First Team programme to flight test NVPS (night vision pilotage system) developed by Martin Marietta.

CUSTOMERS: Total 413 all civil versions delivered by 31 December 1994, total includes 284 S-76s (including Mark II), 17 S-76A+ conversions, 80 S-76Bs and 32 S-76Cs. Japan Maritime Safety Agency selected S-76C in advanced SAR configuration, with first delivery early 1994.

UPDATED

SIKORSKY S-76B

TYPE: PT6B-36A-engined S-76 Mark II.

PROGRAMME: Initiated October 1983, first flight (N3123U) 22 June 1984, first flight of reworked ground test S-76B February 1985, certificated in FAA Category A early 1987. UK certification testing began July 1987; increase in maximum T-O weight to 5,307 kg (11,700 lb) approved by FAA in June 1988.

CUSTOMERS: S-76Bs operating in China, Germany, Japan, South Korea, Netherlands, UK and USA; total 80 delivered by 31 December 1994.

DESIGN FEATURES: Meets FAR Pt 29 with Category A IFR; intended for offshore support, business transport, medical evacuation and general utility use, technology and aerodynamics based on those of UH-60 Black Hawk.

Four-blade main rotor with high twist and varying section and camber based on Sikorsky SC-1095, tapered blade tip has 30° leading-edge sweep; fully articulated rotor head with single elastomeric bearings, hydraulic drag dampers, dual bifilar vibration absorber assemblies above rotor head, four blade cross-beam tail rotor on port side, transmission rating 969 kW (1,300 shp), rotor brake optional.

Experimental higher harmonic control (HHC) system, to damp vibration through control actuators at rotor head tested Spring 1985, demonstrated 90 per cent vibration reduction. Ice protection kit weighing 68 kg (150 lb), of which 45 kg (100 lb) could be removed in Summer, also under development. Optional manual blade folding introduced in 1993.

Additional power of P&WC PT6B-36A engines and raised transmission rating increases take-off power in S-76B by 48 per cent, useful load increased 51 per cent in hot and high conditions; maximum T-O weight increased by 635 kg (1,400 lb), tail rotor pylon area reduced by 15 per cent and engine exhaust reconfigured.

Emergency medical service installation includes multiple-position pivoting primary patient litter, a second litter, and track-mounted seats for four attendants, forward and rear oxygen systems, and dual access to external power on ground; cabin volume 4.0 m³ (141 cu ft).

FLYING CONTROLS: Dual powered hydraulic controls with autostabilisation and autopilot, releasable spring-centring trim system for both cyclic and collective controls.

STRUCTURE: Main rotor blades have formed and welded titanium oval-section tubular main spar with Nomex honeycomb aerofoil core, glassfibre composite outer skin and titanium/nickel leading-edge abrasion strips. Fuselage contains extensive Kevlar and honeycomb components.

LANDING GEAR: Hydraulically retractable tricycle type, with single wheel on each unit. Nosewheel retracts rearward, main units inward into rear fuselage, all three wheels are enclosed by doors when retracted. Mainwheel tyres size 14.5 × 5.5-6, pressure 11.38 bars (165 lb/sq in); nosewheel tyre size 13 × 5.00-4, pressure 9.31 bars (135 lb/sq in). Hydraulic brakes, hydraulic mainwheel parking brake. Non-retractable tricycle gear, with low-pressure tyres, optional.

POWER PLANT: Two Pratt & Whitney Canada PT6B-36A turboshafts, 5 minute T-O rating 732 kW (981 shp), maximum continuous rating 661 kW (887 shp), 30 minute OEI rating 771 kW (1,033 shp); 30 minute OEI rating, S/L, 90°F, 686 kW (920 shp); 30 minute OEI rating, 305 m (1,000 ft), up to 90°F 602 kW (807 shp); maximum continuous rating at 1,524 m (5,000 ft) and 30°C (77°F) 504 kW (676 shp). Transmission rating 1,118 kW (1,500 shp). Standard fuel capacity 1,064 litres (281 US gallons, 234 Imp gallons), optional auxiliary tank capacity 208 litres (55 US gallons; 46 Imp gallons).

ACCOMMODATION: Two pilots and 12 to 13 passengers. Three four-abreast rows of seats, floor-mounted at a pitch of 79 cm (31 in). A number of executive layouts are available including a four passenger 'office in the sky' configuration. Executive versions have luxurious interior trim, full carpeting, special soundproofing, radiotelephone, and co-ordinated furniture. Dual controls optional. Two large doors on each side of fuselage, hinged at forward edges, sliding doors available optionally. Baggage hold aft of cabin, with external door each side of fuselage. Cabin heated and ventilated. Windscreen demisting and dual windscreen wipers. Windscreen heating and external cargo hook optional.

SYSTEMS: Hydraulic system at pressure of 207 bars (3,000 lb/sq in) supplied by two pumps driven from main gearbox. Hydraulic system maximum flow rate 15.9 litres (4.2 US gallons; 3.5 Imp gallons)/min. Bootstrap reservoir. Pump head pressure 3.45 bars (50 lb/sq in). In VFR configuration, electrical system comprises two 200 A DC starter/generators and a 24 V 17 Ah Ni/Cd battery. In IFR configuration, system comprises gearbox-driven 7.5 kVA

Sikorsky S-76B twin turboshaft helicopter

1995

Sikorsky S-76C SAR helicopter of the Japan Maritime Safety Agency

1995

generator, and a 115 V 600 VA 400 Hz static inverter for AC power. 34 Ah battery optional. Engine fire detection and extinguishing system.

AVIONICS: Standard avionics (utility configuration) with four-tube EFIS display comprise dual Collins VHF com/nav with single Collins Mode S transponder, ADF and DME, Baker audio/cabin ICS system and Artec emergency locator transmitter. Two optional avionics packages include Bendix/King com/nav and dual Honeywell Primus II integrated avionics system; other options include VHF/UHF/HF/AM/FM com radios, cockpit voice recorder, FMS/Loran/Omega/GPS and Decca navigation systems, flight data recorder and colour weather radar.

EQUIPMENT: Standard equipment includes provisions for dual controls, cabin fire extinguishers, cockpit, cabin, instrument, navigation and anti-collision lights; landing light, external power socket, first aid kit, and utility soundproofing. Optional equipment includes air conditioning, cargo hook, rescue hoist, emergency flotation gear, engine air particle separators and litter installation.

DIMENSIONS, EXTERNAL:

Main rotor diameter	13.41 m (44 ft 0 in)
Main rotor blade chord	0.39 m (1 ft 3½ in)
Tail rotor diameter	2.44 m (8 ft 0 in)
Tail rotor blade chord	0.16 m (6½ in)
Length: overall, rotors turning	16.00 m (52 ft 6 in)
fuselage	13.21 m (43 ft 4 in)
Height overall, tail rotor turning	4.41 m (14 ft 5¾ in)
Tailplane span	3.05 m (10 ft 0 in)
Width of fuselage	2.13 m (7 ft 0 in)
Wheel track	2.44 m (8 ft 0 in)
Wheelbase	5.00 m (16 ft 5 in)
Tail rotor ground clearance	1.97 m (6 ft 5¾ in)

DIMENSIONS, INTERNAL:

Passenger cabin: Length	2.46 m (8 ft 1 in)
Max width	1.93 m (6 ft 4 in)
Max height	1.35 m (4 ft 5 in)
Floor area	4.18 m² (45.0 sq ft)
Volume	5.78 m³ (204 cu ft)
Baggage compartment volume	1.08 m³ (38 cu ft)

AREAS:

Main rotor disc	141.26 m² (1,520.53 sq ft)
Tail rotor disc	4.67 m² (50.27 sq ft)
Tailplane	2.00 m² (21.5 sq ft)

WEIGHTS AND LOADINGS:

Weight empty, standard equipment	3,012 kg (6,641 lb)
Max T-O weight	5,307 kg (11,700 lb)
Max disc loading	37.6 kg/m² (7.69 lb/sq ft)
Max power loading	4.75 kg/kW (7.80 lb/shp)

PERFORMANCE (at max T-O weight, ISA):

Max level speed	155 kts (287 km/h; 178 mph)
Cruising speed	145 kts (269 km/h; 166 mph)
Max rate of climb at S/L	502 m (1,650 ft)/min
Max operating altitude	4,575 m (15,000 ft)
Service ceiling, OEI	1,980 m (6,500 ft)
Hovering ceiling: IGE	2,440 m (8,000 ft)
OGE	1,143 m (3,750 ft)

Range at 139 kts (257 km/h; 160 mph) at 1,220 m (4,000 ft) with standard fuel:

no reserves	350 n miles (648 km; 402 miles)
30 min reserves	280 n miles (518 km; 322 miles)

UPDATED

SIKORSKY H-76 EAGLE

TYPE: Military armed utility derivative of S-76B.

PROGRAMME: First flight (N3124G) February 1985, weapon firing from four-station pitch-compensated armament pylon at Mojave, California, early 1987.

CURRENT VERSIONS: **H-76**: Standard military armed version, *as described in detail*.

H-76N: Naval version announced 1984; no known customers so far. Details in 1991-92 and earlier *Jane's*.

Fantail Demonstrator: Fitted with Boeing Sikorsky Fantail anti-torque system for RAH-66 Comanche (which see) and flown 6 June 1990; eight-blade tail rotor 1.20 m (3 ft 11¼ in) diameter, generating 737 kg (1,624 lb) maximum thrust at 610 m (2,000 ft) and 35°C (95°F).

CUSTOMERS: Thailand ordered six in 1995.

DESIGN FEATURES: Airframe modifications include armoured crew seats, sliding cabin doors, heavy-duty floor, optical sight above instrument panel, self-sealing high-strength fuel tanks, and door-mounted weapons; main transmission, intermediate and tail rotor gearboxes uprated, main rotor hub and shaft strengthened, broader tail rotor blade chord, dual spars in tail pylon, fuselage side skin thickened to resist weapon blast. Strobex rotor blade tracker optional.

H-76 can be equipped for troop transport/logistic support, as gunship, or for airborne assault, air observation post, combat SAR, evacuation, ambulance and conventional SAR. Can carry either mast-mounted or roof-mounted sight, plus HUD, laser ranger and integrated armament management system, also provision for self-protection system including radar warning, infra-red jammer, and chaff/flare dispensers, high-clearance landing gear and Honeywell SPZ-7000 dual digital autopilot available.

Armament pylon has faired leading-edge, giving 3 to 4 knots speed increase; weapons tested include Giat 20 mm cannon pod, 7.62 mm and 12.7 mm machine gun pods, VS-MD-H mine dispenser and 70 mm (2.75 in) rockets;

Mockup of Sikorsky S-92C Helibus proposed 19/22-passenger transport in 1993 configuration *1993*

H-76 could carry 16 AAMs or eight AAMs and two cannon pods; integrated armament management system allows weapons to be selected from collective lever as well as from panel; system ready lights and sideslip trim ball on HUD.

External/internal dimensions generally as for S-76B; *details below show differences from civil S-76s*.

POWER PLANT: As for S-76B, except fuel is contained in two high-strength, optionally self-sealing, tanks located below the rear cabin, with a total capacity of 993 litres (262.4 US gallons; 218.4 Imp gallons). Gravity refuelling point on each side of fuselage. Engine fire detection and extinguishing systems. Engine air particle separator optional.

ACCOMMODATION: Pilot and co-pilot, plus varying troop/passenger loads according to role. Armoured pilots' seats optional. Ten fully armed troops can be transported, or seven troops when configured as an airborne assault vehicle with multipurpose pylon system (MPPS) and one 7.62 mm door gun installed. For evacuation use the cabin can be equipped with 12 seats or, in emergency, all seats can be removed and 16 persons can be airlifted sitting on the cabin floor. For SAR use the cabin will accommodate three patients on litters, or six persons lying prone on the floor and on the rear cabin raised deck. The standard medevac layout provides for three litters and a bench seat for two medical attendants.

SYSTEMS: Generally as for S-76B, except electrical system has a 17 or optional 34 Ah battery. Engine ice protection by bleed air anti-icing system.

AVIONICS: *Comms*: Typically including VHF-20A VHF transceiver, AN/ARC-186 VHF-AM/FM, 719A UHF, ADF-60A ADF.

Flight: ELT, Andrea A301-61A intercom, cabin speaker system and loudhailer, DF-301E UHF DF, VIR-30A VOR with ILS, glide slope and marker beacon receivers, DME-40 DME, TDR-90 transponder and dual RMI-36 RMI, all by Collins; course deviation indicators.

Mission: Targeting equipment can include FLIR, Saab-Scania reticle sight, TOW roof sight or TOW mast-mounted sight and laser rangefinder.

EQUIPMENT: Typical equipment includes dual controls and instrumentation, stability augmentation system, dual 5 in VGIs, Allen RCA-26 standby self-contained attitude indicator, Collins ALT-50A radio altimeter, soundproofing, 'Fasten seat belt—No smoking' sign, first aid kit, two cabin fire extinguishers, external power socket, provisions for optional emergency flotation system, and provisions for installation of cargo hook with certificated capacity of 1,497 kg (3,300 lb) and rescue hoist of 272 kg (600 lb) capacity. Standard lighting includes cockpit, cabin and instrument lights, navigation lights, anti-collision strobe light, and a battery operated cabin emergency light.

ARMAMENT: One 7.62 mm machine gun can be pintle-mounted in each doorway and fired with or without the MPPS system installed. Pintles incorporate field of fire limiters and will accept FN Herstal or Maramount M60D machine guns. The MPPS can be installed on the cabin floor, providing the capability to carry and deploy pods containing single or twin 7.62 mm machine guns, 0.50 in machine guns, 2.75 in and 5 in rocket pods, Mk 66 2.75 in rockets, Oerlikon 68 mm rockets, mines, Hellfire, TOW, Sea Skua and Stinger missiles, and Mk 46 torpedoes (see also Design Features).

WEIGHTS AND LOADINGS:

Basic weight empty	2,545 kg (5,610 lb)
Weight empty, equipped (typical)	3,030 kg (6,680 lb)
Max fuel weight	792 kg (1,745 lb)
Max T-O weight	5,171 kg (11,400 lb)

PERFORMANCE: Similar to S-76B, but range highly variable according to loading and mission.

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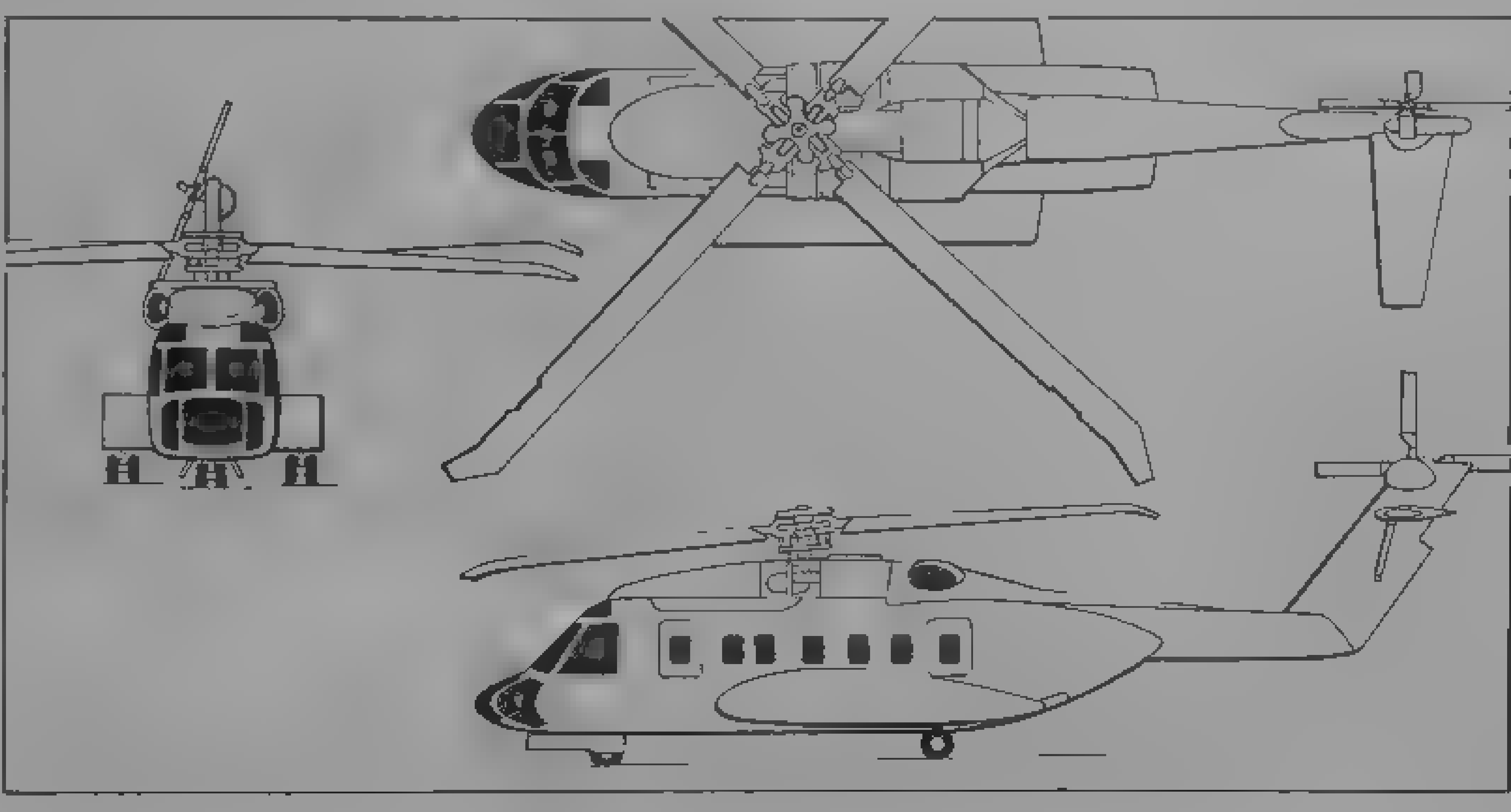


Sikorsky S-92 medium-lift helicopter *(Jane's/James Goulding)* *1995*

SIKORSKY S-76C

TYPE: Arriel 1S1-engined S-76B

PROGRAMME: Announced June 1989, first flight 18 May 1990; FAA certification and first deliveries April 1991. S-76C+, scheduled for certification in first quarter of 1996, features uprated Arriel 2S1 turboshafts with FADEC for improved single-engine performance and fuel efficiency.

CUSTOMERS: Two ordered for Royal Hong Kong Auxiliary Air Force and eight for Spanish Air Force (for IFR training at Ala 78 helicopter school, Granada/Armilla), deliveries to Spain began November 1991. Bond Helicopters, Scotland ordered seven for delivery from 1993. Malaysian Helicopter Services ordered three for 1992 delivery plus options for three, deliverable in 1993; two delivered 1994 to Japan Maritime Safety Agency (MSA) for coastguard duties, equipped with Honeywell SAR avionics package, rescue hoist, Nightsun searchlight and manual rotor blade fold facility. Deliveries totalled 32 by 31 December 1994.

DESIGN FEATURES: Same airframe and power train as S-76B, but powered by two Turbomeca Arriel 1S1 turboshafts; initial certification for maximum T-O weight 5,171 kg (11,400 lb), useful load 299 kg (660 lb) greater than S-76 for same range. In typical UK CAA IFR offshore configuration, S-76C can fly 12 passengers for 220 n miles (407 km, 253 miles) or 10 passengers for 320 n miles (593 km, 368 miles) with 45 minutes reserves.

POWER PLANT: Two Turbomeca Arriel 1S1 turboshafts, each rated at 539 kW (723 shp) for take-off and maximum continuous, 591 kW (792 shp) maximum contingency OEI for 2½ minutes and 498 kW (668 shp) for normal cruise. Transmission and fuel details as S-76B.

AVIONICS: As S-76B

ACCOMMODATION: As S-76B

DIMENSIONS, EXTERNAL: As S-76B

DIMENSIONS, INTERNAL: As S-76B

AREAS: As S-76B

WEIGHTS AND LOADINGS:
Weight empty, standard equipment: 2,849 kg (6,282 lb)
Max T-O weight: 5,307 kg (11,700 lb)
Max disc loading: 37.56 kg/m² (7.69 lb/sq ft)
Max power loading: 4.75 kg/kW (7.80 lb/shp)

PERFORMANCE (at max T-O weight, ISA, except where indicated):
Max level speed at S/L: 155 kts (287 km/h; 178 mph)
Normal cruising speed at S/L: 145 kts (269 km/h, 166 mph)
Max rate of climb at S/L, T-O power: 445 m (1,460 ft)/min
Service ceiling: two engines: 3,505 m (11,500 ft)
single engine at 30 min power: 630 m (2,070 ft)
Fuel consumption at 138 kts (255 km/h, 159 mph) at 915 m (3,000 ft), 3,261 kg (10,700 lb) gross weight: 268 kg/h (593 lb/h)
Range at 138 kts (255 km/h, 159 mph) at 915 m (3,000 ft) with standard fuel:
no reserves: 430 n miles (798 km, 494 miles)
30 min reserves: 366 n miles (678 km, 421 miles)

UPDATED

SIKORSKY S-92 HELIBUS

TYPE: Twin-turboshaft medium-lift helicopter.

PROGRAMME: Announced March 1992; originally envisaged as 'Growth Hawk' development of S-70; market evaluation co-ordinated with Mitsubishi Corporation and Mitsubishi Heavy Industries. Launched at Paris Air Show, June 1995. Risk-sharing partners Mitsubishi Heavy Industries (7.5 per cent), Jingdezhen Helicopter Group of China (2 per cent), and Gamesa of Spain (7 per cent), with Taiwan Aerospace (6.5 per cent), and Embraer 4 per cent) as additional fixed-price supplier/partners. Russia's Mil is associated with programme, but not yet a full partner; other suppliers include GEC-Marconi (health monitoring system), Hamilton Standard (automatic flight control system), Sanders (cockpit instrumentation), and Parker Bertea (servos). First of five flying prototypes (two S-92C, three S-92IU) scheduled to fly in second quarter of 1998, with FAA/JAA Pt 29 certification in first quarter of 2000 for S-92C and third quarter for S-92IU.

CURRENT VERSIONS: **S-92C**: Civil transport version, will be first to fly.

S-92IU: International utility/military version with external cargo hook.

CUSTOMERS: Estimated market for more than 5,000 helicopters in class between 2000-2019.

COSTS: Programme $600 million; target direct operating cost $2,500 per hour and $0.83 per air seat mile.

DESIGN FEATURES: Design, manufacture and assembly will use CATIA database system; both versions share common 'core airframe' comprising cockpit, cabin with rear ramp, sponsons, main rotor, aft transition section, and tail rotor pylon; dynamic components based on proven Sikorsky technology to reduce development risks, including yoke-type infinite life main rotor head with elastomeric bearings; four-blade all-composite main rotor based on scaled-up version of wide-chord, drooped-tip blades tested on Black Hawk; new transmission based on upgraded four-stage version of Black Hawk's three-stage main gearbox; new intermediate tail rotor gearbox; and new four-blade fully articulated tail rotor to starboard, meeting FAR/JAR 29 bird-strike requirements; high-set, strut-braced tail plane to port.

FLYING CONTROLS: Similar, but not identical, to Black Hawk; dual digital automatic flight control system with autopilot and stability augmentation features; Hamilton Standard primary processor based on that of RAH-66 Comanche, and is expected to have 8,000 hour MTBF.

STRUCTURE: Modular structure of aluminium and composites (about 40 per cent of structure will be composites, though mostly non-structural to reduce costs); composites main rotor blades (including spars); structure optimised for minimum parts count.

Sikorsky responsible for rotor and transmission systems, final assembly and flight test. Airframe largely designed and manufactured by 'Team S-92' partners, as follows: Mitsubishi (main cabin), Taiwan Aerospace (flight deck), Embraer (sponsons and fuel system), Gamesa (cabin interior and transmission housing), and Jingdezhen (tail pylon and tailplane).

LANDING GEAR: Retractable tricycle; main units retract rearwards into sponsons, nosewheel retracts forwards under flight deck.

POWER PLANT: *S-92C*: Two GE CT7-6D turboshafts, rated (S/L, 90°F) at 1,305 kW (1,750 shp) for T-O, 1,081 kW (1,450 shp) continuous, 1,603 kW (2,150 shp) OEI 30 seconds, 1,454 kW (1,950 shp) OEI 2 minutes, 1,342 kW (1,800 shp) OEI continuous. *S-92IU*: Two GE CT7-8 turboshafts, rated (1,220 m; 4,000 ft, 35°C, 95°F) at 1,417 kW (1,900 shp) for T-O, 1,081 kW (1,450 shp) continuous, 1,491 kW (2,000 shp) OEI 30 seconds, 1,417 kW (1,900 shp) OEI 2 minutes, 1,342 kW (1,800 shp) OEI continuous. Transmission rating 3,109 kW (4,170 shp). Crashworthy fuel system standard.

ACCOMMODATION: Two-pilot crew on separate flight deck; 19 passengers or up to three LD-3 cargo containers in S-92C; 22 combat-ready troops in S-92IU; both versions have rear loading ramp.

SYSTEMS: GEC-Marconi health usage monitoring system standard, with cockpit displays and downloading facility to enable groundcrew to access system via hand-held diagnostic equipment; active noise control system will reduce cabin noise by 3 to 4 dB; active vibration control may be employed in key airframe areas.

AVIONICS: Open architecture avionics system accommodating Arinc 429 and MIL-STD-1553 interfaces; Sanders 'glass cockpit' based on C-130J units, with four liquid crystal EFIS displays and option for fifth; all avionics housed in removable mission equipment rack behind co-pilot station with wiring routed through conduits in fuselage frames for added protection.

DIMENSIONS, EXTERNAL:
Main rotor diameter: 17.71 m (56 ft 4 in)
Length overall, rotors turning: 20.85 m (68 ft 5 in)
Fuselage: Length: 17.32 m (56 ft 10 in)
Max width over sponsons: 3.89 m (12 ft 9 in)
Height overall: 6.45 m (21 ft 2 in)
Wheel track: 3.48 m (11 ft 5 in)
Wheelbase: 5.79 m (19 ft 0 in)

DIMENSIONS, INTERNAL:
Cabin: Length: 5.66 m (18 ft 7 in)
Max width: 2.01 m (6 ft 7 in)
Max height: 1.83 m (6 ft 0 in)
Volume: 16.88 m³ (596 cu ft)
Baggage volume (S-92C): 3.11 m³ (110 cu ft)

AREAS:
Main rotor disc: 231.55 m² (2,492.4 sq ft)

WEIGHTS AND LOADINGS (A: S-92C, B: S-92IU):
Weight empty: A: 6,743 kg (14,866 lb)
Max hook capacity: B: 4,536 kg (10,000 lb)
Max T-O weight:
internal load: A, B: 10,931 kg (24,100 lb)
external load: A, B: 12,020 kg (26,500 lb)

PERFORMANCE (estimated, at max internal load T-O weight, S/L, ISA):
Max cruising speed: 155 kts (287 km/h, 178 mph)
Econ cruising speed: 140 kts (259 km/h, 161 mph)
Hovering ceiling: IGE: A: 2,990 m (9,800 ft)
B: 3,870 m (12,700 ft)
OGE: A: 1,525 m (5,000 ft)
B: 2,530 m (8,300 ft)
Range: A: 510 n miles (944 km, 587 miles)
B: 480 n miles (889 km, 552 miles)

UPDATED

OTHER AIRCRAFT

Description of **RAH-66 Comanche** attack helicopter appears under Boeing Sikorsky in this section. No reports of Sikorsky **Tilt-Rotor** developments since 1991 (see 1994-95 edition).

NEW ENTRY

SKYSTAR

SKYSTAR AIRCRAFT CORPORATION

Nampa Municipal Airport, 100 North Kings Road, Nampa, Idaho 83687
Telephone: 1 (208) 466 1711
Fax: 1 (208) 466 8703
PRESIDENT: Philip L. Reed III
DIRECTOR, SALES AND MARKETING: Larry E. Robb

SkyStar Aircraft Corporation took over Kitfox programme from former Denney Aerocraft Company in 1993. Kitfox production continues; tricycle variant Vixen was shown at Oshkosh in August 1993. Local variants also produced by Skyfox in Australia and PACI in Philippines, which see.

VERIFIED

SKYSTAR KITFOX IV

TYPE: Side by side two-seat, dual control homebuilt.

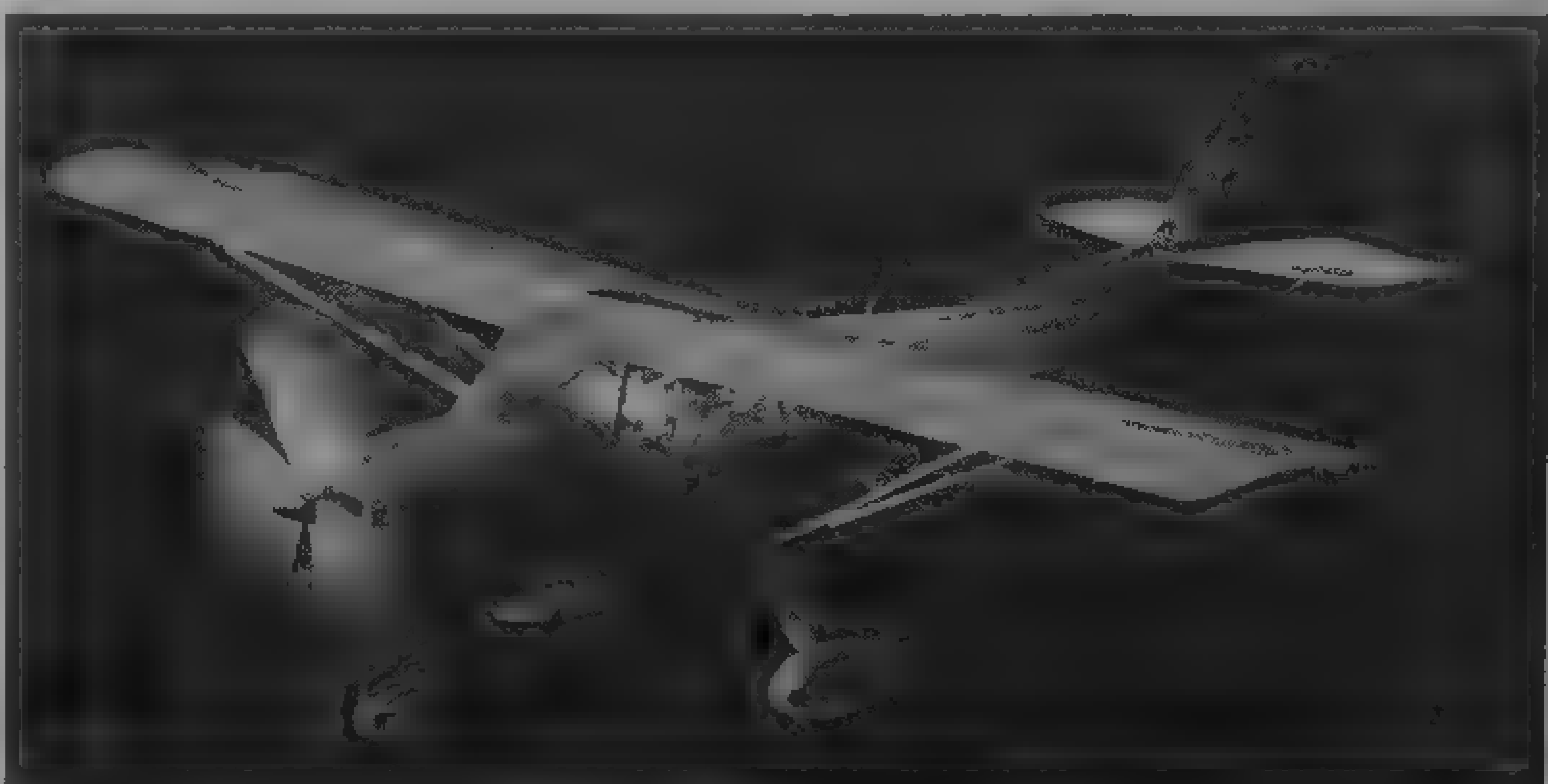
PROGRAMME: Prototype Kitfox first flown 7 May 1984. Vixen derivative is to be certificated under new FAA Primary Aircraft category.

CURRENT VERSIONS: **Kitfox IV**: Also referred to as Kitfox IV-1200. *Detailed description applies to this version.*

Speedster: Higher performance version through optional package costing further $2,000.

Vixen: Non-retractable tricycle landing gear version of Kitfox, with steerable nosewheel, and Rotax 912 engine under new smooth engine cowling. To be FAA certificated under Primary Aircraft category.

XL: Fourth variant of basic Kitfox IV. Rotax 503 engine; maximum T-O weight 431 kg (950 lb). Flight testing to VLA criteria completed early 1993.



The tri-gear Kitfox Vixen *(C. O. Denney)*

1994

CUSTOMERS: Some 2,000 Kitfox aircraft ordered, and 850 built.

COSTS: Kits: start at $14,995 including engine; Kitfox with Speedster package (Rotax 912) is approximately $25,000 including engine.

DESIGN FEATURES: Designed to have good short-field performance. Kitfox IV was introduced in 1991, featuring new wing with laminar flow section and all-metal hinge brackets for full span flaperons, windscreen material thickened and given increased slope and, with other changes, resulted in increase in cruising speed, stalling and landing speeds decreased, former due to use of flaperons; differential ailerons, can have 0.14 m³ (5 cu ft) storage space behind seat, wing folding standard. Speedster optional package

increases cruising speed to approximately 109 knots (202 km/h, 125 mph) with Rotax 912 engine; included are cropped wings of about 8 84 m (29 ft) span with new wing tips, revised tail unit, wheel fairings, airscoop and more Optional agricultural spray and underfuselage cargo pods

STRUCTURE: Wings of aluminium alloy tubing with aluminium inserts, plywood ribs and drooped glassfibre tips, with Stits Poly Fiber covering overall Steel tube fuselage and tail unit, with Poly Fiber covering

LANDING GEAR: Non-retractable tailwheel type, with hydraulic disc brakes Optional composite floats, amphibious floats and skis.

POWER PLANT: One 38.8 kW (52 hp) Rotax 503 or 48 5 kW (65 hp) Rotax 582 LC two-cylinder two-stroke engine, with 3 1 reduction gear Optional 59 7 kW (80 hp) Rotax 912 flat-four Fuel capacity 36 litres (9 5 US gallons, 8 Imp gallons) standard. Two 22 7 litre (6 US gallon; 5 Imp gallon) or two 49 litre (13 US gallon, 10.8 Imp gallon) optional fuel tanks in wings

DIMENSIONS, EXTERNAL:
Wing span 9 75 m (32 ft 0 in)
Wing aspect ratio 7 83
Length overall 5 38 m (17 ft 8 in)
Height overall 1 73 m (5 ft 8 in)
Propeller diameter 1.73 m (5 ft 8 in)

AREAS:
Wings, gross 12 16 m² (130 84 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 216 kg (475 lb)
Pilot weight range 68-113 kg (150-250 lb)
Max recommended pilot and passenger weight 181 kg (400 lb)
Max T-O weight 544 kg (1,200 lb)
Max wing loading 44.77 kg/m² (9 17 lb/sq ft)
Max power loading:
Rotax 503 14 04 kg/kW (23 08 lb/hp)
Rotax 582 11 24 kg/kW (18 46 lb/hp)

PERFORMANCE (two crew, unless stated otherwise):
Max level speed 109 kts (201 km/h; 125 mph)
Cruising speed 91 kts (169 km/h, 105 mph)
Stalling speed 25 kts (47 km/h, 29 mph)
Max rate of climb at S/L, at max T-O weight 396 m (1,300 ft)/min
Service ceiling, pilot only 6,100 m (20,000 ft)
T-O run, pilot only 26 m (85 ft)
Landing run 46 m (150 ft)
Range: standard fuel 195 n miles (362 km, 225 miles)
max fuel 825 n miles (1,528 km, 950 miles)
Endurance, standard fuel 3 h
g limits, pilot only +6/-3

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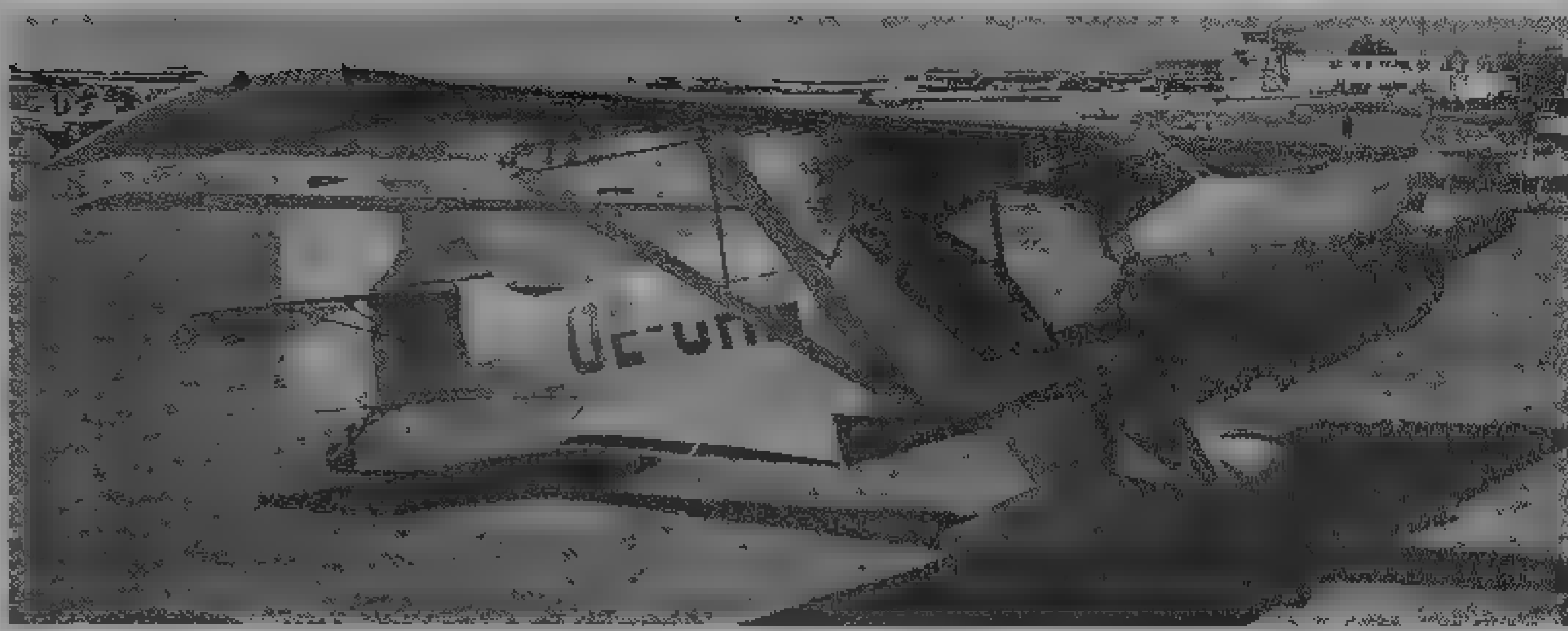


SkyStar Kitfox IV two-seat homebuilt *(Paul Jackson)*
1995

SPENCER

SPENCER AMPHIBIAN AIRCRAFT INC

PO Box 327, Kansas, Illinois 61933
Telephone: 1 (217) 948 5504/5505
and
1629 Park Drive, Schaumburg, Illinois 60194
Telephone: 1 (708) 882 0123
MANAGING DIRECTOR: Robert F Kerans

UPDATED

SPENCER S-12-E

TYPE: Four-seat, dual control homebuilt amphibian

PROGRAMME: Continues to be available in 1995

CURRENT VERSIONS: **S-12-E**: Standard current version, available in plans and kit forms. *Description applies to this version.*

S-12-D: Earlier version, plans and some components still available.

CUSTOMERS: At least 38 completed and flown by January 1995. Plans and components sold in Brazil, Canada, Germany, Italy, New Zealand, USA and elsewhere

COSTS: Kit: $27,000 without engine and instruments. Plans $350

DESIGN FEATURES: Slightly sweptback high-wing, pusher-engined monoplane; strut-mounted, wire-braced stabilising float under each wing near tip. Single-step hull with retractable water rudder Specially designed STOL wing section (modified NACA 4415); one-piece leading edge

FLYING CONTROLS: Conventional, mechanically actuated primary surfaces, trailing-edge flaps

STRUCTURE: Fuselage has wooden frames, longerons and skin sheathed in GFRP and Kevlar, with welded steel tube framework for wing/engine mountings and landing gear attachment; wing is wood, steel and GFRP, with wooden ailerons and flaps, glassfibre tip floats All-glassfibre hull a future possibility

LANDING GEAR: Retractable tricycle type, with GFRP legs, forward wheel protrudes from nose when retracted

POWER PLANT: One 212 5 kW (285 hp) Teledyne Continental Tiara 6-285 engine Also recommended is 224 kW (300 hp) Teledyne Continental IO-520 flat six. Development undertaken from 1988 to install a Ford 351 W converted motorcar engine Fuel capacity 360 litres (95 US gallons, 79 Imp gallons)

DIMENSIONS, EXTERNAL:
Wing span 11 38 m (37 ft 4 in)
Wing aspect ratio 7 57
Length overall 8 05 m (26 ft 5 in)
Height overall 2 90 m (9 ft 6 in)
Propeller diameter 2 13 m (7 ft 0 in)

AREAS:
Wings, gross 17.1 m² (184 0 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 993 kg (2,190 lb)
Max T-O weight 1,451 kg (3,200 lb)
Max wing loading 84 9 kg/m² (17 39 lb/sq ft)
Max power loading: Tiara 6 83 kg/kW (11 23 lb/hp)
IO-520 6.49 kg/kW (10 67 lb/hp)

PERFORMANCE (at max T-O weight):
Cruising speed 122 kts (225 km/h, 140 mph)
Econ cruising speed at 3,050 m (10,000 ft) 109 kts (201 km/h, 125 mph)
Stalling speed, flaps down 38 kts (70 km/h, 43 mph)
Max rate of climb at S/L 320 m (1,050 ft)/min
Service ceiling 4 875 m (16,000 ft)
T-O run from calm water 213 m (700 ft)
Landing run 213 m (700 ft)
Range, 65% power at 2,315 m (7,600 ft), 20 min reserves 695 n miles (1,285 km, 800 miles)
Endurance with 37 9 litres (10 0 US gallons, 8 3 Imp gallons) reserve 7 h

UPDATED

Spencer S-12-E amphibian
1995

SPORT

SPORT AIRCRAFT INC

Manufacture of kits for Sport Aircraft (Sunderland) S-18 (see 1994-95 *Jane's*) is understood to have terminated, although assembly from plans may continue by amateur constructors

UPDATED

Sport Aircraft S-18 two-seat homebuilt (112 kW; 150 hp Textron Lycoming O-320-E2A engine)
1994

STARKRAFT

STARKRAFT

Fort Scott, Kansas

First product of StarKraft is the SK-700. Intended for sale in kit form, this will now be marketed complete

NEW ENTRY

STARKRAFT SK-700

TYPE: Eight-seat, twin-engined transport.

PROGRAMME: First flight (N700SK) December 1994. Production version will have 1 21 m (4 ft 0 in) fuselage stretch, foreplane, additional fuel and maximum T-O weight increase of 780 kg (1,720 lb)

CUSTOMERS: Anticipated orders for 20 in 1995 and 40 in 1996 Deliveries begin in 1997, following certification

COSTS: Target $1 million to $1 2 million.

DESIGN FEATURES: Push-pull configuration, design assistance from Aircraft Design (responsible for Lancair IV).

STRUCTURE: All composites

LANDING GEAR: Tricycle, retractable; mainwheels retract inwards, nosewheel rearwards.

POWERPLANT: Two 261 kW (350 hp) Teledyne Continental TSIOL-550 six-cylinder, liquid-cooled engines as tractor and pusher, each driving a three-blade propeller Turboprop alternatives under consideration

WEIGHTS AND LOADINGS:

Max T-O weight	4,082 kg (9,000 lb)

NEW ENTRY

Prototype StarKraft SK 700 eight seat transport
1995

STARPAC

STAR OF PHOENIX AIRCRAFT

Manufacturing plans are believed to have been abandoned of the Phoenix Flyer lightplane

UPDATED

STODDARD-HAMILTON

STODDARD-HAMILTON AIRCRAFT INC

8701 58th Avenue North-East, Arlington, Washington 98223

Telephone: 1 (206) 435 8533

Fax: 1 (206) 435 9525

PRESIDENT: Theodore E. Setzer

GENERAL MANAGER: Kelly J. Lee

MARKETING AND SALES MANAGER: Tim Johnson

Glasair I and II have been superseded by II-S and III Details of Glasair I in 1989-90 *Jane's* Two-seat GlaStar added to product range in 1995 Company delivered 1,400th kit in Spring 1995, 15 years after formation

UPDATED

Stoddard-Hamilton Glasair II-RGS with appropriate UK registration *(Paul Jackson)*
1995

STODDARD-HAMILTON GLASAIR II-S

TYPE: Side by side two-seat, dual control homebuilt.

PROGRAMME: Glasair II-S (stretched) available in **RG** (retractable landing gear), **FT** (non-retractable tricycle gear) and **TD** (tailoragger) forms to supersede earlier Glasair series

CUSTOMERS: 1,450 kits sold, about 600 flying (early 1995)

COSTS: Kits, $28,500 for RG, $20,400 for FT, $21,400 for TD, all without engine, propeller, instruments and avionics, engine $23,800 for 180 hp version, fixed-pitch propeller $1,500, constant-speed propeller $5,700

DESIGN FEATURES: Wing section NASA LS(1)-0413. Upswept Hoerner style trailing-edges

STRUCTURE: Glassfibre and foam composite construction.

LANDING GEAR: Three types available, as detailed above. RG version has inward-retracting mainwheels and rearward-retracting nosewheel Brakes fitted

POWER PLANT: One 119 to 134 kW (160 to 180 hp) Textron Lycoming O-360 series engine. Fuel capacity 182 litres (48 US gallons, 40 Imp gallons). Auxiliary tanks of 42 litres (11 US gallons, 9 2 Imp gallons) capacity in optional wingtip extensions

ACCOMMODATION: Enclosed cockpit with gull-wing doors

DIMENSIONS, EXTERNAL (all versions):

Wing span standard	7 10 m (23 ft 3½ in)
Wing aspect ratio	6.67
Length overall	6.16 m (20 ft 2½ in)
Height overall	2.07 m (6 ft 9½ m)

AREAS:

Wings, gross	7.55 m² (81 3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty: RG	601 kg (1,325 lb)
FT	567 kg (1,250 lb)
TD	544 kg (1,200 lb)
Baggage capacity: all versions	36 kg (80 lb)
Max T-O weight: RG, FT	953 kg (2,100 lb)
TD	907 kg (2,000 lb)
Max wing loading: RG, FT	126 1 kg/m² (25 83 lb/sq ft)
TD	120.1 kg/m² (24.60 lb/sq ft)

PERFORMANCE (RG and TD with 180 hp engine, FT with 160 hp):

Max level speed at S/L:	
RG	217 kts (402 km/h, 250 mph)
FT	207 kts (383 km/h, 238 mph)
TD	208 kts (385 km/h, 239 mph)
Econ cruising speed at 2,440 m (8,000 ft):	
RG	189 kts (351 km/h, 218 mph)
FT	178 kts (330 km/h, 205 mph)
TD	179 kts (332 km/h, 206 mph)
Stalling speed, flaps down, power off:	
RG	43 kts (80 km/h, 50 mph)
FT, TD	42 kts (78 km/h, 49 mph)
Service ceiling: all versions	approx 5,790 m (19,000 ft)
Max rate of climb at S/L:	
all versions	732 m (2,400 ft)/min
Range:	
RG, standard fuel	1,125 n miles (2,083 km, 1,295 miles)
RG, with auxiliary fuel	1,383 n miles (2,561 km, 1,591 miles)
FT, TD, standard fuel	1,042 n miles (1 930 km; 1,199 miles)
FT, TD, with auxiliary fuel	1,281 n miles (2,372 km; 1,474 miles)
g limits at AUW of 708 kg (1,560 lb):	
all versions	+6/–4 limit
	+9/–6 ultimate

UPDATED

STODDARD-HAMILTON GLASAIR III

PROGRAMME: First flight July 1986; similar configuration to earlier models but designed to offer exceptional performance, constructional simplicity and economical kit price Construction takes approximately 1,800 working hours

CUSTOMERS: 300 kits delivered by early 1995

COSTS: Kit $37,700 without engine, propeller, instruments and avionics, engine $33,350, fixed-pitch propeller $1,500, constant-speed propeller $5,700.

DESIGN FEATURES: Larger and wider fuselage for increased baggage space, payload capacity and comfort, also improving the longitudinal and directional stability and thereby making it a better cross-country and IFR aircraft Thicker windscreen to improve protection against bird strikes at higher speeds, and additional glassfibre laminates, integral longerons, and lay-up schedule which provides structurally stronger and torsionally stiffer fuselage Wing section LS(1)-0413; strengthened, carries more fuel than previous models. NACA style air vents provide cabin ventilation. Under development is turbocharging system to be offered as retrofit kit option for IO-540-K engined Glasair IIIs. Projected maximum cruising speed with system is 284 kts (526 km/h; 327 mph) at 5,485 m (18,000 ft)

LANDING GEAR: Retractable

POWER PLANT: One 224 kW (300 hp) Textron Lycoming IO-540-K1H5. Fuel capacity in wings 201 litres (53 US gallons, 44 Imp gallons). Fuselage header tank, capacity 30 litres (8 US gallons, 6.7 Imp gallons). Optional tanks in wingtip extensions, total capacity 41 6 litres (11 US gallons, 9 2 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span, standard	7 10 m (23 ft 3½ in)
Wing aspect ratio	6.67
Length overall	6.52 m (21 ft 4¾ in)
Height overall	2.29 m (7 ft 6 in)

AREAS:

Wings, gross	7.55 m² (81 3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	703 kg (1,550 lb)
Baggage capacity	45 kg (100 lb)
Max T-O weight, without wingtip extensions	1,089 kg (2,400 lb)
Max wing loading	144 13 kg/m² (29 52 lb/sq ft)
Max power loading	4.86 kg/kW (8.00 lb/hp)

PERFORMANCE (at max T-O weight, ISA, standard wings, except where indicated):

Max level speed at S/L	252 kts (467 km/h, 290 mph)
Cruising speed, 75% power at 2 440 m (8,000 ft)	243 kts (451 km/h, 280 mph)
50% power at 5,335 m (17,500 ft)	223 kts (414 km/h, 257 mph)
Stalling speed: pilot only, flaps and wheels up	65 kts (119 km/h, 74 mph)
flaps down, at max T-O weight	70 kts (129 km/h, 80 mph)
Max rate of climb at S/L	732 m (2,400 ft)/min
Service ceiling	approx 7 315 m (24,000 ft)
Range at 55% power:	
standard fuel	1,112 n miles (2,059 km, 1,280 miles)
with tip tanks	1,313 n miles (2 432 km; 1,511 miles)
g limits at AUW of 962 kg (2,120 lb)	+6/–4 limit
	+9/–6 ultimate

UPDATED

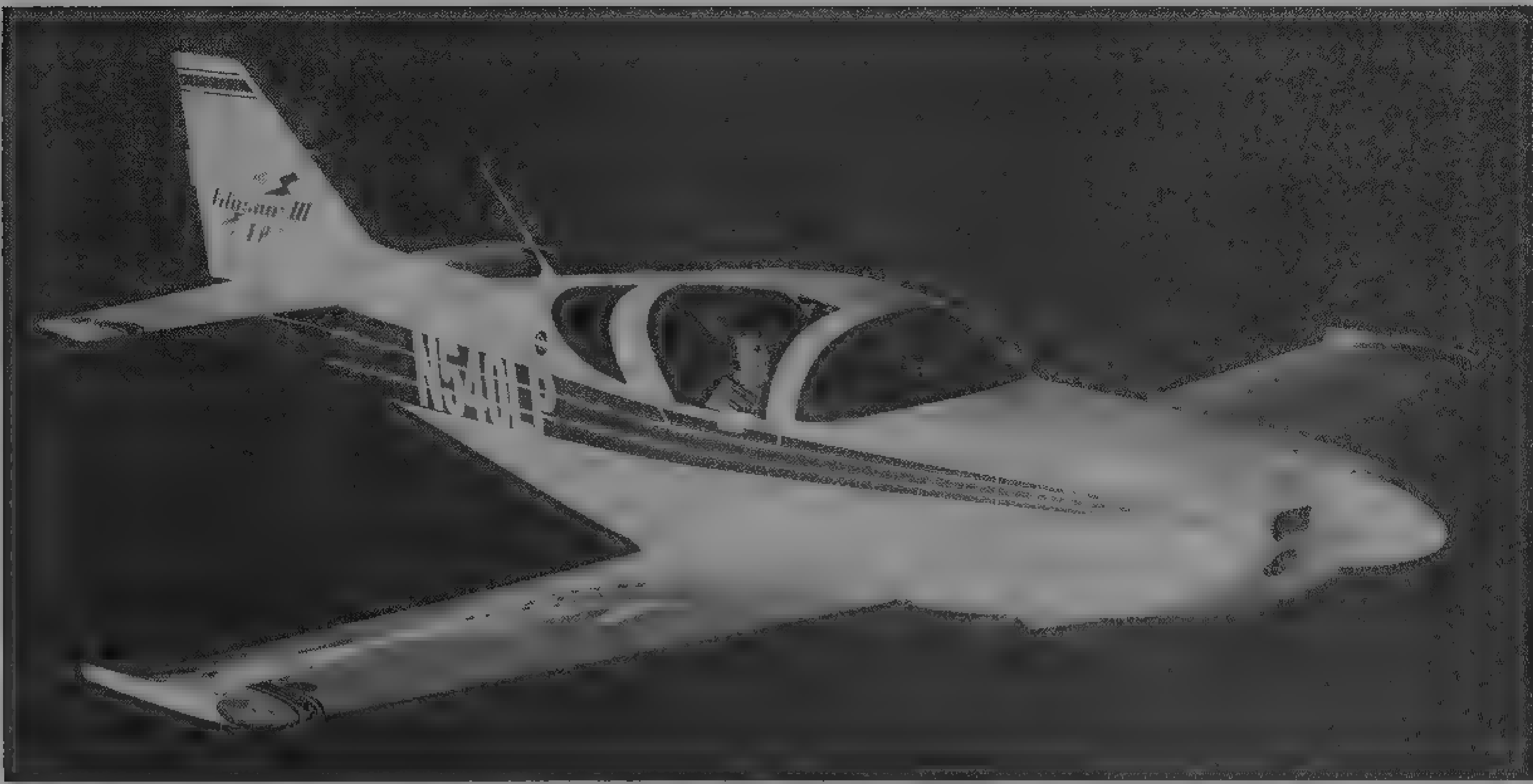
STODDARD-HAMILTON GLASTAR

TYPE: Two-seat monoplane.

PROGRAMME: Prototype (N824G) first flew 29 November 1994, deliveries of kits started 1995, initially rear section only, followed by wings and fuselage at three month intervals; complete kits available from December 1995. Over 170 hours flown by May 1995 when prototype converted to tailwheel configuration

CUSTOMERS: Over 200 kits sold by mid-1995, mostly tricycle landing gear

COSTS: $19 950 per kit, excluding engine, instructions, upholstery and paint



Stoddard-Hamilton Glasair III with 224 kW (300 hp) engine

1995

DESIGN FEATURES: Objective is cheap basic two-seater of moderate performance. Fixed undercarriage, high wing with struts; conventional tail layout. Wings fold for compact hangarage or for trailer mounting. Three-position flaps, 10, 20 and 30°.

FLYING CONTROLS: Conventional mechanical ailerons, elevator and rudder. Frise ailerons. Elevator tab for pitch trim. Fixed tabs on ailerons and rudder for adjustments before flight.

STRUCTURE: Fuselage construction of reinforced glassfibre with metal tube frame surrounding cockpit section. Wings and tail surfaces of aluminium; wings fold and tailplane detaches for transportation and storage.

LANDING GEAR: Fixed nosewheel type with spats, tailwheel or float versions also available. Tailwheel (15 cm, 6 in tyre) conversion effected in 2 hours; mainwheels with 8.00-6 tundra tyres.

POWER PLANT: 93 kW (125 hp) Continental IO-240. Sensenich two-blade propeller. Fuel capacity 129 litres (34 US gallons, 28.3 Imp gallons).

ACCOMMODATION: Two crew side by side, seats adjust for pilot heights between 1.52 and 1.98 m (5 ft 20 in and 6 ft 6 in). Baggage capacity 91 kg (200 lb).

SYSTEMS: Electrical system 12 V 30 Ah battery, alternator fit appropriate to engine.

AVIONICS: Customer specified.

DIMENSIONS, EXTERNAL:

Wing span	0.67 m (35 ft 0 in)
Wing aspect ratio	9.57
Length overall	6.78 m (22 ft 3 in)
*Height overall	2.57 m (8 ft 5 in)
Tailplane span	3.35 m (11 ft 0 in)
Propeller diameter	.83 m (6 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin: Max width	1.12 m (3 ft 8 in)

AREAS:

Wings, gross	1.89 m² (128 sq ft)
Ailerons (total)	0.37 m² (3.97 sq ft)
Trailing-edge flaps (total)	0.65 m² (6.95 sq ft)
*Fin	1.29 m² (13.92 sq ft)
*Rudder	0.47 m² (5.08 sq ft)
Tailplane	1.11 m² (12.00 sq ft)
Elevators	0.99 m² (10.67 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	499 kg (1,100 lb)
Fuel weight	92.2 kg (203.3 lb)
Max T-O weight	861 kg (1,900 lb)
Max wing loading	72.47 kg/m² (14.84 lb/sq ft)
Max power loading	9.25 kg/kW (15.20 lb/hp)

PERFORMANCE (at max T-O weight):

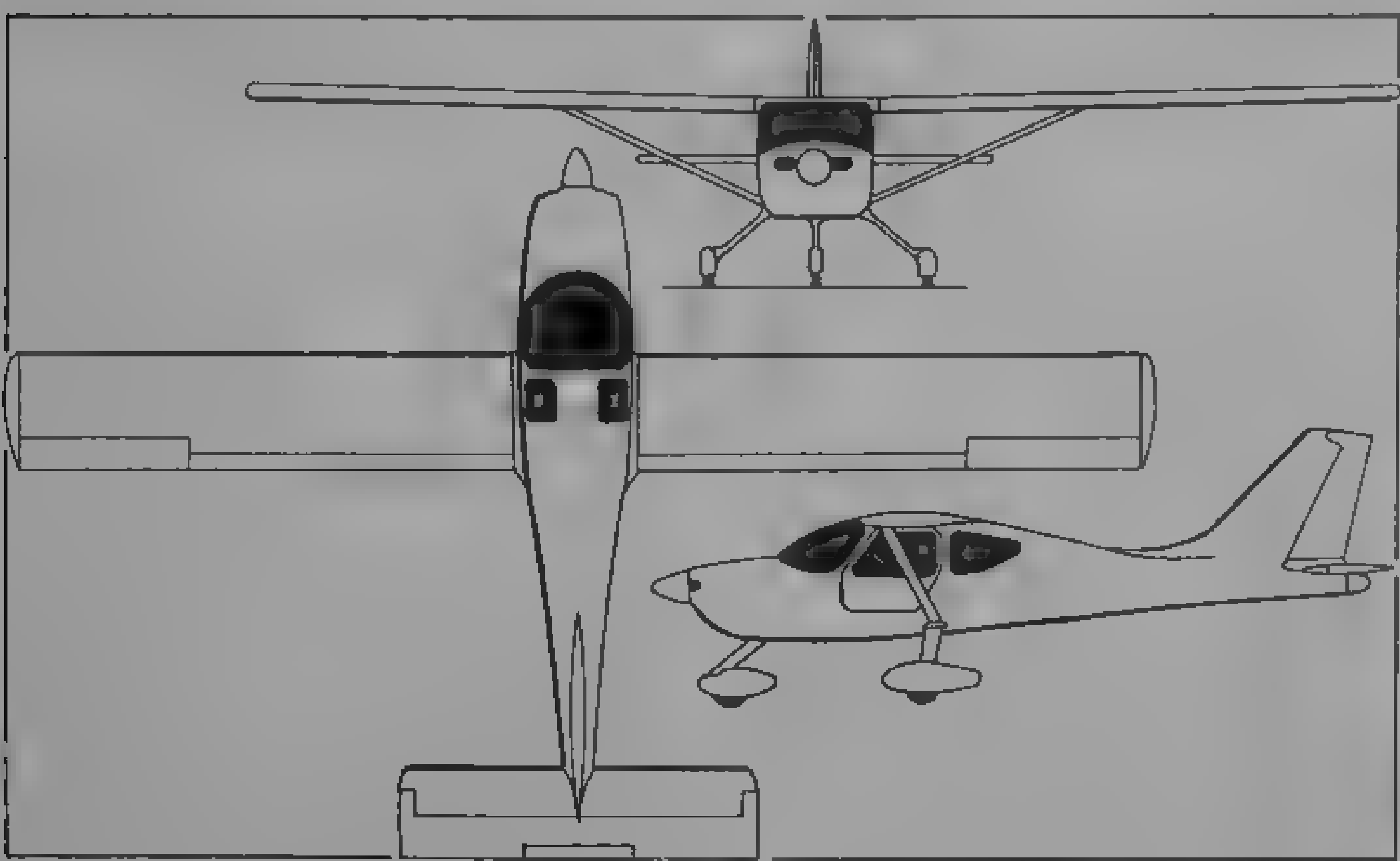
Max level speed	135 kts (250 km/h; 155 mph)
Max cruising speed at 75% power	121 kts (224 km/h; 139 mph)
Stalling speed, power off, flaps down	39 kts (73 km/h; 45 mph)
Max rate of climb at S/L	365 m (1,200 ft)/min
Range with max fuel	738 n miles (1,366 km; 849 miles)
Endurance with max fuel	6 h

**Prior to early 1995 fin and rudder extension*

NEW ENTRY

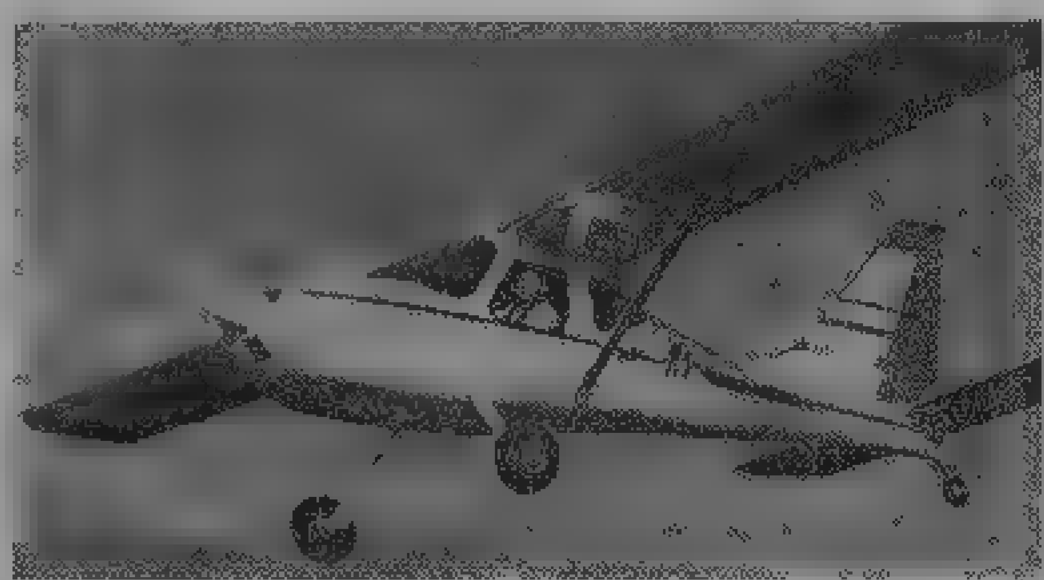
Prototype Stoddart-Hamilton GlaStar

1995



Tricycle version of GlaStar two-seat kitplane *(Jane's/Paul Jackson)*

1995



GlaStar in tailwheel form

1995

SWEARINGEN

SWEARINGEN AIRCRAFT INC

1234 99th Street, San Antonio, Texas 78214
Telephone: 1 (512) 921 0055
Fax: 1 (512) 921 0198
CHAIRMAN AND CEO: E J Swearingen
SENIOR VICE-PRESIDENT: James R Hyslop
VICE-PRESIDENTS:
Joseph E Karwowski (Procurement and Manufacturing programmes)
Robert N Buckley
DIRECTORS:
John C Maurer (International Marketing)
Thomas F Connelly (US Sales)
Robert A Kromer (Technical Marketing Operations)

Ed Swearingen is well known for designing Merlin and Metro commuter and business aircraft (see under Fairchild in this section), and for engineering such aircraft as Piper Twin Comanche and Lockheed 731 JetStar II; also built prototype SA-32T for Jaffe (1991-92 *Jane's*). Now building Swearingen SJ30 small business jet. Joint venture company with Sino Aerospace of Taiwan, called Sino-Swearingen, will certificate and produce SJ30 at new 18,580 m² (200,000 sq ft) facility at Martinsburg, West Virginia.

UPDATED

Swearingen SJ30 (two Williams Rolls FJ44 turbofans) *1995*

SWEARINGEN SJ30

TYPE: Twin-turbofan pressurised business jet.

PROGRAMME: Announced 30 October 1986 as SA-30 Fanjet; Gulfstream Aerospace, Williams International and Rolls-Royce announced they were joining programme in October 1988 and aircraft renamed Gulfstream SA-30 Gulfjet; Gulfstream withdrew from programme 1 September 1989; place taken by Jaffe Group of San Antonio, Texas, and aircraft renamed Swearingen/Jaffe SJ30; now solely a Swearingen project; first flight of prototype (N30SJ) 13 February 1991; certification due 1995, plans two preproduction aircraft and two static test airframes, first customer deliveries 1997.

CUSTOMERS: Three distributors appointed in USA and 10 for international sales, 66 orders reported.

COSTS: Standard aircraft $3 million, Spring 1995.

DESIGN FEATURES: Tapered, 30° sweptback wing of computer-designed section with integral fuel tanks in torsion box.

FLYING CONTROLS: Mechanical, with electrically actuated variable incidence tailplane, rudder and aileron trim tabs; two large outward-canted ventral fins under tail; slotted Fowler trailing-edge flaps actuated electrically; hydraulically actuated full-span leading-edge slats; single electro-hydraulically actuated airbrake/lift dumper panel on each wing ahead of flap.

STRUCTURE: All-metal with chemically milled skins on fuselage.

LANDING GEAR: Retractable tricycle type, with twin wheels on each unit. Trailing-link oleo-pneumatic suspension on main units. Hydraulic actuation, main units retracting inward and rearward into fuselage, nose unit forward. Electrically steerable nose unit.

POWER PLANT: Two 8.45 kN (1,900 lb st) Williams Rolls FJ44 turbofans, pod-mounted on pylons on sides of rear fuselage. Fuel in three integral tanks, one in each wing and one in rear fuselage, combined capacity 1,893 litres (500 US gallons; 416 Imp gallons). Single-point refuelling.

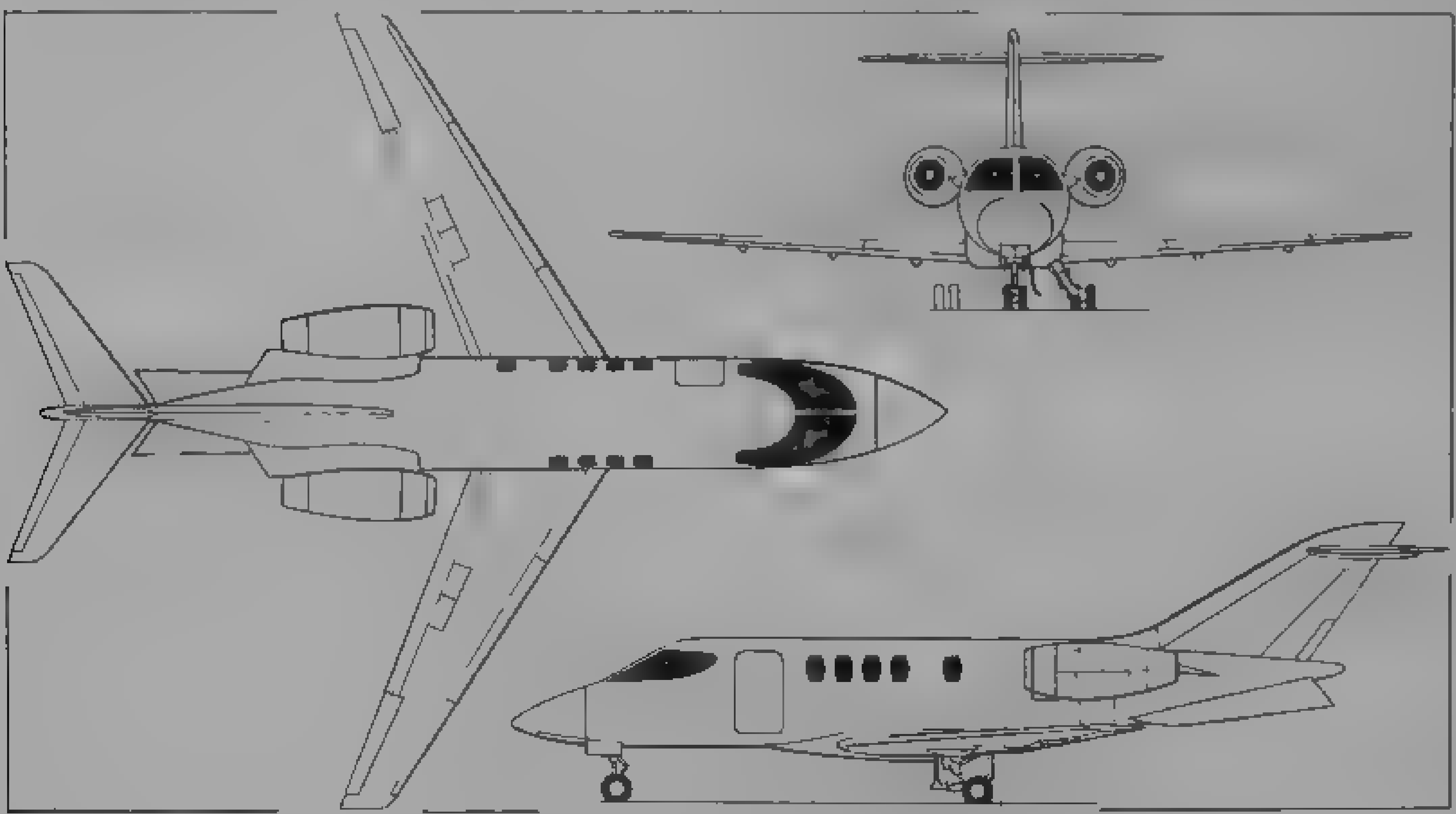
ACCOMMODATION: Pilot and one passenger (or co-pilot) on flight deck. Main cabin separated by a bulkhead, four chairs in facing pairs, each with adjustable reclining backs and retractable armrests, plus two foldaway tables, optional refreshment centre at front, and toilet, washbasin and storage cabinets at rear. Other layouts for up to seven passengers optional. Lengthened cabin for two extra seats in production version. Airstair passenger door at front on port side. Baggage compartment aft of main cabin, with external access via port side door aft of wing. Two-piece birdproof electrically heated wraparound windscreen.

SYSTEMS: Cabin pressurised to 0.69 bar (10.0 lb/sq in) on prototype (0.83 bar; 12.0 lb/sq in on second and production aircraft), and heated by engine bleed air; cooled by a Freon-cycle system. Hydraulic system (207 bars, 3,000 lb/sq in) for actuation of leading-edge slats, airbrake/lift dumpers and landing gear extension/retraction. Two 300 A engine-driven starter/generators and static inverters. Redundant frequency-wild alternators provide power for windscreen heating. Wing and tailplane have TKS liquid de-icing systems; inlets de-iced by engine bleed air.

AVIONICS: Bendix/King Gold Crown III dual IFR avionics.
Radar: Colour weather radar.
Flight: Autopilot/flight director.

DIMENSIONS, EXTERNAL:	
Wing span	11.07 m (36 ft 4 in)
Wing aspect ratio	8.00
Length overall	12.98 m (42 ft 7¼ in)
Height overall	4.24 m (13 ft 11 in)
DIMENSIONS, INTERNAL:	
Cabin: Length	
between pressure bulkheads	5.23 m (17 ft 2 in)
passenger section	3.61 m (11 ft 10 in)
Max width	1.43 m (4 ft 8½ in)
Max height	1.31 m (4 ft 3½ in)
Volume	8.95 m³ (316.22 cu ft)
AREAS:	
Wings, gross	15.33 m² (165.0 sq ft)
WEIGHTS AND LOADINGS:	
Weight empty, equipped	2,817 kg (6,210 lb)
Fuel weight	1,519 kg (3,350 lb)
Max ramp weight	4,762 kg (10,500 lb)
Max zero-fuel weight	3,447 kg (7,600 lb)
Max T-O weight	4,717 kg (10,400 lb)
Max landing weight	4,309 kg (9,500 lb)
Max wing loading	291.5 kg/m² (59.7 lb/sq ft)
Max power loading	278.9 kg/kN (2.74 lb/lb st)
PERFORMANCE (estimated, at max T-O weight except where indicated):	
Max operating speed (V_{MO})	Mach 0.82 (470 kts, 871 km/h; 541 mph)
Max cruising speed	445 kts (824 km/h, 512 mph)
Long-range cruising speed	413 kts (765 km/h, 475 mph)
Stalling speed at max landing weight	81 kts (150 km/h, 93 mph)
Max rate of climb at S/L	1,195 m (3,920 ft)/min
Max operating altitude	13,100 m (43,000 ft)
FAA T-O balanced field length	1,015 m (3,330 ft)
FAA landing distance	762 m (2,500 ft)
Range at Mach 0.72 (413 kts; 765 km/h, 475 mph):	
NBAA VFR reserves	2,076 n miles (3,845 km, 2,389 miles)
NBAA IFR reserves	1,730 n miles (3,204 km, 1,991 miles)

UPDATED



Swearingen SJ30 business jet (*Jane's/Dennis Punnett*) *1991*

THURSTON

THURSTON AEROMARINE CORPORATION

24 Ledge Road, Cumberland Foreside, Maine 04110
Telephone: 1 (207) 829 6108
PRESIDENT: David B Thurston

Company owns type certificate A15EA and related data for original TSC-1A Teal amphibian and, following cessation of operations by International Aeromarine Corporation of Sanford, Florida, during 1991, design data and all rights to TA16 Seafire reverted to Thurston Aeromarine Corporation. Plans to develop eight-seat Seamaster twin-engined amphibian.

VERIFIED

THURSTON TSC-1A3 TEAL III

TYPE: Two-seat amphibian.

PROGRAMME: Thurston Aircraft built 19 Teal Is from 1968. Schweizer produced 12 Teal IIs and Washac Industries assembled seven more from Schweizer components by 1994; all tailwheel versions. Construction of Teal III prototype started February 1991, first flight 1994. Financing by International Aeromarine Inc. for first deliveries due June 1995 from assembly line of International Aeromarine, Fort Erie, Canada.

CURRENT VERSIONS: **Teal III**: Basic model, *as described below*.

CUSTOMERS: Delivery began to USA and Norway, June 1995.

COSTS: Standard aircraft $125,000 (1992).

DESIGN FEATURES: Development of TSC-1A Teal with wing span increased by 1.22 m (4 ft 0 in), horizontal tail surfaces increased in area; pylon mount similar to TA16 Seafire; 134 kW (180 hp) engine in place of original 112 kW (150 hp) unit. Hull structure revised to take tricycle landing gear with nosewheel steering, maximum T-O weight increased to 1,043 kg (2,300 lb). Wing section NACA 4415.

FLYING CONTROLS: Conventional ailerons, elevator and rudder both with trim tabs.

STRUCTURE: All-metal D-spar wing, all-metal semi-monocoque fuselage with GFRP foredeck and cabin top skins; cantilever all-metal T tail.

LANDING GEAR: Retractable tricycle type.
POWER PLANT: One 134 kW (180 hp) Textron Lycoming O-360-A1F6D flat-four engine, driving a Hartzell HC-C2YK-1BF/F7666A-2 tractor propeller. Two leading-edge fuel tanks, total capacity 174 litres (46 US gallons; 38.3 Imp gallons).
ACCOMMODATION: Enclosed cabin seating two side by side; baggage space behind seats.

DIMENSIONS, EXTERNAL:
Wing span 10.97 m (36 ft 0 in)
Wing aspect ratio 7.32
Length overall 7.27 m (23 ft 10¼ in)
Height overall 2.79 m (9 ft 2 in)
Propeller diameter 1.88 m (6 ft 2 in)

AREAS:
Wings, gross 16.44 m² (177.0 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 680 kg (1,500 lb)
Baggage weight 113 kg (250 lb)
Max T-O weight 1,043 kg (2,300 lb)
Max wing loading 63.42 kg/m² (12.99 lb/sq ft)
Max power loading 7.78 kg/kW (12.78 lb/hp)

PERFORMANCE:
Max level speed 101 kts (187 km/h; 116 mph) IAS
Max cruising speed at 2,285 m (7,500 ft) 104 kts (193 km/h; 120 mph)
Cruising speed at 75% power at 2,285 m (7,500 ft) 97 kts (180 km/h; 112 mph)
Stalling speed, flaps up, power off 48 kts (89 km/h; 55 mph)
Max rate of climb at S/L 244 m (800 ft)/min
Service ceiling 4,875 m (16,000 ft)
T-O run: land 305 m (1,000 ft)
water 366 m (1,200 ft)
Landing run: land 213 m (700 ft)
water 275 m (900 ft)
Range with standard fuel 434 n miles (804 km; 500 miles)
Endurance 5 h 30 min
g limit 5.7

UPDATED

THURSTON TA16 SEAFIRE

TYPE: Four-seat amphibian.
PROGRAMME: Construction of prototype (N16SA) started June 1980; first flight 10 December 1981; original development by International Aeromarine continued by Thurston. FAR Pt 23 type certification 1992; financing for production due end 1995.
CURRENT VERSIONS: **Seafire**: Basic version, *as described below*.
COSTS: Standard aircraft approximately $235,000 (1992).
DESIGN FEATURES: Wing section NACA 64_2A215; dihedral 3°, incidence 4°.
FLYING CONTROLS: Thurston ailerons (US Patent 3,598,340) with ground adjustable trim tab, single-slotted trailing-edge flaps, elevators with bungee trim system; conventional rudder. Dual controls.
STRUCTURE: All-metal constant chord wings, all-metal single-step planing hull with retractable water rudder; cantilever all-metal tail surfaces.
LANDING GEAR: Hydraulically retractable tricycle type. Main units retract inward, steerable nosewheel retracts forward to close opening in hull, which needs no closure doors. Oleo-pneumatic shock-absorbers. Parker-Hannifin aluminium alloy wheels, all three size 6.00-6, with tyre size 17.5 × 6.30, 6 ply rating. Tyre pressures: mainwheels 2.76 bars (40 lb/sq in), nosewheel 2.07 bars (30 lb/sq in). Parker-Hannifin dual-pad disc brakes. Toe brakes. Parking brake. Wheel landing gear designed to meet Canadian DoT snow-ski load conditions.
POWER PLANT: One 186 kW (250 hp) Textron Lycoming O-540-A4D5 flat-six engine, pylon-mounted and braced from upper surface of hull directly over wing, driving Hartzell two-blade constant speed metal tractor propeller. Fuel tank in leading-edge of each wing, with combined capacity of 340 litres (90 US gallons; 75 Imp gallons). Refuelling point on upper surface of each wing. Oil capacity 11.5 litres (3 US gallons; 2.5 Imp gallons). Engine air intake incorporates filter and automatic inlet door which opens if main duct becomes blocked by ice or debris.
ACCOMMODATION: Pilot and three passengers in pairs in enclosed cabin, with two-section rearward-sliding canopy. Forward section slides aft over rear canopy, and both can then be rotated to either side of hull, or removed, to facilitate loading/unloading of bulky items. All glass tinted. Adjustable seats with belts and shoulder harness. Space for baggage or freight at rear of cabin. Accommodation heated and ventilated.
SYSTEMS: Electrical system powered by 24 V 70 A engine-driven alternator; 24 V 37 Ah battery. Electrically driven hydraulic pump provides system pressure of 69 bars (1,000 lb/sq in) for actuation of landing gear. Oxygen system optional.
AVIONICS: Standard Narco package, optional nav/com equipment to customer requirements.

DIMENSIONS, EXTERNAL:
Wing span 11.28 m (37 ft 0 in)
Wing chord, constant 1.52 m (5 ft 0 in)
Wing aspect ratio 7.40
Length overall 8.28 m (27 ft 2 in)
hull 7.42 m (24 ft 4 in)
Height overall 3.28 m (10 ft 9 in)
Tailplane span 3.05 m (10 ft 0 in)
Wheel track 4.01 m (13 ft 2 in)
Wheelbase 3.28 m (10 ft 9 in)
Propeller diameter 2.03 m (6 ft 8 in)

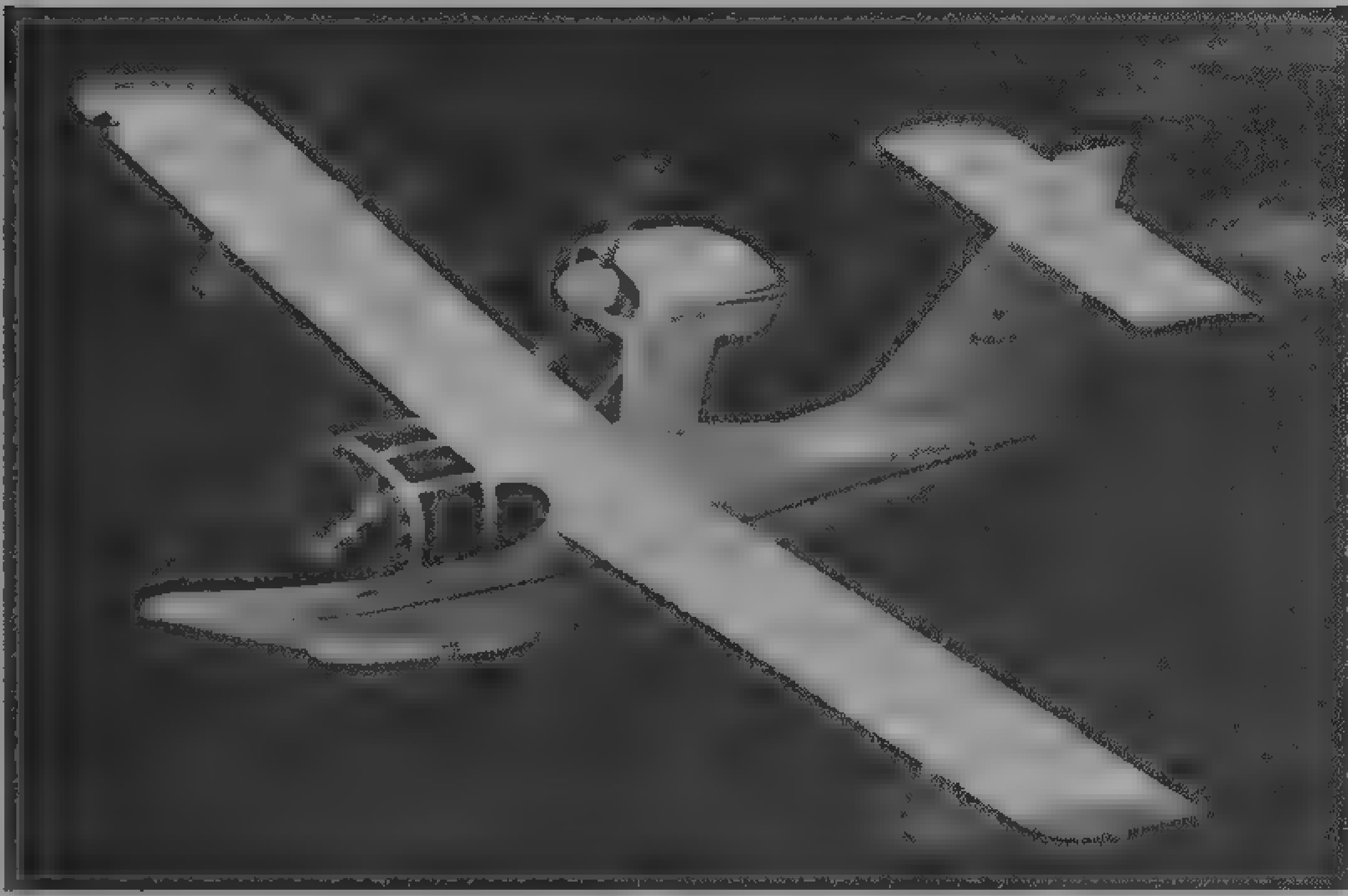
DIMENSIONS, INTERNAL:
Cabin: Length 2.13 m (7 ft 0 in)
Max width 1.01 m (3 ft 4 in)
Max height 1.22 m (4 ft 0 in)
Floor area 1.86 m² (20.0 sq ft)
Volume 2.26 m³ (80.0 cu ft)

AREAS:
Wings, gross 17.00 m² (183.0 sq ft)
Ailerons (total) 1.11 m² (12.0 sq ft)
Trailing-edge flaps (total) 2.51 m² (27.0 sq ft)
Fin 2.34 m² (25.2 sq ft)
Dorsal fin 0.12 m² (1.30 sq ft)
Rudder 0.67 m² (7.2 sq ft)
Tailplane 1.95 m² (21.0 sq ft)
Elevators 1.45 m² (15.6 sq ft)

WEIGHTS AND LOADINGS:
Weight empty, equipped 885 kg (1,950 lb)
Max fuel weight 245 kg (540 lb)
Max T-O and landing weight 1,451 kg (3,200 lb)
Max wing loading 85.44 kg/m² (17.5 lb/sq ft)
Max power loading 7.80 kg/kW (12.8 lb/hp)

PERFORMANCE (at max T-O weight, ISA):
Never-exceed speed (VNE) 160 kts (298 km/h; 185 mph) IAS
Max level speed at 2,135 m (7,000 ft) 152 kts (281 km/h; 175 mph) IAS
Max cruising speed, 75% power at 2,135 m (7,000 ft) 139 kts (257 km/h; 160 mph)
Econ cruising speed, 67% power at 2,135 m (7,000 ft) 135 kts (249 km/h; 155 mph)
Stalling speed, engine idling:
flaps up 63 kts (117 km/h; 73 mph)
flaps down 52 kts (97 km/h; 60 mph)
Max rate of climb at S/L 323 m (1,060 ft)/min
Service ceiling 5,485 m (18,000 ft)
T-O run: land 198 m (650 ft)
water 259 m (850 ft)
T-O to 15 m (50 ft): land 305 m (1,000 ft)
water 366 m (1,200 ft)
Landing from 15 m (50 ft): land or water 366 m (1,200 ft)
Range with max fuel 868 n miles (1,609 km; 1,000 miles)

UPDATED



Thurston TA16 Seafire four-seat amphibian prototype
1993

THURSTON TA19 SEAMASTER

TYPE: Eight-seat transport amphibian.
PROGRAMME: Design studies completed 1992, construction of prototype 1995, with production aircraft available 1997.
CURRENT VERSIONS: **Seamaster**: Basic version, *as described below*.
COSTS: Standard aircraft approximately $1.2 million.
DESIGN FEATURES: Being developed as modern turboprop replacement for Grumman Goose and Mallard amphibians. Wing section GA 40U-A215.
FLYING CONTROLS: Droop ailerons, conventional rudder and elevators, double-slotted flaps.
STRUCTURE: Aluminium alloy main structure, GFRP secondary structure (wingtips, forward cabin top, bow deck).
LANDING GEAR: Retractable tricycle type with steerable nosewheel, underwing floats, skis optional.
POWER PLANT: Two 335.5 kW (450 shp) Allison 250-B17F turboprops, each driving a Hartzell three-blade constant-speed propeller. Four interconnected fuel tanks in each wing, total capacity 1,363 litres (360 US gallons; 300 Imp gallons).
ACCOMMODATION: Two pilots on flight deck, eight passengers in main cabin.

DIMENSIONS, EXTERNAL:
Wing span 16.15 m (53 ft 0 in)
Wing aspect ratio 8.39
Length overall 11.89 m (39 ft 0 in)
Height overall 4.27 m (14 ft 0 in)
Propeller diameter 2.24 m (7 ft 4 in)

AREAS:
Wings, gross 31.12 m² (335.0 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 2,204 kg (4,860 lb)
Max T-O weight 3,901 kg (8,600 lb)
Fuel weight 1,111 kg (2,450 lb)
Max wing loading 125.34 kg/m² (25.67 lb/sq ft)
Max power loading 5.81 kg/kW (9.56 lb/shp)

PERFORMANCE (estimated, at max T-O weight, ISA):
Max level speed at S/L 191 kts (354 km/h; 220 mph)
Cruising speed, 75% power at 2,285 m (7,500 ft) 174 kts (322 km/h; 200 mph)
Econ cruising speed, 50% power at 2,285 m (7,500 ft) 152 kts (281 km/h; 175 mph)
Stalling speed 52 kts (97 km/h; 60 mph)
Max rate of climb at S/L 457 m (1,500 ft)/min
Rate of climb at S/L, OEI 152 m (500 ft)/min
Service ceiling 6,100 m (20,000 ft)
T-O run: land 427 m (1,400 ft)
water 564 m (1,850 ft)
Landing run: land 366 m (1,200 ft)
water 427 m (1,400 ft)
Range with max standard fuel, 50% power, 30 min reserves 1,164 n miles (2,156 km; 1,340 miles)
Range with max payload, power and reserves as above 956 n miles (1,770 km; 1,100 miles)
Endurance with max standard fuel 9 h

VERIFIED

TRIDAIR

TRIDAIR HELICOPTERS INC

Conversions of Bell 206 helicopters by Tridair are detailed in *Jane's Aircraft Upgrades*.

UPDATED

UNC

UNC HELICOPTER (part of UNC Inc Aviation Services Division)

Refer to *Jane's Aircraft Upgrades* for information on the UNC (Bell) Ultra Huey.

UPDATED

UNITED STATES AIR FORCE

UNITED STATES AIR FORCE MATERIEL COMMAND

Formed 1 July 1992, incorporating former Logistics and Systems Commands, duties include management of procurement programmes.

Aeronautical Systems Center

Wright Patterson AFB, Dayton, Ohio 45433-6503
Telephone. 1 (513) 255 3334
PUBLIC AFFAIRS OFFICER Col Patrick C. Mullaney

UPDATED

JOINT PRIMARY AIRCRAFT TRAINING SYSTEM (JPATS)

TYPE: Primary/basic pilot trainer; version of Pilatus PC-9

PROGRAMME: USAF and USN issued Joint-Service Operational Requirements Document, November 1991, Department of Defense go-ahead of 19 January 1993 re-timed programme, but further delays followed, draft RFP July 1993, final RFP 18 May 1994 (aircraft only, associated ground training package now separate); flight trials of seven contenders in July to October, following which Vought Pampa 2000 International dropped from contest, manufacturing development contract award scheduled for February 1995. However, major restructuring revealed on 24 January 1995 featured six month slippage of contract award to 25 August and stretching of programme from 12 to 20 years. Initial planned purchase of 168 aircraft over five year period also amended to 141 over seven years, but ultimate requirement of 372 USAF and 339 USN examples stands, plus 45 for NATO school in USA. In short term, FY96 funding cut to $55 million for purchase of three aircraft instead of six, and year two procurement also down, from 10 to three. Revision of JPATS programme means first USAF aircraft will now be delivered in 1999, with USN examples following in 2002. Decision in favour of Beech Mk II (Pilatus PC-9 Mk II) announced 22 June 1995

COSTS: $6,000 million programme

DESIGN FEATURES: Tandem, stepped cockpits specified November 1991, eliminating Promavia Jet Squalus, Teledyne Ryan (with revised Fairchild Republic T-46 design) and Saab 2060. Minimum 250 knots (463 km/h; 288 mph) IAS cruising speed; 270 knots (500 km/h; 311 mph) objective, canopy resistance to 1.8 kg (4 lb) bird at objective speed; pressurised accommodation; provision for blind-flying hood in front cockpit; zero height/60 knots (111 km/h; 69 mph) ejection seats. Land-based only

Contenders summarised in accompanying table. All are described on the appropriate pages of this edition

STRUCTURE: Life of 24 years/19,000 flying hours, +6/−3 g

AVIONICS: To include GPS microwave landing system, collision warning system and provision for HUD

UPDATED

1995 JPATS CONTENDERS

US Manufacturer	Original Manufacturer	JPATS Bid Aircraft Name	Remarks
Raytheon	Pilatus, Switzerland	Beech Mk II	Modified PC-9, single uprated turboprop (932 kW; 1,250 shp)
Cessna	—	CitationJet	New design, twin turbofans (each 6.67 kN, 1,500 lb st)
Lockheed Martin	Aermacchi, Italy	T-Bird II	Re-engined MB-339A, single turbojet (17.79 kN, 4,000 lb st)
Northrop Grumman	Embraer, Brazil	Super Tucano	Stretched/re-engined Tucano, single uprated turboprop (1,193 kW, 1,600 shp)
Northrop Grumman	Agusta, Italy	S.211A	Modified S.211, single uprated turbofan (14.19 kN, 3,190 lb st)
Rockwell	DASA, Germany	Ranger 2000	Fantrainer development, single turbofan (11.12 kN, 2,500 lb st)

NON DEVELOPMENT AIRLIFT AIRCRAFT (NDAA)

TYPE: Strategic transport

PROGRAMME: NDAA requirement evolved as alternative to, or supplement for, troubled C-17A Globemaster III and therefore dependent upon outcome of 'Milestone 3B' programme review. Contest open to either FAA certified commercial aircraft derivative or US military certified airlift aircraft. Request for proposals for competitive commercial aircraft released in March 1995, with joint C-17/NDAA Defense Acquisition Board scheduled for November 1995 to evaluate Globemaster III performance, cost, quality and reliability, and establish most cost-effective mix of C-17 and NDAA aircraft to satisfy future Air Force/Army strategic airlift requirements. If programme carried through, successful NDAA will be purchased off-the-shelf and 'missionised' for aircraft role (Refer to Boeing 747F and Lockheed Martin C-5D in this section for two potential contenders.)

NEW ENTRY

C-32A

TYPE: Large, special mission (VIP) transport.

PROGRAMME: Boeing C-137B/C replacement, USAF has invited industry bid to supply initial six long-range, high-volume aircraft with executive interiors for service with executive-tasked 89th Airlift Wing at Andrews AFB Maryland. Initial acquisition expected on lease basis, with option to buy. Aircraft must be capable of carrying at least 60 passengers, 18 crew and baggage; and transport 40 passengers, 18 crew and baggage non-stop from Frankfurt, Germany to Andrews at normal cruise speed. USAF anticipates entering into lease agreement in FY96, with aircraft delivery in FY97, culminating in planned buy, if option is exercised, of one aircraft in FY98, one in FY99 and two each in FY00-01. Communications systems must provide global clear and secure voice, data and facsimile capability; and aircraft will also feature automated self-defence system to limit vulnerability to shoulder-launched, IR-guided missiles

NEW ENTRY

Electronic Systems Center

Hanscom AFB, Massachusetts 01731
Telephone. 1 (617) 377 4441

NEW ENTRY

ADVANCED SURVEILLANCE AND TRACKING TECHNOLOGY/AIRBORNE RADAR DEMONSTRATOR (ASTT/ARD)

PROGRAMME: Part of AFMC's Electronic Systems Center programme to develop new AWACS aircraft for use in 21st century, wind tunnel tests conducted late 1990; flight test demonstrator not expected before 1996. Current proposals envisage Boeing 747 platform aircraft, with GE Aerospace (now Lockheed Martin) advanced L-band phased-array radar installed in very large E-Systems dorsal radome (40 × 14.5 × 3.8 m; 131.2 × 47.6 × 12.5 ft), called a 'synergistic plandome', supported by multiple-strut structure above fuselage

UPDATED

OTHER AIRCRAFT

Joint Advanced Strike Technology (**JAST**) now described under US Navy entry. Boeing OC-135 appears in *Jane's Aircraft Upgrades*

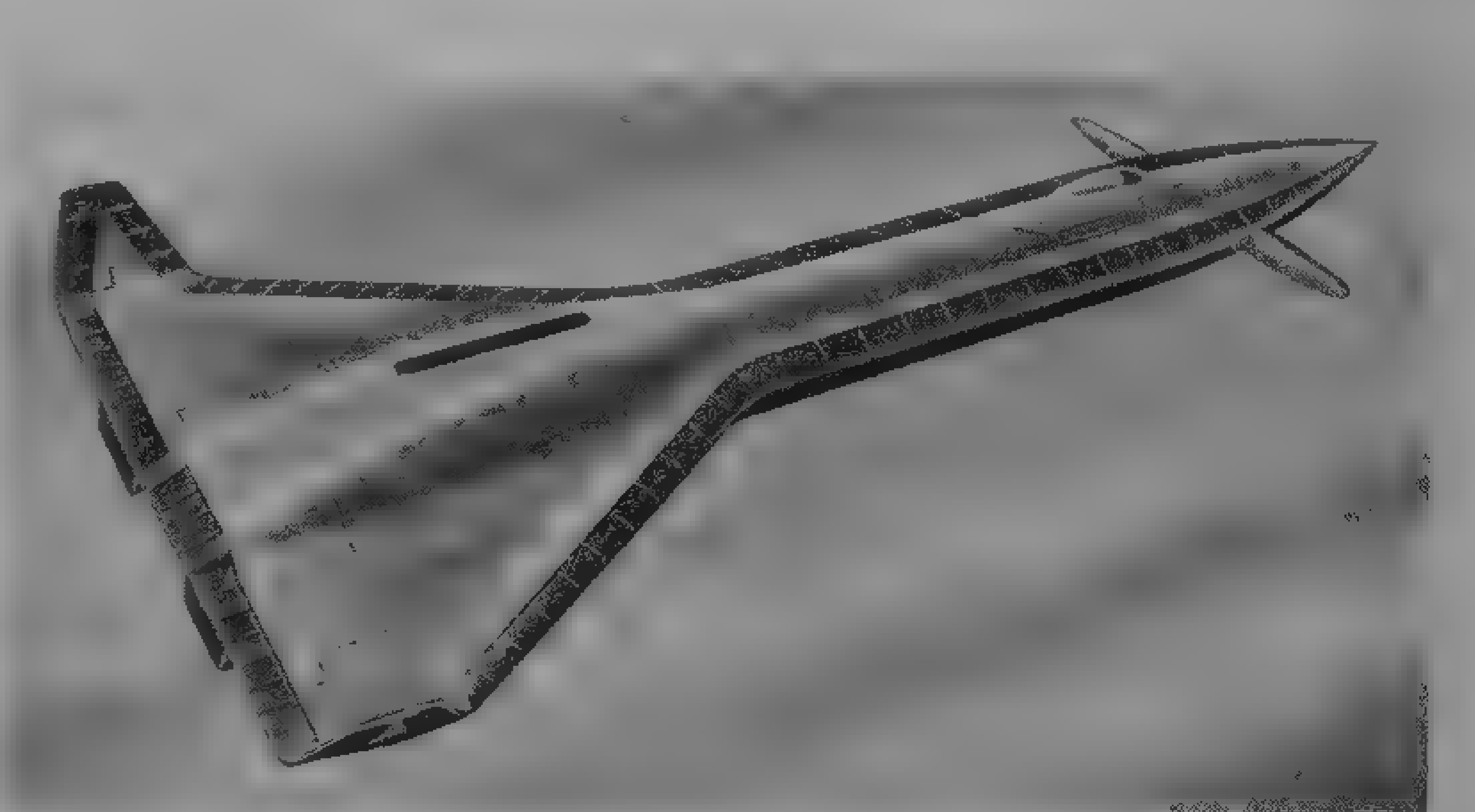
UPDATED

'BLACK' PROJECTS

Some disinformation, and minimal verifiable fact, are available on 'black' programmes that have followed the Lockheed U-2, A-12/SR-71 and F-117. Central to almost all reports is secret USAF test site at Groom Lake, Nellis range, Nevada. In October 1993, USAF announced intent to seal-off last public land having view over test site complex and lake bed. However, public objections delayed this, but authorisation to proceed eventually obtained in first half of 1995. Data below have been gathered from many uncorroborated sources and do not conform to *Jane's* usual standards of accuracy, their reproduction here does not imply that *Jane's* accepts the existence of all or some of those aircraft described below

Much speculation surrounds so-called **'Aurora'** codename accidentally revealed 1985, often linked with Lockheed Martin and most commonly used by published sources to refer to manned hypersonic vehicle believed under flight test from Groom Lake from end of 1980s onwards. Pentagon officials, Congressional sources and Lockheed representatives persistently denied these stories, with former Skunk Works manager Ben Rich offering explanation that 'Aurora' codename referred to B-2 funding in autobiography published shortly before his death

Balance of probability indicates existence of hypersonic project of unknown status and application and not named 'Aurora'; press reports, 1988, of aircraft under development, linked to Groom Lake test site, reportedly cancelled in 1990.



Alleged 'Aurora' design based on sighting reports during 1992, length about 60 m (200 ft) *(Jane's/Mike Keep)*

1993

but sonic booms of Mach 3 to 5 aircraft, about 27 m (90 ft) in length and heading towards southern Nevada, tracked by seismological stations since June 1991, radio intercepts reveal operating altitude of at least 20,420 m (67,000 ft) for unknown aircraft near Edwards AFB, April 1992. Deep rumbling/booming engine noise associated with hypersonic project frequently reported night flying from Groom Lake from 1990 to at least 1992. Aircraft apparently has pulse detonation wave engine which, under varying conditions, allegedly produces distinctive 'donuts-on-a-rope' or 'string of sausages' condensation trails, however, similar trails seen behind civil airliners and may be aerodynamic/meteorological phenomenon.

Physical characteristics uncertain, but appears possible that parasite concept employed (as per SR-71 predecessor M-12 with D-21A reconnaissance drone) for mid-air launch, airliner crew reported airmiss near Los Angeles, August 1992, with F-16 size aircraft having SR 71 shape forward fuselage and indistinct tail surfaces; possibly after launch. Presence of unusually tall hangar at Groom Lake supports contention that it may be for repositioning parasite vehicle on launch platform.

'Northrop TR-3A': Designation almost certainly bogus; attributed to stealthy flying wing of approximately 20 m (66 ft) span first reported over California in 1990, originally believed scale demonstrator of GD/McDonnell Douglas A-12. Possibly developed from Northrop THAP (Tactical High-Altitude Penetrator), prototype of which first flew mid-1981, conceivably adapted for low altitude penetrating reconnaissance mission. Press speculation that 'TR 3A' aircraft involved in accident near Boscombe Down, UK on 26 September 1994, but no other recent reports. (See also British Aerospace, Advanced Aircraft Studies, UK section.)

Two other fixed wing 'black' aircraft projects presently said to exist. Both reportedly fighter attack types with stealth attributes and possessing moderate range/payload characteristics. Current view is that one of these is a Northrop development based on unsuccessful YF-23 contender for USAF's Advanced Tactical Fighter programme. This reportedly is a stealthy variable geometry attack aircraft, having potential as F-111 replacement.

Many sightings of 'black' aircraft with 'flying wing' or 'triangle' shapes undoubtedly relate to unmanned aerial vehicle (UAV) programmes, such as now-cancelled 'Tier 3' high altitude reconnaissance aircraft, replaced by less ambitious 'Tier 3 Minus' project.

UPDATED

Alleged 'Northrop TR 3A' reconnaissance aircraft *(Jane's/Mike Keep)*

1997

UNITED STATES ARMY

ARMY AVIATION AND TROOP COMMAND

4300 Goodfellow Boulevard, St Louis, Missouri 63120-1798
Telephone: 1 (314) 263 1164
Fax: 1 (314) 263 1242/1326

UPDATED

ADVANCED CARGO AIRCRAFT (ACA)

PROGRAMME: Possible replacement for existing Boeing CH-47D Chinooks; full scale engineering development 1998, IOC 2002, 11,800 kg (26,014 lb) payload with full fuel; 18,000 kg (39,683 lb) 'zero range' lift. Sikorsky to offer new design; Boeing offering interim CH-47F Advanced Chinook with MH-47E fuel tanks, refuelling probe, improved rotors and advanced avionics, estimated non-recurring cost $200 to 300 million (1992) and flyaway cost $15 to 20 million.

VERIFIED

UH-X

PROGRAMME: Replacement for Bell UH-1H Iroquois utility helicopter; 1,279 required for procurement from FY98 specification currently undefined, contenders include Sikorsky UH-60X Advanced Black Hawk, Eurocopter/Vought AS 565 Panther 800 and improved/re-engined UH-1s (see Bell Helicopter, UNC and Global Helicopters in *Jane's Aircraft Upgrades*). Likely to be deferred for financial reasons.

UPDATED

UNITED STATES NAVY

NAVAL AIR SYSTEMS COMMAND

Jefferson Plaza 1, Washington, DC 20361-0001
Telephone: 1 (262) 693 2260

NAVAIR has over 46,000 military and civilian employees and an annual budget of $13,000 million.

VERIFIED

JOINT ADVANCED STRIKE TECHNOLOGY (JAST)

TYPE: Multirole, dual-configuration, bi-service combat aircraft.

PROGRAMME: Originally launched as replacement for several USAF and USN programmes cancelled in 1993 (A/F-X, ATA, JSSA and JAF), initial concept resembled JSSA and JAF in anticipating use of modular construction techniques, examples include elements assembled to produce 600 n mile (1,120 km, 691 mile) aircraft with internal weapons or 350 n mile (653 km, 403 mile) aircraft with larger, external bomb load. Dozen nine month, concept-exploration contracts awarded May 1994 at total cost of $10 million out of $30 million JAST appropriation for FY94, recipients Boeing Defense & Space (basic concept, including low-cost procedures), McDonnell Douglas (affordable offboard architecture, joint strike warfare and weapons integration), Lockheed Martin (Fort Worth) (strike mission studies), Northrop Grumman (affordability studies, and systems architecture and configuration management for 'virtual strike warfare' environment), Hughes Missiles (weapons carriage), Cambridge Research (virtual strike environment architecture); Litton Amecom (sensor integration), and Honeywell (next generation avionics).

Initial programme objectives included decision on required JAST technologies to be taken 1996; two demonstrators (Concept-X and Concept-Y) to fly by 2000, one probably in ASTOVL configuration to incorporate Navy's SSF requirement, all technologies to be demonstrated prior to EMD phase in 2001 for risk/cost reduction, target of 75 per cent use of existing B-2/F-22 technology for near term JAST aircraft, prototype JAST first flight expected 2005-2006, IOC in 2008-2010; possible second stage involving 75 per cent new technology JAST to be developed over 15 to 20 years; JAST planned as replacement for F-14, AV-8B, F-111F, F-117, F-15E and F-16, but international collaboration a possibility, with UK first to express interest. Follow-on concept development study contracts, worth $175 million, to be awarded in FY95.

Most of those objectives still being pursued, but project base broadened in latter half 1994/early 1995; prospect of Congressional-driven amalgamation of separate JAST and Advanced Research Projects Agency (ARPA) Common Affordable Lightweight Fighter (CALF) ASTOVL projects emerged in 1994, with Deputy Secretary of Defense John Deutch endorsing earlier rather than later merger at JAST forum in Arlington, Virginia, on 28 June; Congress subsequently issued directive to that effect in Autumn, with efforts in vital technology areas detrimentally affected by accompanying $61 million funding cut.

MoU covering merger concluded and signed by Pentagon JAST Program Office's Maj Gen George Muellner and ARPA's head Gary Denman by early November 1994, subsequently approved by Defense Research and Engineering Director Anita Jones and service acquisition chiefs. Phase 3 of revised programme to start 1996, will address key concerns over payload/radius and survivability attributes; changes arising from combination of JAST and CALF considered beneficial in allowing contractors to tailor design proposals to satisfy service needs, rather than concentrate solely on technology advancement.

In meantime, Pentagon confirmed that up to four research contracts to be awarded for integrated aircraft weapon system concept definition and design research phase; formal Request for Proposals issued 2 September 1994, inviting submissions from industry by 4 November with contract issue by 16 December. Additionally, up to 10 separate projects envisaged for research and development of potential propulsion and avionics systems, structures and materials.

Some elements of US industry joined forces to secure future JAST work, with international collaboration in evidence. McDonnell Douglas heading one team after signing MoU end October 1994 with Northrop Grumman and British Aerospace, each company submitted individual bids for work on JAST project, but all three to participate in event of securing contract; Boeing also linked with Dassault on aspects of subsystem design effort.

Total of 24 contracts covering definition and design phase awarded to 18 US companies in December 1994, major share distributed between four airframe manufacturers for overall weapon system work to be completed by March 1996, Boeing allocated $27.6 million, Lockheed Martin (Fort Worth) $19.9 million, McDonnell Douglas $28.2 million and Northrop Grumman $24.1 million.

Further 20 contracts totalling $28 million allotted to related areas of avionics, structures and materials, propulsion, and modelling and simulation. Recipients included Boeing ($2.3 million for avionics virtual systems engineering and prototyping and $1.7 million for JAST multi-service common airframe work), Lockheed Martin ($0.44 million for structurally integrated, reconfigurable multi-function apertures and $2 million for onboard/offboard information fusion), Northrop Grumman ($2.1 million for avionics virtual systems engineering and prototyping), Pratt & Whitney ($5.4 million for propulsion system demonstrations); General Electric/Allison ($3.6 million for work on low-cost nozzles and turbocooler engine demonstration for flexible thermal management), Lockheed Martin (Marietta) ($0.54 million for work on a modular electro-optical/infra-red sensor subsystem), Texas Instruments ($2.5 million for avionics virtual systems engineering); TRW ($2.0 million for advanced strike integrated diagnostics), Loral ($1.2 million for multiprocessing system work) and Westinghouse ($0.31 million for radio frequency/intermediate frequency packaging).

Reconfiguration of JAST in light of merger with CALF to result in expanded flight test programme, with two finalists each building two demonstrators; one to have ASTOVL capability while other employs conventional take-off and landing (CTOL); currently expected that request for demonstration phase proposals from industry will lead to contract awards to successful contenders in Spring 1996. Longer-term manufacturing effort increasingly likely to employ modular airframe structure, which has potential for variable levels of stealthiness with low observable attributes tailored to customer requirements, which could accommodate single-place or two-place crew options, and which would allow several variations on basic tactical fighter theme, utilising either CTOL or ASTOVL, to be assembled on single production line to satisfy US and UK armed forces requirements: USAF seeking CTOL version as F-16 Fighting Falcon replacement; USN wants strengthened CTOL version to replace F-14 Tomcat and F/A-18 Hornet aboard carrier fleet, STOVL variant candidate to replace F/A-18 Hornet and AV-8B Harrier II with USMC plus Sea Harrier F/A Mk 2 of Royal Navy, RAF potential buyer to replace Harrier GR Mk 7 and Tornado GR Mks 1/4.

Refer also to individual company entries in this section and McDonnell Douglas/BAe in International section for illustrations and additional information on JAST and related CALF (see next entry).

UPDATED

COMMON AFFORDABLE LIGHTWEIGHT FIGHTER (CALF)

TYPE: Strike-fighter technology demonstrator.

PROGRAMME: Requirement defined by USN in April 1992, project managed by ARPA, RFP deadline 5 December 1992; proposals received from Lockheed Fort Worth (ex General Dynamics), Lockheed, Grumman, Boeing and McDonnell Douglas/British Aerospace, two to be selected for 30 month concept validation phase; ARPA then to select most promising design, demonstrator to fly 2000; fighter in service 2010. Potential replacement for F/A-18 Hornet and AV-8B Harrier II. **X-32** designation allocated to technology demonstrator programme.

First decision, March 1993, awarded Phase 2 concept validation contracts to Lockheed Martin (see this section) and McDonnell Douglas (see International section). Former uses shaft-driven fan for lift during STO and VL phase, latter relies on gas-coupled fan, both fans are mounted forward, rear element of thrust coming from

Impression of Northrop Grumman CALF contender *1995*

engine nozzle deflection; fan doors on both aircraft close for normal forward flight. Under Congressional instructions, ARPA later admitted Boeing's CALF project (which see) in January 1994, despite earlier rejection of direct jet lift design; $6 million Boeing ARPA 12-month concept design contract signed 25 March 1994. Northrop Grumman also entered programme in mid-1994 at own expense with lift-plus-lift/cruise propulsion concept. One non-flying airframe from each of two original teams to be pylon mounted at NASA/Ames for engine trials and later tested in wind tunnel at same facility. One design due to be selected for Phase 3 production of two flying prototypes, powered by single afterburning engine in class of Lockheed F-22 power plant 200 kN (45,000 lb st) in conventional flight; 165 kN (37,000 lb st) during lift phase; however, Congressional directive in Autumn 1994 forced merger of this project with JAST (see previous entry).

Illustrations of some CALF projects appear under individual company headings in this section.

UPDATED

COMBAT SUPPORT HELICOPTER REPLACEMENT

FY96 budget request included statement that US Navy to seek off-the-shelf replacement for Boeing CH-46D Sea Knight combat support/vertical replenishment helicopter, due to increasing improbability of redundant US Marine Corps CH-46E Sea Knight version becoming available at desired time. Procurement planning anticipates funding initial batch of four new helicopters in FY99 budget, selected type will be either variation of helicopter currently in US Navy inventory or missionised version of commercially available machine.

NEW ENTRY

JOINT PRIMARY AIRCRAFT TRAINING SYSTEM (JPATS)

See USAF entry. Navy anticipates receiving first aircraft in FY00.

UPDATED

VAN'S

VAN'S AIRCRAFT INC

PO Box 160, North Plains, Oregon 97133
Telephone: 1 (503) 647 5117
PRESIDENT: Richard VanGrunsven

The name Van's is from Richard VanGrunsven, who is known as 'Van'. Details of the current single-seat Van's RV-3 sporting homebuilt, available in kit and plan forms, can be found in the 1992-93 *Jane's*.

UPDATED

VAN'S RV-4

TYPE: Tandem two-seat sporting kit-built/homebuilt.

PROGRAMME: First flight of prototype 21 August 1979. Plans and kits available to homebuilders.

CUSTOMERS: By early 1995, over 3,950 sets of plans sold, with about 1,800 aircraft under construction and 550 RV-4s flying.

COSTS: Kit, $8,890. Plans: $165. Information pack: $8.

DESIGN FEATURES: Wing section Van's Aircraft 135.

POWER PLANT: One 112 kW (150 hp) Textron Lycoming O-320-E1F flat-four engine, two-blade propeller. Fuel capacity 121 litres (32 US gallons, 26.6 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span	7.01 m (23 ft 0 in)
Wing aspect ratio	4.81
Length overall	6.21 m (20 ft 4½ in)
Height overall	1.60 m (5 ft 3 in)
Propeller diameter	1.73 m (5 ft 8 in)

AREAS:

Wings, gross	10.22 m² (110.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	404 kg (890 lb)
Baggage capacity	13.6 kg (30 lb)
Max T-O weight	680 kg (1,500 lb)
Max wing loading	66.58 kg/m² (13.64 lb/sq ft)
Max power loading	6.07 kg/kW (10.00 lb/hp)

PERFORMANCE (at max T-O weight, and prior to prototype's aerodynamic clean-up):

Max level speed at S/L	175 kts (323 km/h, 201 mph)
Econ cruising speed, 55% power at 2,440 m (8,000 ft)	142 kts (264 km/h, 164 mph)
Stalling speed	47 kts (87 km/h, 54 mph)
Max rate of climb at S/L	503 m (1,650 ft)/min
Service ceiling	5,945 m (19,500 ft)
T-O run	137 m (450 ft)
Landing run	130 m (425 ft)
Range with max fuel, 55% power	695 n miles (1,287 km; 800 miles)

UPDATED

Van's RV-4 tandem-seat light aircraft *(Paul Jackson)* *1995*

VAN'S RV-6

TYPE: Side by side two-seat sporting kit-built/homebuilt.

PROGRAMME: Prototype first flight June 1986. Plans and kits available.

CUSTOMERS: By early 1995, more than 4,000 sets of RV-6/RV-6A plans sold, with about 2,500 aircraft under construction and 150 flying.

COSTS: Kit, $9,615. Plans: $195. Information pack: $8.

DESIGN FEATURES: Basically side by side two-seat derivative of RV-4.

POWER PLANT: One 112-134 kW (150-180 hp) Textron Lycoming flat-four engine. Fuel capacity 140 litres (37 US gallons, 30.8 Imp gallons).

DIMENSIONS, EXTERNAL: As RV-4 except:

Length overall	6.16 m (20 ft 2½ in)

AREAS: As RV-4

WEIGHTS AND LOADINGS:

Weight empty	431 kg (950 lb)
Baggage capacity	27.2 kg (60 lb)
Max T-O weight	726 kg (1,600 lb)
Max wing loading	71.04 kg/m² (14.55 lb/sq ft)

PERFORMANCE (at max T-O weight):

Max level speed at S/L	175 kts (323 km/h, 201 mph)
Econ cruising speed, 55% power at 2,440 m (8,000 ft)	146 kts (270 km/h, 168 mph)
Stalling speed	47 kts (87 km/h, 54 mph)
Max rate of climb at S/L	503 m (1,650 ft)/min
Service ceiling	5,945 m (19,500 ft)
T-O run	160 m (525 ft)
Landing run	153 m (500 ft)
Range with max fuel (55% power)	803 n miles (1,488 km, 925 miles)

UPDATED

VAN'S RV-6A

TYPE: Tricycle landing gear variation of RV-6.

PROGRAMME: Prototype first flight July 1988. Plans and kits available. AIEP of Nigeria (which see) has developed version known as Air Beetle, now in production for Nigerian Air Force as military trainer for screening new pilots before more expensive training.

CUSTOMERS: By early 1995, about 100 RV-6As had flown and about 800 were under construction.

COSTS: Kit, $10,215. Plans: $205. Information pack: $8.

POWER PLANT: Similar to RV-6, fuel capacity 144 litres (38 US gallons; 31.6 Imp gallons).

DIMENSIONS, EXTERNAL: As RV-6 except:

Length overall	6.07 m (19 ft 11 in)
Height overall	2.13 m (7 ft 0 in)

AREAS: As RV-6

WEIGHTS AND LOADINGS: As RV-6 except:

Weight empty	451 kg (995 lb)

PERFORMANCE (two persons):

Max level speed	174 kts (322 km/h, 200 mph)
Econ cruising speed, 55% power at 2,440 m (8,000 ft)	144 kts (267 km/h, 166 mph)
Stalling speed	48 kts (89 km/h; 55 mph)
Max rate of climb at S/L	427 m (1,400 ft)/min
Service ceiling	4,970 m (16,300 ft)
T-O run	92 m (300 ft)
Landing run	153 m (500 ft)
Range, 55% power at 2,440 m (8,000 ft)	760 n miles (1,408 km, 875 miles)

UPDATED

Van's RV-6 (left) and RV-6A illustrate alternative landing gear *(Paul Jackson)* *1995*

VAT

VERTICAL AVIATION TECHNOLOGIES INC

PO Box 2527, Sanford, Florida 32773
Telephone: 1 (407) 322 9488
Fax: 1 (407) 330 2647
PRESIDENT: Bradley G Clark
CONSULTANT ENGINEER: Ralph P Alex

Vertical Aviation Technologies Inc is FAA approved repair facility for various Sikorsky helicopters. In 1984 development began to modify four-seat Sikorsky S-52-3 former production helicopter (of which 87 originally produced) into kit for assembly by individuals, corporations or military, with all tooling and fixtures completed by 1988. In 1991, VAT purchased assets of Orlando Helicopter Airways and is continuing Orlando's activity in remanufactured Sikorsky helicopters.

UPDATED

VAT HUMMINGBIRD

TYPE: Four-seat helicopter.

CUSTOMERS: Thirteen Hummingbird kits sold at $86,000 including engine by early 1995, of which six flying. See also entry under Hungary for version being developed by Danubian Aircraft Company.

DESIGN FEATURES: Based on previously type certificated Sikorsky S-52-3. VAT replaced standard Sikorsky S-52-3 power plant with 194 kW (260 hp) aluminium block V8

engine. Newly manufactured airframes and tailcones identical to S-52-3, except for nose section. Assembly takes about 1,500 working hours and kit includes original Sikorsky components. Currently under development are five-blade rotor system, Allison turbine power plant, supercharged liquid-cooled power plant, and military/law enforcement variant.

DIMENSIONS, EXTERNAL:

Main rotor diameter	10.06 m (33 ft 0 in)
Length overall, rotors turning	12.11 m (39 ft 9 in)
fuselage	9.27 m (30 ft 5 in)
Height: to top of rotor head	2.62 m (8 ft 7 in)
overall	2.87 m (9 ft 5 in)

AREAS:

Main rotor disc	79.46 m² (855.3 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	771 kg (1,700 lb)
Max payload	453 kg (1,000 lb)
Max T-O weight	1,225 kg (2,700 lb)
Max disc loading	15.41 kg/m² (3.16 lb/sq ft)

PERFORMANCE (three-blade rotor):

Cruising speed	85 kts (157 km/h, 98 mph)
Max rate of climb at S/L	366 m (1,200 ft)/min
Service ceiling	3,350 m (11,000 ft)
Range	approx 304 n miles (563 km, 350 miles)

UPDATED

Vertical Aviation Technologies Hummingbird kit built version of modified Sikorsky S-52-3 helicopter, with components

1993

OTHER AIRCRAFT

VAT modified Sikorsky **S-55/H-19s** and **S-58/H-34s**, including the VAT **Elite**, are detailed in *Jane's Aircraft Upgrades*.

UPDATED

VIKING

VIKING AIRCRAFT LTD

PO Box 646, Elkhorn, Wisconsin 53121-0646
Telephone: 1 (414) 728 7861
Fax: 1 (414) 728 7862
OWNER: Patrick Taylor

UPDATED

VIKING DRAGONFLY

TYPE: Side by side two-seat, dual control sporting homebuilt.

PROGRAMME: Prototype first flight 16 June 1980. Plans available, together with preformed engine cowling and canopy. Kits of prefabricated component parts, requiring no complex jigging or tooling, also available, in this form aircraft known as 'Snap' Dragonfly. Kits estimated to save builder more than 700 working hours.

CURRENT VERSIONS: **Dragonfly Mark I:** Original configuration, with non-retractable mainwheels at tips of foreplane.

Dragonfly Mark II: In parallel production, for operation from unprepared strips and narrow taxiways. Main landing gear in short non-retractable cantilever units under wings, with individual hydraulic toe brakes, and increased foreplane and elevator areas; wheel track 2.44 m (8 ft).

Dragonfly Mark III: Flight tested in 1985, non-retractable tricycle landing gear.

CUSTOMERS: By Spring 1994, more than 100 kits delivered, together with 1,800 sets of plans, some 70 kit built and more than 300 plans built aircraft flying.

COSTS: Kit $14,000. Plans: $259 in USA, $300 foreign.

DESIGN FEATURES: Wing section Eppler 1213. Foreplane GU25 section.

STRUCTURE: Composites wing, foreplane and tail unit structures of styrene foam, glassfibre, carbonfibre and epoxy. Semi-monocoque fuselage, formed (not carved) from 12.5 mm (½ in) thick urethane foam, with strips of 18 mm (¾ in) foam bonded along edges to allow large-radius external corners. Fuselage covered with glassfibre inside and out.

LANDING GEAR: See Current Versions. Brakes fitted.

POWER PLANT: One 44.5 kW (60 hp) 1,835 cc modified Volkswagen motorcar engine, 1,600 cc engine, rated at 33.5 kW (45 hp), optional. Fuel capacity 56.8 litres (15 US gallons, 12.5 Imp gallons).

DIMENSIONS, EXTERNAL:

Wing span	6.71 m (22 ft 0 in)
Wing aspect ratio	9.18
Foreplane span	6.40 m (21 ft 0 in)
Length overall	5.79 m (19 ft 0 in)
Height overall: Mk I	1.22 m (4 ft 0 in)
Propeller diameter	1.32 m (4 ft 4 in)

AREAS:

Wings, gross	4.90 m² (52.75 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	283 kg (625 lb)
Baggage capacity	22.6 kg (50 lb)
Max T-O weight	522 kg (1,150 lb)
Max wing loading	106.53 kg/m² (21.80 lb/sq ft)

PERFORMANCE (ISA, max T-O weight):

Max level speed at 2,285 m (7,500 ft), 75% power	143 kts (266 km/h, 165 mph)
Cruising speed at S/L	104-146 kts (193-270 km/h, 120-168 mph)
Stalling speed	42 kts (78 km/h, 48 mph)
Max rate of climb at S/L	259 m (850 ft)/min
Service ceiling	5,640 m (18,500 ft)
T-O run	213 m (700 ft)
Range	434 n miles (804 km, 500 miles)
Endurance	4 h 15 min
g limits	+4.4/−2

UPDATED

Viking Aircraft Dragonfly Mark I

1994

Viking Cygnet SF-2A

1995

VIKING CYGNET SF-2A

TYPE: Two-seat light aircraft.

PROGRAMME: Designed by Bert Sisler as Whistler SF-2, flew at Oshkosh EAA convention 1973. EAA NASAD Class I certificate of compliance No. 119, dated 8 August 1981. Build time suggested at 1,700 hours.

CUSTOMERS: About 25 flying.

COSTS: Information pack $10, plans $150, kit $12,000.

DESIGN FEATURES: Shoulder wing with struts, conventional tail surfaces; tailplane strut-braced. NACA 3413 wing section.

FLYING CONTROLS: Conventional mechanical ailerons, elevator and rudder. Elevator tab for pitch trim. Fixed tabs on ailerons and rudder.

STRUCTURE: Fuselage of metal tube, wing with wood spars and conventional spruce ribs overlayed with a lattice of spruce strips not dissimilar to geodetic construction principle. Fabric coverings.

LANDING GEAR: Tailwheel type.

POWER PLANT: 50.7 kW (68.0 hp) 1,835 cc VW engine. Fuel capacity 56.8 litres (15.0 US gallons, 12.5 Imp gallons).

ACCOMMODATION: Two persons side by side.

SYSTEMS: Electrical system 12 V 30 Ah battery, alternator fit appropriate to engine.

AVIONICS: Customer specified.

DIMENSIONS, EXTERNAL:

Wing span	9.14 m (30 ft 0 in)
Wing chord	1.27 m (4 ft 2 in)
Wing aspect ratio	7.20
Length overall	5.79 m (19 ft 0 in)
Height overall	1.78 m (5 ft 10 in)
Tailplane span	2.39 m (7 ft 10 in)
Wheelbase	1.93 m (6 ft 4 in)
Propeller diameter	1.47 m (4 ft 10 in)

DIMENSIONS, INTERNAL:

Cabin: Max width	0.99 m (3 ft 3 in)

AREAS:

Wings, gross	11.61 m² (125.0 sq ft)
Ailerons (total)	0.80 m² (8.6 sq ft)
Fin	0.46 m² (5.0 sq ft)
Rudder	0.65 m² (7.0 sq ft)
Tailplane	0.98 m² (10.5 sq ft)
Elevator	0.93 m² (10.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	265 kg (585 lb)
Max payload	233 kg (515 lb)
Baggage weight with two crew	32 kg (70 lb)
Fuel weight	40.9 kg (90.2 lb)
Max T-O weight	499 kg (1,100 lb)
Max wing loading	42.97 kg/m² (8.80 lb/sq ft)
Max power loading	9.85 kg/kW (16.18 lb/hp)

PERFORMANCE (at max T-O weight)
Never-exceed speed (VNE) 117 kts (217 km/h, 135 mph)
Max level speed 95 kts (176 km/h, 109 mph)
Max cruising speed 94 kts (174 km/h, 108 mph
Econ cruising speed 98 kts (161 km/h, 100 mph)
Stalling speed, power off 42 kts (78 km/h, 49 mph)
Max rate of climb at S/L 176 m (580 ft)/min
T-O run 92 m (300 ft)
T-O to 15 m (50 ft) 213 m (700 ft)
Landing from 15 m (50 ft) 213 m (700 ft)
Landing run 77 m (250 ft)
Range with max internal fuel 334 n miles (619 km, 385 miles)
Endurance with max internal fuel 4 h 30 min
g limit +4

NEW ENTRY

VOLMER

VOLMER AIRCRAFT

PO Box 5222, Glendale, California 91201
Telephone 1 (818) 247 8718
PRESIDENT: Volmer Jensen

VJ-22 Sportsman amphibian is available to homebuilders only as plans; last described in 1994-95 *Jane's*.

UPDATED

VOUGHT

VOUGHT AIRCRAFT COMPANY

Dating from 1917, Vought acquired by Northrop Grumman on 31 August 1994 and incorporated within its Commercial Aircraft Division (which see). Vought (FMA) **Pampa 2000 International** jet trainer (see under Argentina) eliminated from JPATS competition in November 1994; Vought (Eurocopter) **Panther 800** last described in 1994-95 *Jane's*.

UPDATED

WAG-AERO

WAG-AERO INC

PO Box 181, 1216 North Road, Lyons, Wisconsin 53148
Telephone 1 (414) 763 9586
Fax 1 (414) 763 7595
PRESIDENT: Richard H Wagner
MARKETING SUPERVISOR: Mary Pat Henningfield

VERIFIED

WAG-AERO SPORT TRAINER

TYPE: Modernised versions of Piper J-3

PROGRAMME: Sport Trainer first flew 12 March 1975

CURRENT VERSIONS: **Sport Trainer:** Basic two-seat design with wooden main spar and ribs, light alloy leading-edge and fabric covering. The fuselage and tail unit are of welded steel tube with fabric covering. Can be powered by any flat-four Teledyne Continental, Franklin or Textron Lycoming engine of between 48.5 and 93 kW (65 and 125 hp). *Description applies to this version*

Acro Trainer: Differs from standard version by having strengthened fuselage, shortened wings (8.23 m, 27 ft), modified lift struts, improved wing fittings and rib spacing, and new leading-edge.

Observer: Replica of L-4 military liaison aircraft.

Super Sport: Structural modifications to accept engines of up to 112 kW (150 hp), making it suitable for glider towing, bush operations, or operation as floatplane.

COSTS: Plans $65, kit $18,000

DIMENSIONS, EXTERNAL
Wing span 10.73 m (35 ft 2½ in)
Wing aspect ratio 6.94
Length overall 6.82 m (22 ft 4½ in)
Height overall 2.03 m (6 ft 8 in)

AREAS
Wings, gross 16.58 m² (178.5 sq ft)

WEIGHTS AND LOADINGS
Weight empty 327 kg (720 lb)
Max T-O weight 635 kg (1,400 lb)
Max wing loading 38.3 kg/m² (7.84 lb/sq ft)

PERFORMANCE (at max T-O weight, ISA)
Max level speed at S/L 89 kts (164 km/h; 102 mph)
Cruising speed 82 kts (151 km/h, 94 mph)
Stalling speed 34 kts (63 km/h; 39 mph)
Max rate of climb at S/L 149 m (490 ft)/min
Service ceiling over 3,660 m (12,000 ft)
T-O run 114 m (375 ft)
Range: at cruising speed with standard fuel (45.5 litres, 12 US gallons; 10 Imp gallons) 191 n miles (354 km, 220 miles)
with auxiliary fuel (98.5 litres, 26 US gallons; 21.6 Imp gallons) 395 n miles (732 km; 455 miles)

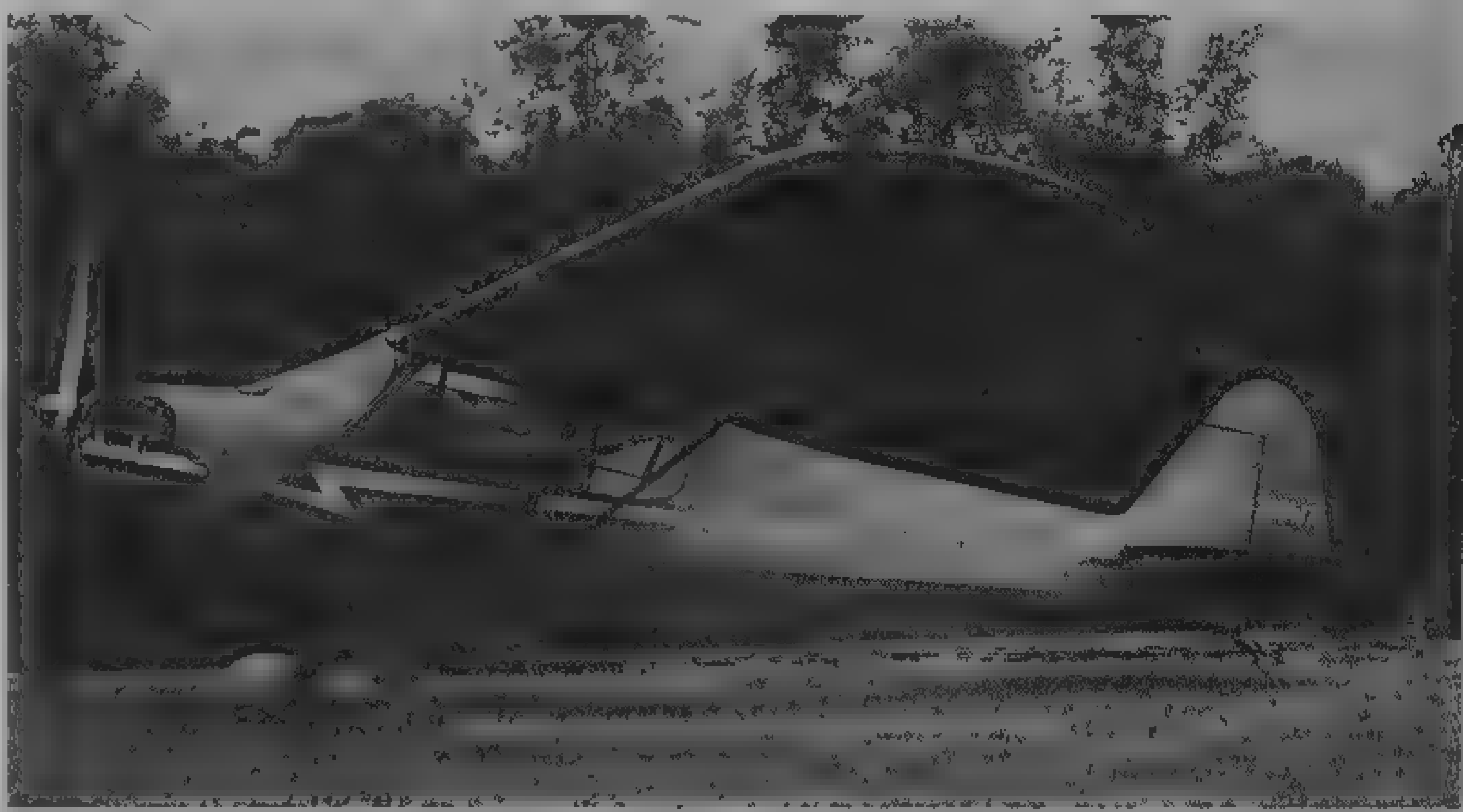
UPDATED

WAG-AERO WAG-A-BOND

TYPE: Side by side two-seat homebuilt; replica of Piper PA-15 Vagabond

PROGRAMME: Prototype Wag-A-Bond completed May 1978; plans and kits available

DESIGN FEATURES: Two versions (**Classic** and **Traveler**); Traveler is modified and updated version of Vagabond with port and starboard doors, overhead skylight window, extended sleeping deck (conversion from aircraft to camper interior taking about two minutes and accommodating two persons), extended baggage area, engine of up to 85.7 kW (115 hp), and provision for full electrical system.



WAG-Aero Sport Trainer

1995

STRUCTURE: All-wood wing and aluminium alloy aileron structures. Welded steel tube and flat plate fuselage structure, and steel tube tail unit. Complete airframe is fabric covered

LANDING GEAR: Non-retractable tailwheel type. Optional skis

POWER PLANT: Traveler can be powered by a Textron Lycoming engine of 80.5 to 85.7 kW (108 to 115 hp). Classic can be powered by a Teledyne Continental engine of 48.5 to 74.5 kW (65 to 100 hp). Fuel capacity: Traveler 98.5 litres (26 US gallons; 21.6 Imp gallons), Classic 45.5 litres (12 US gallons, 10 Imp gallons)

DIMENSIONS, EXTERNAL
Wing span 8.32 m (29 ft 3½ in)
Wing aspect ratio 5.82
Length overall 5.66 m (18 ft 7 in)
Height overall 1.83 m (6 ft 0 in)

AREAS
Wings, gross 13.70 m² (147.5 sq ft)

WEIGHTS AND LOADINGS
Weight empty: Traveler 329 kg (725 lb)
Classic 290 kg (640 lb)
Baggage capacity
Traveler 27 kg (60 lb)
Classic 18 kg (40 lb)
Max T-O weight: Traveler 658 kg (1,450 lb)
Classic 567 kg (1,250 lb)
Max wing loading: Traveler 47.99 kg/m² (9.83 lb/sq ft)
Classic 41.35 kg/m² (8.47 lb/sq ft)

PERFORMANCE
Max level speed
Traveler 118 kts (219 km/h; 136 mph)
Classic 91 kts (169 km/h, 105 mph)
Cruising speed: Traveler 108 kts (200 km/h, 124 mph)
Classic 83 kts (153 km/h; 95 mph)
Stalling speed
Traveler, Classic 39 kts (73 km/h; 45 mph)
Max rate of climb at S/L: Traveler 259 m (850 ft)/min
Classic 190 m (625 ft)/min

VERIFIED

WAG-AERO 2+2 SPORTSMAN

TYPE: Four-seat homebuilt

PROGRAMME: Plans and material kits available.

COSTS: Plans $89, kit $22,000

DESIGN FEATURES: Based on Piper PA-14 Family Cruiser. True four-seater, with option of hinged rear fuselage decking to provide access to baggage and rear seat areas. The rear seat can be removed for cargo or litter

FLYING CONTROLS: Include upper and lower spoilers.

STRUCTURE: Similar construction to Wag-A-Bond, with glassfibre wingtips. Alternatively drawings and materials provided to modify standard PA-12, PA-14 or PA-18 wings. Prewelded fuselage structure also available

POWER PLANT: Engine of 93 to 149 kW (125 to 200 hp). Usable fuel capacity 148 litres (39 US gallons; 32.5 Imp gallons)

DIMENSIONS, EXTERNAL
Wing span 10.90 m (35 ft 9 in)
Wing aspect ratio 7.34
Length overall 7.12 m (23 ft 4½ in)
Height overall 2.02 m (6 ft 7½ in)

AREAS
Wings, gross 6.18 m² (174.12 sq ft)

WEIGHTS AND LOADINGS
Weight empty 490 kg (1,080 lb)
Max T-O weight 998 kg (2,200 lb)
Max wing loading 61.67 kg/m² (12.63 lb/sq ft)

PERFORMANCE (typical, actual data depend on engine fitted)
Max level speed 112 kts (207 km/h, 129 mph)
Cruising speed 108 kts (200 km/h, 124 mph)
Stalling speed 33 kts (62 km/h, 38 mph)
Max rate of climb at S/L 244 m (800 ft)/min
Service ceiling 4,510 m (14,800 ft)
Range at cruising speed 582 n miles (1,078 km, 670 miles)

UPDATED

WASHINGTON AEROPROGRESS

WASHINGTON AEROPROGRESS INC

8535 Perimeter Road South, Boeing Field, Seattle, Washington 98108
Telephone: 1 (206) 763 4915
Fax: 1 (206) 768 0661
PRESIDENT: Lloyd Lounsbury
SALES MANAGER: Vadim Karpan

Company founded 1994 as Western source for selected products of Russian design and manufacturing group Aeroprogress Corporation (which see). Operations begun with marketing of T-411 Wolverine kitplane to North American market. To be expanded with three further light transports, two of which yet to be officially launched by Russian parent company; Washington Aeroprogress responsible for development (including conversion to Federal Standard measurements), production, certification and sales; also collaborates with number of East European and Asian manufacturers with production of airframe elements

NEW ENTRY

AEROPROGRESS T-121 GRIF

TYPE: 10-passenger utility transport.

PROGRAMME: Offered for joint development by ROKS-AERO (Aeroprogress) in collaboration with MERO company; also suitable for agricultural and parachuting duties, to be certified to FAR Pt 23

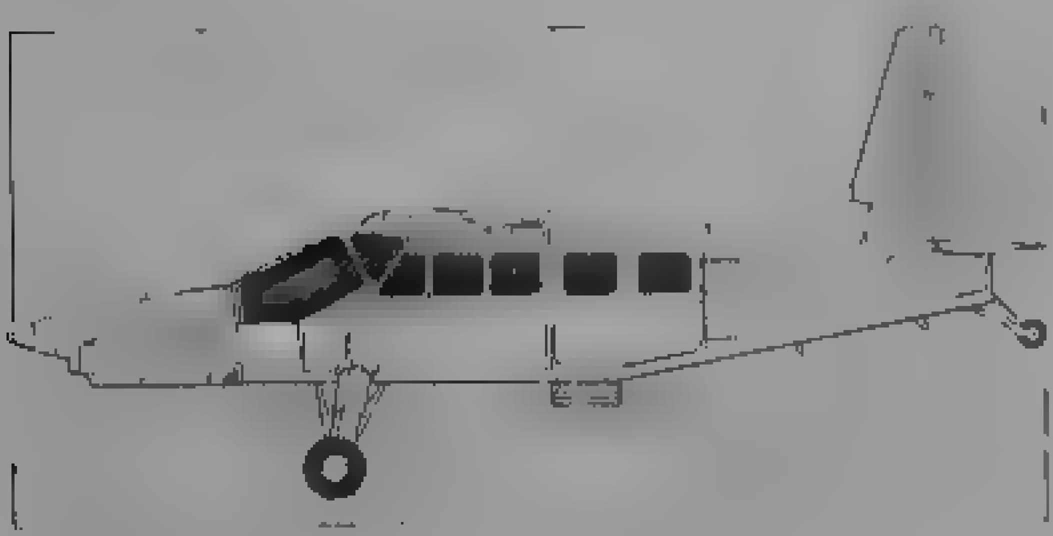
DESIGN FEATURES: Components adapted from other aircraft for simplicity and economy: wing of PZL M-18 Dromader (Poland), main landing gear from Antonov An-2; Dromader tailwheel, flying controls improved from Dromader and M-24 Dromader Super

POWER PLANT: One 716 kW (960 shp) PZL Rzeszów PZL-10S (TWD-10B) turboprop

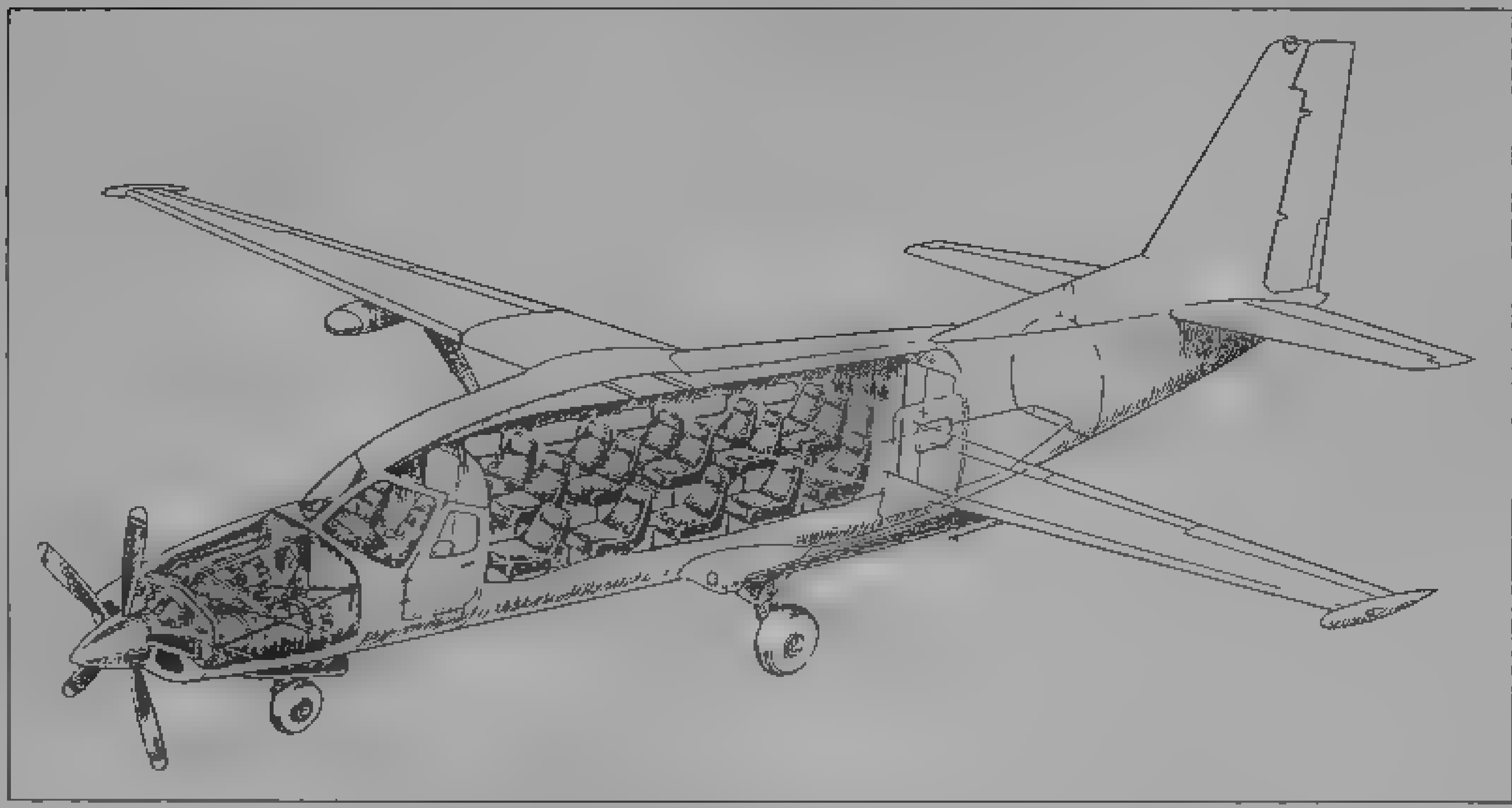
ACCOMMODATION: 12 persons, including one or two pilots.

DIMENSIONS, EXTERNAL:

Wing span	17.70 m (58 ft 0¾ in)
Length overall	14.00 m (45 ft 11 in)
Height	5.20 m (16 ft 4¾ in)



Profile of Washington Aeroprogress T-121 Grif *(Jane's/James Goulding)*
1995



Cutaway view of Washington Aeroprogress T-720DP Korshun
1995

WEIGHTS AND LOADINGS:

Max payload	1,150 kg (2,535 lb)
Max T-O weight	4,800 kg (10,582 lb)
Max zero-fuel weight	3,250 kg (7,165 lb)

PERFORMANCE:

Max cruising speed	157 kts (290 km/h, 180 mph)
Range with max payload	593 n miles (1,100 km, 683 miles)

NEW ENTRY

AEROPROGRESS T-204 CONDOR

TYPE: Nine-passenger, STOL utility transport

PROGRAMME: Western version of T-204, described in Russian section

NEW ENTRY

AEROPROGRESS T-411 WOLVERINE

TYPE: Four-seat, kit built STOL light aircraft

PROGRAMME: Western version of Aeroprogress T-411 Aist, as described in Russian section, but more closely related to Khrunichev-built version; employs US made materials, avionics, wheels and brakes; dimensions converted to Federal Standard units

NEW ENTRY

AEROPROGRESS T-720DP KORSHUN

TYPE: 17-passenger utility transport

PROGRAMME: Under development, timescale unspecified

DESIGN FEATURES: Employs components from other aircraft, including wing, centre and rear fuselage elements of Antonov An-28 and vertical tail of Aeroprogress T-10. Floatplane and stretched versions also available

POWER PLANT: Solov Dual Pac of two P&W Canada PT6A-114 turboprops; 1,267 kW (1,700 shp) combined rating

ACCOMMODATION: Two crew and 17 passengers

DIMENSIONS, EXTERNAL:

Wing span	22.06 m (72 ft 4½ in)
Length overall: standard	13.70 m (44 ft 11¼ in)
stretched	14.35 m (47 ft 1 in)
Height	5.55 m (18 ft 2½ in)

WEIGHTS AND LOADINGS:

Max payload	1,200 kg (2,645 lb)
Max T-O weight	5,700 kg (12,566 lb)

PERFORMANCE:

Max cruising speed	189 kts (350 km/h, 217 mph)
Range	842 n miles (1,560 km, 969 miles)

NEW ENTRY

WHITE LIGHTNING

WHITE LIGHTNING AIRCRAFT CORPORATION

PO Box 497, Walterboro, South Carolina 29488-0494
Telephone: 1 (803) 549 1800
PRESIDENT: Howell C. Jones Jr

VERIFIED

WL AIRCRAFT WHITE LIGHTNING

TYPE: Four-seat homebuilt

PROGRAMME: Prototype first flew 8 March 1986. In same year it established several world speed records in Classes C1b and C1c. Construction from kit takes about 1,000 working hours for the first-time builder

CUSTOMERS: 32 kits sold, 13 aircraft flying by 1992, no known recent completions

COSTS: Kit: $40,000. Many optional kits, including electrical for $1,110

DESIGN FEATURES: Options include electrical, various engine installation, light, strobe light and interior kits, plus other items. Wing section NACA 66_2-215

STRUCTURE: Wings have graphite tubular 'wet' main spar, and glassfibre/epoxy front and rear spars and ribs, all precast in the lower glassfibre/epoxy skin. Glassfibre/epoxy fuselage moulded in upper and lower halves. Spars and ribs of fin and tailplane precast into one skin of each

LANDING GEAR: Retractable tricycle type, with brakes

POWER PLANT: Prototype has 156.6 kW (210 hp) Teledyne Continental IO-360-CB flat-six engine. Usable fuel capacity 257 litres (68 US gallons, 56.6 Imp gallons)

DIMENSIONS, EXTERNAL:

Wing span	8.43 m (27 ft 8 in)
Wing aspect ratio	8.60
Length overall	7.11 m (23 ft 4 in)
Height overall	2.18 m (7 ft 2 in)
Tailplane span	2.74 m (9 ft 0 in)
Propeller diameter	1.85 m (6 ft 1 in)

AREAS:

Wings, gross	8.29 m² (89.22 sq ft)
Tailplane	1.81 m² (19.5 sq ft)

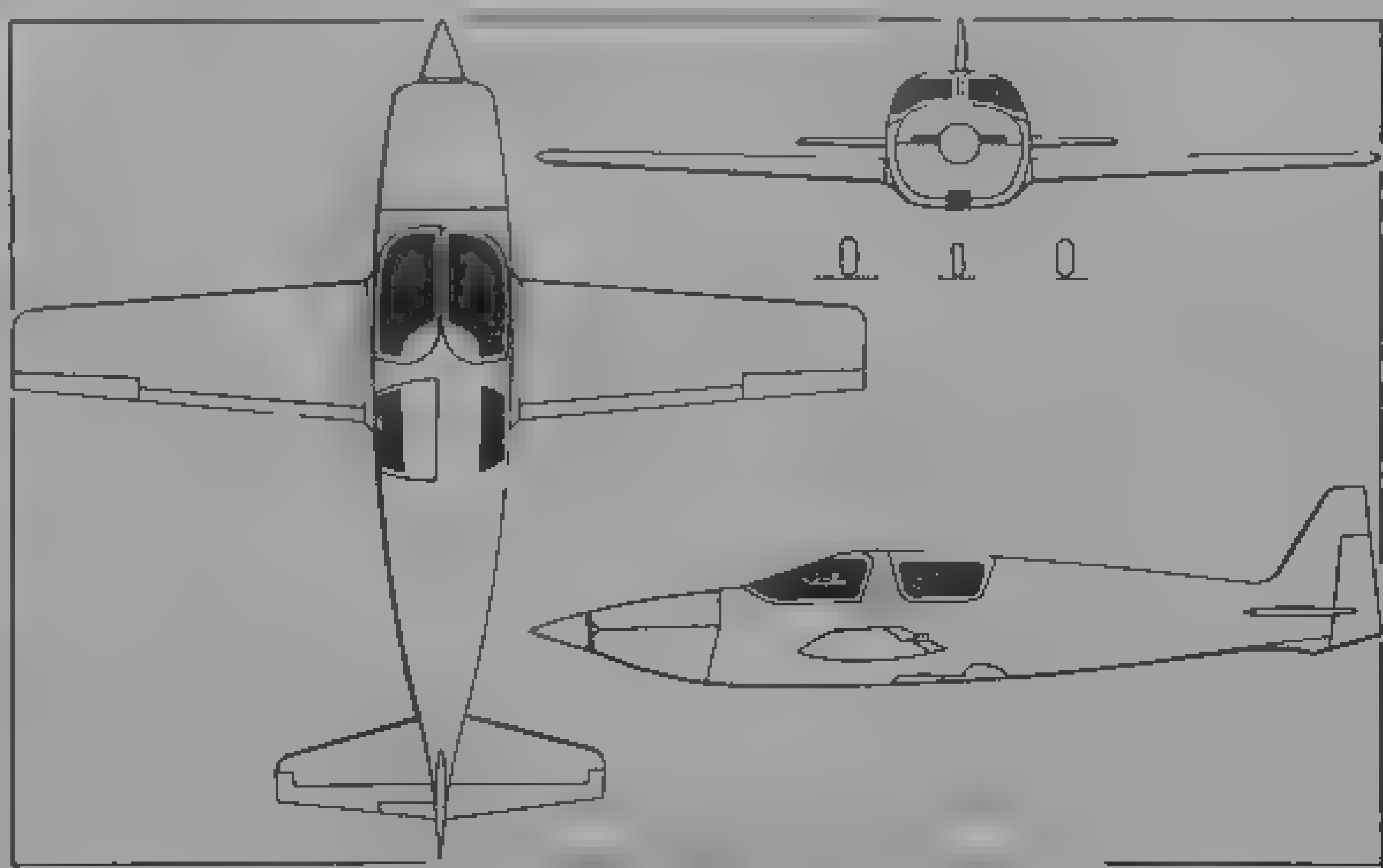
WEIGHTS AND LOADINGS:

Weight empty	635 kg (1,400 lb)
Max baggage capacity	154 kg (340 lb)
Max T-O weight	1,225 kg (2,700 lb)
Max wing loading	148.12 kg/m² (30.34 lb/sq ft)
Max power loading	7.83 kg/kW (12.86 lb/hp)

PERFORMANCE (at max T-O weight, ISA):

Max level speed at S/L	243 kts (450 km/h; 280 mph)
Max cruising speed at 2,440 m (8,000 ft)	230 kts (426 km/h, 265 mph)
Econ cruising speed at 3,200 m (10,500 ft)	217 kts (402 km/h, 250 mph)

WL Aircraft White Lightning four-seat composites kit aircraft
1995



WL Aircraft White Lightning *(Jane's/Paul Jackson)*
1995

Stalling speed: flaps up	80 kts (148 km/h, 92 mph)
flaps down	60 kts (110 km/h, 69 mph)
Max rate of climb at S/L	442 m (1 450 ft)/min
Service ceiling	7,010 m (23,000 ft)
T-O run, full flap	381 m (1,250 ft)
Landing run	397 m (1,300 ft)
Range with max fuel	
55% power	1,738 n miles (3,218 km; 2,000 miles)
75% power	1,423 n miles (2,636 km, 1,638 miles)
Endurance	6 h 10 min
g limits	+4 4/−2 utility

UPDATED

WIPAIRE

WIPAIRE INC

Floatplane conversions by Wipaire of DHC Beaver, Twin Otter and various Cessnas are detailed in *Jane's Aircraft Upgrades*

UPDATED

ZENITH

ZENITH AIRCRAFT COMPANY

Mexico Airport, Mexico, Missouri 65265-0650
Telephone 1 (314) 581 9000
Fax 1 (314) 581 0011
PRESIDENT: Sebastien C Heintz
MANAGER, ADMINISTRATION: Susan M McCullough
MANAGER, PRODUCTION: Nicholas M Heintz

Zenith Aircraft Company is the US licensee and manufacturing works for the Canadian Zenair range of light aircraft See Zenair in the Canadian section

UPDATED

UZBEKISTAN

CHKALOV

TASHKENTSKOYE APOiCh (Tashkent Aircraft Production Corporation named after V. P. Chkalov)

61 Vorovski Street, 700016 Tashkent
Telephone 7 (3712) 32 11 67 or 33 65 32
Fax 7 (3712) 68 03 18
Telex 11475 TAPO SU

Founded in 1932, this large manufacturing centre has built Li-2s, Il-14s, An-8s, Ka-22s, An-12s, An-22s and Il-76s. It manufactures wings for An-70, An-124 and An-225 transports, and has repaired MiG and Sukhoi fighters and Tu-22M bombers. About 120 Il-76s have been exported. It has prepared to build Il-114 twin-turboprop transports at the rate of five to seven a month

UPDATED

YUGOSLAVIA (SERBIA)

New state of Yugoslavia proclaimed 27 April 1992, is, effectively, former provinces of Serbia and Montenegro

UTVA

UTVA—SOUR METALNE INDUSTRIJE, RO FABRIKA AVIONA

Jabučki Put bb, YU-26000 Pančevo
Telephone 38 (13) 515383, 512584
Fax 38 (13) 519859
Telex 13250 UTVA YU

Utva (Sheldrake) Aircraft Industry formed at Zemun, 5 June 1937, to Pančevo 1939. Second World War production of Trojka, 212, 213, Aero 3, Utva 56, 60, 65P and 66; currently 85,500 m² (920,320 sq ft) of covered floor area. Subcontract work previously included flaps and weapon pylons for Soko/Avioane Orao/IAR-93, centre and rear fuselage sections, tail surfaces and gun pod for Super Galeb, components for FLS Aerospace Optica, Boeing 737 rib assemblies, Boeing 747 assemblies, Boeing 757 wingtips and floor supports, tools for Israel Aircraft Industries, McDonnell Douglas and CIS aircraft industry; external trade prohibited by UN embargo 1992

Following termination of aircraft production at the Soko (Falcon) works in newly proclaimed independent Bosnia-Hercegovina, on 1 May 1992, some machinery and jigs from G-4 Super Galeb and Gazelle production lines removed to 'new' Yugoslavia, despite UN trade embargoes. Utva reportedly has assumed development responsibilities for G-4M version of Super Galeb, G-5 derivative and Soko/Avioane Orao (see International section) as well as returning to production an upgraded version of the Utva 75 lightplane. Utva also involved with aircraft maintenance and munitions production during civil war

UPDATED

Single-seat agricultural version of the Utva-75, of similar appearance to projected Utva-95 *1994*

UTVA-95

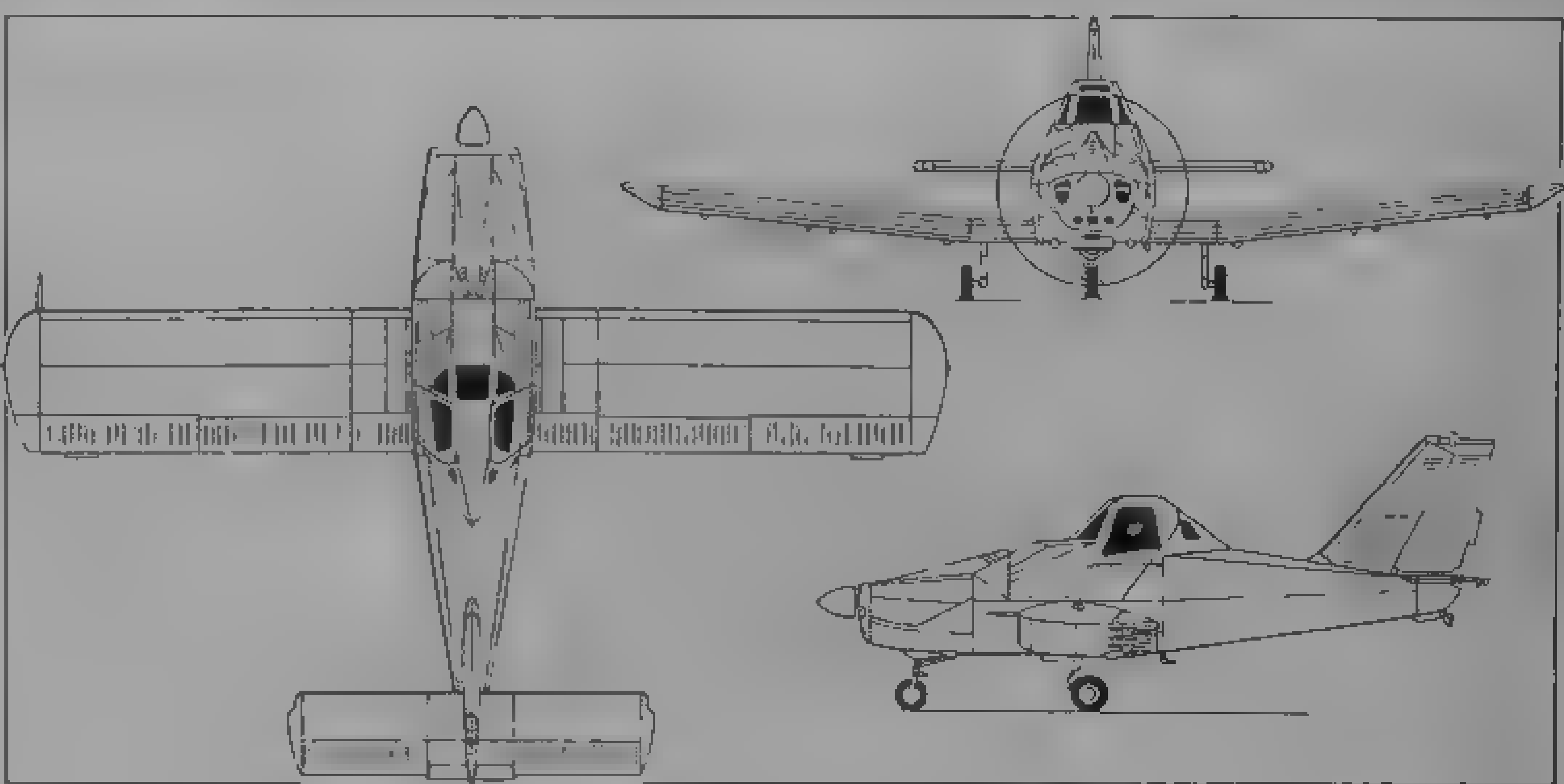
TYPE: Single-seat agricultural aircraft

PROGRAMME: Turboprop version of Utva-75AG11; first flight due 1996. Derived from Utva 75 two/four-seat tourer, of which over 150 built 1976-86; 75AG11 prototype (YU-XAF) first flown 3 March 1989 as single-seat variant carrying up to 870 litres (230 US gallons, 191 Imp gallons) of chemicals, no further production

DESIGN FEATURES: Utva-95 fitted with 2,000 litre (528 US gallons; 440 Imp gallon) chemical hopper. *Data follow for Utva-75AG11, to which Utva 95 is similar*

Wing section NACA 65_2415, dihedral 0° on centre-section, 6° on outer panels

FLYING CONTROLS: Conventional mechanical. Fluted skin on ailerons, flaps, fin, rudder and elevators, rudder and elevators horn balanced, ground adjustable tab on rudder;



Utva-75AG11 on which Utva-95 is based *(Jane's/Mike Keep)* *1995*

Flettner trim tab on each aileron. Teleflex acuator for elevator control tab.

STRUCTURE: All metal semi-monocoque.

LANDING GEAR: Non-retractable tricycle type, with single wheel on each unit, and small tail bumper; oleo-pneumatic shock-absorbers. Tyres, size 7.00-8 on mainwheels; size 6.00-6 on nosewheel, hydraulic brakes.

ACCOMMODATION: Pilot only, in high set cabin. Downward-hinged canopy door on each side. Cabin heated and ventilated.

SYSTEMS: Electrical system 24 V 60 A DC, with 19 Ah Ni/Cd battery. Vacuum system standard.

DIMENSIONS, EXTERNAL:

Wing span	9.73 m (31 ft 11 in)
Wing chord, constant	1.55 m (5 ft 1 in)
Wing aspect ratio	6.47
Length overall	7.11 m (23 ft 4 in)
Height overall	3.15 m (10 ft 4 in)
Tailplane span	3.80 m (12 ft 15½ in)
Wheel track	2.58 m (8 ft 5½ in)
Wheelbase	1.99 m (6 ft 6¼ in)

AREAS:

Wings, gross	14.63 m² (157.5 sq ft)
Ailerons (total)	1.38 m² (14.85 sq ft)
Flaps (total)	1.61 m² (17.33 sq ft)
Vertical tail surfaces (total)	1.78 m² (19.16 sq ft)
Horizontal tail surfaces (total)	3.34 m² (35.95 sq ft)

NEW ENTRY

OTHER AIRCRAFT

Anticipated restart to production of **Lasta 2, G-4 Super Galeb and Gazelle** appears not to have taken place, these aircraft last described in 1994-95 *Jane's*; Super Galeb in *Jane's Aircraft Upgrades*.

UPDATED

LIGHTER THAN AIR

The inclusion of balloons produced primarily for sport or recreational flying has been discontinued. Last full coverage of such types appeared in the 1991-92 edition with a partial update in the 1992-93 *Jane's*

AUSTRALIA

AHA

ADVANCED HYBRID AIRCRAFT LTD

96 Rankins Road, Kensington, Victoria 3031
Telephone 61 (3) 372 1998
Fax 61 (3) 391 9569
MANAGER: Bruce N Blake

Formerly based in Isle of Man, UK (see 1993-94 *Jane's*) Mr Blake relocated to Australia in 1993, where he is continuing to seek venture capital for his buoyant aircraft programme. AHA was based in Adelaide, South Australia, during 1994 An independent, privately funded market survey in the USA indicates that best support is most likely to be gained in that country, and AHA planned to relocate to the USA in 1995, investor funding has not been forthcoming in Australia Survey results were encouraging, and a business plan has been prepared

UPDATED

AHA HORNET LV

TYPE: Recreational hybrid buoyant aircraft (50 per cent buoyant)

PROGRAMME: Design of Hornet LV (leisure variant) initiated October 1991 next stage will be to develop prototype (not for certification) and undertake six-month US demonstration tour, followed by set-up of production lines, initial work planned to concentrate on kits or fully assembled examples of single-seat sports version This would be followed by certificated AW (aerial work) version with two or more seats, to be offered for aerial photography, advertising, police patrol, surveillance and similar missions, as a viable and economic alternative to helicopters; design of the AW version has been established

CUSTOMERS: Hornet LV aimed specifically at US sport flying market, where members of EAA were of much assistance during 1994 market survey, interest also received from Denmark, France, Germany, India, Italy and UK

DESIGN FEATURES: Single-seat gondola/cabin of LV is essentially microlight 'podule' with fixed tricycle landing gear Hornet can be taxied like a microlight, mast-moored by one person (mainly an automated operation), and remain on ground when vacated by pilot Some 67.45 m² (726 sq ft) of advertising area (10.06 × 3.35 m, 33 × 11 ft panel each side) is available on envelope

Hornet range designed to operate at heaviness of about 50 per cent, compared with conventional types with which operation at or near equilibrium is essential Hybrid buoyant aircraft do not require ballast and have flexibility to carry greater or lesser load, thus providing greater productivity

POWER PLANT: Two 18 kW (24 hp) König SC 430 three-cylinder radial engines, mounted on stub-wings that can be tilted upward to vector thrust 30° downward for climb

DIMENSIONS, EXTERNAL:

Envelope: Length overall	15.24 m (50 ft 0 in)
Max diameter	3.81 m (12 ft 6 in)
Height overall (incl gondola)	4.88 m (16 ft 0 in)
Wing span	6.86 m (22 ft 6 in)
Wheel track	2.13 m (7 ft 0 in)
Wheelbase	2.74 m (9 ft 0 in)
Propeller diameter	1.37 m (4 ft 6 in)
Distance between propeller centres	4.95 m (16 ft 3 in)

DIMENSIONS, INTERNAL:

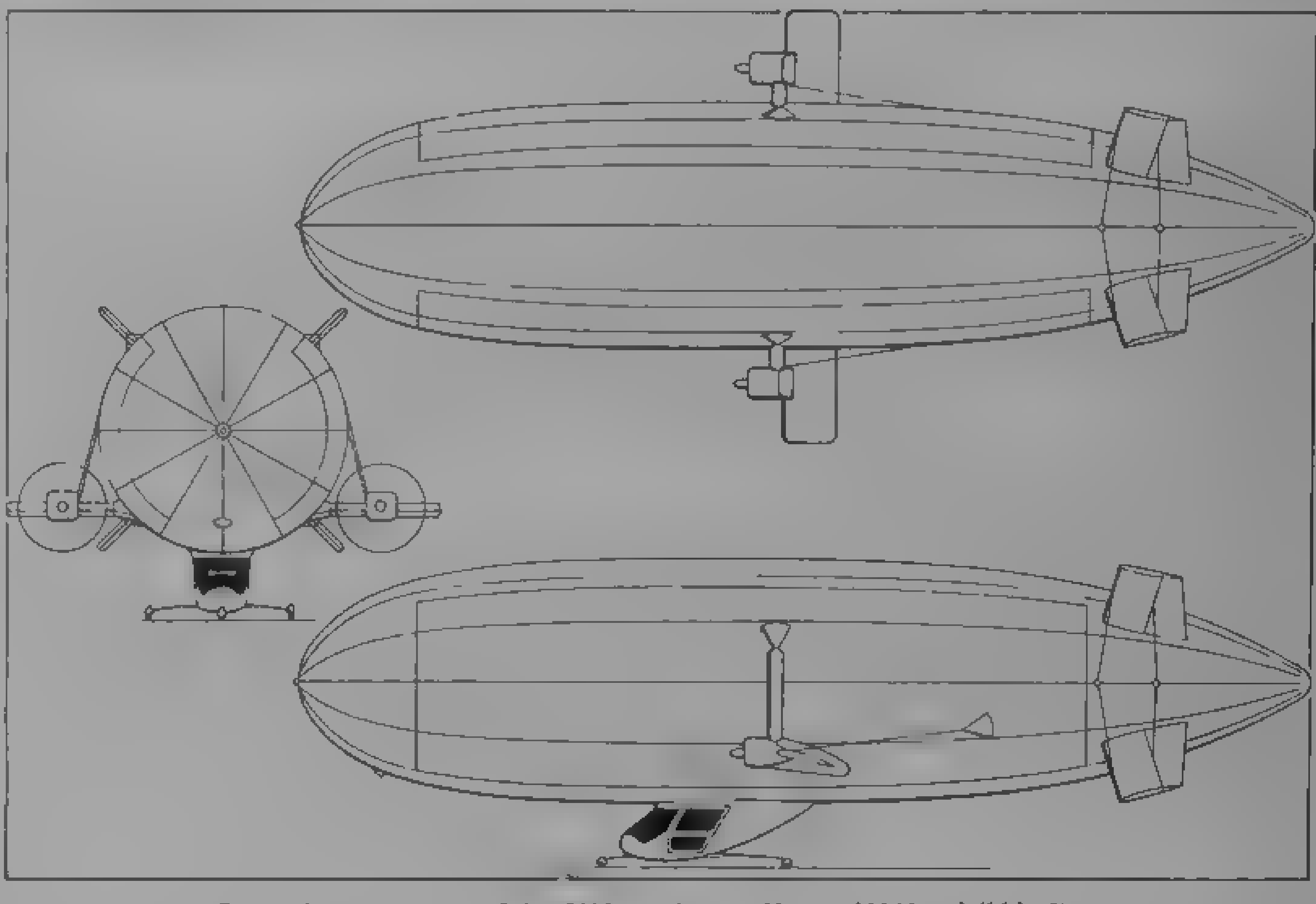
Envelope volume	121.8 m³ (4,300 cu ft)
Ballonet volume (two, total)	12.18 m³ (430 cu ft)

AREAS:

Envelope surface, total	145.86 m² (1,570 sq ft)

Scale model of the AHA Hornet LV

1995



General arrangement of the AHA single-seat Hornet LV *(Jane's/Mike Keep)*

1992

WEIGHTS AND LOADINGS:

Weight empty	152.4 kg (336 lb)
Weight empty at mast (heaviness)	30 kg (66 lb)
Max normal heaviness	122.5 kg (270 lb)
Gross aerostatic lift at 5% ballonet inflation	122.5 kg (270 lb)
Disposable load	92.5 kg (204 lb)
Max T-O weight	250 kg (540 lb)

PERFORMANCE (estimated):

Max level speed	51 kts (95 km/h; 59 mph)
Min flying speed	23 kts (43 km/h; 27 mph)
Max rate of climb at S/L, thrust vectored 30°	610 m (2,000 ft)/min

UPDATED

CANADA

21ST CENTURY

21ST CENTURY AIRSHIPS INC

PO Box 177, 180 Main Street, Newmarket, Ontario L3Y 4X1
Telephone: 1 (905) 898 6274
Fax: 1 (905) 898 7245
PRESIDENT AND CEO: Hokan Colting

Company formed 1988 to focus on R&D aimed at improving airship low-speed manoeuvrability, a problem its President identified and has studied since 1978 He moved from Sweden to Canada 1981, has extensive experience in manufacturing and piloting lighter than air craft; has achieved all objectives of his original 1978 research programme.

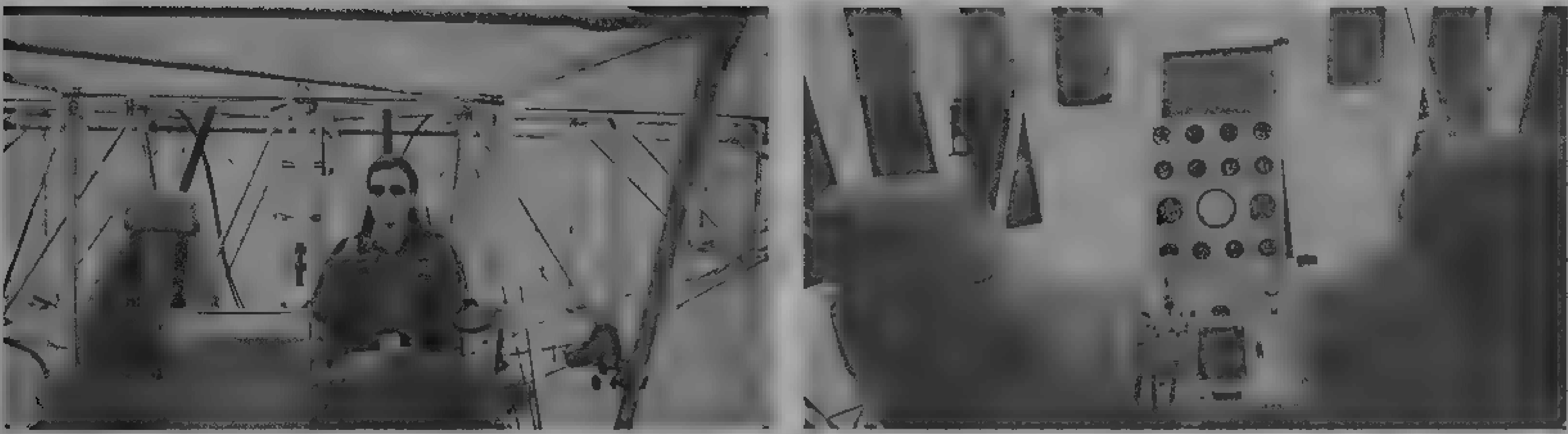
Construction of an 11 seat spherical airship for passenger sightseeing and advertising was under way in January 1995

UPDATED

21ST CENTURY AIRSHIPS PROTOTYPES

TYPE: Non-rigid helium airships; all illustrated in 1994-95 *Jane's*.

CURRENT VERSIONS: **SPAS-1**: First version Spherical finless envelope, 10.67 m (35 ft 0 in) in diameter, powered by two 17.9 kW (24 hp) König engines; maximum speed 16 knots (30 km/h, 18 mph). Steering and altitude controls achieved through variable and deflected thrust No gondola, pilot's seat attached to open platform. Several



These two views illustrate the spacious accommodation, simple control panel and all-round field of view from within the SPAS 13 envelope

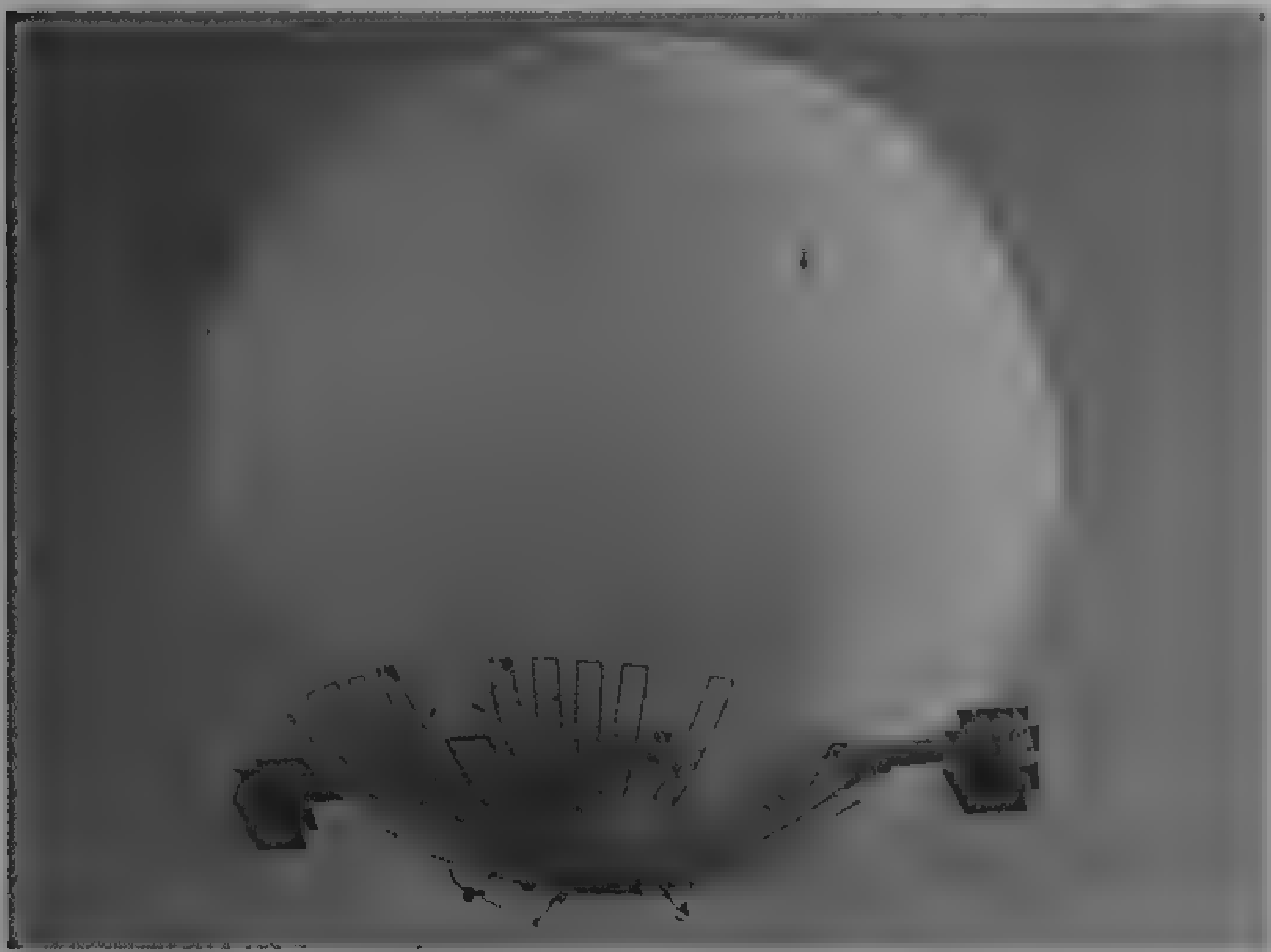
1995

hundred flights made during three month period, Summer 1991.

SPAS-2: Second version. Spherical finless envelope, 10.06 m (33 ft 0 in) in diameter, powered by four 1.86 kW (2.5 hp) Quadra engines, one on each side of envelope and one each side of single-seat gondola. Smiling face with 1.83 m (6 ft) long protruding nose on one side of envelope, teddy bear's face on the other. Planned test programme of 16 flights successfully flown Spring 1992.

SPAS-3: Third version. Same envelope as SPAS-2, but powered by two 3.73 kW (5 hp) Honda engines on envelope and one 17.9 kW (24 hp) König engine on single-seat gondola. Planned test programme of five flights successfully flown Autumn 1992; reached altitude of 2,270 m (7,450 ft) on 8 November 1992 on power of third engine only, establishing nine records in FAI Classes BA2-BA10.

UPDATED



21st Century Airships Inc SPAS 13 demonstrator

1995

21ST CENTURY AIRSHIPS SPAS-13

TYPE: Semi-rigid helium airship.

PROGRAMME: Demonstrator prototype; first flight (C-FRLM) 10 June 1994. Made 112 flights before being deflated on 20 November 1994. Was to be reinflated in May 1995 after series of minor modifications including increased fuel capacity.

DESIGN FEATURES: Spherical envelope, requires only one-man groundcrew.

FLYING CONTROLS: Steering and altitude controlled through varied and deflected thrust technology developed and patented by 21st Century Airships Inc.

LANDING GEAR: Twin-skid helicopter-type gear.

POWER PLANT: Two 37.3 kW (50 hp) Rotax piston engines, mounted on stub-wings.

ACCOMMODATION: Pilot and one passenger, seated inside envelope in spacious cabin enhanced by large tinted windows surrounding base of envelope.

DIMENSIONS, EXTERNAL:

Envelope diameter	13.11 m (43 ft 0 in)

PERFORMANCE (estimated):

Max level speed	28 kts (52 km/h; 32 mph)

UPDATED

21ST CENTURY AIRSHIPS PRODUCTION VERSION

TYPE: Semi-rigid helium airship.

PROGRAMME: Construction and certification under way January 1995.

DESIGN FEATURES: Spherical envelope; pressurised 11-seat gondola built into envelope; for sightseeing tours and advertising. Ground crew of two required.

FLYING CONTROLS: As for demonstrator.

POWER PLANT: Two 104 kW (140 hp) piston engines.

ACCOMMODATION: Pilot and 10 passengers inside envelope, 360° view through wraparound panoramic windows.

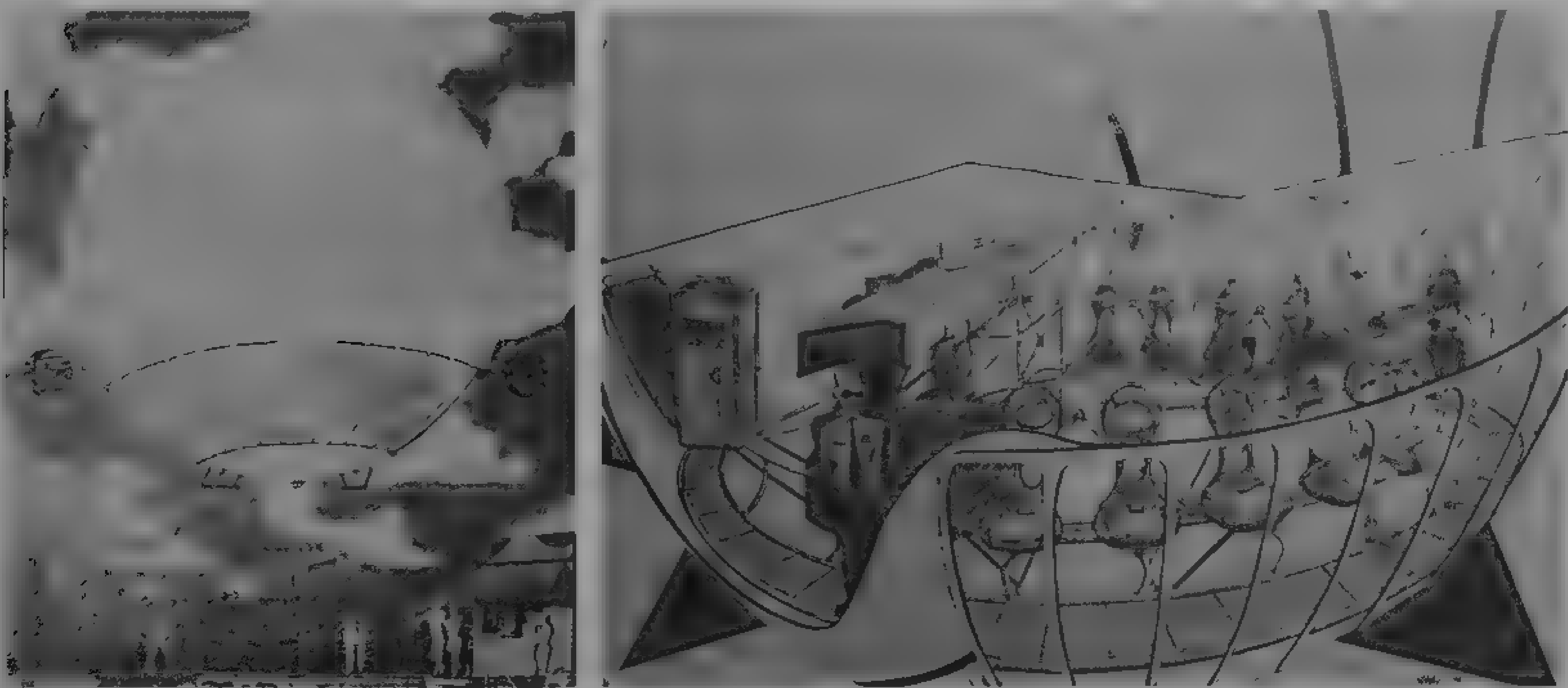
DIMENSIONS, EXTERNAL:

Envelope diameter	19.51 m (64 ft 0 in)

PERFORMANCE (estimated):

Max level speed	30 kts (55 km/h; 34 mph)

UPDATED



Artist's impressions of the 21st Century Airships 10-passenger production model and the interior of its 'glass-bottomed' envelope

1995

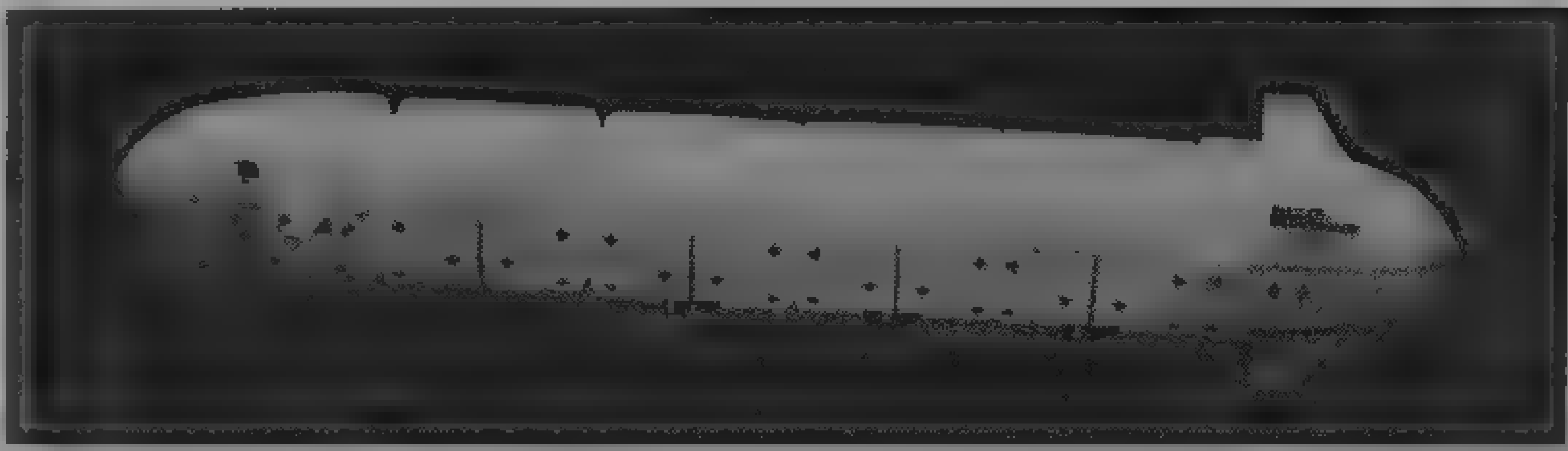
PAN ATLANTIC/NORD-AM

PAN ATLANTIC AEROSPACE CORPORATION

HEADQUARTERS: 881 Lady Ellen Place, Suite 302, Ottawa, Ontario K1Z 5L3
Telephone: 1 (613) 722 1454
Fax: 1 (613) 228 9152
MAILING ADDRESS: PO Box 599, Station B, Ottawa, Ontario K1P 5P7
CHAIRMAN: Fredrick D. Ferguson
PRESIDENT: Brian K. Penney
CHIEF RESEARCH ENGINEER: Dave Wehrle
COMMUNICATIONS DIRECTOR: Nick Baumberg
Nord-Am Research Corporation
HQ AND MAILING ADDRESSES: As above
CHAIRMAN AND CEO: Fredrick D. Ferguson
Magnus Aerospace Corporation
PRESIDENT: Philip Stockton (Boston, Massachusetts, USA)
Telephone: 1 (508) 768 3822

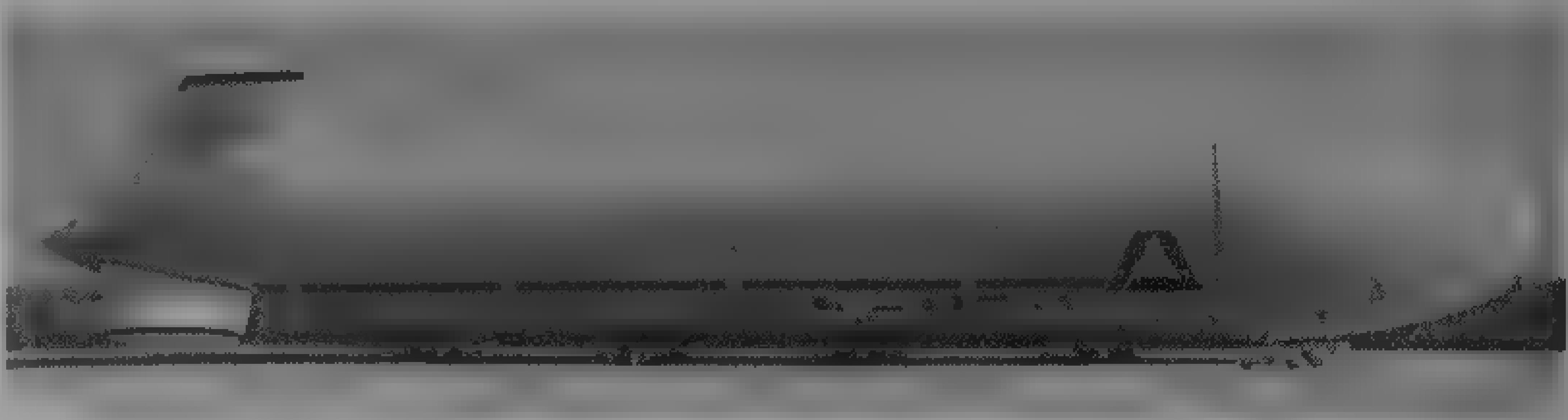
Pan Atlantic is a principal Canadian operating company overseeing management, systems and engineering integration of lighter than air project development; it is affiliated with Nord-Am Research Corporation, which has been involved in past development of Cargo Airship System. Pan Atlantic also represents and is affiliated with Magnus Aerospace Corporation, co-owner in development of Magnus rotating-sphere airship designed and developed by F. D. Ferguson (see 1989-90 and earlier *Jane's*). Pan Atlantic represents a collective development encompassing more than 15 years dedicated to R&D advancing state of the art in airship technologies, and has expended over $20 million in this area. The companies are private and financed privately by a small group of shareholders.

UPDATED



Droned first prototype of the Pan Atlantic cargo airship

1995



Model of the projected full-scale modular CAS

1994

PAN ATLANTIC CAS 1200 CARGO AIRSHIP SYSTEM

TYPE: Non-rigid, segmented pressure airship.

PROGRAMME: Concept originated by F. D. Ferguson in 1988; 15.24 m (50 ft) proof-of-concept (POC) scaled first prototype test flown as drone, September to December 1990; second prototype, same size, flight tested September to November 1991; now in 18 month, $20 million (approximately) detailed engineering phase leading to preproduction CAS 1200 approximately 183 m (600 ft) long, scheduled to fly by Spring 1997.

COSTS: $10 million for initial development including two prototypes.

DESIGN FEATURES: New patented technology based on six modular segments (middle four for payload) made of high strength, lightweight materials and designed to articulate to overcome gust problems encountered by rigid airships, intended for all weather operation, articulation allowing effective load transfer throughout module envelopes. Long envelope, with high fineness ratio, is able to accommodate ISO containerised loads such as produce, livestock and large department store inventories at rates potentially comparable with road transport. Four tailfins, in X configuration.

FLYING CONTROLS: Ballonet in each segment, ruddervator on each tail surface.

STRUCTURE: Dacron/Tedlar and Kevlar/Spectra laminates under consideration.

POWER PLANT: Four 4,474 kW (6,000 shp) Allison AE 2100 turboprops. See Weights and Loadings for fuel details.

DIMENSIONS, EXTERNAL:

Envelope: Length	457.20 m (1,500 ft)
Max diameter	60.96 m (200 ft)
Fineness ratio	7.5
Drag coefficient (Cd)	0.026
Payload modules, each: Length	60.96 m (200 ft)
Max diameter	60.96 m (200 ft)
Nose and tail modules, each: Length	106.68 m (350 ft)

DIMENSIONS, INTERNAL:

Envelope total volume	1.13 million m³ (39.8 million cu ft)
Ballonet total volume	0.23 million m³ (8.0 million cu ft)
Lifting volume	0.90 million m³ (31.8 million cu ft)

WEIGHTS AND LOADINGS:

Weight empty	190,508 kg (420,000 lb)
Max fuel weight	107,955 kg (238,000 lb)
Net available payload	582,412 kg (1,284,000 lb)
Max T-O weight (gross lift at S/L)	891,762 kg (1,966,000 lb)

PERFORMANCE (estimated):

Max level speed	82 kts (153 km/h; 95 mph)
Cruising speed	66 kts (122 km/h; 76 mph)
Range, 10% reserves	3,476 n miles (6,437 km; 4,000 miles)
Endurance, 10% reserves	52 h 36 min

UPDATED

MAGNUS 60

Build programme for Magnus 60 rotating-sphere airship has been suspended indefinitely. Details and photograph in 1994-95 *Jane's*.

UPDATED

PAN ATLANTIC LEMS

TYPE: Non-rigid segmented, solar-powered helium airship.

PROGRAMME: Design definition completed (LEMS = Long Endurance Manned Solar).

DESIGN FEATURES: Similar segmented design to Cargo Airship System, but with only three interconnected modules, motive power from onboard solar cells, powering electric motors and charging batteries to store energy for use at night or in poor light conditions. Prototype to be promoted for single-sponsor use, follow on production craft to be marketed as surveillance, environmental research and monitoring, advertising and peacetime military vehicles.

DIMENSIONS, EXTERNAL (approx):

Length overall	42.98 m (141 ft)
Height overall	6.71 m (22 ft)

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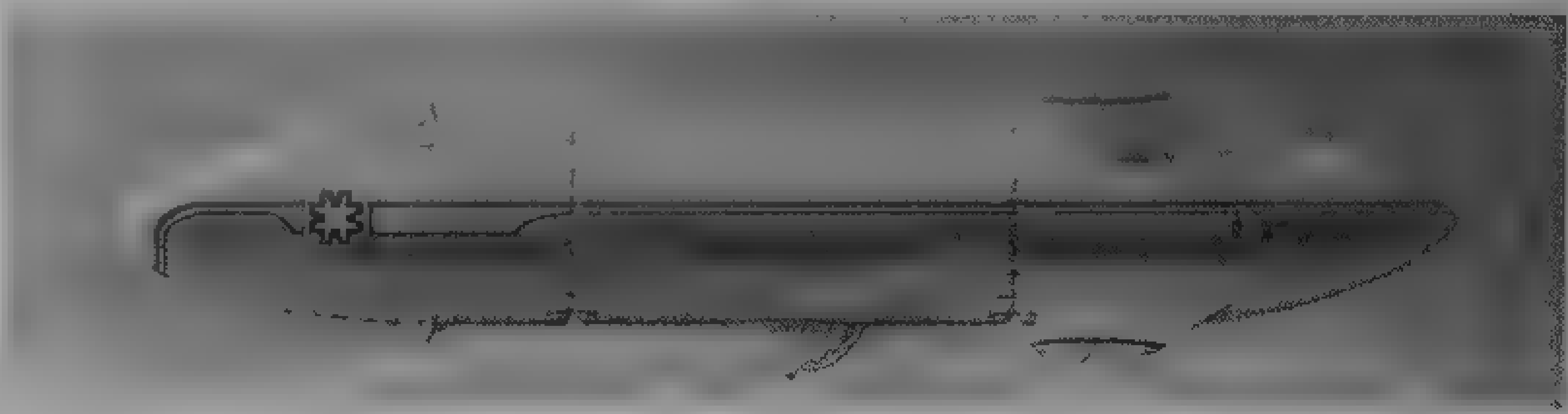

Artist's impression of the LEMS solar-powered airship

1994

CHINA, PEOPLE'S REPUBLIC

HADG

HUAHANG AIRSHIP DEVELOPMENT GROUP

PO Box 307, Jingmen, Hubei 448035
Telephone: 86 (724) 332525 and 332521
Fax: 86 (724) 332551
CHAIRMAN: Wang Fu Ling
MARKETING MANAGER: Xiu Feng Tian
INFORMATION: Dong Xue Ping

HADG launched its first passenger-carrying non-rigid, the FK-4, on 10 August 1990. (For description and illustration, see 1992-93 and earlier editions.) The remotely controlled FK-6 was described and illustrated in the 1993-94 *Jane's*. Two new models, the FK-11 and FK-12, were developed in 1994.

HADG also produces a range of special shape balloons and tethered aerostats.

UPDATED

Huahang FK 11 advertising airship *(Zhang Yi)*

1995

HADG FK-11 and FK-12

TYPE: Remotely controlled non-rigid helium airships.

PROGRAMME: Developed and first flown in 1994. Two prototypes of FK-12 shown at Guangzhou Aviation Fair

December 1994. Used for advertising (12.0 m², 129.2 sq ft available on FK 11)

CUSTOMERS: Orders for 20 FK-11s reported by mid-1994.

DESIGN FEATURES: Conventional envelope shape with cruciform tail surfaces, small gondola with tubular landing gear; vectored-thrust ducted propellers

The two prototypes of the HADG FK 12 *(Zhang Yi)*

1995

POWER PLANT: One Chinese YH-40 piston engine in FK-11 two Japanese OS BGX-1 piston engines (each 3.06 kW 4.1 hp) in FK 12

DIMENSIONS, EXTERNAL

Envelope: Length overall	
FK-11	10.40 m (34 ft 1½ in)
FK-12	11.80 m (38 ft 8½ in)
Max diameter: FK 11	3.40 m (11 ft 1¾ in)
FK 12	3.32 m (10 ft 10¾ in)
Height overall: FK-11	3.70 m (12 ft 1¾ in)
FK-12	4.06 m (13 ft 3¾ in)

DIMENSIONS, INTERNAL

Envelope volume: FK 11	38.0 m³ (1,342 cu ft)
FK 12	40.0 m³ (1,412.5 cu ft)

WEIGHTS AND LOADINGS

Weight empty: FK-12	43 kg (95 lb)
Max payload: FK-11	10 kg (22 lb)
FK 12	8 kg (17.6 lb)
Max T-O weight: FK-12	55 kg (121 lb

PERFORMANCE

Max level speed	
FK 11	27 kts (50 km/h, 31 mph)
FK 12	32 kts (60 km/h, 37 mph
Ceiling: FK	200 m (660 ft)
FK-12	500 m (1,640 ft)
Endurance: FK 11	1 h

NEW ENTRY

SARI

SHANGHAI AIRCRAFT RESEARCH INSTITUTE

Long Hua Airport Building, 2 Long Hua West Road, PO Box 232-003, Shanghai 200232
Telephone: 86 (21) 4380296
Fax: 86 (21) 4390584
PRESIDENT: Wu Xing Shi
AIRSHIP CHIEF DESIGN ENGINEER: Wu Li Yao

A division of Shanghai Aviation Industrial Group, SARI is an institute for research and design of major civil aircraft, of which most notable was Y-10 jet airliner of the 1970s. It has been engaged in study of development of a major hybrid helium airship since 1989. Development of larger airships is continuing

UPDATED

SARI SHEN ZHOU-1 and -2

TYPE: Remotely controlled non-rigid helium airships.

PROGRAMME: Development study began 1989, Shen Zhou-1 made first flight April 1992, Shen Zhou-2 in May 1993

CURRENT VERSIONS: **Shen Zhou-1**: Initial version. Third engine mounted ahead of gondola and can be swivelled to augment turning and manoeuvring

Shen Zhou-2: Slightly larger envelope; third engine mounted aft of gondola for faster forward speed but without swivel mechanism

CUSTOMERS: Both airships sold during 1994 (customers not named)

DESIGN FEATURES: Conventional envelope shape with cruciform tail surfaces, VTOL capability by vectoring paired ducted propellers

FLYING CONTROLS: Helium provides neutral buoyancy; ducted propellers, one each side of gondola, can be pivoted through 270° for VTOL, climb and descent, elevators assist pitch control, yaw control by rudders on lower fin only of Shen Zhou-1, on both fins of Shen Zhou-2. Internal ballonets

STRUCTURE: Envelope of coloured nylon fabrics; ballonets of three ply nylon film, tail surfaces are frame structures with tough silk covering. Helicopter-type twin-skid landing gear under gondola

POWER PLANT: Three 2.24 kW (3 hp) OS MAX-108 FSR piston engines, two mounted on gondola sides and driving ducted propellers that can be swivelled through 270°. Third engine mounted ahead of gondola on Shen Zhou-1 and able to swivel independently 60° to left and right to assist turning and manoeuvring; on Shen Zhou-2, third engine is mounted aft of gondola and does not swivel

AVIONICS: *Mission:* Video camera with real-time imagery downlink to ground receivers.

DIMENSIONS, EXTERNAL

Envelope: Length overall	
SZ-1	8.70 m (28 ft 6½ in)
SZ-2	9.20 m (30 ft 2¼ in)
Max diameter: SZ-1	2.80 m (9 ft 2¼ in)
SZ 2	2.40 m (7 ft 10½ in)

DIMENSIONS, INTERNAL

Envelope volume: SZ-1	29.0 m³ (1,024.1 cu ft)
SZ-2	30.0 m³ (1,059.4 cu ft)

WEIGHTS AND LOADINGS

Max T-O weight: SZ-1	33 kg (72.8 lb)
SZ-2	24 kg (52.9 lb)

PERFORMANCE

Max level speed: SZ-1	27 kts (50 km/h, 31 mph)
SZ-2	32 kts (60 km/h, 37 mph)
Max cruising speed	
SZ-1	21.5 kts (40 km/h, 25 mph)
SZ-2	27 kts (50 km/h, 31 mph)
Min air turning radius: SZ-1	30 m (100 ft)
SZ 2	40 m (132 ft)
Max flying altitude: SZ-1, SZ-2	2,000 m (6,560 ft)
Max control distance: SZ-1, SZ-2	3,000 m (9,840 ft
Endurance: SZ-1, SZ-2	30 min

UPDATED

Shanghai Aircraft Research Institute Shen Zhou-1

1995

SARI Shen Zhou-2 remotely controlled non-rigid airship

1994

FRANCE

AERAZUR

AERAZUR
(Member company of the Groupe Zodiac)
Division Equipements Aéronautiques
58 boulevard Galliéni, F-92137 Issy-les-Moulineaux Cedex
Telephone: 33 (1) 41 23 23 23
Fax: 33 (1) 46 48 74 79
Telex: 631891 F
CEO: Jean Louis Gerondeau
INTERNATIONAL MARKETING MANAGER: Jean Pierre Fetu

Aerazur began building lighter than air craft before Second World War, and in 1960s manufactured world's largest non-rigid kite balloons (up to 15,000 m³, 529,720 cu ft), used for tests in the atmosphere of French nuclear weapons. It manufactures envelopes for Skyship series, and is associated in designing envelopes for Westinghouse Sentinel airships.

UPDATED

GERMANY

GEFA-FLUG

GESELLSCHAFT ZUR ENTWICKLUNG UND FÖRDERUNG AEROSTATISCHER FLUGSYSTEME mbH
Weststrasse 14, D-52074 Aachen
Telephone: 49 (241) 874026/27
Fax: 49 (241) 875206
MANAGING DIRECTOR: Karl Ludwig Busemeyer

GEFA-Flug established 1975 to operate advertising and passenger-carrying hot-air balloons; has R&D department to develop remotely controlled airships for manned and unmanned civil and environmental research applications such as aerial photogrammetry and pollution monitoring. Photogrammetry for archaeological research has been undertaken in Egypt, France, Germany, Greece, Israel, Oman, Pakistan, Syria, Turkey, UK, former Yugoslavia and elsewhere.

Company currently operates more than half a dozen hot-air balloons, four hot air airships and a number of remotely controlled aerostats, and has sold about 100 systems (mostly unmanned and remotely controlled) worldwide. Fleet includes two AS 80 GD hot-air airships (see 1991-92 *Jane's*), a modified version of the Thunder & Colt AS 80 Mk II. Future market seen as survey projects for environmental research. GEFA-Flug also developing manned family of civil hot-air aerostats, and developing scientific measuring equipment in partnership with German Mining Technology, a partly government funded body.

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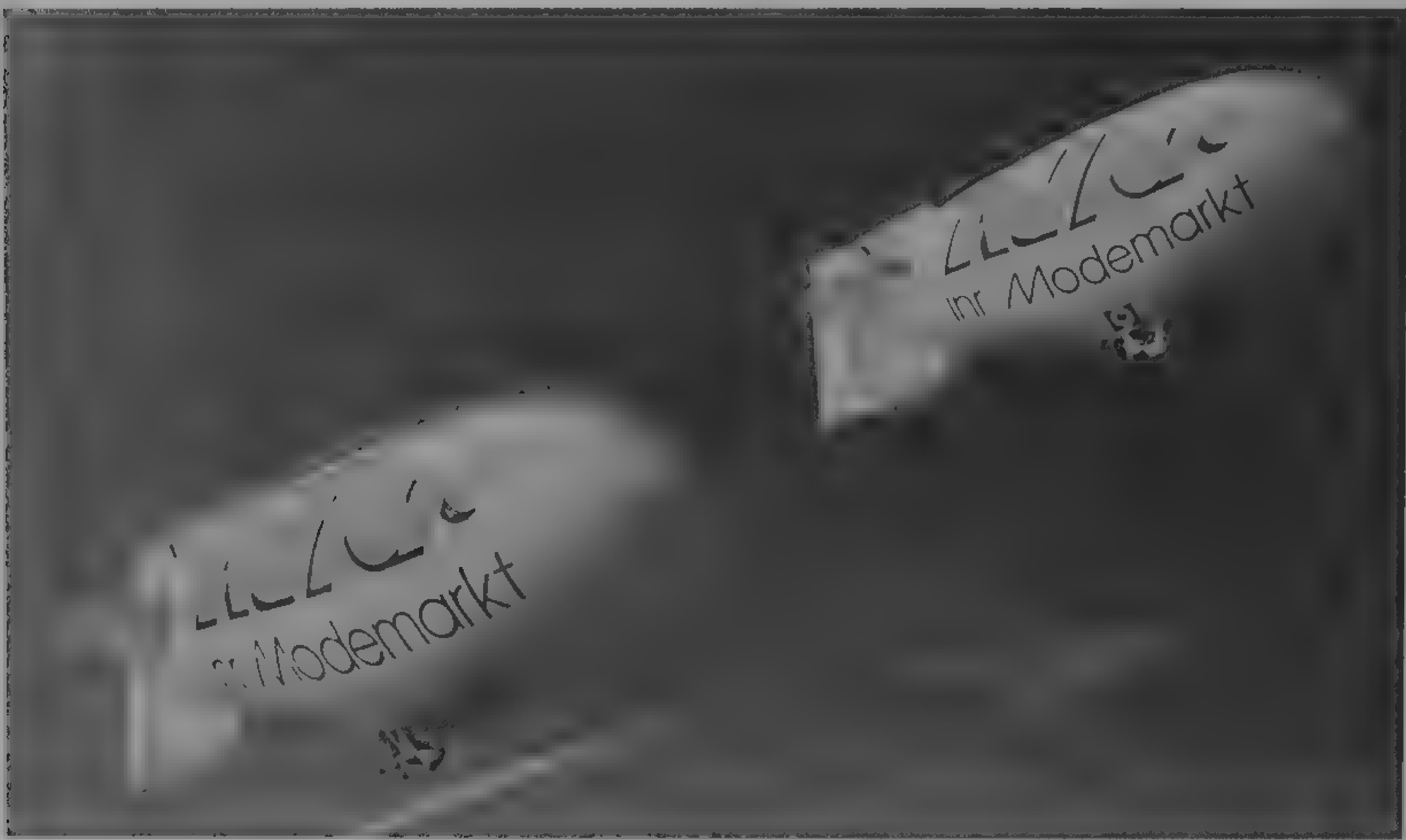

GEFA Flug's pair of two-place AS 80 GDs

1995

WDL

WESTDEUTSCHE LUFTWERBUNG THEODOR WULLENKEMPER KG (WDL Flugdienst GmbH and WDL Luftschiff GmbH)
Flughafen Essen-Mulheim, D-45000 Mulheim/Ruhr
Telephone: 49 (208) 378080
Fax: 49 (208) 3780833 (Management)
49 (208) 3780841 (Operations)
Telex: 856810
OWNER: Theodor Wüllenkemper

WDL resumed airship construction in 1987 with first of new design known as WDL 1B. In addition to airship activities, WDL operates Fokker F27 transports on passenger/cargo flights within Europe.

UPDATED

WDL 1B seven-passenger non-rigid (two Teledyne Continental IO-360-CD flat six engines)

1990

WDL 1B

TYPE: Passenger carrying non-rigid helium airship.

PROGRAMME: First flight (D-LDFP *Asahi*) 30 August 1988; first delivery (to Mitsui, Japan) mid September 1988.

CUSTOMERS: Four completed; fifth under construction for 1995 delivery.

DESIGN FEATURES: World's second largest certificated non-rigid; improved gondola compared with WDL 1; panel 33 × 8 m (108.3 × 26.2 ft) each side with advertising graphics and computer-controlled coloured 10,000 bulb night sign on *Asahi*.

FLYING CONTROLS: Two ballonets (40 per cent air-filled) and 300 litres (79.25 US gallons; 66 Imp gallons) water ballast; ballonet valves actuated by digital computer which indicates gas temperature and pressure.

POWER PLANT: Two 157 kW (210 hp) Teledyne Continental IO-360-CD flat-six engines, each driving a two-blade propeller. Total fuel capacity (two tanks) 400 litres (105.7 US gallons; 88 Imp gallons)

ACCOMMODATION: Pilot and up to seven passengers in new-design gondola

AVIONICS: Instrumentation improved compared with WDL 1

DIMENSIONS, EXTERNAL:

Envelope: Length overall	59.90 m (196 ft 6¼ in)
Max diameter	16.40 m (53 ft 9¾ in)
Gondola: Length overall	7.60 m (24 ft 11¼ in)
Width: top	2.10 m (6 ft 10¾ in)
bottom	1.30 m (4 ft 3¼ in)
Height: excl landing gear	2.53 m (8 ft 3½ in)
incl landing gear	3.68 m (12 ft 1 in)

DIMENSIONS, INTERNAL:

Envelope volume	7,200 m³ (254,265 cu ft)

WEIGHTS AND LOADINGS:

Envelope weight	2,000 kg (4,409 lb)
Max payload	1,180 kg (2,601 lb)
Weight empty	5,100 kg (11,243 lb)

PERFORMANCE:

Never-exceed speed (VNE)	48 kts (90 km/h; 60 mph)
Max manoeuvring speed	35 kts (65 km/h; 40 mph)
Max endurance	22 h

UPDATED

ZEPPELIN

ZEPPELIN LUFTSCHIFFTECHNIK GmbH

Zeppelin Werftgelände, Leutholdstrasse, D-88045 Friedrichshafen
Telephone: 49 (7541) 202515
Fax: 49 (7541) 202516
MANAGING DIRECTOR: Max Mugler
NT PROJECT MANAGER: Klaus Hagenlocher

Zeppelin Luftschifftechnik (ZLT) was formed in 1993 for the development and production of new technology (NT) airships. Luftschiffbau Zeppelin GmbH, of which ZLT is a subsidiary, was founded by Count Ferdinand von Zeppelin in 1908 and still exists under the auspices of the Zeppelin Foundation.

Current NT programme comprises N 07 (under construction), N 17 (under development) and N 30 (planned).

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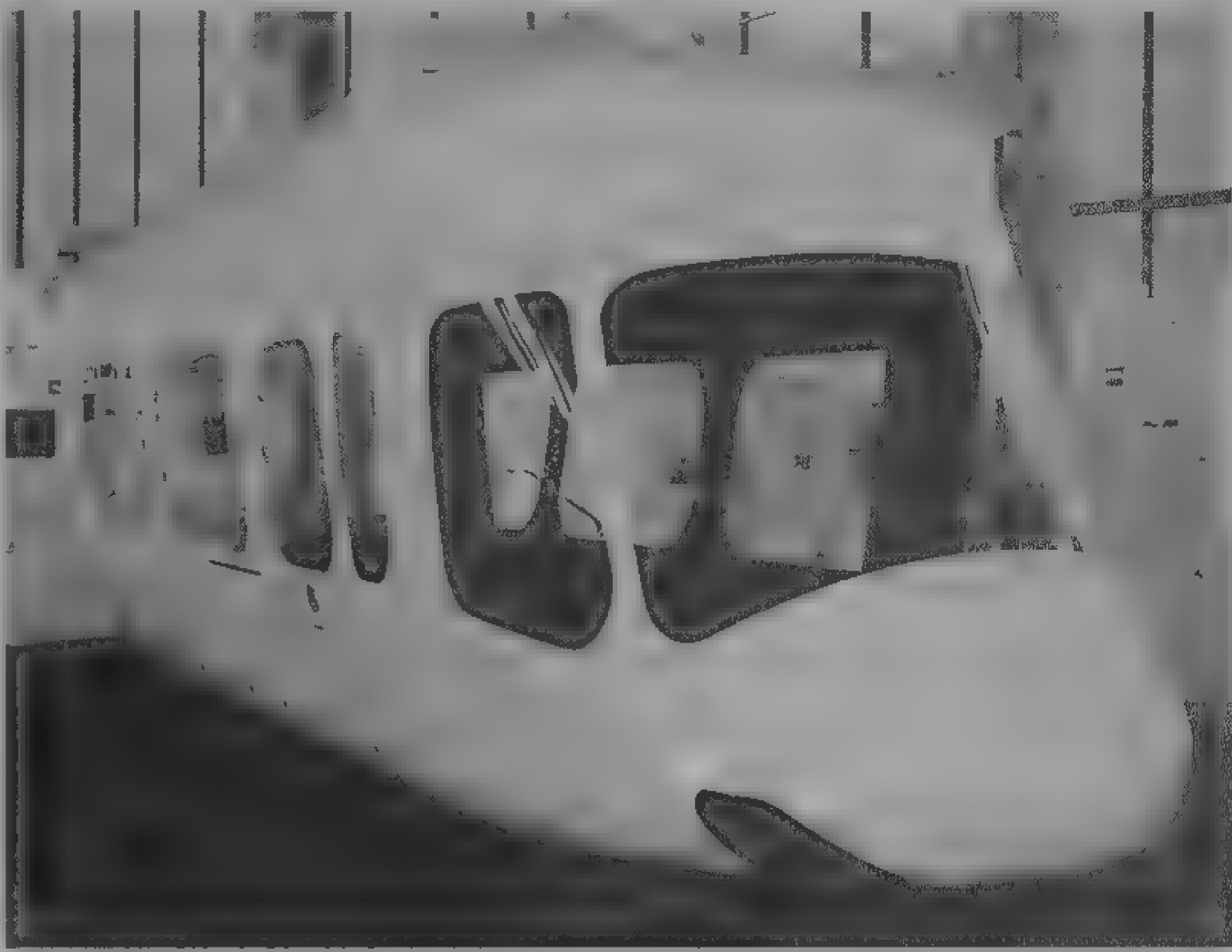


N 07 gondola mockup

1995

ZEPPELIN N 07

TYPE: Semi-rigid helium airship demonstrator.

PROGRAMME: Study group for revival of modern rigid airships formed 1989, concluded that combination of vectored thrust and new constructional approach offers best solution, resulting in NT programme, 10 m (32 ft 10 in) long, remotely controlled proof-of-concept model tested extensively in 1991. Design definition of demonstrator (originally designated N 05, now N 07) completed late 1992, construction scheduled to start October 1995 leading to first flight early 1997, certification and commercial production in 1998. Intended as precursor of product line of commercial airships for variety of applications including scientific research, environmental monitoring, TV missions and tourism.

DESIGN FEATURES: Internal 'prism' primary structure modified and optimised from Stuttgart University proposal of 1975 and British patent of 1924; multiple gas cells increase safety; placement of vectored thrust units near CG and also at rear enhances manoeuvrability and control at low speeds, further improving safety and reducing groundcrew requirements to three persons, thereby also reducing operating costs.

FLYING CONTROLS: Computer-assisted flight control, propulsion and landing. Dual fly-by-wire flight control system; no mechanical back-up. Elevators or rudders on all four tail surfaces. Engine thrust control (see under Power Plant) in pitch and yaw.

STRUCTURE: Internal primary structure consists of three rows of aluminium tubular longerons, interconnected with triangular carbonfibre frames, providing internal prism-shaped structure accounting for only 12 per cent of gross weight; this frame and pressurised envelope are both load-carrying structures to enhance safety factor (airship remains fully manoeuvrable even if internal pressure drops). Envelope is a high-strength, multilayer laminate of Dacron, Mylar and Tedlar with multiple internal helium cells; this material has low gas permeability and allows airship to be moored permanently in the open. Air ballonets in lower part of envelope afford protection to cabin and airframe in the event of a hard landing.

LANDING GEAR: Twin landing/ground handling wheels in tandem under gondola and rear of envelope. Airship can be moored to a fixed or mobile mast.

POWER PLANT: Three 149 kW (200 hp) Textron Lycoming flat-four engines; one each side of hull above gondola in vectored-thrust propulsion unit, driving a three-blade variable-pitch tractor propeller; engine in tailcone drives one pusher and one vectoring propeller via a two-shaft gearbox, thus being able to deliver both lateral thrust and vectored/horizontal thrust for precise pitch and yaw control. Combination of thrust vectoring and fuel trim tanks virtually obviate need for ballast management.

ACCOMMODATION: Crew of two, on ergonomically designed flight deck; gondola main cabin accommodates up to 12 passengers on individual seats, with galley, toilet and wardrobe provision, or equivalent cargo or other payload.

AVIONICS: Said to be comparable to those of a modern twin-engined general aviation aircraft; include weather radar and Stormscope.

DIMENSIONS, EXTERNAL:

Envelope: Length overall	68.40 m (224 ft 5 in)
Max diameter	14.16 m (46 ft 5½ in)

DIMENSIONS, INTERNAL:

Envelope volume	7,200 m³ (254,266 cu ft)

WEIGHTS AND LOADINGS:

Max payload	1,850 kg (4,078 lb)
Max T-O weight	6,950 kg (15,322 lb)

PERFORMANCE (estimated):

Max level speed	76 kts (140 km/h; 87 mph)
Cruising speed	62 kts (115 km/h; 71 mph)
Cruising altitude	1,000 m (3,280 ft)
Pressure ceiling	2,500 m (8,200 ft)
Endurance at 38 kts (70 km/h; 43 mph):	
with max payload	18 h
with reduced payload	36 h

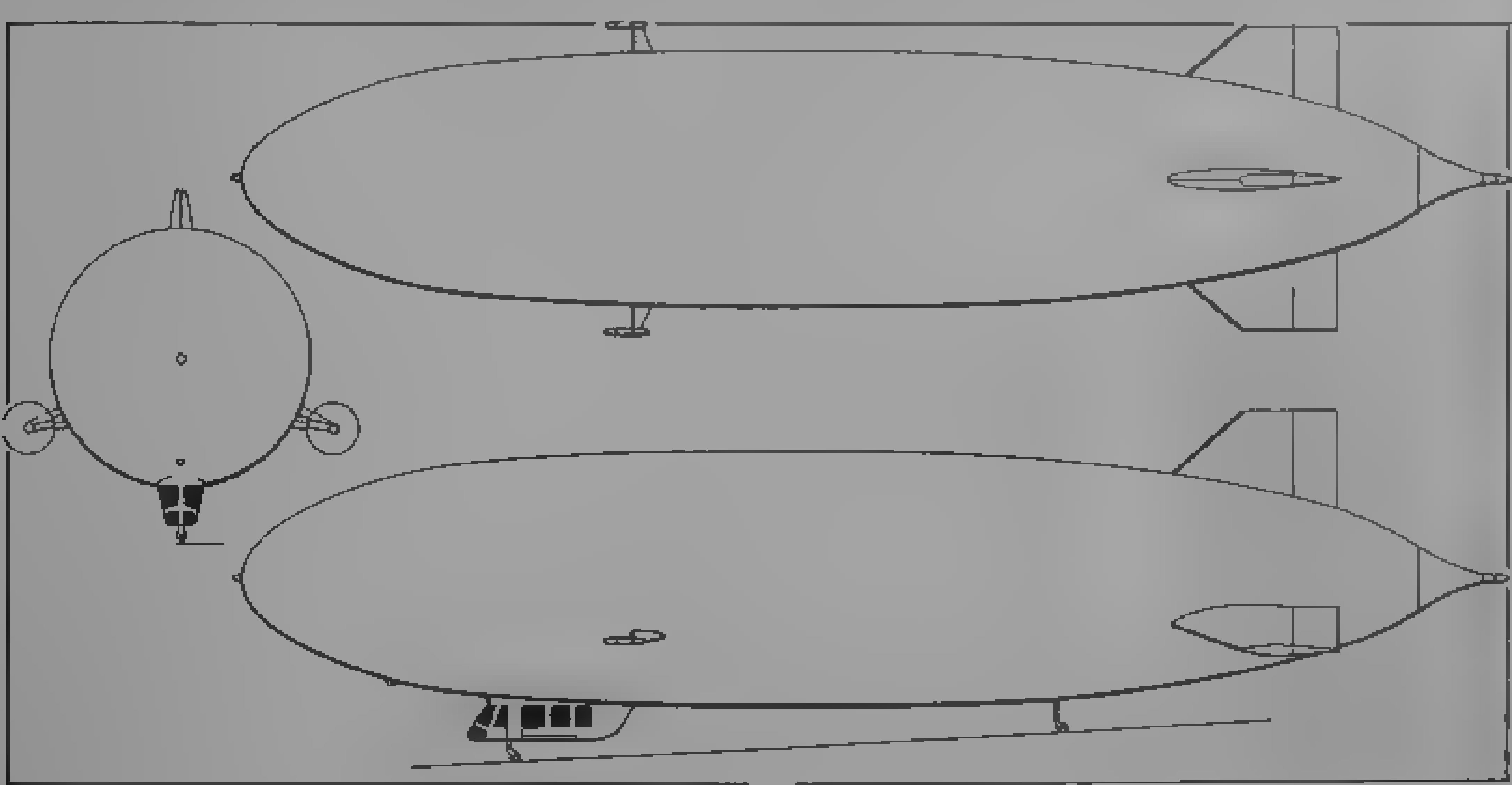
UPDATED

ZEPPELIN N 17

TYPE: Passenger-carrying semi-rigid helium airship.

PROGRAMME: Under development 1995.

POWER PLANT: Three 313 kW (420 hp) engines; type to be decided.



Zeppelin N 07 prototype of proposed new family of rigid airships (*Jane's/Mike Keep*)

1993

N 07 propulsion system test rig

1995

ACCOMMODATION: Crew of two and up to 46 passengers

DIMENSIONS, EXTERNAL:

Envelope: Length overall	90.20 m (295 ft 11¼ in)
Max diameter	18.90 m (62 ft 0 in)

DIMENSIONS, INTERNAL:

Envelope volume	17,000 m³ (600,350 cu ft)

WEIGHTS AND LOADINGS:

Max payload	5,300 kg (11,684 lb)
Max T-O weight	16,400 kg (36,155 lb)

PERFORMANCE (estimated):

Max level speed	76 kts (140 km/h; 87 mph)
Cruising speed	65 kts (120 km/h; 74 mph)
Cruising altitude	1,000 m (3,280 ft)
Pressure ceiling	2,500 m (8,200 ft)
Endurance at 38 kts (70 km/h; 43 mph):	
with max payload	22 h
with reduced payload	40 h

NEW ENTRY

Artist's impression of the Zeppelin N 07

1995

ZEPPELIN N 30

TYPE: Proposed passenger-carrying semi-rigid helium airship.

PROGRAMME: Envisaged as passenger transport and/or surveillance platform.

POWER PLANT: Three engines; type and rating to be decided.

ACCOMMODATION: Crew of two and up to 84 passengers.

DIMENSIONS, EXTERNAL:

Envelope: Length overall	110.00 m (360 ft 10¾ in)
Max diameter	22.50 m (73 ft 10 in)

DIMENSIONS, INTERNAL:

Envelope volume	30,000 m³ (1,059,440 cu ft)

WEIGHTS AND LOADINGS:

Max payload	15,000 kg (33,069 lb)
Max T-O weight	30,000 kg (66,138 lb)

PERFORMANCE (estimated):

Max level speed	76 kts (140 km/h; 87 mph)
Cruising speed	67 kts (125 km/h; 78 mph)
Cruising altitude	1,000 m (3,280 ft)
Pressure ceiling	3,000 m (9,850 ft)
Endurance at 38 kts (70 km/h; 43 mph):	
with max payload	23 h
with reduced payload	82 h

NEW ENTRY

RUSSIA

AEROSTATICA

AEROSTATICA

31-1-315 Krylatskaya Street, Moscow 121614

Telephone: 7 (095) 1584818

Fax: 7 (095) 4132630

PRESIDENT: Dr Alexander N. Kirilin

NEW ENTRY

AEROSTATICA-01

TYPE: Small multifunction helium airship.

PROGRAMME: Developed by this private company with assistance from Moscow Aviation Institute (MAI); first flight at Kubinka 12 August 1994, and 20 take-offs and landings made between then and 4 September same year. Partial testing (light winds only) of captive aerostat form also undertaken; flight testing of pilotless version planned for 1995.

DESIGN FEATURES: Designed to fly in one of three modes: as single-seater with 50 to 70 kg (110 to 154 lb) payload, pilotless under automatic remote control and payload of up to 100 kg (220 lb), or as captive aerostat at up to 1,000 m (3,280 ft) altitude with maximum payload of 150 kg (330 lb).

Conventional-shape envelope encircled at rear by eight sweptback tailfins (probably reducing to four for captive version). Single, centrally located ballonet.

FLYING CONTROLS (piloted version): Electromechanical (control column) for rudders and elevators, throttle control, lever control of engine exhaust vector vanes. In the event of engine failure, emergency control exercised by means of pilot controlled gas galve, operation of electric compressor to inflate ballonet, and ballast discharge system. Rudder or elevator on each vertical and horizontal fin, none on intermediate (X configuration) fins.

STRUCTURE: Envelope mainly of Kapron synthetic fibre and polyethylene film, laminated with 12 layers of rubberised adhesive of which three combined with aluminium powder to inhibit gas loss. Reinforced area above gondola (four gores each 4 m; 13.12 ft long) is of Lavsan and film. All envelope and ballonet seams cold-sealed with self-vulcanising adhesive and reinforced with hermetic adhesive tape. Tailfins each have two tubular spars and are braced to envelope by four cables. Gondola based on fuselage of Aviatika MAI 89 microlight, attached to envelope by longitudinal and cross-tubes.

POWER PLANT: Two 20.9 kW (28 hp) RMZ-640 two-cylinder air-cooled piston engines, each driving a four-blade fixed-pitch ducted propeller. Five movable vanes in duct aft of each propeller permit exhaust gases to be vectored between 0 and 90°.

ACCOMMODATION: Single seat, with safety belt, in open-sided gondola; plastics side doors optional.

AVIONICS: *Flight:* Include GPS (NavStar) navigation.

DIMENSIONS, EXTERNAL:

Length overall	22.88 m (75 ft 0½ in)
Fineness ratio	4
Height overall	7.68 m (25 ft 2½ in)
Propeller diameter	0.99 m (3 ft 3 in)

DIMENSIONS, INTERNAL:

Envelope volume	370.0 m³ (13,066.5 cu ft)
Ballonet volume	45.0 m³ (1,589.2 cu ft)

AREAS:

Tailfins (eight, each)	2.25 m² (24.22 sq ft)

WEIGHTS AND LOADINGS:

Max payload	see Design Features

PERFORMANCE:

Max level speed	40-43 kts (75-80 km/h; 46-50 mph)
Pressure ceiling	1,000 m (3,280 ft)

NEW ENTRY

DKBA

DESIGN BUREAU AUTOMATICA

1 Letnaya Sreet, 141700 Dolgoprudny, Moscow Region

Telephone: 7 (095) 4088909

Fax: 7 (095) 4087511

CHIEF DESIGNER: Petr Petrovich Dementyev

VERIFIED

DKBA DP-800 ECOLOGIYA

TYPE: Multipurpose semi-rigid helium airship.

PROGRAMME: First revealed in form of model (then known as **DS-3**) at 1989 Paris Air Show; was originally planned to make first flight in 1993, but delayed due to lack of funding; most development work now completed; possible first flight during 1995.

DESIGN FEATURES: Helium-filled semi-rigid, with cruciform tail surfaces. Can perform launches and landings from 700 m (2,300 ft) diameter grass or hard-surface area.

FLYING CONTROLS: Mechanical control of elevators and rudders by rods and cables; no rudder pedals. Electrical control of tail surfaces available as customer option. Three-section ballast compartment in lower portion of gondola.

STRUCTURE: Internally rigged envelope of two-ply diagonally laminated, rubberised Kapron-based aluminium-coated fabric (estimated life 10,000 hours over five year period). Metal framed, fabric-covered tail surfaces. All metal semi-monocoque gondola (frames and stringers), suspended from envelope by load bearing belt and 28 steel cables.

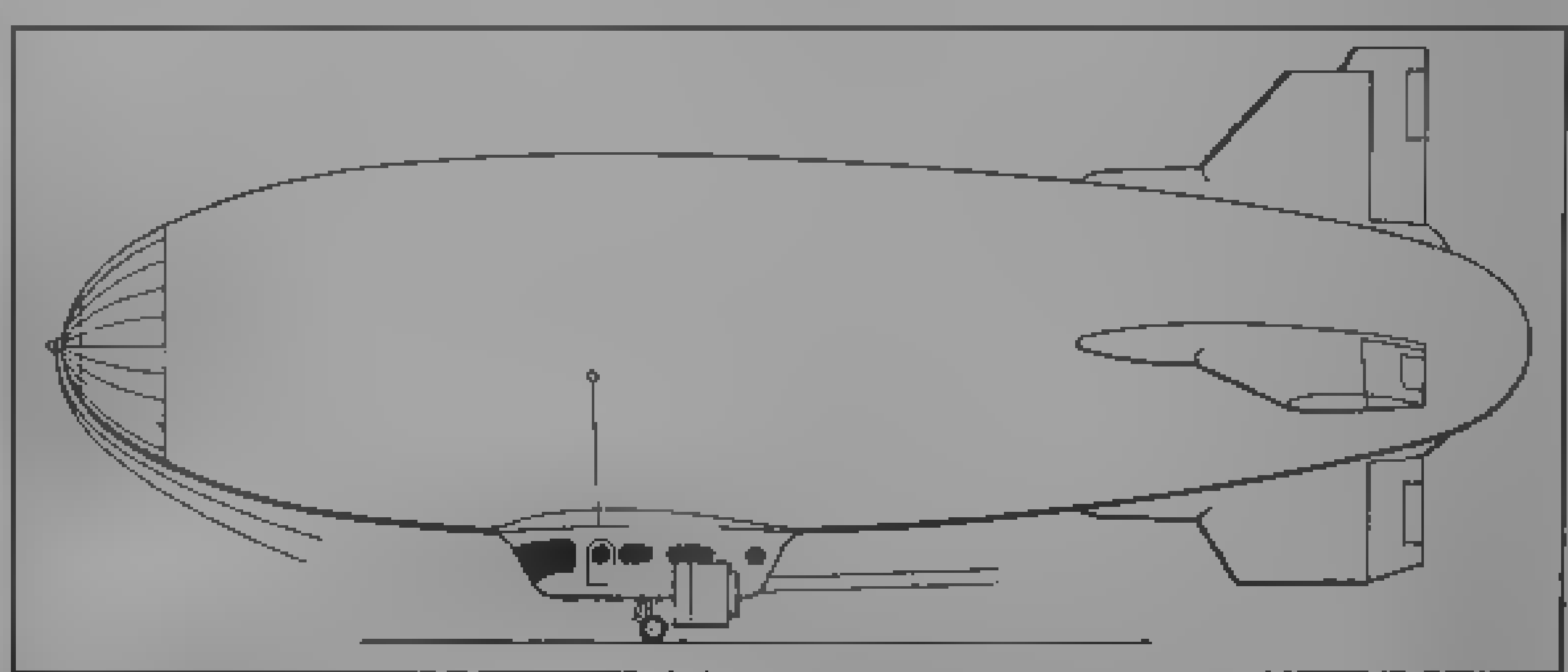
LANDING GEAR: Single-strut, twin-wheel unit, derived from that of Mi-24 helicopter. Groundcrew requirement is three to five persons.

POWER PLANT: Two 242 kW (325 hp) VOKBM M-14V-26 nine-cylinder air-cooled radial engines (nominal power 205 kW; 275 hp each), driving AV-83 four-blade, variable- and reversible-pitch ducted propellers, one each side of gondola, via a modified reduction gearbox. Propeller thrust can be vectored 120° upward and 120° downward.

ACCOMMODATION: Gondola accommodates crew of two and up to 12 passengers or equivalent cargo; bulky loads of up to 2,000 kg (4,409 lb) can be carried on external sling.

DIMENSIONS, EXTERNAL:

Envelope: Length overall	62.00 m (203 ft 5 in)
Max diameter	15.75 m (51 ft 8 in)
Lift/drag ratio	3.95
Height overall, incl landing gear	22.00 m (72 ft 2¼ in)
Gondola: Length	10.00 m (32 ft 9¾ in)
Max width	3.00 m (9 ft 10 in)
Max height	2.40 m (7 ft 10½ in)
Propeller diameter	1.50 m (4 ft 11 in)



Preliminary drawing (*Jane's/Mike Keep*) and model photo (*Paul Jackson*) of the DKBA DP-800 passenger/cargo airship

1989/1995

DIMENSIONS, INTERNAL:
Envelope volume 8,039 m³ (283,895 cu ft)
WEIGHTS AND LOADINGS
Weight empty 5,150 kg (11,354 lb)
Max fuel weight 1,000 kg (2,205 lb)
Max useful load (incl fuel and ballast) 3 000 kg (6,614 lb)
Max T-O weight 8,400 kg (18,518 lb)
PERFORMANCE (estimated):
Max level speed 59 kts (110 km/h, 68 mph)
Max cruising speed 43 kts (80 km/h; 50 mph)
Max rate of climb at S/L 600 m (1,968 ft)/min
Max operating altitude 2,700 m (8,860 ft)
Range at cruising speed of 38 kts (70 km/h, 43 mph) 723 n miles (1,340 km, 832 miles)
Endurance at cruising speed of 38 kts (70 km/h, 43 mph) 44 h 42 min

UPDATED

DKBA DP-6000 VITYAZ (KNIGHT)

TYPE: Projected development of DP 800.
PROGRAMME: Development started 1993 and continuing.
DESIGN FEATURES: Objective is 20 tonne payload capability in two-deck gondola.
FLYING CONTROLS: Electric remote control of elevators and rudder.
POWER PLANT: Two vectored thrust ducted propeller units each driven by two 596 kW (800 hp) diesel engines and two cruise propeller units each driven by a 1,864 kW (2,500 shp) turboshaft; or two vectored-thrust ducted propeller units each driven by two 746 kW (1 000 hp) diesel engines and one cruise propeller unit driven by 2,500 shp turboshaft.
ACCOMMODATION: Double-deck gondola utilised as load-bearing structure housing power plant accessories, flight equipment, flight deck, main cabin (144 passenger or military transport seats, 20 tonnes of cargo, or typically a mix of 84 passengers plus cargo), fuel tanks, ballast compartment, crew utility and rest quarters, refreshment and toilet facilities.
Hull volume sufficient to accommodate large phased-array radars, intelligence-gathering and processing facilities or other mission equipment.
DIMENSIONS, EXTERNAL:
Envelope: Length overall 125 46 m (411 ft 7½ in)
Gondola: Length 32.50 m (106 ft 7½ in)
Height (incl landing gear) 6 10 m (20 ft 0¼ in)
DIMENSIONS, INTERNAL:
Envelope volume 60,000 m³ (2,118 882 cu ft)
WEIGHTS AND LOADINGS:
Max payload 20,000 kg (44,092 lb)
PERFORMANCE (estimated):
Typical cruising speed 54 kts (100 km/h, 62 mph)
Cruising altitude:
with 12,000 kg (26,455 lb) payload 3,000 m (9,840 ft)
with 20,000 kg (44,092 lb) payload 1,000 m (3,280 ft)
Range at 1,000 m (3,280 ft) with 20 t payload 1 890 n miles (3,500 km, 2,175 miles)

NEW ENTRY

THERMOPLANE

THERMOPLANE DESIGN BUREAU, MOSCOW AVIATION INSTITUTE

4 Volokolamskoe Highway, 125871 Moscow
Telephone: 7 (095) 1584127
Fax: 7 (095) 1582977
DIRECTOR OF MAI: Academician Yuri A. Ryzhov
CHIEF DIRECTOR, THERMOPLANE DESIGN BUREAU: Yuri G. Ishkov
COMMERCIAL DIRECTOR: Dr Leon Ponyaev

Thermoplane Design Bureau formed at MAI in 1980 to study requirement for large, unballasted airship, ecologically friendly, able to transport heavy or bulky cargoes in Siberian winter conditions, yet needing minimal ground support bases, hangars, mooring masts and personnel.

VERIFIED

THERMOPLANE ALA-40

TYPE: Proof-of-concept demonstrator for unique 'two-gas' airship.
PROGRAMME: Began 1985, originally funded by former Soviet government and first reported 1989, when preliminary design work completed; objective to develop ecologically clean heavy-lift airships to transport bulky cargo (for example for construction, logging or mining industries) in remote areas; three prototypes being built, with funding in 1992 provided by joint venture complex of Russian timber, oil and other industries; buoyancy, static and dynamic ground testing of first prototype 1992 at Aviastar factory in Ulyanovsk; first flight (tethered) 1993, free flights not considered necessary; 02 due for roll-out 1995.
DESIGN FEATURES: Disc-shaped envelope with elliptical cross-section and unique two-gas lift system; disc configuration claimed to offer smaller size, lower weight, greater strength, and more even distribution of stress loads, than conventional cigar shape; Mi-2 helicopter fuselage adapted as gondola.
FLYING CONTROLS: Centre portion of envelope is occupied by spheres filled with non-combustible mixture of helium and oxygen; hot air bled from main propulsion engines ducted into disc to augment basic lift provided by spheres; smaller engines fore and aft generate additional lift and control in conjunction with horizontal and vertical control surfaces.
STRUCTURE: Composites structure and skin (thermoplastics skin, based on Terlon, and carbonfibre tapes).
POWER PLANT: Two 112 kW (150 hp) piston engines for primary propulsion, propellers mounted on extension shafts from envelope/gondola junction; small diesel engines on centreline (one forward, one aft) to supplement main lift and control systems.
ACCOMMODATION: Modified Mi-2 helicopter fuselage serves as gondola for test crew and equipment.
DIMENSIONS, EXTERNAL:
Envelope: Diameter 40 00 m (131 ft 3 in)
Max depth 16 00 m (52 ft 6 in)
Height, overall 19 514 m (64 ft 0¼ in)
to envelope c/l 11 514 m (37 ft 9¼ in)
to base of tail unit 7 662 m (25 ft 1¾ in)
to base of envelope 3 00 m (9 ft 10 in)
DIMENSIONS, INTERNAL:
Envelope volume:
helium/oxygen 5,800 m³ (204,825 cu ft)
hot air 4,860 m³ (171,629 cu ft)
total 10,660 m³ (376,455 cu ft)
WEIGHTS AND LOADINGS:
Weight empty 6,150 kg (13,558 lb)
Fuel weight 200 kg (441 lb)
Max payload 2,150 kg (4,740 lb)
Max T-O weight 8,500 kg (18,739 lb)
PERFORMANCE (estimated):
Max level speed 59 kts (110 km/h, 68 mph)
Cruising speed 43 kts (80 km/h; 50 mph)
Pressure ceiling 2,000 m (6,560 ft)

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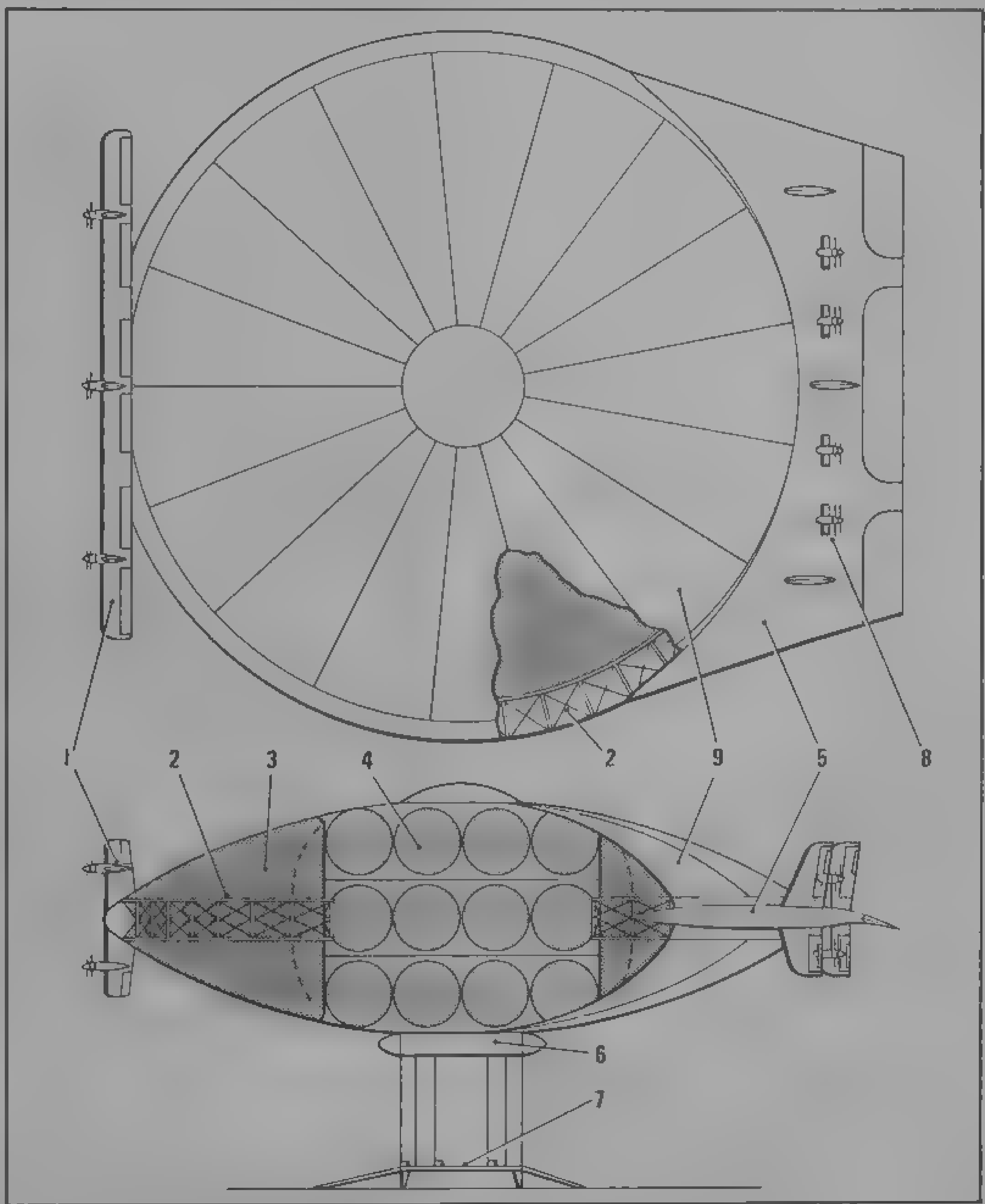

Structural details of the Thermoplane ALA-600
1. Front vertical and horizontal stabilisers
2. Internal hull construction
3. Hot air volume
4. Oxygen/helium spheres
5. Rear stabiliser
6. Fuselage module
7. Cargo platform
8. Engines
9. Hull skin

1993

THERMOPLANE ALA-600

TYPE: Projected 600 tonne Thermoplane.
PROGRAMME: First flight planned for late 1995, service entry by 2000.
ACCOMMODATION: Crew of four per shift (16 total), plus 150 passengers or equivalent cargo.
DIMENSIONS, EXTERNAL:
Length overall 210 0 m (688 ft 11¾ in)
Envelope: Diameter 198.0 m (649 ft 7½ in)
Max depth 82.0 m (269 ft 2½ in)
Cargo platform: Diameter 30 0 m (98 ft 5 in)
Height 6 0 m (19 ft 8¼ in)
WEIGHTS AND LOADINGS:
Fuel weight 190.000 kg (418,878 lb)

Max payload	600,000 kg (1,322,772 lb)
Max T-O weigh	1,200,000 kg (2,645,544 lb)

PERFORMANCE (estimated):

Max level speed	97-108 kts (180-200 km/h; 112-124 mph)
Cruising speed	38 kts (70 km/h; 43 mph)
Pressure ceiling	7,000 m (22,965 ft)
Range	2,700 n miles (5,000 km; 3,107 miles)

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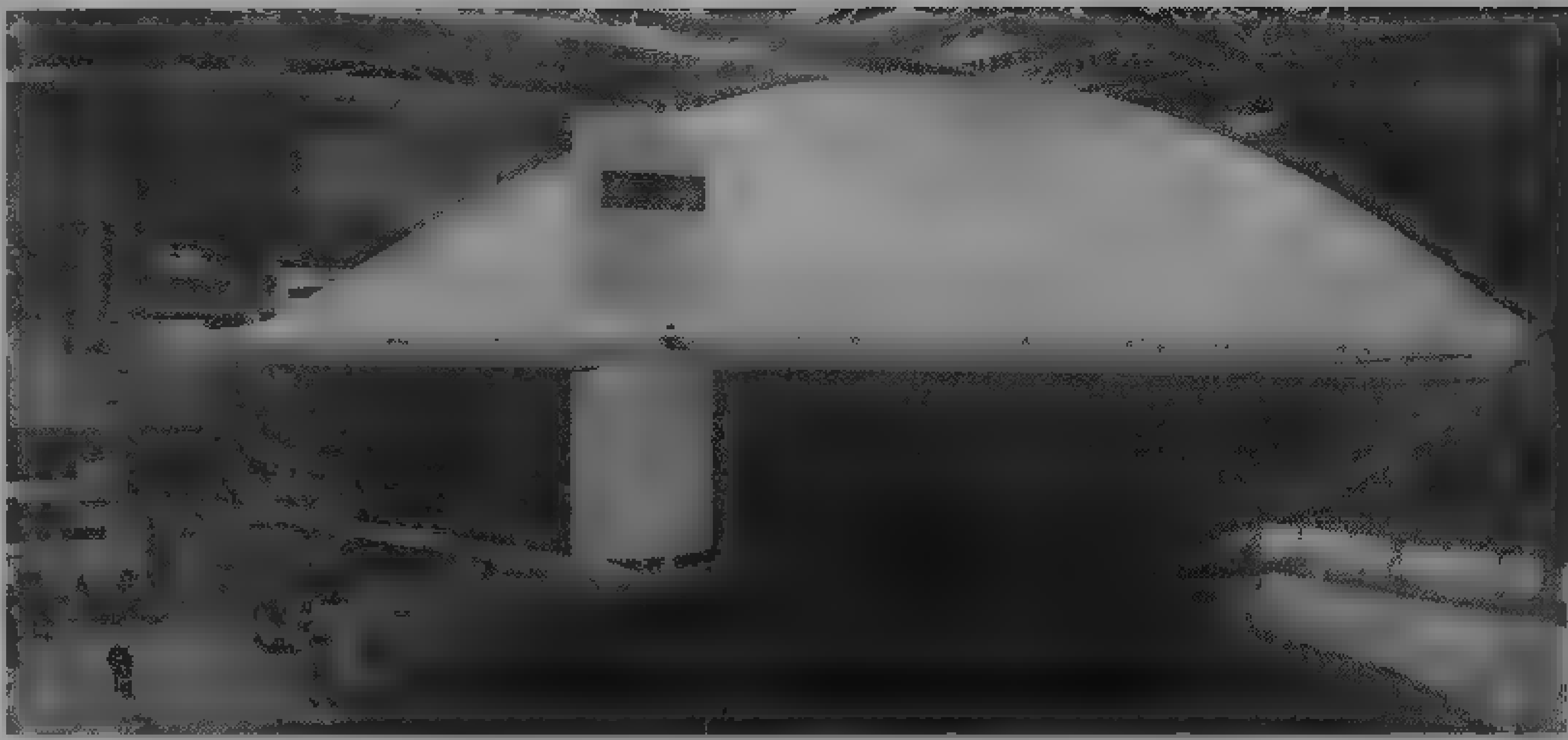
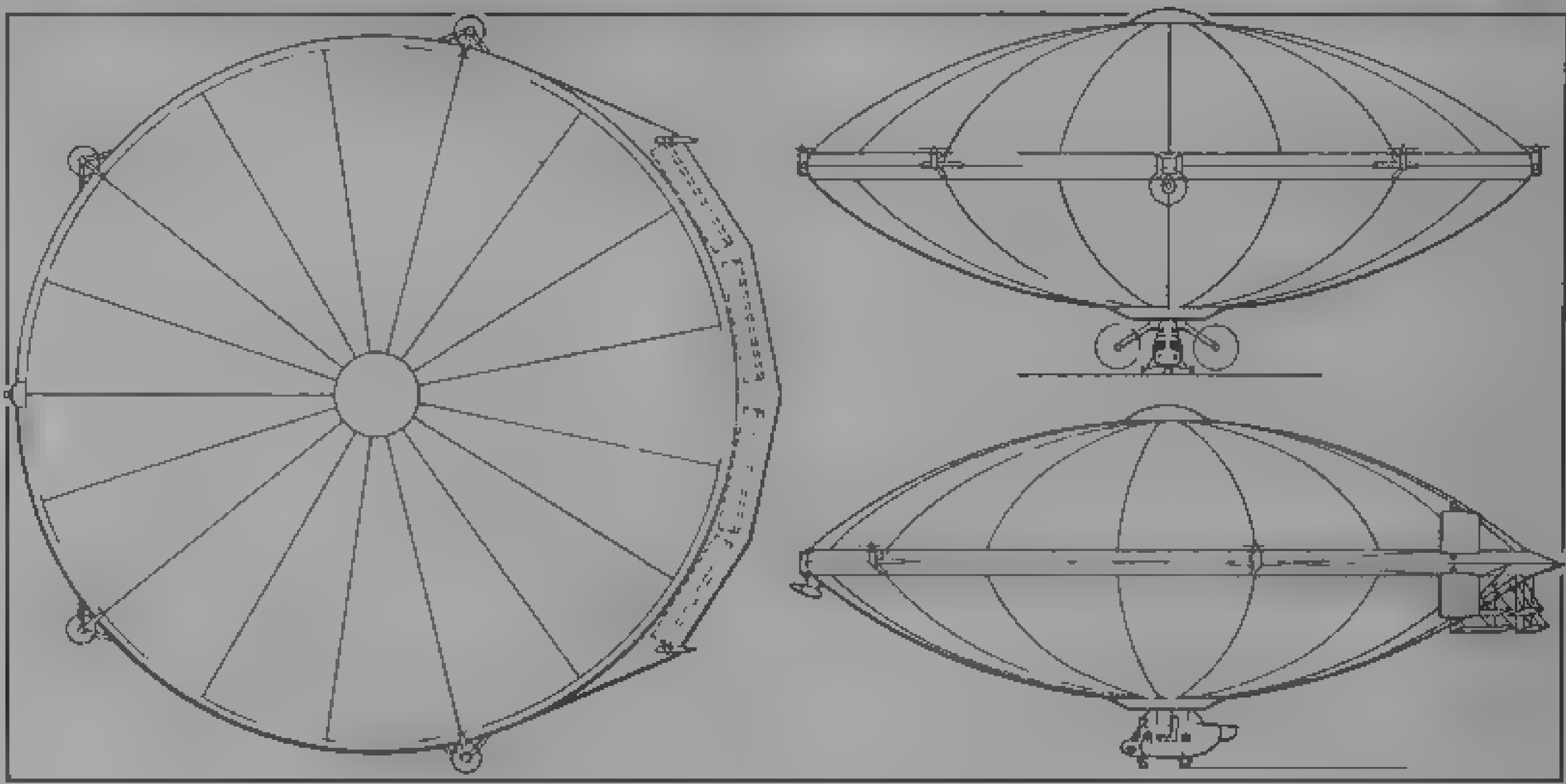


One of the ALA-40 proof-of-concept Thermoplanes under test at Ulyanovsk in mid-1992 *(Paul R. Duffy)* *1994*



Three-view drawing of the ALA-40 proof-of-concept Thermoplane *(Jane's/Mike Keep)* *1993*

UNITED KINGDOM

CAMERON

CAMERON BALLOONS LTD

St John's Street, Bedminster, Bristol BS3 4NH
Telephone: 44 (117) 963 7216
Fax: 44 (117) 966 1168
Telex: 444825 GASBAG G

MANAGING DIRECTOR:
D. A. Cameron
SALES DIRECTOR: Philip Dunnington

Cameron Balloons, formed in 1970, holds CAA, FAA, French CNT and German Musterzulassungsschein type certificates for its balloons. It is now world's largest manufacturer of special-shape and conventional hot-air balloons, and by 1 January 1995 had produced nearly 3,800 from main factory in Bristol and smaller unit at Harrogate. A sister company in Dexter, Michigan, USA, had then produced more than 800.

Details of Cameron's conventional-shape balloon range last appeared in the 1992-93 *Jane's*. The company acquired the balloon assets of the former Thunder & Colt Ltd in late 1994.

Cameron also designs and produces hot-air airships, being first company to develop a craft of this type. Production hot-air airships now include pressurised DP series. Helium-filled airships have included DG-14 and DG-19 single-seaters and DG-25 two-seater.

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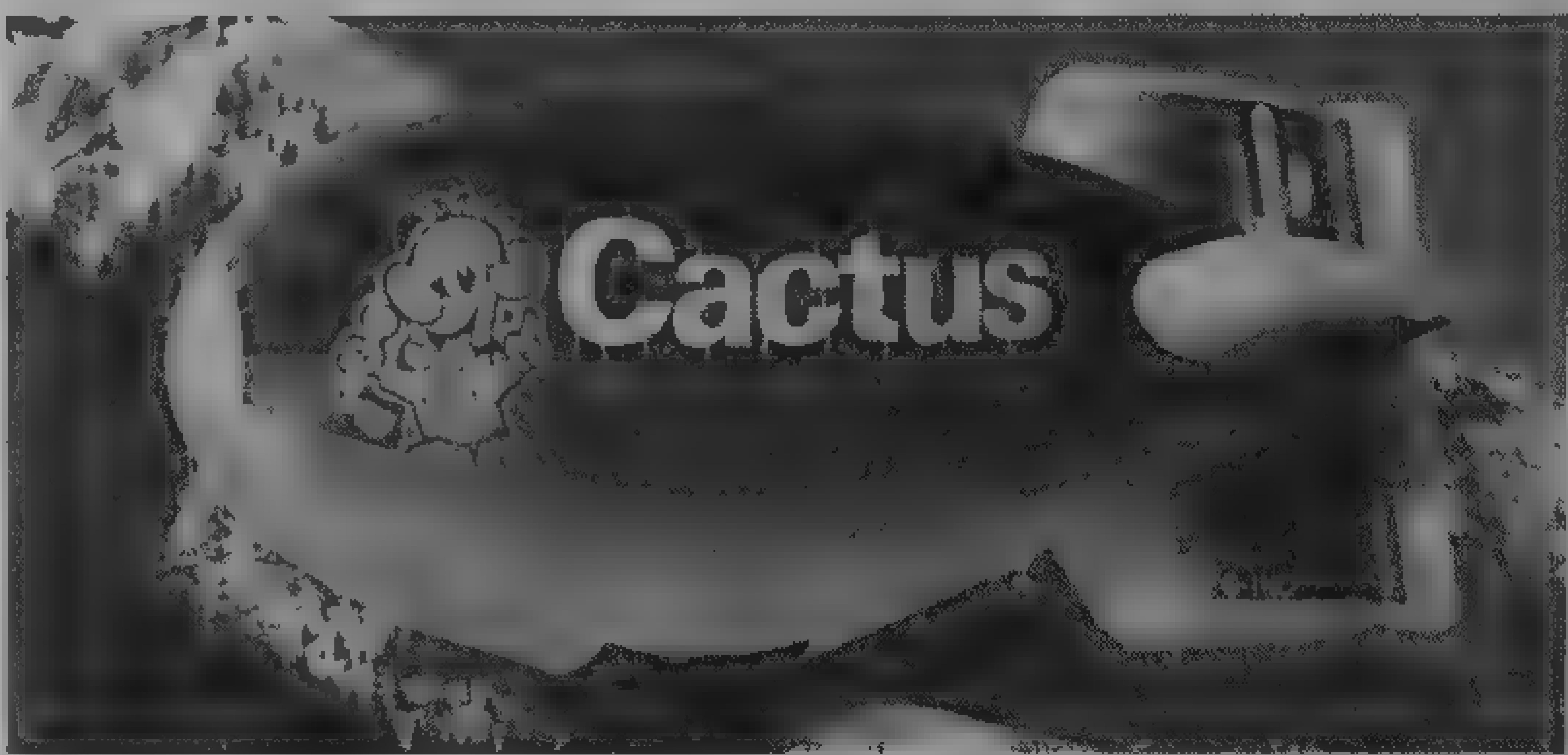


Cameron DP 80 hot-air airship for Luxembourg *1995*

CAMERON DP SERIES

TYPE: Pressurised hot-air airships; figures in designations indicate volume in thousands of cubic feet.

PROGRAMME: DP prototype (G-BMEZ) made first flight April 1986, DP series first/second/third in World Hot-Air Airship Championships 1990; DP 70 first in British and European Championships 1991, DP 80 holds current world endurance record and in 1994 received CAA approval for night flying.

CURRENT VERSIONS: **DP 60:** Single/two-place.

DP 70: As DP 60, but larger envelope, two-seater.

DP 80: Two-seater, with better performance in hot/high conditions.

DP 90: Larger envelope version of DP 80.

CUSTOMERS: By 1 January 1995 Cameron had completed, in addition to DP 50 prototype, 29 DP series airships, customer countries comprise Australia, Belgium, Brazil, Chile, Czech Republic, Germany, Hungary, Luxembourg, Switzerland, UK, USA and Venezuela.

DESIGN FEATURES: Differ from earlier hot-air airships in utilising single engine for both propulsion and pressure control. Cameron self regulating pressure control system; can be flown unpressurised in event of engine failure and landed like hot air balloon. Twin silencers minimise engine noise level; ergonomically designed cockpit.

STRUCTURE: All-aluminium gondola. Envelope incorporates twin pressure relief valves and Hyperlast fabric top.

POWER PLANT: One 21 kW (28 hp) König SD 570 four-cylinder two-stroke engine standard for DP 60/70, optional for DP 80/90, driving a three-blade König shrouded pusher propeller. Standard engine for DP 80/90 is 47 kW (63 hp) Rotax 582 UL. Fuel capacity 22.7 litres (6 US gallons; 5 Imp gallons) of 40:1 two-stroke mixture for König engine; Rotax runs on unleaded automotive fuel.

ACCOMMODATION: Gondola seats one or two persons with full-harness seat belts. Full-height polycarbonate windscreen.

EQUIPMENT: Manometer, rev counter, fuel contents gauge, voltmeter, variometer, altimeter and thermistor. 12 V 30 Ah battery standard. Propane fuel in two Worthington, Cameron 599 or Cameron 426 tanks, according to model, with respective capacities of 77.3, 86.4 or 109 litres (20.4, 22.8 or 28.8 US gallons; 17, 19 or 24 Imp gallons) per tank. Manual piezoelectric or electronic ignition.

DIMENSIONS, EXTERNAL:

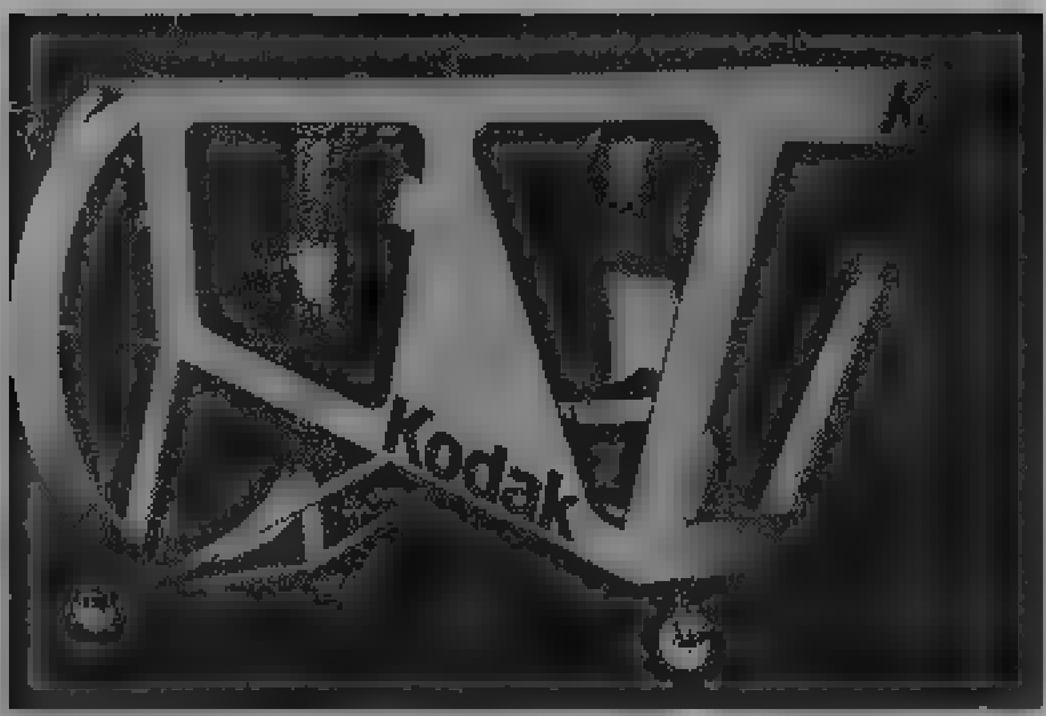
Envelope: Length overall: DP 60	30.48 m (100 ft 0 in)
DP 70	32.31 m (106 ft 0 in)
DP 80	33.83 m (111 ft 0 in)
DP 90	35.05 m (115 ft 0 in)
Height: DP 60	13.72 m (45 ft 0 in)
DP 70	14.63 m (48 ft 0 in)
DP 80	15.24 m (50 ft 0 in)
DP 90	15.54 m (51 ft 0 in)
Max width: DP 60	11.28 m (37 ft 0 in)
DP 70	11.89 m (39 ft 0 in)
DP 80	12.19 m (40 ft 0 in)
DP 90	12.80 m (42 ft 0 in)
Max display area per side: DP 60	86.96 m² (936 sq ft)
DP 70	95.97 m² (1,033 sq ft)
DP 80	91.97 m² (990 sq ft)
DP 90	99.03 m² (1,066 sq ft)

DIMENSIONS, INTERNAL:

Envelope volume: DP 60	1,699.0 m³ (60,000 cu ft)
DP 70	1,982.2 m³ (70,000 cu ft)
DP 80	2,265.3 m³ (80,000 cu ft)
DP 90	2,548.5 m³ (90,000 cu ft)

WEIGHTS AND LOADINGS:

Gondola (all models)	195 kg (430 lb)



Gondola of the Cameron DP series
1989

Envelope: DP 60	146 kg (322 lb)
Useful passenger load (S/L, 15°C)	
DP 60	149 kg (328 lb)
DP 70	222 kg (489 lb)
DP 80	285 kg (628 lb)
DP 90	359 kg (791 lb)
Max T-O weight: DP 60: one person	469 kg (1,034 lb)
two persons	546 kg (1,204 lb)
DP 70: one person	485 kg (1,069 lb)
two persons	562 kg (1,239 lb)
PERFORMANCE:	
Max level speed: DP 60	15 kts (28 km/h, 17 mph)

UPDATED

CAMERON AS 80 Mk II and AS 105 Mk II

TYPE: Hot-air airship.

PROGRAMME: AS 80 Mk II developed and certificated by Thunder & Colt 1988.

CURRENT VERSIONS: **AS 80 Mk II**: *Description applies to this version except where indicated.*

AS 105 Mk II: As AS 80 except for larger envelope.

CUSTOMERS: Total of 18 AS 80 Mk II and AS 105 Mk II built by Thunder & Colt by 1 January 1994, including two **AS 80 GD** for GEFA Flug of Germany (which see).

DESIGN FEATURES: Envelope fineness ratio 2.5; cruciform tail surfaces with rudder on each vertical fin; twin catenary load suspension system distributes loads of gondola weight and power plant forces evenly into envelope.

FLYING CONTROLS: Burners located inside envelope and operated electrically, with manual override; pilot lights fitted with electric spark and piezoelectric ignition, specially modified to operate directly underneath inflation fan without blowing out; steering by rudder on each vertical fin, operated by cables connecting them to gondola.

STRUCTURE: Envelope made from HTN90K high-tenacity and high-temperature-resistant fabric; engine drives generator supplying electric fan used to pressurise envelope, additional air for envelope pressurisation via scoop located in propeller slipstream. Gondola is stainless steel tube spaceframe with aluminium skin panels; windscreen, of polycarbonate sheet, forms partially enclosed cockpit.

LANDING GEAR: Non-retractable tricycle type.

POWER PLANT: One 38.8 kW (52 hp) Rotax 462 two-cylinder water-cooled engine, driving a two-blade pusher propeller.

ACCOMMODATION: Pilot and one passenger in tandem; second seat can be replaced by auxiliary fuel tank.

AVIONICS: *Comms:* 720-channel VHF transceiver and pilot/passenger intercom optional.

Instrumentation: Altimeter, variometer, envelope temperature and pressure gauges, propane volume gauge, petrol level gauge, voltmeter, engine water temperature and engine rpm gauge.

Cameron AS 80 Mk II single/two-person hot-air airship
1993

Cameron R-77 transatlantic Rozière balloon
1992

DIMENSIONS, EXTERNAL:	
Envelope: Length overall: 80	31.00 m (101 ft 8½ in)
105	34.00 m (111 ft 6½ in)
Max diameter: 80	12.40 m (40 ft 8¼ in)
105	13.87 m (45 ft 6 in)
Gondola: Length overall: 80, 105	3.84 m (12 ft 7¼ in)
Max width: 80, 105	1.75 m (5 ft 9 in)
Height overall: 80, 105	1.80 m (5 ft 11 in)
Propeller diameter: 80, 105	1.57 m (5 ft 2 in)
DIMENSIONS, INTERNAL:	
Envelope volume: 80	2,123.8 m³ (75,000 cu ft)
105	2,973.3 m³ (105,000 cu ft)
WEIGHTS AND LOADINGS:	
Envelope: 80	190 kg (419 lb)
105	213 kg (469 lb)
Gondola, empty: 80, 105	210 kg (463 lb)
Propane fuel: 80, 105	60-110 kg (132-242 lb)
Gross lift: 80	600 kg (1,323 lb)
PERFORMANCE:	
Max level speed: 80, 105	20 kts (37 km/h, 23 mph)
Max endurance: 80, 105	2 h 30 min

UPDATED

CAMERON DG-14

TYPE: Non-rigid helium airship.

PROGRAMME: First flight (G-BRDU) October 1989; trials completed 1990; certificated to BCAR 31, 20 February 1991; made 54 n mile (100 km, 62 mile) flight in 1993, piloted by Don Cameron. No further examples yet built. Details in 1994-95 and earlier editions.

UPDATED

CAMERON ROZIERE BALLOONS

Rozières are combination helium/hot-air balloons in which small propane burner maintains helium efficiency at night when solar heating is absent, providing greatly extended flight duration without expending helium or sand ballast. Cameron manufactures seven types: the R-15, R-42, R-60, R-77, R-150, R-225 and R-700. An R-60 (illustrated in 1991-92 *Jane's*) made first UK to USSR balloon flight in October 1990. Another R-60 completed east-west Atlantic crossing (Canary Islands to Venezuela) in February 1992; three Rozières successfully completed 1992 transatlantic race (crews of two others rescued safely), several more under construction for other long-distance flights, including Autumn 1995 transatlantic race and one for an attempt to make first round-the-world flight.

UPDATED

LINDSTRAND

LINDSTRAND BALLOONS LTD

Maesbury Road, Oswestry, Shropshire SY10 8ZZ
Telephone: 44 (1691) 671717
Fax: 44 (1691) 671122
MANAGING DIRECTOR: Per Lindstrand

Company formed November 1992 with initial workforce of 25; planned product range will include airships and balloons, in sizes from one-man to passenger-carrying. Early work included repurchase of GA 42 airships 01 and 02 (see Thunder & Colt entry in 1994-95 *Jane's*) from Imperial Airships for refurbishment and resale; also makes inner envelopes for Virgin Lightships (see ABC entry in US section).

UPDATED

LINDSTRAND AS 300

TYPE: Very large hot-air airship.

PROGRAMME: Ordered August 1992 by Dany Cleyet Marrel for botanical research into deterioration of rain forests, planned deployment in Borneo and Sumatra in 1993 postponed for political and other reasons, but was used in Myanmar in 1994.

DESIGN FEATURES: Enlarged and improved version of Thunder & Colt AS 261 (see 1991-92 *Jane's*) which flew 260 hours and made 82 raft drops; drops large, man-carrying inflatable raft on to tree canopy (only type of aircraft able to do this without damage to canopy). World's largest hot-air airship.

Same envelope cross-section as AS 261, but longer and with more rounded tail end; redesigned cruciform tail surfaces with new air distribution system, new catenary load curtain to inhibit pitch instability, upgraded gondola; more powerful engine (89.5 kW, 120 hp instead of 75 kW, 100 hp), with twin thrust reverser vanes aft of propeller. Changes make it faster and more manoeuvrable than AS 261.

ACCOMMODATION: Pilot and six passengers.

DIMENSIONS, INTERNAL:	
Envelope volume	8,495 m³ (300,000 cu ft)
WEIGHTS AND LOADINGS:	
Inflatable raft	680 kg (1,500 lb)

UPDATED

LINDSTRAND HS 110

TYPE: Hot-air airship.

PROGRAMME: Designed 1994, and several features tested that year on the AS 300 airship (see previous entry). First example was due to fly Spring 1995, expected to behave like a gas airship.

CUSTOMERS: Four firm orders placed by mid-January 1995.

DESIGN FEATURES: Designed using latest computer-aided design technology. Conventional-shape envelope with cruciform tailfins and small ventral gondola; envelope can carry advertising artwork directly on fabric or on three banners (one each side and one under nose) which are attached by Velcro and can be changed in less than 1 hour.

FLYING CONTROLS: Burners activated from electrical switches on top of joystick located on control panel between seats. Rudder on each vertical fin.

STRUCTURE: Envelope is of high-tenacity polyamide fabric with heat-resistant polyurethane coating, double-fell, twin-needle seams reinforced with load tape, catenary load curtain and four gondola suspension cables each side. Tail fins, inflated through fan in gondola, have much higher pressure than envelope and thus stay rigid even in full turns. Monocoque gondola built of glassfibre, Kevlar and carbonfibre. All metal components are of stainless steel or anodised aluminium.

LANDING GEAR: Non-retractable tricycle type.

POWER PLANT: One 48.5 kW (65 hp) Arrow GT 500 air-cooled flat-twin engine, driving a three-blade composites propeller. Fuel capacity 35 litres (9.25 US gallons, 7.7 Imp gallons). Modified Lindstrand Jetstream double burner for hot air supply (see under Weights and Loadings for fuel quantity). Burners can be fired singly or as a pair.

ACCOMMODATION: Side by side seats for pilot and one passenger in gondola, behind polycarbonate windscreen

AVIONICS: *Instrumentation*: Altimeter, variometer, envelope temperature and pressure gauges, engine rpm indicator and engine cylinder head temperature gauge.

DIMENSIONS, EXTERNAL:

Length overall	34.00 m (111 ft 6½ in)
Envelope max diameter	13.20 m (43 ft 3¾ in)
Envelope fineness ratio	2.575
Width over tailfins	14.80 m (48 ft 6¾ in)
Height overall	15.80 m (51 ft 10 in)
Wheel track	1.75 m (5 ft 9 in)
Gondola: Length	3.00 m (9 ft 10 in)
Max width	1.65 m (5 ft 5 in)
Height (incl landing gear)	1.80 m (5 ft 10¾ in)

DIMENSIONS, INTERNAL:

Envelope volume	3,125 m³ (110,358 cu ft)

AREAS:

Side banner displays (each)	300.0 m² (3,229.2 sq ft)
Nose banner display	14.0 m² (150.7 sq ft)

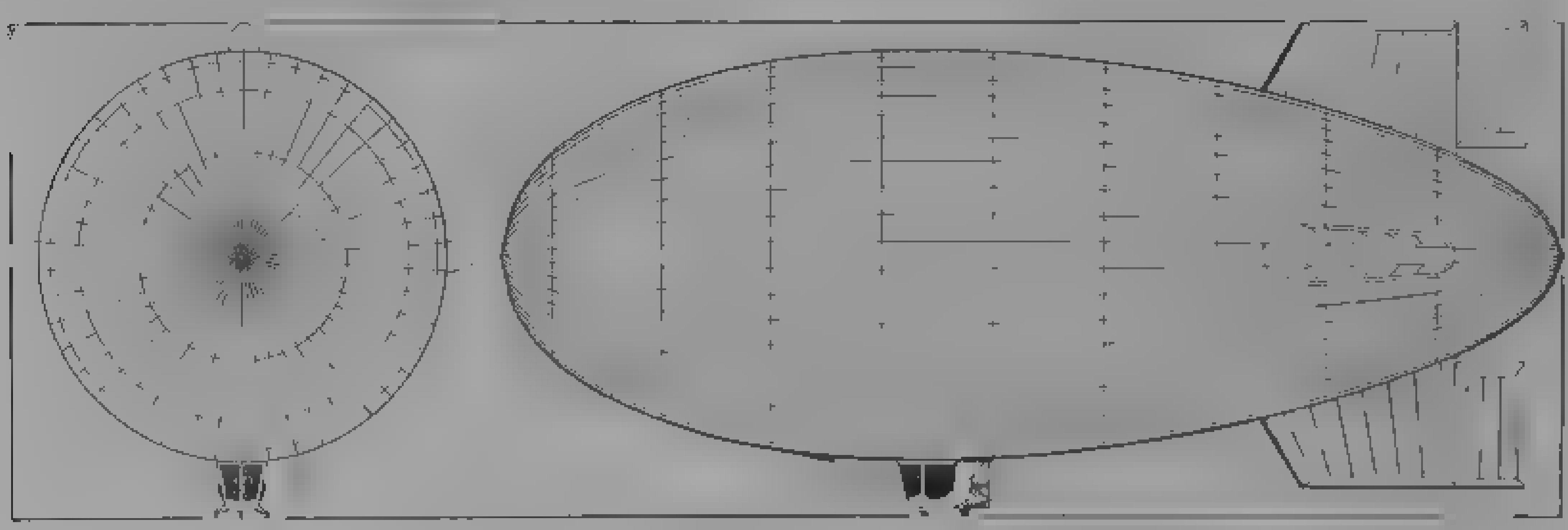
WEIGHTS AND LOADINGS:

Envelope	170 kg (375 lb)
Gondola, empty	184 kg (405 lb)
Burner fuel: standard	80 kg (176 lb)
max (solo pilot)	120 kg (264 lb)

PERFORMANCE (estimated):

Max level speed	20 kts (37 km/h, 23 mph)
Normal cruising speed	10-12 kts (18-22 km/h, 11-14 mph)
Endurance: standard burner fuel	2 h
max burner fuel	more than 3 h

NEW ENTRY



Lindstrand HS 110 two-seat hot-air airship

1995

PIG

PROMOTIONAL IDEAS GROUP

15 Winchendon Road, Teddington, Middlesex TW11 0SU
Telephone/Fax: 44 (181) 943 1868 or (1628) 34290
MANAGING DIRECTOR: Doug Smith
TECHNICAL DIRECTOR: Jeremy Russell

Partnership formed 1993, primarily to design and build a remotely controlled airship for advertising and aerial filming. First prototype, already tested, was designated PIG 1.

NEW ENTRY

PIG 2

TYPE: Small non-rigid helium airship.

PROGRAMME: Redesigned and re-engineered development of PIG 1; due to fly mid-1995. Suitable for advertising and remote filming. Once perfected, will form basis for larger manned airship.

DESIGN FEATURES: Four-fold power increase compared with PIG 1; high power/weight ratio permits flight in non-perfect conditions. Assembly, including inflation, takes approximately 1 hour; when deflated is fully portable and can be carried in typical estate car.

FLYING CONTROLS: Remote radio control via seven-channel PCM unit: computer channel mixing for rudder, elevator and engine thrust vector control, one channel configured to operate emergency dump valve.

STRUCTURE: Spinnaker outer shell with foil laminate inner envelope incorporating quick-release safety mechanism.

POWER PLANT: Two high-performance 2.05 kW (2.75 hp) electric motors, powered by two 22- to 28-cell, 5,000 mAh (26.4 to 33.6 V) Ni/Cd batteries. Engines rotate 90° up/90° down to vector thrust for climb and descent, and can each run independently in forward or reverse direction.

Appropriately decorated envelope of the remotely controlled PIG 2 non-rigid

1995

AVIONICS: *Comms*: Two PCM receivers: one for engine control, one for tail surface and dump valve actuation.

DIMENSIONS, EXTERNAL:

Length overall	8.25 m (27 ft 0¾ in)
Max diameter	2.40 m (7 ft 10½ in)
Propeller diameter	0.36-0.46 m (14-18 in)

DIMENSIONS, INTERNAL:

Envelope volume	24.0 m³ (847.5 cu ft)

WEIGHTS AND LOADINGS:

Free payload, depending upon battery configuration	4-8 kg (8.8-17.6 lb)
Max T-O weight	22 kg (48.5 lb)
Gross lift	26 kg (57.3 lb)

PERFORMANCE (estimated):

Max level speed	30-40 kts (55-74 km/h, 34.5-46 mph)
Cruising speed	10 kts (18.5 km/h, 11.5 mph)
Max operating height	1,000 m (3,280 ft)
Max range	1,000 m (3,280 ft)
Endurance, at max speed	15 min
at cruising speed	1 h

NEW ENTRY

THUNDER & COLT

Thunder & Colt went into receivership 7 November 1994. Purchase of balloon assets by Cameron Balloons Ltd (which see) announced 8 December 1994; no purchaser of airship assets found at time of going to press.

UPDATED

UNITED STATES OF AMERICA

ABC

AMERICAN BLIMP CORPORATION

1900 North-East 25th Avenue (Suite 5), Hillsboro, Oregon 97124
Telephone: 1 (503) 693 1611
Fax: 1 (503) 681 0906
PRESIDENT: James Thiele
EXECUTIVE VICE-PRESIDENT: Charles Ehrler
CHIEF ENGINEER: Rudy Bartel

VERIFIED

ABC A-60 PLUS LIGHTSHIP

TYPE: Five-seat non-rigid helium airship.

PROGRAMME: A-50 prototype (see 1990-91 *Jane's*) made first flight 9 April 1988; first flight of production A-60 (1991-92 *Jane's*) June 1989; A-60 certificated by FAA 18 May 1990 for day/night and VFR/IFR flight; first delivery (to Virgin Lightships Ltd) November 1990; A-60 Plus certificated Autumn 1991 by FAA; APU upgrade certificated by FAA.

One of the Lightships operated by Lightships Group

1994

and FLIR Systems Inc infra-red gyrostabilised camera approved by FAA, in 1993, all A-60s converted to A-60 Plus in 1993

CURRENT VERSIONS: **A-60:** Initial production version, described in 1991-92 *Jane's*. All now converted to A-60 Plus

A-60 Plus. Current version from 1991, larger envelope, payload increased by 181 kg (400 lb) compared with A-60; Lightsign message board option from 1992. *Description applies to this version*

CUSTOMERS: Eight in operation by Spring 1995 with Lightships Group (merger of Virgin Lightships and Lightship America Inc). Nos 8 and 9 delivered in 1994 (to Brazil and China respectively)

DESIGN FEATURES: Conventional shape envelope; cruciform tail surfaces, gondola suspended by 12 catenary cables each attached to external patches, eliminating need for internal cables, gastight fittings and bellow sleeves. Can be inflated without a net by attaching ballasted gondola before adding helium, gondola can be removed from inflated Lightship without a net by ballasting catenary cables

FLYING CONTROLS: Single internal ballonet; rudder or elevator on each of four tailfins, primary flight controls for left-hand front seat only

STRUCTURE: Outer envelope skin of Dacron/Mylar with separate urethane film inner gastight bladder and single ballonet. All structural attachments to sewn outer bag, such as nose mooring, fin base and guy wires, car catenary and handling lines, made with webbing reinforcements sewn directly to envelope

LANDING GEAR: Single twin-wheel unit beneath gondola; small tailwheel at base of lower vertical fin

POWER PLANT: Twin 60 kW (80 hp) Limbach L 2000 engines, pusher-mounted to enhance propulsive efficiency and reduce noise. Standard capacity of rear-mounted fuel tank is 280 litres (74 US gallons, 61.6 Imp gallons); can be refuelled in the field without mooring

ACCOMMODATION: Two single seats and three-person rear bench seat in gondola

SYSTEMS: APU capable of delivering 2.5 kW at 110 V certificated December 1993 and now standard. Used mainly to power internal illumination lights, but can be used also for other airborne equipment

EQUIPMENT: Certificated for gyrostabilised TV camera mount, complete with microwave downlink for live broadcast, can be operated simultaneously with APU

DIMENSIONS, EXTERNAL:

Envelope: Length overall	39.01 m (128 ft 0 in)
Max diameter	10.01 m (32 ft 10 in)
Fineness ratio	3.80
Gondola: Length overall	3.96 m (13 ft 0 in)
Width	1.52 m (5 ft 0 in)
Height overall	2.90 m (9 ft 6 in)
Propeller diameter	1.52 m (5 ft 0 in)

Gondola and power plant of the A-60 Plus Lightship *1993*

DIMENSIONS, INTERNAL:

Envelope volume	1,925.5 m³ (68,000 cu ft)
Gondola: Cabin length	2.74 m (9 ft 0 in)
Cabin height	1.83 m (6 ft 0 in)

AREAS:

Tailfins (four, total)	42.74 m² (460.0 sq ft)

WEIGHTS AND LOADINGS:

Total weight empty	1,216 kg (2,680 lb)
Max buoyancy	1,814 kg (4,000 lb)
Max dynamic lift	113 kg (250 lb)
Max useful lift, ISA at 656 m (2,000 ft)	680 kg (1,500 lb)
Max gross weight	1,993 kg (4,394 lb)

PERFORMANCE:

Max level speed	46 kts (85 km/h, 53 mph)
Max rate of ascent	457 m (1,500 ft)/min
Service ceiling	2,225 m (7,300 ft)
Max rate of descent	396 m (1,300 ft)/min
Min T-O distance	112 m (366 ft)
Max range at 35 kts (65 km/h, 40 mph)	521 n miles (965 km, 600 miles)
Max endurance at 35 kts (65 km/h, 40 mph)	15 h

UPDATED

ABC A-120 LIGHTSHIP

Conceptual study continues for nine-passenger development with 3,398 m³ (120,000 cu ft) envelope and stretched gondola. Power plant to be decided, but performance expected to be comparable to that of A-60 Plus

VERIFIED

AEROS

WORLDWIDE AEROS CORPORATION

485 Aviator Drive, Atwater, California 95301
Telephone: 1 (209) 357 7000
Fax: 1 (209) 357 0591
PRESIDENT: Igor Pasternak
COMMUNICATIONS: Irina Svirid

Company specialises in developing and manufacturing airships and tethered aerostats for such applications as atmospheric research, advertising and surveillance. Headquarters and main production facilities moved in October 1993 from Ukraine (see 1993-94 *Jane's*) to California, where activities by May 1994 included full-scale production of several modifications of tethered aerostats used for advertising, aerial photography and environmental research

UPDATED

The Aeros 50-02 *Dina* in the hangar at Castle AFB, California *1995*

AEROS-50

TYPE: Semi-rigid helium airship

PROGRAMME: Original prototype was nearing completion in Ukraine by Spring 1993, but following transfer of activity to USA Aeros undertook new, modified version, latter version, to which description applies, was completed in 1994 (N4236K); ground testing beginning in 1995 at Castle AFB, California. New design meets current FAA requirements

DESIGN FEATURES: Conventional shape envelope, with cruciform tail surfaces, capable of being flown by pilot with limited airship experience. Can be landed by pilot without groundcrew assistance, by using electric winch installed in gondola

FLYING CONTROLS: Two ballonets (one forward, one aft) provide attitude control by compensating for atmospheric changes. Ballonets are inflated with air by pressurising fan controlled manually by pilot; automatic valves respond when pressure limit is reached, in the event of fan malfunction, air is supplied via a duct aft of the propeller. Elevator or rudder on each tail surface. Envelope has helium valve which can be opened manually, but responds automatically when pressure ceiling is reached

STRUCTURE: Envelope of high-strength polyurethane fabric, tail surfaces of composite materials. Loads of gondola and propeller thrust distributed through two central and two side catenary curtains. Gondola has tubular aluminium frame and composites skin, with large window and door openings (including windows in ceiling) for maximum field of view (ceiling window permits observation of envelope internal structure). Engine is mounted on steel frame at rear of gondola

POWER PLANT: One 59.7 kW (80 hp) Rotax 912 flat four engine, driving a three-blade variable-pitch ducted pusher propeller. Fuel capacity 60.6 litres (16 US gallons, 13.3 Imp gallons)

SYSTEMS: Electrical power for avionics, instruments and mooring winch supplied by engine-driven generator, which also supplies a 17 Ah battery to provide back-up power for emergency use

DIMENSIONS, EXTERNAL:

Length overall	23.93 m (78 ft 6 in)
Width overall (tail span)	10.88 m (35 ft 8½ in)
Height overall	12.03 m (39 ft 4¾ in)
Envelope: Length	23.77 m (78 ft 0 in)
Max diameter	8.00 m (26 ft 3 in)
Gondola: Length	2.70 m (8 ft 10¼ in)
Max width	1.10 m (3 ft 7¼ in)
Max height	1.55 m (5 ft 1 in)
Propeller diameter	1.83 m (6 ft 0 in)

DIMENSIONS, INTERNAL:

Envelope volume	750.4 m^3 (26,500 cu ft)
Ballonet volume (two, total)	187.6 m^3 (6,625 cu ft)

AREAS:

Envelope surface, total	470.1 m^2 (5,060.0 sq ft)
Tail surfaces (four, total)	31.96 m^2 (344.0 sq ft)

WEIGHTS AND LOADINGS: No details received

PERFORMANCE:

Max level speed	78 kts (145 km/h; 90 mph)
Econ cruising speed	61 kts (112 km/h; 70 mph)
Pressure ceiling	1,500 m (4,920 ft)
Range at econ cruising speed, 20% reserves	521 n miles (965 km; 600 miles)
Max endurance	8 h

UPDATED

AEROS-500

TYPE: Projected 20-passenger rigid airship.

PROGRAMME: Design development continuing in 1994. No update received for 1995-96 edition; all known details in 1994-95 *Jane's*.

UPDATED

AEROS D-1 and D-4

TYPE: Cargo-carrying rigid helium airships.

PROGRAMME: Realisation of cargo airship project initiated in the former USSR in the 1970s, now being implemented under joint programme developed between Worldwide Aeros Corporation and the Ukrainian company Aeroplast; construction of D-1 subscale prototype scheduled to begin October 1995.

DESIGN FEATURES: Applications to include transportation of cargo internally or on external sling, flying crane; ship's escort, tourism. Conventional shape hull; sweptback vertical fin and rudder; T tailplane with sweptback leading-edge and one-piece elevator. Large cargo compartment inside hull.

FLYING CONTROLS: Computer-based flight and engine thrust control system.

STRUCTURE: Semi-monocoque rigid hull made up of three-ply CFRP panels, with plasma-sprayed aluminium film outer coating. Radially distributed internal ballonets (20) of Vectran fabric.

LANDING GEAR: Retractable quadricycle type.

POWER PLANT (D-1): Two 224 kW (300 hp) Zoche ZO 02A piston engines, one each side of hull near centre of buoyancy in ducted propulsion unit which can be vectored 120° up and 90° down; one rear-mounted 2,535 kW (3,400 shp) General Electric T64 turboprop. Fuel tanks on each side of cargo compartment.

POWER PLANT (D-4): Same arrangement as for D-1 except that selected engines will have power ratings of 746 kW (1,000 hp) for lateral units and 4,474 kW (6,000 shp) for main propulsion engine.

ACCOMMODATION: Gondola at forward end of cargo compartment is three-tier structure, with auxiliary compartments and living quarters on top deck (inside hull) and landing gear retraction bay beneath lower deck. Latter contains four-place cockpit at front (two pilots, navigator and flight engineer) and cargomaster's cockpit at rear, with stairs to upper deck between them on starboard side. Main cargo compartment is accessible in flight via passage from upper deck.

SYSTEMS: Electrical power supply 200/115 V AC (three-phase, 400 Hz) from 125 kW main and standby engine-driven generators and 27 V DC from two batteries and inverter. Hot air anti-icing of hull and tail unit, electrothermal anti-icing of propellers; combination of three systems for anti-icing of engines, rudder, elevator, observation windows, lights, AoA and pressure indicators and cargo platform locks.

DIMENSIONS, EXTERNAL:

Length overall: D-1	95.00 m (311 ft 8¼ in)
Height overall, excl landing gear:	
D-1	33.00 m (108 ft 3¼ in)
Hull length: D-1	84.00 m (275 ft 7 in)
D-4	168.00 m (551 ft 2¼ in)
Max diameter: D-1	25.00 m (82 ft 0¼ in)
D-4	50.00 m (164 ft 0½ in)
Tailplane span: D-1	22.40 m (73 ft 6 in)
Wheel track: D-1	8.20 m (26 ft 10¾ in)
D-4	24.00 m (78 ft 9 in)
Wheelbase: D-1	20.05 m (65 ft 9½ in)
D-4	52.00 m (170 ft 7¼ in)

DIMENSIONS, INTERNAL:

Hull volume: D-1	27,500 m^3 (971,155 cu ft)
D-4	220,000 m^3 (7,769,238 cu ft)
Cargo compartment:	
Length: D-1	16.00 m (52 ft 6 in)
D-4	50.00 m (164 ft 0½ in)
Max width: D-1	6.20 m (20 ft 4 in)
D-4	16.00 m (52 ft 6 in)
Max height: D-1	3.30 m (10 ft 10 in)
D-4	3.50 m (11 ft 5¾ in)
Volume: D-1	327.36 m^3 (11,560.6 cu ft)
D-4	2,800.0 m^3 (98,881.2 cu ft)
Gondola:	
Length: D-1	6.75 m (22 ft 1¾ in)
Max width: D-1	3.60 m (11 ft 9¾ in)
Height: D-1	4.70 m (15 ft 5 in)

AREAS:

Hull surface area: D-1	5,370 m^2 (57,802 sq ft)
Vertical tail surfaces: D-1	160 m^2 (1,722.2 sq ft)
Horizontal tail surfaces: D-1	100 m^2 (1,076.4 sq ft)

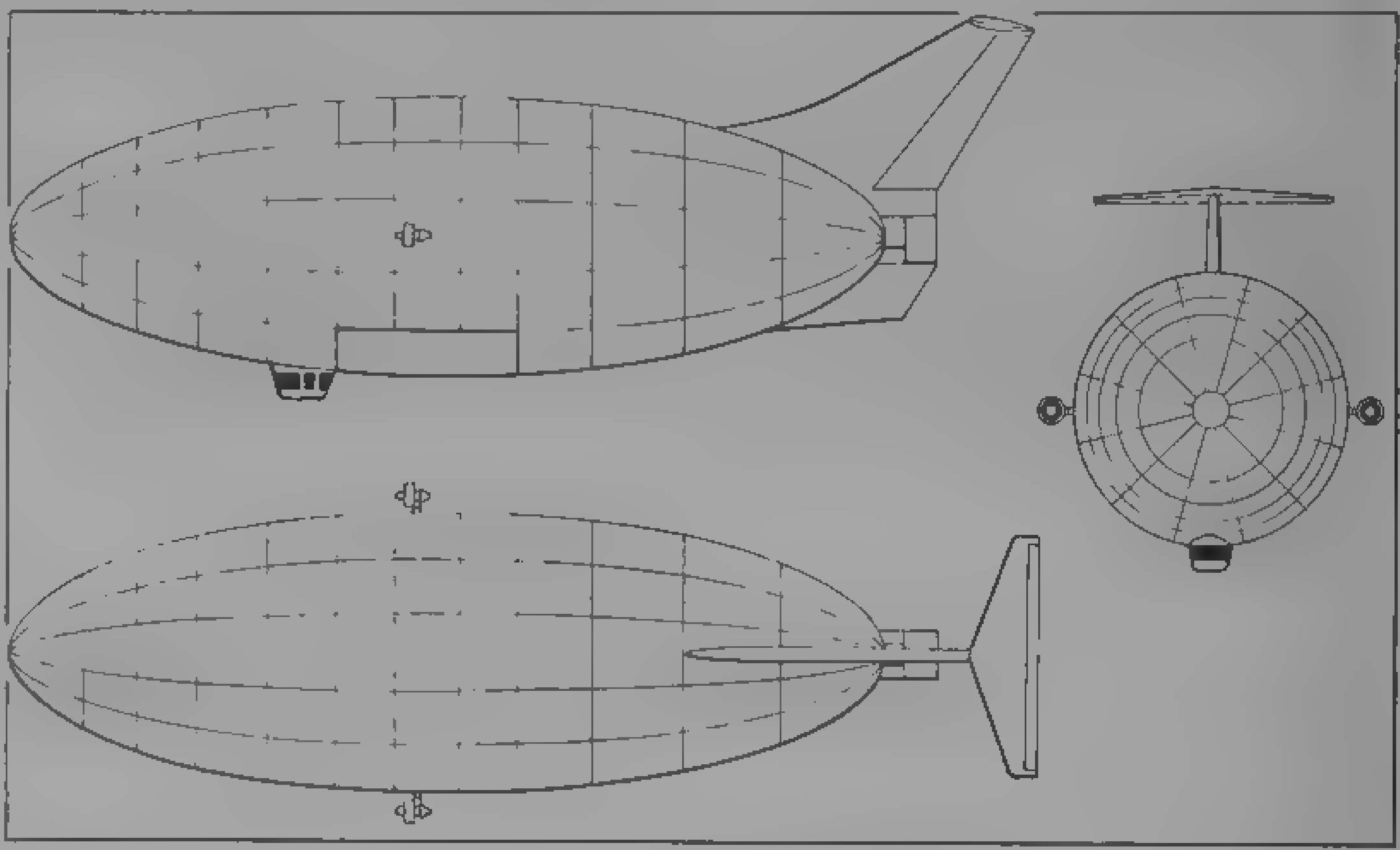
WEIGHTS AND LOADINGS:

Max payload, incl fuel:	
D-1	12,500 kg (27,558 lb)
D-4	125,000 kg (275,578 lb)

PERFORMANCE (estimated, both):

Max level speed	151 kts (280 km/h; 174 mph)
Cruising speed	124 kts (230 km/h; 143 mph)
Design altitude range	0-3,000 m (0-9,840 ft)

NEW ENTRY



Aeros D-1 subscale prototype for the D-4 large cargo airship *(Jane's/James Goulding)* *1995*

RAVEN/SCALED

RAVEN INDUSTRIES INC

PO Box 1007, Sioux Falls, South Dakota 57117-1007
Telephone: 1 (605) 336 2750
Fax: 1 (605) 335 0133
PRESIDENT: David A. Christensen
GENERAL MANAGER: Dale F. McAvoy

SCALED COMPOSITES INC

1624 Flightline, Mojave Airport, Mojave, California 93501-1663
Telephone: 1 (805) 824 4541
Fax: 1 (805) 824 4174
PRESIDENT: Burt (Elbert L.) Rutan
VICE-PRESIDENT AND GENERAL MANAGER: Michael W. Melvill

Sponsors

Hilton Hotels Corporation; Virgin Atlantic Airways; American Express, Miller Brewing Company, Nestlé USA

Contributing Sponsors

AlliedSignal Corporation, American West Airlines, Loral Defense Systems, Magnavox, McDonnell Douglas Space Systems, Rockwell Corporation

HILTON HOTELS PROJECT CONSULTANT: Erin Porter
9336 Civic Center Drive, Beverly Hills, California 90210
Telephone: 1 (310) 205 4347
Fax: 1 (310) 205 7800

Larry Newman of the USA, who crossed Atlantic in helium balloon *Double Eagle II* in 1978 and Pacific in *Double Eagle V* three years later, plans to attempt non-stop round-the-world flight in unique double balloon *Earthwinds Hilton*. Other crew members will be co-captains Richard Abruzzo and David Melton of the USA. Maj Gen Vladimir Dzhanibekov, a former Russian cosmonaut, is the project's scientific attaché. Objectives are to make first circumnavigation of the Earth in a manned balloon and to conduct tests of the Earth's atmosphere, including condition of ozone layer.

Balloon will carry wind data collection equipment on behalf of NASA and instrument package from US Desert Research Institute, to provide information on atmospheric turbulence and how jetstream bends, by measuring motion of balloon capsule and changes in atmospheric pressure and temperature. Russian experiments are named Obzor (survey), to measure thickness of ozone layer along flight path and ultraviolet radiation penetration into atmosphere; Impactor, to explore aerosol particle contamination; and SSD (solid-state detector), to measure background radiation at flight altitude to help determine intensity and composition of cosmic rays.

Supporting agencies are NASA and NOAA (National Oceanic and Atmospheric Administration) in the USA, and Yuri Gagarin Cosmonaut Training Centre in Russia. Balloon system is devised and manufactured by Raven Industries, capsule designed and built by Scaled Composites.

VERIFIED

EARTHWINDS HILTON

TYPE: Unique manned two-balloon system for global circumnavigation and research.

PROGRAMME: Planned for original launch window between 1 November 1993 and 28 February 1994 when conditions most favourable; tiedown break November 1993, 7 hour trial flight made on 12 January 1994, but launch not possible within original time frame; new window of opportunity awaited.

Launch will be from Reno Stead Airfield, Nevada; flight aimed to follow 45th parallel, within altitude band 9,750 to 10,670 m (32,000 to 35,000 ft), but could deviate anywhere between 30 and 60° N, overflying up to 73 countries, depending on air currents. Flight duration approximately 12 to 21 days.

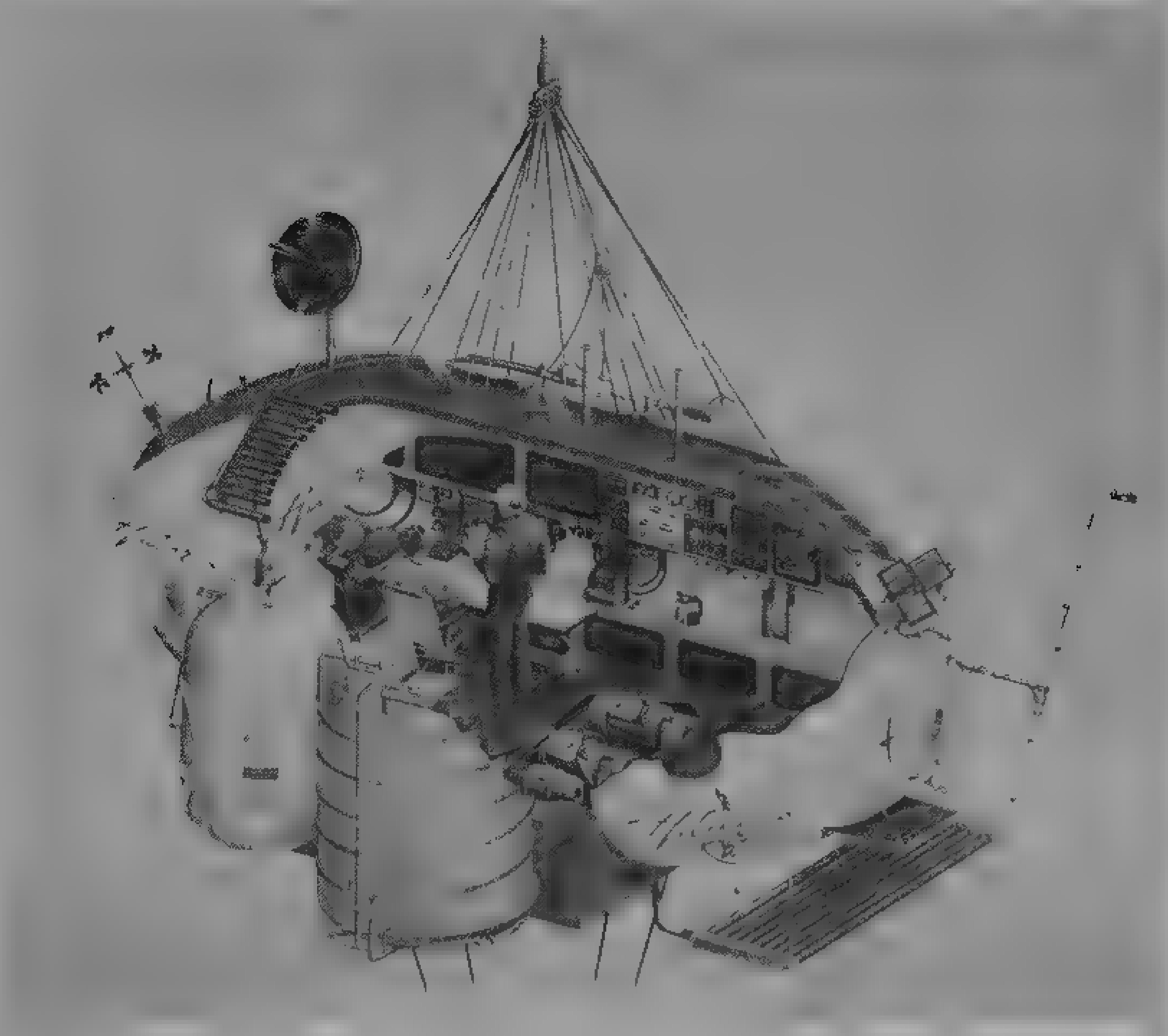
DESIGN FEATURES: Unique two-balloon system designed by Tim Lachenmeier of Raven Industries, upper one containing helium for lift, lower one acting as anchor, filled with air under pressure to act as ballast. Pressurised crew capsule, designed by Burt Rutan of Scaled Composites, suspended between upper and lower balloons.

FLYING CONTROLS: Upper (zero pressure) balloon has openings through which excess helium can vent automatically to equalise internal pressure with that of surrounding atmosphere; liquid helium from storage tanks can be gasified to replenish any helium lost during flight. Pilot initiates descent by releasing helium through three electric valves at top of balloon. Electric blower inside lower anchor balloon enables crew to pump additional air pressure into it to increase its displaced weight; varying this weight keeps combined system in virtually level flight.

STRUCTURE: Helium balloon fabricated from three layers of clear plastics astrofilm, reinforced with glassfibre load tapes; lower anchor balloon made from an extremely strong lightweight polyester material made by Winzen International. Crew capsule is of glassfibre and other high-performance fibres, bonded with epoxy resins; walls, ceilings and floors are covered with sound-absorbing materials.

ACCOMMODATION: Crew of three (see introductory paragraphs). Capsule pressurised to provide environment equivalent to 2,440 m (8,000 ft) above S/L; temperature controlled manually at 18 to 21°C (65 to 70°F) via external heat exchanger. Onboard amenities include astronaut-type meals, beds, bath, toilet with holding tank, movies, worldwide telephone link via satellite, and daily 'newspaper' received by fax. Interior decor, meals and travel kits by Hilton.

SYSTEMS: Two 7.5 kW (10 hp) Honda liquid-cooled petrol engines supply electrical power for life support systems, capsule pressurisation, electrical equipment and onboard



Artist's impression of the *Earthwinds Hilton*'s three-man crew capsule *(Bob Sandford/Loral Defense Systems)*
1994

The world's first 10 ton balloon system fully rigged, the *Earthwinds Hilton* will measure some 112.8 m (370 ft) from top to bottom
1994

experiments. Fuel for these engines (2,650 litres, 700 US gallons, 583 Imp gallons) in large tanks alongside capsule.
AVIONICS: Nav/com avionics provided by Bendix/King and NASA.
Comms: HF and VHF radio.
Flight: Satellite data via GPS to provide precise position and wind data information, downlink via Argos satellite to provide exact balloon location to operations centre at Reno Hilton, Cospas/Sarsat satellite locator transmitter to aid search and rescue in event of emergency.
DIMENSIONS, EXTERNAL:
Helium balloon:
Height at launch 54.86 m (180 ft)
Height at floating altitude 42.67 m (140 ft)
Diameter at launch 30.48 m (100 ft)
Diameter at floating altitude 42.67 m (140 ft)
Air balloon: Diameter 33.53 m (110 ft)
Crew capsule: Length 7.32 m (24 ft)
Diameter 3.05 m (10 ft)
DIMENSIONS, INTERNAL:
Helium balloon volume 31,148 m³ (1,100,000 cu ft)
Air balloon volume 19,734 m³ (696,910 cu ft)
WEIGHTS AND LOADINGS:
Crew capsule, empty 907 kg (2,000 lb)
Liquid helium 680 kg (1,500 lb)
Crew capsule at T-O 6,804 kg (15,000 lb)
Total T-O weight of capsule, fuel and inflated balloons 9,072 kg (20,000 lb)
PERFORMANCE:
Estimated average ground speed 65 kts (121 km/h; 75 mph)
Estimated average daily travel 1,564 n miles (2,897 km; 1,800 miles)

UPDATED

TCOM

TCOM LP

7115 Thomas Edison Drive, Columbia, Maryland 21046-2113
Telephone: 1 (410) 312 2400
Fax: 1 (410) 312 2455
VICE PRESIDENT, MARKETING: Stephen E. Silvoy

During the past 24 years TCOM has designed, manufactured and operated (up to February 1994) a total of 61 advanced tethered aerostat systems, mostly to support sophisticated radar systems at altitudes from 900 to more than 6,000 m (2,950 to above 19,685 ft). The aerostats have varied in length from 25 to 71 m (82 ft 0⅛ in to 232 ft 11¼ in), with volumes from 750 to 16,700 m³ (26,486 to 589,755 cu ft). they have operated, or are still operational, at sites in the USA, Caribbean, Bahamas, Canada, Middle East, Africa and Far East. TCOM experience includes development and deployment of such systems in Arctic, tropical and desert environments, and in mountainous terrain, conducting operations from fixed, road transportable and sea-based mooring installations. Current production types are the 32M and 71M.

UPDATED

TCOM 32M and 71M

TYPE: Helium filled non-rigid aerostats.
PROGRAMME: See introductory paragraph.
CURRENT VERSIONS: **32M**: Largest version of TCOM's transportable series of aerostat systems, can be mounted on a flatbed trailer, deployed from a ship or towed by a helicopter. Communications with surface use latest fibre optic technology, with both electrical power and optical fibres embedded in core of umbilical tether.
MATSS (Maritime Aerostat Tracking and Surveillance System): Latest and most versatile system offered for sea-based or land-based surveillance of littoral regions, utilises a fully coherent I/J band radar mounted on the 32M platform. When operated between 900 and 1,200 m (2,950 and 3,940 ft) the specially designed sea surveillance radar can detect 2 m² (21.5 sq ft) surface or air targets out to the line

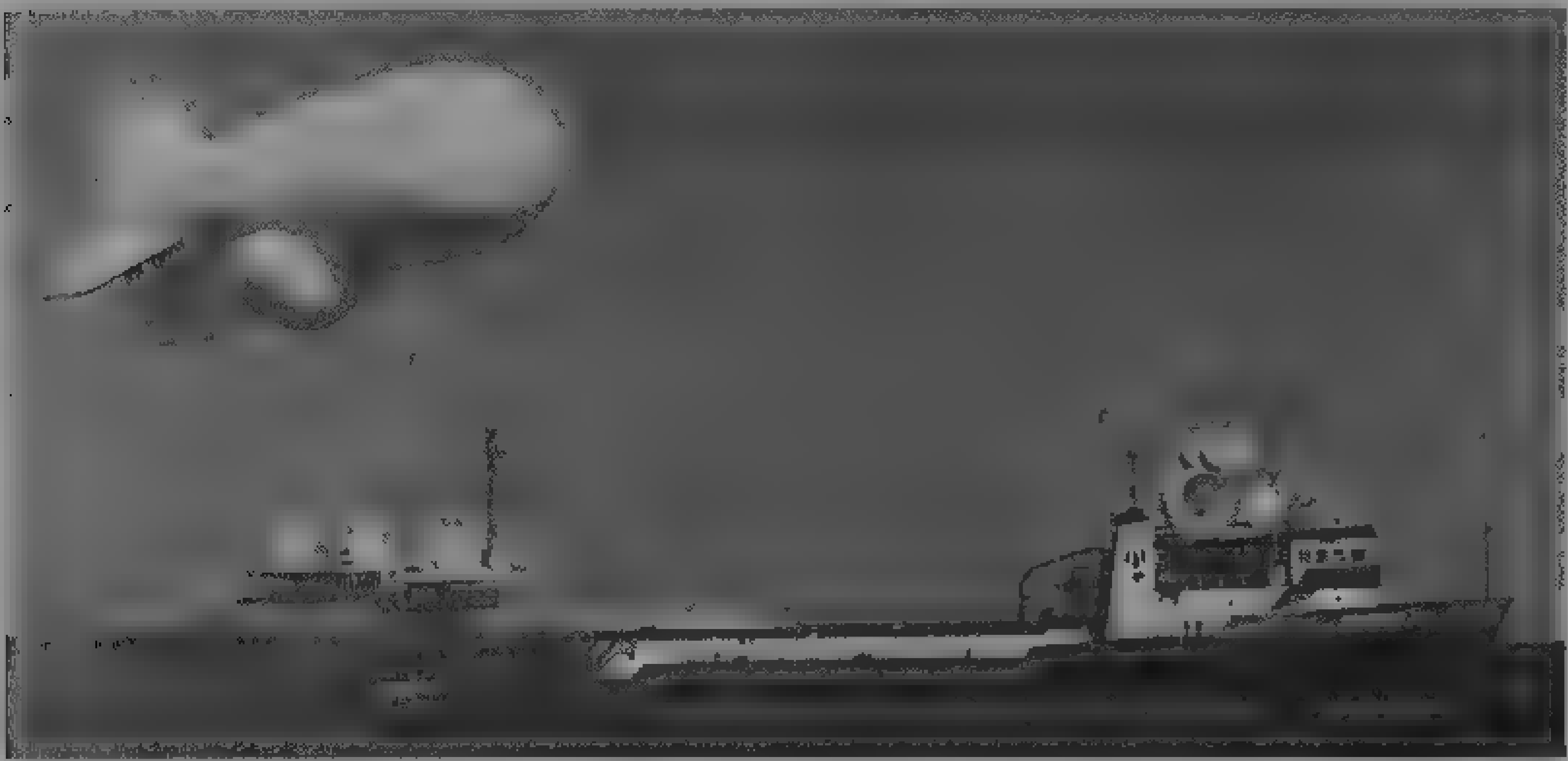
TCOM 71M LASS aerostat at its mooring mast. Ventral blister houses the radar antenna
1994

US CUSTOMS SERVICE

Fleet of 16 LASS aerostats in service or planned, operated for USCS by US Air Force and based as under, first four (Nos. 1, 2, 3 and 14) ordered October 1986, Nos. 7, 8, 9 and 10 were under construction in 1993. Intended to form unbroken surveillance line across southern border of USA and out to Bahamas

1. Yuma, Arizona
2. Fort Huachuca, Arizona
3. Deming, New Mexico
4. Marfa, Texas
5. Eagle Pass, Texas
6. Rio Grande, Texas
7. Matagorda, Texas
8. Morgan City, Louisiana
9. Alabama Point, Alabama
10. Horseshoe Beach, Florida
11. Venice, Florida
12. Cudjoe Key, Florida
13. High Rock, Bahamas
14. Georgetown, Bahamas
15. Great Inagua, Bahamas
16. Lajas, Puerto Rico

of sight horizon. In addition to radar, a GCI (ground-controlled intercept) radio relay system is incorporated to facilitate control of aircraft or surface vessel interceptors. Optional payloads include latest comint and direction finding equipment.



Ship-based MATSS, using the TCOM 32M aerostat as the radar platform

1994

71M: Largest TCOM aerostat in current production, can operate 24 hours per day for several weeks, flights need be interrupted only to avoid thunderstorms or for occasional helium top-up.

LASS (Low-Altitude Surveillance System): Ordered by US agencies and worldwide customers for long-range detection of small low-flying aircraft. Platform is 71M aerostat, carrying an all-solid-state D-band coherent radar (Westinghouse AN/TPS-63 derivative) known as E-LASS with a range capability of 173 n miles (320 km, 199 miles).

STRUCTURE: Multilayered synthetic fabrics, with bonded seams. Tether cable of braided Kevlar, with braided copper sheath to protect against lighting strikes.

CUSTOMERS: Include US Customs Service (see table), US Army, US Coast Guard, South Korea (eight), Kuwait (two), Saudi Arabia (one), UAE (one).

DIMENSIONS, EXTERNAL:	
Length overall: 32M	32.00 m (104 ft 11¾ in)
71M	71.00 m (232 ft 11¼ in)
DIMENSIONS, INTERNAL:	
Volume: 32M	1,700 m³ (60 035 cu ft)
71M	10,335 m³ (365,000 cu ft)
WEIGHTS AND LOADINGS:	
Max payload: 32M	400 kg (882 lb)
71M	1,600 kg (3,527 lb)
Structural weight: 71M	2,500 kg (5,511 lb)
PERFORMANCE:	
Operating altitude	
32M with 400 kg (882 lb) payload	900 m (2,950 ft)
32M with 200 kg (441 lb) payload	1,400 m (4,590 ft)
71M with 1,600 kg (3,527 lb) payload	4,600 m (15 090 ft)

UPDATED

THOMPSON

JAMES THOMPSON, AIAA

1700 Citizens Plaza, Louisville, Kentucky 40202
Telephone: 1 (502) 566 0504
Fax: 1 (502) 589 0148

UPDATED

THOMPSON AIRSHIP

TYPE: Sport/advertising non-rigid helium airship.

PROGRAMME: Protracted construction on opportunity basis (see earlier editions), but by January 1993 nearly all components completed and airship transferred to Oregon for final assembly, rigging and flight test. Inflated at Tillamook, Oregon, in July 1994, in-hangar tests of buoyancy, suspension and other systems conducted, engine tests and rigging of controls completed. Flight testing deferred by bad weather; hoped to start Spring 1995.

DESIGN FEATURES: See accompanying illustration. Inverted Y tail surfaces (all three angles 120°); no catenary curtains (cables attached to five finger patches on each side of envelope suspend gondola slightly forward of centre of buoyancy to compensate for pitch-up). Gondola stabilised by three cables attached to propeller shroud.

FLYING CONTROLS: Two 48.9 m³ (1,728 cu ft) air ballonets, fillable unequally to provide pitch trim; elevators on lower pair of tail surfaces operate differentially for roll control. 81.6 kg (180 lb) of lead shot or sand ballast in gondola.

STRUCTURE: Tail unit is fabric covered aluminium tube structure. Gondola has steel tube frame, with glassfibre and urethane foam skin panels.

POWER PLANT: One 1,200 cc Honda liquid-cooled engine, with 2.2:1 toothed belt reduction drive to a shrouded two-blade wooden pusher propeller.

The fully inflated Thompson two-person airship

1995

ACCOMMODATION: Pilot and one passenger in gondola.

DIMENSIONS, EXTERNAL:	
Envelope: Length overall	24.91 m (81 ft 9 in)
Max diameter	7.91 m (25 ft 11¼ in)
Fineness ratio	3.15
DIMENSIONS, INTERNAL:	
Envelope volume: helium	695.0 m³ (24,544 cu ft)
ballonets (two, total)	97.9 m³ (3,456 cu ft)
design total	792.9 m³ (28,000 cu ft)
WEIGHTS AND LOADINGS:	
Envelope	244 kg (538 lb)
Gondola	187 kg (412 lb)
Ballast	81.6 kg (180 lb)
Max T-O weight	696 kg (1,534 lb)
PERFORMANCE (estimated):	
Design speed	30 kts (55 km/h, 34 mph)

UPDATED

ULITA

ULITA INDUSTRIES INC (Manufacturing Division)

PO Box 412, Sheboygan, Wisconsin 53082-0412
Telephone and Fax: 1 (414) 458 2842
PRESIDENT AND CHAIRMAN: Thomas S. Berger

Ulita has undergone organisational and financial restructuring in recent years, resulting in termination of UM20-48 and UM25-64 programmes (see 1992-93 *Jane's*). Current hardware development programme is UM10-23 Cloud Cruiser; concept development and detail design of UM30-71 (see 1994-95 *Jane's*) being continued.

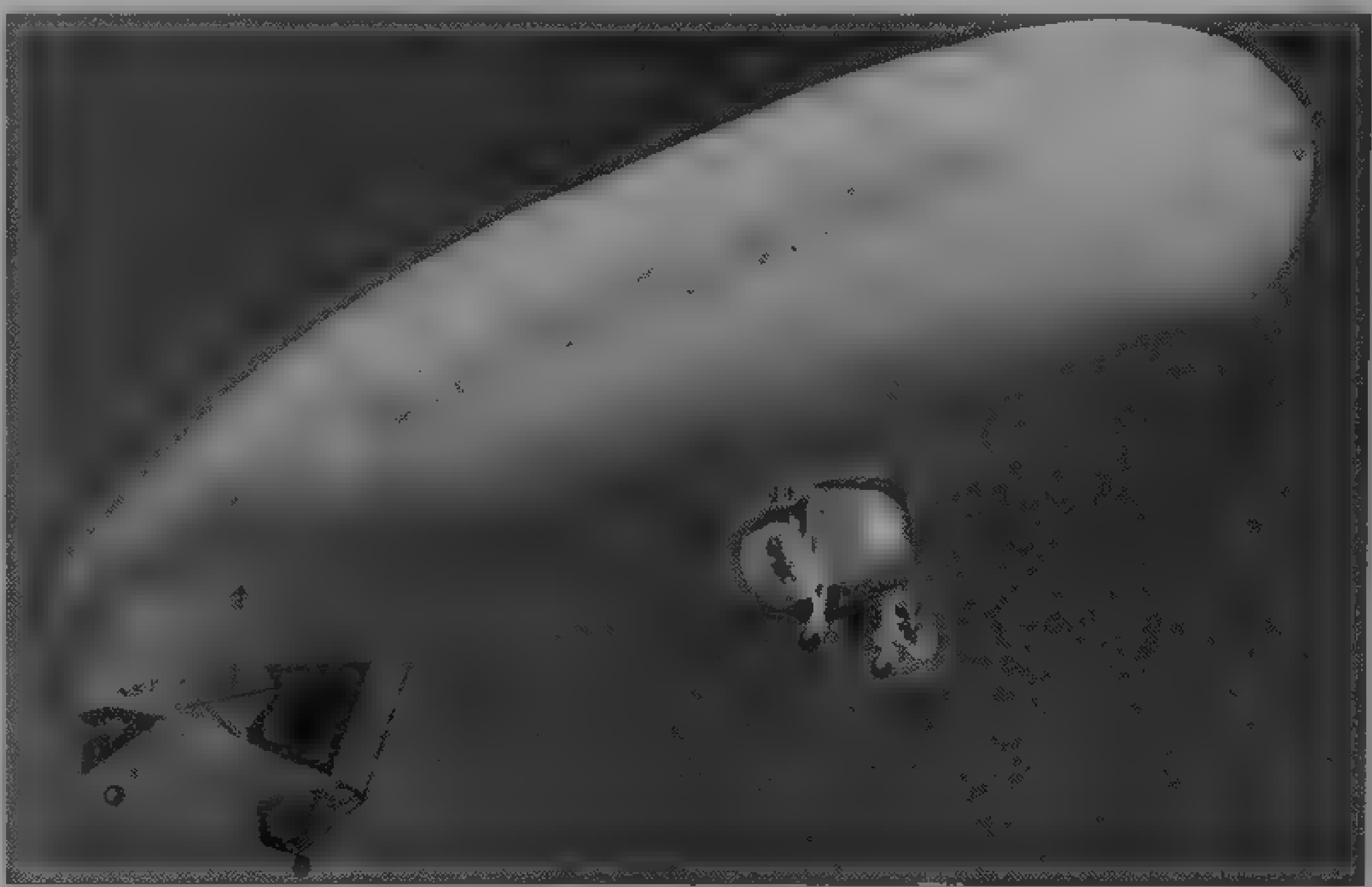
UPDATED

ULITA UM10-23 CLOUD CRUISER

TYPE: Non-rigid helium airship.

PROGRAMME: Prototype under construction; enlarged slightly from original 637.2 m³ (22,503 cu ft) UM10-22 design described in 1992-93 and earlier editions.

DESIGN FEATURES: Optimised for ARV (air recreational vehicle) market as low-cost light utility craft; to be available initially in kit form only, but certification being



Model of the Ulita UM10-23 Cloud Cruiser air recreational vehicle airship

1990

considered. Twin horizontal and vertical stabilisers, each with movable control surface, attached to ends of internally mounted inverted V structure.

FLYING CONTROLS: Two internal ballonets (one forward, one aft) for pitch trim; twin elevators and rudders for pitch and yaw control.

LANDING GEAR: Landing wheel, mounted on outrigger, on each side of gondola, small wheel at base of each tailfin.

POWER PLANT: Two 18 kW (24 hp) Konig SC 340 three-cylinder two-stroke engines, each driving a three-blade fixed-pitch ducted propeller mounted on outrigger from gondola and rotatable to provide horizontal or vertical thrust. Main fuel tank in gondola, with provision for auxiliary tanks on outriggers. Main fuel tank capacity 60 6 litres (16 US gallons; 13.3 Imp gallons); increasable with auxiliary tanks to 98 5 litres (26 US gallons, 21 6 Imp gallons).

ACCOMMODATION: Side by side seating, with dual control wheels, for pilot and one pupil/passenger. Gondola ventilated, but not heated.

SYSTEMS: 12 V DC battery and alternators.

DIMENSIONS, EXTERNAL:

Length overall	25 48 m (83 ft 7 in)
Width overall	8.15 m (26 ft 8¾ in)
Height overall	8 97 m (29 ft 5 in)
Envelope: Length	24 99 m (82 ft 0 in)
Max diameter	6.95 m (22 ft 9½ in)
Fineness ratio	3.6
Gondola: Length at top	3.12 m (10 ft 3 in)
overall	3 44 m (11 ft 3½ in)
Width: at top	1 32 m (4 ft 4 in)
at floor	1.04 m (3 ft 5 in)
overall (incl propulsors)	4.33 m (14 ft 2½ in)
Height: excl landing gear	1 71 m (5 ft 7¼ in)
incl landing gear	2 12 m (6 ft 11½ in)
Propeller diameter (each)	1 07 m (3 ft 6 in)

DIMENSIONS, INTERNAL:

Envelope volume	658.4 m³ (23,250 cu ft)
Ballonet volume (two, total)	144 8 m³ (5,115 cu ft)

WEIGHTS AND LOADINGS:

Weight empty	427 kg (941 lb)
Fuel (standard)	32.7 kg (72 lb)
Crew of two	154 kg (340 lb)
Payload	32 kg (70 lb)
Total gross lift	645 kg (1,423 lb)

PERFORMANCE (estimated):

Max level speed	39 kts (72 km/h, 45 mph)
Econ cruising speed	26 kts (48 km/h, 30 mph)
Pressure ceiling	2,440 m (8,000 ft)

UPDATED

UPship

The DIRIGIBLE Airship

RT 2, Box 53-4, Elba, Alabama 36323
Telephone: 1 (334) 897 6132
DIRECTOR: Jesse Blenn

UPDATED

UPSHIP 100-001

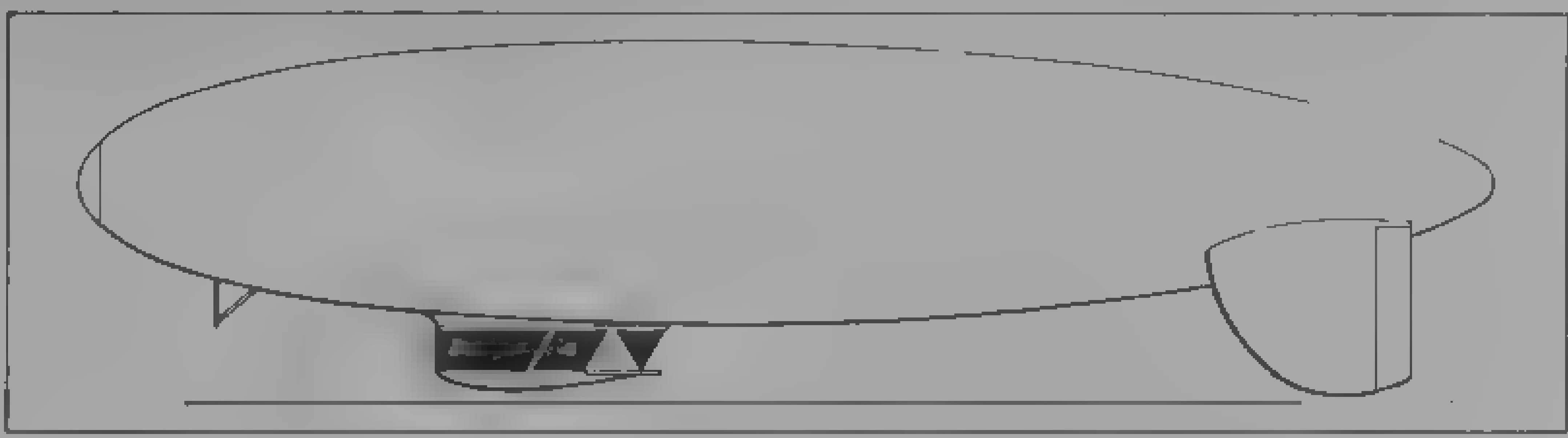
TYPE: Semi-rigid helium airship.

PROGRAMME: Design started 1989; original 750-001 (see 1992-93 *Jane's*) now enlarged as 100-001 proof-of-concept vehicle, progress in 1992 included full-scale gondola and tailfin mockups, land acquisition and further detail design work accomplished in 1993 and 1994, full-time construction of 100-00, not expected to begin before 1996, after completion of current project intended to provide necessary funding.

CUSTOMERS: Markets foreseen in tourism, advertising, scientific research, cargo, resource management, and minimum-impact logging operations, where UPships can be built and operated at competitive price.

DESIGN FEATURES: Aim is to develop helium airships able to utilise full potential of buoyant flight, semi-rigid configuration chosen as offering better low-speed control and more design flexibility than a non-rigid, simple but effective control system claimed to give design efficient control at all speeds and to eliminate major expense of need for groundcrew. Conventional-shape envelope, with inverted V tail surfaces.

FLYING CONTROLS: Pitch and yaw control by ruddervators, ballonet for pitch trim.



Preliminary drawing of the UPship 100-001 *(Jane's/Mike Keep)*

1993

STRUCTURE: Triangular-section aluminium girder keel, outer envelope of sewn polyester fabric, with three-compartment inner helium bag of Mylar film, tailfins and ruddervators have balsa and carbonfibre framework with polyester fabric covering.

POWER PLANT: Three 3.7 kW (5 hp) Honda GX 140 piston engines, each driving a mahogany propeller. Fuel capacity 66 litres (17 5 US gallons, 14.6 Imp gallons).

ACCOMMODATION: Pilot and one passenger, seated in tandem.

DIMENSIONS, EXTERNAL:

Envelope: Length overall	30.48 m (100 ft 0 in)
Max diameter	6.10 m (20 ft 0 in)
Height overall, incl gondola	7 52 m (24 ft 8 in)
Propeller diameter	1 02 m (3 ft 4 in)

DIMENSIONS, INTERNAL:

Envelope volume	620 8 m³ (21,925 cu ft)
Ballonet volume (20%)	124 17 m³ (4,385 cu ft)

WEIGHTS AND LOADINGS (approx):

Weight empty	363 kg (800 lb)
Useful lift	181 kg (400 lb)
Total lift	544 kg (1,200 lb)

PERFORMANCE (estimated):

Max level speed	29 kts (53 km/h; 33 mph)
Cruising speed, 70% power	25 kts (47 km/h, 29 mph)
Ceiling above T-O, normal	610 m (2,000 ft)
max	1,830 m (6,000 ft)
Range at cruising speed, two engines, 20% reserves	510 n miles (946 km, 588 miles)
Endurance, conditions as above	20 h
Fuel consumption (cruising speed, two engines)	2 23 litres (0 59 US gallon, 0 49 Imp gallon)/h

UPDATED

US-LTA

US LIGHTER THAN AIR CORPORATION

6040 Hangar Road, Tillamook, Oregon 97141
Telephone: 1 (503) 842 3032
Fax: 1 (503) 842 7362

Originally known as Grace Aircraft Corporation, later (1985) as US Airship Corporation, and then (April 1986) as Aerotek Corporation, came under new ownership July 1988 and renamed US Lighter Than Air Corporation. Assets acquired included prototype Aerotek USA 100 (originally Grace GAC-20) airship, now known as US-LTA 138-S. Major components of prototype built at Eugene; final assembly in former US Navy airship hangar at Tillamook.

VERIFIED

US-LTA 138-S

TYPE: Non-rigid helium airship.

PROGRAMME: Prototype made first flight 28 October 1987, FAA certification received 1990 after more than 200 hours flown, one production airship completed and flown, but lost in non-fatal crash in Manhattan, New York, on 4 July 1993; construction of second production example reportedly started in 1992.

Prototype employed 1992 and subsequently on several oceanographic missions for Naval Research Laboratory, Woods Hole Oceanographic Institute, Washington University and others, typical programme was NRL/WU research into sea-surface wind phenomena, deploying 317 kg (700 lb) AeroVironment boat-shaped rig stowed alongside gondola and lowered to about 10 m (33 ft) above water (100 m; 330 ft below airship) to collect data. Other missions have included pollution monitoring and atmospheric sampling.

CUSTOMERS: None sold, airship owned and operated by US-LTA.

DESIGN FEATURES: Conventional ellipsoid envelope with inverted Y tail surfaces, gondola also shaped as ellipsoidal hyperbola with circular end section, separated acoustically from engine compartment at rear.

FLYING CONTROLS: Two air-filled ballonets within helium compartment to compensate for variations in gas pressure and adjust in-flight trim; air supplied via ram air duct aft of propeller, with mechanically controlled valves to duct air to front or rear ballonet as required, passive pressure relief valve fitted to each ballonet and in helium compartment to control and prevent accidental envelope overpressure. Manual cable control permits controlled venting of helium or air if required. Flight control system is cable-driven and hydraulically boosted, using a conventional stick with pushrods in combination with an adjustable friction damper, hydraulic boost system and mechanical mixer for the tail surfaces. System can be flown manually in the event of hydraulic failure.

STRUCTURE: Envelope made of polyurethane coated Dacron with a non woven material laminated on the inside for bias stability; seams heat sealed inside and out, nose stiffened by 16 battens to permit higher airspeeds and distribute mooring loads. Weight of gondola supported by cables attached to two internal catenary curtains which hang from upper quarter of envelope over half of its length, side loads and thrust from gondola transmitted to envelope via gondola catenary, a fabric doubler extending away from gondola perimeter in all directions to ensure uniform load distribution to envelope. Three identical aluminium framework fins, covered with doped fabric, each fin is attached to envelope with 13 fan patches at its base and supported by three guy wires on each side.

Gondola has exterior shell of glassfibre epoxy sandwich construction with a foam core, over a welded steel tube frame. Windows of Plexiglas.

LANDING GEAR: Single-wheel gear of trailing link type, pivoting about vertical axis.

POWER PLANT: One 224 kW (300 hp) Textron Lycoming IO-540-K1A5 flat six engine, mounted aft of gondola on a 4130 steel tube frame and driving a Hartzell HC-3YR-7LF three-blade constant speed reversible-pitch pusher propeller within an annular duct. Fuel tanks at rear of gondola, combined capacity 386 litres (102 US gallons; 85 Imp gallons).

ACCOMMODATION: Seats for six persons, including crew, in pairs.

SYSTEMS: Electrical system is standard light aircraft 28 V 100 A negative ground type, powered by engine-driven alternator. While moored, a blower system is powered by a ground-based generator for automatic monitoring and control of envelope pressurisation.

AVIONICS: *Comms:* Dual nav/com radios, transponder.

Flight: VOR/ILS, Loran, ADF and marker beacon receivers.

Instrumentation: Standard instrumentation includes ASI, VSI, attitude indicator, barometric and radar altimeters, turn co-ordinator, direction gyro, magnetic compass, engine and fuel system instruments, inside and outside air temperature gauges, ballonet and helium envelope manometers, hydraulic system temperature and pressure gauges, and clock.

DIMENSIONS, EXTERNAL:

Envelope: Length overall	48.77 m (160 ft 0 in)
Max diameter	12.80 m (42 ft 0 in)
Height overall, incl gondola	17 37 m (57 ft 0 in)
Gondola: Length incl power plant	6 55 m (21 ft 6 in)
Length excl power plant	approx 5 79 m (19 ft 0 in)
Max width	approx 1 83 m (6 ft 0 in)
Max height	approx 2.74 m (9 ft 0 in)

DIMENSIONS, INTERNAL:

Envelope volume	3 908 m³ (138 000 cu ft)
Gondola: Length	4 07 m (13 ft 4¼ in)
Max width: at floor	1 65 m (5 ft 4¾ in)
at ceiling	1 77 m (5 ft 9½ in)
Max height	1 93 m (6 ft 4 in)

WEIGHTS AND LOADINGS:

Weight empty	2,660 kg (5,865 lb)
Gondola, empty	1,052 kg (2,320 lb)
Max fuel	278 kg (612 lb)
Payload with standard fuel	1 143 kg (2,520 lb)
Max T-O weight	3,804 kg (8,386 lb)

PERFORMANCE:

Max level speed	56 kts (104 km/h, 65 mph)
Demonstrated service ceiling	2,745 m (9 000 ft)
Range with max fuel, cruising at 30 kts (56 km/h, 35 mph)	434 n miles (804 km; 500 miles)
Endurance with max fuel, speed as above	14 h 30 min

UPDATED

WAI

WESTINGHOUSE AIRSHIPS INC

PO Box 17319 (MS A255), Baltimore, Maryland 21203-7319
Telephone: 1 (410) 765 6812
Fax: 1 (410) 765 2950
CHAIRMAN: William Adams
ODM PROGRAMME MANAGER: James R Fisher
VICE-PRESIDENT, BUSINESS DEVELOPMENT:
E Judson Brandreth Jr
PUBLIC RELATIONS: Ann Grizzel

Following collapse of Airship Industries (UK) Ltd in 1990, Westinghouse Electric Corporation acquired that company's 50 per cent share in their WAI joint venture company together with Sentinel 1000/5000 programmes and military/defence applications of AI's smaller airships. In late 1993 WAI purchased from Slingsby Aviation Ltd of the UK the design and manufacturing rights for the Skyship 500/500HL/600, and is now FAA and CAA type certificate holder for these airships. WAI has a construction facility at Weeksville, North Carolina, and a design office at Luton, UK.

UPDATED

WAI SKYSHIP 600

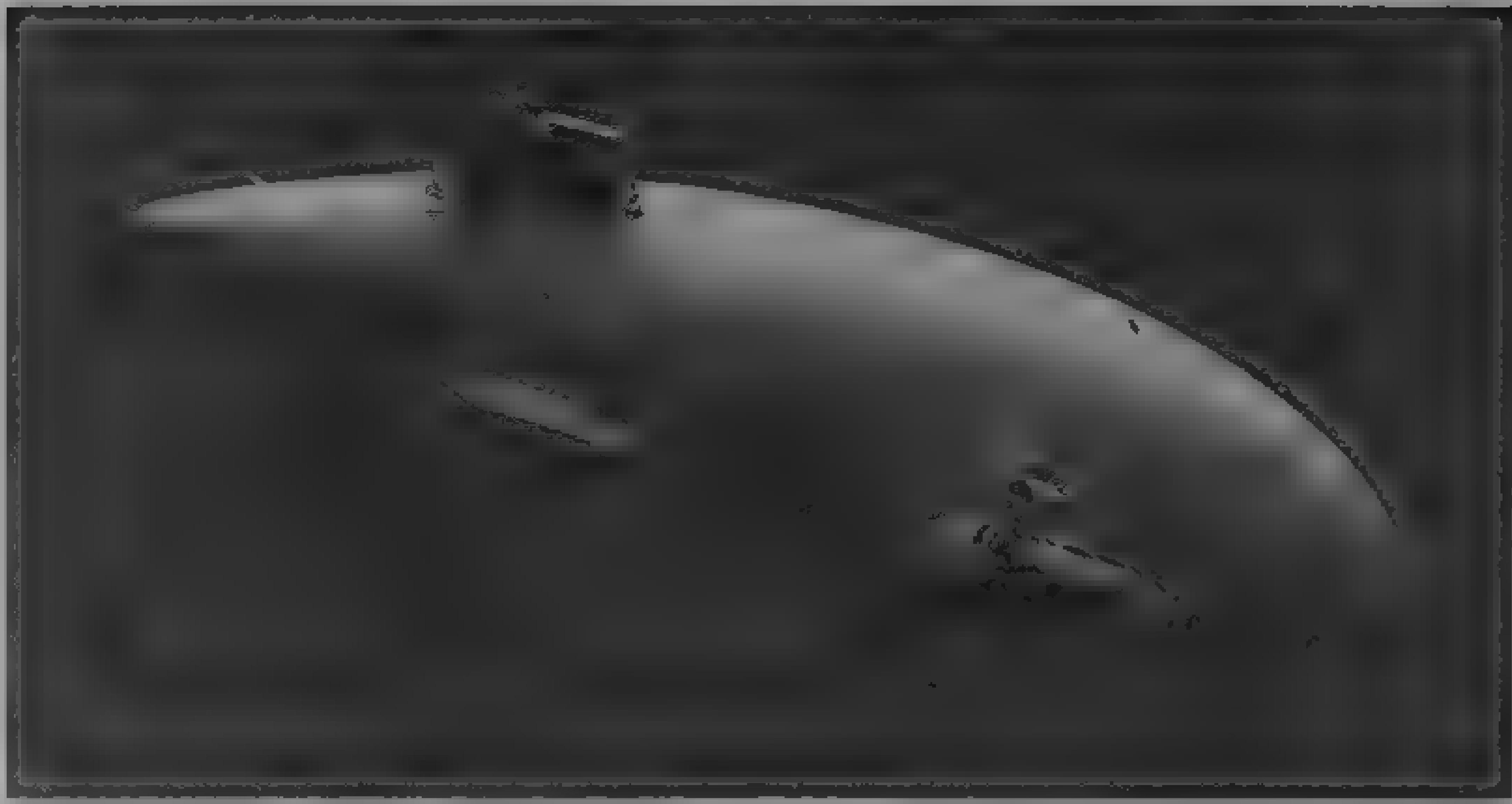
TYPE: Non-rigid helium airship.

PROGRAMME: First flight 6 March 1984; special category C of A awarded by UK CAA 1 September 1984, aerial work certification received Spring 1986; full passenger-carrying C of A 8 January 1987, initiating Skycruise aerial sightseeing service over London, San Francisco, Munich and Sydney in 1987, and over Paris in 1988. First US FAA type certificate awarded to an airship for civil use was issued to Skyship 600 May 1989. During 1990 Farnborough Air Show a Skyship 600 (G-SKSC) with two 227 litre (60 US gallon, 50 Imp gallon) long-endurance fuel tanks made unrefuelled flight of 50 hours 15 minutes, sufficient fuel for a further 20 hours remained at end of flight. Production completed. See 1994-95 and earlier *Jane's* for description.

CUSTOMERS: Total of nine built, of which three operating in early 1995 with UK MoD (c/n 01), Airship Management Services, USA (07) and Japan Airship Services (06).

Skyship 600-01 (G-SKSC) purchased by UK MoD in June 1993 and made first flight under this ownership 15 September 1993 after receiving new envelope manufactured by Aerazur, France. MoD flight trials at A&AEE Boscombe Down followed by handover to British Army (as ZH762) early 1995 to consider potential future uses will continue until mid-1996.

UPDATED



Skyship 600-01 in current operation by the British Army ***(Christopher F. Foss)***

1995

WAI SENTINEL 1000

TYPE: Non-rigid helium airship.

PROGRAMME: Initiated by Airship Industries (UK) and taken over after collapse by WAI; first flight 26 June 1991, first flight with production-standard fly-by-light system, 11 April 1992; ARPA-funded UHF communications relay demonstration October 1992 involving cruiser USS *Anzio* and destroyer USS *Conolly*; at certification under FAR Pt 21 for single-pilot operation on 22 October 1993, airship had logged 320 hours in 97 flights. Made first 24 hour unrefuelled flight August 1994, using only 443 of its 931 litres fuel load (117 of 246 US gallons, 97.4 of 205 Imp gallons). Over 400 hours flown by start of 1995.

Note: Sentinel 1000 destroyed in hangar fire at Weeksville, 2 August 1995.

DESIGN FEATURES: Derivative of Skyship 600 (see 1994-95 *Jane's*), larger envelope (one-half linear scale model of Sentinel 5000 and currently the largest non-rigid airship flying), higher performance engines, upgraded avionics, new tricycle landing gear; substantial increase in payload, improved flight control through autopilot/autostabilisation elements of YEZ-2A flight control system. Official trials vehicle for US Navy YEZ-2A programme.

Tested January 1995 with new, British-designed bow thruster device which enables pilot to approach and moor airship to standard mast without groundcrew assistance.

FLYING CONTROLS: GEC-Marconi optical fibre (fly-by-light) flight control system. Vectored thrust propulsion (see Power Plant), differential inflation of ballonets for static fore and aft trim, cable-operated rudders and elevators, each with spring tab.

STRUCTURE: Envelope has outer skin of Tedlar, impervious to ultraviolet radiation, and heat-bonded seams. Parabolic arch load curtains, carrying multiple Kevlar 29 gondola suspension cables. Nose structure is domed disc, moulded from GFRP and carrying fitting by which airship is moored to its mast. Four GFRP tailfins, in X configuration, each attached to envelope at root and braced by wires on each side; all four surfaces constructed from interlocking ribs and spars of Fibrelam with GFRP skins.

One piece moulded gondola of Kevlar reinforced plastics, with flooring and bulkheads of Fibrelam panels; those forming engine compartment at rear are faced with titanium for fire protection.

LANDING GEAR: Non-retractable tricycle type; single wheels.

POWER PLANT: Two 190 kW (255 hp) Porsche 930/67 six-cylinder air-cooled and turbocharged piston engines, mutually mounted in rear of gondola. Each drives a ducted propulsor consisting of a Hoffmann five-blade reversible-pitch propeller within an annular duct of carbonfibre-reinforced GFRP. Each propulsor can be rotated about its pylon attachment to gondola through an arc of 210°, 90° upward and 120° downward, vectored thrust thus providing both V/STOL and in-flight hovering ability. Porsche engines to be replaced during 1995 by 224 kW (300 shp) Zoche ZO 02A eight-cylinder air-cooled two-stroke diesel radials.

Fuel tank at rear of engine compartment. Auxiliary fuel tanks optional.

ACCOMMODATION: Two flight deck positions, but single-pilot operation. Main cabin area has ample space for relief pilot, mission equipment, two or three mission specialists, plus bunks, toilet and galleys for long-endurance missions.

SYSTEMS: 28 V electrical system, supplied by engine-driven alternators. Pneumatic control of valves that maintain envelope pressure.

AVIONICS: *Flight:* Three-axis autopilot, with sidestick controller.

Mission: Can include low light TV camera with 2-200 mm zoom lens; IR sensors, maritime surveillance radar; communications equipment, datalink. Radar's 7 m (30 ft) wide antenna can detect 3 m² (32.3 sq ft) targets at ranges of more than 135 n miles (250 km, 155 miles).

DIMENSIONS, EXTERNAL:
Envelope: Length overall — 67.50 m (221 ft 5½ in)
Max diameter — 16.70 m (54 ft 9½ in)
Height overall (incl gondola and landing gear) — 20.20 m (66 ft 3¼ in)
Gondola: Length overall — 11.67 m (38 ft 3¼ in)
Max width — 2.56 m (8 ft 4¾ in)
Propeller diameter — 1.68 m (5 ft 6¼ in)

DIMENSIONS, INTERNAL:
Envelope volume — 10,700 m³ (377,868 cu ft)
Ballonet volume (total) — 2,405 m³ (84,932 cu ft)
Gondola: Cabin length — 6.89 m (22 ft 7¼ in)
Cabin height — 1.92 m (6 ft 3½ in)
Cabin width — 2.60 m (8 ft 6½ in)
Cabin floor area (usable) — 12.00 m² (130.0 sq ft)

WEIGHTS AND LOADINGS (design):
Max usable fuel — 1,133 kg (2,498 lb)
Gross disposable load — 4,200 kg (9,260 lb)

PERFORMANCE:
Max continuous speed — 55 kts (102 km/h, 63 mph)
Cruising speed (70% power) — 48 kts (89 km/h, 55 mph)
Endurance at 35 kts (65 km/h, 40 mph) with two 454 litre (120 US gallon, 100 Imp gallon) long-endurance tanks — 35 h

UPDATED

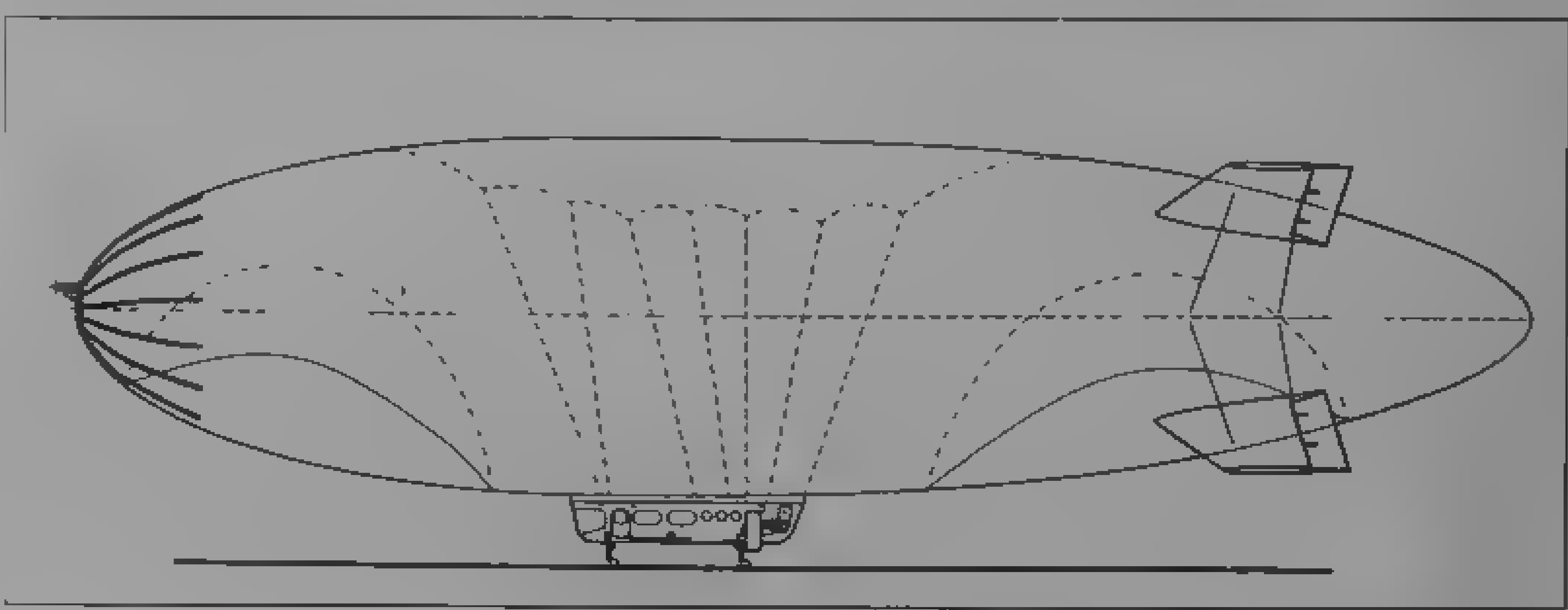
WAI SENTINEL 1240

TYPE: Non-rigid helium airship.

PROGRAMME: Being developed to meet requirements of specific military and government agencies requiring higher

Westinghouse Airships 10,700 m³ (377,868 cu ft) Sentinel 1000 non-rigid

1994



General arrangement of the WAI Sentinel 1240

1994

disposable loads at altitude than existing range of small airships

DESIGN FEATURES: Development of Sentinel 1000 with larger envelope and uprated engines.

FLYING CONTROLS: GEC-Marconi optical fibre (fly-by-light) flight control system. Bow thruster for ground and low speed handling.

STRUCTURE: Generally similar to Sentinel 1000

POWER PLANT: Two 235 kW (315 hp) Porsche 930/67/WAI/1 six-cylinder turbocharged air-cooled engines or 224 kW (300 hp) eight-cylinder Zoche (ZO-02A) air-cooled two-stroke diesel engines. Fuel capacity as for Sentinel 1000.

DIMENSIONS, EXTERNAL

Envelope: Length overall	72.50 m (237 ft 10¼ in)
Max diameter	18.00 m (59 ft 0¾ in)
Height overall (incl gondola and landing gear)	21.60 m (70 ft 10¼ in)
Gondola	as for Sentinel 1000
Propeller diameter	1.68 m (5 ft 6¼ in)

DIMENSIONS, INTERNAL

Envelope volume	12,400 m³ (437,902 cu ft)
Ballonet volume (total)	3,720 m³ (131,371 cu ft)
Gondola	as for Sentinel 1000

WEIGHTS AND LOADINGS (design)

Max usable fuel	1,133 kg (2,498 lb)
Max gross disposable load	5,730 kg (12,632 lb)

PERFORMANCE (estimated)

Max continuous speed	52 kts (96 km/h, 60 mph)
Cruising speed (70% power)	48 kts (89 km/h, 55 mph)
Endurance at 35 kts (65 km/h, 40 mph) with two 454 litre (120 US gallon; 100 Imp gallon) long-endurance tanks	32 h

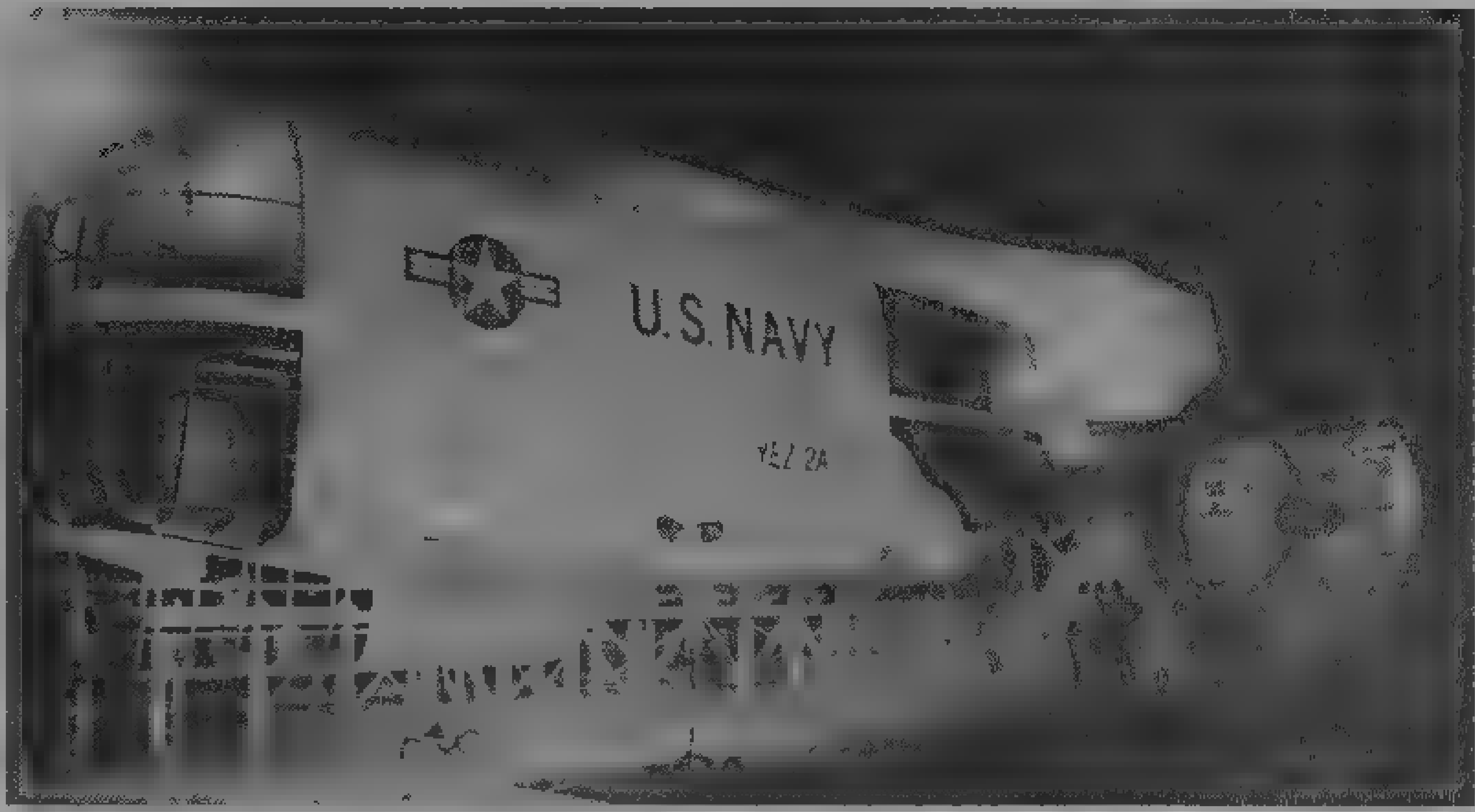
UPDATED

WAI SENTINEL 5000

US Navy designation: YEZ-2A

TYPE: AEW non-rigid helium airship

PROGRAMME: Naval Airship Program (NAP) initiated by Naval Air Systems Command 1985 to investigate suitability of airships in AEW role; early history of programme in previous editions of *Jane's*; $168.9 million contract to WAI June 1987, selecting Sentinel 5000 as basis for operational development model (ODM) airship. In October 1988, NAP evolved from an exclusively US Navy programme to one by Defense Advanced Research Projects Agency (DARPA); since FY90 has been funded under DoD's Air Defense Initiative. Programme still focuses primarily on demonstration of long-range, long-endurance surveillance system capable of seeing low-observable sea-skimming cruise missiles; other potential applications include OTH (over-the-horizon) targeting, drug surveillance and interdiction functions.



Ground test vehicle for the YEZ-2A Sentinel 5000 gondola and propulsion system, at Weeksville, North Carolina

1991

Original Navy requirement was for independent airborne early warning system capable of operating with surface attack groups anywhere in the world. ODM vehicle will have unrefuelled endurance of two to three days; by refuelling and replenishing from surface units within a task force, a mission capability of some 30 days is intended. Designated USN missions are surveillance and targeting, AEW and communications. ARPA contract, ending May 1994, included critical design review of ODM; recently renewed USN interest hoping to produce funding to build ODM for first flight 1996 and production start in 1998.

CUSTOMERS: US Navy; original NASC contract included options for up to five more Sentinels after ODM.

DESIGN FEATURES: Will be largest non-rigid ever built; general configuration similar to Sentinel 1000, but much larger with considerably different gondola; four tailfins in X configuration.

FLYING CONTROLS: GEC-Marconi computer-controlled, optically signalled fly-by-light flight control system, using two MIL-STD-1750A standard computers and a MIL-STD-1553B databus, providing redundant fail-safe actuation of movable tail surfaces (two on each tailfin) via fibre optic signalling, automatic stability and good handling characteristics throughout flight regime, hands-off autopilot control for cruising, hovering and mooring, and automatic speed control.

STRUCTURE: Envelope made of single ply Dacron weave material, laminated with Tedlar and Mylar and bonded with Hytrel.

POWER PLANT: Unpressurised engine room aft contains CODAG (combined diesel and gas turbine) propulsion system, comprising internally mounted pair of 1,544 kW (2,070 hp) ducted propulsion CRM diesel units, with thrust vectoring, plus a 1,394 kW (1,870 shp) General Electric CT7-9 turboprop, mounted on gondola centreline at rear, to provide additional power when higher dash speed required. Substantial winching bay between engine room aft and pressurised accommodation section forward, from where refuelling, re-storing and personnel transfers will be conducted through large opening in base of gondola.

ACCOMMODATION: Crew of 10 to 15 in multideck pressurised gondola. Upper deck provides living accommodation for crew, including double cabins, showers, separate wardrobe, galley and small gymnasium. Mission avionics, control information centre, galley, replenishment stores and refuelling equipment on lower main deck. Below these two is smaller flight deck containing flight controls and instrumentation.

DIMENSIONS, EXTERNAL

Envelope: Length overall	129.54 m (425 ft 0 in)
Max diameter	32.00 m (105 ft 0 in)
Height overall, incl gondola and landing gear	46.33 m (152 ft 0 in)
Gondola: Length overall	25.91 m (85 ft 0 in)
Max width	5.08 m (16 ft 8 in)
Max height	7.32 m (24 ft 0 in)

DIMENSIONS, INTERNAL

Envelope volume	70,792 m³ (2,500,000 cu ft)

WEIGHTS AND LOADINGS

Max usable fuel	17,690 kg (39,000 lb)
Max gross disposable load	27,375 kg (60,350 lb)

PERFORMANCE (estimated)

Max level speed (three engines)	88 kts (163 km/h, 101 mph)
Operating height range	S/L to 3,050 m (10,000 ft)
Pressure ceiling	4,270 m (14,000 ft)
Max unrefuelled endurance at 40 kts (74 km/h, 46 mph) at 1,525 m (5,000 ft)	more than 60 h
Mission capability	30 days

UPDATED

General configuration of the YEZ-2A Sentinel 5000

1991

AERO-ENGINES

This section includes all available details of engines of the aircraft which are featured in this annual. Engines of homebuilts, and propulsion systems used purely for UAVs, targets, missiles and spaceflight are no longer included. Readers are referred for these subjects to *Jane's Unmanned Aerial Vehicles and Targets* and *Jane's Space Directory*

AUSTRALIA

HDHV

HAWKER DE HAVILLAND VICTORIA LTD

PO Box 779H, GPO Melbourne, Victoria 3001
Telephone: 61 (3) 647 6111
Fax: 61 (3) 646 3431
Telex: AA 30721

HDHV makes components for engines and airframes. It makes F404 blades and seals, and assembles and tests engines for the RAAF. It makes CF6-50 and -80 rings for GE, and CFM56 rings, and supports RAAF Viper engines.

VERIFIED

JABIRU

JABIRU AIRCRAFT PTY LTD

PO Box 5186, Bundaberg West, Queensland 4670
Telephone: 61 (71) 55 1778
Fax: 61 (71) 55 2669

OFFICERS: See Aircraft section

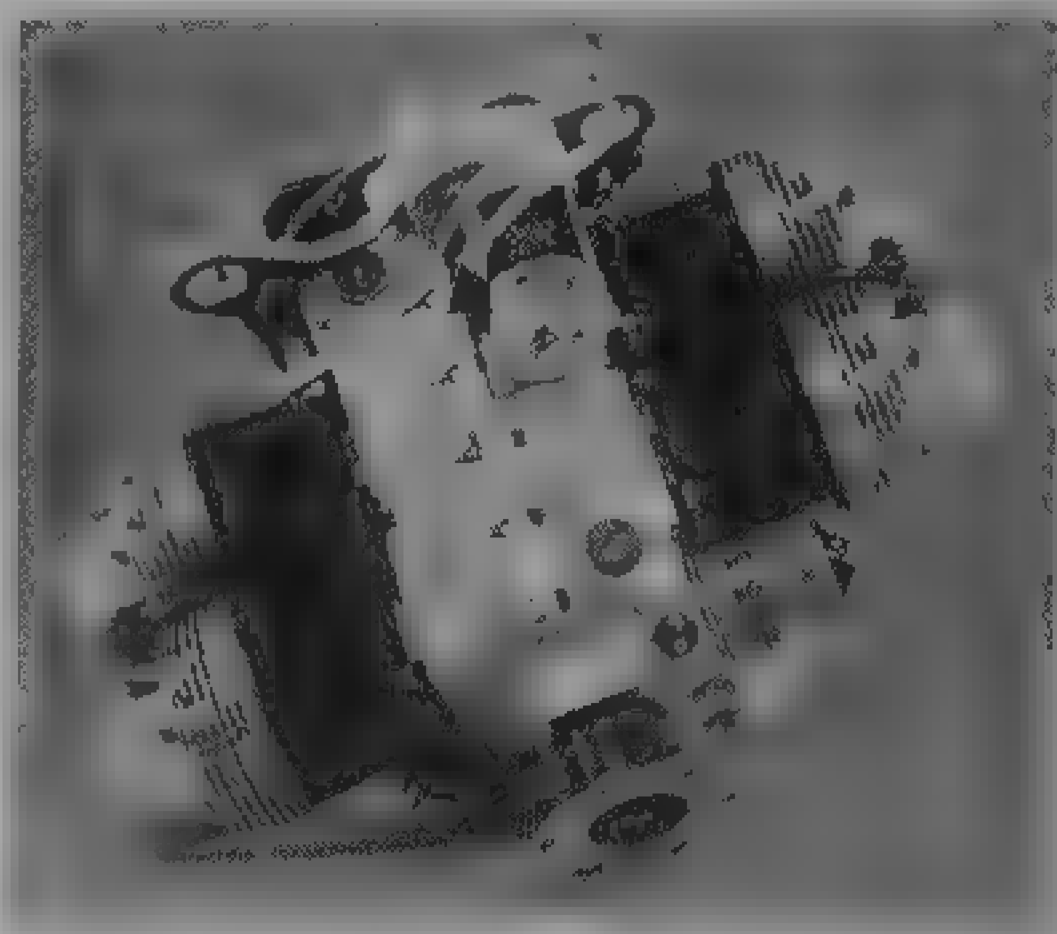
To power its LSA aircraft this company has designed the **Jabiru 1600** direct drive horizontally opposed four-stroke air-cooled piston engine, in production at A$10,800, with fixed price overhauls

CYLINDERS: Bore 88.0 mm (3.465 in). Stroke 66.0 mm (2.598 in). Capacity 1,606 cc (248.9 cu in³)

DIMENSIONS: Length overall 532 mm (20.9 in)
Width 574 mm (22.6 in)
Height 472 mm (18.6 in)

WEIGHT, DRY (equipped): 54.0 kg (119.0 lb)

RATING: Max 45 kW (60 hp) at 3,300 rpm



Jabiru 1600 four-cylinder piston engine
1994

AUSTRIA

ROTAX

BOMBARDIER ROTAX GmbH

PO Box 5, A-4623 Gunskirchen
Telephone: 43 (7246) 271-0
Fax: 43 (7246) 370
Telex: 25 546 BRG K A

PRODUCT MANAGER: Josef Fürlinger

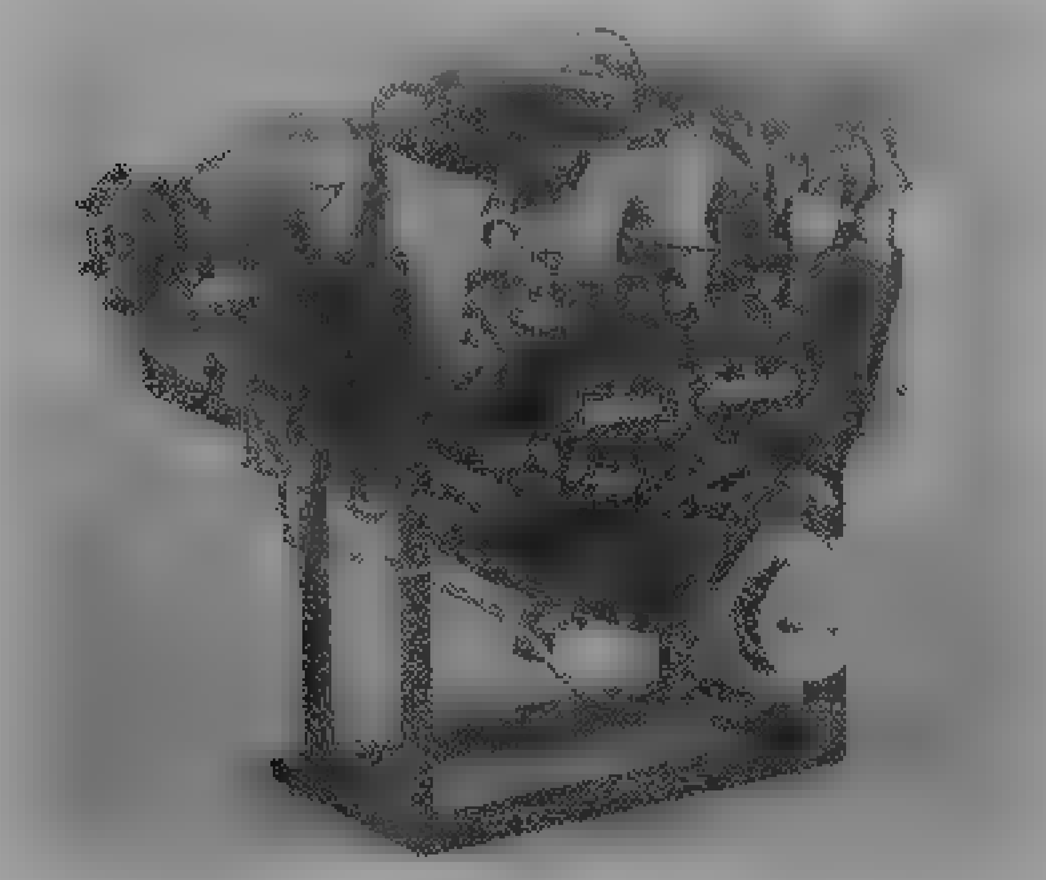
This company is one of the world's largest producers of light piston engines. In the past 10 years it has sold 60,000 engines for aircraft propulsion. The types described below are used in a growing range of kitbuilt and factory-built light aircraft, an increasing proportion of which are being officially certificated under the European JAR Very Light Aircraft and US FAA Primary Aircraft regulations

UPDATED

ROTAX 912 A

Specially designed for use in aircraft, added to the range in 1988. 912 A3 certificated with hydraulic governor for constant-speed propeller in mid-1993. FAR 33 end 1994

TYPE: Four-cylinder four-stroke piston engine, certificated to FAR 22. Dry sump forced lubrication. Electric starter. Reduction gear 2.273:1



Rotax 914 four-cylinder piston engine
1994

CYLINDERS: Air-cooled barrels, liquid-cooled heads. Bore 79.5 mm (3.13 in). Stroke 61.0 mm (2.40 in). Capacity 1,211.2 cc (73.912 cu in). Compression ratio 9.0

IGNITION: Breakerless dual-condenser discharger

OPTIONAL EQUIPMENT: Vacuum pump, external 13.5 V 40 A alternator, engine mount, oil and coolant radiators, air filter and engine instruments

FUEL: Unleaded minimum RON 90 or Avgas 100 LL

WEIGHT, DRY:
With carburettors, intake silencer and exhaust system
912 A2 and A4 60.1 kg (132.5 lb)
912 A3 62.8 kg (138.4 lb)

RATING: T-O 59.6 kW (81 hp) at 5,800 rpm
Cruise 58.0 kW (78 hp) at 5,500 rpm

UPDATED

ROTAX 914 DCDI

Uprated version of 912, to be certified to FAR 33 by end 1995 on RON 95 or Avgas 100LL.

WEIGHT, DRY:
With gearbox, two CD carburettors, intake silencer and exhaust 66.2 kg (145.9 lb)

RATING: Max 5 min 85.7 kW (115 hp) at 5,800 rpm

UPDATED

ROTAX 618UL DCDI

Based on 582 (see next) with stroke increased to 68.0 mm (2.68 in) and fitted with adjustable exhaust and electronic dual ignition

WEIGHT, DRY:
With gearbox, carburettors, intake silencer and exhaust 52.8 kg (116.4 lb)

RATING: 55.0 kW (73.8 hp)

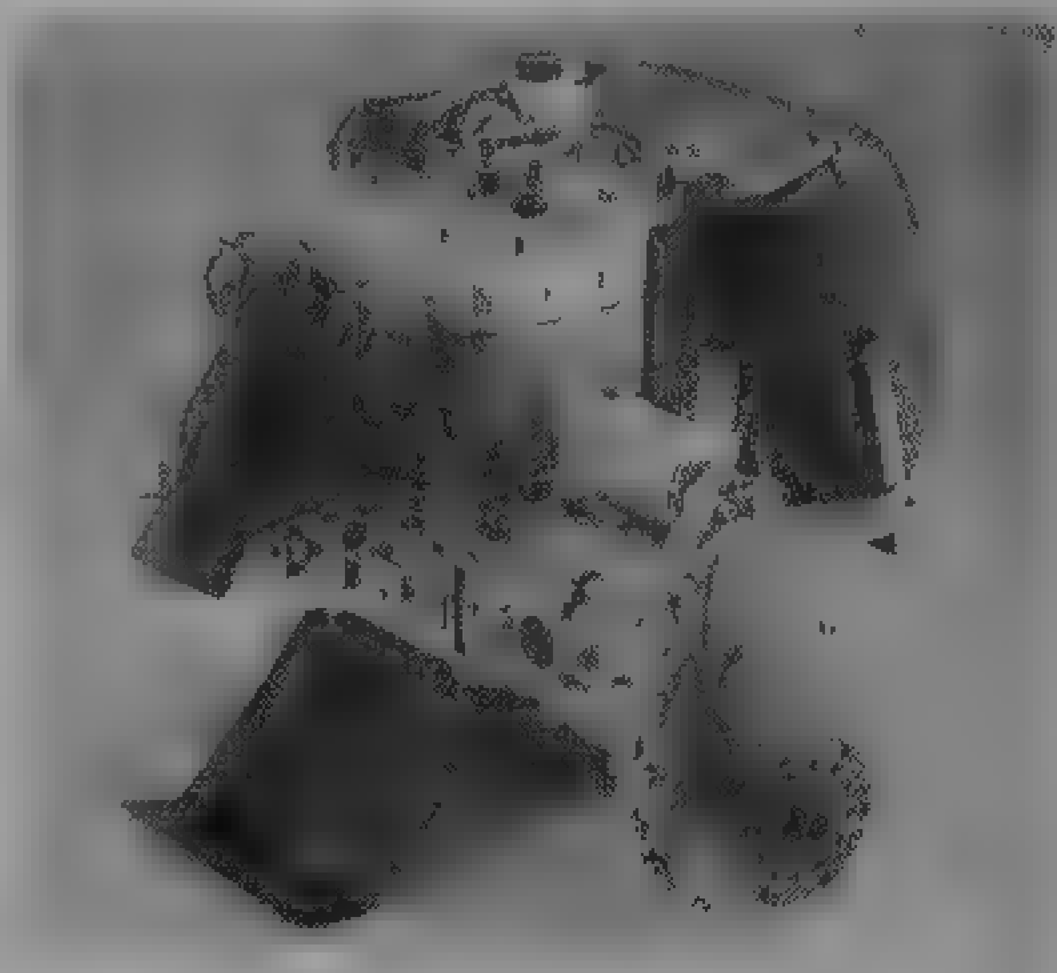
VERIFIED

ROTAX 582

Non-certified engine for very light aircraft

TYPE: Two-cylinder two-stroke rotary-valve piston engine

CYLINDERS: In-line in water-cooled block. Bore 76.0 mm (2.99 in). Stroke 64.0 mm (2.52 in). Capacity 580.7 cc (35.44 cu in)



Rotax 618 two-cylinder piston engine
1994

IGNITION: Dual breakerless

WEIGHT, DRY:
With carburettors and exhaust system 33.8 kg (74.5 lb)

RATING: 47.0 kW (63 hp) at 6,500 rpm

VERIFIED

ROTAX 503

Non-certified engine for very light aircraft. Available with or without cooling fan, with choice of reduction gears and with single (type 1V) or twin (2V) carburettors

TYPE: Two-cylinder two-stroke piston engine.

CYLINDERS: Air-cooled. Bore 72.0 mm (2.84 in). Stroke 61.0 mm (2.40 in). Capacity 496.7 cc (30.31 cu in)

OPTIONAL EQUIPMENT: Includes 155 W generator, electric starter, filters and silencers

WEIGHT, DRY:
Basic engine, with cooling fan 31.4 kg (69.2 lb)

RATING: 503UL 1V 34.0 kW (45.6 hp) at 6,500 rpm
503UL 2V 37.0 kW (49.5 hp) at 6,500 rpm

NEW ENTRY

BELGIUM

TECHSPACE

TECHSPACE AERO SA
(Subsidiary of Fabrique Nationale Nouvelle Herstal)

Route de Liers 121, B-4411 Herstal
Telephone 32 (41) 784671
Fax 32 (41) 785207 (General)
32 (41) 786739 (Sales and Marketing)
Telex B 41223 FABNA
DIRECTOR AND GENERAL MANAGER: P Bourgeois
BUSINESS DEVELOPMENT: J C Morin

Previously known as FN Moteurs, this company began jet engine production in 1949. Today's activity is equally distributed in three sectors: fighter engine production, medium/large transport and space propulsion production, and depot maintenance for air forces. Major programmes are:

Production and assembly of P&W F100 fan and engine core modules, and for assembly and test of complete engines.

Responsible for four major parts of GE F110: fan discs 1 and 3, HP turbine disc, and fan stator case.

Member of consortium (RR, MTU, SNECMA, TA) producing Tyne 21 and 22 engines for Atlantique and Transall, with a 9.5 per cent share.

After having produced parts for the JT8D and JT9D-7R4 TA signed a partnership agreement with Pratt & Whitney for a 3 per cent share in the PW4000 series. TA is responsible for the HP compressor case and various other components.

Since 1972, in association with SNECMA, TA has developed and produced the lubrication modules of all CFM56 versions. TA has increased its participation up to 10 per cent of the SNECMA share (5 per cent overall) in the -5A and -5C versions, to power respectively the Airbus A320 and A340. TA is responsible for the lubrication and shop modules and other stator or rotor parts. TA is also performing endurance testing of complete engines.

TA has signed a co-operation agreement with Turbomeca, developed several critical parts of the TM 333.

VERIFIED

BRAZIL

CELMA

CELMA-CIA ELECTROMECANICA

PO Box 90341, 25669-900 Petrópolis, RJ
Telephone 55 (242) 43 4962
Fax 55 (242) 42 3684
Telex (021) 21271
PRESIDENT: Alexandre Gonçalves Silva
TECHNICAL DIRECTOR: Carlos A R Pereira

This company of 1,050 people has facilities totalling 45 000 m² (485 000 sq ft) in which it overhauls many kinds of engine (GE, P&W, P&WC, CFM and RR) and accessories. It shares in the production of components for the Rolls-Royce Spey 807 turbofan.

VERIFIED

CANADA

CAM

CANADIAN AIRMOTIVE INC

7400 Wilson Avenue, Delta, British Colombia V4G 1E5
Telephone 1 (604) 940 9378
Fax 1 (604) 940 9566
PROGRAMME MANAGER: Don Arney

CAM 100

Honda Civic car engine conversion for aircraft use. In production at US$5,895, with minimal operating costs.

TYPE: Four-cylinder in-line four-stroke piston engine.

CYLINDERS: Liquid-cooled, overhead camshaft, three-valve. Bore 74.0 mm (3.07 in). Stroke 86.5 mm (3.41 in). Capacity 1,488 cc (90.7 cu in). Compression ratio 9.2.

PROPELLER DRIVE: 100 mm (4.0 in) HTD cog belt reducing maximum 6,000 rpm to 2,500.

FUEL: 90 octane unleaded or 100LL.

DIMENSIONS:

Length	813 mm (32.0 in)
Width	520 mm (20.5 in)
Height	641 mm (25.25 in)

WEIGHT, DRY: 92.1 kg (202.7 lb)

PERFORMANCE RATING: 74.6 kW (100 hp)

SPECIFIC FUEL CONSUMPTION:

T-O as above	69.29 μg/J (0.41 lb/h/hp)

CAM 100 four-cylinder piston engine *1994*

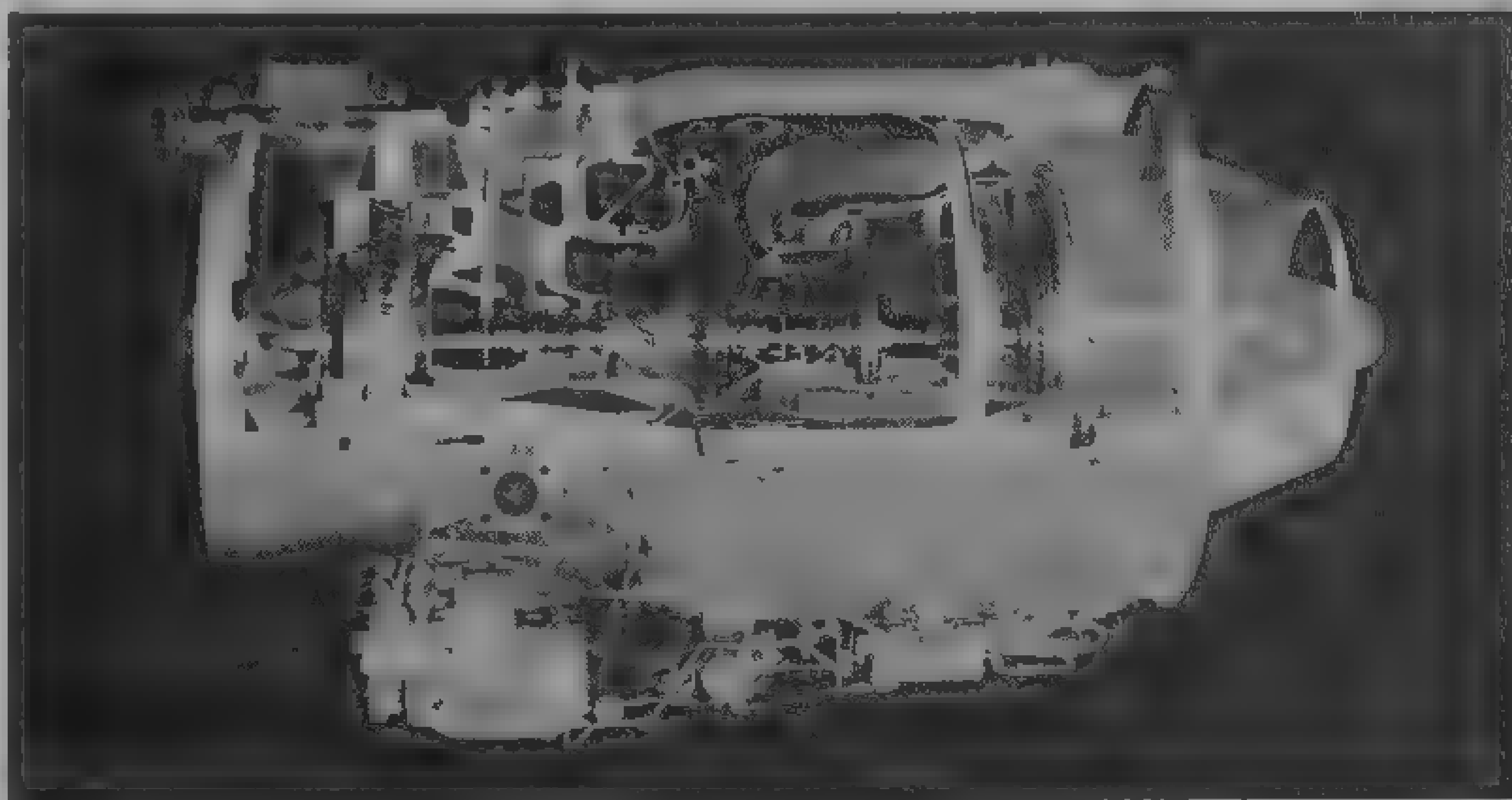
P&WC

PRATT & WHITNEY CANADA
(Subsidiary of United Technologies Corporation)

1000 Marie Victorin, Longueuil, Quebec J4G 1A1
Telephone 1 (514) 677 9411
Fax 1 (514) 647 3620
Telex 05 267509
CHAIRMAN AND CEO: L D Caplan
PRESIDENT AND COO: G P Ouimet
VICE-PRESIDENTS:
C Lloyd (Marketing and Customer Support)
F Osborne (Communications)
B H Sanders (Engineering)

Pratt & Whitney Canada is owned 97 per cent by United Technologies Corporation, Connecticut, USA, and is the P&W Group member responsible for engines for general aviation and regional transport. Approximately 7,300 employees. By 1 January 1995 P&WC had delivered 40,164 engines. Link with Klimov (Russia) June 1993.

UPDATED



Cutaway P&WC JT15D-5 turbofan *1987*

P&WC JT15D

Designed to power business aircraft, small transports and training aircraft, the JT15D first ran on 23 September 1967. Initial application was the twin-engined Cessna Citation. Up to 1976 Cessna used the **JT15D-1**. Late that year it announced the Citation I powered by the **JT15D-1A** and the Citation II powered by the **JT15D-4**. During 1983 the D-1A was replaced by the **D-1B**.

Other twin-engined business jets powered by the JT15D-4 are the Aerospatiale Corvette and Mitsubishi Diamond I. TBO is 3,500 hours for the JT15D-1/D-1A, and 3,000 hours for the JT15D-4.

JT15D-4B. Altitude optimised variant for the Citation S/II.

JT15D-4C. Oil system for sustained inverted flight, and an electronic fuel control. Powers Agusta S.211.

JT15D-4D. Flat rated for improved hot and high performance for the Diamond 1A.

JT15D-5. Growth version. A new fan with higher pressure ratio and flow, plus an improved boost stage and HP compressor, are combined to produce 25 per cent more altitude cruise thrust, with a 3 per cent improvement in sfc. HP turbine blades and electronic fuel control are also improved. Powers Cessna T-47A, Diamond II and Beechjet.

JT15D-5A. Hydromechanical fuel control. Selected for Citation V.

JT15D-5B. Dash 5A modified to suit Beech T-1A Jayhawk.

JT15D-5C. Oil system for sustained inverted flight. Powers Agusta S.211A.

JT15D-5D. New fan with integrally bladed rotor and HP turbine with single-crystal blades. Selected for Citation V Ultra.

By the fourth quarter of 1994 total deliveries of all JT15D engines had reached 4,866. Operating time totalled 17,733,214 hours.

The following description relates to the JT15D-1B, except where indicated.

TYPE: Two-shaft turbofan.

FAN: Single-stage axial with 28 solid titanium blades with part span shrouds. Mass flow, 34 kg (75 lb)/s; bypass ratio about 3.3; fan pressure ratio 1.5.

COMPRESSOR: Single-stage titanium centrifugal. Overall pressure ratio about 10:1. (D-4 and D-5 have axial boost stage between fan and compressor.)

COMBUSTION CHAMBER: Annular reverse flow type. Spark igniters at 5 and 7 o'clock (viewed from rear).

FUEL SYSTEM: Pump delivering at 44.8 bars (650 lb/sq in)

D -4 -4B -4D -5A have DP-L2 hydromechanical control, 4C -5 and 5C have JFC 118 or 119 electronic system.

FUEL GRADES: JP-1, JP-4, JP-5 to CPW 204

TURBINE: Single-stage HP with 71 solid blades, two-stage LP first stage cast integrally with 61 blades and second carrying 55 blades in fir tree roots

LUBRICATION SYSTEM: Integral oil system, with gear type pump delivering at up to 5.52 bars (80 lb/sq in). Capacity, 9.0 litres (2.4 US gallons, 2.0 Imp gallons).

OIL SPECIFICATION: PWA521 Type II, CPW 202

STARTING: Air turbine starter or electric starter/generator

DIMENSIONS:

Diameter: JT15D-1	691 mm (27.2 in)
JT15D-4	686 mm (27.0 in)
Length overall: JT15D-1	1,506 mm (59.3 in)
JT15D-4	1,600 mm (63.0 in)

WEIGHT, DRY:

JT15D-1,	232.5 kg (514 lb)
JT15D-1A, -1B	235 kg (519 lb)
JT15D-4	253 kg (557 lb)
JT15D-4B	258 kg (568 lb)
JT15D-4C	261 kg (575 lb)
JT15D-4D	255 kg (560 lb)
JT15D-5, -5A	291.5 kg (632 lb)
JT15D-5B	291.7 kg (643 lb)
JT15D-5C	302 kg (665 lb)
JT15D-5D	284.4 kg (627 lb)

PERFORMANCE RATINGS:

T-O: JT15D-1, -1A, -1B	9.79 kN (2,200 lb st)
JT15D-4, -4B, -4C, -4D	11.12 kN (2,500 lb st)
JT15D-5, -5A, -5B	12.9 kN (2,900 lb st)
JT15D-5C	14.19 kN (3,190 lb st)
JT15D-5D	13.54 kN (3,045 lb st)
Max continuous:	
JT15D-1, -1A, -1B	9.3 kN (2,090 lb st)
JT15D-4, -4B, -4C, -4D	10.56 kN (2,375 lb st)
JT15D-5, -5A, -5B	12.9 kN (2,900 lb st)
JT15D-5C	14.19 kN (3,190 lb st)
JT15D-5D	13.54 kN (3,045 lb st)

SPECIFIC FUEL CONSUMPTION (T-O):

JT15D-1, -1A, -1B	15.30 mg/Ns (0.540 lb/h/lb st)
JT15D-4, -4B, -4C, -4D	15.92 mg/Ns (0.562 lb/h/lb st)
JT15D-5, -5A, 5B	15.61 mg/Ns (0.551 lb/h/lb st)
JT15D-5C	16.23 mg/Ns (0.573 lb/h/lb st)
JT15D-5D	15.86 mg/Ns (0.550 lb/h/lb st)

UPDATED

P&WC PW300

This high-BPR turbofan has been optimised for long-range business jets. MTU is a 25 per cent risk sharing partner responsible for the LP turbine. Principal versions are:

PW305A. T-O rating 20.81 kN (4,679 lb st) to 33.9°C. Selected for Learjet 60.

PW305B. T-O rating 23.42 kN (5,266 lb st) to 23.5°C. Selected for Hawker 1000.

PW306A. Larger fan, improved hot-end materials, lobed propulsive nozzle. T-O rating 25.35 kN (5,700 lb st) to 31.7°C. To be certificated January 1996. Selected for Astra Galaxy.

The following description applies to all PW300 series engines.

TYPE: Two-shaft turbofan.

FAN: Single-stage, overhung ahead of front bearing. Pointed (PW305) or round (PW306) rotating spinner. Bypass ratio (S/L, T-O): PW305A/B 4.3, PW306A 4.5.

COMPRESSOR: Four axial stages followed by one centrifugal. Core pressure ratio: PW305A/B, 12.9, PW306A, 12.7.

COMBUSTION CHAMBER: Annular, fed around periphery by ring of separate curved piped ducting air from diffuser case of centrifugal compressor.

Cutaway P&WC PW300 turbofan

1993

Cutaway P&WC PW500 turbofan

1995

FUEL GRADES: JP-1, JP-4, JP-5 to CPW 204

CONTROL SYSTEM: Dowty and Smiths Industries full authority digital, with dual channels.

HP TURBINE: Two axial stages, the PW305 having air-cooled blades for the first stage, and the PW306 having air cooled blades for both stages.

LP TURBINE: Three axial stages joined via centre stage disc to fan shaft. Two main shaft bearings.

LUBRICATION SYSTEM: Integral oil system with gear-type pump. Capacity 8 litres (2.11 US gallons; 1.76 Imp gallons).

OIL SPECIFICATION: CPW 202

STARTING: Electric starter/generator

DIMENSIONS (estimated):

Diameter	927.1 mm (36.5 in)
Length	2,070.1 mm (81.5 in)

WEIGHT, DRY (basic):

PW305A/B	450 kg (993 lb)
PW306A	473 kg (1,043 lb)

PERFORMANCE RATINGS (ISA):

T-O, Static: see under model listing	
Cruise at Mach 0.8 at 12,200 m (40,000 ft):	
PW305A	5.14 kN (1,155 lb)
PW305B	5.14 kN (1,155 lb)
PW306A	5.91 kN (1,329 lb)

SPECIFIC FUEL CONSUMPTION:

T-O rating:	
PW305A	10.99 mg/Ns (0.388 lb/h/lb st)
PW305B	11.07 mg/Ns (0.391 lb/h/lb st)
PW306A	11.16 mg/Ns (0.394 lb/h/lb st)
Cruise at Mach 0.8 at 12,200 m (40,000 ft):	
PW305A	19.29 mg/Ns (0.681 lb/h/lb)
PW305B	19.29 mg/Ns (0.681 lb/h/lb)
PW306A	19.23 mg/Ns (0.679 lb/h/lb)

VERIFIED

P&WC PW500

This high BPR turbofan will be rated in the bracket 13.34 to 17.79 kN (3,000 to 4,000 lb st). Compared with the JT15D it will offer 12-15 per cent lower sfc. By 1995 two versions had found customers.

PW530A. Basic two-shaft engine with two axial plus one centrifugal compressor stages. LP spool has integrally bladed single-stage fan driven by two-stage turbine. Hydromechanical control system. Selected for Cessna Citation Bravo. First engine test October 1993.

PW545A. Fan diameter increased 101.6 mm (4.0 in), integrally bladed boost stage added, third stage added to LP turbine, single-crystal HP turbine blades. Electronic control. Selected for Cessna Citation Excel. To run 1996.

UPDATED

P&WC PW100

The PW100 is a free turbine turboprop consisting of turbomachine and reduction gearbox modules connected by a torque-measuring driveshaft and integrated structural intake case.

Flight development of the PW100 began in February 1982. Principal versions are as follows:

PW118. T-O rated at 1,411 ekW, 1,342 kW (1,892 ehp, 1,800 shp) at 1,300 propeller rpm to 33°C. Selected for EMB-120 Brasilia. Certificated March 1986.

PW118A. T-O rated at 1,411 ekW, 1,342 kW (1,892 ehp, 1,800 shp) at 1,300 propeller rpm to 42°. Selected for EMB-120 Brasilia. Certificated June 1987.

PW119B. T-O rated at 1,702 ekW; 1,626 kW (2,282 ehp, 2,180 shp) at 1,300 propeller rpm to 23°C. Selected for Dornier 328. Certificated June 1993.

PW120. T-O rated at 1,566 ekW; 1,491 kW (2,100 ehp, 2,000 shp) at 1,200 propeller rpm to 27.7°C. Selected for Aérospatiale/Alenia ATR 42 and Snow SA-210TA. Certificated December 1983.

PW120A. T-O rated at 1,566 ekW, 1,491 kW (2,100 ehp, 2,000 shp) at 1,200 propeller rpm to 29°C. Selected for Dash 8-100. Certificated September 1984.

PW121. T-O rated at 1,679 ekW; 1,603 kW (2,252 ehp, 2,150 shp) at 1,200 propeller rpm to 26°C. Selected for Dash 8-100 and ATR 42. Certificated February 1987.

PW123. T-O rated at 1,866 ekW, 1,775 kW (2,502 ehp, 2,380 shp) at 1,200 propeller rpm to 35°C. Selected for Dash 8-300. Certificated June 1987.

PW123AF. T-O rated at 1,866 ekW, 1,775 kW (2,502 ehp, 2,380 shp) at 1,200 propeller rpm to 35°C. Selected for CL-215/415. Certificated February 1990.

PW123B. T-O rated at 1,958 ekW, 1,864 kW (2,626 ehp, 2,500 shp) at 1,200 propeller rpm to 30°C. Selected for Dash 8-300. Certificated November 1991.

PW123C. T-O rated at 1,687 ekW, 1,603 kW (2,262 ehp, 2,150 shp) at 1,200 propeller rpm to 25.5°C. Selected for Dash 8-200.

PW123D. T-O rated at 1,687 ekW, 1,603 kW (2,262 ehp, 2,150 shp) at 1,200 propeller rpm to 45.0°C. Selected for Dash 8-200.

PW123E. T-O rated at 1,866 ekW, 1,775 kW (2,502 ehp, 2,380 shp) to 40.6°C. Selected for Dash 8-315.

PW124B. PW124 with PW123 turbomachinery to suit four-blade propeller at 1,200 rpm, same rating. Selected for ATR 72. Certificated May 1988.

PW125B. Growth PW124 with T-O rating of 1,958 ekW; 1,864 kW (2,626 ehp; 2,500 shp) at 1,200 propeller rpm to 30°C. Powers Fokker 50. Certificated May 1987.

PW126. Growth engine, maximum contingency 2,078 ekW; 1,978 kW (2,786 ehp, 2,653 shp) at 1,200 propeller rpm to 32.4°C. Powers Jetstream ATP. Certificated May 1987.

PW126A. Growth 124A with T-O rating of 2,084 ekW, 1,985 kW (2,795 ehp; 2,662 shp) at 1,200 propeller rpm to 29.2°C. Powers Jetstream ATP. Certificated June 1989.

PW127 T-O rated at 2,148 ekW, 2,051 kW (2,880 ehp; 2,750 shp) at 1,200 propeller rpm to 31.6°C. Selected for ATR 72 and ATR 42-500.

PW127A. T-O rated at 1,864 kW (2,500 ehp). Selected for An-140.

PW127B T-O rated at 2,147 ekW, 2,051 kW (2,880 ehp, 2,750 shp) at 1,200 propeller rpm to 30°C. Selected for hot and high performance Fokker 50.

PW127C T-O rated at 2,148 ekW, 2,051 kW (2,880 ehp, 2,750 shp) at 1,200 propeller rpm to 30.2°C. Selected for XAC Y7-200A.

PW127D T-O rated at 2,148 ekW, 2,051 kW (2,880 ehp, 2,750 shp) at 1,200 propeller rpm to 33.0°C. Powers Jetstream 61. Certificated January 1994.

PW127E. T-O rated at 2,148 ekW, 1,790 kW (2,880 ehp, 2,400 shp) at 1,200 propeller rpm to 45°C. Selected for ATR 42-500.

PW150 Growth version. Selected for Dash 8-400.

By September 1994 deliveries of PW100 engines had reached 3,276. Operating time reached 23,431,400 hours.

The following description applies to all PW100 series engines.

TYPE: Free turbine turboprop.

PROPELLER DRIVE: Twin-layshaft gearbox with propeller shaft offset above turbomachine. Maximum propeller speed 1,200 rpm.

AIR INTAKE: S-bend duct. A secondary duct forms a flowing bypass to prevent foreign object ingestion.

COMPRESSOR: Two centrifugal impellers in series, each driven by its own turbine. Air guided through ring of curved pipes from LP diffuser to HP entry.

COMBUSTION CHAMBER: Annular reverse flow type, with 14 air blast fuel nozzles around periphery and two spark igniters.

FUEL SYSTEM: Hydromechanical control and electronic power management.

FUEL GRADES: JP-1, JP-4, JP-5 to PWA Spec 522.

TURBINES: Single-stage HP with 47 air-cooled blades. Single-stage LP with 53 solid blades. Two-stage power turbine, first with 68 blades and second with 74, all with shrouded tips.

ACCESSORY DRIVES: Pads driven by HP compressor for starter/generator, hydromechanical fuel control and hand turning. Pads on reduction gearbox for alternator, hydraulic pump, propeller control module, overspeed governor and electric aux hairy pump. Electric torque signal and auto power augmentation.

LUBRICATION SYSTEM: One pressure pump and two scavenge pumps, all driven off HP rotor. Integral tank, capacity 9.44 litres (2.5 US gallons, 2.08 Imp gallons).

OIL SPECIFICATION: CPW 202 or PWA521 Type II.

STARTING: Electric starter/generator.

DIMENSIONS:

Length: PW118, 118A, 119B	2,057 mm (81 in)
others	2,134 mm (84 in)
Width: PW118-121	635 mm (25 in)
others	660 mm (26 in)
Height: PW118-121	787 mm (31 in)
others	838 mm (33 in)

WEIGHT, DRY:

PW118	391 kg (861 lb)
PW118A	394 kg (866 lb)
PW119B	415.5 kg (916 lb)
PW120	417.8 kg (921 lb)
PW120A	423 kg (933 lb)
PW121	425 kg (936 lb)
PW123, 123B, 123AF	450 kg (992 lb)
others	481 kg (1,060 lb)

PERFORMANCE RATINGS (S/L, static):

T-O: See under model listings

Max cruise:

PW118	1,188 ekW, 1,128 kW (1,593 ehp; 1,513 shp) at 1,300 rpm to 20°C
PW118A	1,188 ekW, 1,127 kW (1,593 ehp; 1,513 shp) at 1,300 rpm to 29.4°C
PW119B	1,339 ekW, 1,267 kW (1,796 ehp; 1,699 shp) at 1,300 rpm to 22°C
PW120	1,271 ekW, 1,207 kW (1,704 ehp; 1,619 shp) at 1,200 rpm to 15°C
PW120A	1,296 ekW, 1,231 kW (1,738 ehp; 1,651 shp) at 1,200 rpm to 15°C
PW121	1,330 ekW, 1,268 kW (1,784 ehp; 1,700 shp) at 1,200 rpm to 15°C
PW123, 123B	1,593 ekW, 1,514 kW (2,136 ehp; 2,030 shp) at 1,200 rpm to 22.2°C
PW123C, 123D	1,532 ekW, 1,454 kW (2,054 ehp, 1,950 shp) at 1,200 rpm to 26.1°C
PW124B	1,593 ekW, 1,514 kW (2,136 ehp; 2,030 shp) at 1,200 rpm to 22.2°C
PW125B	1,623 ekW, 1,513 kW (2,203 ehp, 2,029 shp) at 1,200 rpm to 22.2°C
PW126	1,635 ekW, 1,553 kW (2,193 ehp, 2,083 shp) at 1,200 rpm to 26.3°C
PW126A	1,632 ekW, 1,553 kW (2,189 ehp, 2,083 shp) at 1,200 rpm to 27.2°C
PW127	1,667 ekW, 1,591 kW (2,236 ehp, 2,134 shp) at 1,200 rpm to 22.7°C
PW127B	1,424 ekW, 1,351 kW (1,911 ehp, 1,812 shp) at 1,200 rpm to 34.7°C
PW127C	1,667 ekW, 1,589 kW (2,237 ehp; 2,132 shp) at 1,200 rpm to 20.5°C
PW127D	1,667 ekW, 1,589 kW (2,237 ehp; 2,132 shp) at 1,200 rpm to 24.7°C

SPECIFIC FUEL CONSUMPTION:

T-O rating:

PW118	84.2 µg/J (0.498 lb/h/ehp)
PW118A	85.2 µg/J (0.504 lb/h/ehp)
PW119B	82.8 µg/J (0.490 lb/h/ehp)
PW120, 120A	82.0 µg/J (0.485 lb/h/ehp)
PW121	80.4 µg/J (0.476 lb/h/ehp)
PW123, 123AF	79.4 µg/J (0.470 lb/h/ehp)
PW124B	79.1 µg/J (0.468 lb/h/ehp)
PW123C, 123D	81.6 µg/J (0.483 lb/h/ehp)
PW123B, 125B, 126	78.2 µg/J (0.463 lb/h/ehp)
PW126A	77.9 µg/J (0.461 lb/h/ehp)
PW127, 127B, 127C	77.6 µg/J (0.459 lb/h/ehp)

Cutaway P&WC PW100 turboprop

1987

P&WC PT6A

US military designations: T74 (separate entry) **and T101** (PT6A-45R)

The PT6A is a free turbine turboprop, built in many versions since November 1959. By late 1994 a total of 31,326 had logged over 168 million hours (190 million including turboshafts) with 5,460 customers. Several versions are to be built under licence by Klimov of St Petersburg, designated PT6K.

Current versions of the PT6A are as follows:

PT6A-11. Flat rated at 394 ekW, 373 kW (528 ehp, 500 shp) at 2,200 propeller rpm to 42°C. Piper Cheyenne I and IA, T-1040.

PT6A-11AG. Flat rated at 394 ekW, 373 kW (528 ehp, 500 shp) at 2,200 propeller rpm to 42°C. Can use diesel fuel. Ayres Turbo-Thrush, Turbo Ag-Cat and Weatherly 620 TP.

PT6A-112. Flat rated at 394 ekW, 373 kW (528 ehp, 500 shp) at 1,900 propeller rpm to 56°C. Cessna Conquest I, Reims-Cessna F 406 Caravan II.

PT6A-114. Flat rated at 471 ekW, 447 kW (632 ehp, 600 shp) at 1,900 propeller rpm to 54.4°C. Cessna Caravan I with single exhaust.

PT6A-114A. Flat rated at 529 ekW, 503 kW (709 ehp, 675 shp) at 1,900 propeller rpm to 46°C. Cessna Caravan 208B.

PT6A-15AG. Flat rated at 533 ekW; 507 kW (715 ehp, 680 shp) at 2,200 propeller rpm to 22°C. Can use diesel fuel. Ayres Turbo-Thrush, Frakes Turbo-Cat, Turbo Ag-Cat D and Air Tractor AT-402/502.

PT6A-21. Flat rated at 432.5 ekW, 410 kW (580 ehp, 550 shp) at 2,200 propeller rpm to 33°C. Mates A-27 power unit with A-20A gearbox. Beechcraft King Air C90.

PT6A-25. Flat rated at 432.5 ekW, 410 kW (580 ehp, 550 shp) at 2,200 propeller rpm to 33°C. Oil system for sustained inverted flight and Beechcraft T-34C.

PT6A-25A. Some castings of magnesium alloy instead of aluminium alloy. Pilatus PC-7 and NAC Firecracker.

PT6A-25C. Flat rated at 584 ekW, 559 kW (783 ehp, 750 shp) at 2,200 propeller rpm to 31°C. A-25 with A-34 hot end and A-27 first-stage reduction gearing. Embraer EMB-312 and Pilatus PC-7 Mk II.

PT6A-27. Flat rated at 553 ekW, 507 kW (715 ehp, 680 shp) at 2,200 propeller rpm to 22°C, attained by increase in mass flow, at lower turbine temperatures than in PT6A-20. Hamilton Westwind II/III (Beech 18) conversions, Beechcraft 99 and 99A, and U-21A and U-21D (as T74-CP-700/702). DHC-6 Twin Otter 300, Pilatus/Fairchild Industries PC-6/B2-H2 Turbo-Porter, Frakes Aviation (Grumman) Mallard conversion, Let L 410A Turbolet, Saunders ST-27A conversion, Embraer EMB-110 Bandeirante (early) and Harbin Y-12 II.

PT6A-28. Similar to PT6A-27, this has an additional cruise rating of 486 ekW (652 ehp) available to 21°C and maximum cruise up to 33°C. Beechcraft King Air E90 and A100, and 99A, Piper Cheyenne II and Embraer Xingu I.

PT6A-34. Flat rated at 584 ekW, 559 kW (783 ehp, 750 shp) at 2,200 propeller rpm to 31°C, this version has air-cooled nozzle guide vanes. IAI 102/201 Arava, Saunders ST-28, Frakes Aviation (Grumman) Mallard conversion, Embraer EMB-110P1/P2 and EMB-111.

PT6A-34B. Aluminium alloy replaces magnesium in major castings. Beechcraft T-44A.

PT6A-34AG. Agricultural, certificated on diesel fuel. Frakes conversion of Ag-Cat and Ayres Turbo-Thrush, Turbo Ag-Cat, Air Tractor AT-402/502/503A and Croplease Fieldmaster.

PT6A-135. Flat rated at 587 ekW, 559 kW (787 ehp, 750 shp) at 1,900 rpm. Changed drive ratio to reduce noise, higher cycle temperatures. Beech F90, Embraer 121A Xingu II, Piper Cheyenne IIXL, and Schafer Comanchero/Comanchero 750 conversions.

PT6A-135A. Higher thermodynamic ratings. Beech F90-1, Isravlation ST-50 and Dornier Composite Seasta.

PT6A-36. Flat rated at 586 ekW, 559 kW (786 ehp, 750 shp) at 2,200 rpm to 36°C. Similar to -34 but higher rating. IAI 101B/202 Arava and Beechcraft C99.

PT6A-41. Higher mass flow, air-cooled nozzle guide vanes and two-stage free turbine. T-O rating of 673 ekW, 634 kW (903 ehp; 850 shp) at 2,000 propeller rpm, to 41°C. Thermodynamic power 812 ekW (1,089 ehp). Beechcraft Super King Air 200 and C-12, and Piper Cheyenne III.

PT6A-41AG. For agricultural aviation. Frakes Turbo-Cat and Turbo Ag-Cat.

PT6A-42. A-41 with increase in cruise performance. Beechcraft Super King Air B200.

PT6A-45A. A-41 with gearbox to transmit higher powers at reduced speeds. Rated at 916 ekW, 875 kW (1,229 ehp, 1,173 shp) at 1,700 rpm to 8°C, or to 21°C with water injection. Shorts 330 and Mohawk 298.

PT6A-45B. A-45A with increased water injection.

PT6A-45R. A-45B with reserve power rating and deleted water system.

T101-CP-100. A-45R for Shorts C-23A.

PT6A-50. A-41 with higher ratio reduction gear for quieter operation. T-O 875.5 ekW, 835 kW (1,174 ehp, 1,120 shp) with water at 1,210 propeller rpm up to 34°C. DHC-7.

PT6A-60A. A-45B with jet flap intake and increased mass flow for high-altitude cruise. Rated at 830 ekW, 783 kW (1,113 ehp, 1,050 shp) at 1,700 rpm to 25°C. Beech Super King Air 300.

PT6A-61. A-60 gas generator matched with A-41 power section with 2,000 rpm gearbox. T-O rating 673 ekW, 634 kW (903 ehp, 850 shp) to 46°C. Cheyenne IIIA.

PT6A-62. Flat rated at 708 kW (949 shp). Pilatus PC-9 and PZL Orlik.

PT6A-64. A-67 gas generator with A-61 gearbox. Flat rated at 522 kW (700 shp) at 2,000 rpm to 63.5°C. TBM 700.

PT6A-65B. A-65R without reserve rating. Flat rated at 875.5 ekW, 820 kW (1,174 ehp, 1,100 shp) at 1,700 rpm to 51°C. Beechcraft 1900 and C-12J, PZL M 28 (An-28PT) and Beriev Be-32.

PT6A-65R. A-45R with four-stage compressor with jet flap intake, fuel control and fuel dump. Improved hot end and exhaust duct. Reserve power 1,087 ekW, 1,026 kW (1,459 ehp, 1,376 shp) at 1,700 rpm to 28°C. Alternative T-O at 975 ekW, 917 kW (1,308 ehp, 1,230 shp) at 1,700 rpm to 24°C. Shorts 360.

PT6A-65AG. Ag/firefighting version of -65. T-O rating 969 kW (1,300 shp) to 21°C. Ayres Turbo Thrush, Air Tractor AT-802 and 802A and Croplease Firemaster.

PT6A-65AR. Reserve power 1,125 ekW, 1,062 kW (1,509 ehp, 1,424 shp) at 1,700 rpm to 27.7°C. Shorts 360 and AMI DC-3.

PT6A-66. Flat rated at 674 ekW, 534 kW (905 ehp, 850 shp) at 2,000 rpm to 62.2°C. Myasishchev M-102 and Piaggio Avanti with opposed rotation gearbox.

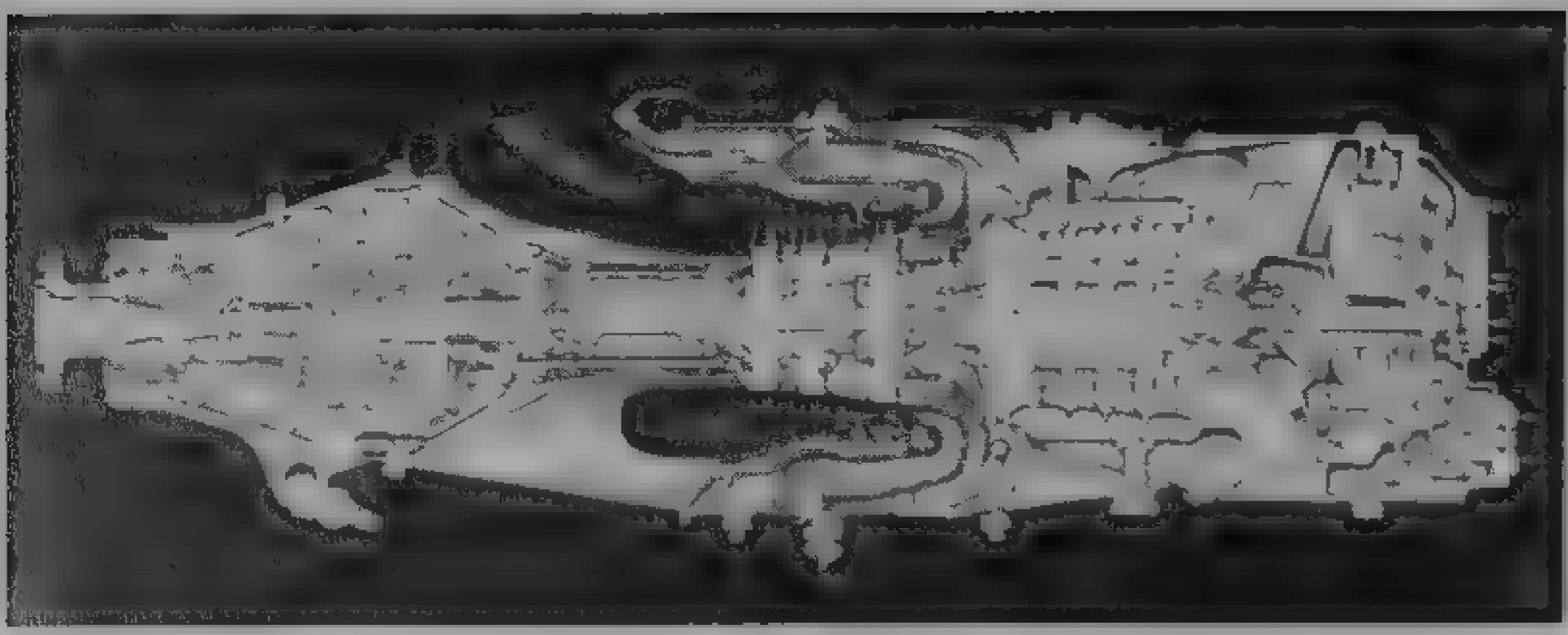
PT6A-67. Flat rated at 870 ekW, 820 kW (1,167 ehp, 1,100 shp) at 1,700 rpm to 60°C. Beechcraft RC-12K/N/P/Q.

PT6A-67A. Flat rated at 948 ekW, 894 kW (1,272 ehp, 1,199 shp) at 1,700 rpm to 51°C. Beech Starship 2000.

PT6A-67AF. Flat rated at 1,125 ekW, 1,062 kW (1,509 ehp, 1,424 shp) at 1,700 rpm to 37.2°C. Conair Turbo Firecat.

PT6A-67B. A-67 modified for medium altitudes. Flat rated at 895 kW (1,200 shp) at 1,700 rpm to 52°C. Pilatus PC-12.

PT6A-67D. A-67B with A-67R gearbox. Flat rated at 909 kW (1,219 shp) at 1,700 rpm to 39°C. Beech 1900D.



Longitudinal section of P&WC PT6A-67 turboprop

1987

PT6A-67R. A-67 with reserve power rating for commuter aircraft. Flat rated at 1,125 ekW, 1,062 kW (1,509 ehp; 1,424 shp) at 1,700 rpm to 37.2°C. Shorts 360-300 and Basler Turbo BT-67.

PT6A-68. Comprises -67 core with 2,000 rpm gearbox, [illegible] flight capability and full authority power management; configured to JPATS Beech (PC-9) Mk II and EMB 312H.

The following data apply generally to the PT6A series:

TYPE: Free turbine axial-plus-centrifugal turboprop.

PROPELLER DRIVE (all models up to and including PT6A-41): Two-stage planetary. Ratio 15. Higher ratio gears for A-45R, -50, -60, -65 and -67.

AIR INTAKE: Annular at rear with screen. Aircraft-supplied alcohol or inertial anti-icing.

COMPRESSOR: Three axial stages, plus single centrifugal (-65 series, four axial stages). PT6A-27: pressure ratio 6.7, mass flow 3.1 kg (6.8 lb/s). PT6A-65: pressure ratio 10, mass flow 4.3 kg (9.5 lb/s).

COMBUSTION CHAMBER: Annular reverse flow, with 14 simplex fuel nozzles.

FUEL SYSTEM: Bendix DP-F2 hydropneumatic automatic fuel control. A-50 has DP-F3 with starting spill valve and motive flow systems. A-60 series (except -62) have Woodward 83212 hyoromechanical system.

FUEL GRADE: JP-1, JP-4, JP-5, MIL-J-5624. Gasolines (MIL-G-5572) grades 80/87, 91/98, 100/130 and 115/145 for up to 150 [illegible] only overhaul period. Agricultural [illegible], diesel to CPW-46.

TURBINES: Up to A-34 two single-stage axial. HP (58 blades) drives compressor and LP [illegible] blades drives output shaft. A-41 onwards have two-stage LP turbine. All blades have hr tree root.

ACCESSORIES: Pads on accessory case (rear of engine) for starter/generator, fluid pump, two aircraft accessories and tachometer generator. Pad on reduction gear for propeller governor, constant-speed unit, overspeed governor and tachometer.

LUBRICATION SYSTEM: One pressure and four scavenge elements driven by gas generator. Integral oil tank 8.75 litres (2.3 US gallons).

OIL SPECIFICATION: CPW202, PWA521 Type II (7.5 cs vis) (MIL-L-23699, MIL-L-7808 for military engines).

STARTING: Electric starter/generator on accessory case.

DIMENSIONS:

Max diameter	483 mm (19 in)
Length, excl accessories:	
PT6A-11 to -36	1,575 mm (62 in)
PT6A-41, 42, 61	1,701 mm (67 in)
PT6A-45, 60A	1,829 mm (72 in)
PT6A-50	2,133 mm (84 in)
PT6A-62, -66	1,778 mm (70 in)
PT6A-65B	1,880 mm (74 in)
PT6A-65R, -65AR, -65AG	1,905 mm (75 in)
PT6A-67, -67R	1,930 mm (76 in)
PT6A-68	1,784 mm (70 in)

WEIGHT, DRY:

PT6A-11	148.8 kg (328 lb)
PT6A-11AG	149.7 kg (330 lb)
PT6A-110, 112	151.5 kg (334 lb)
PT6A-114, -114A	158.8 kg (350 lb)
PT6A-15AG, -21, -27, -28	148.8 kg (328 lb)
PT6A-25	160.1 kg (353 lb)
PT6A-25A	155.6 kg (343 lb)
PT6A-25C	151.9 kg (335 lb)
PT6A-34, -36	150.1 kg (331 lb)
PT6A-34B, -135, -135A	156.0 kg (344 lb)
PT6A-34AG	150.1 kg (331 lb)
PT6A-41, -42	182.8 kg (403 lb)
PT6A-41AG	186.9 kg (412 lb)
PT6A-45A, -45B	196.8 kg (434 lb)
PT6A-45R	203.2 kg (448 lb)
PT6A-50	275.3 kg (607 lb)
PT6A-60A	215.5 kg (475 lb)
PT6A-61	194.6 kg (429 lb)
PT6A-62	205.9 kg (454 lb)
PT6A-64	207.0 kg (456 lb)
PT6A-65B, -65R	218.2 kg (481 lb)
PT6A-65AR, -65AG	220.4 kg (486 lb)
PT6A-66	213.2 kg (470 lb)
PT6A-67, -67A	229.5 kg (506 lb)
PT6A-67AF	241.0 kg (532 lb)
PT6A-67R, -67B, -67D	233.5 kg (515 lb)
PT6A-68	250.0 kg (551 lb)

PERFORMANCE RATINGS (S/L, static):

T-O: See under model listings

Max continuous:

PT6A-110	374 ekW; 354 kW (502 ehp; 475 shp) at 1,900 rpm (to 38°C)
PT6A-11, -11AG	394 ekW, 373 kW (528 ehp, 500 shp) at 2,200 rpm (to 42°C)
PT6A-112	394 ekW, 373 kW (528 ehp; 500 shp) at 1,900 rpm (to 56°C)
PT6A-114	471 ekW; 447 kW (632 ehp; 600 shp) at 1,900 rpm (to 54.4°C)
PT6A-114A	529 ekW, 503 kW (709 ehp; 675 shp) at 1,900 rpm (to 46.1°C)
PT6A-15AG, -27, -28	533 ekW, 507 kW (715 ehp; 680 shp) at 2,200 rpm (to 22°C)
PT6A-21	432.5 ekW; 410 kW (580 ehp, 550 shp) at 2,200 rpm (to 33°C)
PT6A-25, -25A	432.5 ekW, 410 kW (580 ehp; 550 shp) at 2,200 rpm (to 33°C)
PT6A-25C	584 ekW, 559 kW (783 ehp, 750 shp) at 2,200 rpm (to 31°C)
PT6A-34	584 ekW, 559 kW (783 ehp; 750 shp) at 2,200 rpm (to 30°C)
PT6A-135	587 ekW, 559 kW (787 ehp, 750 shp) at 1,900 rpm (-135 to 29°C, -135A to 34°C)
PT6A-36	586 ekW, 559 kW (786 ehp; 750 shp) at 2,200 rpm (to 36°C)
PT6A-41	673 ekW, 634 kW (903 ehp, 850 shp) at 2,000 rpm (to 41°C)
PT6A-42	674 ekW, 634 kW (904 ehp; 850 shp) at 2,000 rpm (to 41°C)
PT6A-45A, -45B, -45R	798 ekW; 761 kW (1,070 ehp; 1,020 shp) at 1,700 rpm (to: -45A, 26.7°C; -45B, 29°C; -45R, 33°C)
PT6A-50	762 ekW, 725.5 kW (1,022 ehp; 973 shp) at 1,210 rpm (to 32°C)
PT6A-60A	830 ekW, 783 kW (1,113 ehp; 1,050 shp) at 1,700 rpm (to 25°C)
PT6A-61	673 ekW, 634 kW (903 ehp; 850 shp) at 2,000 rpm (to 46°C)
PT6A-62	751 ekW; 708 kW (1,008 ehp, 950 shp) at 2,000 rpm (to 37°C)
PT6A-64	557 ekW (747 ehp) at 2,000 rpm (to 63.5°C)
PT6A-65B	875 ekW, 820 kW (1,173 ehp, 1,100 shp) at 1,700 rpm (to 45°C)
PT6A-65R	931 ekW, 875 kW (1,249 ehp, 1,173 shp) at 1,700 rpm (to 38°C)
PT6A-66	675 ekW; 634 kW (905 ehp, 850 shp) at 2,000 rpm (to 62°C)
PT6A-67	870 ekW, 820 kW (1,167 ehp; 1,100 shp) at 1,700 rpm (to 54.4°C)
PT6A-67A	950 ekW, 895 kW (1,273 ehp, 1,200 shp) at 1,700 rpm (to 53°C)
PT6A-67AF	965 ekW (1,294 ehp) at 1,700 rpm (to 48.3°C)
PT6A-67B	949 ekW (1,272 ehp) at 1,700 rpm (to 52°C)
PT6A-67D	1,009 ekW (1,353 ehp) at 1,700 rpm (to 39°C)
PT6A-67R	965 ekW, 910 kW (1,294 ehp; 1,220 shp) at 1,700 rpm (to 48°C)

SPECIFIC FUEL CONSUMPTION:

At T-O rating:

PT6A-11, -11AG	109.4 µg/J (0.647 lb/h/ehp)
PT6A-112	107.6 µg/J (0.637 lb/h/ehp)
PT6A-114	108.2 µg/J (0.640 lb/h/ehp)
PT6A-15AG, -27, -28	101.8 µg/J (0.602 lb/h/ehp)
PT6A-21, -25, -25A	106.5 µg/J (0.630 lb/h/ehp)
PT6A-25C, -34, -34B, -34AG	100.6 µg/J (0.595 lb/h/ehp)
PT6A-135, -135A	98.9 µg/J (0.585 lb/h/ehp)
PT6A-36	99.7 µg/J (0.590 lb/h/ehp)
PT6A-41, -61	99.9 µg/J (0.591 lb/h/ehp)
PT6A-42	101.5 µg/J (0.601 lb/h/ehp)
PT6A-45A, -45B	93.5 µg/J (0.554 lb/h/ehp)
PT6A-45R	93.4 µg/J (0.553 lb/h/ehp)
PT6A-50	94.6 µg/J (0.560 lb/h/ehp)
PT6A-60A	92.6 µg/J (0.548 lb/h/ehp)
PT6A-62	95.8 µg/J (0.567 lb/h/ehp)
PT6A-64	118.8 µg/J (0.703 lb/h/ehp)
PT6A-65B	90.6 µg/J (0.536 lb/h/ehp)
PT6A-65R	86.5 µg/J (0.512 lb/h/ehp)
PT6A-65AR, -65AG	86.0 µg/J (0.509 lb/h/ehp)
PT6A-66	104.8 µg/J (0.620 lb/h/ehp)
PT6A-67	92.4 µg/J (0.547 lb/h/ehp)
PT6A-67A	92.8 µg/J (0.549 lb/h/ehp)
PT6A-67AF, -67R	87.9 µg/J (0.520 lb/h/ehp)
PT6A-67B	93.3 µg/J (0.552 lb/h/ehp)
PT6A-67D	89.6 µg/J (0.530 lb/h/ehp)
PT6A-68	91.5 µg/J (0.540 lb/h/ehp)

OIL CONSUMPTION:

Max	0.091 kg (0.20 lb)/h

UPOATED

P&WC T74

T74 is a US designation for military versions of the PT6A turboprop and PT6B turboshaft.

T74-CP-700. US Army PT6A-20. More than 300 delivered to Beech for 129 U-21A. Inertial separator system.

T74-CP-702. Rated at 580 ekW (778 ehp) and retrofitted in Beechcraft U-21.

VERIFIED

P&WC PT6B/PT6C

The PT6B is the commercial turboshaft version of the PT6A and has a lower ratio reduction gear. Current versions are:

PT6B-36. Reverse drive 6,409 rpm gearbox. T-O rating 732 kW (981 shp) to 15°C, with 2½ minute's contingency 770 kW (1,033 shp) to 15°C. Sikorsky S-76B.

PT6B-36A. Identical to -36 but with different ratings.

PT6B-36B. Improved hot section, ratings as -36A.

PT6C. Direct drive from the power turbine.

DIMENSIONS:

Max diameter	495 mm (19.5 in)
Length, excl accessories	1,504 mm (59.2 in)

WEIGHT, DRY:

PT6B-36	169 kg (372 lb)

P&WC PT6B-36 turboshaft

1993

PT6B-36A	171 kg (378 lb)
PT6B-36B	175 kg (386 lb)

PERFORMANCE RATINGS
T-O: See under model listings
Max cruise, continuous:

PT6B-36	640 kW (870 shp) to 15°C
PT6B-36A, -36B	652 kW (887 shp) to 15°C

SPECIFIC FUEL CONSUMPTION
At T-O rating:

PT6B-36	100.5 µg/J (0.594 lb/h/shp)
PT6B-36A, -36B	98.2 µg/J (0.581 lb/h/shp)

OIL CONSUMPTION:

Max	0.091 kg (0.20 lb)/h

VERIFIED

P&WC PT6T TWIN-PAC

First run in July 1968, the Twin-Pac comprises two PT6 turboshaft engines side by side and driving a combining gearbox.

PT6T-3 T-O rating 1,342 kW (1,800 shp). For Bell and Agusta-Bell 212 and California/Sikorsky S-58T.

In these applications, shaft power is limited by the transmission. In the Model 212 the 1,342 kW (1,800 shp) PT6T-3 is restricted to a T-O rating of 962 kW (1,290 shp) and 843 kW (1,130 shp) for continuous power. In the S-58T the limits are 1,122 kW (1,505 shp) at T-O and 935 kW (1,254 shp) for continuous operation.

PT6T-3B PT6T-3 with some T-6 hardware and improved single-engine performance. Bell 212, 412 and 412SP.

PT6T-3BE PT6T-3B with upgraded combining reduction gearbox and modified torque control unit. For Bell 412HP and AB 412HP.

PT6T-3D. Improved engine for 412EP. Certificated August 1993.

PT6T-6. Improved compressor-turbine nozzle guide vanes and rotor blades. S-58T and AB 212.

PT6T-6B Upgraded, combining reduction gearbox and modified torque control. AB 412HP.

The following features differ from the PT6:

TYPE: Coupled free turbine turboshaft.

SHAFT DRIVE: Combining gearbox comprises three separate gear trains, two input and one output, each contained within an individual sealed compartment and all interconnected by driveshafts. Overall reduction ratio 5.

AIR INTAKES: Additional inertial particle separator to reduce ingestion. High frequency compressor noise suppressed.

FUEL SYSTEM: As PT6 with manual back-up, and dual manifold for cool starts. Automatic power sharing and torque limiting.

FUEL GRADES: JP-1, JP-4 and JP-5.

ACCESSORIES: Starter/generator and tachogenerator on accessory case at front of each power section. Other drives on gearbox, including power turbine governors and tachogenerators, and provision for blowers and aircraft accessories.

OIL SPECIFICATION: PWA Spec 521. For military engines, MIL-L-7808 and -23699.

STARTING: Electrical, with cold weather starting down to -54°C.

DIMENSIONS:

Length	1,702 mm (67.0 in)
Width	1,118 mm (44.0 in)
Height	838 mm (33.0 in)

WEIGHT, DRY (standard equipment):

PT6T-3	294 kg (648 lb)
PT6T-3B, -3BE, -6	299 kg (660 lb)
PT6T-3D	317 kg (690 lb)

PERFORMANCE RATINGS:
T-O (5 min):
Total output, at 6,600 rpm

PT6T-3, -3B, -3BE, -3D	1,342 kW (1,800 shp)
PT6T-6	1,398 kW (1,875 shp) (to 21°C)

Single power section only, at 6,600 rpm

PT6T-3, -3B	671 kW (900 shp)
PT6T-6, -6B, -3BE (2½ min)	764 kW (1,025 shp)
PT6T-3D (2½ min)	820 kW (1,100 shp)

30 min power (single power section), at 6,600 rpm

PT6T-3B, -3BE, -6	723 kW (970 shp)

Cruise A:
Total output, at 6,600 rpm

PT6T-3, -3B, -3BE	932 kW (1,250 shp)
PT6T-6	1,014 kW (1,360 shp)

Single power section only, at 6,600 rpm

PT6T-3, -3B	466 kW (625 shp)
PT6T-3D, -6	500 kW (670 shp)

Cruise B:
Total output, at 6,600 rpm

PT6T-3, -3B, -3BE	820 kW (1,100 shp)
PT6T-6	891 kW (1,195 shp)

Single power section only, at 6,600 rpm

PT6T-3, -3B	410 kW (550 shp)
PT6T-6	440 kW (590 shp)
Ground idle, at 2,200 rpm	44.7 kW (60 shp) max

SPECIFIC FUEL CONSUMPTION:
At 2½ min rating (single power section):

PT6T-3B	100.7 µg/J (0.596 lb/h/shp)
PT6T-3D	101.5 µg/J (0.601 lb/h/shp)
PT6T-6	101.6 µg/J (0.602 lb/h/shp)

OIL CONSUMPTION:

Max (for both gas generators)	0.18 kg (0.4 lb)/h

UPDATED

P&WC PW200

Helicopter engine announced 1983. The basic design is flexible and is planned to permit increased power and reduced sfc without dimensional change.

PW206A. Initially certificated (see 1993-94 *Jane's* for ratings) December 1991 to power Explorer; by end of 1993 18 delivered. Recertificated at higher ratings November 1993.

PW206B Configured for Eurocopter EC135. For certication 1995.

PW206C. Announced 1995, maximum continuous rating 419 kW (562 shp). Selected for Agusta A 109 Power and (with engines assembled by Klimov) Kazan Ansat.

TYPE: Free turbine turboshaft.

AIR INTAKE: Inwards amidships through mesh screen.

COMPRESSOR: Single-stage centrifugal of machined titanium. Pressure ratio 8.

COMBUSTION CHAMBER: Reverse-flow annular with 12 air blast nozzles. Two capacitor discharge igniters.

FUEL SYSTEM: Hydromechanical with digital electronics powered by dedicated alternator.

FUEL GRADE: JP-1, JP-4, JP-5 or a range of gasolines.

TURBINES: Single-stage axial compressor and power turbines with blades held in dovetail slots. Cold junction temperature sensing.

GEARBOX: 206A: front mounted combined reduction and accessory gearbox with 6,000 rpm output; includes phase shift torquemeter and drives for starter/generator, hydraulic pump and alternator. 206B: similar but bevel accessory gearbox with 5,898 rpm output.

DIMENSIONS:

Length: 206A	912 mm (35.9 in)
206B	1,042 mm (41.0 in)
Width	500 mm (19.7 in)
Height: 206A	566 mm (22.3 in)
206B	627 mm (24.7 in)

PERFORMANCE RATINGS:

206A: 2½ min	514 kW (690 shp)
T-O and OEI	477 kW (640 shp)
Max continuous	410 kW (550 shp)
206B:	
2½ min	509 kW (683 shp)
T-O and OEI	474 kW (635 shp)
Max continuous	404 kW (542 shp)

SPECIFIC FUEL CONSUMPTION:

206A: T-O	91.7 µg/J (0.543 lb/h/shp)
Max continuous	94.6 µg/J (0.560 lb/h/shp)
206B:	
T-O	92.6 µg/J (0.548 lb/h/shp)
Max continuous	95.7 µg/J (0.566 lb/h/shp)

UPDATED

Cutaway P&WC PW206A free turbine turboshaft

1993

CHINA, PEOPLE'S REPUBLIC

AVIC

AVIATION INDUSTRIES OF CHINA

PRESIDENT: Zhu Yuli

Replaced former Ministry of Aero-Space Industry 1993 as industrial ruling body for Chinese aviation activities. See aircraft section for details.

UPDATED

CAREC

CHINA NATIONAL AERO-ENGINE CORPORATION

67 Jiao Nan Dajie, Beijing 100712
Telephone: 86 (1) 4013322 ext 5401
Cables: 9696

INTERNATIONAL MARKETING:
CATIC (China National Aero-Technology Import and Export Corporation)
See aircraft section for details

In the past 30 years China has enormously expanded its aero-engine industry. Today there are eight major engine manufacturing centres, five factory managed design institutes and four engine research and design institutes. Over 48,000 engines of 25 types have been manufactured for the air force and navy, 756 engines of 10 types manufactured for CAAC, and smaller numbers for export. Nine types of large solid and liquid rocket engines have also been manufactured. Most factories are seeking foreign orders or partners.

The following survey is by alphabetical order in English of the design or manufacturing organisation.

UPDATED

BUAA

BEIJING UNIVERSITY OF AERONAUTICS AND ASTRONAUTICS

37 Xue Yuan Road, Beijing 100083
Telephone: 86 (10) 201 7251
Telex: 222700 BUAA CN

This university's propulsion department is producing the **WP11** turbojet, for various manned and unmanned applications. It is derived from the Turbomeca Marboré II.

UPDATED

CEC

CHENGDU ENGINE COMPANY

PO Box 77, Chengdu, Sichuan 610067
Telephone: 86 (28) 443628
Fax: 86 (28) 442470
Telex: 60142 CET CN
Cables: 4721
GENERAL MANAGER: Duan Changping

This company was formed in October 1958, and is also known as CEF (Chengdu Aero-Engine Factory). Most of the staff and resources came from the Shenyang Overhaul Factory, and the first task was to produce the **RD-500K** (RR Derwent derivative) turbojet for a cruise missile.

Today CEC has a site area of 137 ha (338.5 acres) and a workforce of almost 20,000. It produces the **WP6** turbojet (see LM), the **WP13** turbojet (see LMC) and components for the Pratt & Whitney **JT8D** turbofan, including combustion liners. In October 1988 SNECMA announced that it was assisting CATIC to develop the improved **WP13G** and **WP14** for later F-7 versions. New annular combustion chambers will be produced.

VERIFIED

CLXMW

CHANGZHOU LAN XIANG MACHINERY WORKS

PO Box 37, Changzhou, Jiangsu 213123
Telephone: 86 (596) 602095, 602097
Cables: 5046
DIRECTOR: Tian Taiwu

Also known as JHEF (Jiangxi Helicopter Engine Factory), this works has a payroll of over 5,000. Its main product is the **WZ6** turboshaft and the **WZ6G** industrial derivative. Rated at 1,145 kW (1,536 shp) and with a dry weight of 300 kg (661 lb), the WZ6 is derived from the Turbomeca Turmo IIIC. Work began in 1975, testing occupied 1980-82 and WZ6 engines first flew in a Z-8 helicopter in 1986.

VERIFIED

DEMC

DONGAN ENGINE MANUFACTURING COMPANY

PO Box 51, Harbin, Heilongjiang 150066
Telephone: 86 (451) 802120
Fax: 86 (451) 802266
Telex: 87131 HDEC CN
Cables: 0021
GENERAL MANAGER: Song Jingang

Also known as HEF (Harbin Engine Factory), this establishment was founded in 1948 and employs more than 10,000. Its first product was the 1,268 kW (1,700 hp) **HS7**, a 14-cylinder radial piston engine based on the Soviet Shvetsov ASh-82V. In parallel, in 195[illegible] [illegible] ASh-21 engines were made, but only the HS7 went into production, for the Z-5 helicopter. In the late 1950s there was a need for a better engine for the Il-12, Il-14, Tu-2 and Curtiss C-46, with better altitude performance. The result, produced from 1962 until 1980, was the **HS8**, which combined the main body and supercharger of the HS7 with the reduction gear of the ASh-82T. The HS8 is rated at 1,380 kW (1,850 hp).

A larger effort began in 1968 when development of the **WJ5** was transferred from ZEF. A derivative of the Ivchenko (ZMKB Progress) AI-24A rated at 1,901 ekW (2,550 ehp) was developed. Among problems solved were broaching of the turbine disc and welding of the annular combustion chambers. Following 5,678 test hours the WJ5 was certificated in January 1977. From 1969 the **WJ5A** was developed, to meet the needs of the SH-5. The turbine was redesigned, with air-cooled rotor blades, and many other parts changed in design or material. The first 5A went on test in late 1970, and certification was gained in January 1980. This modernised engine is rated at 2,350 ekW (3,150 ehp) up to 30°C. In 1979 work began on modifying the original WJ5 to enable the Y-7 series of aircraft to have better hot and high performance. The result, certificated in 1982, is the **WJ5A I**, basically a 5A flat rated at 2,162.5 ekW (2,900 ehp) to 38°C.

In 1988 an agreement was reached with General Electric of the USA for development of the **WJ5E** with reduced sfc. The prototype passed initial static tests in 1990, with sfc reduced from 98.7 μg/J (0.584 lb/h/shp) to 89.4 μg/J (0.529 lb/h/shp). The WJ5E is the engine of the Y7-200B.

In 1966 Harbin was assigned the task of modifying the WJ5 into the **WZ5** turboshaft engine for the Z-6 helicopter. After a prototype had been run this engine was transferred to ZARI (which see).

UPDATED

GADRI

GUIZHOU AERO-ENGINE DESIGN AND RESEARCH INSTITUTE

Supported by many companies, GADRI developed the **WP7B** fighter engine which is included in the entry for LMC.

VERIFIED

GEF — *see under LMC*

HEF — *see under DEMC*

JHEF — *see under CLXMW*

LM

LIMING ENGINE MANUFACTURING CORPORATION

PO Box 424 (6 Dongta St, Dadong District), Shenyang, Liaoning 110043
Telephone: 86 (24) 443139
Fax: 86 (24) 732221
Cables: 4104
Telex: 80025 LMMCS CN
GENERAL MANAGER: Yan Guangwei

With site area exceeding 100 ha (247.1 acres), more than 200,000 m² (2,152,850 sq ft) covered area, and a workforce of over 20,000, Liming (Daybreak) is one of the largest and most experienced aero-engine centres in China. Alternatively known as SEF (Shenyang Aero-Engine Factory), or just as The New Factory, it was set up on the basis of the old overhaul factory in 1954-57. The first product was the **WP5** turbojet, a licensed version of the Soviet Klimov VK-1F (Rolls-Royce Nene derivative). Production of the WP5 was achieved in June 1956. By 1957 the WP5A, based on the VK-1A, was in production, but in 1963, following increased demand to power the H-5, production was transferred to XEF (see XAE).

In 1956 SADO (Shenyang Aero-Engine Design Office) was established, later being restyled SARI. This undertook the design of the first Chinese turbojet, the **PF1A**, based on the WP5 but smaller and rated at 15.7 kN (3,527 lb st) to power the JJ-1 trainer. Design was complete in 1957 and the PF1A powered the prototype JJ-1 in July 1958, but later the requirement for the JJ-1 was dropped.

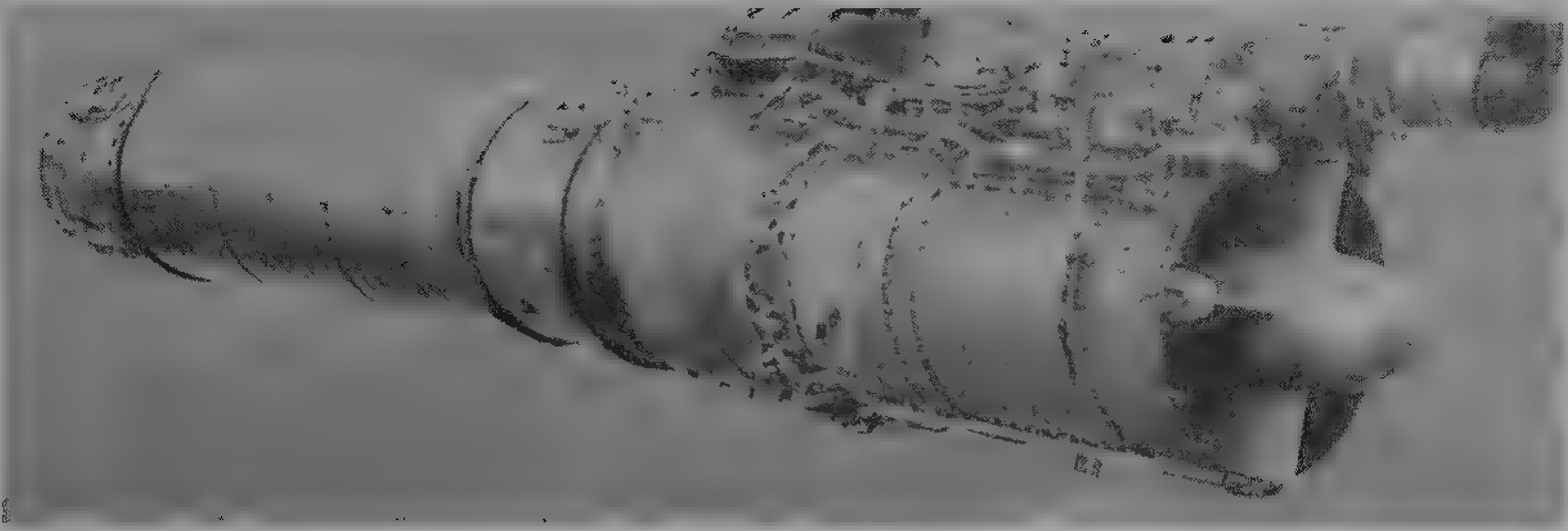
VERIFIED

LM WP6

In early 1958 Soviet documents arrived for licence production of the Tumansky (Soyuz) RD-9BF-811. This single-shaft axial turbojet with afterburner proved a major challenge, but the Shenyang **WP6** was first tested at the end of 1958. Tests were not successful, but following improvements in quality control trial production restarted in 1961. Subsequently several thousand, with progressive upgrades, have been made for the J-6, JJ-6 and Q-5. The **WP6A** for the Q-5 I attack aircraft, has a variable inlet stator stage and increased turbine temperature. This engine was certificated in August 1973. A further variant was the **WP6B** for the J-12, not made in quantity.

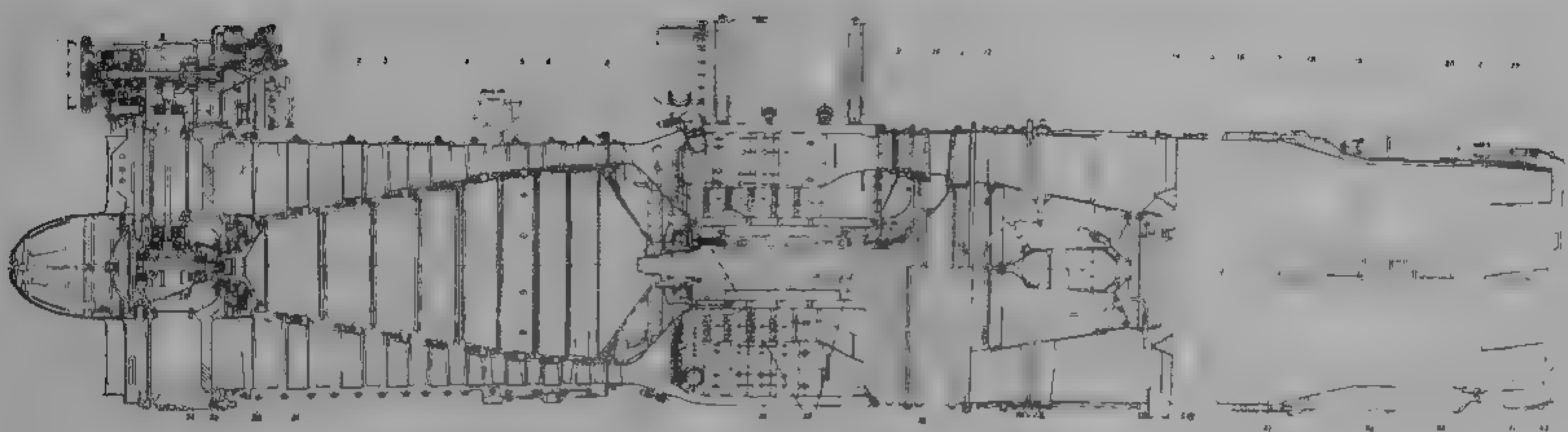
The following is a description of the WP6A:

INLET: Cast assembly with four de-iced radial struts, one housing drive to accessory section above and projecting ahead of inlet. Central fixed bullet and front bearing



WP6A afterburning turbojet

1986



Longitudinal section through WP6A turbojet (afterburner shown shortened)

1 variable inlet stator, 2 stator vanes, 3 compressor case, 4 air bleed band, 5 bleed actuating cylinder, 6: rear load relief cavity, 7: centre bearing, 8 starting igniter, 9 stage 1 nozzle, 10 turbine rotor, 11 stage 2 nozzle, 12 quick-release ring, 13. diffuser, 14 quick-release ring, 15 front flange, 16 case, 17 shroud, 18 bracket, 19 actuating cylinder, 20 adjustable flap flange, 21 actuator and rod heat shield, 22 nozzle adjusting ring, 23 copper plate 24 flap 25 centring pin, 26 cylinder cowl, 27 clamp strip 28 rear bearing 29 oil jet, 30 flame tube, 31 compressor, 32 front load relief cavity 33 front bearing 34 front case

1987

COMPRESSOR: Welded ring construction with one row of variable inlet stators and nine rows of rotor blades. Mass flow 46.2 kg (101 85 lb)/s Pressure ratio 7.44

COMBUSTION CHAMBER Can-annular type with 12 flame tubes, each terminating in a section of turbine inlet periphery Spill type burners Two igniters fed from starting tank

TURBINE: Two-stage type with blades inserted into large flat discs, driving compressor via tubular shaft

AFTERBURNER Constant diameter type with main starting burner in turbine rear cone and single ring of fuel nozzles and gutter flameholders around rear of cone Ten adjustable nozzle flaps positioned by four rams

DIMENSIONS:	
Length	5,483 mm (215 9 in)
Max height	950 mm (37 4 in)
Diameter	668 mm (26.3 in)
WEIGHT, DRY	725 kg (1 598 lb)
PERFORMANCE RATINGS (S/L, static)	
Afterburner: WP6A	36 78 kN (8 267 lb st)
WP6B	39 72 kN (8 929 lb st)
Max dry, WP6A	29 42 kN (6 614 lb st)
Normal: WP6A	24 03 kN (5,401 lb st)
WP6B	24.51 kN (5,511 lb st)
SPECIFIC FUEL CONSUMPTION (WP6A)	
Afterburner	0 163 kg/h/N (45 24 mg/Ns, 1 597 lb/h/lb st)
Max	0 1 kg/h/N (27 76 mg/Ns, 0 980 lb/h/lb st)
Normal	0.099 kg/h/N (27 48 mg/Ns, 0.970 lb/h/lb st)

UPDATED

LM WP7

For the J 7 fighter the Shenyang factory produced the Tumansky (Soyuz) R 11F-300 afterburning turbojet under Licence. Designated **WP7** this Mach 2 engine was an even greater challenge as many key Soviet documents were not supplied, and 1,097 documents had errors or omissions Eventually, using indigenous materials, the first WP7 went on test in October 1965 Dry and afterburning ratings were 38 2 kN (8,598 lb st) and 56.4 kN (12,676 lb st) respectively By 1970 production of this engine was transferred to LMC Shenyang continued to introduce improvements, and a stall flutter problem was solved by using 24 larger blades in the first stage of the compressor instead of 31, while other changes were made to the HP turbine disc, bearing lubrication and afterburner nozzle flap design

In 1964 a decision had to be made on how to power the F-8 fighter No engine in the 120 kN (12 tonne) class could be produced in time, but Rong Ke, deputy director of Beijing Aeronautical Materials Institute, undertook to produce air-cooled blades within a year to allow two uprated WP7 engines to be used. In May 1965 the resulting engine was authorised as the **WP7A** After testing against forged blades with three large cooling holes the decision was taken to use nine-hole cast blades. Dry and afterburning ratings were established at 43 14 kN (9,698 lb st) and 59 kN (13,265 lb st) respectively These engines powered the J-8 on its first flight in July 1969, and were certificated in June 1982 Subsequently LMC developed the **WP7B** (see LMC) and **WP7C** The latter powers J 7 and J-7 II aircraft. Thrust ratings are maximum 60.6 kN (13,623 lb st), maximum dry 42 65 kN (9 588 lb st) and normal 33 54 kN (7,540 lb st). TBO is 300 hours Latest known variant is the **WP7F**, which powers the J 7E, dry rating is 44 13 kN (9,921 lb st) and with afterburning 63.74 kN (14,330 lb st)

VERIFIED

WP7C afterburning turbojet (afterburner not fitted)

1991

LM WS6

Also in 1964 a meeting was held to select an engine for a new indigenous fighter The choice fell on an augmented turbofan, the **WS6** In collaboration with SARI, drawings were produced in 1964-66, and by 1969 two prototype engines had been made. Then the cultural revolution delayed the programme by about 10 years but after 1978 eight more engines were built. A two-spool engine with air-cooled HP blades, it reached design figures in 1980 Augmented thrust was increased to 122 1 kN (27,450 lb st) in 1982, but by then the associated fighter programme had been cancelled

TYPE Two-shaft augmented turbofan for supersonic applications.

FAN Three stages, First stage transonic No inlet guide vanes. Mass flow 155 kg (342 lb)/s. Bypass ratio 1

COMPRESSOR: Eleven stages, with variable inlet vanes and fifth-stage bleed Pressure ratio 6 78 at 9,400 rpm. Overall pressure ratio 14.44.

COMBUSTION CHAMBER Can-annular

TURBINES: Two-stage HP inlet temperature 1,177°C. Two-stage LP
AFTERBURNER: Five circular gutters and six fuel-injection zones. Maximum temperature 1,527°C
NOZZLE: Outer nozzle only, multiflap type

DIMENSIONS:	
Length	4,654 mm (183.2 in)
Diameter (nozzle)	1,370 mm (53.94 in)
WEIGHT, DRY:	2,100 kg (4,630 lb)
THRUST RATINGS (S/L):	
Max T-O	122.1 kN (27,445 lb st)
Max dry	71.1 kN (15,991 lb st)
SPECIFIC FUEL CONSUMPTION:	
Max T-O	64.01 mg/Ns (2.26 lb/h/lb st)
Max dry	17.56 mg/Ns (0.62 lb/h/lb st)

VERIFIED

WS6 afterburning turbofan
1992

LMC

LIYANG MACHINERY CORPORATION

PO Box 5, Pingba, Guizhou 561102
Telephone: 86 (34) 551779, 523313
Telex: 66044 LYMCG CN
Cables: 4099, 4101 PINGBA
GENERAL MANAGER: Hu Wenqin

With a covered area of 750,000 m² (8,073,200 sq ft), and a workforce of about 10,000, LMC is also known as GEF (Guizhou Aero Engine Factory). The associated GADRI undertook the development of the **WP7B** afterburning turbojet, the programme being transferred to LMC because Shenyang (LM) was overloaded.

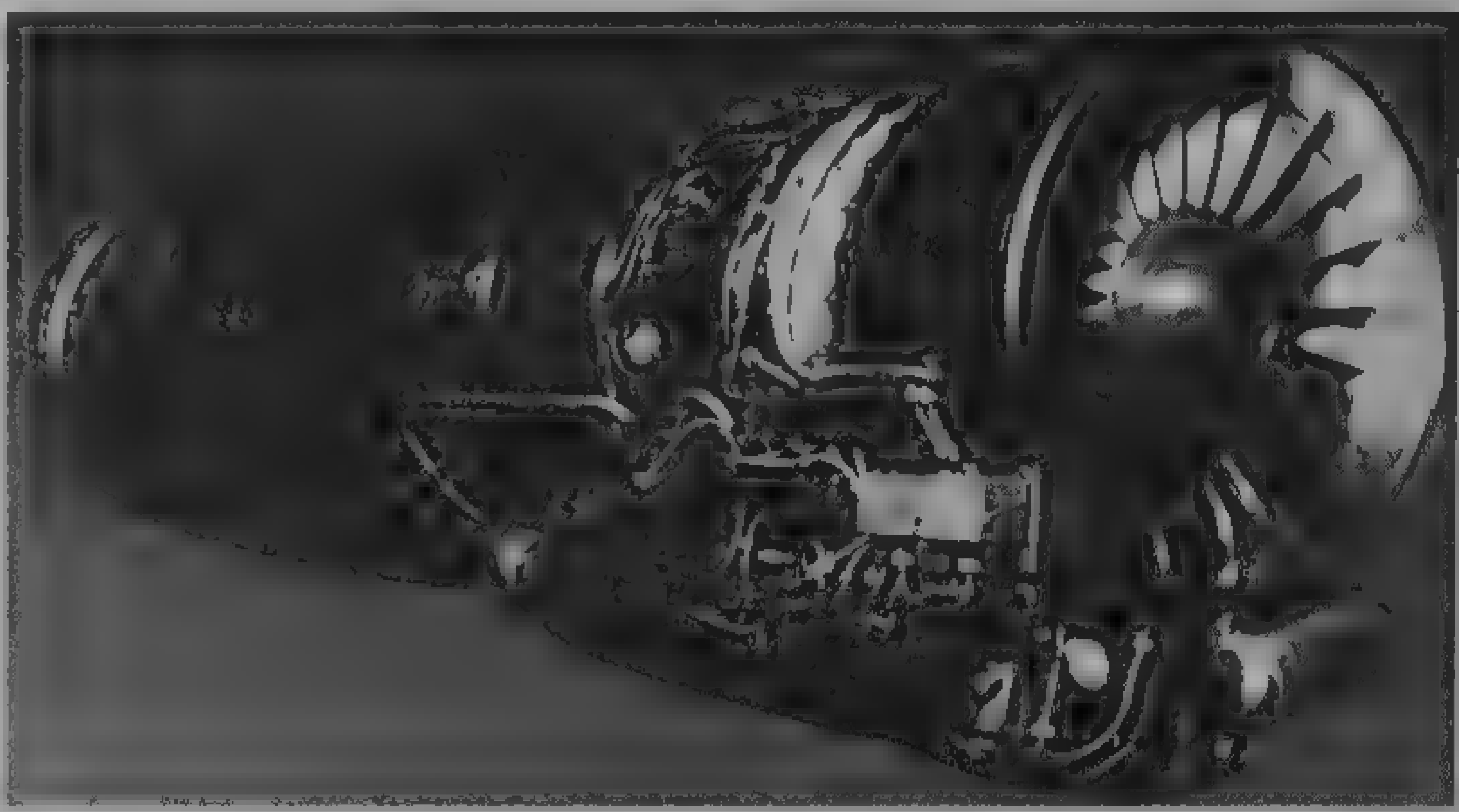
UPDATED

LMC WP7B

This engine powers the J-7 fighter and JJ-7 trainer. The main change in the 7B concerned the structure and length of the afterburner. The cast air-cooled turbine blades tended to crack, with a high reject rate of castings, and burning of the rear fuselage was caused by excessive afterburner wall temperatures. The 7B was eventually certificated in 1978 and succeeded the WP7 in production in 1980. Further changes enabled TBO to be increased from 100 to 200 hours. Guizhou then eliminated the separate petrol (gasoline) starter and its tank and supply system. The engine is known as the **WP7B (M batch)** and entered production in 1982. A further modification, the **WP7B(BM)**, reduces weight by 17 kg (37.5 lb), enabling the F-7M to add drop tanks.

The following refers to the WP7B (BM).

TYPE: Two-shaft turbojet with afterburner
INLET: No inlet guide vanes, first LP compressor stage overhung ahead of front roller bearing
COMPRESSOR: Three-stage LP compressor with pressure ratio of 2.74. Five-stage HP compressor giving overall pressure ratio of 8.1. All blades inserted into discs carried on short tubular shafts
COMBUSTION CHAMBER: Can-annular, with 10 flame tubes, Nos. 1 and 6 being of a different pattern and incorporating torch igniters. Air film liners coated on both sides with ceramic material



WP7B(BM) afterburning turbojet for the F-7M Airguard fighter
1987

TURBINES: Single-stage HP with 96 inserted shrouded blades. Single-stage LP with shrouded blades. Outlet gas temperature 1,083°K (810°C)
AFTERBURNER: Multiple gutters and double-wall liner. Multiflap nozzle driven by four hydraulic rams. Up to 40 hours operation permitted in each 200 hours overhaul period

PERFORMANCE RATINGS (S/L, static):	
Max afterburner	59.82 kN (13,448 lb st)
Max dry	43.15 kN (9,700 lb st)
SPECIFIC FUEL CONSUMPTION (as above):	
Max afterburner	56.37 mg/Ns (1.99 lb/h/lb st)
Max dry	28.61 mg/Ns (1.01 lb/h/lb st)

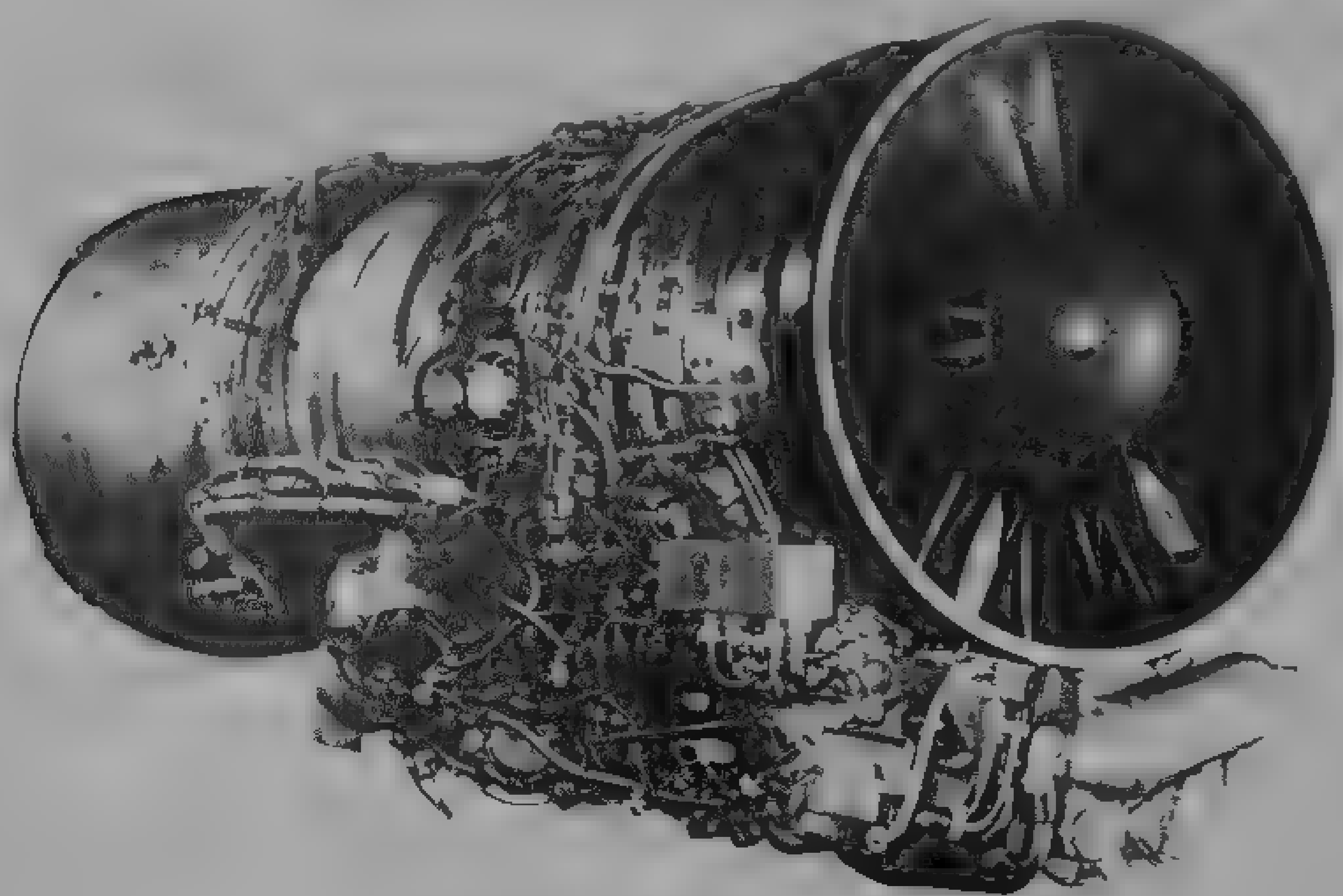
UPDATED

LMC WP13

The next major product of LMC was the **WP13**. Though this has some features in common with the Gavrilov R-13 it is a Chinese development, based on experience with the WP7. A two-spool afterburning turbojet, it was developed to power the J-7 III and J-8 II. Compared with the WP7 the air flow is increased, work per stage improved, pressure ratio raised (the HP spool having new blades) and surge margin doubled. New titanium alloys were used for the compressor discs and blades, and in a major development two more new titanium alloys were used for the cast compressor casings. WP13 development began in 1978, and it was decided to make the engine a 50/50 joint project with CEC. Both factories tested engines, and certification was gained in 1985. Further development introduced air-cooled HP turbine blades and modifications to the combustion chamber and afterburner, the afterburner of the **WP13A II** being longer.

DIMENSIONS:	
Length overall:	
WP13	4,600 mm (181.1 in)
WP13A II	5,150 mm (202.75 in)
Diameter: both	907 mm (35.71 in)
Max height: WP13	1,085 mm (42.72 in)
WEIGHT, DRY:	
WP13	1,211 kg (2,670 lb)
WP13A II	1,201 kg (2,648 lb)
PERFORMANCE RATINGS (S/L, static):	
Max afterburner:	
WP13	64.73 kN (14,550 lb st) at 11,156 LP rpm
WP13A II	65.9 kN (14,815 lb st)
Max dry:	
WP13	40.21 kN (9,039 lb st) at 11,156 LP rpm
WP13A II	42.7 kN (9,590 lb st)
SPECIFIC FUEL CONSUMPTION (as above):	
Max afterburner:	
WP13	63.73 mg/Ns (2.25 lb/h/lb st)
WP13A II	62.32 mg/Ns (2.20 lb/h/lb st)
Max dry:	
WP13	27.19 mg/Ns (0.96 lb/h/lb st)
WP13A II	28.04 mg/Ns (0.99 lb/h/lb st)
OVERHAUL LIFE:	
WP13	500 h (total service life 1,500 h)
WP13A II	300 h (including up to 90 h in afterburner)

UPDATED



LMC WP13A II turbojet (afterburner not fitted)
1987

SAC

SHENYANG AERO-ENGINE COMPANY

This was formed in 1979 from the merger of SEF and SARI. Today it is part of LM

VERIFIED

SAMP

SHANGHAI AERO-ENGINE MANUFACTURING PLANT

PO Box 600, 600 Guangzhong Road, Shanghai 200083
Telephone: 86 (21) 6650644
Fax: 86 (21) 6651482
Telex: 33136 SHAIR CN
Cables: 5834
DIRECTOR: Shen Huansheng

This factory was built in 1971-74 and was originally the SAF (Shanghai Aero-Engine Factory). It has a covered area of 56,191 m² (604,855 sq ft) and workforce of 2,000. Apart from various non-aero engines and components its main development effort was the **WS8** turbofan, to power the Y-10. Work proceeded quickly and the first engine went on test in June 1975. Eight engines were built, one running a 1,000 hour test, one a 150 hour certification test and one was flight tested, making eight flights totalling 22 hours. A front fan engine with a short bypass duct, the WS8 was rated at 80 kN (18,000 lb st). About 17 per cent was titanium, and new techniques included anti-corrosion coating with cadmium and nickel, graphite varnish of titanium parts; and aluminised siliconising of turbine blades. The Y-10 was not put into production and the engine had no other application.

UPDATED

SARI

SHENYANG AVIATION ENGINE RESEARCH INSTITUTE

PO Box 428, Shenyang, Liaoning 110015
Telephone: 86 (24) 820057
Fax: 86 (24) 820673
Telex: 80055 SARI CN
Cables: 4391 (national), SARI (international)
DIRECTOR: Hai Yide

Shenyang Aero-engine Research Institute (SARI), founded in 1961, has nearly 3,000 employees. It is responsible for research, design and development of large and intermediate size turbojet and turbofan engines and their components and systems. In the 1960s SARI modified the **WP7** engine into the **WP7A**, and transferred the engine to Liming Corporation in Shenyang and Liyang Corporation for serial production for F-7 and J-8 aircraft. From 1965 SARI developed the **WS6**, a high thrust turbofan with afterburner. There were 10 WS6 demonstrator engines built. All performance goals were achieved, but the WS6 was not put into production (see under LM).

SARI is now developing new types of turbojet and turbofan engines.

VERIFIED

SEF — *Original abbreviation of SAC (see LM)*

SMPMC

SOUTH MOTIVE POWER AND MACHINERY COMPLEX

PO Box 211, Zhuzhou, Hunan 412002
Telephone: 86 (733) 21151
Fax: 86 (733) 24220
Telex: 995002 CHENF CN
Cables: 2820

SAEC (South Aero-Engine Company)

Address as above
GENERAL MANAGER: Wu Shenduo

With a covered area of nearly 300,000 m² (3,230,000 sq ft) and workforce of over 10,000, SMPMC is one of the larger MAS establishments. Until 1983 its aero-engine division SAEC was known as ZEF (Zhuzhou Aero-Engine Factory), and in 1951 was set up as the first aero-engine factory in China. Its first product was the Soviet Shvetsov **M-11FR** radial piston engine rated at 119 kW (160 hp), the first three being completed in July 1954. Mass production followed. To meet the needs of the Y-5 (licensed An-2) ZEF began in September 1956 to work on the **HS5** (licensed ASh-621R). Over 2,600 of these 746 kW (1,000 hp) radial piston engines were produced by 1986, some being installed in CAAC Li-2s.

Lacking the chosen Praga Doris B engine to power the CJ-6 trainer, the Soviet Ivchenko (ZMKB Progress) AI-14R radial piston engine was produced as the **HS6**. Rated at 191 kW (260 hp), the HS-6 entered production in June 1962, about 700 being produced. To improve performance, especially at altitude, ZEF increased rpm, compression ratio and supercharger ratio. The result, in 1963, was the **HS6A**, with T-O power increased to 212.5 kW (285 hp). About 3,000 were made by 1986. In 1975 the engine was again modified to power the Y-11, rpm were increased and the reduction gear strengthened. The resulting **HS6D**, with power of 224 kW (300 hp), was certificated in August 1980. The **HS6E**, for the NAMC Haiyan, has a further increased compression ratio and modifed exhaust valves and reduction gear, raising output to 261 kW (345 hp). In 1990 the simplified **HS6K** was certificated at 298 kW (400 hp) and is intended as the future engine of the N-5A. Experimental models, in the 1963-70 period, were the turbocharged **HS6B** and the **HS6C** for helicopters used in the 701 and Yan'an II helicopters.

Work on gas turbines began in January 1965 in support of the development by BIAA (Beijing Institute of Aeronautics and Astronautics) of the **WP11**. This simple turbojet, rated at 8.3 kN (1,874 lb st), powered the WZ-5 unmanned reconnaissance vehicle. The WP11 first ran in June 1971 and was certificated in 1980, manufacture then being transferred to ZEF. In September 1965 ZEF was selected to develop the **WJ5** turboprop, but this was transferred in 1968 to HEF (see DEMC). In 1969 ZEF was ordered to develop the **WJ6** turboprop, based on the Soviet Ivchenko AI-20M, to power the Y-8. Testing started in 1970, but various problems delayed certification until January 1977. Further changes (for example to compressor vane angle, igniter and lubrication clearances) resulted in TBO being raised in stages from 300 to 3,000 hours. T-O power was 3,169 ekW (4,250 ehp) and weight 1,200 kg (2,645 lb). In 1977 work began on the **WJ6A** to power the Y-8C with a pressure cabin and greater payload. By using air-cooled blades and raising the rpm this engine was successfully run in 1983 at 3,393 ekW (4,550 ehp).

In 1980 ZEF began the assembly and test of the **WZ8** (Turbomeca Arriel 1C) for the Z-9 helicopter. ZEF gives the output as 522 kW (700 shp) for a weight of 118 kg (260 lb). An all-Chinese WZ8 ran in 1985, and resulted in major technical upgrades at Zhuzhou (the high-voltage igniter box was the only imported part). As part of the offset, 40 accessory gearboxes were supplied to France.

ZEF also produces solid rocket motors for air-to-air missiles.

UPDATED

XAE

XIAN AERO-ENGINE CORPORATION

PO Box 13, Xian, Shaanxi 710021
Telephone: 86 (29) 6613411, 6613422, 6613888
Fax: 86 (29) 6614019, 6614035
Telex: 70102 XIARO CN
Cables: 5411
PRESIDENT: Wang Xin Yan

Construction of this factory began in August 1958, as XEF (Xian Aero-Engine Factory), and today its workforce exceeds 10,000. Its history was given in the 1993-94 *Jane's*. Today it has a wide range of products, for aerospace and many other fields. It has established business relations with GE, Pratt & Whitney, Rolls-Royce and other Western companies. The photograph shows a WS9, the Rolls-Royce Spey 202 made in 1975-79 under licence. In 1994 XAE delivered its 30,000th nozzle guide vane for Rolls-Royce Spey and Tay engines.

UPDATED

WS9 two-shaft augmented turbofan *1991*

ZAC

ZHUZHOU AERO-ENGINE COMPANY

This organisation, apparently an alternative or earlier title for SAEC (see SMPMC entry), was formed in 1983 by merging ZEF and ZARI. Its main task so far has been to produce the **WJ9** turboprop to power a production version of the Y-12. This engine, rated at 507 kW (680 shp), is based on the WZ8 (Arriel 1C), but with a new reduction gear, accessory drives and fuel and lubrication systems. The first engine ran in 1986 and met the design figures. A production WJ9 would probably also power agricultural and other special purpose aircraft.

VERIFIED

ZARI

ZHUZHOU AERO-ENGINE RESEARCH INSTITUTE

This organisation was established in 1968 From the start it has been tasked with R&D of shaft-drive gas-turbine engines, starting with the **WZ5** (see DEMC). The poor payload and lack of twin-engine safety of the Z-5 and Z 6 led to a new helicopter, the Z-7, in 1970. This was powered by the twin packaged **WZ5A**, developed at ZARI. Contingency power of each power section was 1,737 kW (2,330 shp). Design was finished in 1971, but the cultural revolution caused a delay of eight years. The WZ5A then reached its design targets, but was cancelled upon the abandonment of the Z-7 ZARI was merged with ZEF in 1983 to form ZAC

ZEF

ZHUZHOU AERO-ENGINE FACTORY

Established in 1951 as China s first aero-engine factory (see SMPMC entry), ZEF was amalgamated with ZARI in 1983 to form ZAC

VERIFIED

CZECH REPUBLIC

OMNIPOL

OMNIPOL AS

Nekázanka 11, CR-112 21 Prague 1
Telephone: 42 (2) 2401 1111
Fax: 42 (2) 2401 2241
Telex 121297 or 121299 OMPO

GENERAL DIRECTOR Mgr Jiří Fiala

Omnipol is now a joint stock company responsible for import and export of aircraft, aeronautical products and defence equipment

UPDATED

AEROTECHNIK

AEROTECHNIK

CR-68601 Uherské Hradiste, Kunovice
Telephone 42 (632) 49122
Fax. 42 (632) 49128
Telex: 60380
TECHNICAL DEPARTMENT Ing E. Parma

UPDATED

AEROTECHNIK MIKRON

The factory at Moravska Trebova produces the Mikron IIIAE piston engine, of 2,440 cc (149 cu in) capacity.

WEIGHT, DRY: 70 0 kg (154 lb)

PERFORMANCE RATINGS
T-O 48.5 kW (65 hp) at 2,600 rpm
Cruise 35.5 kW (47 6 hp) at 2,350 rpm

UPDATED

Aerotechnik Mikron IIIAE piston engine *(Paul Jackson)*
1995

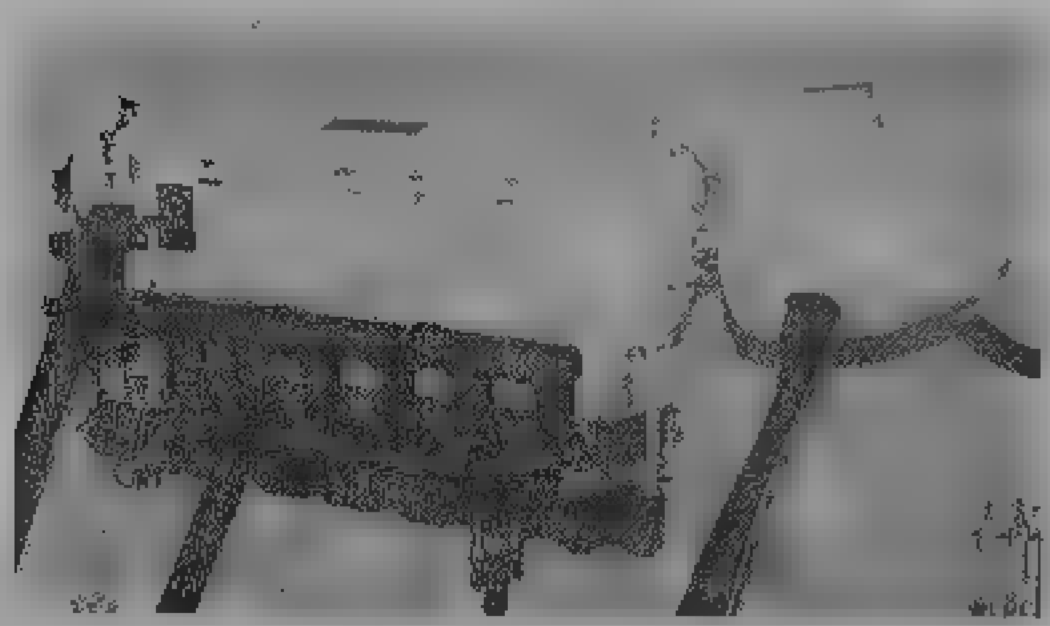
LOM

LOM PRAGUE

270 Černokostelecká Street, CR-10038 Prague 10
Telephone. 42 (2) 701166, 702749
Fax: 42 (2) 706523
GENERAL MANAGER Vladimir Zasa...
SALES MANAGER Josef Bel...k

On 22 August 1990 the production of Avia piston engines was transferred to LOM Prague, a public corporation. LOM Prague also produces propellers and overhauls a wide range of jet and turboshaft engines of Russian and Czech origin

UPDATED



LOM M337 piston engine
1995

LOM PISTON ENGINES

LOM is producing the engines shown in the table All are air-cooled four-stroke piston engines operating at a compression ratio of 6.3 on 78-octane fuel with cylinders of 105 mm (4 13 in) bore and 115 mm (4 53 in) stroke giving capacity of 3 98 litres (242 88 cu in) for four-cylinder engines and 5 97 litres (364 31 cu in) for six-cylinder. Current output is 60 to 80 engines per year

			Dimensions			
Model	No of cylinders	T-O rating kW (hp) at rpm	Length mm (in)	Width mm (in)	Height mm (in)	Dry weight kg (lb)
M132 A, AR, AK	4	90 (121) at 2,700	1070 (42 12)	425 (16 73)	628 (24 72)	102 (224.8
M332 A, AR AK	4	103 (138) at 2,700	1120 (44.09)	425 (16 73)	628 (24.72)	102 (224 8)
M137 A. AL, AZ	6	134 (180) at 2,750	1360 (53 54)	444 (17 48)	630 (24 80)	141 (310 8)
M337 A, AK, AK1, AK2, AK3	6	154 (207) at 2,750	1410 (55 51)	444 (17 48)	628 (24 72)	153 (337 3)

Model letters. A, AL, basic type, 5 seconds inverted only except M137 fully aerobatic, AR, basic aerobatics, M332 without alternator; AK, aerobatic except no flick rolls, AK1, 1 7 kW alternator and V500 propeller; AK2, 1 7 kW and V532, AK3, 1 7 kW and V546; AZ, unlimited aerobatics

UPDATED

WALTER

WALTER A S

Jinonická 329, CR 158 01 Prague 5
Telephone: 42 (2) 5296 1111
Fax: 42 (2) 526060
Telex. 121434 motp c
GENERAL MANAGER Ing Zdeněk Přinosil
MARKETING MANAGER Ing Jiří Blatny

Walter operates the main aero-engine establishment in the Czech Republic. It has delivered over 17,000 piston engines, 16,000 turbojets and nearly 4,500 turboprops. The Walter company was re-named Motorlet but reverted to its original title in March 1995, although the Walter name was used throughout as a trademark

UPDATED

WALTER M 601

The M 601 was designed to power the L-410 transport. It drives an Avia V 508 propeller.

The first version, rated at 410 ekW (550 ehp), ran in October 1967. Development of the **M 601 A**, of increased diameter, started during 1968. The Let L-410M powered by M 601 A engines was in Aeroflot service by early 1976. The **M601B** powers the L-410MA and L-410UVP In 1982 a

further variant, the **M 601 D**, entered production. This gives increased power and can be operated to longer TBO. It powers the L-410UVP and PZL-106 BT. By 1983 the derated **M 601 Z** had entered production to power the Z 137T agricultural aircraft. It drives an auxiliary piston compressor and a mechanical take-off shaft for the spraying/dusting installation. All the above drive AVIA/HamStan VJ8 508 three-blade propellers.

The **M 601 E** powers the L-410UVP-E. It has a TBO of 2,000 hours without hot-section inspection. It drives a VJ 8 510 five-blade propeller, and an alternator for anti-icing windscreens and propeller blades. It is certificated to Russian NLGS-2 Swedish JAR and FAR Pt 33 in the Czech Republic, and received FAA certification in January 1995.

The **M 601 T** is an aerobatic version for the PZL-130TM and -130TB Orlik. The **M601 F**, with TBO of 3,000 hours without hot-section inspection, is intended for Western markets, initially with FAA and Canadian certification. It entered production in early 1995 to power the L-420, Myasishchev M-101 and Aero Ae 270.

TYPE: Free turbine turboprop

PROPELLER DRIVE: Reduction gear at front of engine with drive from free turbine. Reduction ratio 14.9

AIR INTAKE: Annular, at rear (reverse flow engine)

COMPRESSOR: Two axial stages of stainless steel, plus single centrifugal stage of titanium. Pressure ratio (601 B) 6.4, (601 D) 6.55, (601 E, F, T) 6.65, at 36,660 rpm gas generator speed. Air mass flow (601 B) 3.25 kg (7.17 lb)/s, (601 D) 3.55 kg (7.83 lb)/s, (601 E, F, T) 3.6 kg (7.94 lb)/s

COMBUSTION CHAMBER: Annular combustor with rotary fuel injection and low-voltage ignition

COMPRESSOR TURBINE: Single stage with solid blades, inlet temperature 957°C

POWER TURBINE: Single stage

FUEL SYSTEM: Low-pressure regulator

FUEL GRADE: PL-6, PL-7, PSM-2, RT, TS-1 and Jet A-1 kerosene

LUBRICATION SYSTEM: Pressure gear pump circulation. Integral oil tank

OIL SPECIFICATION: B3V synthetic oil or Aeroshell 500, 555, 560, Mobil Jet II, Exxon 2380, Castrol 599

STARTING: LUN 2132-8 8 kW electric starter/generator

DIMENSIONS:

Length: 601 D	1,658 mm (65.27 in)
601 B, E, Z, F, T	1,675 mm (65.94 in)
Width	590 mm (23.23 in)
Height	650 mm (25.59 in)

WEIGHT, DRY:

601 B, D	193 kg (425.5 lb)
601 Z	197 kg (434.3 lb)
601 E	200 kg (441 lb)
601 F, T	202 kg (445 lb)

PERFORMANCE RATINGS (T-O):

601 B	515 kW (691 shp)
601 D	540 kW (724 shp)
601 E, T	560 kW (751 shp)
601 Z	382 kW (512 shp)
601 F	580 kW (778 shp)

SPECIFIC FUEL CONSUMPTION (T-O):

601 B	110.8 μg/J (0.656 lb/h/ehp)
601 D	110.5 μg/J (0.654 lb/h/ehp)
601 E, T	109.7 μg/J (0.649 lb/h/ehp)
601 F	106.9 μg/J (0.633 lb/h/ehp)
601 Z	135.8 μg/J (0.804 lb/h/ehp)

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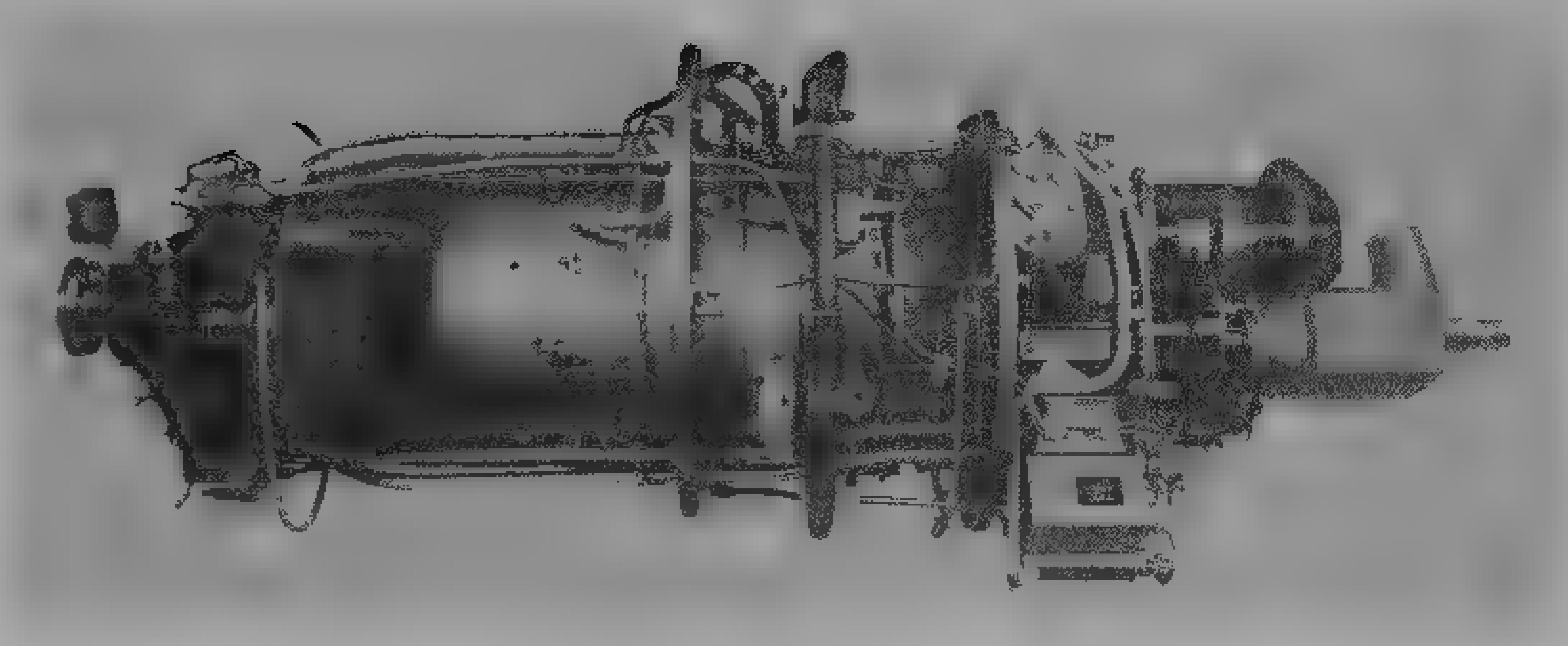
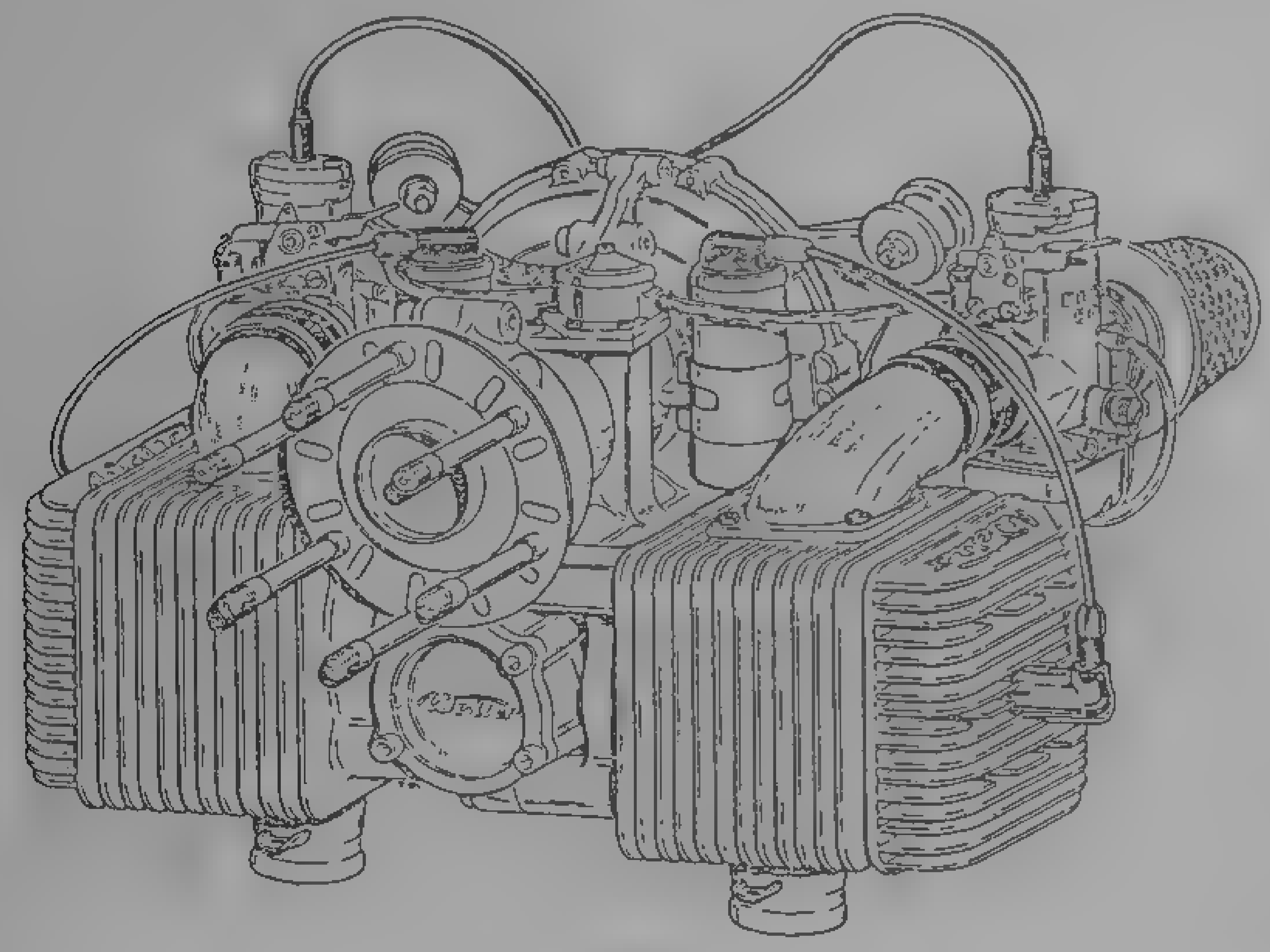


Walter M 601 E turboprop

1993



Walter M 202

1995

WALTER M 602

This engine was developed to power the L-610, which first flew on 28 December 1988. Full production launch awaited, though 34 engines had run by 1993.

TYPE: Three-shaft turboprop

PROPELLER DRIVE: Double spur reduction, ratio 12.58

AIR INTAKE: At front, S duct from chin inlet passing up behind reduction gear

COMPRESSORS: LP centrifugal, pressure ratio 4.15 at 25,000 rpm. HP centrifugal, pressure ratio 3.133 at 31,489 rpm. Overall pressure ratio 13. Mass flow 7.33 kg (16.16 lb)/s

COMBUSTION CHAMBER: Short annular reverse flow with 14 simplex nozzles and low-voltage semiconductor ignition

COMPRESSOR TURBINES: Single-stage HP, single-stage LP

POWER TURBINE: Two-stage, 16,600 rpm

FUEL SYSTEM: LP electrohydraulic regulator and electronic limiter

FUEL GRADE: T-1, TS-1, RT, Jet A-1

LUBRICATION SYSTEM: Pressure gear-pump circulation, integral oil tank and cooler

OIL SPECIFICATION: B3V, AeroShell 500, 550

STARTING: LUN 5363.8 pneumatic

DIMENSIONS:

Length	2,669 mm (105.08 in)
Width	753 mm (29.65 in)
Height	872 mm (34.33 in)

WEIGHT, DRY (equipped): 570-580 kg (1,257-1,279 lb)

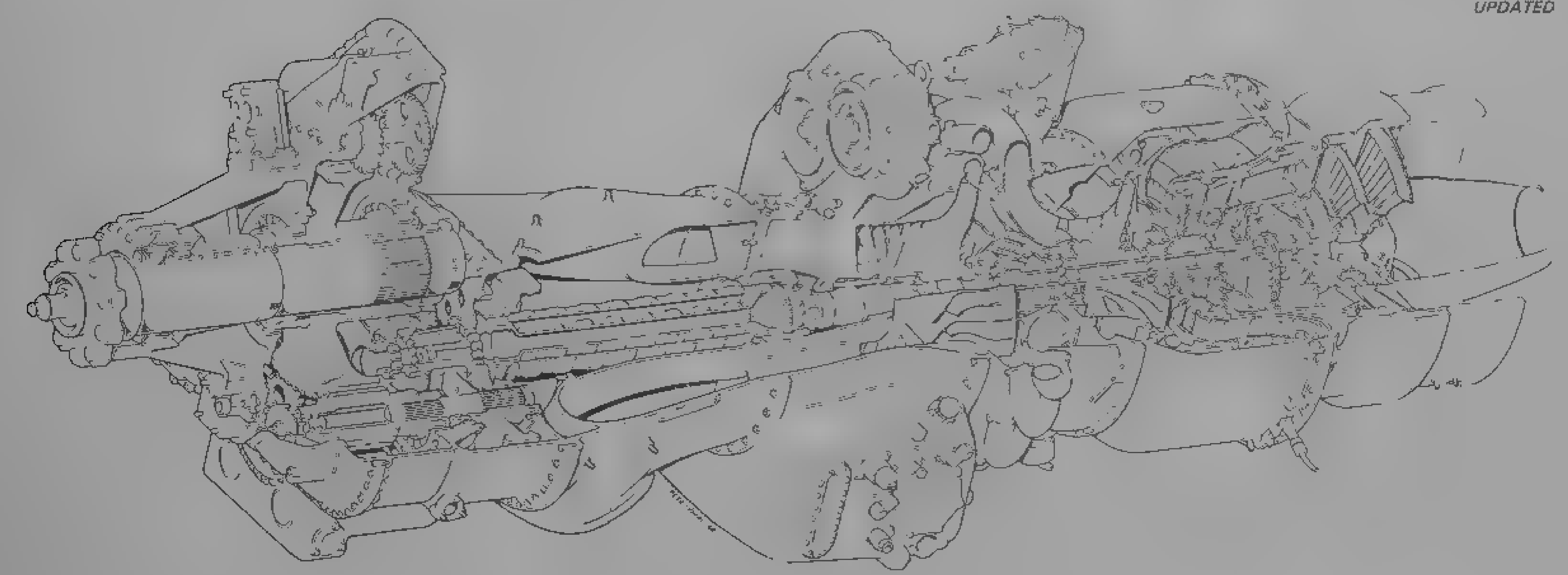
PERFORMANCE RATINGS (S/L):

T-O	1,360 kW (1,824 shp)
Max continuous	1,200 kW (1,608 shp)
Cruise	700 kW (938 shp)

SPECIFIC FUEL CONSUMPTION:

T-O	94.5 μg/J (0.559 lb/h/shp)

UPDATED



Cutaway drawing of the Walter M 602 turboprop

1988

WALTER M 202

The M 202 is the first new product starting Walter's comeback in the piston engine business. Aimed at very light aircraft, it entered production in early 1995. It is certificated to Czech L8/S and JAR 22H

TYPE: Air-cooled two-stroke opposed two-cylinder piston engine with geared drive as tractor or pusher

CYLINDERS: Bore 82 mm (3.23 in). Stroke 64 mm (2.52 in). Capacity 676 cc (41.25 cu in).

ACCESSORIES: Carburettor for each cylinder, silenced exhausts, magneto-electronic capacitor ignition without breaker, manual or electric starter. Minimum fuel octane 96.

DIMENSIONS:

Length	424 mm (16.7 in)
Width	566 mm (22.3 in)
Height	426 mm (16.8 in)
WEIGHT (bare):	36 kg (79.4 lb)

PERFORMANCE RATING:

T-O	48 kW (65 hp) at 6,300 rpm (propeller 2,350 rpm)
Max cruise, S/L	31 kW (42 hp)

FUEL CONSUMPTION:

Cruise

10-16 litres (2.6-4.2 US gallons, 2.2-3.5 Imp gallons)/h

NEW ENTRY

EGYPT

AOI

AOI ENGINE FACTORY (EF)

PO Box 12, Helwan
Telephone: 20 (2) 787577, 781404 and 781088
Fax: 20 (2) 781236
Telex: 23138 ENFAC UN

CHAIRMAN: Eng Yosry Abu-Amer

Among other work, EF assembles and tests the Larzac 04 and PT6A-25E and overhauls the Atar 9C, CT64 and APUs.

VERIFIED

FRANCE

FAM

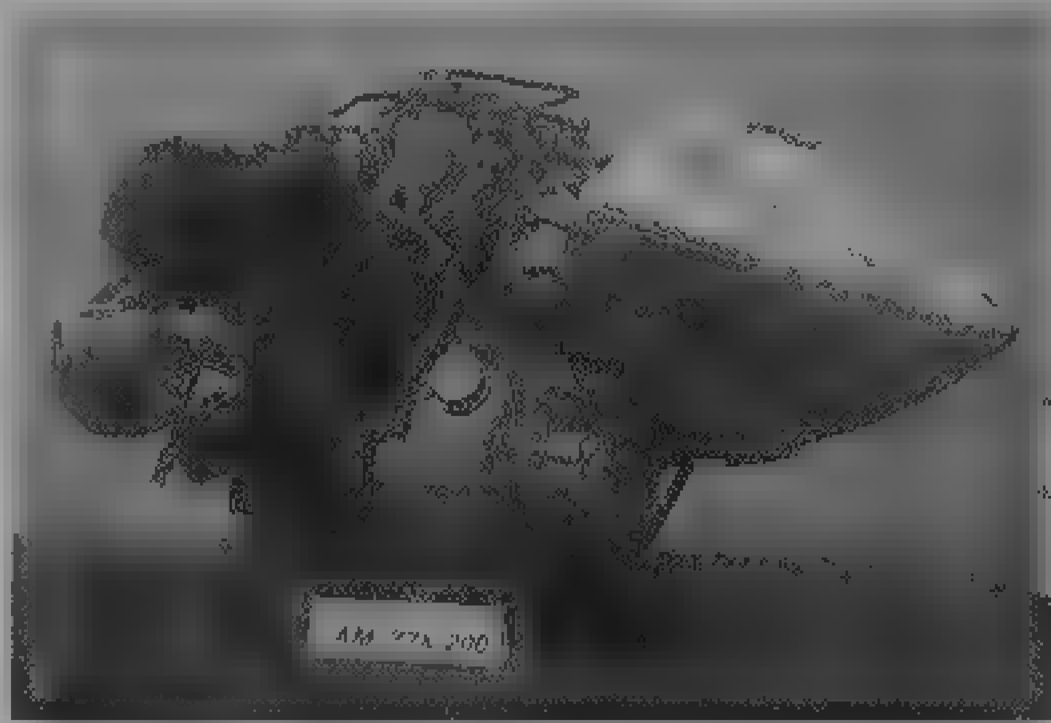
FRANCE AERO MOTEURS SARL

Roanne

CONTACT: Avions Robin (see Aircraft section)

This company was formed by Avions Pierre Robin jointly with the Motorop division of Besson-Moteurs Sopart to develop the FAM 200, an aircraft version of the mass-produced PRV (Peugeot-Renault Volvo) V6 car engine. Withdrawn from *Jane's* in 1993-94, it is reinstated because of this engine's selection for the Remo V6. It has a capacity of 3 litres (183 cu in), dry weight (with electronic fuel injection, water pump, oil filter, vacuum pump and exhaust manifold) of 179 kg (395 lb) and continuous rating of 136 kW (182 hp) at 2,430 rpm (propeller 1,074 rpm). It received JAR E certification in June 1993.

NEW ENTRY



FAM 200 V 6 piston engine
1995

JPX

SARL JPX

Z. I. Nord, BP 13, F-72320 Vibraye
Telephone: 33 43 93 61 74
Fax: 33 43 93 62 7
Telex: 72215 1

Details of smaller JPX engines were last given in the 1992-93 edition of *Jane's*.

VERIFIED

JPX 4T60/A

Unlike previous JPX engines, this is a four-stroke with four opposed air-cooled cylinders with bore 93.0 mm (3.66 in) and stroke 75.4 mm (2.97 in). Capacity 2,050 cc (125 cu in). Compression ratio 8.2. Overall length 650 mm (25.6 in). Width 805 mm (31.7 in). Weight, dry (without propeller hub), 73.0 kg (161 lb). Developed from the Volkswagen VW 126A of smaller capacity, the 4T60/A has an electric starter and alternator, and is rated at 47.8 kW (65 hp) at 3,200 rpm, and 42.0 kW (57 hp) at 2,500 rpm. Using four star motor fuel or 100LL fuel, this engine has flown over 400,000 hours in the Robin ATL and Jodel D 18 and D 19, with TBO of 1,000 hours. The **4T60/AES** for ultralight aircraft weighs 61 kg (134 lb).

VERIFIED

JPX 4TX 75

Designed with the benefit of 4T60 experience, the 4TX 75 has four cylinders of 95 mm (3.74 in bore) and 82 mm

JPX 4TX 75
1992

(3.23 in) stroke, capacity being 2,325 cc (141.9 cu in). Compression ratio is 8.7, and fuel can be 100LL or four star motor fuel. Dry weight is 75 kg (165 lb) and take-off power 56 kW (75 hp) at 2,800 rpm. JAR/E and FAR Pt 33 certified.

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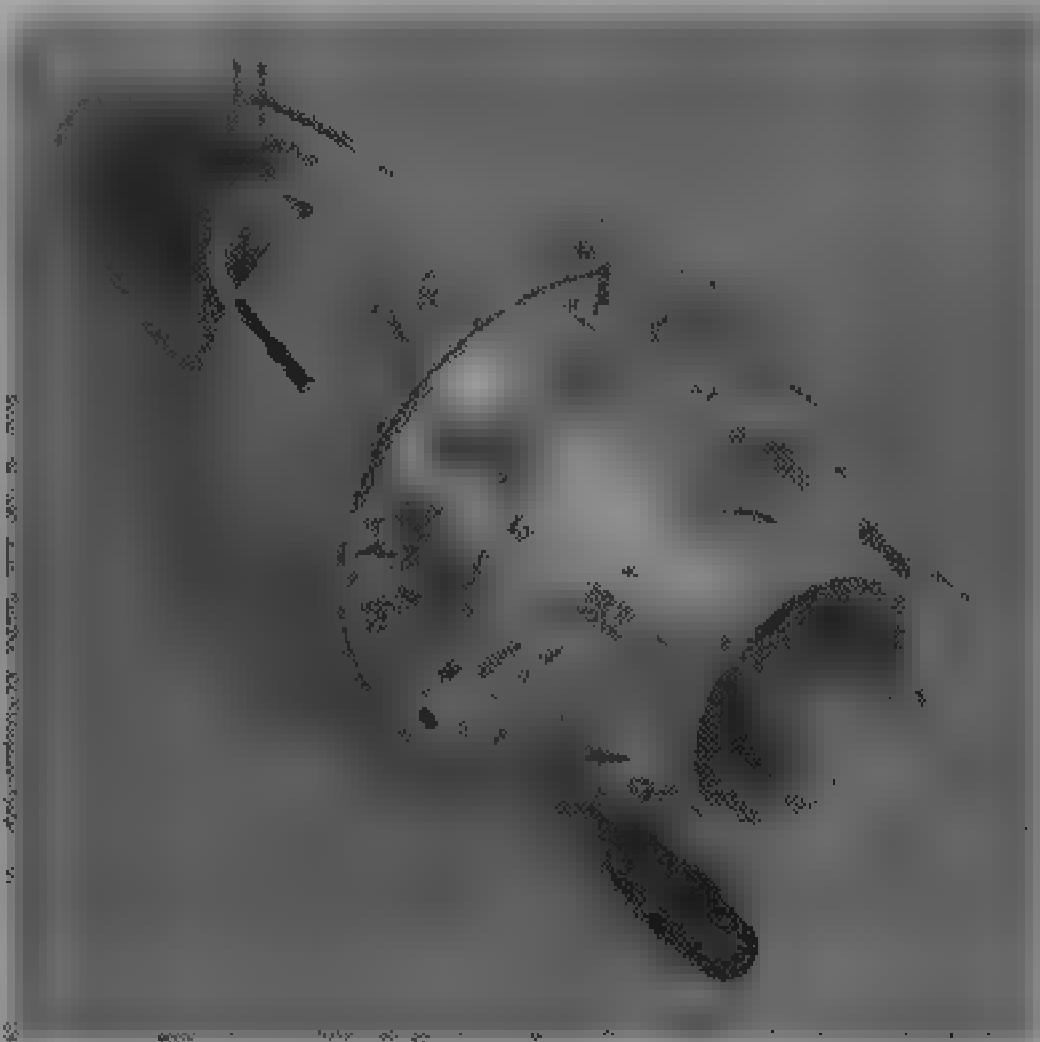


JPX T620 turbojet
1992

JPX T620

JPX has announced a family of small single-shaft turbojets, of simple design with a centrifugal compressor and inward-radial turbine. The largest, the T620, has a rating of 0.196 kN (44.06 lb st) at 80,000 rpm, and is suitable for light aircraft. Weight without the electronic fuel control is 6.2 kg (13.67 lb).

VERIFIED

SNECMA

SOCIETE NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION

2 boulevard du Général Martial Valin, F-75724 Paris Cedex 15
Telephone: 33 (1) 40 60 80 80
Fax: 33 (1) 40 60 81 02
Telex: 600 700 SNECMA

CHAIRMAN AND CEO: Bernard Dufour

SENIOR VICE-PRESIDENT: Yves Bonnet

VICE-PRESIDENTS:
Alain Habrard (Military Engines Business)
Pierre Alesi (Commercial Engines Business and Marketing)

COMMUNICATION MANAGER: Rosy Tardivon

More than 5,200 Atar turbojets have been produced for Mirage fighters. SNECMA is now producing the M53 turbojet and developing the M88. It is also participating in international collaborative programmes, the most important being CFM.

Today, SNECMA has about 23,000 personnel in its major subsidiaries: SEP (rocket motors, remote sensing and composites), Hispano-Suiza (aeronautical equipment, nuclear and robotic equipment), Messier Bugatti (braking systems) and Sochata (engine repair). SNECMA has this year (1995) deleted reference to the Project Blue collaborative programme with PWA, GE and MTU on 'mid-thrust' civil turbofans.

UPDATED

SNECMA ATAR 9K50

The Atar is a single-shaft military turbojet, first run in 1946 and subsequently developed and cleared for flight at Mach numbers greater than 2. The final version was the Atar 9K50, which powers all production Mirage F1 and Mirage 50 versions. Total 1,075 built for 28 customers by January 1995; further 17 to be produced.

DIMENSIONS:

Diameter	1,020 mm (40.2 in)
Length overall	5,944 mm (234 in)

WEIGHT, DRY:

Complete with all accessories	1,582 kg (3,487 lb)

PERFORMANCE RATINGS:

With afterburner	70.6 kN (15,870 lb st) at 8,400 rpm
Without afterburner	49.2 kN (11,055 lb st)

SPECIFIC FUEL CONSUMPTION
With afterburner 55.5 mg/Ns (1.96 lb/h/lb st)
Without afterburner 27.5 mg/Ns (0.97 lb/h/lb st)
OIL CONSUMPTION 1.5 litres (3.2 US pints, 2.64 Imp pints)/h

UPDATED

SNECMA M53

The M53 is a single-shaft bypass turbojet capable of propelling fighter aircraft to Mach 2.5, without any throttle limitations over the flight envelope. Its modular construction allows easier maintenance.

It includes a three-stage fan, five-stage compressor (pressure ratio 9.8 at 10,600 rpm), annular combustion chamber, two-stage turbine and an afterburner equipped with a multiflap variable nozzle. The control system is monitored by an Elecma electronic computer. The following versions are in service:

M53-5 Produced in 1980-85 as the initial engine of the Mirage 2000.

M53-P2 Designed to power the Mirage 2000 from 1985; current production version.

Orders totalled 684 for seven customers by January 1995, at which time 547 engines had been built.

DIMENSIONS
Length overall 5,070 mm (199.6 in)
Max diameter 1,055 mm (41.5 in)
WEIGHT, DRY
M53-5 1,470 kg (3,240 lb)
M53-P2 1,500 kg (3,307 lb)
PERFORMANCE RATINGS
Max with afterburner
M53-5 88.2 kN (19,830 lb st)
M53-P2 95.0 kN (21,355 lb st)
Max without afterburner
M53-5 54.4 kN (12,230 lb st)
M53-P2 64.3 kN (14,455 lb st)
SPECIFIC FUEL CONSUMPTION (without afterburner)
M53-5 24.64 mg/Ns (0.87 lb/h/lb st)
M53-P2 25.55 mg/Ns (0.90 lb/h/lb st)

UPDATED

SNECMA M53-P2 augmented bypass turbojet

1984

Longitudinal section through SNECMA M53-P2 augmented bypass turbojet

1975

SNECMA M88

The M88 is a family of advanced augmented turbofans, built around the same core, with thrust ranging from 50 kN (11,250 lb) to 105 kN (23,600 lb).

M88-2. This is the basic engine of the family, under development since 1987 for the Rafale aircraft for the French Air Force and Navy. The first engine went on test on 27 February 1989, and by December 1994 a total of 22 M88-2 engines had run 8,500 hours including 2,350 hours in flight. The programme is on schedule and within initial budget; deliveries start in 1996 from the 14 on order by January 1995.

The following relates to the basic M88-2:

TYPE: Two-shaft augmented turbofan.

COMPRESSOR: Variable inlet guide vanes, three-stage LP (fan), six-stage HP, with variable stators on first three stages.

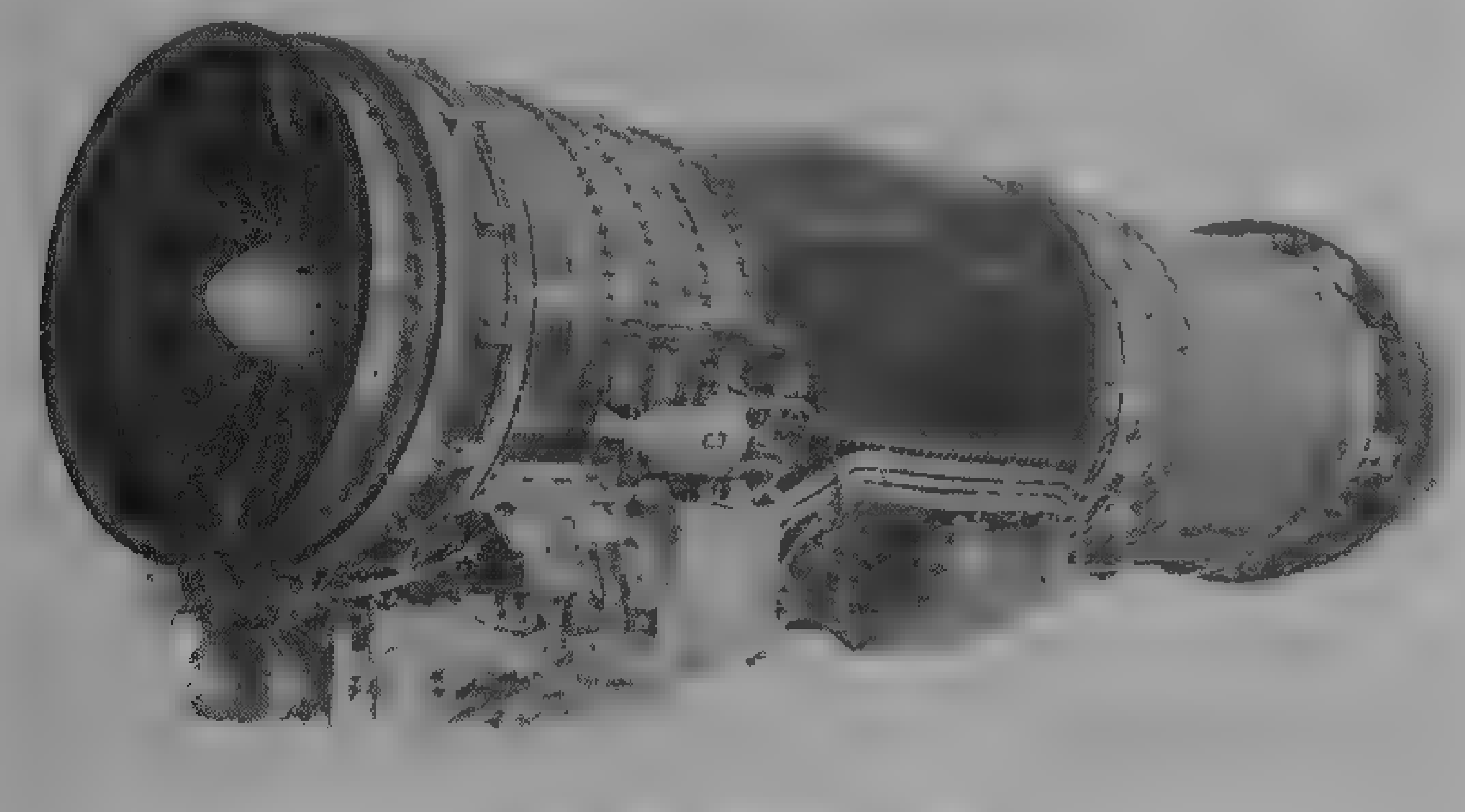
COMBUSTOR: Annular, with aerodynamic fuel injection.

TURBINES: Single-stage HP (TET 1,850 K, 2,870 F), single-stage LP.

ACCESSORIES: Full-authority digital control system.

DIMENSIONS
Length 3,540 mm (139.0 in)
WEIGHT, DRY 897 kg (1,970 lb)
PERFORMANCE RATINGS (installed)
With afterburner 75 kN (16,872 lb st)
Without afterburner 50 kN (11,250 lb st)
SPECIFIC FUEL CONSUMPTION
With afterburner 49.9 mg/Ns (1.76 lb/h/lb st)
Without afterburner 22.1 mg/Ns (0.78 lb/h/lb st)

UPDATED



SNECMA M88-2 augmented turbofan

1994

Longitudinal section through SNECMA M88 augmented turbofan

1990

GE/SNECMA GE90

SNECMA participates in the General Electric GE90 with a share of 25 per cent in all phases of the programme.

VERIFIED

GE/SNECMA/MTU/VOLVO/FIAT CF6

As a continuation of the CF6-50 and CF6-80A programmes, SNECMA participates in the General Electric CF6-80C2, in the derived LM6000 industrial gas turbine with a share of 10 per cent, and in the CF6-80E1 with a share of 20 per cent.

VERIFIED

CFM INTERNATIONAL CFM56

This programme is covered under CFM in the International part of this section.

VERIFIED

TURBOMECA-SNECMA LARZAC

This appears under Turbomeca-SNECMA GRTS.

VERIFIED

RR/SNECMA/MTU/TA TYNE

Under Rolls-Royce licence the Tyne 22 turboprop for the Transall C-160 was put back into production in October 1977. The similar Tyne 21 was in production for the Dassault Atlantique 2. All 906 Tynes ordered had been built by 1995. These 4,549 ekW (6,100 ehp) engines were last described in the 1975-76 *Jane's*.

UPDATED

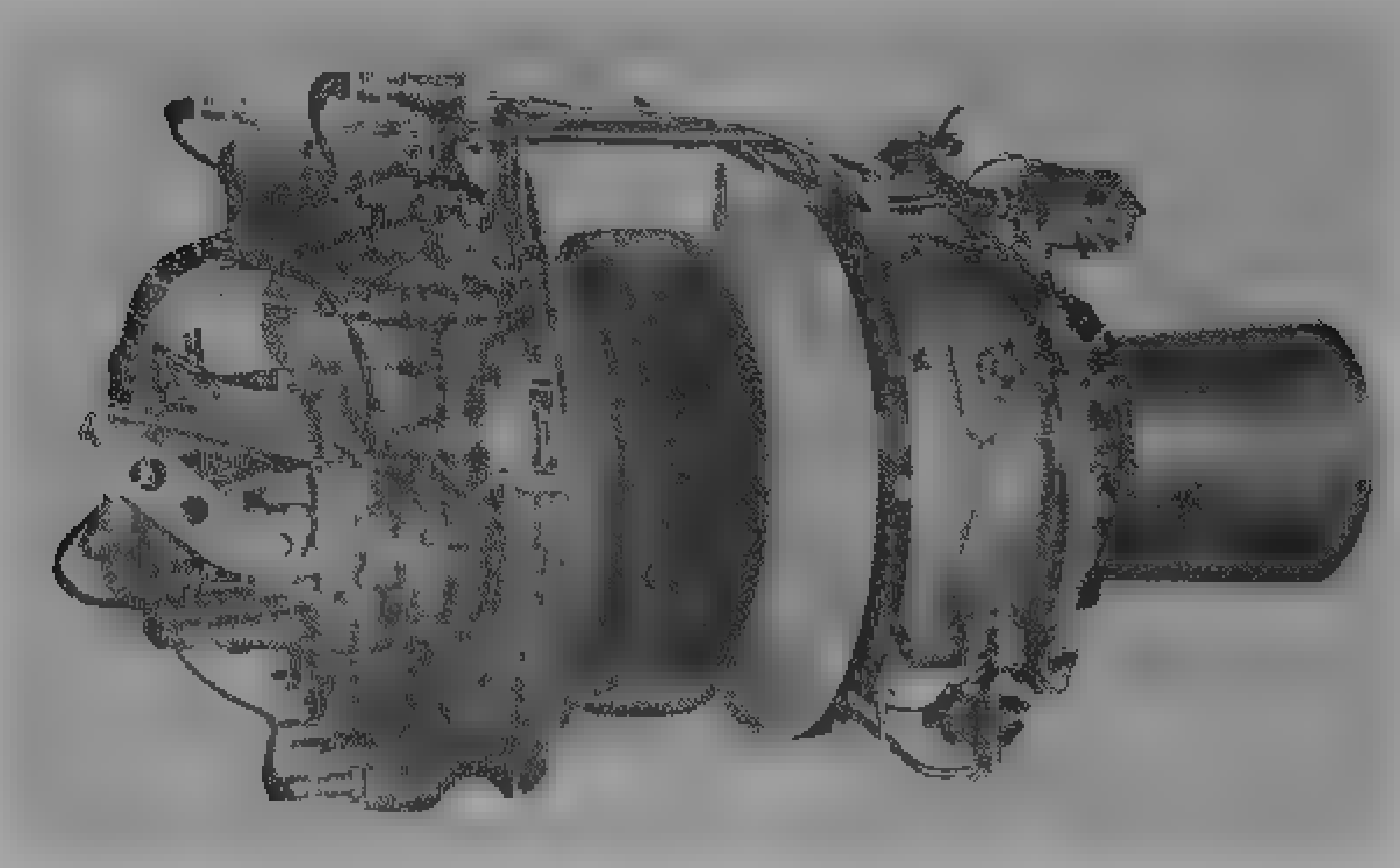
TURBOMECA

SOCIETE TURBOMECA

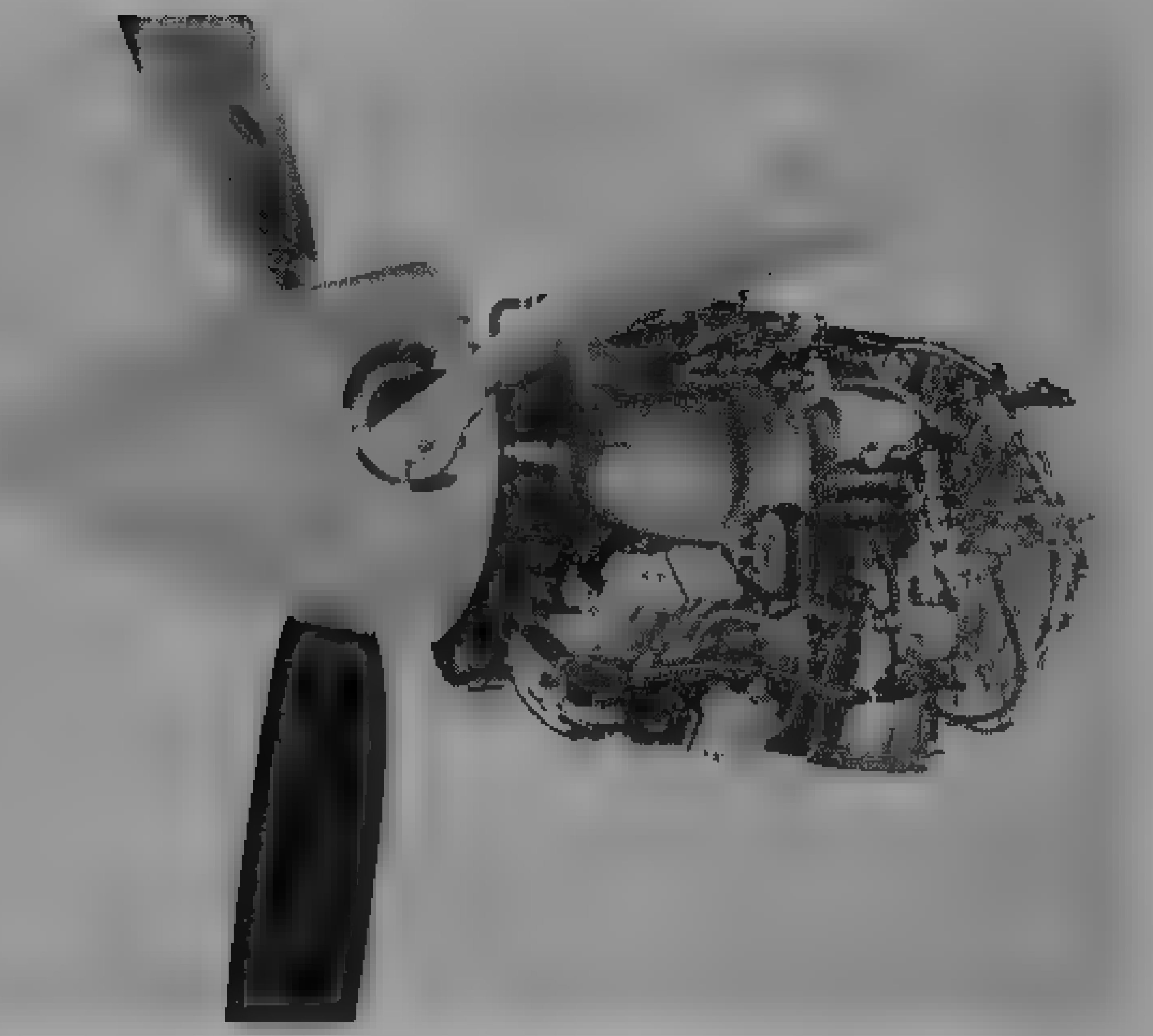
F-64511 Bordes
Telephone: 33 59 32 84 37
Fax: 33 59 53 15 12 and 33 59 53 20 93
Telex: 560928

PARIS OFFICE: 1 rue Beaujon, F-75008 Paris
Telephone: 33 (1) 40 75 01 78
Fax: 33 (1) 40 75 01 79
Telex: 650347
CHAIRMAN: Mme Sonia Meton
PRESS RELATIONS MANAGER: Jacques Millepied

More than 27,000 Turbomeca aircraft engines have been delivered to customers in 125 countries and approximately 14,000 more built under licence by what are today Rolls-Royce plc in the UK, Teledyne CAE in the USA, ENMASA in Spain, Hindustan Aeronautics in India, Bet-Shemesh in Israel, SMPMC in China and factories in Romania and former Yugoslavia.



Turbomeca Arrius free turbine turboshaft
1992



Turbomeca Arrius 1D free turbine turboprop
1990

A European Small Engines Co-operation Agreement signed in April 1985 joins Turbomeca, MTU of Germany and Rolls-Royce of the UK in promoting three complementary new engines: the Turbomeca TM 333, MTU-Turbomeca-RR MTR 390 and Rolls-Royce Turbomeca RTM 322. Other European small engine makers may join the collaboration, in which each partner may share in engines sold to its own government.

In March 1989 a UK marketing company was formed: Turbomeca Ltd. Address as for Rolls-Royce Turbomeca (see International part of this section). General Manager St John Williamson.

Total covered floor area for Turbomeca's three plants at Bordes, Mézières and Tarnos is 140,500 m² (1,512,200 sq ft). The company employs about 3,900 people.

UPDATED

ROLLS ROYCE TURBOMECA ADOUR

See the International part of this section.

VERIFIED

TURBOMECA-SNECMA LARZAC

See under Turbomeca SNECMA GRTS.

VERIFIED

MTU-TURBOMECA-RR MTR 390

See the International part of this section.

VERIFIED

ROLLS-ROYCE TURBOMECA RTM 322

See the International part of this section.

VERIFIED

TURBOMECA ARRIUS

Previously known as the TM 319, this turboshaft is compact, with just a single centrifugal compressor, reverse flow combustor, single-stage HP and single-stage LP turbines, and FADEC control.

The initial rating is 340 kW (456 shp). The first was run on the bench on 21 February 1983. Full-authority digital electronic control is supplied by Elecma.

Production deliveries for the AS 355/555 began in 1987, and reached 280 by January 1995, out of 648 then on order. The same gas generator is used in the Arrius 1D turboprop.

Arrius 1. Basic version to which data below apply. Twin TM 319s at a T-O rating of 358 kW (480 shp) are an alternative power plant for the Eurocopter EC 155.

Arrius 2. Growth version, maximum T-O rating 473 kW (634 shp). Optional for McDonnell Douglas Explorer.

DIMENSIONS:

Length	782 mm (30.78 in)
Width	360 mm (14.2 in)
Height	540 mm (21.26 in)
WEIGHT, DRY:	87 kg (192 lb)
PERFORMANCE RATINGS (Arrius 1, ISA, S/L):	
Max contingency	408 kW (547 shp)
Max T-O	380 kW (509 shp)
Max continuous	295 kW (395 shp)

UPDATED

TURBOMECA ARRIUS 1D

The turboprop version is fully aerobatic. The gas generator and power turbine modules are identical with those of the Arrius 1. The first Arrius 1D ran on 11 September 1985. Flight testing in an Epsilon began in November 1985, followed by a Valmet L-90 TP in December 1987. The Arrius 1D is flying in the Socata Omega.

DIMENSIONS:

Length	826 mm (32.52 in)
Width	476 mm (18.74 in)
Height	590 mm (23.22 in)
WEIGHT, DRY (bare):	111 kg (245 lb)
PERFORMANCE RATINGS (ISA, S/L):	
T-O	313 kW (420 shp)
Cruise (6,100 m, 20,000 ft)	179 kW (240 shp)

VERIFIED

TURBOMECA ARRIEL

This turboshaft powers the single-engined AS 350 Ecureuil/AS 550 Fennec, twin-engined AS 365/565 Dauphin/Panther, Agusta A 109K and 109K2, and Sikorsky S-76A+ and S-76C and Eurocopter/Kawasaki BK 117 C1.

The Arriel has modular construction. The first complete engine ran on 7 August 1974.

There are 13 qualified production versions, differing essentially only in power rating.

Arriel 1A, 1B. T-O rating 478 kW (641 shp); power AS 350B/BA and AS 365C.

Arriel 1C. T-O rating 492 kW (660 shp); powers AS 365N.

Arriel 1D. T-O rating 510 kW (684 shp), powers AS 350B and L1.

Arriel 1C1, 1M, 1K, 1S. All have T-O rating of 522 kW (700 shp), power AS 365F and N1, A 109K and S-76A+.

Arriel 1C2. T-O rating 550 kW (738 shp); powers AS 365N2.

Arriel 1D1. T-O rating 558 kW (749 shp), powers AS 350B2 and AS 550U2. Selected for Kamov Ka-128.

Arriel 1M1. T-O rating 558 kW (749 shp); powers AS 565UA and AS 565MA.

Arriel 1S1. T-O rating 539 kW (723 shp); powers S-76C.

Arriel 1E. T-O rating 528 kW (708 shp); powers BK 117 C1.

Arriel 2. Growth version with single-stage gas generator turbine. To provide at least 16 per cent more power than 1S. Candidate engine for EC 120, Dauphin and S-76.

By 1 January 1995 a total of 3,439 Arriels had been delivered, out of 3,622 then on order. Totals do not include engines produced under licence in China.

The following relates to the Arriel 1A, 1B.

TYPE: Single-shaft free turbine turboshaft.

COMPRESSOR: Single-stage axial and supersonic centrifugal. Pressure ratio 9.

COMBUSTION CHAMBER: Annular, with flow radially outwards and then inwards. Centrifugal fuel injection.

GAS GENERATOR TURBINE: Two integral cast axial stages with solid blades.

POWER TURBINE: Single axial stage with inserted blades.

REDUCTION GEAR: Light alloy gearbox, containing two stages of helical gears, giving drive at 6,000 rpm to front and rear. Hydraulic torquemeter.

ACCESSORY DRIVES: Main pad provides for optional 12,000 rpm alternator, other drives for oil pumps, tachometer generator, governor and starter.

LUBRICATION SYSTEM: Independent circuit through gear pump and metallic cartridge filter.

OIL SPECIFICATION: AIR 3512 or 3513A.

STARTING: Electric starter or starter/generator.

DIMENSIONS:

Length, excl accessories	1,090 mm (42.91 in)
Height overall	569 mm (22.40 in)
Width	430 mm (16.93 in)
WEIGHT, DRY:	
With all engine accessories	120 kg (265 lb)
PERFORMANCE RATINGS: See variants list	
SPECIFIC FUEL CONSUMPTION:	
T-O	96.8 µg/J (0.573 lb/h/shp)

UPDATED

TURBOMECA ASTAZOU TURBOSHAFT

This turboshaft series is derived from the Astazou II turboprop. Variants are:

Astazou IIA. Rated at 390 kW (523 shp) for SA 318C.

Astazou IIIA. Derived from IIA but with revised turbine to match power needs of SA 341G. Produced jointly by Turbomeca and Rolls-Royce, with 1,008 delivered.

Astazou XIVB and XIVF. For SA 319B, XIVB is civil and XIVF military. Flat rated to 441 kW (591 shp) (1 h) up to 4,000 m (13,125 ft) or +55°C.

Astazou XIVH. For SA 342J/L, to remove altitude and temperature limitations; 1,146 delivered.

Astazou XVIIIA. Higher gas temperature. Powers AS 360C.

Astazou XX. Fourth axial compressor stage added. Designed for operation in hot and high countries.

By 1993 a total of 2,253 Astazous had been delivered; the engine is no longer in production.

The following description relates to the Astazou III, except where indicated.

TYPE: Single-shaft axial-plus-centrifugal turboshaft.

REDUCTION GEAR: Two-stage epicyclic having helical primary and straight secondary gears. Ratio 7.039 : 1 (XIVB/F, 7.345, XVIIIA, 7.375).

COMPRESSOR: Single-stage axial (IIA, III), two-stage axial (XIV, XVIII) or three-stage axial (XX) followed by single-stage centrifugal. Mass flow 2.5 kg (5.5 lb)/s.

COMBUSTION CHAMBER: Reverse flow annular with centrifugal injector using rotary atomiser. Two ventilated torch igniters.

TURBINE: Three-stage axial with blades integral with discs.

ACCESSORIES: Five drive pads on casing forming rear of air intake.

FUEL SYSTEM: Automatic constant-speed control.

LUBRICATION SYSTEM: Pressure type with gear type pumps. Oil tank of 8 litres (17 US pints, 14 Imp pints) capacity.

STARTING: Electrical, automatic.

DIMENSIONS:

Length overall: Astazou IIA	1,272 mm (50.0 in)
Astazou III, XIVB/F	1,433 mm (56.3 in)
Astazou XIVH	1,470 mm (57.9 in)
Astazou XVIIIA	1,327 mm (52.2 in)
Astazou XX	1,529 mm (60.22 in)
Height: Astazou IIA	458 mm (18.0 in)
Astazou III, XIVH	460 mm (18.1 in)
Astazou XVIIIA	698 mm (27.48 in)
Astazou XX	721 mm (28.4 in)
Width: Astazou IIA	480 mm (18.8 in)
Astazou III, XIVH	460 mm (18.1 in)
WEIGHTS:	
Equipped: Astazou III	147 kg (324 lb)
Astazou III (suffix 2)	150 kg (330 lb)
Astazou XIVB/F	166 kg (366 lb)
Astazou XIVH	160 kg (353 lb)
Astazou XVIIIA	155 kg (341 lb)
Astazou XX	195 kg (430 lb)
PERFORMANCE RATINGS:	
Max power: Astazou IIA	390 kW (523 shp)
Astazou III	441 kW (591 shp)
Astazou III$_2$	481 kW (645 shp)
Astazou XX	749 kW (1,005 shp)
One hour: Astazou XIVB/F	441 kW (591 shp)
Astazou XVIIIA	651 kW (873 shp) maintained at sea level to 40°C
Max continuous: Astazou IIA	353 kW (473 shp)
Astazou III	390 kW (523 shp)
Astazou III (suffix 2)	441 kW (592 shp)
Astazou XIVB/F	405 kW (543 shp)
Astazou XIVH	flat rated in SA 341 at 440.7 kW (591 shp) to 55°C or 4,000 m (13,125 ft)
Astazou XVIIIA	600 kW (805 shp)
Astazou XX	675 kW (905 shp)

SPECIFIC FUEL CONSUMPTION
At max power rating

Astazou IIA	105.3 µg/J (0.623 lb/h/shp)
Astazou III	108.7 µg/J (0.643 lb/h/shp)
Astazou III (suffix 2)	109.9 µg/J (0.650 lb/h/shp)
Astazou XIVB/F	105.5 µg/J (0.624 lb/h/shp)
Astazou XVIIIA	91.3 µg/J (0.540 lb/h/shp)
Astazou XX	85.9 µg/J (0.508 lb/h/shp)

UPDATED

TURBOMECA ARTOUSTE III

The Artouste IIIB is a single-shaft turboshaft with two-stage axial-centrifugal compressor and three-stage turbine. Pressure ratio 5.2. Mass flow 4.3 kg/s (9.5 lb/s) at 33,300 rpm. Built under licence in India by Hindustan Aeronautics.

The IIIB powers the SA 315B and SA 316B/C. The uprated IIID has a reduction gear giving 5,864 rpm at the driveshaft (instead of 5,773) and in revised equipment. The IIID powers the SA 316C, data are for this version. Over 2,500 Artouste III engines have been built.

DIMENSIONS:

Length	1,815 mm (71.46 in)
Height	627 mm (24.68 in)
Width	507 mm (19.96 in)

WEIGHT, DRY: 178 kg (392 lb)
PERFORMANCE RATING (T-O, maintained up to 55°C at S/L or up to 4,000 m, 13,125 ft): 440 kW (590 shp)
SPECIFIC FUEL CONSUMPTION: 126.2 µg/J (0.747 lb/h/shp)

UPDATED

TURBOMECA TM 333

This turboshaft was launched in July 1979 to power the AS 365 and other helicopters in the 4,000 kg (8,800 lb) class, including the Indian ALH. French certification of the 1A version was obtained on 11 July 1986.

TM 333 1A. Basic version, composed of a gas generator module, free turbine module and reduction gear module.

TM 333 1M. For military AS 565.

TM 333 2B. Growth version with single crystal HP turbine, giving T-O rating of 747 kW (1,001 shp). Selected for HAL (India) ALH. First flight 20 August 1992, certificated December 1993. Total 14 built by January 1995 and no further orders received.

The TM 333 is one of three new engines included in the European Small Engines Co-operation Agreement. Data are for the 2B.

TYPE: Free turbine turboshaft.
COMPRESSOR: Variable inlet guide vanes, two-stage axial compressor, single-stage centrifugal.
COMBUSTION CHAMBER: Annular, reverse flow.
GAS GENERATOR TURBINE: Single-stage with uncooled inserted blades.
POWER TURBINE: Single-stage axial with uncooled inserted blades.
GEARBOX: Two stages to give drive at 6,000 rpm to front output shaft.
LUBRICATION: Independent system. Oil passes through gear pump and metallic cartridge filter.
FUEL SYSTEM: Microprocessor numerical control.
DIMENSIONS:

Length, including accessories	1,045 mm (41.1 in)
Height overall	712 mm (28.0 in)
Width	454 mm (17.9 in)

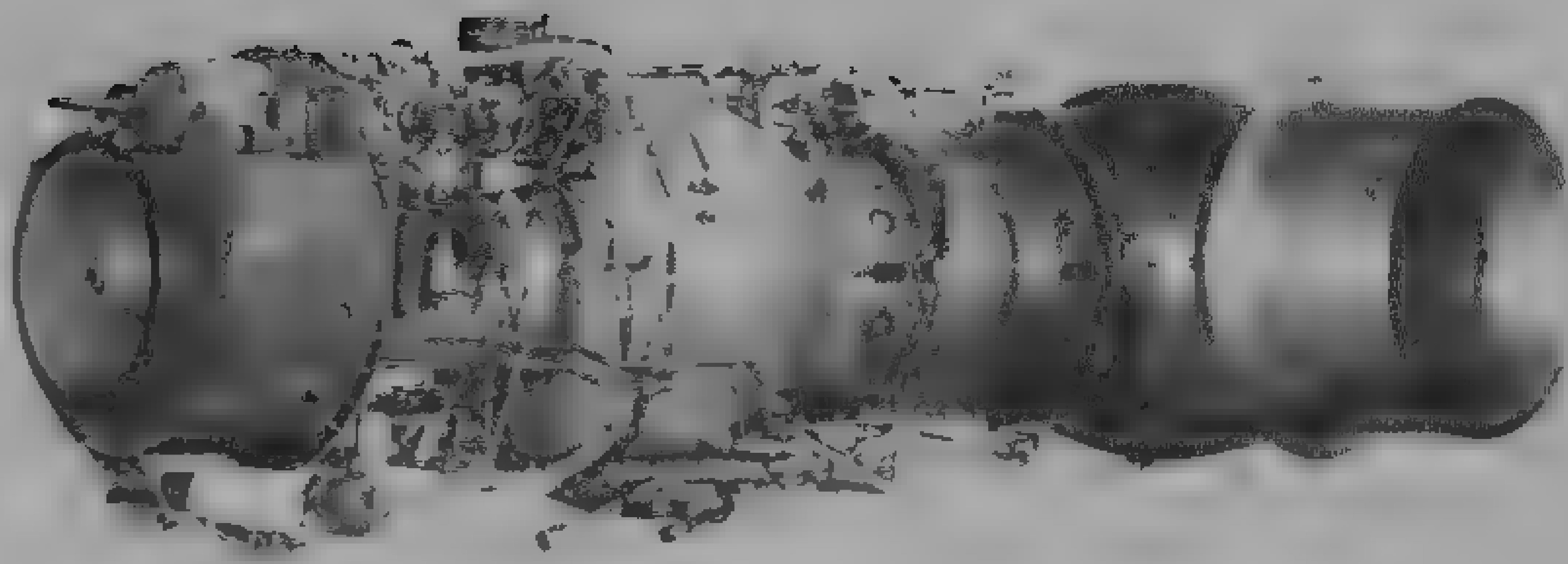
WEIGHT, DRY: 156 kg (345 lb)
PERFORMANCE RATINGS:

Max contingency	788 kW (1,057 shp)
T-O	747 kW (1,001 shp)
Max continuous	663 kW (889 shp)

SPECIFIC FUEL CONSUMPTION:

Max contingency	88 µg/J (0.523 lb/h/shp)
T-O	89.4 µg/J (0.529 lb/h/shp)
Max continuous	91.7 µg/J (0.543 lb/h/shp)

UPDATED



Turbomeca Makila 1A free turbine turboshaft

1987

TURBOMECA TURMO

The Turmo free turbine engine is in service in both turboshaft and turboprop versions. A total of 2,020 had been ordered and built by January 1995, no further production contracts received.

Current variants are as follows:

Turmo IIIC$_5$, IIIC$_6$, IIIC$_7$. For SA 321F/G/H/Ja. Total production 549.

Turmo IIIE$_6$. Higher turbine temperature.

Turmo IVA. Civil engine derived from IIIC$_4$, with contingency rating of 1,057 kW (1,417 shp). The IVB is a military version.

TYPE: Free turbine turboshaft.
REDUCTION GEAR: IIIC$_3$, C$_5$ and E$_3$ fitted with rear-mounted reduction gear; IIIC$_4$ direct drive.
COMPRESSOR: Single-stage axial followed by single-stage centrifugal. Pressure ratio 5.9 on IIIC$_3$. Mass flow 5.9 kg (13 lb)/s.
COMBUSTION CHAMBER: Reverse flow annular with centrifugal fuel injector using rotary atomiser. Two ventilated torch igniters.
GAS GENERATOR TURBINE: Two-stage axial.
POWER TURBINE: Two-stage axial unit in IIIC$_3$, C$_5$ and E$_3$, and single-stage in IIIC$_4$.
ACCESSORIES: Pads for oil pump, fuel control, electric starter, tacho-generator and, on IIIC$_4$, oil cooler fan.
FUEL SYSTEM: Fuel control for gas generator on IIIC$_3$, C$_5$ and E$_3$ with speed limiter for power turbine on E$_3$. Constant speed system on IIIC$_4$ power turbine.
FUEL GRADE: AIR 3405 for IIIC$_4$.
LUBRICATION SYSTEM: Pressure type with oil cooler and 13 litre (27.5 US pint, 23 Imp pint) tank.
OIL SPECIFICATION: AIR 3155A, or AIR 3513, for IIIC$_4$.
STARTING: Automatic system with electric starter motor.
DIMENSIONS:

Length	
Turmo IIIC$_3$, C$_5$ and E$_3$	1,975.7 mm (78.0 in)
Turmo IIIC$_4$	2,184 mm (85.5 in)
Turmo IIID$_3$	1,868 mm (73.6 in)
Width	
Turmo IIIC$_3$, C$_5$ and E$_3$	693 mm (27.3 in)
Turmo IIIC$_4$	637 mm (25.1 in)
Turmo IIID$_3$	934 mm (36.8 in)
Height	
Turmo IIIC$_3$, C$_5$ and E$_3$	716.5 mm (28.2 in)
Turmo IIIC$_4$	719 mm (28.3 in)
Turmo IIID$_3$	926 mm (36.5 in)

WEIGHT, DRY:

Turmo IIIC$_3$ and E$_3$, fully equipped	297 kg (655 lb)
Turmo IIIC$_5$, IIIC$_6$ and IIIC$_7$	325 kg (716 lb)
Turmo IIIC$_4$, equipped engine	225 kg (496 lb)
Turmo IIID$_3$, basic engine	365 kg (805 lb)

PERFORMANCE RATINGS:

T-O: Turmo IIIC$_3$, D$_3$ and E$_3$	1,104 kW (1,480 shp)
Turmo IIIE$_6$	1,181 kW (1,584 shp)
Max contingency	
Turmo IIIC$_4$ at 33,800 gas generator rpm	1,032 kW (1,384 shp)
Turmo IIIC$_6$ at 33,550 gas generator rpm	1,156 kW (1,550 shp)
Turmo IIIC$_7$ at 33,800 gas generator rpm	1,200 kW (1,610 shp)
Turmo IVA at 33,950 gas generator rpm	1,057 kW (1,417 shp)
Turmo IVC at 33,800 gas generator rpm	1,163 kW (1,560 shp)
T-O and intermediate contingency	
Turmo IIIC$_5$	1,050 kW (1,408 shp)

SPECIFIC FUEL CONSUMPTION:

At T-O rating	
Turmo IIIC$_3$ and E$_3$	101.9 µg/J (0.603 lb/h/shp)
Turmo IIID$_3$	104.1 µg/J (0.616 lb/h/shp)
At max contingency rating	
Turmo IIIC$_4$, C$_5$, C$_6$, C$_7$ and IV	106.8 µg/J (0.632 lb/h/shp)
Turmo IVA	106.3 µg/J (0.629 lb/h/shp)

UPDATED

TURBOMECA MAKILA

This turboshaft powers the AS 332. Derived partly from the Turmo, it incorporates rapid-strip modular construction, three axial stages of compression plus one centrifugal, centrifugal atomiser; two-stage gas generator turbine with cooled blades, two-stage free power turbine, and lateral exhaust.

Makila 1A. Certificated 1980. OEI rating 1,310 kW (1,757 shp).

Makila 1A1. Certificated 1984. OEI rating 1,400 kW (1,877 shp).

Makila 1A2. Under development. OEI rating (30 seconds) 1,569 kW (2,103 shp), (2 minutes) 1,433 kW (1,921 shp).

By 1 January 1995 deliveries of Makila engines had reached 1,165 from 1,216 then on order.

DIMENSIONS:

Length, intake face to rear face	1,395 mm (54.94 in)
Max diameter	514 mm (20.25 in)

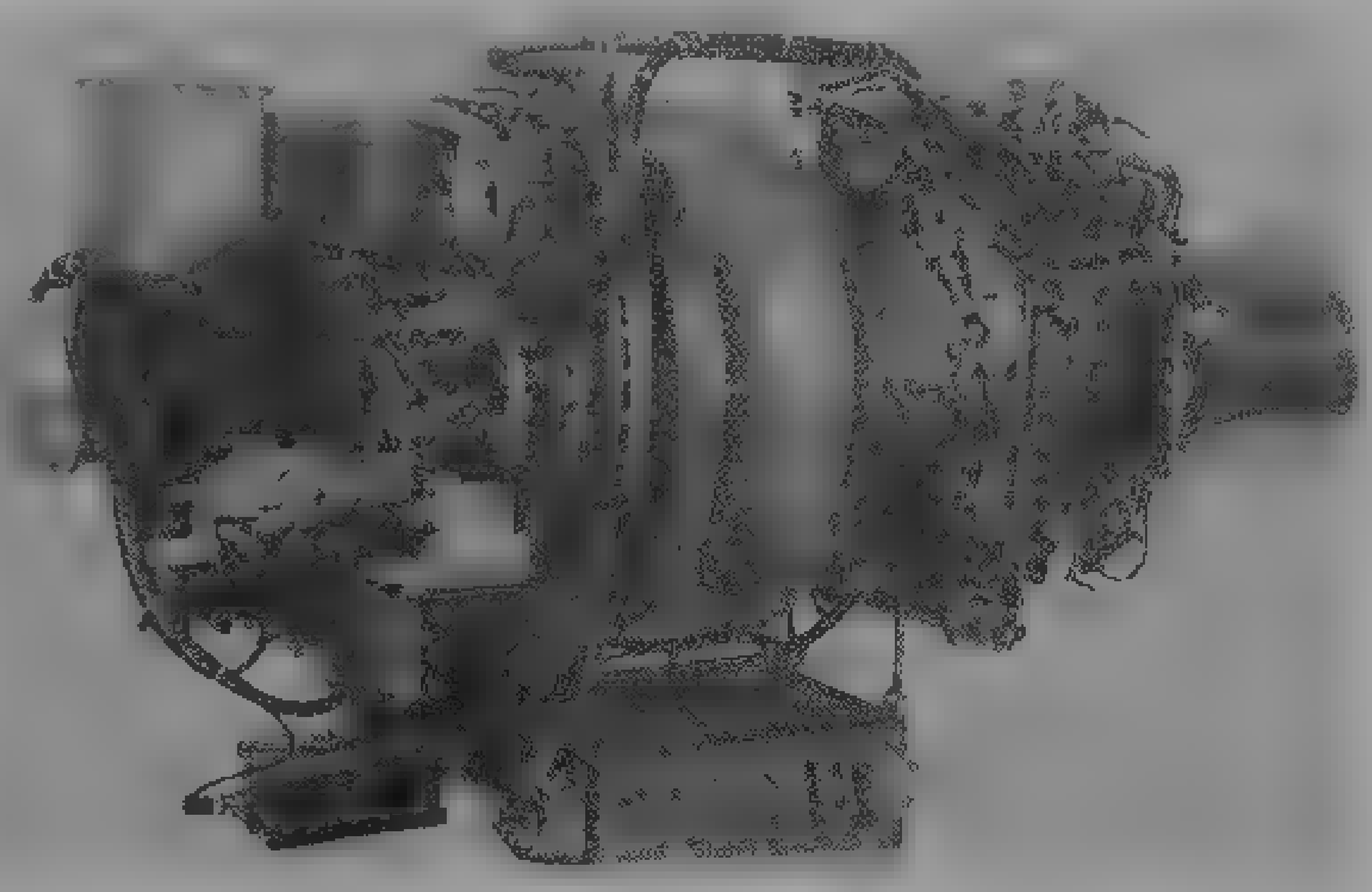
WEIGHT, DRY: Basic 210 kg (463 lb)
Equipped 243 kg (535 lb)
PERFORMANCE RATINGS (ISA, S/L):
Max contingency: see model listings
Cruise: 1A, 1A1, 1A2 700 kW (939 shp)
SPECIFIC FUEL CONSUMPTION:

Max contingency: 1A	83.9 µg/J (0.496 lb/h/shp)
1A1	81.4 µg/J (0.481 lb/h/shp)
Cruise: 1A	97.7 µg/J (0.578 lb/h/shp)
1A1	95.0 µg/J (0.562 lb/h/shp)

UPDATED

Turbomeca Arriel 1S free turbine turboshaft

1990



Turbomeca TM 333 2B free turbine turboshaft

1992

TURBOMECA-SNECMA

GROUPEMENT TURBOMECA SNECMA (GRTS)

2 boulevard du Général Martial Valin, F 75725 Paris Cedex 15
Telephone: 33 (1) 40 60 80 80
Fax: 33 (1) 40 60 81 02

Groupement Turbomeca-SNECMA is a company formed jointly by Société Turbomeca and SNECMA to manage the Larzac turbofan launched in 1968

VERIFIED

TURBOMECA-SNECMA LARZAC

In February 1972 the **Larzac 04** turbofan was selected for a joint Franco-German programme to provide propulsion for the Alpha Jet (see under Dassault/Dornier in 1992-93 International part of Aircraft section). In addition to the two French engine partners, two German companies, MTU and KHD (now BMW RR), shared in production and development. A total of 1,264 engines was assembled in the two countries and production has ceased

Larzac 04-R20. Version of C20 selected to power MiG-AT trainer

Larzac 04-V3 Projected version for Polish I-22 Iryda

DIMENSIONS

Overall length of basic engine	1,179 mm (46.4 in)
Overall diameter	602 mm (23.7 in)
WEIGHT, DRY	302 kg (666 lb)
T-O THRUST (S/L, static)	
Larzac 04-R20	14.12 kN (3,175 lb st)
Larzac 04-V3	16.18 kN (3,637 lb st)
SPECIFIC FUEL CONSUMPTION	
Larzac 04-R20	20.95 mg/Ns (0.74 lb/h/lb st)

UPDATED

GERMANY

BMW RR

BMW ROLLS ROYCE GmbH

Hohemarkstrasse 60-70, PO Box 1246, D-61440 Oberursel
Telephone: 49 (61) 71 906 59.
Fax: 49 (61) 71 907 633
Telex: 410727
CHAIRMAN: Albert Schneider
PUBLIC AFFAIRS: Holger Lapp

This joint venture company was established in July 1990 by BMW AG of Munich (50½ per cent) and Rolls-Royce plc of London (49½ per cent). It is located at the facilities of the former KHD Luftfahrttechnik, with over 1,200 employees and capital of DM250 million. It is an independent German company

It has taken over activities of the former KHD, including the Tornado secondary power system, T117 propulsion for the CL-289 UAV, T118 APU demonstrator and T128 low-cost turbojet. It has a 20 per cent share in the Rolls-Royce Tay programme, 5 per cent in the Rolls-Royce Trent, and 5 per cent in the CFM56-5

Both partners are supporting the BR700 series, a new family of turbofans. These entered production at a new factory at Dahlewitz, 20 miles south of Berlin in June 1995

UPDATED

BR710

This is the baseline engine of the BR700 family, and the first in timing. The first complete engine ran on 1 September 1994, and a 150 hour endurance test was successfully completed on 28 February 1995. The initial application is the Gulfstream GV, for which an order for 200 engines was placed on 8 September 1992. The GV is to fly in late 1995 and engine certification is due in October 1996. The second application is the Bombardier Global Express. Certification is scheduled for February 1997, with the first delivery to Canadair late that year

TYPE: Two-shaft turbofan

CONFIGURATION: Single-stage wide-chord fan, 10-stage HP compressor, two-stage HP and LP turbines

EMISSIONS: Noise significantly below FAR 36 Stage 3, NO_x 30 per cent below ICAO, with advanced combustor designed for further 30 per cent reduction.

FAN DIAMETER:	1,219 mm (48.0 in)
RATING (T-O, ISA + 20°C)	
GV	66.28 kN (14,900 lb st)
Global Express	65.30 kN (14,680 lb st)

UPDATED

BR715

BR715 is the largest current member of the BR700 engine family. It has been selected for the MDC MD-95, will run for the first time in June 1996, and be certified in December 1997. A dual-stage low-emissions combustor will be available for service in 2000

TYPE: Two-shaft turbofan

CONFIGURATION: Single-stage wide-chord fan, two-stage booster, 10-stage HP compressor, two-stage HP and three-stage LP turbines

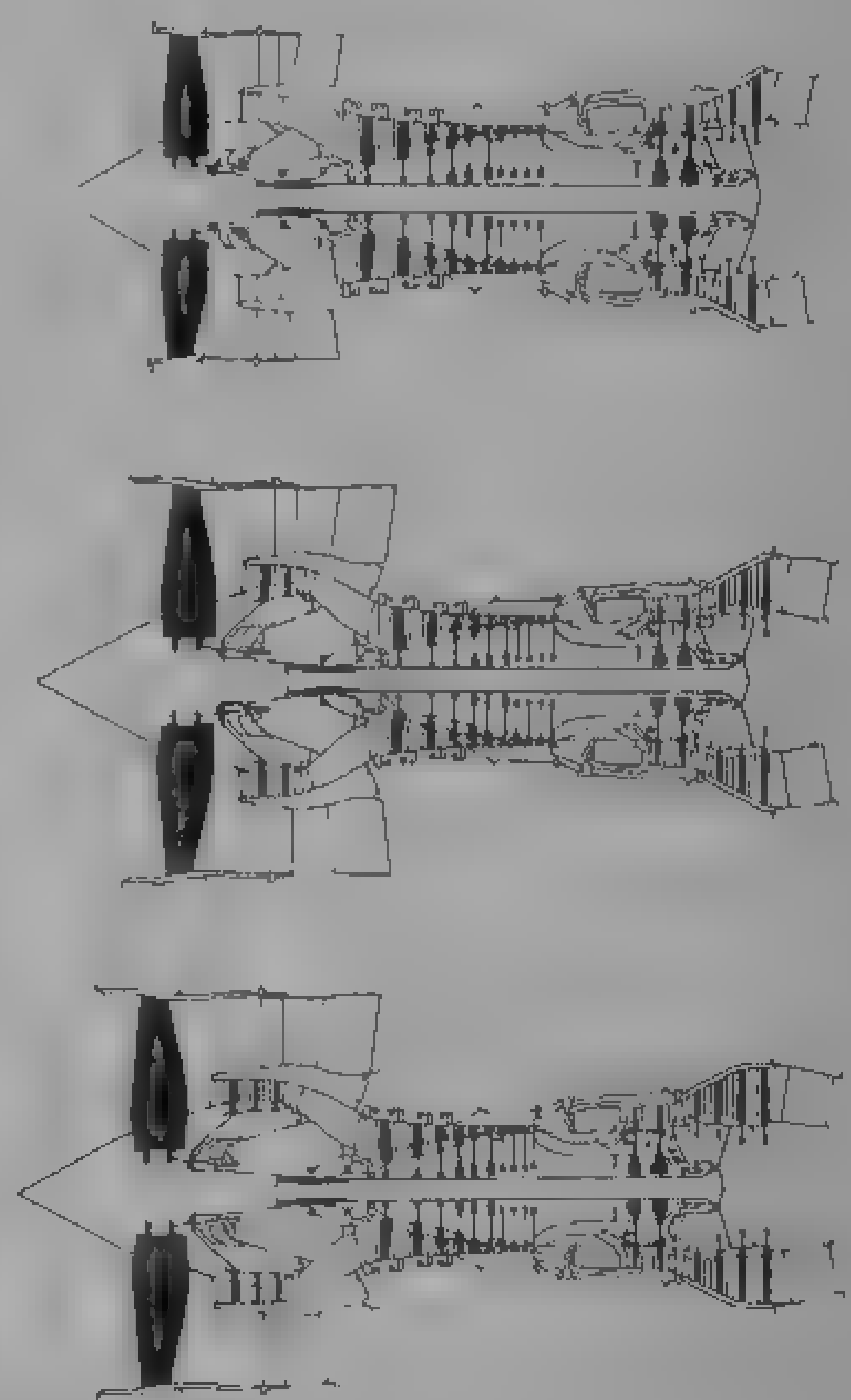
EMISSIONS: Noise significantly below FAR 36 Stage 3, NO_x 30 per cent below ICAO, with advanced combustor designed for further 30 per cent reduction

FAN DIAMETER:	1,422.4 mm (56 in)
RATING (T-O, ISA + 15°C)	
MD-95	82.29 kN (18,500 lb st) with option of 88.97 kN (20,000 lb st)

NEW ENTRY

Cutaway drawing of BR715

1995



Early members of the BR700 family longitudinal sections of BR710 (top), BR715 and projected BR720

1995

HIRTH

GÖBLER-HIRTHMOTOREN GmbH

PO Box 20, Max Eyth Strasse 10, D-7141 Benningen
Telephone: 49 (71) 44 6074
Fax: 49 (71) 44 5415
Telex: 7 264 530 GHIR D

This company produces small piston engines for microlights and other aircraft in the range 2.61 to 82 kW (3.5 to 110 hp). Details of the 16.2 kW (22 hp) F 263 R 53 and 17 kW (23 hp) F 22 were last given in the 1992-93 *Jane's*

VERIFIED

HIRTH F 23A

Cylinders 72 mm (2.835 in) bore and 64 mm (2.52 in) stroke, giving capacity of 521 cc (31.79 cu in). Compression ratio 10.5, using 50.1 fuel mix. Equipped weight 24.0 kg (52 lb), silencer adding 4.5 kg (10 lb). Maximum power 30 kW (40 hp) at 5,500 rpm

VERIFIED

HIRTH 2701 R 03

Cylinders 70 mm (2.756 in) bore and 64 mm (2.52 in) stroke, giving capacity of 493 cc (30.08 cu in). Compression ratio 11, using 50.1 fuel mix. Weight with fan and recoil starter 32.8 kg (72.5 lb). Maximum power 32 kW (43 hp) at 6,750 rpm

VERIFIED

HIRTH 2702 R 03

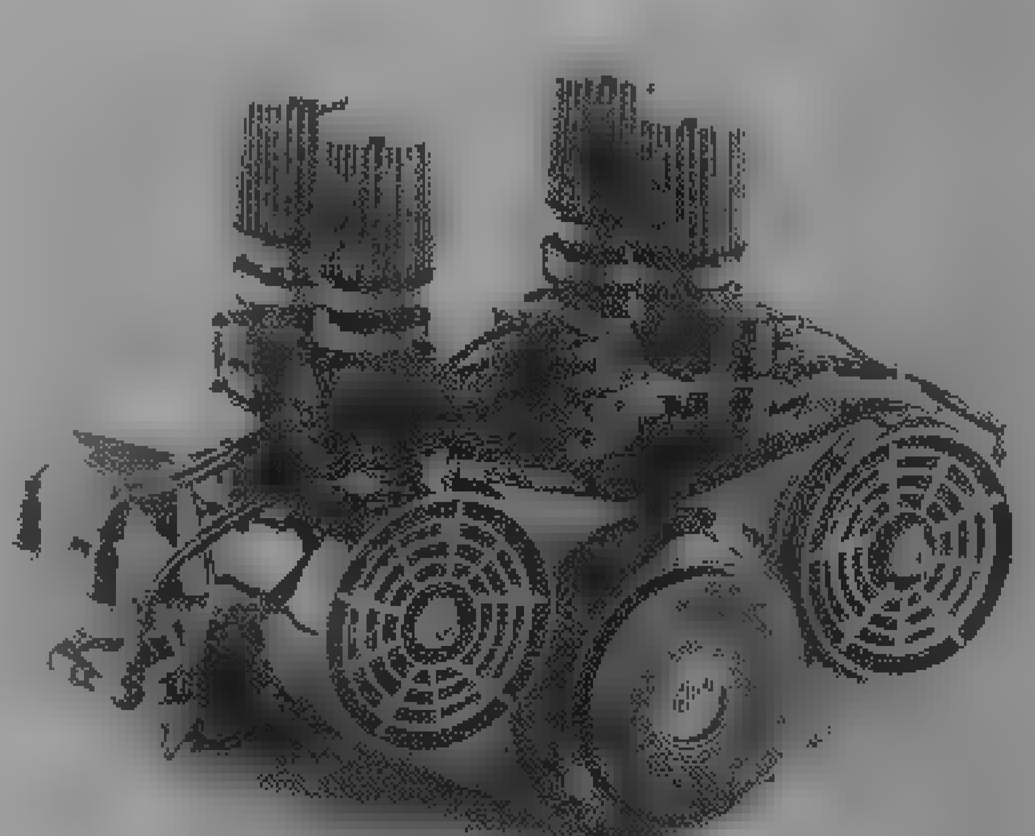
Cylinders as F 23A. Weight with fan and recoil starter 35.0 kg (77 lb). Maximum power 31 kW (41.6 hp) at 5,500 rpm.

VERIFIED

HIRTH 2703

Similar to 2702 but twin carburettors. Maximum power 44 kW (59 hp) at 6,200 rpm.

VERIFIED



Hirth F 30 helicopter version

1995

HIRTH 2704

Again enlarged, to 625 cc (38 1 cu in). Maximum power 38 kW (51 hp) at 4,500 rpm.

VERIFIED

HIRTH F 30

Four-cylinder engine tested in two sizes, the smaller (1,042 cc) being a twinned 2702 but lighter Both can have direct or geared drive

1,042 cc (63.58 cu in) version: Weight dry 36 0 kg (79 4 lb) Maximum power 48 5 kW (65 hp) at 4,500 rpm, 82 kW (110 hp) at 6,500 rpm

Helicopter version: fitted with cooling air blowers to give 86 5 kW (116 hp)

UPDATED

LIMBACH

LIMBACH FLUGMOTOREN GmbH

Kotthausener Strasse 5, D-53639 Konigswinter 21, Sassenberg
Telephone: 49 (2244) 92010
Fax: 49 (2244) 920130
Telex: 889574 plm d
ADMINISTRATIVE DIRECTOR: Dieter Wistoff
TECHNICAL DIRECTOR: Peter Limbach Jr
SALES DIRECTOR: Pierre Schmitt
In USA: Amera Tech Aviation
Parks Airport, 10 Omega Dr, Sauget, Illinois 62206
Telephone: 1 (618) 332 0082
Fax: 1 (618) 332 0084

This company manufactures four-stroke and two-stroke piston engines for light aeroplanes and powered gliders. Full details appeared in the 1992-93 *Jane's*

UPDATED

LIMBACH SL 1700

Several variants of this engine have been certificated. Applications include Scheibe SF 25C Falke 1700. The following description refers to the SL 1700E

TYPE: Four-cylinder opposed air-cooled four-stroke piston engine

CYLINDERS: Bore 88 mm (3 46 in). Stroke 69 mm (2 71 in) Capacity 1,680 cc (102 51 cu in) Compression ratio 8

INDUCTION: Stromberg-Zenith 150CD carburettor

FUEL GRADE: 90 octane

IGNITION: Single Slick 4230 magneto feeding one Bosch WB 240 ERT 1 plug in each cylinder

STARTING: One Fiat 0 37 kW (0 5 hp) starter (EA, EAI, one Bosch 0 3 kW, 0 4 hp)

ACCESSORIES: Ducellier 250W alternator; APG 17 09 001 fuel pump

DIMENSIONS:

Length overall	618 mm (24 3 in)
Width overall	764 mm (30 1 in)
Height overall	368 mm (14 5 in)

WEIGHT DRY: 73 kg (161 lb)

PERFORMANCE RATINGS:

T-O	51 kW (68 hp) at 3,600 rpm
Continuous	45.5 kW (61 hp) at 3,200 rpm

UPDATED

LIMBACH L 1800

Basically an L 2000 with reduced stroke

CYLINDERS: Bore 90 mm (3 54 in). Stroke 69 mm (2 7 in) Capacity 1,756 cc (107 cu in) Compression ratio 7 5

FUEL GRADE: 100LL or Mogas

WEIGHT DRY: about 70 kg (154 lb)

PERFORMANCE RATINGS (S/L):

T-O	49 2 kW (66 hp) at 3,600 rpm
Cruise	41 kW (55 hp) at 2,600 rpm

VERIFIED

LIMBACH L 2000

This family is based on the SL 1700 with increased bore and stroke

L 2000EO1 As 1700EI Installed in Fournier RF 5, RF 9 and RF-10, IAR IS-28M2 and Aerotechnik L-13L Vivat motor gliders, and Tecnam P92

L 2000EA1 As 1700EA1 Installed in Scheibe SF-25C Falke 2000 and SF-36

L 2000EB1. As 1700EB1 Installed in Grob G 109, Valentin Taifun and Hoffmann Dimona

L 2000DA2. Compression ratio reduced to 8 5 JAR 22F certificated with TBO 1 000 hours. Installed in Robin ATL II and Stiletto T 9 Certificated to JAR 22F

Details as for SL 1700, except for following

CYLINDERS: Bore 90 mm (3 54 in) Stroke 78 4 mm (3 09 in) Capacity 1,994 cc (120 26 cu in). Compression ratio 8 7 (EAI, 8 9)

FUEL GRADE: 100LL or Mogas

WEIGHT DRY (with all accessories):

L 2000EO1	70 kg (154 lb)
L 2000EA1	69 kg (152 lb)
L 2000EB1	71 5 kg (157.5 lb)

PERFORMANCE RATINGS:

T-O: all models	59 kW (80 hp) at 3,400 rpm
Continuous:	
L 2000EO1, EA1	52 kW (70 hp) at 3,000 rpm
L 2000EB1	53 kW (72 hp) at 3,000 rpm

UPDATED

LIMBACH L 2400

Similar to L 2000 but 2.400 cc JAR 22 certificated

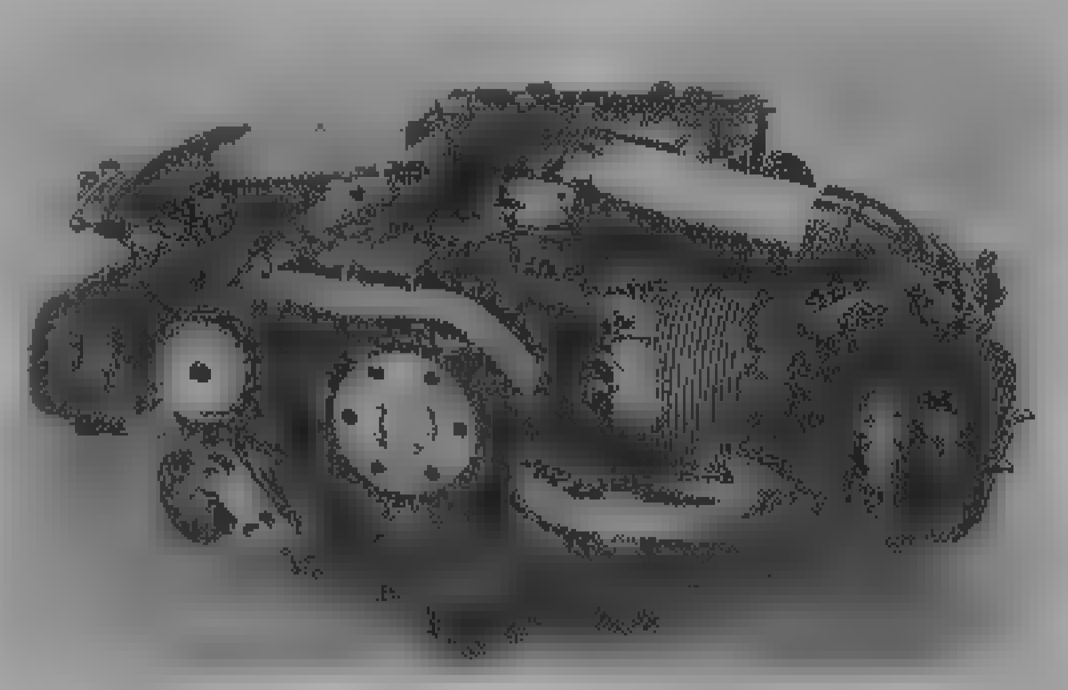
L 2400EB1A Installed in G 109A and G 109B

L 2400EB1B Installed in Taifun

L 2400EB1C Optional on HK 36 Super Dimona

L 2400EB1D Installed in Stemme S 10

L 2400DE3X Version with dual magneto ignition



Limbach L 2400EFI four-stroke piston engine *1995*

Weight with all accessories and silencer 87 5 kg (193 lb) T-O power 67 kW (90 hp) at 3 200 rpm

L2400DWFI Dual water-cooled injection, about 67 kW (90 hp)

L2400DWFIG Geared DWFI, about 97 kW (130 hp) at 4,500 rpm (2 000 to 2,200 propeller rpm)

L2400EFI Electronic fuel injection, compression ratio 9, liquid-cooled heads, weight 85 kg (187 lb) including radiator By late 1995 a geared version should be available weight 105 kg (231 lb), rated at 103 kW (140 hp), or 119 kW (160 hp) with turbo

L 2400EO3X Single ignition, single carburettor

CYLINDERS: Bore 97 mm (3 82 in). Stroke 82 mm (3 23 in) Capacity 2.424 cc (147 91 cu in) Compression ratio 8 5

INDUCTION: Twin Stromberg Zenith 150 CD-3 carburetors

FUEL GRADE: Minimum 96 RON

IGNITION: Slick 4230 magneto feeding single Bosch WB 240 ERT 1 plugs

ACCESSORIES: 1 4 kW starter, 14V 33 or 55 A generator, fuel pump and tachometer Provision for Hoffmann or Muhlbauer variable-pitch propeller

WEIGHT DRY: 82 kg (181 lb)

PERFORMANCE RATINGS:

L 2400EB1A, B and C	
T-O (5 min)	65 kW (87 hp) at 3,200 rpm
Continuous	63 kW (84 5 hp) at 3,000 rpm
L 2400EB1D	
T-O	70 kW (94 hp) at 3,400 rpm
L 2400EFI	
T-O	75 kW (100 hp) at 3,000 rpm

UPDATED

MTU

MOTOREN- UND TURBINEN-UNION MÜNCHEN GmbH

PO Box 50 0640, D-80976 Munich
Telephone: 49 (89) 1489 0
Fax: 49 (89) 150 2621
Telex: 529 500-15 MT D

MTU Munchen, a subsidiary of Daimler-Benz Aerospace AG, is Germany's largest aero-engine company It produces engines for most classes of aircraft. In March 1990 it signed an agreement which gives Pratt & Whitney a firm foothold in Europe and makes MTU United Technologies' 'preferred partner worldwide'

UPDATED

PRATT & WHITNEY PW4084

MTU is a partner with 12½ per cent share It is reponsible for the LP turbine. The engine powers the Boeing 777 and is suitable for the A330 Advanced

UPDATED

GENERAL ELECTRIC CF6

MTU has approximately a 12 per cent share in the manufacture of the CF6-50 for the A300, approximately an 8 per cent share of the CF6-80A/A1 for the A310 and 767 and a 9 per cent share of the CF6-80C2 for the A300-600, 747 and 767. MTU makes HP turbine parts

VERIFIED

MTU 17/20

This high-bypass turbofan was announced in February 1994. To be rated in the 53 3 to 99 79 kN (12 000 to 22 000 lb st) class, it was stated to be a co-operative venture with 'SNECMA, GE, Pratt & Whitney and other participants'

VERIFIED

PRATT & WHITNEY PW2000

MTU is a partner, with FiatAvio, in the PW2037 and 2040 It is responsible for the LP turbine, under a 21 2 per cent share

VERIFIED

IAE V 2500

MTU has a 12 1 per cent share in IAE (see International part of this section)

VERIFIED

PRATT & WHITNEY JT8D-200

MTU has a 12½ per cent share, being largely responsible for the LP turbine

VERIFIED

EUROJET EJ200

MTU has a 33 per cent share in this engine, described in the International part of this section

VERIFIED

TURBOMECA-SNECMA LARZAC

MTU has a 23 per cent share (see under France)

VERIFIED

TURBO-UNION RB199

MTU has a 40 per cent share in this engine, described in the International part of this section

VERIFIED

ROLLS-ROYCE TYNE

MTU has a 28 per cent share in about 170 Tyne turboprops for the Transall MTU supports all Tyne 21 engines (Atlantique) and Tyne 22 (Transall), as well as Tynes used by civil operators

VERIFIED

ALLISON 250-C20B

MTU licence-built more than 700 engines, designated 250-MTU-C20B for the PAH 1 and VBH military variants of the Eurocopter BO 105 helicopter MTU is supporting engines used by civil operators

VERIFIED

ROLLS-ROYCE TURBOMECA RTM322

Under an agreement of October 1991, MTU has a 15 per cent share in the production and further development of this engine

VERIFIED

MTU-TURBOMECA-RR MTR390

Details of this three-nation helicopter engine are given in the International part of this section

VERIFIED

P&WC PW300

MTU has a 25 per cent share in this Canadian turbofan One of its responsibilities is the LP turbine

VERIFIED

P&WC PW500

MTU has a 25 per cent share in this Canadian turbofan

VERIFIED

ZOCHE

MICHAEL ZOCHE

Keferstrasse 13, D-8000 Munich 40
Telephone: 49 (89) 344591
Fax: 49 (89) 342451
Telex: 523 402 ZOCHE D

This company's diesel aero-engines incorporate tungsten counterweights and full aerobatic pressure lubrication. Both engines have a propeller governor and four accessory drive pads. The weights given include starter, alternator, governor, vacuum pump and turbocharger.

VERIFIED

ZOCHE ZO 01A

CYLINDERS: Four, arranged at 90°. Bore 95 mm (3.74 in). Stroke 94 mm (3.70 in). Capacity 2,665 cc (162.6 cu in). Compression ratio 17.

FUEL GRADES: Diesel No. 2, JP-4 or Jet A

DIMENSIONS:

Length	720 mm (28 in)
Height and Width	530 mm (20.9 in)
Diameter	640 mm (25.2 in)
WEIGHT, DRY:	84 kg (185 lb)
PERFORMANCE RATING:	110 kW (150 hp) at 2,500 rpm

SPECIFIC FUEL CONSUMPTION (above rating): 65.0 µg/J (0.3855 lb/h/hp)

VERIFIED

ZOCHE ZO 02A

This is a double-row eight-cylinder engine using 01A cylinders. It is 935 mm (36.8 in) long, weighs 118 kg (259 lb) and has a T-O rating of 220 kW (300 hp).

VERIFIED

Zoche ZO 02A eight-cylinder diesel engine *1989*

INDIA

GTRE

GAS-TURBINE RESEARCH ESTABLISHMENT

Suranjan Das Road, Post Bag 9302, C. V. Raman Nagar, Bangalore 560 093
Telephone: 91 (812) 57 [illegible]
Telex: 0845 2458 GTRE IN
DIRECTOR: Dr R [illegible]

Established in 1959, the GTRE is one of 45 R&D establishments administered by the DRDO (Defence Research & Development Organisation). By far its biggest challenge is the design and development of a new engine for fighter aircraft.

VERIFIED

GTRE GTX

This engine is planned as the power plant of the production LCA (Light Combat Aircraft). Although influenced by existing engines, the GTX is a completely Indian project, and is being developed in the following versions:

GTX37-14U. This afterburning turbojet was the first designed in India. First run in 1977, it has a three-stage LP compressor and seven-stage HP compressor, both driven by single-stage turbines. It is flat rated to ISA +30°C at 44.5 kN (10,000 lb st) dry and 64.3 kN (14,450 lb st) with full reheat. A few engines will continue running to support later variants.

GTX37-14UB. Turbofan version with bypass ratio of 0.215. Maximum thrust 88.9 kN (19,990 lb st) with a larger frontal area.

GTX-35. Advanced turbojet with five-stage HP compressor, new annular combustor and increased turbine temperature. Offered required thrust for LCA, but higher fuel consumption due to higher thrust levels.

Kaveri. Improved turbofan planned as engine for LCA. Earlier designation of GTX-35VS changed to Kaveri with a redesigned core compressor of six stages, updated full-authority digital engine control of Indian design and advanced exhaust nozzle. Core was to run in December 1993 and engine in March 1994.

LP COMPRESSOR: Three stages, with transonic blading. Pressure ratio 3.38.

HP COMPRESSOR: Six stages with some variable stators. Pressure ratio 6.5. Overall pressure ratio 22.

COMBUSTION CHAMBER: Annular with air-blast atomisers.

HP TURBINE: Heavily loaded single-stage with DS cooled blades. Maximum entry gas temperature 1,427°C. Later to have thermal barrier coating.

LP TURBINE: Single-stage, cooled.

CONTROL SYSTEM: FADEC being developed in India and of Indian design.

PERFORMANCE RATINGS (flat rated to ISA + 20°C, S/L):

Max dry	51.3 kN (11,530 lb st)
with afterburning	80.2 kN (18,030 lb st)

VERIFIED

HAL

HINDUSTAN AERONAUTICS LTD

PO Box 5150, 15/1 Cubbon Road, Bangalore 560 001
Telephone: 91 (080) 2256901

OFFICERS: see Aircraft section

The Bangalore Engine and Koraput Divisions of HAL constitute the main aero-engine manufacturing elements of the Indian aircraft industry.

BANGALORE COMPLEX (Engine Division)

This division manufactures under licence the Adour 811 (RRTI), TPE331-5-252D (AlliedSignal) and Artouste IIIB (Turbomeca). Avon, Dart, Orpheus and Gnome engines are repaired and overhauled.

KORAPUT DIVISION

This Division was established to manufacture under Soviet government licence the Tumansky R-11 afterburning turbojet. With help from the Soviet Union, the first engine was run in early 1969. In 1977 production switched to the R-25 for the MiG-21bis, followed in 1984 by the R-29B for the MiG-27M. R-11 and R-25 engines are repaired and overhauled, to be joined soon by the RD-33.

UPDATED

INTERNATIONAL PROGRAMMES

BMW ROLLS-ROYCE

See under Germany in this section

CFM

CFM INTERNATIONAL SA

2 boulevard du Général Martial Valin, F-75015 Paris, France
Telephone: 33 (1) 40 60 81 90
Fax: 33 (1) 40 60 81 47
Sales Engineering: F-75016 Paris
Telephone: 33 (1) 44 14 54 15
Fax: 33 (1) 44 14 55 54
CFM International Inc
111 Merchant Street, Cincinnati, Ohio 45215, USA
Telephone: 1 (513) 552 3300
Fax: 1 (513) 552 3306
CHAIRMAN AND CEO: Gérard Laviec
MARKETING DIRECTOR: Richard B. Shaffer

CFM International, a joint company, was formed by SNECMA (France) and General Electric (USA) in 1974 to provide management for the CFM56 programme and a single customer interface.

GE is responsible for design integration, the core engine and the main engine control. The core engine is derived from that of the F101 turbofan developed for the US military. SNECMA is responsible for the low-pressure system, gearbox, accessory integration and engine installation.

UPDATED

CFM INTERNATIONAL CFM56

US military designation: F108

In the late 1960s SNECMA and General Electric (now GE Aircraft Engines) concluded that a large market existed for a high-bypass ratio engine in the 10 ton class (97.9 to 106.8 kN, 22,000 to 24,000 lb st). The first CFM56 demonstrator ran at GE's Evendale plant on 20 June 1974.

The CFM56 designation covers a family of engines from 82.3 to 151.25 kN (18,500 to 34,000 lb st). By January 1995 a total of 6,937 engines had been delivered, against firm orders for 8,560, and 2,400 aircraft had logged over 59 million flight hours. The following are current versions:

CFM56-2C. Certificated 8 November 1979 under FAR Pt 33 and JAR-E, at 106.8 kN (24,000 lb st); but a 97.9 kN (22,000 lb) T-O rating is used to re-engine the DC-8-60 to Super 70 standard. Scheduled operations began on 24 April 1982. Engine-caused shop visit rate is 0.13 and the dispatch reliability is 99.97 per cent.

CFM56-2B. Certificated 25 June 1982 at 97.9 kN (22,000 lb st), flat rated to 32°C (90°F), the CFM56-2B1 was selected by the US Air Force for its KC-135A tanker re-engining programme on 22 January 1980. First flight of a KC-135R took place on 4 August 1982 and production **F108-CF-100** engines power KC-135R aircraft delivered from late 1983. CFM56-2B1 also powers the C-135CFR tankers of the French Armée de l'Air. Total early 1995 was 380 aircraft.

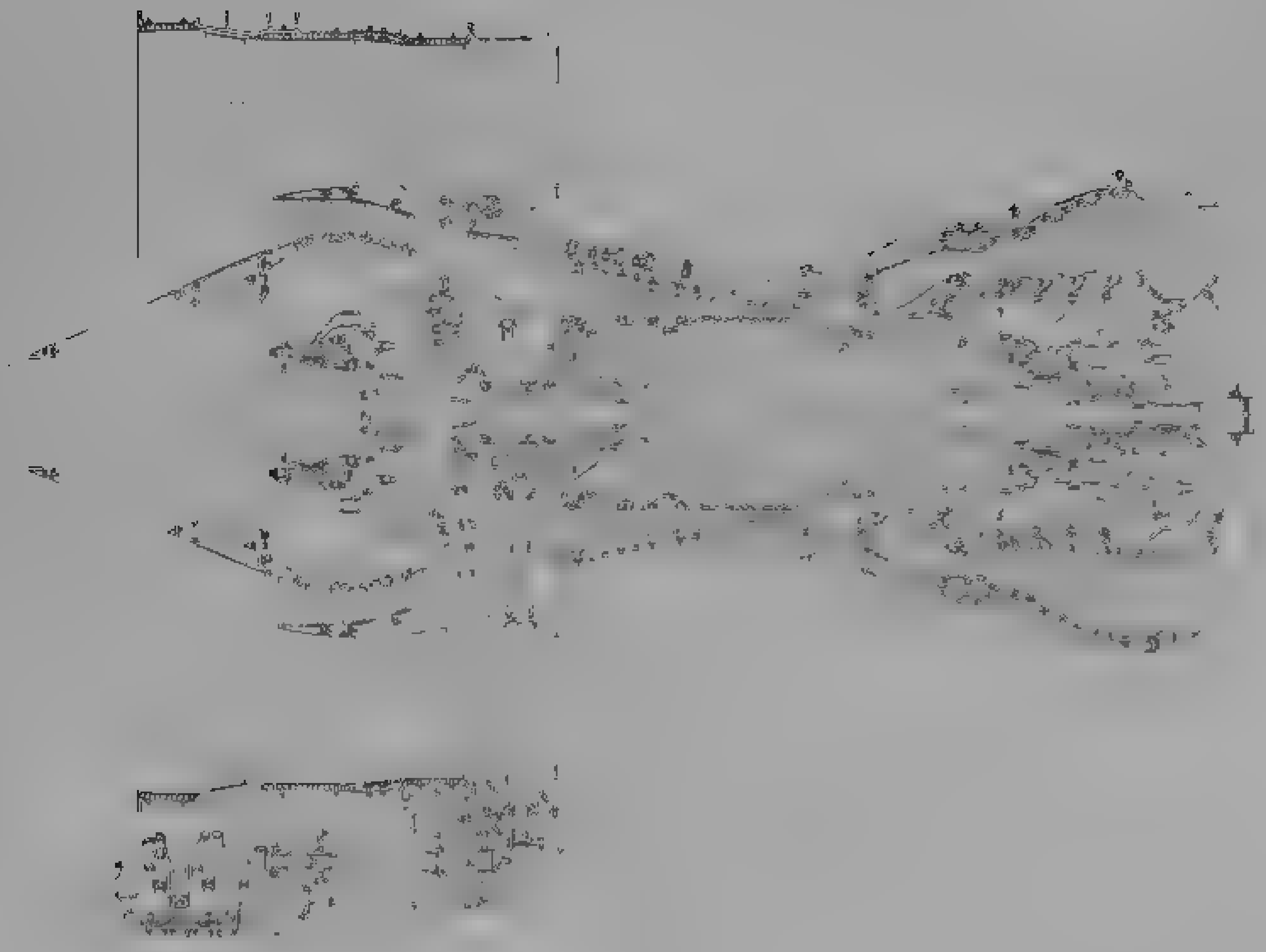
CFM56-2A. Certificated 6 June 1985 at 106.8 kN (24,000 lb st), flat rated to 35°C (95°F), the CFM56-2A-2 and 2A-3 powers the US Navy E-6 communications aircraft, the Royal Saudi Air Force E-3 and KE-3 and the E-3 for the UK and France. These applications require long-duration oil tank, reverser and gearbox for two high-capacity integrated drive generators.

Total 2,403 CFM56-2s of all sub-types delivered to 24 customers out of 2,450 on order by January 1995.

CFM56-3B1. Derivative of CFM56-2, rated at 89.00 kN (20,000 lb st), flat rated to 30°C (86°F), with smaller fan. Powers Boeing 737-300 and -500. First ran in March 1982. US and French certification granted 12 January 1984. Entered airline service December 1984. Rerated at 82.3 kN (18,500 lb st), powers 737-500 which entered service February 1990.

CFM56-3B2. Certificated at 97.90 kN (22,000 lb st), flat rated to 30°C (86°F), on 20 June 1984. For 737-300 and 737-400 with improved payload/range from short, hot, high airfields. 737-400 entered service September 1988.

CFM56-3C1. Rated at 104.5 kN (23,500 lb st) for 737-400. Certificated December 1986. Offered as common engine for all 737 models at 82.3 to 104.5 kN (18,500 to 23,500 lb st). All Dash-3 models ETOPS qualified.



Longitudinal section of CFM56-5A1

1990

By January 1995, 135 customers had ordered 4,246 CFM56-3 engines of which 3,490 had then been delivered. Engine-caused shop visit rate (12 month rolling averages) was 0.073, and dispatch reliability 99.97 per cent.

CFM56-5A1. Launched September 1984, for A320. Has fan diameter of -2, with improved aerodynamics in all LP and HP components, advanced clearance control features and FADEC. Nominal rating of 111.21 kN (25,000 lb st), flat rated to 30°C (86°F). Certificated 27 August 1987 and entered service April 1988. Outstanding reliability resulted in 120 minutes ETOPS certification.

CFM56-5A3. Rated at 117.9 kN (26,500 lb st). To meet specific airline requirements for A320.

CFM56-5A4, -5A5. Respectively rated at 97.9 and 104.5 kN (20,000 and 23,500 lb st), these versions power the A319.

CFM56-5B1. Rated at 133.5 kN (30,000 lb st). Certified February 1994 for A321.

CFM56-5B2. High-performance derivative with core of 5C4. Rated at 137.9 kN (31,000 lb st) for A321. First run 25 October 1991 at Villaroche. Optional double-annular combustor to minimise NO_x emissions. Certification May 1993, entry to service March 1994.

CFM56-5B4. Version of -5B derated to 120.1 kN (27,000 lb st) to 45°C (113°F), available for A320.

CFM56-5B5, -5B6. Alternatives for A319, respectively 97.9 kN (22,000 lb st) and 104.5 kN (23,500 lb st).

CFM56-5B/P. New airfoils throughout and improved seals to extend life and reduce sfc by 3 per cent.

CFM56-5C2. Advanced fan, new four-stage LP compressor, active clearance control HP spool, new turbine section (five-stage LP, new frame, modulated clearance, new aerodynamics throughout), integrated mixer nozzle and FADEC. Rated at 138.8 kN (31,200 lb st). Powers A340, certificated 31 December 1991, service entry February 1993.

CFM56-5C3. Growth version rated at 144.6 kN (32,500 lb st). Certificated 31 December 1991 at 950°C TET. Entered service early 1994.

CFM56-5C4. Growth version certificated October 1994 at 151.25 kN (34,000 lb st) for A340.

Total 1,656 CFM56-5s of all variants ordered by January 1995, of which 1,044 delivered.

CFM56-7B. Matches -5B core and LP turbine with new wide-chord fan, single-crystal HP turbine, streamlined engine flow path and FADEC II control. Rated at 82.3 to 117.4 kN (18,500 to 26,400 lb st) for 737-700. Certification due October 1997; 208 on order for seven customers by January 1995.

CFM56XX. Projected engine in 200 kN (45,000 lb) class with 2,134 mm (84.0 in) fan and 20 per cent greater core air flow.

TYPE: Two-shaft subsonic turbofan.

FAN: Single-stage axial. Forged titanium disc holding (CFM56-2) 44 titanium blades, each with a tip shroud to form a continuous ring, (CFM56-3) 38 titanium blades, each with part-span shroud, (CFM56-5) 36 titanium blades, each with part-span shroud, (CFM56-7) 24 solid wide-chord unshrouded blades. Mass flow (-2A2) 370 kg (817 lb)/s, (-3B2) 312 kg (688 lb)/s, (-5A1) 386 kg (852 lb)/s, (-5B2) 434 kg (956 lb)/s, (-5C2) 466 kg (1,027 lb)/s, (-7B20) 310 kg (686 lb)/s. Bypass ratio (-2) 6, (-3) 5, (-5A) 6, (-5B) 5.5, (-5C) 6.6, (-7B) 5.1-5.6.

LP COMPRESSOR: Three axial stages (4 on -5B and -5C), on titanium drum bolted to fan disc. A ring of bleed doors allows core air flow to escape into fan duct at low power settings.

HP COMPRESSOR: Nine-stage rotor with three stages of titanium blades and remainder of steel. Stator vanes are steel, with first four stators variable. Overall pressure ratio (-2) 25 class, (-3C) 30.6, (-5A) 31.3, (-5B) 35, (-5C2/-5C3, maximum climb) 37.4.

COMBUSTION CHAMBER: Machined ring, fully annular, with advanced film cooling. Dual annular offered on -5B and -7B.

HP TURBINE: Single-stage with air-cooled stator and rotor airfoils, advanced materials on -5. HP system carried in two bearings.

LP TURBINE: Four-stage (5 on -5C) with tip shrouds.

EXHAUST UNIT (FAN): Constant-diameter duct of sound-absorbent construction. Outer cowl and engine cowl form convergent plug nozzle, with airframe-mounted reverser (expected -5C, see next).

EXHAUST UNIT (CORE): Fixed-area with convergent nozzle, mixer on -5C.

ACCESSORY DRIVE: (CFM56-2 and -5) Gearbox in front sump transmits drive from front of HP spool to transfer gearbox on underside of fan case. Air starter at transfer gearbox (-2) or accessory gearbox (-5). (CFM56-3 and -7B) Side-mounted accessory drive gearbox with transfer gearbox, air starter pad on accessory gearbox.

CONTROL SYSTEM: Hydromechanical with electronic trim (-2, -3), FADEC (-5 and -7B).

LUBRICATION: Dry sump system.

DIMENSIONS:

Length, excl spinner:	
CFM56-2	2,430 mm (95.7 in)
CFM56-3	2,360 mm (93.0 in)
CFM56-5A1, -5A3	2,422 mm (95.4 in)
CFM56-5B1, -5B2	2,601 mm (102.4 in)
CFM56-5C	2,616 mm (103.0 in)
CFM56-7B	2,507 mm (98.7 in)
Fan diameter:	
CFM56-2, -5A, -5B	1,735 mm (68.3 in)
CFM56-3	1,524 mm (60.0 in)
CFM56-5C	1,836 mm (72.3 in)
CFM56-7B	1,549 mm (61.0 in)

WEIGHT, DRY:

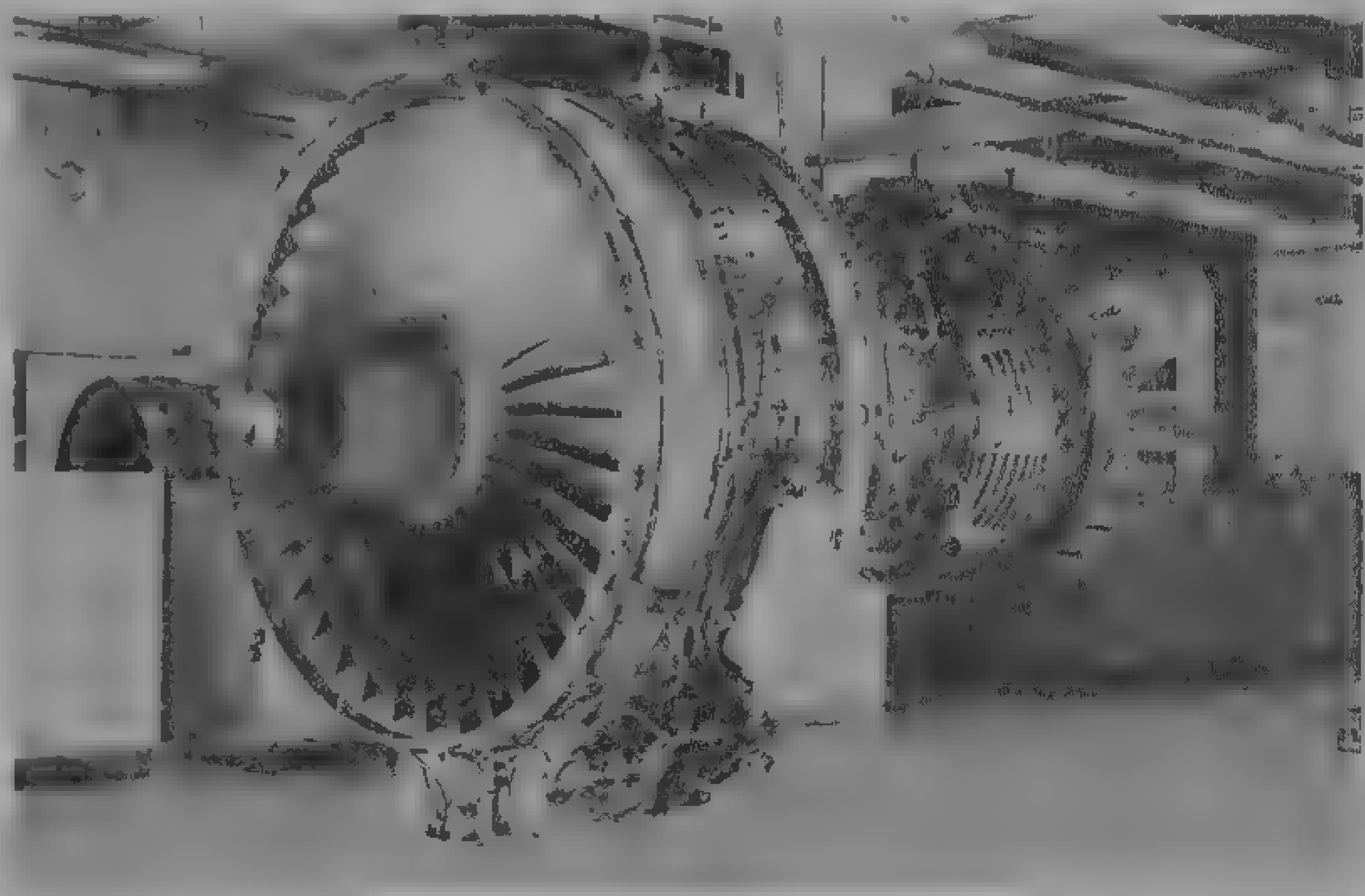
CFM56-2A2	2,187 kg (4,820 lb)
CFM56-2B1	2,119 kg (4,671 lb)
CFM56-2C series	2,102 kg (4,635 lb)
CFM56-3B1	1,940 kg (4,276 lb)
CFM56-3B2, -3C	1,951 kg (4,301 lb)
CFM56-5A1	2,257 kg (4,975 lb)
CFM56-5A3	2,266 kg (4,995 lb)
CFM56-5B1, -5B2	2,381 kg (5,250 lb)
CFM56-5C	2,492 kg (5,494 lb)
CFM56-7B	2,361 kg (5,205 lb)

PERFORMANCE RATINGS:

Max T-O: see under model listings

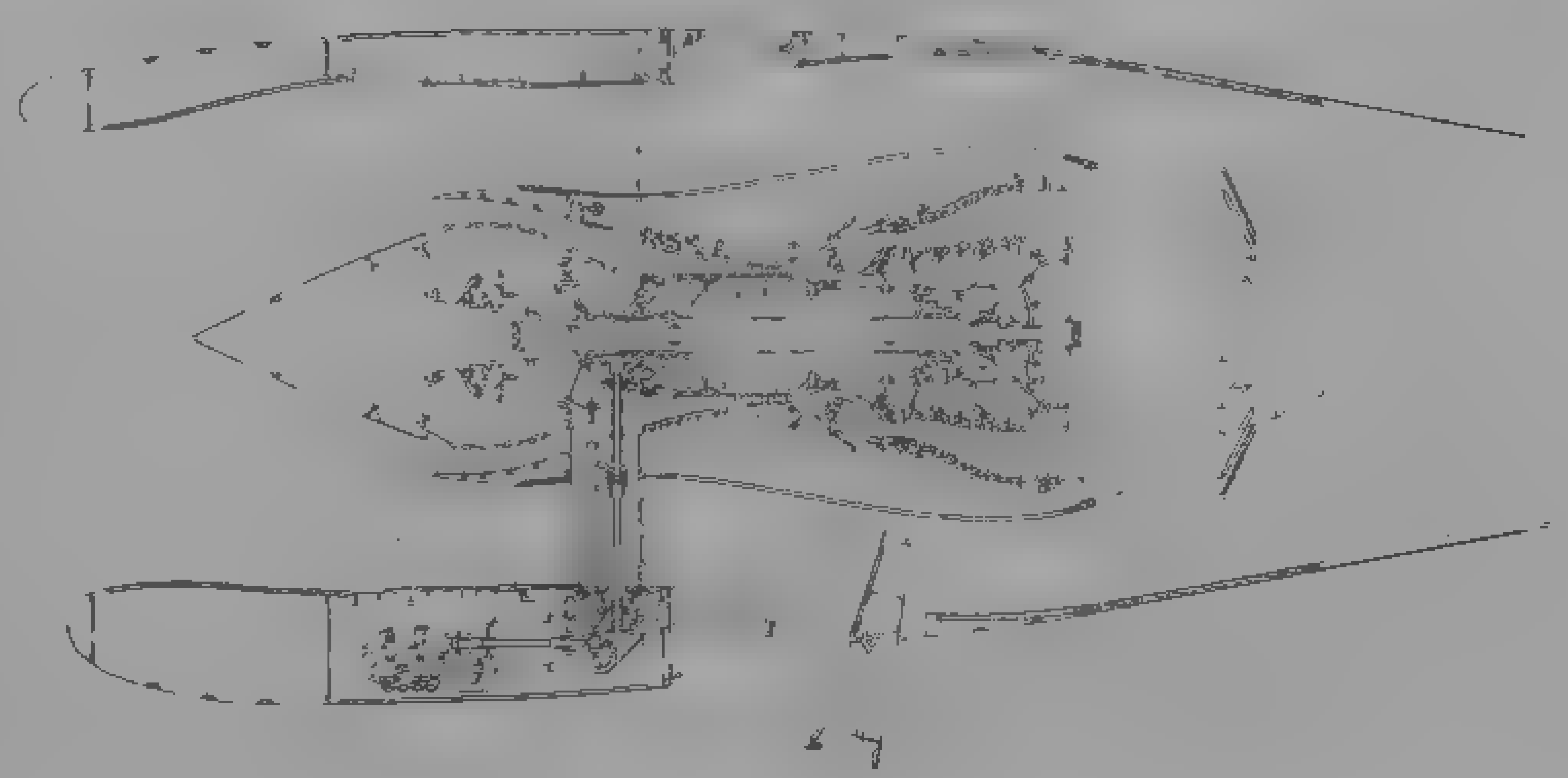
Cruise, installed, 10,670 m (35,000 ft), Mach 0.8, ISA:

CFM56-2A2	23.08 kN (5,188 lb)



CFM International CFM56-5C two-shaft turbofan

1990



Longitudinal section of CFM56-5C complete nacelle, showing (lower half) reverser in operation

1992

CFM56-2B1	22.10 kN (4,969 lb)
CFM56-2C series	23.82 kN (5,356 lb)
CFM56-3B1	20.67 kN (4,650 lb)
CFM56-3B1 rerate	19.57 kN (4,400 lb)
CFM56-3B2	[illegible] kN ([illegible] lb)
CFM56-3C	19.57-23.88 kN (4,400-5,370 lb)
CFM56-5A1, -5A3	22.23 kN (5,000 lb)
CFM56-5B1, -5B2	25.98 kN (5,840 lb)
CFM56-5C (with mixer)	30.74 kN (6,910 lb)

SPECIFIC FUEL CONSUMPTION (cruise, as above):

CFM56-2A2	18.72 mg/Ns (0.661 lb/h/lb)
CFM56-2B1	18.61 mg/Ns (0.657 lb/h/lb)
CFM56-2C series	18.44 mg/Ns (0.651 lb/h/lb)
CFM56-3 (all)	18.55 mg/Ns (0.655 lb/h/lb)
CFM56-5A1, -5A3	16.87 mg/Ns (0.596 lb/h/lb)
CFM56-5B	16.98 mg/Ns (0.600 lb/h/lb)
CFM56-5C (with mixer)	16.06 mg/Ns (0.567 lb/h/lb)

UPDATED

CFM INTERNATIONAL CFM88

This proposed turbofan is based on the core of the SNECMA M88-2 fighter engine, with an added seventh HP compressor stage. The LP spool would have a single fan stage. The CFM88 is seen as leading to a family of engines from 53.38 kN (12,000 lb st) to 88.97 kN (20,000 lb st), for 50/120-seat regional transports, business jets and military transports.

VERIFIED

EUROJET

EUROJET TURBO GmbH

Inselkammerstr 5, D-82008 Unterhaching, Munich, Germany
Telephone: 49 (89) 666920
Fax: 49 (89) 6669 2139/6669 2162
Telex: 5212124 EJET D
MANAGING DIRECTOR: Kenneth J. Greenal

Formed in August 1986 by a consortium of Fiat Aviazione (now FiatAvio) of Italy, MTU-Munchen GmbH of (then) West Germany, Rolls-Royce of the UK and Sener (now ITP) of Spain, this company became operational on 1 January 1987 as EUROJET Turbo GmbH. It was established to co-ordinate the design, development and manufacture of the EJ200 engine for the European Fighter Aircraft (now Eurofighter 2000).

The workshare was proportional to the expected aircraft requirement of the four nations, and was agreed as follows: Fiat (21 per cent), LP turbine and shaft, interstage support, th[illegible] system, gearbox, oil system, and participation in the intermediate casing; MTU (33 per cent), LP compressor, HP compressor, participation in HP turbine, and FADEC (full authority digital electronic control) design responsibility; Rolls-Royce (33 per cent), combustion system, HP turbine, intermediate casing, and participation in LP and HP compressors, LP turbine, interstage support, reheat system and nozzle; ITP (13 per cent), nozzle, jetpipe, exhaust diffuser and bypass duct.

Engine build and test during development and production is at each partner's facilities. Each partner provides comprehensive support for engines of its own national air force. The original requirement of the four nations was for 760 aircraft, including about 2,000 engines.

The development programme is structured in four phases: 1 (Technology Acquisition) which started in 1985, 2 (Design Verification), first DVE run in November 1988, 3 (Full Scale Development), prototype engines (for which contract signed in November 1988) delivered in 1994 for flight testing, DA3 first flight with EJ200 engines in 1995, and 4 (Flight Evaluation and Full Certification), to begin late 1995. The technology used and the extensive testing had led to an engine free from any serious mechanical or engine dynamics problem. By mid 1995 the EJ200 has run more than 5,000 hours, of which more than 1,600 hours were on altitude test.

UPDATED

EUROJET EJ200

This engine is an advanced turbofan designed for Mach numbers of about 2. It is fully modular, and allows for on-condition maintenance with built-in engine health monitoring and test equipment. Low maintenance and life cycle cost along with high reliability have been prime design criteria. The total number of aerofoils is only approximately 60 per cent of those used in the RB199. The EJ200 programme has achieved all technical milestones on time and cost. This includes 150 hours of accelerated mission endurance testing at full temperature rating. Installed in third and subsequent Eurofighter 2000s, first flight 5 June 1995. Entry into service is expected to be in 2000.

TYPE: Two-shaft augmented turbofan.

LP COMPRESSOR: No inlet guide vanes. Three stages, with 3D transonic blades of robust large-chord section held in blisks. Overhung ahead of high-capacity ball bearing and forward roller bearing. Bypass ratio about 0.4. Pressure ratio 4 plus.

HP COMPRESSOR: Five stages, with first stage variable inlet guide vanes and blisk rotor stage. Shaft supported between front ball and rear roller bearings. Overall pressure ratio more than 25.

COMBUSTOR: Fully annular, with airspray can combustor.

HP TURBINE: Single stage, with single crystal blades. Both turbine bearings in single interstage support frame.

LP TURBINE: Single-stage, with single crystal blades. Both turbine bearings in single interstage support frame.

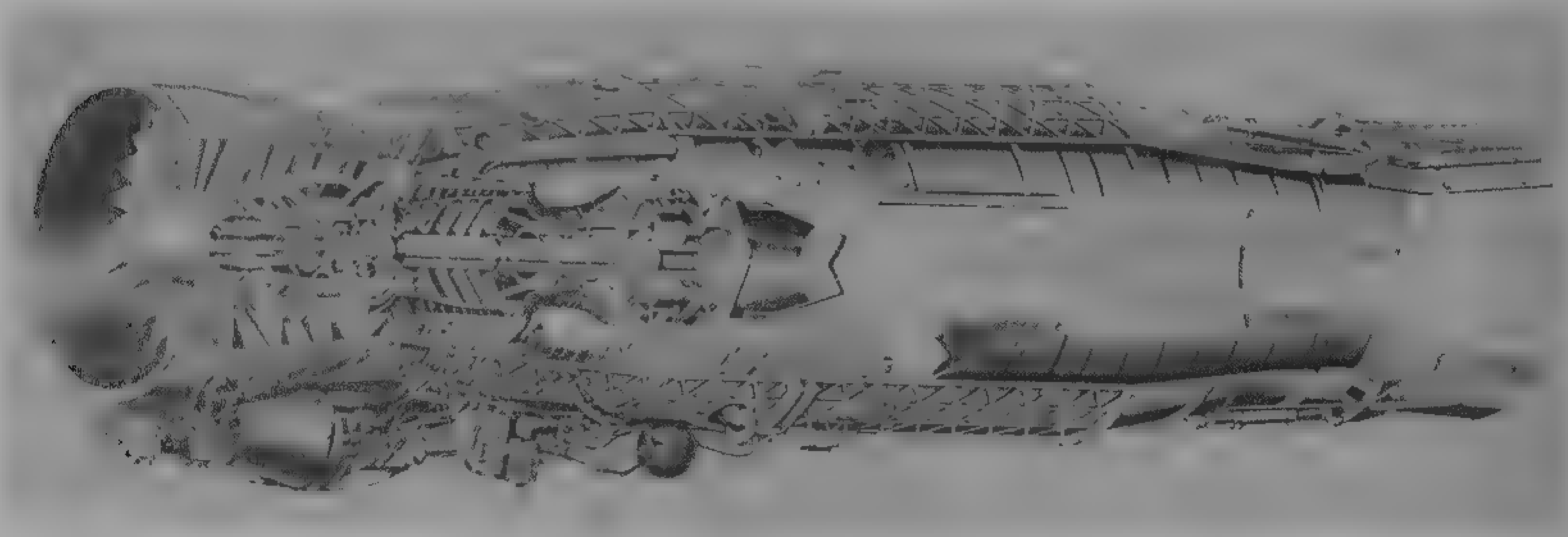
EXHAUST SYSTEM: High efficiency augmentor of burn-then-mix type, with fully variable convergent divergent nozzle.

ACCESSORIES: Central gearbox driven via tower shaft in interstage support. FADEC. Integrated health monitoring system, produced by consortium led by Dornier, with Smiths Industries, Tecnost and Ceselsa. Rotating tank oil system to give artificial positive gravity at all times.

DIMENSIONS: Length overall	4.0 m (157 in)
Inlet diameter	740 mm (29 in)
WEIGHT:	990-1,035 kg (2,183-2,282 lb)

PERFORMANCE RATING: In 90 kN (20,000 lb st) class

UPDATED



Internal arrangement of EUROJET EJ200 two-shaft augmented turbofan *1992*

EJ200 FSD engine for the Eurofighter 2000 fighter aircraft *1992*

IAE

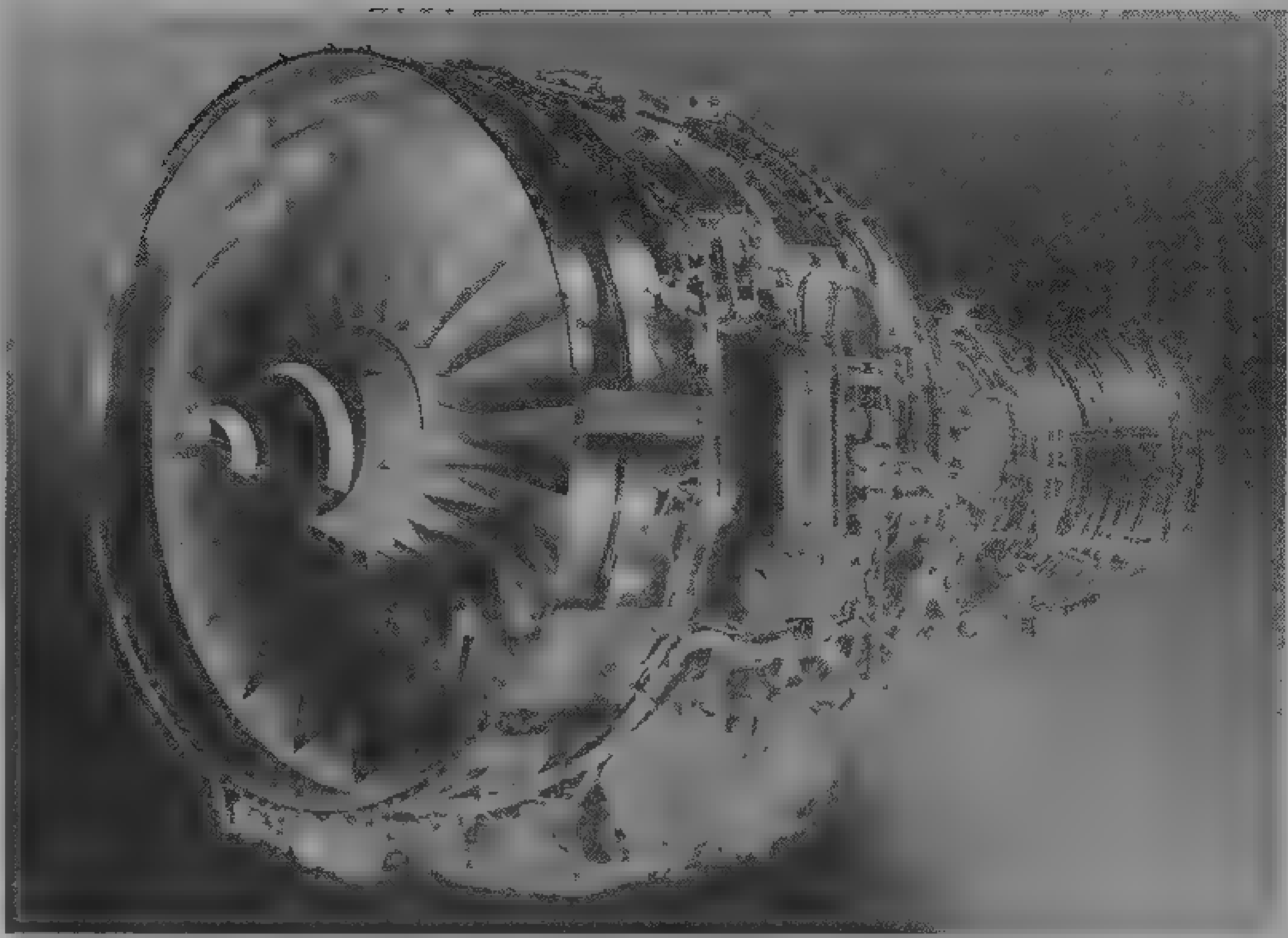
INTERNATIONAL AERO-ENGINES AG

OFFICES Corporate Center II, 628 Hebron Avenue, Glastonbury Connecticut 06033, USA
Telephone: 1 (203) 652 1800
Fax: 1 (203) 659 1410
Telex: 4436031 INTLAERO
PRESIDENT: Barry Eccleston
VICE-PRESIDENT, BUSINESS: Jim Clinton
VICE PRESIDENT MARKETING: Eric Schoenholz
PUBLIC RELATIONS MANAGER: Robert Nuttall

IAE is a management company set up on 14 December 1983 to direct the entire programme for the V2500 turbofan worldwide. The following shareholders signed a 30-year agreement: Rolls-Royce, UTC (P&W), Japanese Aero-Engines (IHI, KHI, MHI), MTU and FiatAvio. Responsibility for each module is allocated according to shareholding. Overall engineering direction is delegated to Pratt & Whitney. Rolls-Royce manages the nacelle programme. Engines are assembled and tested by Pratt & Whitney and Rolls-Royce.

JAEC is responsible for the fan (derived from 535E4) and LP compressor, Rolls-Royce for the HP compressor, Pratt & Whitney for the combustor and HP turbine, MTU for the LP turbine and Fiat for the gearbox. Turbines, gearbox and FADEC use PW2000 technology.

UPDATED



IAE V2500 two-shaft turbofan

1994

IAE V2500

V2500-A1. In service on the A320. IAE supplies the complete package, including the nacelle (by Rohr/Shorts). Testing of the engine began in December 1985. A flight programme on a Boeing 720B in Canada was completed in 35 hours in Spring 1988, and every ingestion and fan-blade-off test was passed first time (believed an industry record). The first pair of propulsion systems was delivered to Airbus Industrie in March 1988 and the V2500 was certificated in June 1988.

The first V2500-powered A320 made its first flight on 28 July 1988. The aircraft entered service in May 1989. Awarded 120 minutes EROPS approval January 1992. Shop visit rate (12 months to December 1994) was 0.073 per 1,000 h.

Subsequent development to higher thrust has been achieved by increasing the core air flow and aerodynamic changes. Pressure ratio of the LP compressor is increased by adding a fourth stage. A engines in the A (Airbus) and D (Douglas) series have common fans and cores, and fit into a common nacelle which for the MD-90 is modified for fuselage side mounting. A5/D5 engines all certificated November 1992. All versions projected with Calcor final nozzle giving 5 per cent area variation.

V2522-A5. Rated at 99.79 kN (22,000 lb st). Four-stage LP compressor, as in all A5 and D5 versions. Bypass ratio 4.9. Pressure ratio 25.3. For A319.

V2524-A5. Rated at 106.6 kN (23,500 lb st).

V2527-A5. Flat rated at 117.88 kN (26,500 lb st). Bypass ratio 4.75. Pressure ratio 28.6. For A320. Flight testing from 1992, first delivery (to United) November 1993.

V2525-D5. Flat rated at 111.25 kN (25,000 lb st). Bypass ratio 4.8. Pressure ratio 27.7. For MD-90-30. Flight testing began February 1993, first delivery (to Delta) early 1995.

V2528-D5. Rated at 124.55 kN (28,000 lb st). Bypass ratio 4.7. Pressure ratio 30.4. For MD-90-50.

V2530-A5. Rated at 133.4 kN (30,000 lb st). Bypass ratio 4.6. Pressure ratio 32.5. For A321-100. Flight testing began March 1993, first delivery (Lufthansa) March 1994.

V2533-A5. Rated at 146.8 kN (33,000 lb st) to power A321-200. Launched by Aero Lloyd April 1995.

V2535. Provisional designation for future growth engine to be rated in the 155.7 kN (35,000 lb st) class, with increased diameter fan and revised LP compressor and turbine.

By December 1994 a total of 39 customers had specified the V2500 for 658 aircraft, comprising 448 A320/321s and 210 MD-90s.

The primary features of the V2500-A5/D5 are as follows:

TYPE: Two-spool subsonic turbofan.

FAN: Single stage, with wide-chord shroudless blading. Diameter 1,600 mm (63.0 in). Pressure ratio 1.70. Bypass ratio 4.6. Mass flow 384 kg (848 lb)/s.

LP COMPRESSOR: Four stages, bolted to rear of fan to boost inlet to core. (Three stages in A1 version.)

HP COMPRESSOR: Ten stages of blading supported by a drum rotor. Inlet guide and first three vane stages variable. Overall pressure ratio 29.4.

COMBUSTOR: Annular segmented construction eliminates hoop stresses and provides low emissions and uniform exit temperatures.

HP TURBINE: Two stages of air-cooled single-crystal blading in powder metallurgy discs. Active tip clearance control.

LP TURBINE: Five stages of uncooled blading in welded and bolted rotor. Active clearance control.

GEARBOX: Modular unit, fan case mounted.

CONTROL SYSTEM: Full-authority digital electronic control (FADEC) to provide command outputs for engine fuel flow, stator vane angle, bleed modulation, turbine and exhaust case cooling, oil cooling, ignition and reverser functions. Supplied by Hamilton Standard.

NACELLE: Full length nacelle with reverser. Cowl load sharing to minimise case deflections. Acoustically treated.

DIMENSIONS:

Length (flange to flange)	3,200 mm (126 in)
Fan diameter	1,600 mm (63 in)

WEIGHT, DRY (with original single-stage LP compressor):

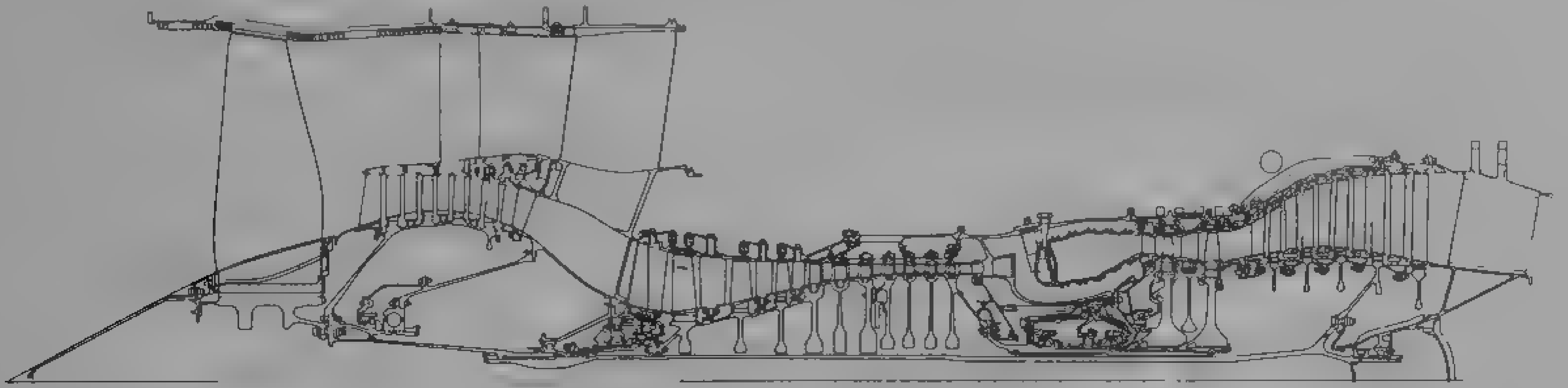
Bare engine	2,370 kg (5,224 lb)
Complete power plant, incl nacelle	3,311 kg (7,300 lb)

PERFORMANCE RATINGS (installed):

T-O, S/L, ISA: 133.4 kN (30,000 lb st) to ISA + 15°C
Cruise Mach 0.8, 10,670 m (35,000 ft): 25.6 kN (5,752 lb)

SPECIFIC FUEL CONSUMPTION (Cruise Mach 0.8, 10,670 m/35,000 ft, installed): 16.26 mg/Ns (0.575 lb/h/lb)

UPDATED



Longitudinal section of IAE V2500-A5/D5 two-shaft turbofan

1990

MTFE

MID THRUST FAMILY ENGINE

MTU (see under Germany in this section)
Pratt & Whitney (see under USA in this section)
PROGRAMME MANAGER: Tom Davenport
DEPUTY PROGRAMME MANAGER: Dr Rainer Schwab

After failure of the Project Blue team (the above plus GE and SNECMA) to reach agreement, these two companies are hoping to produce an engine that will capture at least half the estimated market of 8,800 aircraft of 91 to 160 seats by 2015. Pratt & Whitney has 51 per cent of the MTFE project and MTU 49 per cent.

NEW ENTRY

MTFE

Said to be based on components already run by the partners in previous (unrelated) test programmes. The philosophy behind the engine is that, by making it simpler and running at lower turbine temperatures, it can be produced much more cheaply than competitor engines, even though it would be heavier for a given thrust and have higher fuel consumption. Excluding the nacelle, the estimated development cost is $615 million, and certification is scheduled for 1999.

TYPE: Two-shaft turbofan.

FAN: Single stage, with wide-chord snubberless blades. Bypass ratio 5.2. Rotating with two-stage core booster.

COMPRESSOR: Six stages, with two variable stators. Overall pressure ratio about 27.

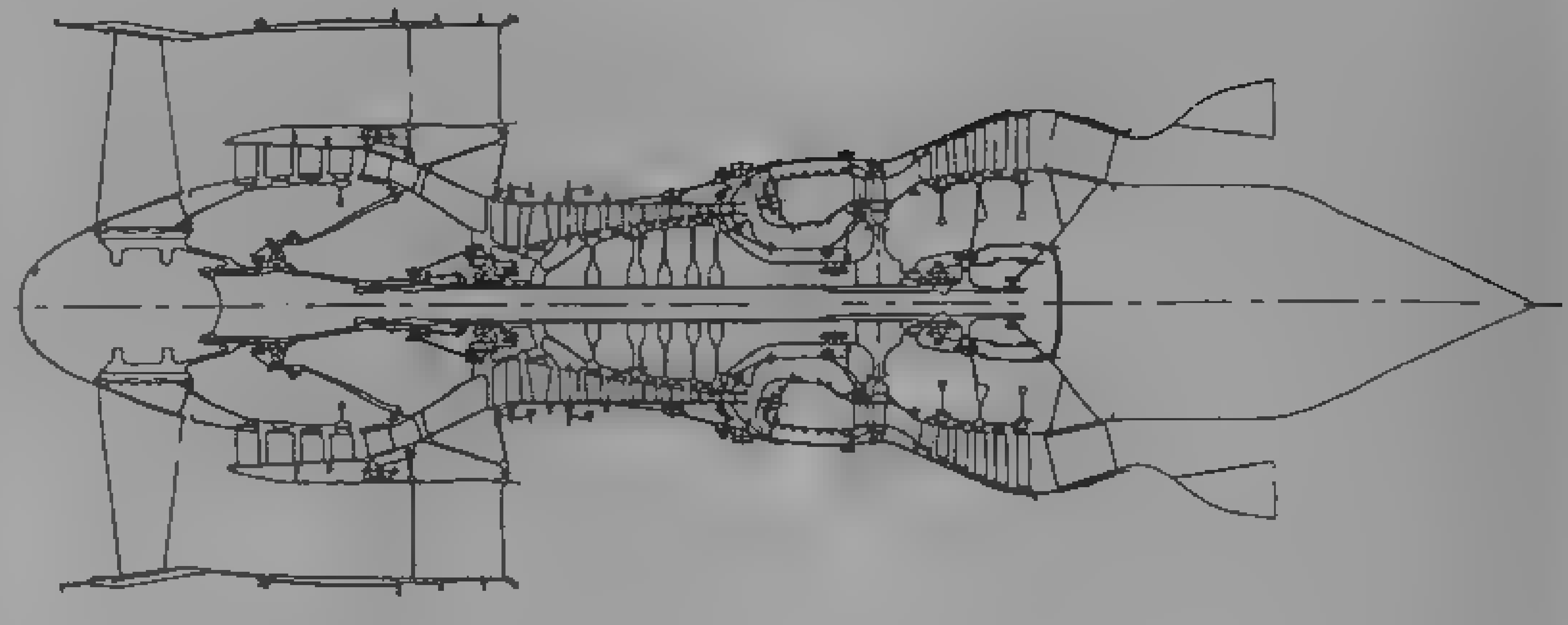
COMBUSTION CHAMBER: Conventional single annular.

TURBINES: Single-stage HP, three-stage LP. Entry gas temperature "100°F (37.8°C) lower than competitor engines".

JETPIPE: Integrated fixed-area mixer nozzle
CONTROL: FADEC
DIMENSIONS:

Fan diameter	1,397 mm (55.0 in)
Length (excluding nozzle)	2,515 mm (99.0 in)
WEIGHT, DRY:	about 1,769 kg (3,900 lb)
THRUST RATING:	89 kN (20,000 lb st) class

NEW ENTRY



Longitudinal section through the proposed MTFE turbofan
1995

MTR

MTU TURBOMECA ROLLS-ROYCE GmbH

Inselkammerstrasse 5, D-82008 Unterhaching, Germany
Telephone: 49 (89) 614 4940
Fax: 49 (89) 614 9526
MANAGING DIRECTOR: H. J. Tenter
TECHNICAL DIRECTOR: J. L. Boucon
PROGRAMME DIRECTOR: K. Heimaier
COMMERCIAL DIRECTOR: B. Lory
MARKETING DIRECTOR: R. Sanderson

This company is owned equally by the three participants. It was set up in 1989 to produce and subsequently support the MTR 390 engine, and to act as contractor for customers.

UPDATED

MTR 390

This turboshaft engine was selected to power the Franco-German Tiger anti-tank and Gerfaut escort/support helicopters. The engine is suitable for military and civil applications in helicopters and fixed wing aircraft in the form of single and twin installations.

The main characteristics of the modular engine are: ample emergency power reserve for OEI operation, high alternating output shaft power capability, low fuel consumption under part load, good acceleration, low life cycle cost, easy handling and simple maintenance. It has a high performance FADEC and an engine monitoring system for flight and maintenance crew support.

Design studies have been extended to derivatives for other applications. A 6,000 rpm drive version (MTR 390L) and a direct drive version (MTR 390T) have been defined.

First run took place at MTU in December 1989, and the first flight engines for the first Tiger prototypes were delivered in September 1990. First flights in a Panther testbed and the prototype Tiger took place on schedule in 1991. By 1995 more than 8,000 hours had been run, including 1,700 on flight test. Basic qualification testing was completed in 1993. The program continues with maturity and mission-simulation testing.

TYPE: Free turbine turboshaft.
COMPRESSOR: Two centrifugal stages for erosion and FOD resistance. Mass flow 3.2 kg (7.05 lb)/s. Pressure ratio 13.
COMBUSTION CHAMBER: Annular reverse-flow, with airblast fuel injectors for low emissions.
HP TURBINE: Single-stage gas generator turbine with high performance blade cooling, single-crystal blades and powder-metal disc.
LP TURBINE: Two-stage free power turbine with shrouded blades.
GEARBOX: Reduces the speed of the power turbine to the output shaft speed of 8,000 rpm. The accessory gearbox in the upper part provides the support and drive for the front- and top-mounted engine equipment.
CONTROL SYSTEM: A FADEC, with engine monitoring system.
LUBRICATION SYSTEM: Integral oil system, with engine-mounted tank and oil cooler with fan.
DIMENSIONS:

Length overall	1,078 mm (42.4 in)
Width overall	442 mm (17.4 in)
Height overall	682 mm (26.9 in)
WEIGHT, DRY:	169 kg (372.6 lb)
PERFORMANCE RATINGS (uninstalled, ISA, S/L):	
Super contingency (OEI, 20 s)	1,160 kW (1,556 shp)
T-O	958 kW (1,285 shp)
Max continuous	873 kW (1,171 shp)
SPECIFIC FUEL CONSUMPTION:	
T-O	77.74 µg/J (0.460 lb/h/shp)
Max continuous	78.93 µg/J (0.467 lb/h/shp)

UPDATED

MTR 390 turboshaft
1994

PS-ZMK

BPS: see under Slovakia
ZMKB: see under Ukraine

The DV-2 turbofan is a joint programme by these two organisations. It is described under ZMKB Progress, Ukraine.

Development began in 1978 in parallel with that of a new trainer to replace the L-39. Under an intergovernment agreement, the former Czechoslovakia was responsible for the aircraft and the former Soviet Union (then at the Lotarev MKB) for the engine. In 1982-87, 16 prototype DV-2 engines were tested. Series production began in 1989 at what are today PS Aero-Engine division and ZMKB Progress. Current development includes life extension and a FADEC.

VERIFIED

ROLLS-ROYCE TURBOMECA

ROLLS-ROYCE TURBOMECA LIMITED

4/5 Grosvenor Place, London SW1X 7HH, UK
Telephone: 44 (171) 235 3641
Fax: 44 (171) 245 6385
Telex: 918944

This joint company was formed in June 1966 to control design, development and production programmes for the Adour two-shaft turbofan.

In 1980 Rolls-Royce Turbomeca launched the RTM 321 turboshaft demonstrator, leading to the RTM 322.

VERIFIED

ROLLS-ROYCE TURBOMECA ADOUR

US military designation: F405

The Adour was designed for the SEPECAT Jaguar. The whole engine is simple and robust and of modular design.

Bench testing began at Derby on 9 May 1967. Engines for Jaguars were assembled at Derby (RR) and Tarnos (Turbomeca) from parts made at single sources in Britain and France. Turbomeca makes the compressors, castings and external pipework.

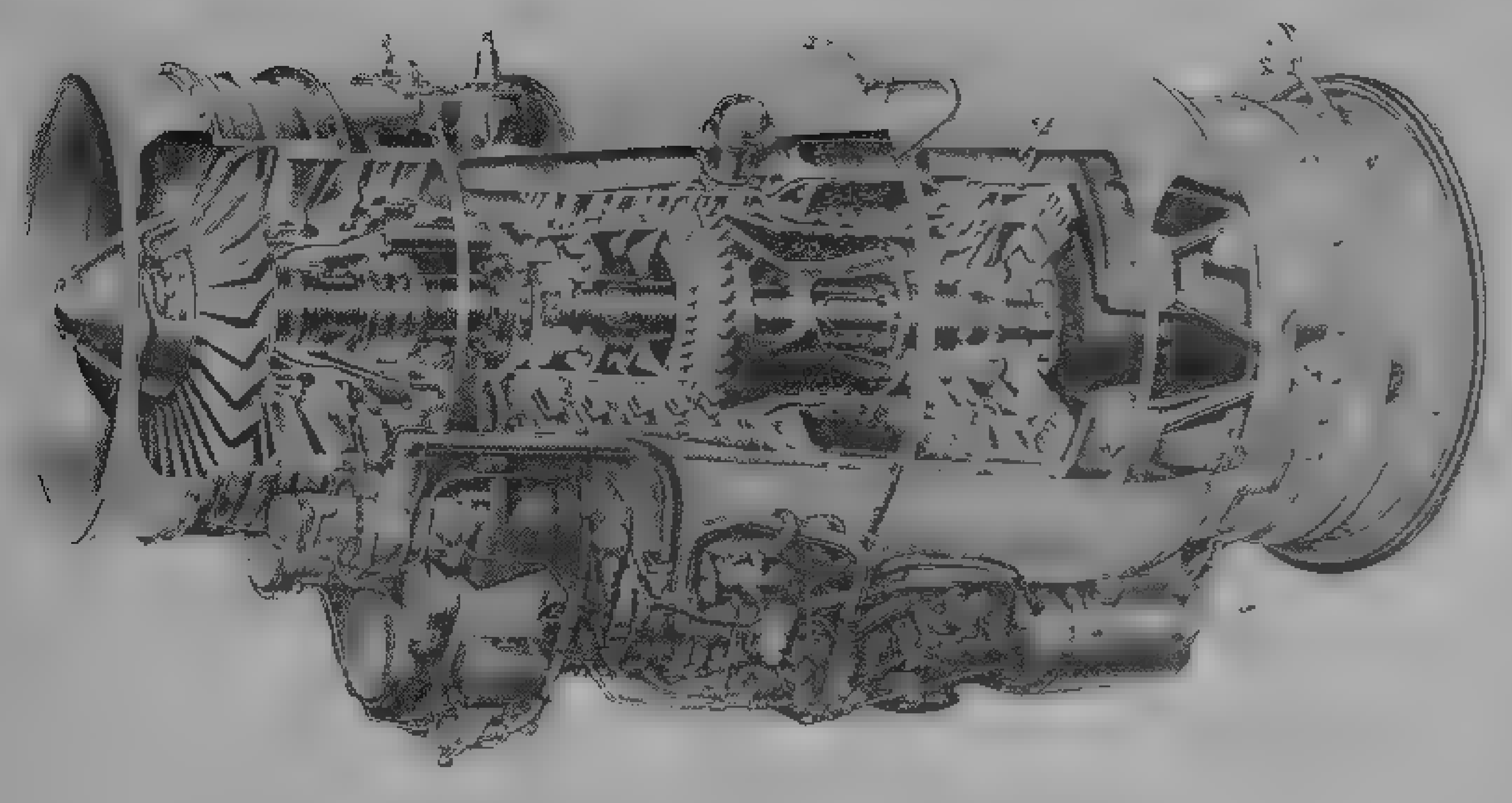
Following selection of the Adour for the Mitsubishi T-2 trainer and F-1 fighter/support aircraft, Ishikawajima-Harima Heavy Industries produced the Adour from 1970 under a licence agreement. In 1972 a non-afterburning Adour was selected to power the British Aerospace Hawk advanced trainer. More than 2,500 engines have been produced including licence manufacture in Finland, India and Japan. The two original partners have received orders for 2,145, of which they had delivered 2,092 by January 1995. Flight hours exceed 4 million.

Currently produced versions of the engine are as follows:

Mk 151. Non-afterburning version for Hawk. Internal components and certification temperatures identical to Mk 102 and Mk 801A. Qualified in 1975.

Mk 801A. Japanese designation TF40-IHI-801A. For Mitsubishi T-2 and F-1. Qualified in 1972.

Mk 804. Uprated engine for Jaguar International. Rating with full afterburner at Mach 0.9 at S/L, ISA, increased by 27 per cent. Qualified in 1976.



Cutaway drawing of Rolls-Royce Turbomeca Adour Mk 871 turbofan

1991

Mk 811. Uprated version for Jaguar International. Revised compressor aerodynamics and hot-end improvements. Assembled by Hindustan Aeronautics, with increasing Indian manufactured content.

Mk 815C. Mk 804 uprated to Mk 811 performance level by conversion at overhaul.

Mk 851. Non-afterburning version of Mk 804 for export Hawk.

Mk 861. Non-afterburning version of Mk 811, first deliveries 1981.

Mk 861-49. US designation **F405-RR-400**. Derated version of Mk 861 for prototype McDD/BAe T-45A Goshawk for US Navy. Certificated 1988.

Mk 871. Uprated version for BAe Hawk Series 100 and 200. Certificated late 1990.

F405-RR-401. US version of Mk 871 with minor changes for production T-45A Goshawk.

The following refers to non-afterburning versions, except where indicated.

TYPE: Two-shaft turbofan for subsonic aircraft.

FAN: Two-stage. Full length bypass duct. Bypass ratio 0.75-0.80.

COMPRESSOR: Five stages. Overall pressure ratio 11.

COMBUSTION CHAMBER: Annular, with 18 air spray fuel nozzles and two igniter plugs. Lucas engine fuel system.

HP TURBINE: Single-stage, air-cooled.

LP TURBINE: Single-stage. Squeeze-film bearings.

DIMENSIONS:

Length overall:	
Mks 102, 801A, 804, 811	2,970 mm (117 in)
Mks 151, 851, 861, 861-49, 871	1,956 mm (77 in)
Inlet diameter (all)	559 mm (22 in)
Max width (all)	762 mm (30 in)
Max height (all)	1,041 mm (41 in)

WEIGHT, DRY:

Mk 102, 801A	704 kg (1,552 lb)
Mk 104, 804	713 kg (1,571 lb)
Mk 151	553 kg (1,220 lb)
Mk 851	568 kg (1,252 lb)
Mk 861	577 kg (1,273 lb)
Mk 811	738 kg (1,627 lb)
Mk 871	603 kg (1,330 lb)

PERFORMANCE RATINGS (S/L, T-O):

Mk 102, 801A	32.5 kN (7,305 lb st)*
Mk 104	35.1 kN (7,900 lb st)*
Mk 151, 851	23.1 kN (5,200 lb st)
Mk 804	35.8 kN (8,040 lb st)*
Mk 861	25.4 kN (5,700 lb st)
Mk 861-49	24.2 kN (5,450 lb st)
Mk 811	37.4 kN (8,400 lb st)*
Mk 871	26.2 kN (5,900 lb st)

*With afterburner

SPECIFIC FUEL CONSUMPTION (Mk 102):

S/L, static, dry	21 mg/Ns (0.74 lb/h/lb st)
Mach 0.8, 11,890 m (39,000 ft)	27 mg/Ns (0.955 lb/h/lb)

UPDATED

ROLLS-ROYCE TURBOMECA RTM 322

Rolls-Royce and Turbomeca combined their extensive experience in helicopter gas turbines to produce the RTM 322 family of engines. Since 1986, Piaggio of Italy has been a 10 per cent participant. The launch engine is the RTM 322-01 turboshaft, which is conservatively rated at 1,566 kW (2,100 shp) with easy growth potential to 2,237 kW (3,000 shp).

The family, which will include turboprop and turbofan derivatives, is configured to combine simple design, reliability, low fuel consumption, light weight and low cost of ownership. A turboprop using the RTM 322-01 core would produce 1,193 to 1,491 kW (1,600 to 2,000 shp), with potential for growth to 2,088 kW (2,800 shp). It is therefore suitable for aircraft in the 35 to 70 seat range.

The turboshaft itself has full-authority digital electronic control, availability of different output drive configurations, a choice of three starting systems, and options for an inlet particle separator and infra-red suppressor. Combined with engine mounts configured for compatibility with a number of existing airframes, these features give the unit a wide range of potential civil and military applications in the 7 to 15 tonne class. Examples are EH 101, Sikorsky S-92, Black Hawk and Seahawk series, European NH 90, Westland WS 70 and AH-64 Apache. The engine has been studied by the US Army as a potential growth power plant for the Black Hawk and Apache, and during 1987 the US Navy carried out an operability study in an SH-60B. In 1985 UTC (Pratt & Whitney) signed a licence agreement for US and Canadian markets.

In 1988 a major competition was held between Rolls-Royce Turbomeca and General Electric for the production engine contract of all UK EH 101 helicopters. In September 1988 the Minister of Defence Procurement announced that Rolls-Royce Turbomeca had won this competition for approximately 500 engines, as it provided 'the best value for money'. The first flight on the EH 101 took place on 6 July 1993. In June 1995 the AH-64D Longbow Apache was ordered for the British Army with RTM 322 engines. Another application is the twin-engined Kamov Ka-62R.

The first complete RTM 322-01 ran on 4 February 1985. Over 1,790 kW (2,400 shp) has been demonstrated. A total of over 10,000 hours running have been completed, which includes 1,100 hours of flight development in the S-70C (from 14 June 1986) and then in the SH-60B. UK military certification was completed in October 1988, and was followed by civil certification in May 1992. Orders totalled 182 by January 1995, production deliveries yet to begin.

The following particulars apply to the RTM 322-01 turboshaft:

COMPRESSOR: Three-stage axial and single-stage centrifugal.

COMBUSTOR: Annular reverse flow. Ignition by Lucas Aerospace exciter.

TURBINES: Two-stage gas generator turbine. Cooling is applied to the first and second stage stators and first stage rotor. The second stage rotor is made of single crystal material and is uncooled. Two-stage power turbine with drive to front or rear.

DIMENSIONS:

Length overall	1,171 mm (46 in)
Diameter	604 mm (23.8 in)

WEIGHT, DRY: 240 kg (538 lb)

PERFORMANCE RATINGS (S/L):

Max contingency	1,724 kW (2,312 shp)
Max T-O	1,566 kW (2,100 shp)
Typical cruise	940 kW (1,260 shp)

SPECIFIC FUEL CONSUMPTION:

Cruise (as above)	81 μg/J (0.48 lb/shp/h)

UPDATED

Rolls-Royce Turbomeca RTM 322-01 turboshaft

1990

TURBO-UNION

TURBO-UNION LTD

PO Box 3, Filton, Bristol BS12 7QE, UK
Telephone: 44 (117) 979 1234
Fax: 44 (117) 979 7575
Telex: 44185 RR BSLG
MUNICH OFFICE: Inselkammerstrasse 5, D-82008 Unterhaching, Germany
Telephone: 49 (89) 666920
Fax: 49 (89) 66692 200
CHAIRMAN: C H Green
MANAGING DIRECTOR: Heinz Pfingstgraef

Formed in 1969 as a European engine consortium comprising Rolls-Royce plc (40 per cent) of the UK, MTU Motoren- und Turbinen-Union München GmbH (40 per cent) of Germany and FiatAvio SpA (20 per cent) of Italy. The consortium was established to design, develop, manufacture and support the RB199 turbofan for the Panavia Tornado aircraft.

VERIFIED

TURBO-UNION RB199

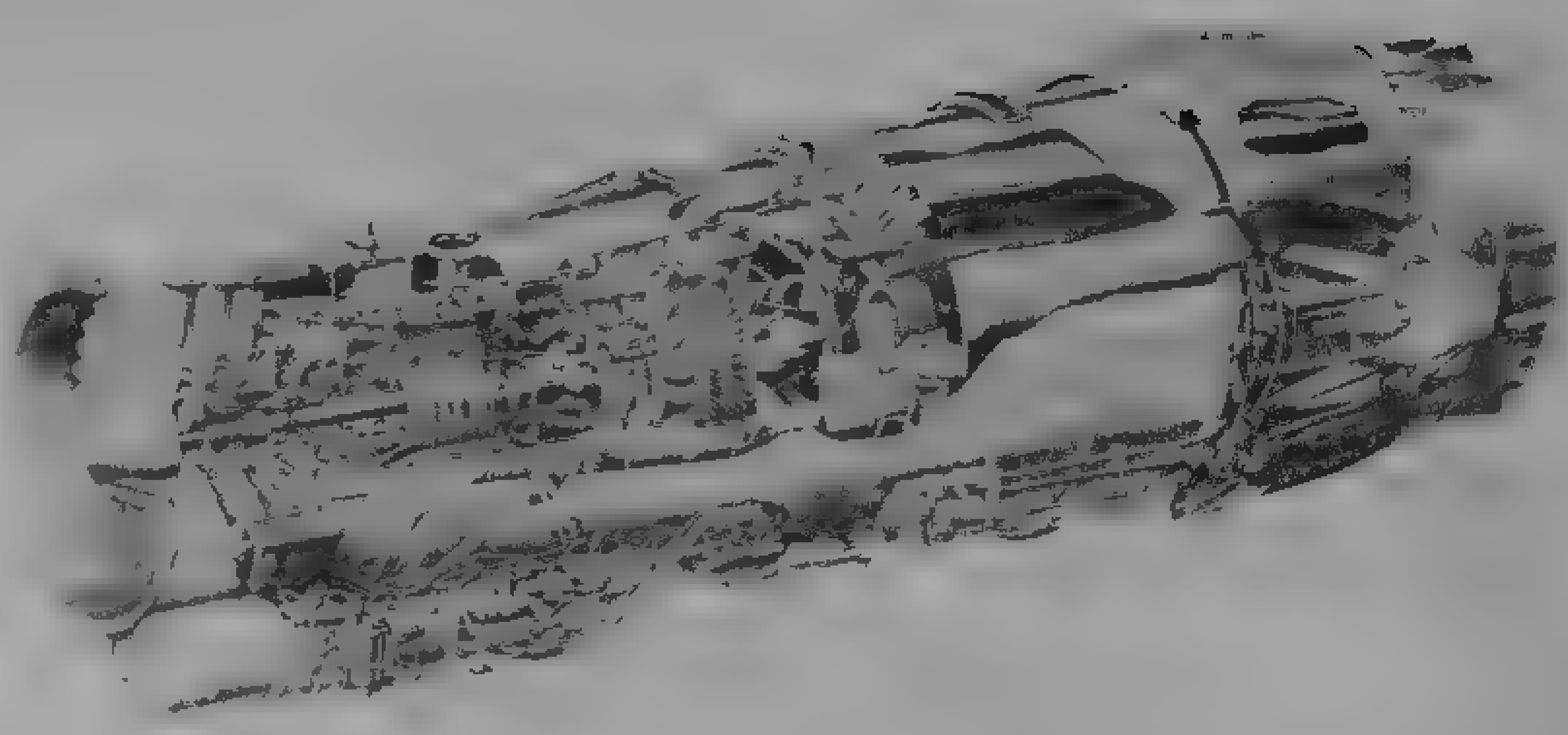
The RB199 is a three-spool turbofan offering low fuel consumption for long-range dry cruise and approximately 100 per cent thrust augmentation with full afterburner for short take-off, combat manoeuvre and supersonic acceleration. An integral thrust reverser system is available. It was the first military engine with FADEC without hydromechanical back-up.

In-service experience of over 3 million flying hours, at low level in the most arduous conditions, has proven the resilience of the RB199 to birdstrike and foreign object damage (FOD). This is a direct result of the relatively short, rigid rotating assemblies held between the small bearing spans in a three-spool layout.

Over 2,400 engines have been produced, with the present engine family comprising:

Mk 103. Standard production engine, with integral thrust reverser, for Panavia Tornado IDS variants.

Mk 104. Identical to the Mk 103 other than the jetpipe, which is extended by 360 mm (14 in) to provide up to 10 per



Cutaway drawing of Turbo-Union RB199 Mk 104 three-shaft augmented turbofan *1989*

cent greater thrust and reduced specific fuel consumption The Mk 104 is the standard production engine for Tornado ADV variants

Mk 104D The power plant for the BAe experimental aircraft programme (EAP) advanced technology demonstrator

Mk 104E. Selected as the interim engine for the Eurofighter 2000, the RB.199 is being used to flight test first two prototypes

Mk 105 Similar to the Mk 103, the Mk 105 incorporates an increased mass flow LP compressor producing higher pressure ratios, and single-crystal HP turbine blades In addition to a 10 per cent thrust increase, these improvements also give significant reductions in life cycle cost In service as the power plant for the German Tornado ECR

The following description refers to the Mk 105

TYPE: Three shaft turbofan with afterburner and reverser

LP COMPRESSOR Three-stage axial of titanium alloy Casing of three bolted sections Rotor of three discs welded together Rotor blades secured by dovetail roots, all with snubbers. Mass flow approximately 74.6 kg (164 lb)/s Bypass ratio about 1 1

IP COMPRESSOR. Three stages of titanium alloy Rotor has welded discs in which blades are secured by dovetails

HP COMPRESSOR Six-stage, material changes from titanium at front to heat resisting alloy at rear, except stator blades are heat resisting steel throughout Rotor discs secured by 10 through-bolts, carrying blades by dovetail roots. Bevel drive to gearbox Overall pressure ratio greater than 23

BYPASS DUCT Fabricated in titanium

COMBUSTION CHAMBER Annular flame tube fabricated from nickel alloy, bolted at rear end between outer casing forged and chemically milled in nickel-iron alloy, and inner casing of nickel alloy. Carries 13 double-headed fuel vaporisers which give combustion without visible smoke Two igniter plugs. Hot-streak injector for afterburner ignition

HP TURBINE. Shrouded single stage Entry temperature over 1,327°C Rotor blades and stator vanes air-cooled

IP TURBINE Shrouded single stage. Air-cooled stator vanes and rotor blades

LP TURBINE. Two-stage with shrouded hollow uncooled rotor blades

AFTERBURNER Front end of titanium fabricated jetpipe carries afterburner in which bypass air and core gas burn concurrently, without a mixing section For core flow, two gutter flameholders fed by upstream atomisers. For bypass flow, reverse colander with radial extensions, each containing vaporising primary burner, between which multiple jets inject remainder of afterburner fuel. Fully modulated augmentation

NOZZLE Variable area, short petal, convergent nozzle operated by shroud actuated by four screwjacks, driven by fourth stage HP air motor via flexible shafting Each of 14 master and 14 secondary petals is precision cast in cobalt alloy which minimises friction

REVERSER External two bucket type driven via flexible shafts by motor using HP air In stowed position outer skins form aircraft profile Deployment takes 1 second at any thrust setting from idle to maximum dry

ACCESSORY DRIVES. Accessory gearbox on underside of intermediate casing (quick attach/detach coupling) carries hydromechanical portions of main and afterburner fuel systems, oil tank and pump, and output shaft to aircraft gearbox carrying KHD gas-turbine starter/APU

FUEL SYSTEM. Electronic main engine control unit uses signals from pilot's lever and power plant sensors. Afterburner fuel from engine-driven vapour core pump

DIMENSIONS

Length overall Mk 103	3,251 mm (128 in)
Mk 104	3,607 mm (142 in)
Mk 105	3,302 mm (130 in)
Intake diameter Mks 103, 104	719 mm (28 3 in)
Mk 105	752 mm (29 6 in)

WEIGHT DRY (excl reverser)

Mk 103	965 kg (2,107 lb)
Mk 104	976 kg (2,151 lb)
Mk 105	980 kg (2,160 lb)

PERFORMANCE RATINGS (S/L, ISA)

Max dry Mks 103, 104	40 48 kN (9,100 lb st)
Mk 105	42 95 kN (9,656 lb st)
Max afterburning Mk 103	71 17 kN (16,000 lb st)
Mk 104	72 95 kN (16,400 lb st)
Mk 105	74 73 kN (16,800 lb st)

UPDATED

WILLIAMS-ROLLS — *see under Williams (USA)*

ISRAEL

BSEL

BET-SHEMESH ENGINES LTD

Post Office Haela Bet Shemesh 99000
Telephone. 972 (2) 9 1284
Fax 972 (2) 91 1970 or 915117

Bet-Shemesh Engines is owned by Ormat Turbines. Its 300 employees produce Turbomeca Marboré VI and Bet-Shemesh Sorek 4 turbojets (not included as it powers missiles and UAVs) and parts for the PW4000, JT9D, F100, J79 and JT8. Support is provided for the Allison 250, F100, J79 T700, Marboré and PW1120 There is an important investment casting division. BSEL is one of the few companies with experience of the F100 upgrading programme to the 220 E version

UPDATED

IAI

ISRAEL AIRCRAFT INDUSTRIES LTD

Ben-Gurion International Airport, 70100
Telephone 972 (3) 97131111
Fax 972 (3) 972290
Telex ISRAV-IL 371133

The Engine Overhaul Plant is part of IAI's Bedek Aviation Division. It produces J79-J1E engines under GE licence and performs extensive overhaul and maintenance of civil and military engines Details of the J79 can be found in the 1978-79 edition of *Jane's*.

UPDATED

ITALY

ALFA ROMEO AVIO

ALFA ROMEO AVIO SpA

I-80038 Pomigliano D'Arco, Naples
Telephone. 39 (81) 8430111
Telex 710083 ARAVIO
CHAIRMAN Gen Fulvio Ristori
MANAGING DIRECTOR Ing Filippo De Luca

Alfa Romeo Avio was prime contractor for the manufacture under General Electric licence, of the J85 J79 and T58 It manufactures CF6 combustors and JT9D components, and assembles PT6T engines for the AB 212 Under GE licence it is responsible for the hot section of the T64 P4D, co-produced with FiatAvio, and participates in the RB199 The company is a partner in Italian production of the Rolls-Royce Spey 807 In November 1988 it became a 6.4 per cent partner in the Rolls-Royce Tay programme

In February 1986 it began deliveries of GE T700-401 engines for EH 101 prototypes. It supplies components for T700 engines fitted to American helicopters and is developing new versions. It is also involved, with FiatAvio, in the development of the GE CT7-6, aimed at the EH 101, NH 90 and a new version of the A 129

VERIFIED

ALFA ROMEO AVIO AR 318

Alfa Romeo Avio developed this simple turboprop to cover powers from 298 to 596 kW (400 800 shp) Prototype, rated at 453 kW (608 shp) for T-O, flown in King Air Full description in 1991-92 *Jane's* No production application reported

VERIFIED

ARROW

ARROW ENGINEERING srl

Via Badiaschi 25, I 29100 Piacenza
Telephone: 39 (523) 41932 and 42271
Fax. 39 (523) 41340

Air-cooled piston engines for microlights, ultralights, homebuilts and UAVs, built by this company have set several world records. Smaller engines were described in the 1992 93 *Jane's*

UPDATED

ARROW AE 530 AC

This is the opposed-twin version of the AE 270. Bore 74 6 mm (2 94 in), stroke 61 0 mm (2.40 in). Capacity 533 cc (32 53 cu in). A 40 mm Bing carburettor. Planetary reduction 0 361 ratio.

DIMENSIONS	
Length	481 mm (18 94 in)
Width	490 mm (19 30 in)
Height	463 mm (18 23 in)
WEIGHT READY TO RUN	50 kg (110 lb)
PERFORMANCE RATING	50 7 kW (68 hp) at 6,800 rpm
FUEL CONSUMPTION	8-12 litres (2 11-3 17 US gallons, 1 76-2 64 Imp gallons)/h

NEW ENTRY

ARROW AE1070 AC

This is the flat-four version, using the same cylinders Capacity 1.066 cc (65 05 cu in). Two 40 mm Bing carburettors. Helical gear reduction 0 478, 0 387, 0 361 or 0 327 ratio.

DIMENSIONS	
Length	521 mm (20.52 in)
Width	490 mm (19.30 in)
Height	458 mm (18.04 in)
WEIGHT READY TO RUN	65 0 kg (143 lb)
PERFORMANCE RATING	89 5 kW (120 hp) at 6,800 rpm
FUEL CONSUMPTION	8-14 litres (2 11 3 70 US gallons, 1 76-3 08 Imp gallons)/h

NEW ENTRY

ARROW GP 1000

This is the flat four version, using the same cylinders as in the smaller engines, with bore 74.6 mm (2 94 in) and stroke 57 0 mm (2 24 in). Two 40 mm Bing carburettors are fitted Capacity 996 cc (60 78 cu in) Helical gear reduction of 0 387 ratio

DIMENSIONS	
Length	521 mm (20.52 in)
Width	490 mm (19 30 in)
Height	458 mm (18 04 in)
WEIGHT READY TO RUN	65 0 kg (143 lb)
PERFORMANCE RATING	89 5 kW (120 hp) at 6,800 rpm
FUEL CONSUMPTION	8-14 litres (2 11-3 70 US gallons, 1 76-3 08 Imp gallons)/h

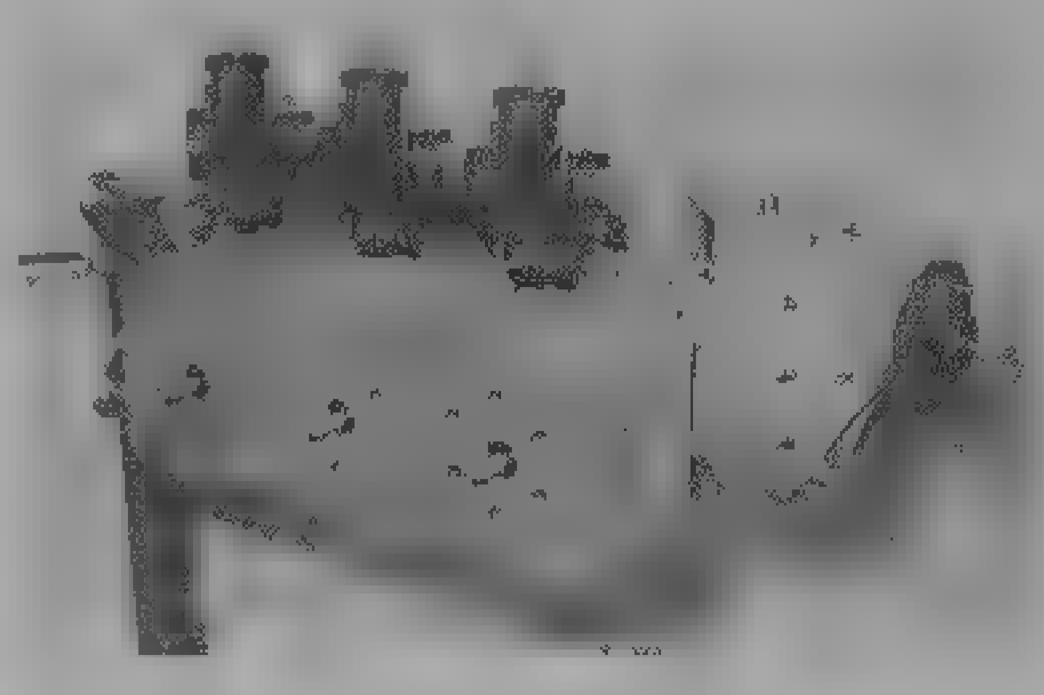
UPDATED

ARROW GP 1500

This is the flat six version of the GP 1000, using the same cylinders. Three 40 mm Bing carburettors are fitted. Capacity 1,495 cc (91 23 cu in). Helical gear reduction of 0 387 ratio.

DIMENSIONS	
Length	821 mm (32 33 in)
Width	490 mm (19.30 in)
Height	458 mm (18 04 in)
WEIGHT READY TO RUN	87 5 kg (192 9 lb)
PERFORMANCE RATING	134 kW (180 hp) at 6,800 rpm
FUEL CONSUMPTION	10-14 litres (2 38-3 70 US gallons, 2 20-3 08 Imp gallons)/h

UPDATED



Arrow GP 1500 flat-six engine 1993

CRM

CRM

Via Manzoni 12, I 20121 Milan
Telephone 39 (02) 708326

This company is famous for high-speed diesel engines for patrol boats and yachts, derived from the Isotta-Fraschini Asso 1000 W-18 aero-engine of 1928 One version has been selected by the US Navy for the Sentinel 5000 airship

VERIFIED

CRM 18D/SS

This engine is a four-stroke turbocharged diesel It has 18 cylinders in W formation, three banks of six, with precombustion chambers.

CYLINDERS: Water cooled Bore 150 mm (5 91 in). Stroke 180 mm (7 09 in). Capacity 57,260 cc (3,495 cu in). Compression ratio 16.25 Two turbochargers

DIMENSIONS	
Length	3,370 mm (132.68 in)
Width	1 350 mm (53 15 in)
Height	1 304 mm (51 34 in)
WEIGHT DRY	about 1,700 kg (3,745 lb)
PERFORMANCE RATING	1,380 kW (1,850 hp) at 2,100 rpm

VERIFIED

CRM 18D/SS 18-cylinder diesel engine 1991

FIAT

FIATAVIO

Via Nizza 312, I-10127 Turin
Telephone. 39 (11) 69311
Telex. 22 320 FIATAV
MANAGING DIRECTOR P Torricelli

FiatAvio's main aircraft engine programmes now concern the IAE V2500, Turbo-Union RB199, Rolls-Royce Spey 807 and Viper 600, Pratt & Whitney PW2037/2040 and PW4000, and General Electric GE 90. CF6 (including CF6-80C2), CT7 and T64. It is a partner in EUROJET Turbo. FiatAvio makes the FA150-Argo APU for the AMX, transmissions for Eurocopter France helicopters and many other aviation products

VERIFIED

EUROJET TURBO EJ200

Fiat is responsible for 21 per cent of this programme. Its duties include design, development and manufacture of the LP turbine and shaft, rear bearing support, gearbox, oil tank and pump, afterburner and some accessories including the nozzle control unit and part of the DECU (FADEC) software

VERIFIED

TURBO-UNION RB199

Fiat holds 20 per cent of the shares of Turbo-Union Ltd. Its responsibility is the LP turbine and shaft, exhaust diffuser, jetpipe and nozzle

VERIFIED

IAE V2500

The V2500 is produced by the IAE consortium. Fiat is responsible for the accessory gearbox, oil tank and pumps, exhaust case and No 5 bearing compartment

VERIFIED

ROLLS ROYCE SPEY 807

This turbofan is produced for the AMX, under a Rolls-Royce licence to the Italian government, by FiatAvio (prime contractor in Italy) and CELMA (prime contractor in Brazil)

VERIFIED

PRATT & WHITNEY PW2000 and PW4000

Since 1974 FiatAvio has been responsible for design and production of the accessory drive gearbox for these Pratt & Whitney engines

VERIFIED

GENERAL ELECTRIC GE90

FiatAvio is a risk-sharing partner on this engine

VERIFIED

GENERAL ELECTRIC CF6

FiatAvio produces components for the CF6 for GE and SNECMA. For GE the company supplies accessory gearboxes, inlet gearboxes and shafts. SNECMA is supplied with gearbox components and shafts for CF6-50 engines. FiatAvio is collaborating with GE on CF6-80C/C2 engines.

VERIFIED

GENERAL ELECTRIC T64-P4D

This turboprop powers most versions of the Alenia G222 Under a licence agreement between GE and the Italian government, the engine is manufactured in Italy, with Fiat-Avio as prime contractor

VERIFIED

GENERAL ELECTRIC T700/CT7

Parts of the T700 are made by FiatAvio, while for the EH 101 helicopter the CT7-6 is being developed by GE, FiatAvio and Alfa Romeo Avio

VERIFIED

ROLLS-ROYCE VIPER 600

Development of this turbojet was undertaken in collaboration with Rolls-Royce. For most versions, components rearward of the compressor (except turbine discs and blades) are FiatAvio's responsibility However, the Mk 632-43 is licensed to Piaggio

VERIFIED

PIAGGIO

INDUSTRIE AERONAUTICHE E MECCANICHE RINALDO PIAGGIO SpA

Via Cibrario 4, I 16154 Genoa
Telephone. 39 (10) 64811
Fax. (marketing) 39 (10) 6520160
Telex 270695 AERPIA I
WORKS AND OFFICERS see Aircraft section

The Aero-Engine Division of Piaggio manufactures the following engines under licence agreements. Rolls-Royce Viper 11, 526, 540 and 632-43 turbojets; Textron Lycoming T53-L-13, T55-L-11 and 712 turboshafts; and Rolls Royce 1004 turboshaft Piaggio also participates in co-production under licence of the Rolls-Royce Spey 807 turbofan and has joined Rolls-Royce Turbomeca in development and production of the RTM 322-01 turboshaft. The Engine Division also develops and produces IR suppression devices

UPDATED

VM

VM MOTORI SpA

Via Ferrarese 29, I 44042 Cento (Fe)
Telephone: 39 (51) 90851,
Fax: 39 (51) 908517
Telex: 511642

VM Motori specialises in high-speed lightweight diesel engines. Following automotive production, the company entered the aeronautical field with a range of horizontally opposed engines. All are air-cooled four-stroke compression ignition engines, cooled by a propylenic glycol mixture and burning Jet A 1, JP 4, JP 5, JP-8 or similar fuel with direct injection by camshaft-driven plunger pumps. Each engine is turbocharged for operation to 8,850 m (29,000 ft). The engines are fully modular and are being offered with an initial TBO of 3,000 h. Cylinder size is 130 mm (5.1 in) by 110 mm (4.33 in) and compression ratio 18. Specific fuel consumption (econ cruise) is 106.4 µg/J (0.63 lb/h/hp).

VERIFIED

VM TPJ 1304HF

Four cylinders, capacity 5.84 litres (356 cu in). Weight, dry with electrical system, 185 kg (408 lb). Maximum power 154 kW (206 hp) at 2,640 rpm

VM TPJ 1306HF

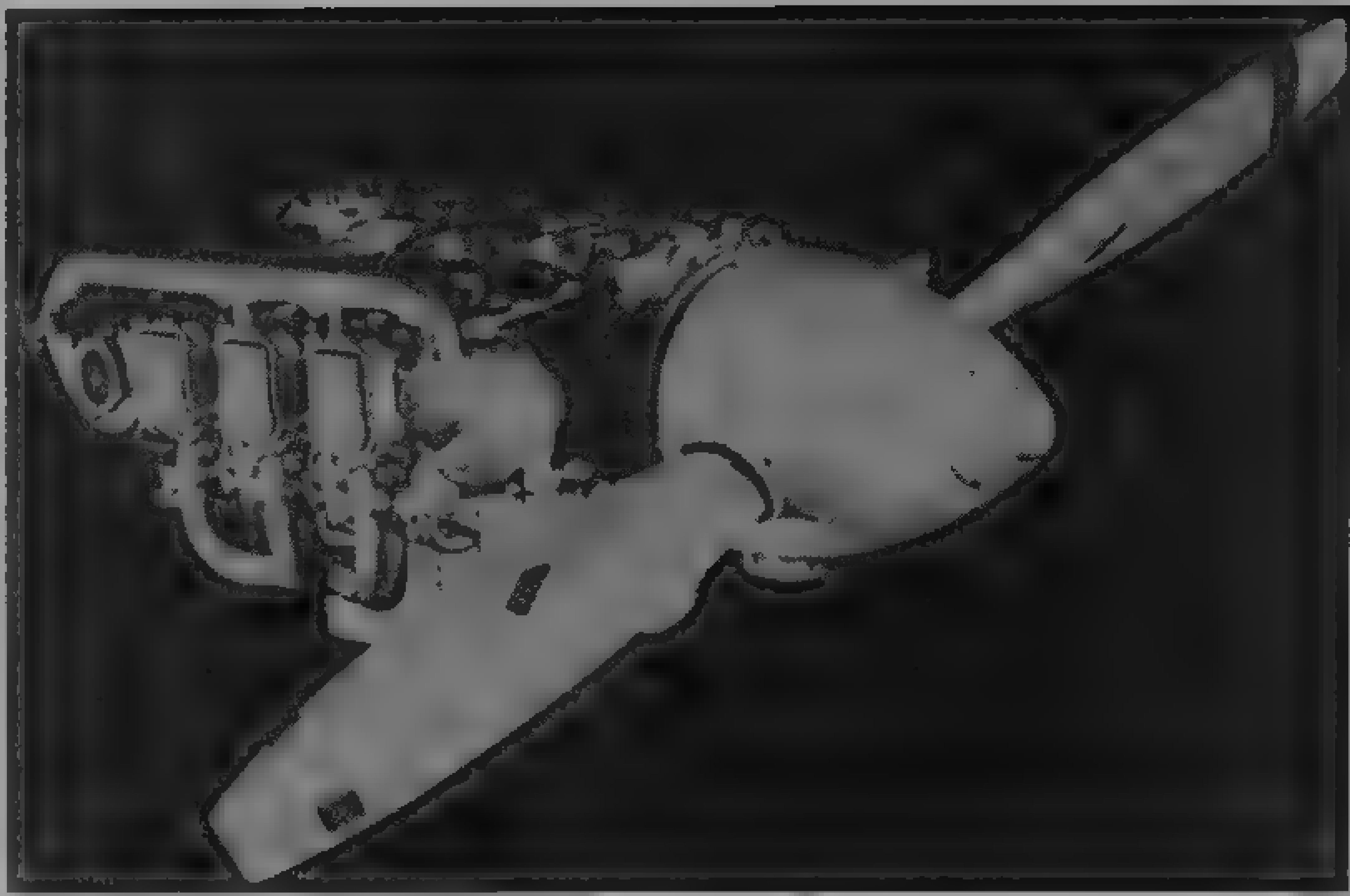
Six cylinders, capacity 8.76 litres (535 cu in). Weight, dry with electrical system, 243 kg (536 lb). Maximum power 235 kW (315 hp) at 2,640 rpm

VERIFIED

VM TPJ 1308HF

Eight cylinders, capacity 11.68 litres (713 cu in). Weight dry with electrical system, 298 kg (657 lb). Maximum power 316 kW (424 hp) at 2,640 rpm

VERIFIED



VM TPJ 1306HF six-cylinder diesel engine

1989

JAPAN

IHI

ISHIKAWAJIMA-HARIMA JUKOGYO KABUSHIKI KAISHA (Ishikawajima-Harima Heavy Industries Co Ltd)

Shin Ohtemachi Building 2-1, Ohtemachi 2-chome
Chiyoda-ku, Tokyo 100
Aero-Engine and Space Operations (ASO)
ADDRESS: As above
Telephone: 81 (3) 3244 5333
Fax: 81 (3) 3244 5398
Telex: 22232 IHIHQT J
PRESIDENT (ASO): Tohru Ishikawa
ASSISTANT GENERAL MANAGER, BUSINESS PLANNING:
Kunihiko Terao

IHI's Aero-Engine & Space Operations specialises in the development and manufacture of aero-engines, space-related equipment, and land/marine gas turbines, as well as maintenance and repair. It has three plants and 3,650 employees. The number of jet engines so far produced totals about 4,000.

IHI began production of the J3 turbojet using Japan's own technology in 1959. This was followed by the licenced production of the J79, T64, T58 and TF40 (Adour) engines. In recent years, the F100, T56, F3 and T700 have been added to the product line.

The company has been involved in numerous engine development projects including the national project for the FJR710 and the Japan Britain joint project for the RJ500. Currently, as the leader of a Japanese consortium, IHI is participating in the IAE V2500.

IHI is actively involved in many aspects of spaceflight.

UPDATED

IHI F3

Development of this turbofan began in 1976, with funding by the JDA's Technical Research & Development Institute. The Phase 1 **XF3-1** form has a single-stage fan with bypass ratio of 1.9, five-stage transonic compressor, 12-burner combustor and single-stage HP and LP turbines. Rating is 11.79 kN (2,650 lb st).

In 1977 JDA contracted with IHI for the **XF3-20**, with reduced bypass ratio and higher turbine temperature to give a rating of 16.28 kN (3,660 lb st). This was followed by the **XF3-30**, which in 1982 was selected by the JASDF as the engine for the T-4 trainer. XF3-30 qualification was completed in March 1986. The engine is now redesignated **F3-IHI-30**, and the first production engine was delivered to JDA on 17 December 1987.

TYPE: Two-shaft turbofan

FAN: Two-stage axial. No inlet guide vanes. Mass flow 34 kg (75 lb)/s. Pressure ratio 2.6. Bypass ratio 0.9

COMPRESSOR: Five stages. First two stators variable. Overall pressure ratio 11

COMBUSTION CHAMBER: Annular, with 12 duplex fuel nozzles

HP TURBINE: Single-stage, air-cooled rotor blades

LP TURBINE: Two-stage, tip shrouded

FUEL SYSTEM: Hydromechanical, with electronic supervisor

DIMENSIONS:

Length	1,340 mm (52.76 in)
Inlet diameter	560 mm (22.0 in)
WEIGHT, DRY:	340 kg (750 lb)
PERFORMANCE RATING (T-O, S/L):	16.37 kN (3,680 lb st) class
SPECIFIC FUEL CONSUMPTION:	19.83 mg/Ns (0.7 lb/h/lb st)

VERIFIED

F3-IHI-30 two-shaft turbofan

1989

KAWASAKI

KAWASAKI HEAVY INDUSTRIES Ltd (KHI)

Kobe Crystal Tower, 1-3 Higashi Kawasaki-cho 1-chome, Chuo-ku, Kobe 650-91
Telephone: 81 (78) 371 9530
Jet Engine Division: World Trade Centre, 4-1 Hamamatsu-cho 2-chome, Minato-ku, Tokyo
Telephone: 81 (3) 3435 2535
Fax: 81 (3) 3578 3519
OFFICERS: see Aircraft section

In 1967 KHI started manufacturing T53 turboshafts. Deliveries of the resulting KT5311A, KT5313B and T53-K-13B engines totalled 355 by 1992. KHI now licence-builds the T53-K-703 (128 by 1993) and T55-K-712 (133 by 1994). Kawasaki shared in parts manufacturing for the Adour, F100 and T56. It is a member of the IAE consortium (see under International heading), and is a risk-sharing partner on the PW4000 and RR Trent.

UPDATED

MITSUBISHI

MITSUBISHI JUKOGYO KABUSHIKI KAISHA (Mitsubishi Heavy Industries Ltd)

HEAD OFFICE: 5 1 Marunouchi 2-chome, Chiyoda-ku, Tokyo 100
Telephone 81 (3) 3212 3111
NAGOYA AEROSPACE SYSTEMS 10 Oye-cho, Minato-ku, Nagoya 455
Telephone 81 (52) 611 2111
Fax 81 (52) 612 3763
NAGOYA GUIDANCE AND PROPULSION: 1200 O-aza, Higashi Tanaka, Komaki 485
Telephone 81 (568) 79 2111
OFFICERS see Aircraft section

Between January 1973 and June 1981, under licence agreement with Pratt & Whitney, MHI delivered 72 JT8D-M-9 turbofans. MHI entered into a risk- and revenue-sharing agreement on the JT8D-200 in 1984, and on the PW4000 in 1989. In collaboration with IHI and Kawasaki, MHI participates in the V2500 (see IAE in the International part of this section). Since 1991, MHI has been developing the XTSI-1 engine for the Japanese Defence Agency

UPDATED

NAL

NATIONAL AEROSPACE LABORATORY

7-44-1 Jindaijihigashi-machi, Chofu City, Tokyo 182
Telephone 81 (422) 47 5911
Fax 81 (422) 48 5888
DIRECTOR GENERAL: Kazuaki Takashima
DIRECTOR OF AERO-ENGINE DIVISION: Hiroyuki Nouse

The NAL is a government establishment responsible for research and development. In 1971 the Ministry of International Trade and Industry (MITI) funded a high-bypass ratio turbofan development programme. This engine, the FJR710, is still being used in experimental testing. A description appeared in the 1991 92 *Jane's*

VERIFIED

POLAND

PZL

PEZETEL FOREIGN TRADE ENTERPRISE

Al Stanów Zjednoczonych 61, PL-04-028 Warsaw 50
Telephone: 48 (22) 108001
Fax: 48 (22) 132356 and 132835
Telex 814651

For details of the organisation and activities of the Polish aircraft and aero-engine industry, see the PZL entry in the Aircraft section

VERIFIED

IL

INSTYTUT LOTNICTWA (Aviation Institute)

HEADQUARTERS A. Krakowska 110/114, PL-02-256 Warsaw-Okecie
Telephone 48 (22) 460011 and 460801
Fax 48 (22) 464 432
Telex 813 537
MANAGING DIRECTOR Witold Wisniowski
CHIEF CONSULTANT FOR SCIENTIFIC AND TECHNICAL CO-OPERATION Jerzy Grzegorzewski, MSc Eng

The Aviation Institute is concerned with aeronautical research and testing It can construct prototypes to its own design.

VERIFIED

IL D-18A

This completely new engine was first run on 16 April 1992

TYPE Two shaft turbofan
AIR INTAKE Direct pitot intake without inlet guide vanes
FAN. Two-stage axial, with steel blades and stators. EB-welded steel rotor carried in ball and roller bearings. Pressure ratio 2 07 Bypass ratio 0.7
COMPRESSOR Five-stage compressor on HP shaft. Steel blades and stators. Rotor consists of two parts bolted together, both EB-welded, connected with HP turbine by Hirth coupling Overall pressure ratio 8
COMBUSTION CHAMBER Annular type with 18 integral vaporisers, six starting atomisers and two high energy igniters
FUEL SYSTEM Full-authority digital electronic control
TURBINE Single-stage HP and single-stage LP, both carried in roller bearings between rotors. Gas temperature 900°C before HP turbine
JET PIPE Plain fixed convergent nozzles for both core gas and bypass flow.
ACCESSORY DRIVES Accessory gearbox driven by power off-take from front of HP shaft
LUBRICATION SYSTEM Integral oil system with vane pumps Oil/fuel heat exchanger
OIL SPECIFICATION: Synthetic, type SDF
MOUNTING Two main pads on intermediate casing. One rear strut on either side of centreline
STARTING 9 kW (12 hp), 27 V starter-generator driven by aircraft battery or ground power unit

DIMENSIONS	
Length	1,940 mm (76.37 in)
Width	750 mm (29 52 in)
Height	900 mm (35 43 in)
WEIGHT DRY	380 kg (837 7 lb)
PERFORMANCE RATING	
T-O	17 65 kN (3,968 lb st)
SPECIFIC FUEL CONSUMPTION	
At T-O rating	20 96 mg/Ns (0.74 lb/h/lb st)

VERIFIED

IL D-18A two-shaft turbofan

1994

IL K 15

This turbojet was announced in Summer 1988 It is being produced by WSK PZL Rzeszów to power the I-22 Iryda in its production form, preseries aircraft having PZL-5s.

TYPE. Single-shaft turbojet
COMPRESSOR Six stages. Rotor blades (stages 1 to 3) titanium (4 to 6 and shrouded stator blades) stainless steel. Two blow-off valves. Pressure ratio 5 3. Mass flow 23.5 kg (51 8 lb)/s
COMBUSTION CHAMBER Short annular type, with 18 vaporising burners and six starting atomisers. Electric ignition
FUEL SYSTEM Hydromechanical with electronic blow-off valve control and overspeed and overtemperature limiters

IL K-15 single-shaft turbojet

1995

FUEL GRADE: Kerosene PSM-2 or TS-1
TURBINE: Single-stage. Disc attached by Hirth coupling
LUBRICATION SYSTEM: Self-contained recirculatory system except total loss for rear bearing. Fully aerobatic
OIL SPECIFICATION: Type SDF synthetic
ACCESSORY DRIVES: Gearbox at bottom of intake casing driven by spur gear from front of compressor

STARTING: 27 V starter/generator in nose bullet
DIMENSIONS:

Length overall	1,560 mm (61.42 in)
Width	725 mm (28.54 in)
Height	892 mm (35.12 in)
WEIGHT, DRY:	320 kg (705.5 lb)

PERFORMANCE RATINGS:

T-O	14.7 kN (3,305 lb st) at 15,900 rpm
Max continuous	11.5 kN (2,585 lb st) at 15,025 rpm

SPECIFIC FUEL CONSUMPTION:

At T-O rating	28.49 mg/Ns (1.006 lb/h/lb st)

UPDATED

PZL KALISZ

WYTWÓRNIA SPRZETU KOMUNIKACYJNEGO PZL KALISZ

ul. Czestochowska 140, PL-62 800 Kalisz
Telephone: 48 (62) 656100
Fax: 48 (62) 37084, 37453
Telex: 046 2231
GENERAL DIRECTOR: Wlodzimierz Jerzyk

In 1952 the Soviet Union transferred responsibility for manufacture and service support of Soviet air-cooled radial piston engines (transport equipment manufacturing centre) at Kalisz. Current production is centred on the following, plus the TWD-10B turboprop (described under WSK PZL Rzeszów), which was supplied to the USSR. Kalisz also overhauls the TWD-10B.

UPDATED

PZL (IVCHENKO) AI-14R

The original 260 hp AI-14R version of this nine-cylinder air-cooled radial engine was produced in very large quantities, in the Soviet Union, China and Poland. Subsequent versions are:

AI-14RA. Rated at 191 kW (256 hp). Piston compressor drive and pneumatic starter. For Yak-12, Yak-18, PZL-101A Gawron and PZL-104 Wilga 35.

AI-14RA-KAF. RA with carburettor further aft, for Wilga 80.

AI-14RD. Rated at 206 kW (276 hp). Electric starter. For PZL-104 Wilga and PZL-130 Orlik.

AI-14RDP. With pneumatic starter. For PZL-104 Wilga and prototypes of PZL-130 Orlik.

K8-AA. Rated at 246 kW (330 hp). Direct-drive and pneumatic starter. Aerobatic. For PZL-130 Orlik until piston engine abandoned in favour of turboprop.

The following description refers to the AI-14RA.

TYPE: Nine-cylinder air-cooled radial
CYLINDERS: Bore 105 mm (4.125 in). Stroke 130 mm (5.125 in). Capacity 10.16 litres (620 cu in). Compression ratio 5.9
FUEL GRADE: 91 to 100 octane
PROPELLER DRIVE: Planetary gears, ratio 0.787
DIMENSIONS:

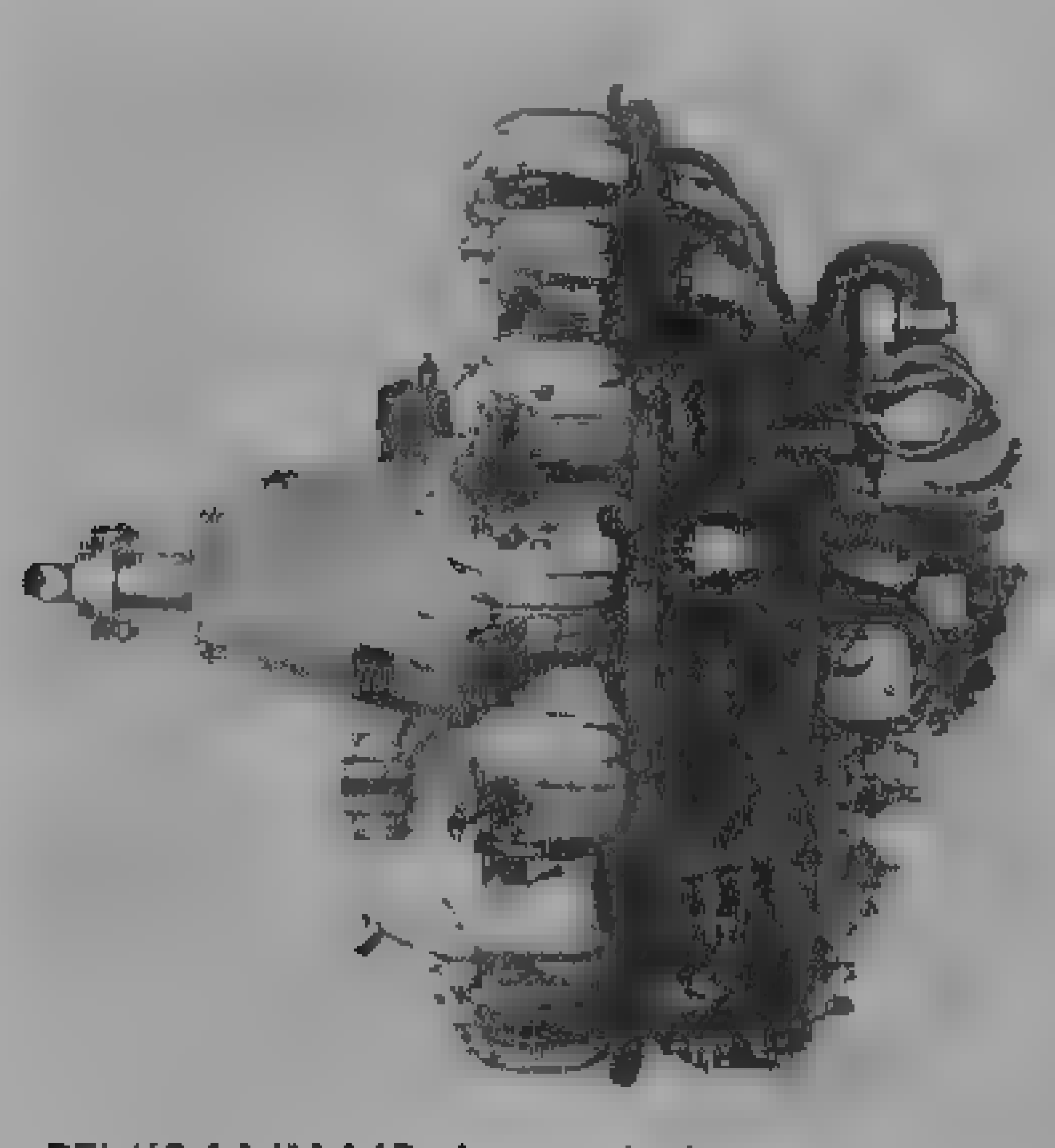
Length	956 mm (37.63 in)
Diameter	985 mm (38.78 in)
WEIGHT, DRY:	200 kg (441 lb)

PERFORMANCE RATINGS:

T-O	191 kW (256 hp) at 2,350 rpm
Rated	162 kW (217 hp) at 2,050 rpm

SPECIFIC FUEL CONSUMPTION:

T-O	95-104.3 µg/J (0.562-0.617 lb/h/hp)



PZL K8-AA (M-14Pm) nine-cylinder piston engine *1989*

PZL (SHVETSOV) ASz-62IR

Power plant of the An-2 transport biplane, the ASz-62IR was developed in the Soviet Union as the ASh-62. Current versions follow:

ASz-62IR-16. Centrifugal oil filter. For An-2 and PZL-106 Kruk.

ASz-62IR-M18. Hydraulic airframe pump drive. For PZL M-18 Dromader.

ASz-62IR-M18/DHC-3. As M18 plus vacuum pump. For DHC-3 Otter retrofit.

K9-AA. Uprated engine designed at Kalisz, 860 kW (1,170 hp) at 2,300 rpm. Electric starter and hydraulic airframe pump. For PZL M-24 Super Dromader.

K9-BA. First of B-series, with improved cylinders and piston rings. Hydraulic and vacuum pumps and provision for feathering propeller, for C-47/DC-3 conversion.

K9-BB. Improved engine for M-24 Super Dromader.

K9-BC. Improved engine for An-2 and PZL-106 Kruk.

TYPE: Nine-cylinder air-cooled radial
CYLINDERS: Bore 155 mm (6.10 in). Stroke 174 mm (6.85 in). Capacity 29.87 litres (1,823 cu in). Compression ratio 6.4
FUEL GRADE: 91 to 100 octane
PROPELLER DRIVE: Planetary gears, ratio 0.687
The following relates to the IR-16.
DIMENSIONS:

Length overall	1,130 mm (44.50 in)
Diameter	1,375 mm (54.13 in)

WEIGHT, DRY:

Without power take-off	580 kg (1,279 lb)

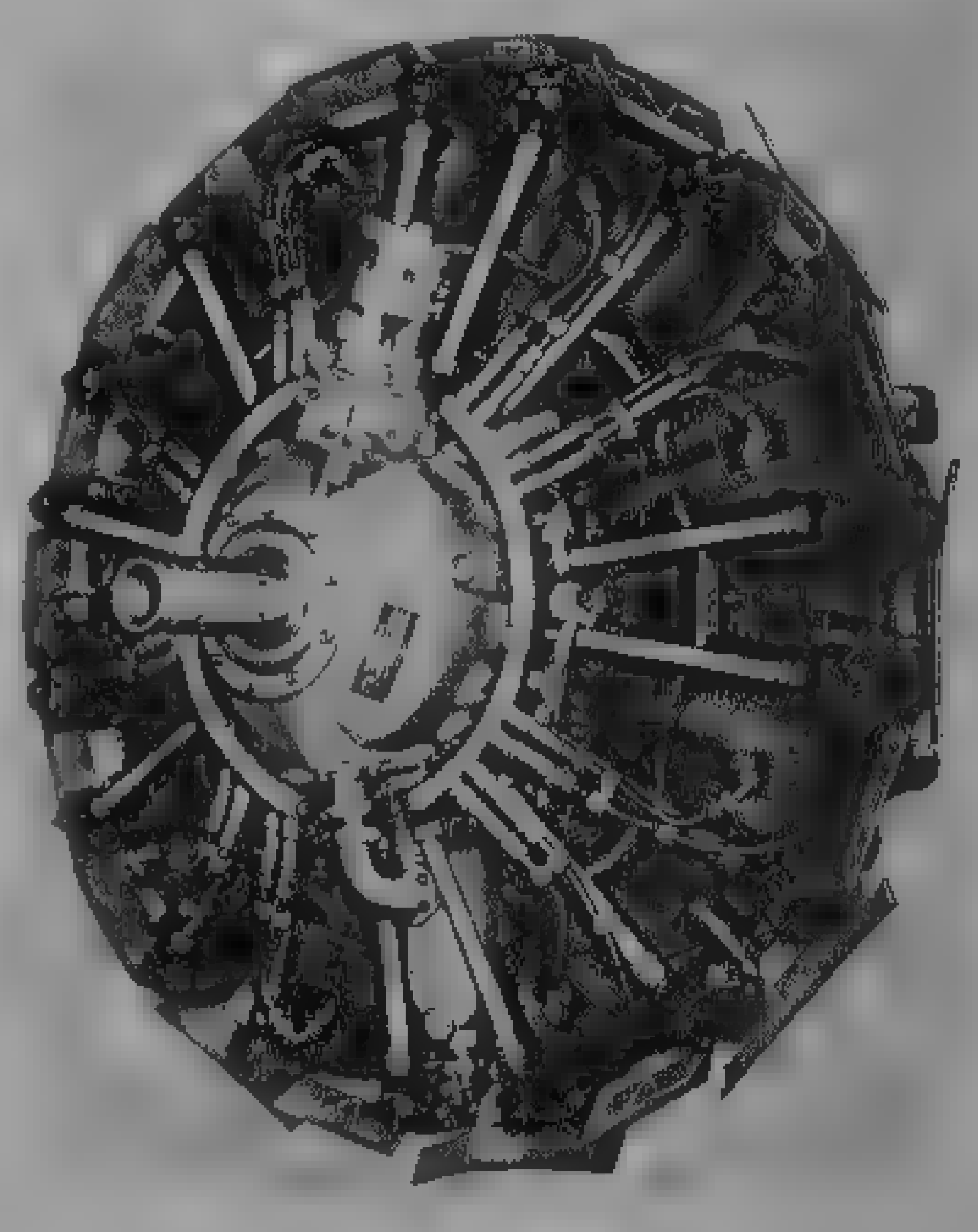
PERFORMANCE RATINGS:

T-O	735 kW (985 hp) at 2,200 rpm
Rated power	603 kW (809 hp) at 2,100 rpm

SPECIFIC FUEL CONSUMPTION:

T-O	112 µg/J (0.661 lb/h/hp)

UPDATED



PZL ASz-62IR nine-cylinder piston engine *1980*

PZL RZESZÓW

WYTWÓRNIA SPRZETU KOMUNIKACYJNEGO-"PZL RZESZÓW", SA

PO Box 340, ul. Hetmańska 120, PL-35 078 Rzeszów
Telephone: 48 (17) 46100 or 46200
Fax: 48 (17) 620750 or 625325
Telex: 0633353 or 0632411
PRESIDENT, GENERAL DIRECTOR: Eng Tadeusz Cebulak

Current production at WSK Rzeszów is centred on the PZL-10W with WR-3 reduction gear for the PZL Sokół, TWD-10B (also produced by Kalisz) for the An-28, GTD-350 with WR-2 reduction gear for the Mi-2, K-15 for the M-93 Iryda, SO-3 for the TS-11 Iskra, PZL-3S for ag aircraft and PZL-Franklin engines.

UPDATED

TWD-10B turboprop *1995*

TWD-10B

The Soviet designed OMKB/Glushenkov TVD-10B turboprop (see Mars under Russia), rated at 716 kW (960 shp), is made under licence in Poland for the An-28 STOL light transport built at WSK PZL Mielec.

TYPE: Free turbine turboprop
AIR INTAKE: Three radial struts, inlet guide vanes and starter de-iced by bleed air from combustion chamber
COMPRESSOR: Six axial stages and one centrifugal. Stage 1 has front bearing journal, bolted to stages 2 to 6 which are pinched by compressor shaft used as tie bolt. Blades in dovetail roots. Pressure ratio 7.4. Mass flow 4.6 kg (10.14 lb)/s at 29,600 rpm
COMPRESSOR CASING: Forward upper and lower halves in titanium, rear section welded from sheet steel and containing anti-surge bleed valve and radial diffuser
COMBUSTION CHAMBER: Annular with centrifugal burner, and two starting units each with semiconductor igniter and auxiliary burner
FUEL SYSTEM: Comprises supply pump, filter, pump governor, acceleration control, signaling block and thermo-corrector
FUEL GRADE: T-1, T-2, TS-1, RT, PSM-2, Jet A-1
COMPRESSOR TURBINE: Two-stage axial. Blades held by fir tree roots. Inlet guide vanes of hollow sheet with air cooling. Casing has ceramic liner
POWER TURBINE: Single-stage axial, blades with fir-tree roots, held in front roller and rear ball bearing
REDUCTION GEARS: Single-stage spur high-speed gear to accessory box and propeller gear; under the high-speed gear is the feathering pump oil tank. Accessory box drives 16 kW alternator, propeller tachometer and reduction gear oil pump, with propeller brake. Upper driveshaft to single-stage planetary reduction gear
ENGINE ACCESSORIES: Box contains oil centrifuge, and drives tachometer, oil pump, fuel pump and pump governor. The starter is on the front with a claw clutch
OIL SYSTEM: Closed and pressurised. Gas generator and reduction gear pumps. Oil tank capacity 16 litres (4.2 US gallons; 3.5 Imp gallons)
OIL GRADE: Oil mixture. 25 per cent MK-22 or MS-20, 75 per cent MK-8, MK-8P or MS-8P

DIMENSIONS
Length without airframe jetpipe 2,060 mm (81.1 in)
Width 555 mm (21.9 in)
Height 900 mm (35.4 in)
WEIGHT DRY: Bare 230 kg (507 lb)
Complete engine (max) 300 kg (661 lb)
PERFORMANCE RATINGS
T-O 754 kW (1,011 shp)
Nominal 613 kW (823 shp)
Max cruise 543 kW (728 shp)
SPECIFIC FUEL CONSUMPTION (T-O)
96.4 µg/J (0.570 lb/h/shp)

VERIFIED

PZL-10W

This is the helicopter version of the TWD-10B, two of which power the PZL Swidnik Sokól. It holds numerous Polish, Russian, US and German certificates, and uses the same gas generator, with the following differences

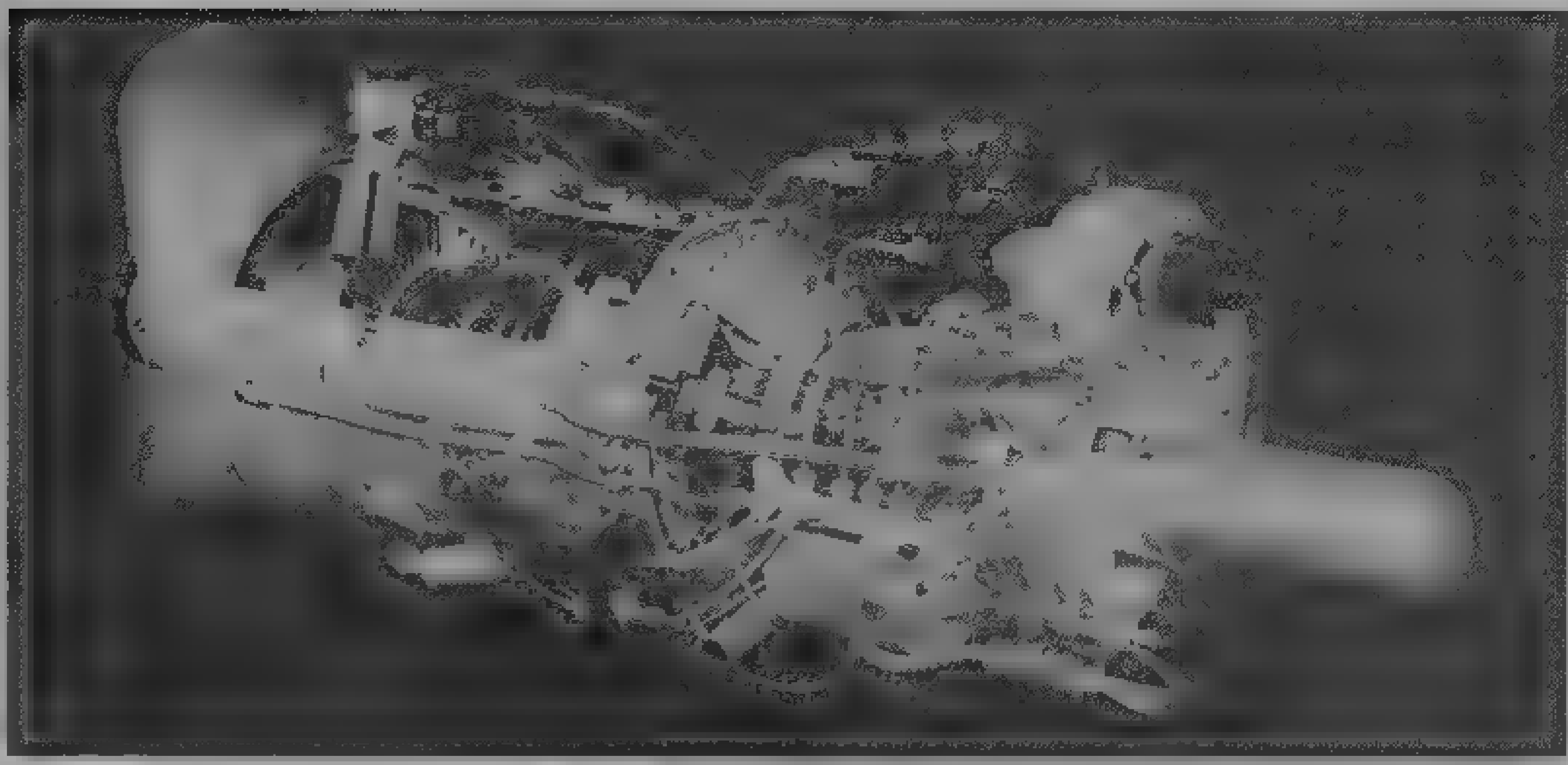
TYPE: Free turbine turboshaft engine
POWER TURBINE: Single-stage axial, with blades held in fir-tree roots. Speed maintained at 22,490 rpm
FUEL SYSTEM: Pump governor provides automatic operation at selected constant helicopter rotor speeds, as well as control of anti-surge bleed valve, maintaining constant fuel flow in starting cycle, limiting shaft speed and gas temperature and automatic switch-off of faulty engine and selection of emergency power on remaining unit
FUEL GRADE: T1, T2, TS-1, RT, PSM-2, Jet A-1
OIL SYSTEM: Closed and pressurised, with one delivery and four-section scavenge pump. Oil tank airframe-mounted, normal capacity 14 litres (3.7 US gallons, 3.08 Imp gallons)
OIL GRADE: B-3W synthetic, Castrol 599 or 5000, Aeroshell or Elf turbine oil, or oil mixture 25 per cent MK-22 or MS-20 and 75 per cent MK-8, MK-8P or MS-8P
ACCESSORIES: Integral cast box drives 5 kW starter/starter unit, electronic temperature limiter, vibration sensor, tachometer generator, oil pumps and centrifuge, phase torquemeter, de-icing valve, power-turbine speed limiter and operation time counter
DIMENSIONS
Length with jetpipe 1,875 mm (73.8 in)
Width: left engine 740 mm (29.0 in)
right engine 765 mm (30.1 in)
WEIGHT, DRY 141 kg (310 lb)
PERFORMANCE RATINGS (ISA)
2.5 min 846 kW (1,134 shp)
30 min 736 kW (986 shp)
T-O 662 kW (888 shp)
Continuous 574 kW (769 shp)
SPECIFIC FUEL CONSUMPTION
T-O 101.1 µg/J (0.60 lb/h/shp)

UPDATED

GTD-350

The **GTD-350** is a helicopter turboshaft. In the Mi-2, the drive is taken from the rear. Though developed by the Isotov bureau in the former Soviet Union, it is in production only in Poland. PZL Rzeszów has developed a new version rated at 309 kW (414 shp) and designated **GTD-350W**. Technical life of the GTD-350 is 4,000 hours

TYPE: Axial/centrifugal flow free turbine turboshaft
AIR INTAKE: Stainless steel. Automatic de-icing of inlet guide vanes and bullet by air bleed
COMPRESSOR: Seven axial stages and one centrifugal, all of steel. Pressure ratio 6.05. Mass flow 2.19 kg (4.83 lb)/s at 45,000 rpm
COMBUSTION CHAMBER: Reverse-flow type with air supply through two tubes. Centrifugal duplex single-nozzle burner. Semi-conductor igniter plug


Cutaway PZL-10W turboshaft
1994

FUEL SYSTEM: NR-40TA pump governor; RO-40TA power turbine governor; DS-40 controlling bleed valves, and electromagnetic starting valve
FUEL GRADE: TS-1, TS-2 or Jet A-1
COMPRESSOR TURBINE: Single-stage. Shrouded blades with fir tree roots. Temperature before turbine 940°C (GTD-350P, 985°C)
POWER TURBINE: Two-stage constant-speed (24,000 rpm). Shrouded blades with fir tree roots. Discs bolted together. Turbine stators integrally cast
REDUCTION GEARING: Two sets of gears, with ratio of 0.246:1 in magnesium alloy casing. Output speed 5,900 rpm
LUBRICATION SYSTEM: Closed type. Gear type pump with one pressure and four scavenge units. Cooler and tank, capacity 12.5 litres (3.30 US gallons; 2.75 Imp gallons)
OIL GRADE: B3-W (synthetic), Castrol 98 or 5000, Elf Turbojet II or Shell Turbine Oil-500
ACCESSORIES: STG3 3 kW starter/generator, NR-40TA governor pump, D1 tachometer and oil pumps driven by gas generator. RO-40TA speed governor, D1 tachometer and centrifugal breather driven by power turbine
STARTING: STG3 starter/generator suitable for operation at up to 4,000 m (13,125 ft) altitude
DIMENSIONS
Length overall 1,385 mm (54.53 in)
Max width 520 mm (20.47 in)
Width, with jetpipes 626 mm (24.65 in)
Max height 630 mm (24.80 in)
Height, with jetpipes 760 mm (29.9 in)
WEIGHT, DRY
Less jetpipes and accessories 139.5 kg (307 lb)
PERFORMANCE RATINGS
T-O rating (6 min) at 96% max gas generator rpm
GTD-350 294 kW (394 shp)
Nominal rating (1 h) at 90% gas generator rpm
GTD-350 236 kW (316 shp)
Cruise rating (I)
210 kW (281 shp) at 87.5% gas generator rpm
Cruise rating (II)
173 kW (232 shp) at 84.5% gas generator rpm
SPECIFIC FUEL CONSUMPTION
T-O 142 µg/J (0.84 lb/h/shp)
Nominal 153 µg/J (0.91 lb/h/shp)
Cruise (I) 162 µg/J (0.96 lb/h/shp)
Cruise (II) 173 µg/J (1.02 lb/h/shp)
OIL CONSUMPTION
Max 0.3 litre (0.63 US pint, 0.53 Imp pint)/h

UPDATED

PZL-3S

Derived from Soviet AI-26W via LiT-3. Applications include PZL-106A Kruk, IAR-827A and conversions of Ag Cat Corp Ag-Cat A, B and C, Thrush Commander and DHC-2 Beaver

TYPE: Seven-cylinder air-cooled radial
CYLINDERS: Bore 155.5 mm (6.12 in). Stroke 155 mm (6.1 in). Capacity 20.6 litres (1,265 cu in). Comp ratio 6.4
PISTONS: Forged aluminium
INDUCTION SYSTEM: Float type carburettor. Mechanically driven supercharger
FUEL GRADE: Aviation gasoline, minimum 91 octane
LUBRICATION: Gear type oil pump. Oil grade Aero Shell 100 or other to MIL-L-6082
PROPELLER DRIVE: Direct. Provision for constant-speed US-132000A propeller
ACCESSORIES: ANG 6423 Prestolite alternator and two output shafts, one 20 kW (27 hp) (26 kW, 35 hp max) for spraying pump and the other 3.7 kW (5 hp)
STARTING: Electric
DIMENSIONS
Diameter 1,267 mm (49.88 in)
Length 1,177 mm (46.34 in)
WEIGHT, DRY 411 kg (906 lb)
PERFORMANCE RATINGS
Max T-O 442 kW (592 hp) at 2,200 rpm
Max continuous 404 kW (542 hp) at 2,050 rpm
Cruise (75 per cent) 304 kW (407 hp) at 2,000 rpm
SPECIFIC FUEL CONSUMPTION
T-O, max continuous 105 µg/J (0.61 lb/h/hp)
Cruise 86 µg/J (0.51 lb/h/hp)

UPDATED

PZL-3SR

This is the geared version of the PZL-3S. Applications include the PZL-106AR and BR and M-21. The following are the main differences

PROPELLER DRIVE: Planetary gear of 0.7 ratio. Provision for constant-speed propeller, Type US-133000
DIMENSIONS
Length 1,271 mm (50.06 in)
WEIGHT, DRY 446 kg (983 lb)

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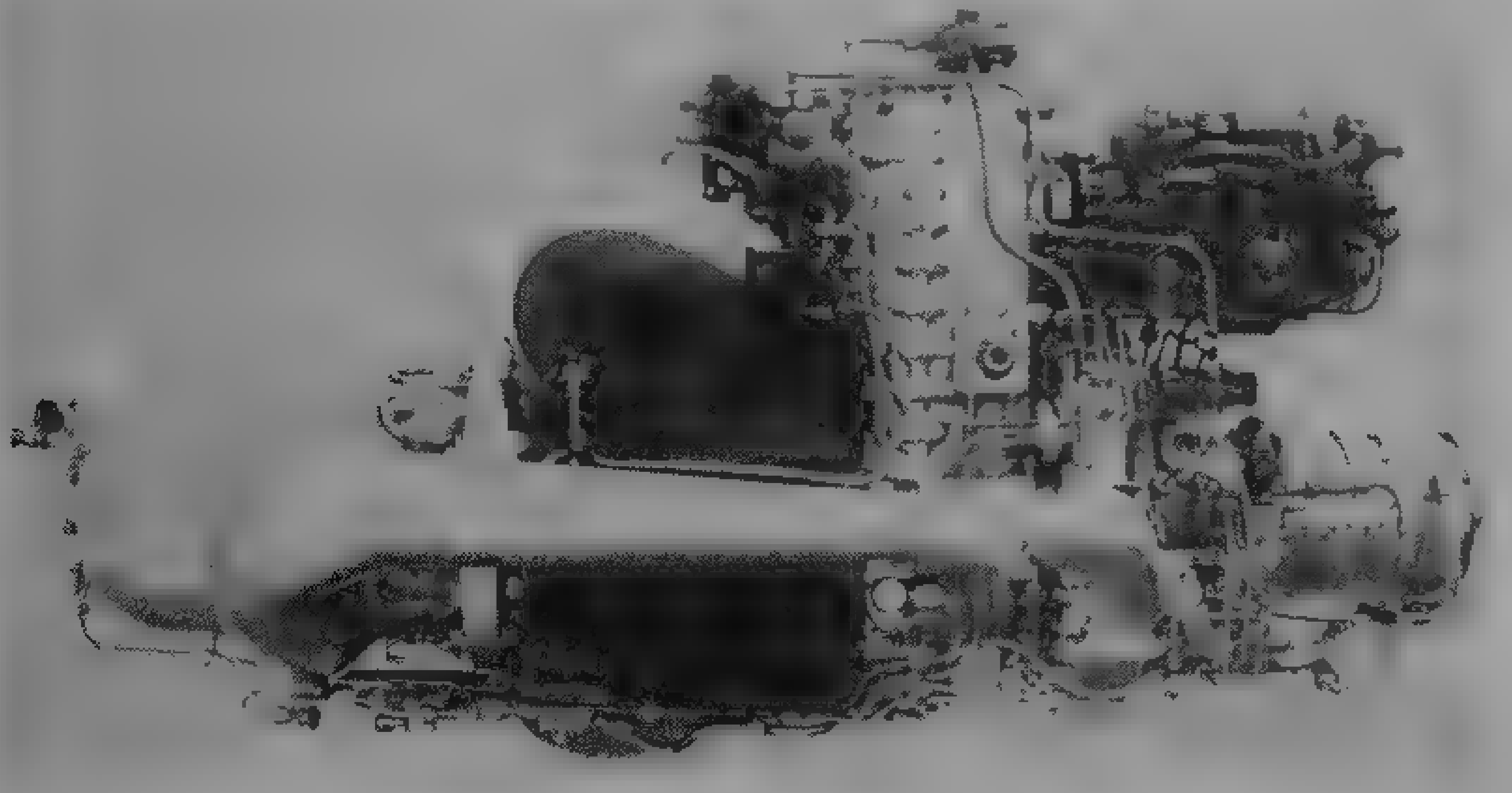
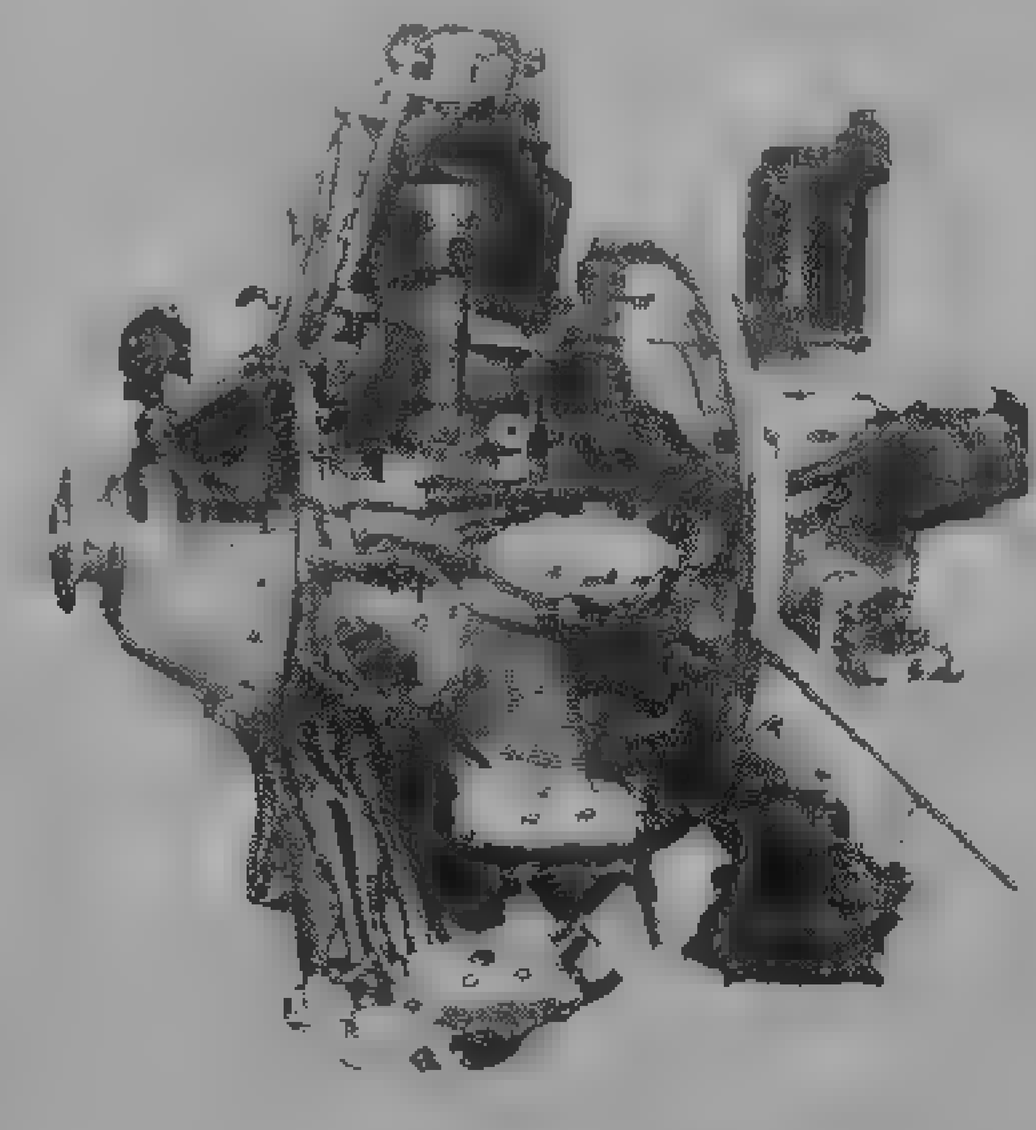
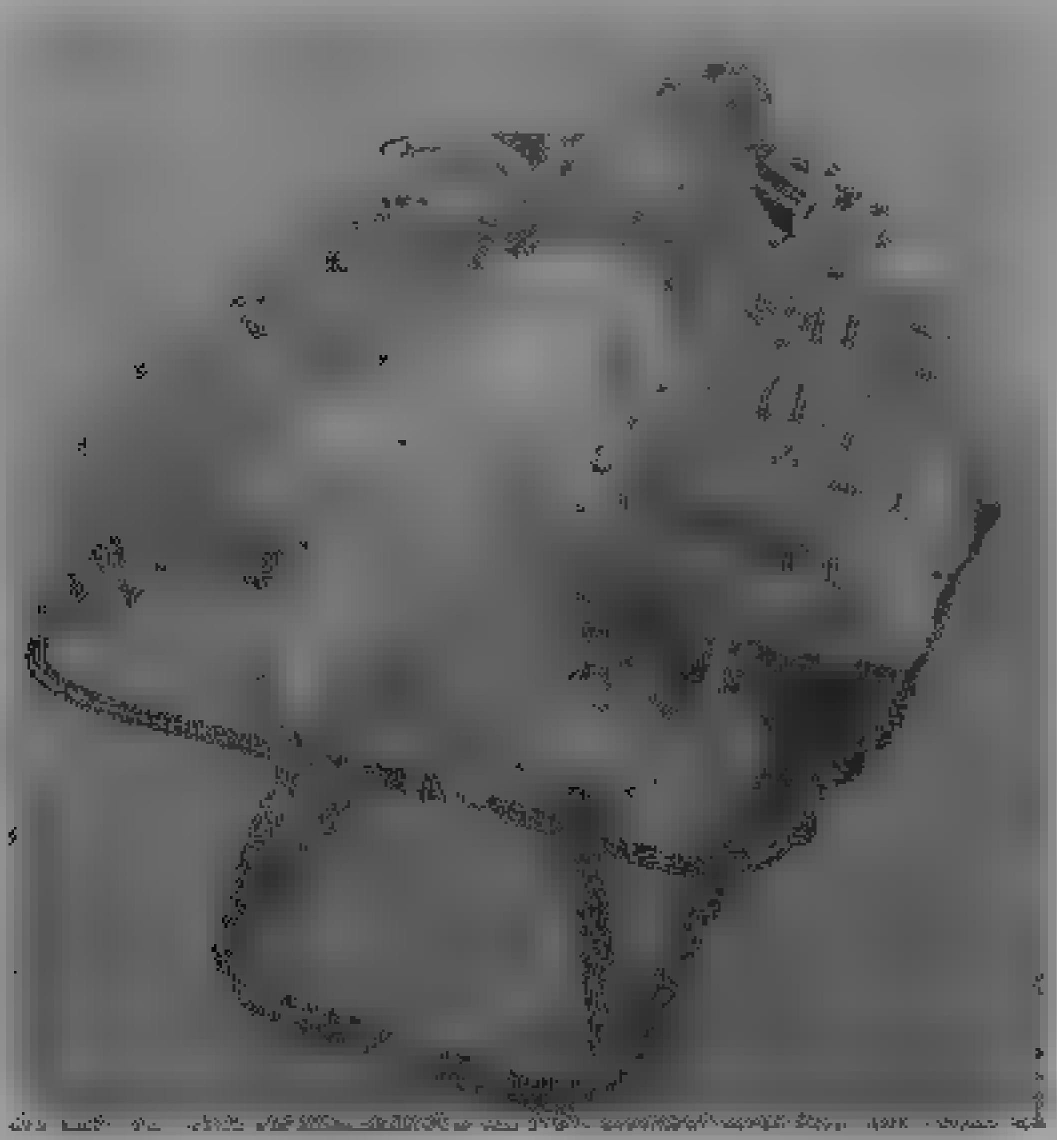
PZL-FRANKLIN ENGINES

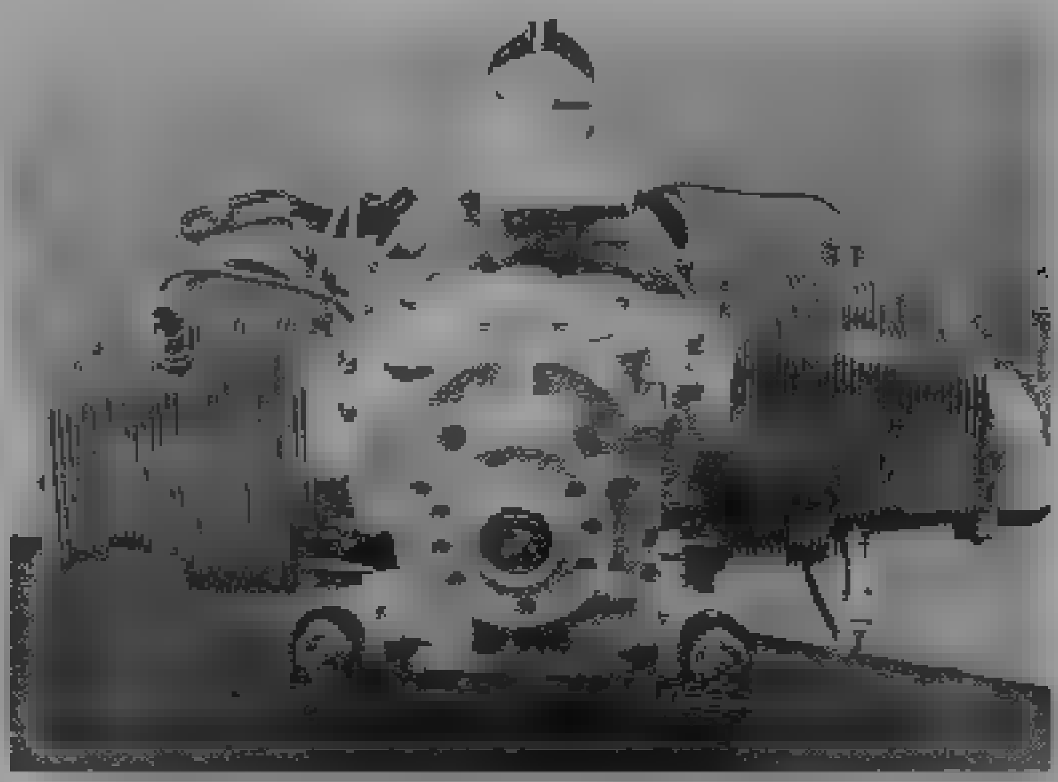
In 1975 Pezetel acquired rights to manufacture and market the entire range of air-cooled piston engines formerly


PZL GTD-350 free turbine turboshaft
1985

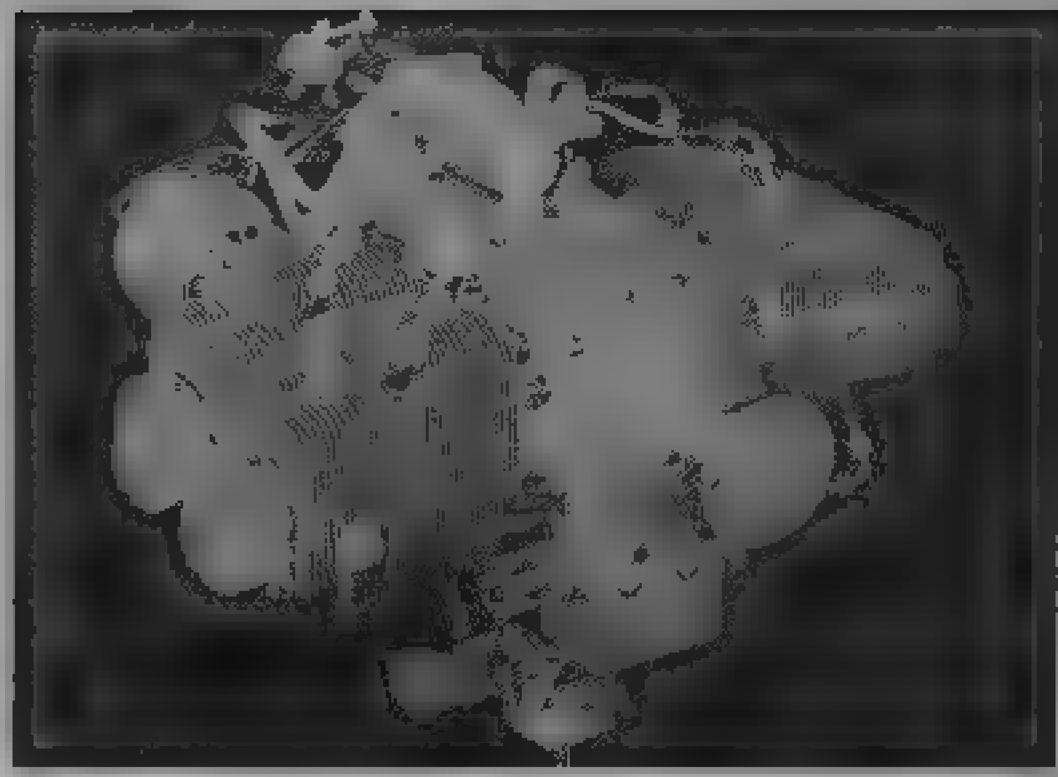

Cutaway PZL 3S seven-cylinder piston engine
1985



PZL-F 6A-350-C1R six-cylinder piston engine *1985*



PZL-F 2A-120-C1 two-cylinder piston engine *1985*



PZL-F 4A-235-B31 four-cylinder piston engine *1994*

produced by the Franklin Engine Company (Air-cooled Motors) of the USA. These engines, known as PZL-F, are being produced by WSK-PZL Rzeszów.

Current applications include the SZD-45-2 Ogar F motor glider (2A-120-C1), PZL-126 Mrówka (2A-120-C1), PZL-110 Koliber (4A-235-B31), and PZL Mielec M-20 Mewa (6A-350-C1R). The 2A-120-C1, 4A-235-B31 and 6A-350-C1R each have a Polish GICA certificate.

All models are of the horizontally opposed type, with cylinders of 117.48 mm (4.625 in) bore and 88.9 mm (3.5 in) stroke. All have direct drive and operate on 100/130 grade fuel. Accessories normally include electric starter, alternator and fuel pump. Other details are tabulated.

PZL-FRANKLIN ENGINES

Engine model	Cylinder arrangement	Capacity cc (cu in)	Compression ratio	Max T-O rating at S/L kW (hp) at rpm	Overall dimensions mm (in) length	width	height	Weight, dry kg (lb)
2A-120-C1	2 horiz	1,916 (117)	8.5	45 (60) at 3,200	605 (23.82)	794 (31.25)	513 (20.2)	58.5 (129)
4A-235-B31	4 horiz	3,850 (235)	8.5	87 (116) at 2,800	742 (29.21)	794 (31.25)	683 (26.89)	102.5 (226)
6A-350-C1*	6 horiz	5,735 (350)	10.5	153 (205) at 2,800	960 (37.8)	794 (31.25)	624 (24.57)	149.7 (330)

* C1L or C1R respectively left- or right-hand rotation

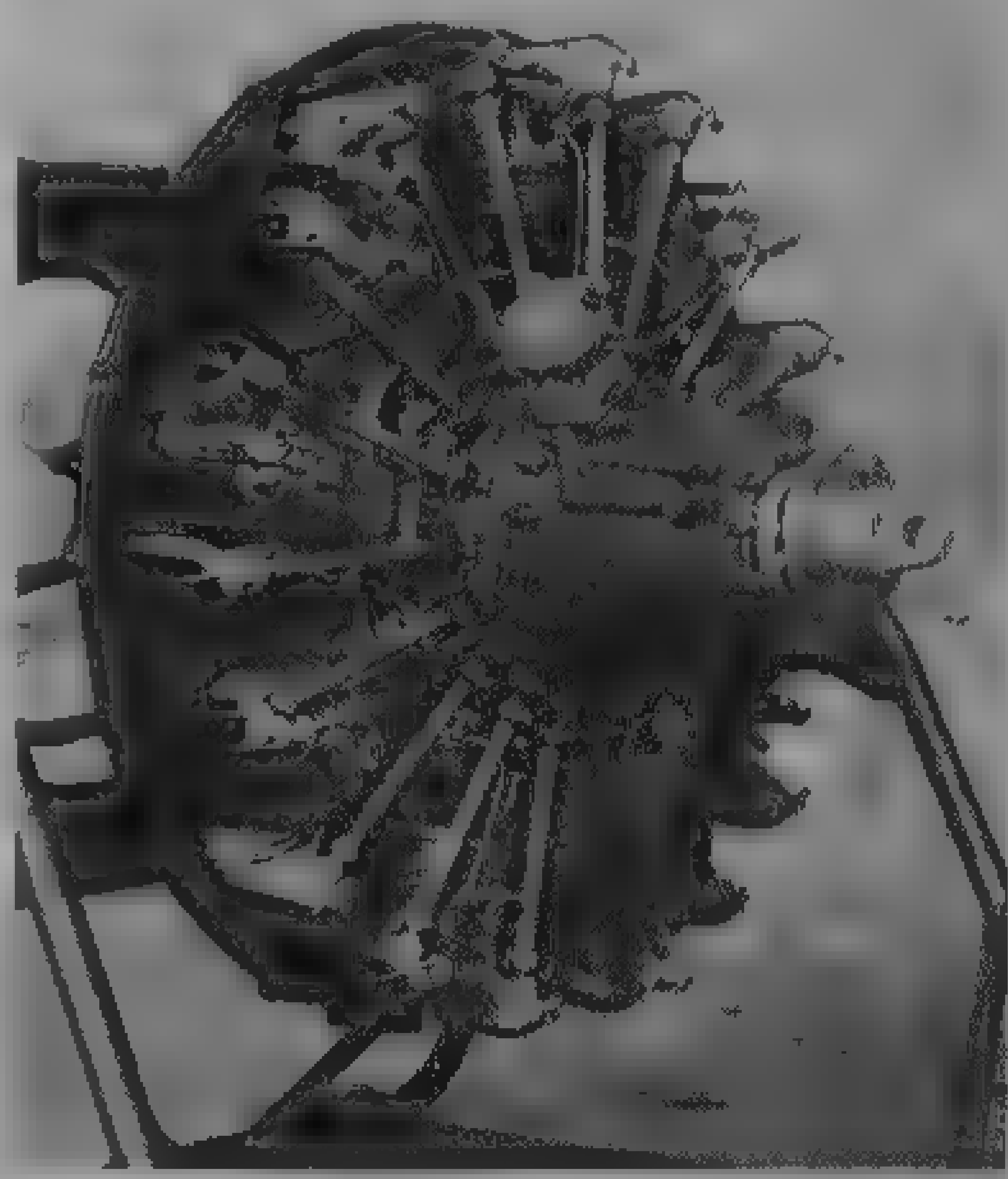
ROMANIA

AEROSTAR

AEROSTAR SA

9 Condorilor St, R-5500 Bacau
Telephone: 40 (93) 141885
Fax: 40 (93) 16 , 13
Telex: 2,339 aero r
OFFICERS: See Aircraft section

Among a diverse range of other products (see Aircraft section), this reorganised factory is manufacturing under licence the Russian VMKB (Vedeneyev) M-14P and M-14V26 piston engines, and the Soyuz/Tumansky RU-19A-300 gas turbine.



Aerostar built M-14P nine-cylinder radial *1992*

TURBOMECANICA

INTREPRINDEREA TURBOMECANICA BUCURESTI

244 Bd Pacii, Sector 6, R-77826 Bucharest
Telephone: 40 (1) 760 6150
Fax: 40 (1) 769 4687
Telex: 10151 TURMO R

GENERAL DIRECTOR: Serban Ciorapciu

Founded in 1975, this factory produces under licence the Rolls-Royce Viper 632-41 and 633-47 and Spey 512-14DW, Turbomeca Turmo IVC, and helicopter gearboxes and rotor heads.

VERIFIED

RUSSIA

Since 1989 the entire industry of the former Soviet Union has been undergoing great changes. Of course, the most profound changes have reflected the breakup of the Soviet Union into separate republics. As in the Aircraft Section, engine centres are now listed under the name of the republic in which they are situated. Most are in this section, but several will be found under Ukraine. In addition, the entire management of the industry has been revolutionised. The changes are generally intended to increase commercial viability, and they are superimposed on changes of name caused by the replacement of deceased or retired chief constructors by their successors. For nearly 70 years the procedure was for new engines to be designed at a KB (construction bureau) always identified by the name of the bureau head, or chief constructor. Their work had the benefit of support from the laboratories of the Central Institute of Aviation Motors. Once cleared for production, an engine would be assigned to a factory for series production. The factory (or factories) remained anonymous, though its GAZ (state aviation factory) number might become known (for example see introduction to Klimov). Today the production plants are being named, many even have a chief designer, and they are taking display stands at exhibitions alongside the KBs. Meanwhile, confusion is increased further by the fact that some of the KBs have received names in honour of former chief designers or based on the city where they are located. As in the case of aircraft, each bureau no longer has guaranteed large home orders but has to fend for itself. This is reflected in the pages that follow. One immediate result is the formation of **ASSAD** in March 1992. This Union of Aviation Engine Producers is intended to assist strategic planning throughout the Independent States, and develop foreign economic links. ASSAD has been established by Viktor Chuiko, formerly Deputy Minister of the Soviet Aviation Industry. It is open to membership by major foreign (mainly engine) companies.

VERIFIED

JSC 'AVIADVIGATEL'

PERM SCIENTIFIC AND PRODUCTION ENTERPRISE 'AIRCRAFT ENGINES'

93 Komsomolsky Prospect (PO Box 624), 614600 Perm
Telephone: 7 (83422) 452151
Fax: 7 (83422) 459777
Telex: 134802 LAVA SU
Teletype: 134135 LAVA
GENERAL DESIGNER: Mikhail I Kuzmenko

This large design bureau, until 1990 named MKB engine design bureau and now Joint Stock Company 'Aviadvigatel', was founded before the Second World War by Shvetsov (which see), who was followed in 1953-89 by Soloviev. The engines created by Shvetsov and Soloviev powered 26 types of production aeroplanes and helicopters. Total flying time of their gas-turbine engines exceeds 48 million hours. They are fitted to the Tu-124, Tu-134, Tu-154M, Il 76, Il-62M, MiG-31, and Mi-6 and Mi-10 helicopters. These are flown by 39 countries.

The PS-90A, Soloviev's last design, is fitted to the Tu-204 and Il 96-300. The engines designed by 'Aviadvigatel' are manufactured by two large-scale production plants in Perm and Rybinsk. Many of the new designs are based on the PS-90A core: the PS-90A10, PS-90A12, PS-90A76, D-100, D-110, and D-112. Attention is also being paid to propfans with contrarotating fans, with a bypass ratio of about 15. Another area of design is industrial gas-turbine plant for gas pumping and power generation. Aviadvigatel has been able to preserve its personnel, and is developing international links.

UPDATED

D-20P

The D-20P was the first turbofan in the USSR to enter scheduled airline service. A two-shaft engine, it was qualified in 1962 to power the Tu-124 at a rating of 52.96 kN (11,905 lb st). A full description last appeared in *Jane's* in 1987-88.

VERIFIED

D-25V

D-25V is the turboshaft which powers the Mi-6 and Mi-10 and -10K helicopters. It is no longer in production, details last appearing in the 1994-95 *Jane's*.

UPDATED

Aviadvigatel (Soloviev) D-30KU-154 two-shaft turbofan with reverser

1992

Aviadvigatel (Soloviev) PS-90A two-shaft turbofan

1992

D-30

The D-30 has powered the Tu-134 since 1966. Since 1972 the Tu-134A has been powered by the **D-30 II** with reverser. Since 1982 the Tu-134A-3 has been powered by the **D-30 III** with an LP zero stage, providing the existing ratings at reduced gas temperature and maintained to ISA + 25°C.

TYPE: Two-shaft turbofan (bypass turbojet).

FAN: Four-stage axial (LP compressor) (III: five stages). First stage has shrouded titanium blades held in disc by pinned joints. Pressure ratio (T-O rating, 7,700 rpm, S/L, static), 2.65. Mass flow 126.8 kg (279.5 lb)/s. Bypass ratio 1.

COMPRESSOR: Ten-stage axial (HP compressor). Drum and disc construction, largely of titanium. Pressure ratio (T-O rating, 11,600 rpm, S/L, static), 7.1. Overall pressure ratio, 17.65.

COMBUSTION CHAMBER: Can-annular, with 12 flame tubes fitted with duplex burners.

FUEL GRADE: T-1 and TS-1 to GOST 10227-62 (equivalent to DERD.2494 or MIL-F-5616).

TURBINE: Two-stage HP turbine. First stage has cooled blades in both stator and rotor. LP turbine also has two stages. All blades shrouded and bearings shock-mounted.

JETPIPE: Main and bypass mixer with curvilinear ducts. D-30-II engine of Tu-134A fitted with twin-clamshell reverser.

LUBRICATION: Open type, with oil returned to tank.

OIL GRADE: Mineral oil MK-8 or MK-8P to GOST 6457-66 (equivalent to DERD 2490 or MIL-O-6081B).

ACCESSORIES: Automatic ice protection system, fire extinguishing for core and bypass flows, vibration detectors on casings, oil chip detectors and automatic limitation of exhaust gas temperature to 620°C at take-off or when starting and to 630°C in flight (5 minute limit). Shaft-driven accessories driven via radial bevel gear shafts in centre casing, mainly off HP spool. D-30-II carries constant-speed drives for alternators.

STARTING: STM-10 pneumatic starter fed by ground supply.

DIMENSIONS:

Length overall	3,983 mm (156.8 in)
Base diameter of inlet casing	1,050 mm (41.3 in)

WEIGHT, DRY: 1,550 kg (3,417 lb)

PERFORMANCE RATINGS:

T-O	66.68 kN (14,990 lb st)
Long-range cruise rating, 11,000 m (36,000 ft) and Mach 0.75	12.75 kN (2,866 lb)

SPECIFIC FUEL CONSUMPTION:

T-O	17.22 mg/Ns (0.608 lb/h/lb st)
Cruise, as above	22.38 mg/Ns (0.79 lb/h/lb)

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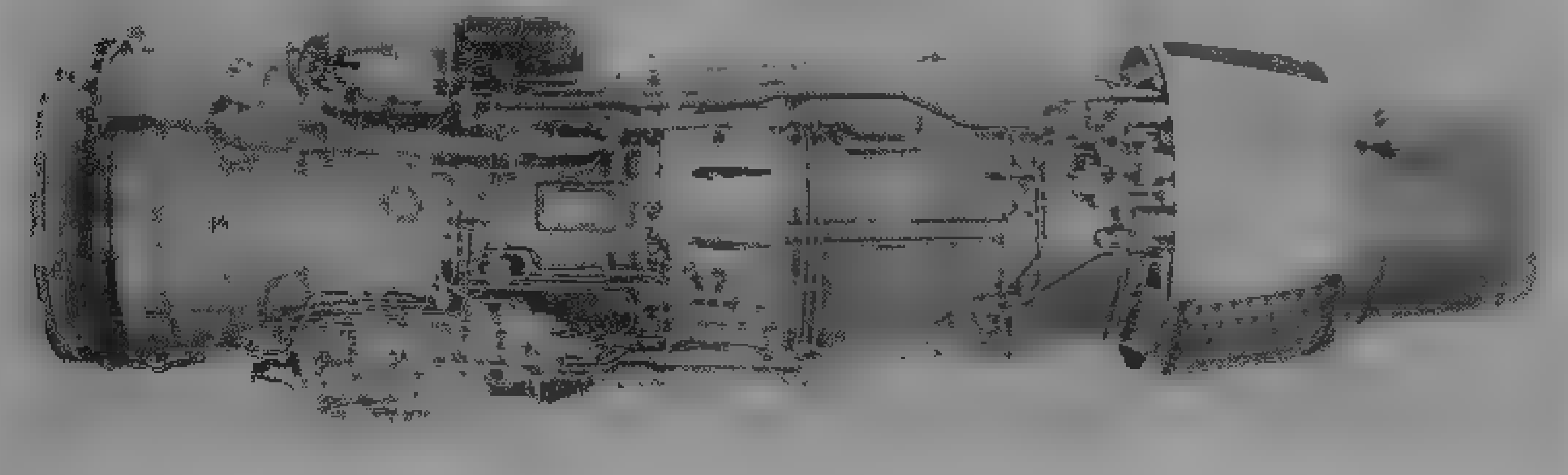


Aviadvigatel (Soloviev) D-30 III two-shaft turbofan with reverser

1992

D-30K

Despite its designation, this turbofan is much larger and more powerful than the D-30. The basic **D-30KU** replaced the NK-8-4 as power plant of the Il-62M in 1974. The **D-30KU II**, or **KU-154**, is configured to suit the Tu-154M and is derated to 104 kN (23,380 lb st) up to ISA + 15°C. The **D-30KP**, rated at 117.7 kN (26,460 lb st), up to ISA + 15°C, was the original engine of all versions of the Il-76. Clamshell reversers are fitted to all four engines of this aircraft, and to the outer engines of the Il-62M. These reversers are airframe assemblies incorporated in the nacelle. In 1980 the KP was replaced in production by the **KP II** which maintains full power to ISA + 23°C. The **D-30KPV**, rated at 117.7 kN (26,460 lb st) and without reverser, powers the Beriev A-40 Albatross.

The following refers to the D-30KU:

TYPE: Two-shaft turbofan, with mixer and reverser.

FAN (LP COMPRESSOR): Three stages, mainly of titanium alloy. First-stage rotor blades with part-span snubbers. Mass flow, 269 kg (593 lb)/s at 4,730 rpm (87.9 per cent), with bypass ratio of 2.42.

HP COMPRESSOR: Eleven stages, first two having part-span snubbers. Guide vanes turn 30° over 7,900 to 9,600 rpm, while air is bled from fifth and sixth stages. Overall pressure ratio (S/L, static) 20 at HP speed of 10,460 rpm (96 per cent).

COMBUSTION CHAMBER: Can-annular type with 12 flame tubes. Each tube comprises hemispherical head and eight short sections welded with gaps for dilution air. Single swirl type main/pilot burner centred in each tube. Igniter plugs in two tubes.

FUEL GRADE: T-1, TS-1, GOST-10227-86, A-1 (D1655/63t), DERD 2494 or 2498, Air 3405/B or 3-GP-23e.

TURBINES: Two-stage HP turbine with cooled blades in both stages. Second-stage rotor blades tip shrouded. Maximum gas temperature 1,122°C. Four-stage LP turbine with shrouded blades.

LUBRICATION: Closed type. Fuel/oil heat exchanger and centrifugal air separator with particle warning.

OIL GRADE: MK-8 or MK-8P to GOST 6457-66 (mineral) or BNII NP-50-1-4F to GOST 13076-67 (synthetic).

ACCESSORIES: Front and rear drive boxes under engine carry all shaft-driven accessories. Differential constant speed drive to alternator and air turbine starter.

STARTING: Pneumatic starter fed by ground supply, APU or cross-bleed.

DIMENSIONS:

Length with reverser	5,700 mm (224 in)
Inlet diameter	1,455 mm (57.28 in)
Max diameter of casing	1,560 mm (61.4 in)

WEIGHT, DRY:

With reverser	2,668 kg (5,882 lb)
Without reverser	2,318 kg (5,110 lb)

PERFORMANCE RATINGS (ISA):

T-O	107.9 kN (24,250 lb st) to 21°C
Cruise at 11,000 m (36,000 ft) and Mach 0.8	27 kN (6,063 lb)

SPECIFIC FUEL CONSUMPTION:

At T-O rating	13.83 mg/Ns (0.49 lb/h/lb st)
Cruise, as above	19.83 mg/Ns (0.70 lb/h/lb)

VERIFIED

PS-90A (D-90A)

This high-bypass ratio turbofan is not derived from any existing engine. It is assembled from 11 modules, and is designed for long life, high reliability and low fuel burn.

Bench testing began in 1984. Flight testing was in progress in 1987 with an engine replacing the starboard inner D-30KP in an Il-76. Certification was completed in 1992, the

certificate being received in April 1992. The PS-90A powers the Il-96-300, first flown on 28 September 1988 with engines derated to 132.4 kN (29,762 lb st), and the Tu-204, first flown on 2 January 1989 with fully rated PS-90As. The Il-96-300 was certified in December 1992 and the Tu-204 in December 1994. This engine is the first to have a designation reflecting the name of the General Designer (Soloviev).

Modifications effected during development included modifying blade profiles, and adding a third stage to the LP compressor. For reliability reasons the variable HP stators have been changed from hydraulic to pneumatic operation. Many parts, including the nose spinner and titanium honeycomb nozzle, have been changed to composite material. There are numerous planned variants.

PS-90A-76 For Il-76TD and Il-76MF, derated to 142.2 kN (31,967 lb), flat rated to 30°C, with full 16 tonne thrust available when required.

TYPE: Two-shaft turbofan with mixer and fan reverser.

FAN: Single stage, with 33 titanium blades, with snubbers. Hub/tip ratio 0.34. Bypass ratio (T-O) 4.6, (cruise) 4.8.

LP COMPRESSOR: Two-stage booster bolted to rear of fan.

HP COMPRESSOR: Thirteen-stage spool with variable inlet guide vanes and first two stators. Overall pressure ratio (cruise) 35.5. Speed (maximum) 11,820 rpm.

COMBUSTION CHAMBER: Can-annular with 12 flame tubes with vaporising burners and two igniters.

HP TURBINE: Two stages, with advanced blades cooled by air passed through cold heat exchanger. Entry gas temperature 1,640°K (1,367°C).

LP TURBINE: Four stages.

JETPIPE: Mixer combines core and bypass flows to single nozzle.

CONTROL SYSTEM: Full-authority digital electronic.

REVERSER: Multiple blocker doors close off fan duct as translating mid-section of cowl moves to rear, to uncover all round reverser cascades. No core reverser.

DIMENSIONS:
- Fan diameter: 1,900 mm (74.8 in)
- Length overall: 4,964 mm (195.4 in)

WEIGHT, DRY: 2,950 kg (6,503 lb)

PERFORMANCE RATINGS (ISA):
- T-O, S/L: 156.9 kN (35,275 lb st) to 30°C
- Cruise at 11,000 m (36,000 ft) and Mach 0.8: 34.32 kN (7,716 lb)

SPECIFIC FUEL CONSUMPTION:
- Cruise, as above: 16.85 mg/Ns (0.595 lb/h/lb)

UPDATED

PS-90A10

The PS-90A10 was developed to power short-range aircraft with 100 to 140 passengers.

TYPE: Two-shaft turbofan with mixer and clamshell reverser.

FAN: Single-stage, 33 titanium blades with snubbers. Bypass ratio (T-O) 3.76, (cruise) 3.58. No intershaft bearing in the fan drive, and no booster stages.

HP COMPRESSOR: As PS-90A without first stage: two rows of variable inlet guide vanes, active clearance control. Overall pressure ratio (climb) 23.1.

COMBUSTION CHAMBER: Annular.

HP TURBINE: Two-stage, with controlled air cooling and active clearance control. Gas exhaust temperature 1,513°K (1,240°C).

LP TURBINE: Two-stage, with active clearance control.

EXHAUST SYSTEM: Lobe-type mixer, integrated nozzle.

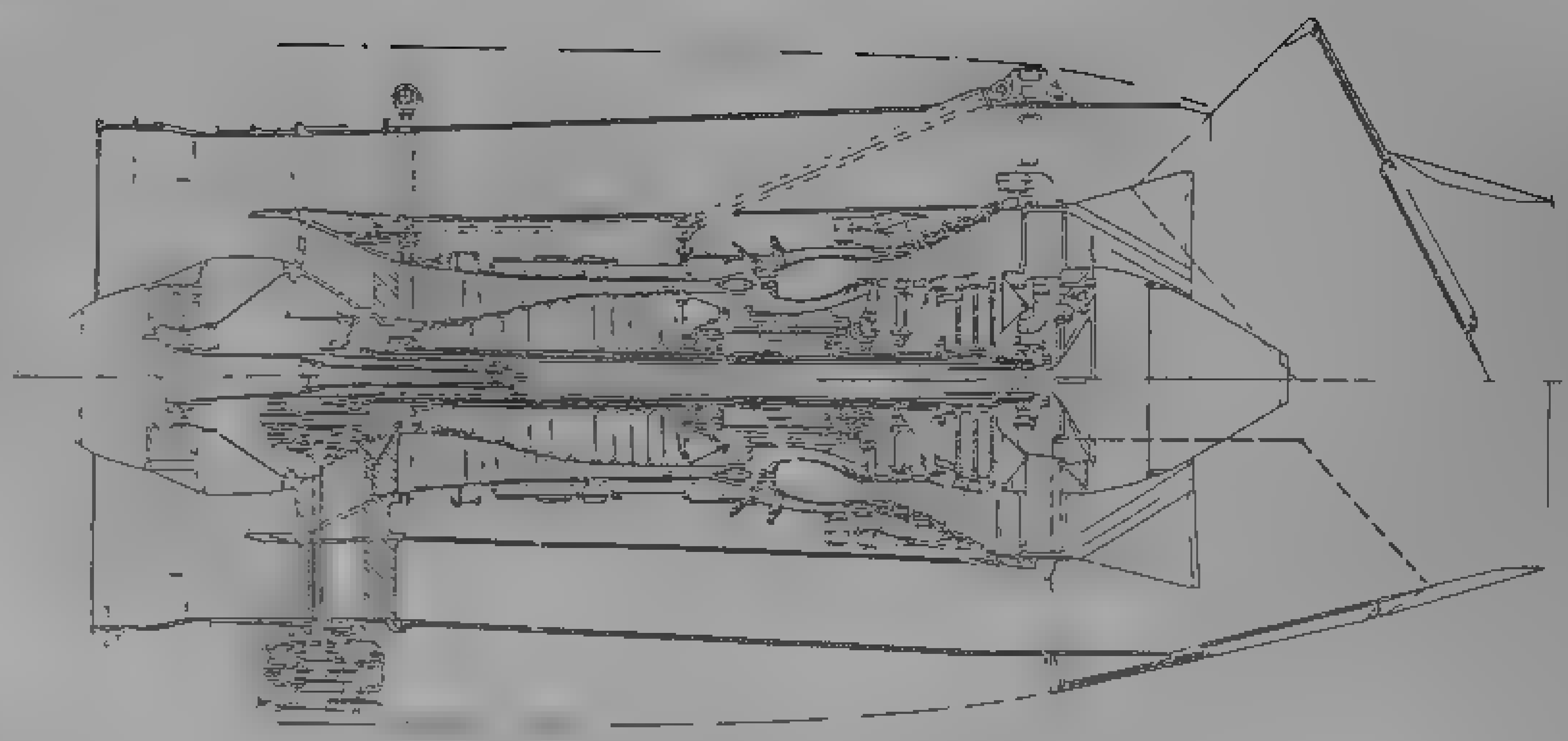
REVERSER: Clamshell-type, reverse factor 0.4.

CONTROL SYSTEM: Full-authority digital electronic.

DIMENSIONS:
- Fan diameter: 1,400 mm (55.13 in)
- Total length: 4,280 mm (168.5 in)

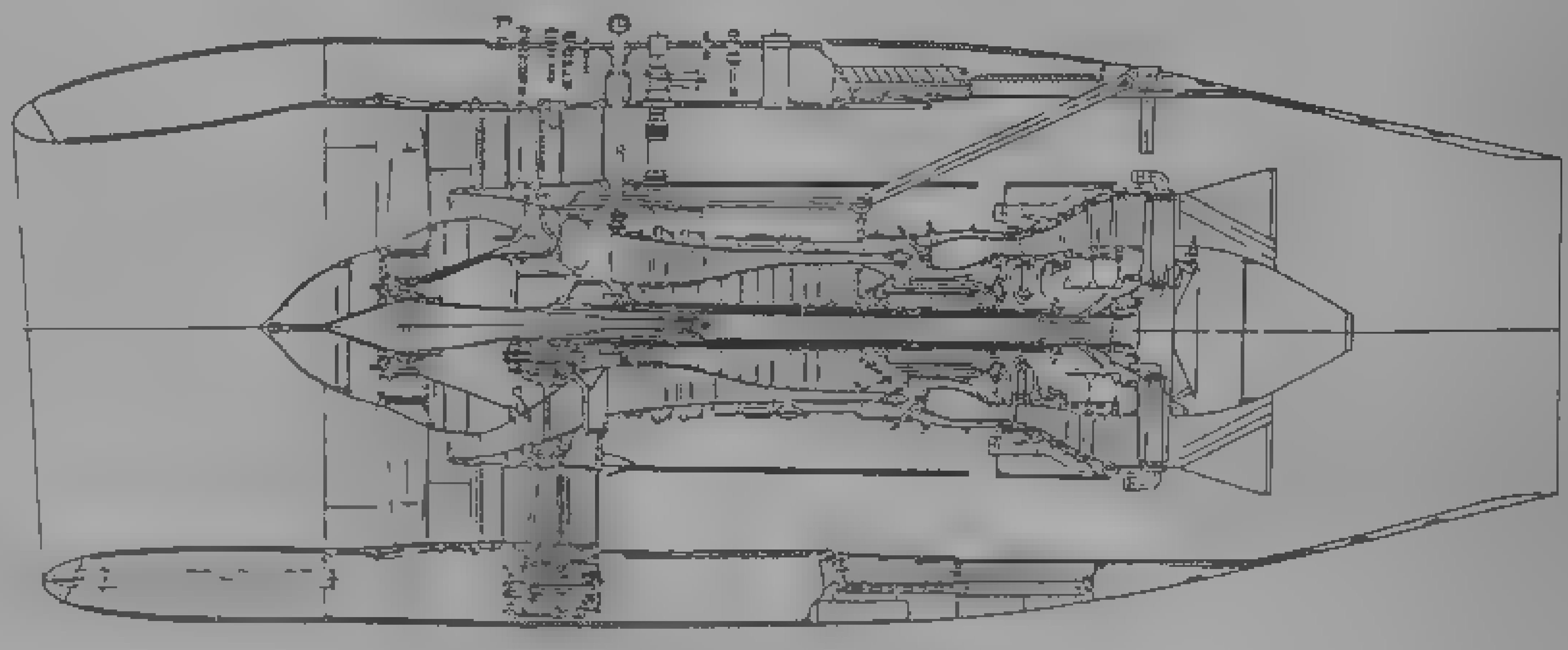
DRY WEIGHT: 1,900 kg (4,180 lb)

PERFORMANCE RATINGS (ISA):
- T-O, S/L: 90.2 kN (20,283 lb st) flat rated to +30°C, 730 mm Hg
- Cruise at 11,000 m (36,000 ft) and Mach 0.8: 19.32 kN (4,343 lb)



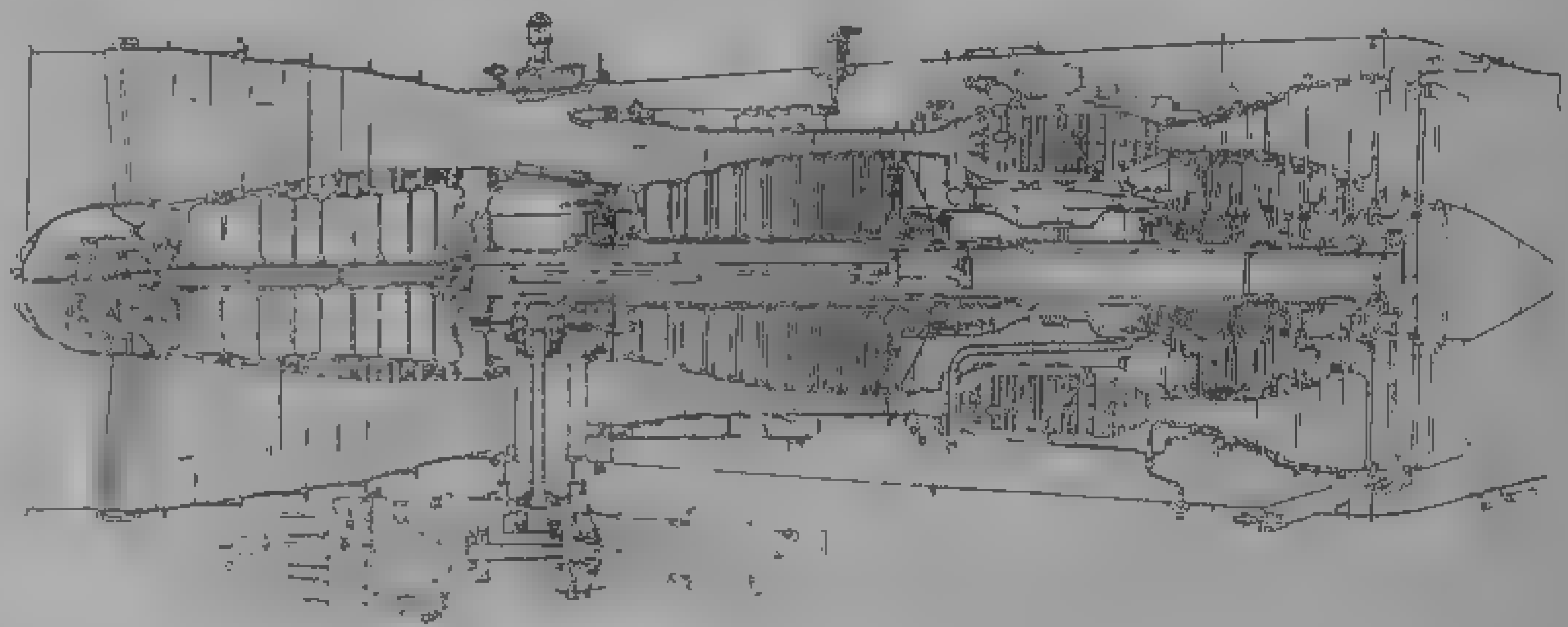
Aviadvigatel PS-90A10, showing reverser operation

1995



Aviadvigatel PS-90A12

1995



Aviadvigatel D-21A1 bypass turbojet

1995

SPECIFIC FUEL CONSUMPTION (installed):
- Cruise, as above: 17.84 mg/Ns (0.63 lb/h/lb)

NEW ENTRY

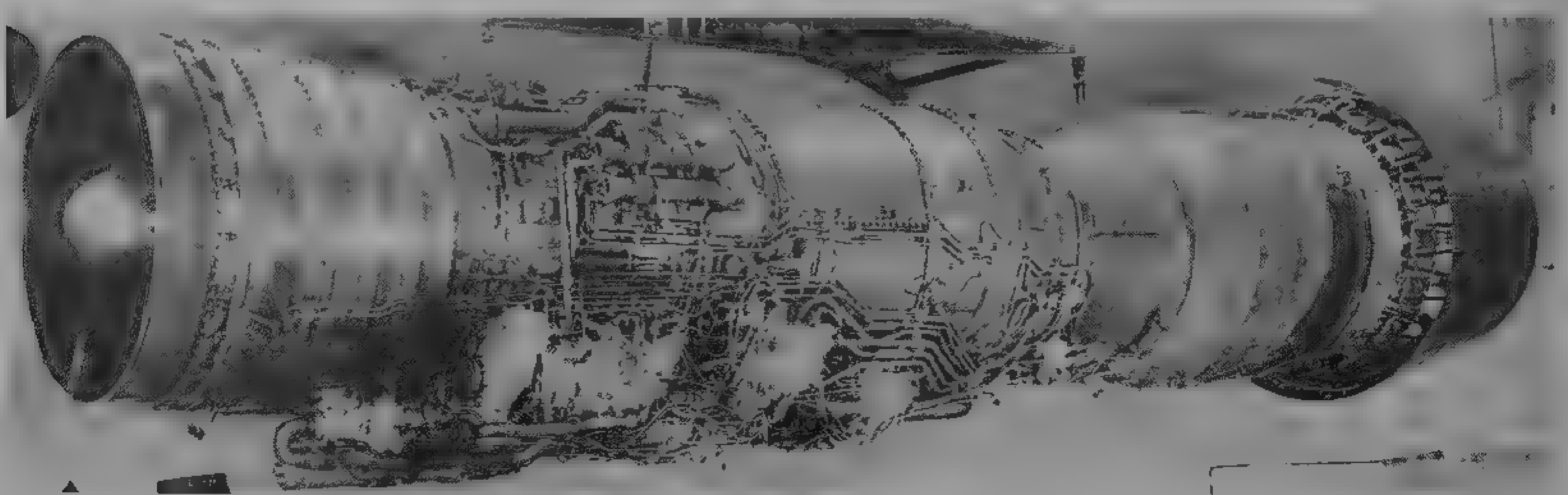
PS-90A12

This engine has been developed to power the Yak-242. Booster (LP) stages are eliminated, and the moderate cycle parameters make gas-generator operating conditions easier, in comparison with the PS-90A, and meet environmental requirements. The developed gas generator provides low life cycle cost.

TYPE: Two-shaft turbofan, with mixed bypass and core airflows, reverser in bypass duct.

FAN: Single-stage. By-pass ratio (T-O) 5.05, (cruise) 4.9. No intershaft bearing.

HP COMPRESSOR: Identical to PS-90A, with three variable guide vanes and active control of radial clearance. Engine pressure ratio (climb) 25.3.



Perm (Aviadvigatel) D-30F6 augmented two-shaft bypass turbojet

1992

COMBUSTION CHAMBER: Annular

HP TURBINE: Two stages, with air cooling and active clearance control. Entry gas temperature 1,558°K (1,285°C).

LP TURBINE: Three stages, with an active clearance control.

EXHAUST SYSTEM: Lobe type mixer and integrated nozzle.

REVERSER: Cascade vanes in bypass duct. No core reverser.

CONTROL SYSTEM: Full-authority digital electronic.

DIMENSIONS:

Fan diameter	1,670 mm (65.76 in)
Length	4,795 mm (188.82 in)

WEIGHT, DRY: 2,300 kg (5,071 lb)

PERFORMANCE (ISA):

T-O, S/L: 117.7 kN (26,455 lb st) to 30°C, 730 mm Hg

Cruise at 11,000 m (36,000 ft) and Mach 0.8: 22.55 kN (5,071 lb)

SPECIFIC FUEL CONSUMPTION (installed):

Cruise, as above: 16.48 mg/Ns (0.582 lb/h/lb)

NEW ENTRY

D-30F6

This large supersonic engine was designed from 1972 expressly for the MiG-31. Requirements included Mach 2.83 cruise at 11,000 to 21,000 m (36,100 to 68,900 ft) with the lowest possible fuel consumption, and Mach 1.25 at S/L. The engine comprises seven interchangeable modules. It has attained an outstanding standard of reliability in several hundred thousand flight hours.

An unaugmented derivative, the D-30-10V, rated at 88.2 kN (19,840 lb st), powers the subsonic high-altitude Myasishchev M-55. A modified version is being developed to power the Sukhoi S-21 (see D-21A1).

TYPE: Two-shaft augmented turbofan (bypass turbojet).

LP COMPRESSOR: Five stages, fixed inlet guide vanes. Mass flow 150 kg (331 lb)/s. Pressure ratio 3. Bypass ratio 0.57.

HP COMPRESSOR: Ten stages, first row variable stators and bypass doors behind stages 4 and 5. Pressure ratio 7.05. Overall pressure ratio 21.15.

COMBUSTION CHAMBER: Can-annular with 12 interlinked flame tubes.

TURBINES: Two-stage HP, with entry temperature 1,367°C. Cooling air bled from HP stages 5, 10, cooled in heat exchanger in bypass duct. Two-stage LP.

AFTERBURNER: High volume, with four flameholder rings.

NOZZLE: Multiflap type with large variable area and cooling flows. Flow stabilised by auxiliary valve plates in divergent petals.

CONTROL SYSTEM: FADEC mounted on airframe.

AUXILIARIES: Independent gas-turbine APU under compressor used for starting (one per engine). Independent lubrication system.

DIMENSIONS:

Inlet diameter	1,020 mm (40.2 in)
Length	7,040 mm (277.2 in)

WEIGHT, DRY: 2,416 kg (5,326 lb)

PERFORMANCE RATINGS (S/L static):

Dry	93.2 kN (20,944 lb st)
Augmented	152.1 kN (34,215 lb st)
Frontal (max)	186.1 kN (41,843 lb st)
Power/frontal area	18,900 kg/m² (3,871 lb/sq ft)

SPECIFIC FUEL CONSUMPTION:

Dry	20.4 mg/Ns (0.72 lb/h/lb st)
Augmented	53.8 mg/Ns (1.9 lb/h/lb st)

UPDATED

D-21A1

The D-21A1 is a bypass engine equipped with a mixer and an axially symmetric supersonic nozzle. It is designed to power the Sukhoi S-21 high-altitude supersonic business jet.

The D-21A1 is a non-augmented modification of the D-30F6. It conforms to requirements concerning emission and noise levels (Chapter 3). Its effect upon the ozone layer is minimal. One of the main advantages of the design is a short-term period of engineering, and minimum cost of development.

TYPE: Two-shaft, bypass turbofan.

LP COMPRESSOR: Five-stage, fixed inlet guide vanes. Pressure ratio 2.99 (climb, 12,000 m, 39,370 ft, Mach 1.2).

HP COMPRESSOR: Ten-stage spool, variable inlet guide vanes, 4th and 5th-stage air bleeds. Pressure ratio 20.15. Bypass ratio 0.83 (maximum cruise, 15,800 m; 51,850 ft, Mach 2, ISA+10°C).

COMBUSTION CHAMBER: Can-annular with 12 flame tubes.

TURBINES: Two-stage HP and two-stage LP, exhaust gas temperature 1266°C at maximum cruise.

NOZZLE: Multiflap, supersonic.

DRY WEIGHT: 2,100 kg (4,630 lb)

PERFORMANCE RATINGS:

T-O, S/L: 52.27 kN (11,750 lb)

Subsonic cruise, 11,000 m (36,000 ft) Mach 0.9, ISA+10°C: 10.10 kN (2,270 lb)

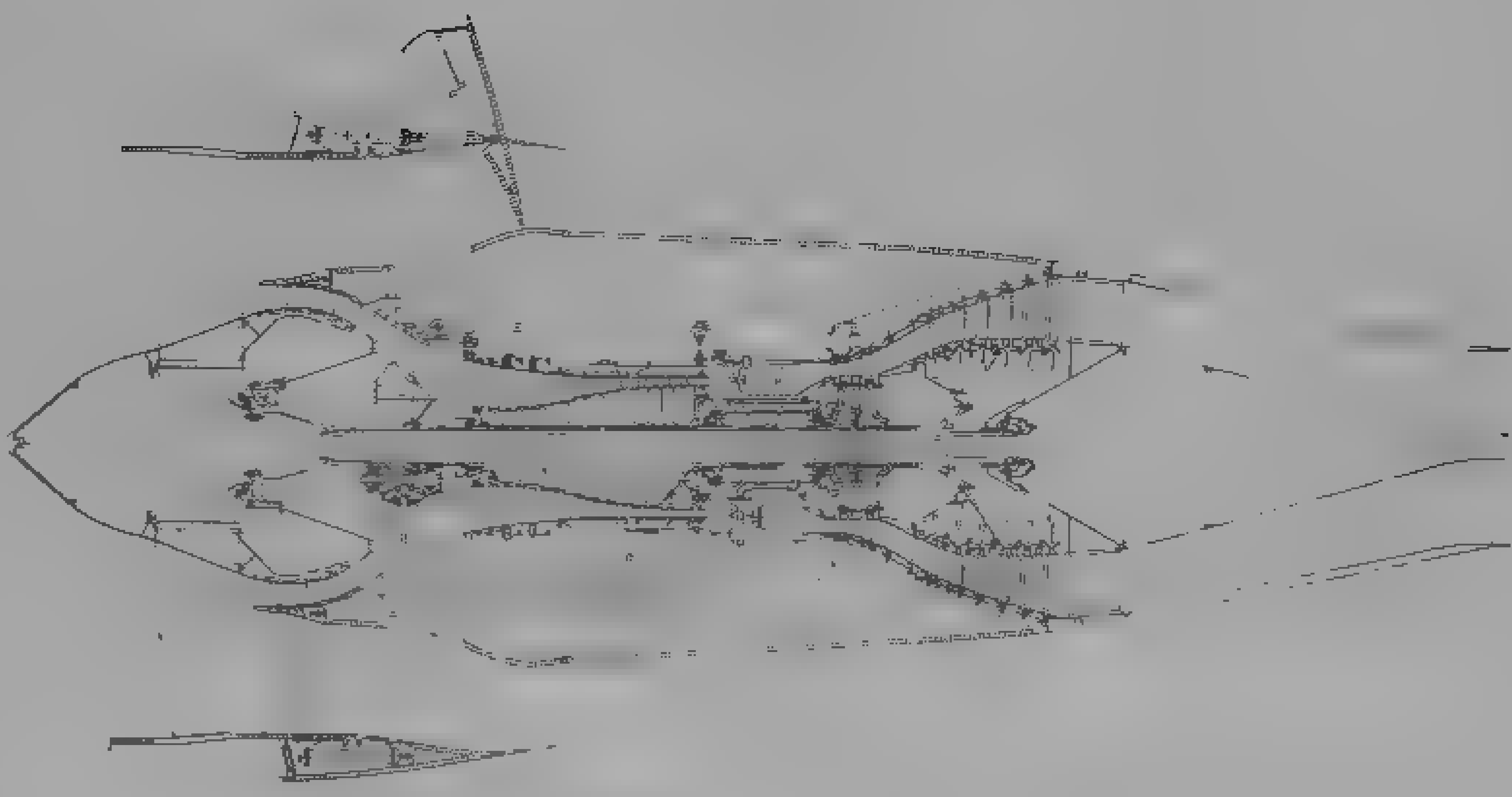
Max acceleration, 12,000 m (39,370 ft) Mach 1.2, ISA+10°C: 28.44 kN (6,393 lb)

Max mode, 15,800 m (51,850 ft), Mach 2, ISA+10°C: 23.34 kN (5,247 lb)

SPECIFIC FUEL CONSUMPTION (engine installed):

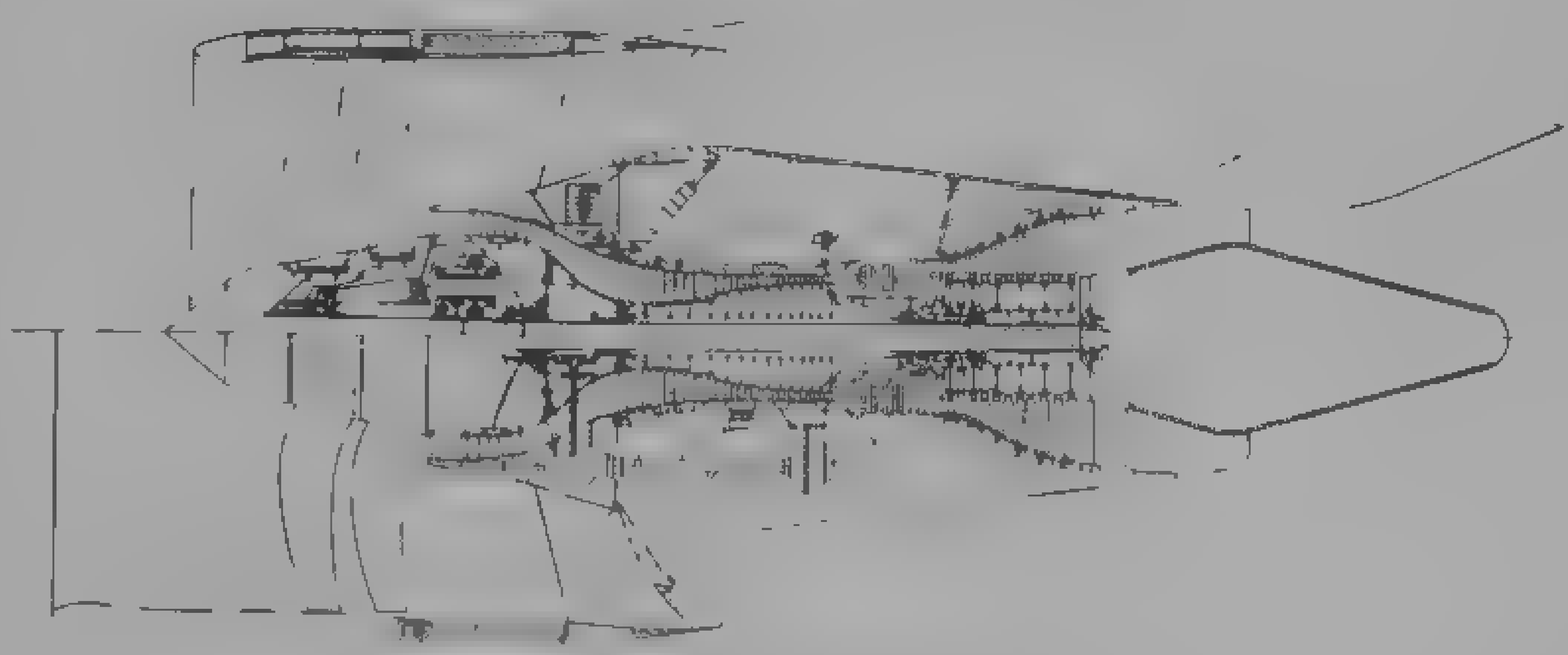
Subsonic cruise	26.9 mg/Ns (0.95 lb/h/lb)
Max mode	33.7 mg/Ns (1.19 lb/h/lb)

NEW ENTRY



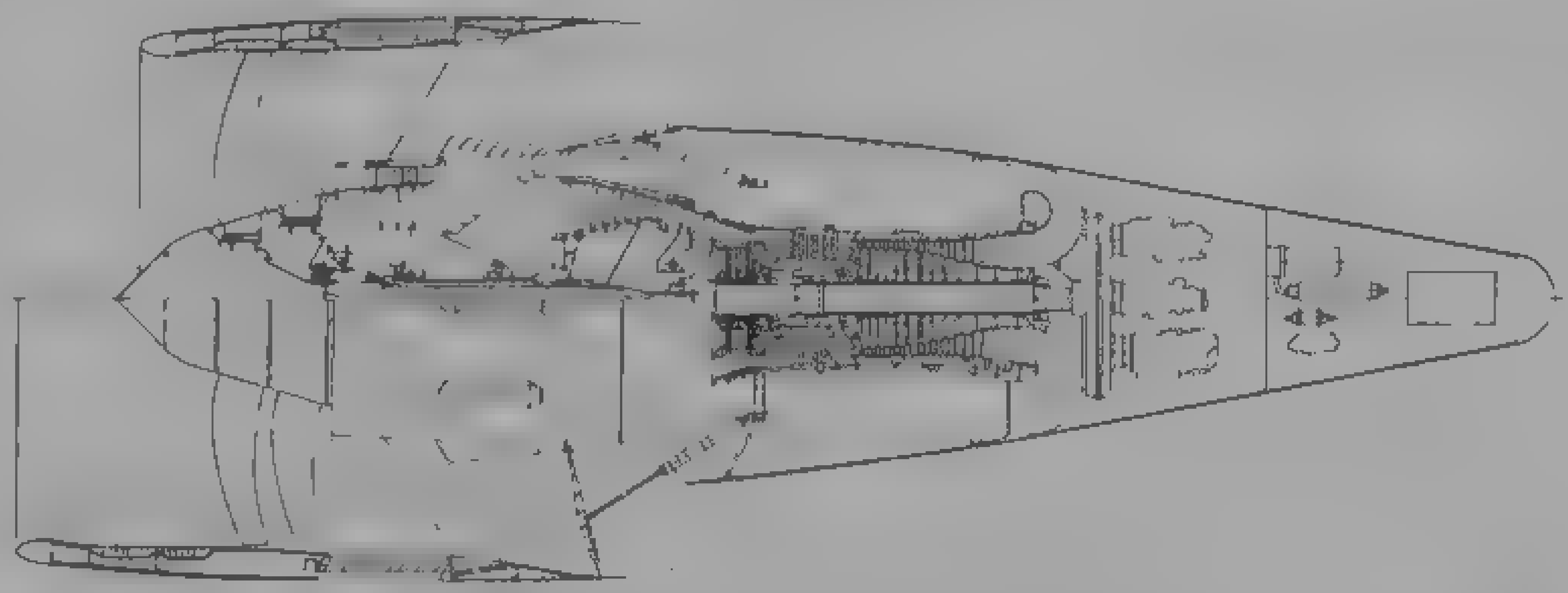
Aviadvigatel D-100 turbofan, showing reverser operation

1992



Aviadvigatel D-110 geared contrarotating propfan

1992



Aviadvigatel D-112 reverse-flow gearless propfan

1992

D-200 geared propeller version with Hartzell propeller (*Piotr Butowski*)

1994

D-100/110/112

The D-100 and D-110 are turbofans for the 1990s, based on the PS-90A core. The **D-100** would have a fan with a diameter of 2,350 mm (92.52 in), the bypass ratio being about 8. Overall pressure ratio would be 35, TET 1,310°C, dry weight 3,350 to 3,550 kg (7,385 to 7,826 lb), T-O thrust 19 to 20 tonnes (186.3 to 196.1 kN, 41,890 to 44,090 lb st) and sfc (cruise, 11 km, 36,000 ft, Mach 0.8) of 15.30 mg/Ns (0.54 lb/h/lb).

The **D-110** is a more advanced engine with a geared fan of 2,670 mm (105 in) diameter, giving a bypass ratio of 12 to 13. Overall pressure ratio would be 31, TET 1,282°C, dry weight 3,520 kg (7,760 lb), T-O thrust 20 tonnes (196.1 kN, 44,090 lb st) and sfc (cruise, same conditions) 14.73 mg/Ns (0.52 lb/h/lb).

Accompanying illustrations show the two engines together with an alternative gearless propfan, the **D-112**. This has some features resembling the Garrett ATF3, with the same double reverse-flow arrangement, accessories being at the rear and the core jet being turned 180° to escape into the fan duct. This enables existing gas generator modules to be used for engines of super high-bypass ratio, typically 15, as the fan shafts are not passed through the core.

UPDATED

D-200

This engine is based on the VAZ-4305 (see under VAZ on later page). It is being marketed for the Mi-34V helicopter and for other light multipurpose aircraft. The data refer to the propeller version as illustrated.

TYPE: Liquid-cooled twin-rotor engine

FUEL: Mogas 91 to 95 octane

IGNITION: Dual coil/plug per rotor

DIMENSIONS:

Length	990 mm (39.0 in)
Width	623 mm (24.5 in)
Height	690 mm (27.2 in)
WEIGHT, DRY:	145 kg (320 lb)
RATING:	162 kW (217 hp)
OUTPUT SPEED:	2,700 rpm
TORQUE:	28 kg-m (202.5 lb-ft)
OPERATING LIMITS:	±50°C, 0-4000 m (13,123 ft)
SPECIFIC FUEL CONSUMPTION:	85.4 µg/J (0.506 lb/h/hp)

VERIFIED

AVIADVIGATEL — *see JSC 'Aviadvigatel'*

BAKANOV — *see VOKBM*

CHERNYSHOV

MOSCOW MACHINE-BUILDING PRODUCTION ASSOCIATION NAMED FOR V. V. CHERNYSHOV

121362 Moscow
Telephone: 7 (095) 491 5722
Telex: ELIKA

This series production factory makes the RD-33 and TV7-117, both designed by Klimov Corporation.

VERIFIED

GALIGUSOV

V. I. Galigusov was a Chief Designer in the Rybinsk KB, see RKBM.

VERIFIED

GAVRILOV

V. Gavrilov was Chief Designer of the R-13-300 and R-25 afterburning turbojets described under Soyuz (Tumansky).

VERIFIED

GLUSHENKOV — *see Mars*

ISOTOV — *see Klimov*

IVCHENKO — *see ZMKB Progress under Ukraine*

KHACHATUROV

K. Khachaturov was Chief Designer of the R-27, R-29 and R-35 families of engines, within the Mikulin/Tumansky bureau (see Soyuz).

VERIFIED

KKBM

KUIBYSHEV ENGINE DESIGN BUREAU

SSPE Trud, 443026 Samara 36
Telephone: 7 (8846) 250 02 28
Fax: 7 (8846) 250 39 79

This is the bureau formerly named for N. D. Kuznetsov. Engines begun under his direction but constructed later, and all work on LH_2 (liquid hydrogen) and LNG (liquid natural gas) are listed under Samara. See also Trud. Details of the P-020 and P-065 small piston engines appeared in the 1992-93 *Jane's*.

VERIFIED

NK-12M

Designed at Kuibyshev in 1947-52 as the **TV-12**, under N. D. Kuznetsov and former German engineers, the NK-12M is the most powerful turboprop in the world. The **NK-12M** developed 8,948 ekW (12,000 ehp). The **NK-12MV** is rated at 11,033 ekW (14,795 ehp) and powered the Tu-114, driving four-blade contrarotating propellers of 5.6 m (18 ft 4 in)

diameter. As the **NK-12MA**, rated at 11,185 kW (15,000 shp), it powers the An-22, with propellers of 6.2 m (20 ft 4 in) diameter. A further application is in the Tupolev Tu-95/-142 bomber and its derivatives, and Tu-126, all usually powered by the NK-12MV. A single **NK-12MK** provides propulsion for the Orlyonok family of Ekranoplans. Tandem engines provide cruise propulsion for the Sukhoi S-90-200.

The NK-12M has a 14-stage axial flow compressor. Pressure ratio varies from 9 to 13 according to altitude, and variable inlet vanes and blow-off valves are necessary. A can-annular type combustion system is used: each flame tube is mounted centrally on a downstream injector, but all tubes merge at their maximum diameter to form an annular secondary region. The single turbine is a five-stage axial. Mass flow is 65 kg (143 lb)/s.

The casing is made in four portions, from sheet steel, precision welded. An electric control for variation of propeller pitch is incorporated, to maintain constant speed.

DIMENSIONS

Length	6,000 mm (236.2 in)
Diameter	1,150 mm (45.3 in)
WEIGHT, DRY:	2,350 kg (5,181 lb)

PERFORMANCE RATINGS (NK-12MV)

T-O	11,033 ekW (14,795 ehp)
Nominal power	8,826 ekW (11,836 ehp) at 8,300 rpm
Idling speed	6,600 rpm

KKBM NK-12MV turboprop *(Piotr Butowski)*

1992

NK-8

The NK-8 was developed through a number of variants, the most powerful of which is the NK-144. Basic versions are the 99.1 kN (22,273 lb st) **NK-8-4**, later uprated to 103 kN (23,150 lb st), which originally powered the Il-62, and the 93.2 kN (20,950 lb st) **NK-8-2** which was the original engine of the Tu-154. The **NK-8-2U** powered the Tu-154B-2. The NK-8-4 remains in service with several Il-62 (not Il-62M) operators. It led to the NK-86 described later. Twin **NK-8-4K** engines provide starting power for the Orlyonok family of Ekranoplans.

TYPE: Two-shaft turbofan.

FAN: Two-stage axial, with anti-flutter sweptback blades on first rotor stage. Pressure ratio 2.15 at 5,350 rpm. Bypass ratio 1.02 (NK-8-2, 1.00).

COMPRESSOR: Two IP stages on fan shaft. Six-stage HP compressor. Construction almost wholly of titanium. Core pressure ratio, 10.8 at 6,950 HP rpm (NK-8-2, 10 at 6,835 rpm).

COMBUSTION CHAMBER: Annular, with 139 burners.

FUEL GRADE: T-1 and TS-1 to GOST 10227-62 or T-7 to GOST 12308-66 (equivalent to Avtur 50).

TURBINE: Single-stage HP turbine, two-stage LP turbine, all with shrouded rotor blades, air-cooled discs and hollow nozzle blades (stators). Gas temperature, not over 870°C (1,143°K) ahead of turbine, not over 670°C (NK-8-2, 650°C) downstream.

JETPIPE: Mixer leads bypass flow into common jetpipe which may be fitted with blocker/cascade type reverser giving up to 48 per cent (NK-8-2, 45 per cent) reverse thrust, and noise suppressor.

LUBRICATION: Continuous pressure feed and recirculation. Pressure not less than 2.28 bars (33 lb/sq in).

OIL GRADE: Mineral oil MK-8 or MK-8P to GOST 6457-66 (DERD 2490 or MIL-O-6081B).

ACCESSORIES: These include automatic flight deck warning of vibration, ice and fire. All grouped beneath fan duct casing. RTA-26-9-1 turbine temperature controller by Smiths Industries.

STARTING: HP spool driven by constant-speed drive type PPO-62M, or started pneumatically by air from TA-6 APU from ground hose or by air bleed (NK-8-2, pneumatic only).

DIMENSIONS

NK-8-4: Length, no reverser	5,100 mm (201 in)
NK-8-2: Length, with reverser	5,288 mm (208.19 in)
Length, no reverser	4,762 mm (187.48 in)
Diameter	1,442 mm (56.8 in)

WEIGHT, DRY:

NK-8-4: no reverser	2,100 kg (4,629 lb)
with reverser	2,400 kg (5,291 lb)
NK-8-2: no reverser	2,100 kg (4,629 lb)
with reverser	2,350 kg (5,180 lb)

PERFORMANCE RATINGS:

NK-8-4: T-O rating	103.0 kN (23,150 lb st)
Cruise rating at 11,000 m (36,000 ft) and 458 kts (850 km/h; 530 mph)	27.0 kN (6,063 lb)
NK-8-2: T-O rating	93.2 kN (20,950 lb st)
NK-8-2U: T-O rating	103.0 kN (23,150 lb st)

SPECIFIC FUEL CONSUMPTION:

At cruise rating at 11,000 m (36,000 ft) and 458 kts (850 km/h; 530 mph)

NK-8-4	22.1 mg/Ns (0.78 lb/h/lb)
NK-8-2	21.53 mg/Ns (0.76 lb/h/lb)

NK-22

Two-shaft augmented turbofan qualified 1967 at 158.9 kN (35,715 lb st) dry and 215.76 kN (48,500 lb st) maximum.

NK-25

Two-shaft augmented turbofan qualified 1977 at 186.4 kN (41,900 lb st) dry and 245.2 kN (55,115 lb st) maximum.

VERIFIED

NK-44

Projected three-shaft turbofan, 392 kN (88,180 lb st).

VERIFIED

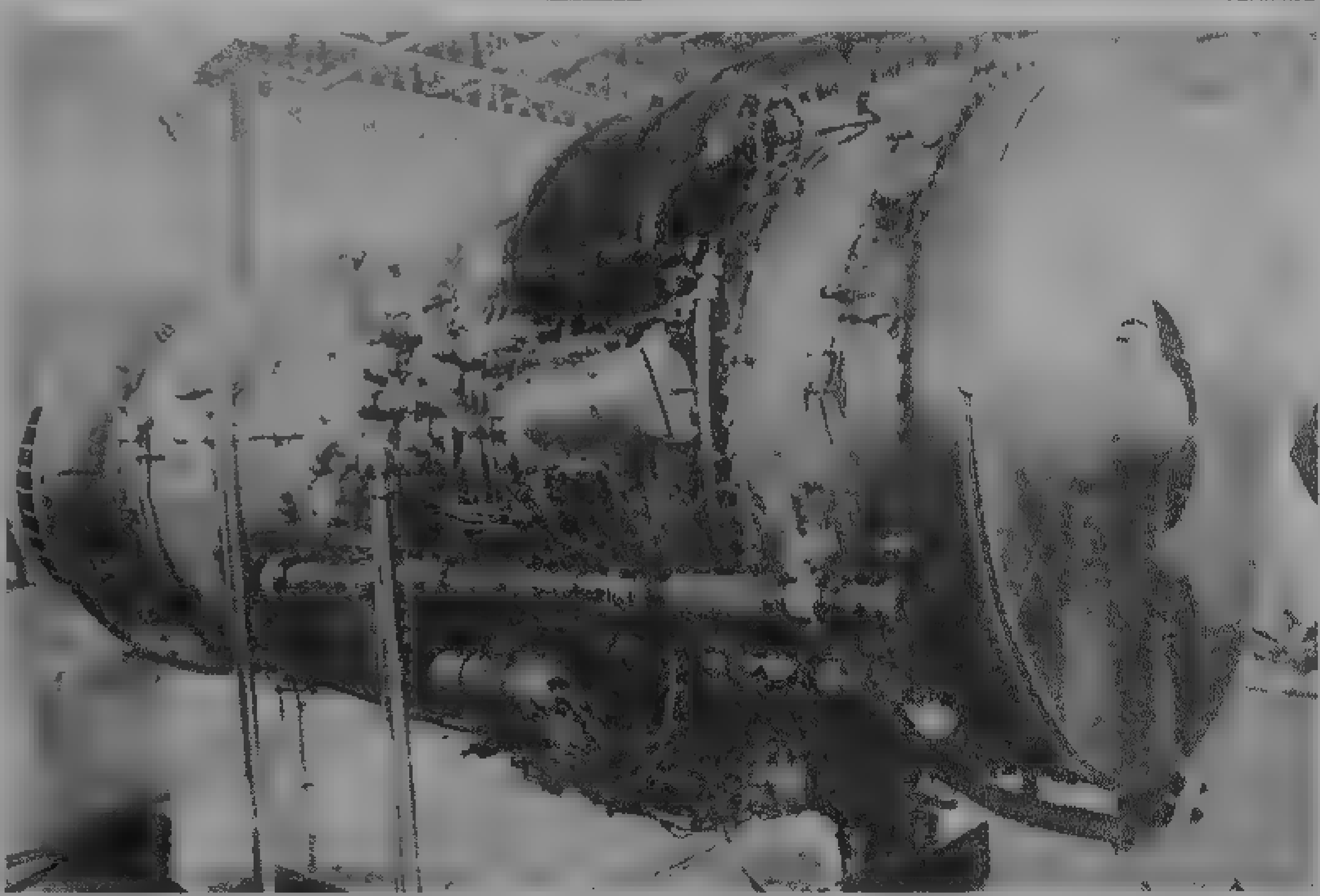
NK-86

This turbofan of 127.5 kN (28,660 lb st) is closely related to the NK-8 series. Four power the Il-86 with combined reversers and noise attenuators.

NK-144

Brief details of this family of SST engines last appeared in the 1991-92 *Jane's*.

VERIFIED



KKBM NK-86 two-shaft turbofan *(Flight International)*

1990

KLIMOV CORPORATION

ST PETERSBURG NPO IM. KLIMOV

13 Kantemirovskaya Street, 184100 St Petersburg
Telephone: 7 (245) 00 35
Fax: 7 (245) 33 55
Telex: 121282 JET SU
GENERAL DESIGNER: Alexander Alexandrovich Sarkisov
CHIEF DESIGNER: Piotr D. Gavra
DEPUTY GENERAL MANAGER: Andrei P. Listratov

The great design bureau and factory at what used to be Leningrad, the former Factory No. 117, was a major centre for high-power piston engines developed under Vladimir Yakovlyevich Klimov. In 1946 it was selected to build the Rolls-Royce Nene turbojet, later developed as the Klimov VK-1. Klimov was succeeded by his deputy, Sergei Pietrovich Isotov, who developed gas turbines mainly for helicopters but who in 1968 moved into the field of fighters. Isotov died in 1983 and was succeeded by Vladimir Styepanov (who retired early) and Alexander Sarkisov, but today the bureau has been renamed for its founder, and the '117' is continued in its engine designations.

Engines designed by NPO Klimov are manufactured at Perm (Sverdlov) and Zaporozhye (Motorostroitel), except for the TV7-117 which is in production at the Chernishov factory (Moscow) and Mars (Omsk), and the RD-33, made by Chernishov. June 1993 link with P&W Canada.

VERIFIED

TV2-117

The power plant of the Mi-8 comprises two **TV2-117A** engines coupled through a VR-8A gearbox. The complete package incorporates a control system (separate from the control system of each gas generator) which maintains desired rotor speed, synchronises the power of both engines, and increases the power of the remaining engine if the other should fail.

TV2-117TG Qualified to operate on a normal gas turbine fuels, and on gasoline (petrol), benzine, diesel or liquefied natural gas, propane or butane gas. Flown on Mi-8TG ratings unchanged, and selected as interim engine for Mi-38. A foreign production facility is sought.

TYPE: Free turbine helicopter turboshaft.

COMPRESSOR: Ten-stage axial. Inlet guide vanes and stators of stages 1, 2 and 3 are variable. Pressure ratio 6.6 at 21,200 rpm.

COMBUSTION CHAMBER: Annular, with eight burner cones.

FUEL GRADE: T-1 or TS-1 to GOST 10227-62 specification (Western equivalents, DERD 2494, MIL-F-5616).

TURBINE: Two-stage axial compressor turbine with solid blades. Two-stage free power turbine.

OUTPUT SHAFT: Conveys torque from the free turbine to the overrunning clutch of the main gearbox (VR-8A) and also to the speed governor. Maximum output speed 12,000 rpm, main rotor speed 192 rpm.

ACCESSORIES: Engine control system includes fuel, hydraulic anti icing, gas temperature restriction, engine electric supply and starting, and monitoring systems. Up to 1.8 per cent of the mass flow can be used to heat the intake and other parts liable to icing. Fire extinguishant can be released by the pilot

LUBRICATION: Pressure circulation type. Oil is scavenged from the five main bearings by the lower pump, returned through the air/oil heat exchanger and thence to the tank

OIL GRADE: Synthetic, Grade B-3V to MRTU 38-1-157-65 (nearest foreign substitute Castrol 98 to DERD 2487)

STARTING: The SP3-15 system comprises DC starter/generator, six storage batteries, control panel, ground supply receptacle, and control switches and relays; airframe mounted except the GS-18TP starter/generator. The ignition unit comprises a control box, two plugs, solenoid valve, and switch. The starting fuel system comprises an automatic unit on the NR 40V pump, constant pressure valve, and two igniters

DIMENSIONS:

Length overall	2,835 mm (111.5 in)
Width without jetpipe	547 mm (21.5 in)
Height	745 mm (29.25 in)

WEIGHT, DRY:

Engine, without generator etc	338 kg (745 lb)
VR-8A gearbox, less entrapped oil	745 kg (1,642 lb)

PERFORMANCE RATINGS:

Max	1,250 kW (1,677 shp)
T-O (S/L, static)	1,118 kW (1,500 shp)
Max continuous	895 kW (1,200 shp)
Cruise (122 kts, 225 km/h; 140 mph at 500 m, 1,640 ft)	746 kW (1,000 shp)

SPECIFIC FUEL CONSUMPTION:

T-O, as above	102.4 µg/J (0.606 lb/h/shp)
Cruise, as above	115.4 µg/J (0.683 lb/h/shp)

VERIFIED

TV3-117

This second-generation turboshaft has been produced in very large numbers. Bench testing began in 1974, the first flight was in 1976 and series production began in 1978.

TV3-117BK. Electronic control. Rated at 1,618 kW (2,170 shp). Powers some Ka-27s and Ka-28.

TV3-117MT. 1,434 kW (1,923 shp). Powers Mi-8T/TB/TBK, -14, -17, -24.

TV3-117V. 1,633 kW (2,190 shp). Powers some Ka-27s, -29 and -32.

TV3-117VK. Electronic control. Rated at 1,618 kW (2,170 shp). Powers Ka-50.

TV3-117VM. Electronic control. Rated at 1,545 kW (2,070 shp) to 3,600 m (11,810 ft). Powers Mi-17-1VA, -25, -28 and -35.

Data below refer mainly to the MT.

TYPE: Free turbine turboshaft

COMPRESSOR: Ten-stage axial. Inlet guide vanes and first three stators variable. Pressure ratio 7.5

COMBUSTION CHAMBER: Annular, improved version of TV2-117

TURBINES: Two-stage gas generator turbine, improved from TV2-117. Two-stage power turbine

OUTPUT: As TV2-117 but more compact jetpipe

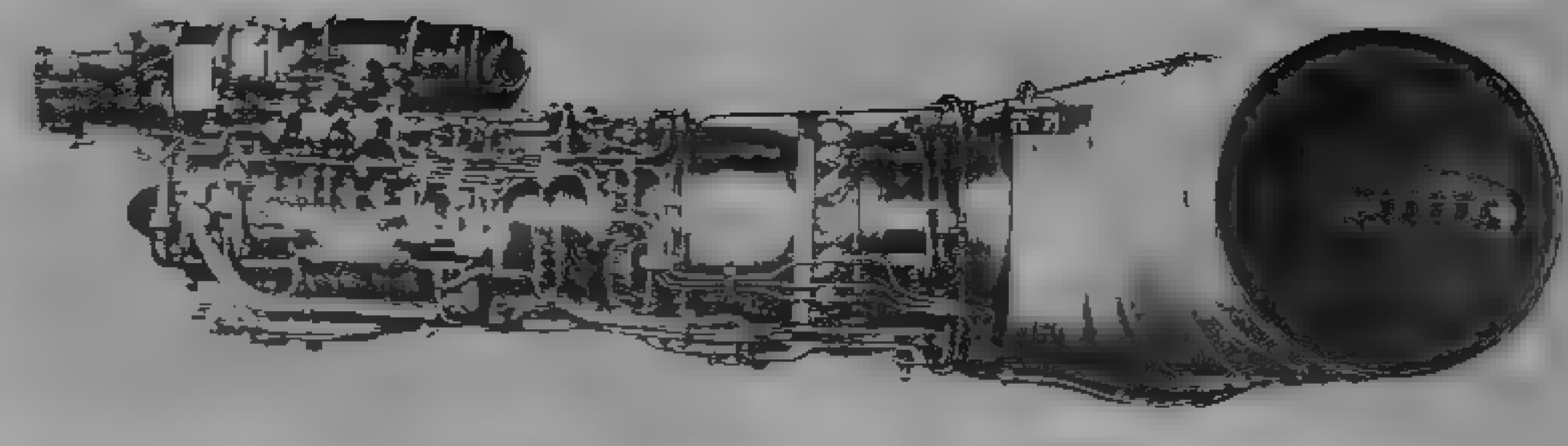
STARTING: BK, MT, pneumatic air turbine; V, VK, VM electric

DIMENSIONS:

Length	2,085 mm (82.1 in)
Width	640 mm (25.2 in)
Height	725 mm (28.5 in)

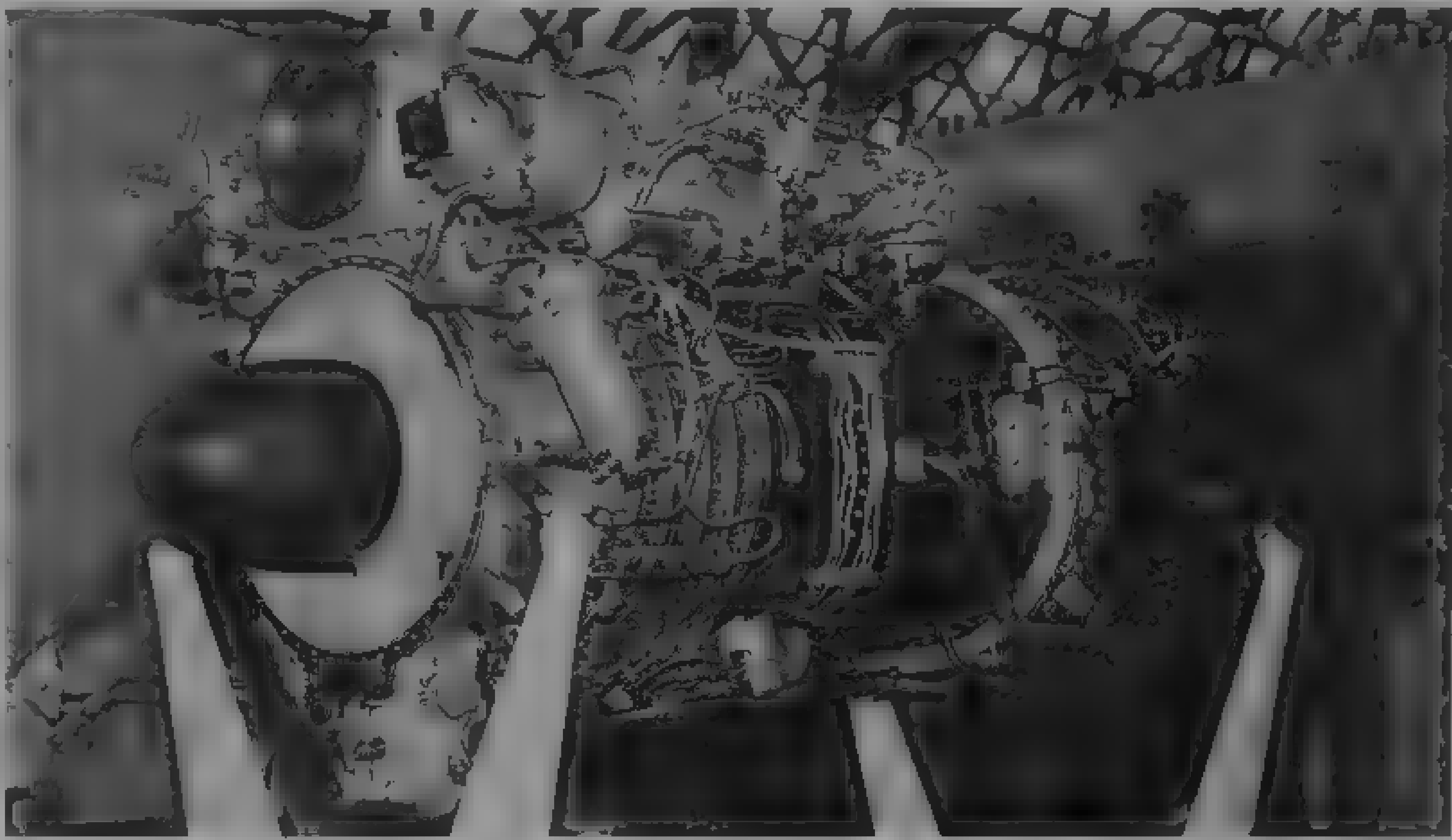
WEIGHT, DRY: 285 kg (628 lb)

PERFORMANCE RATINGS (S/L, max T-O): See variants



Klimov (Isotov) TV2-117A free turbine turboshaft

1975



Klimov TV3-117 free turbine turboshaft *(Piotr Butowski)*

1994

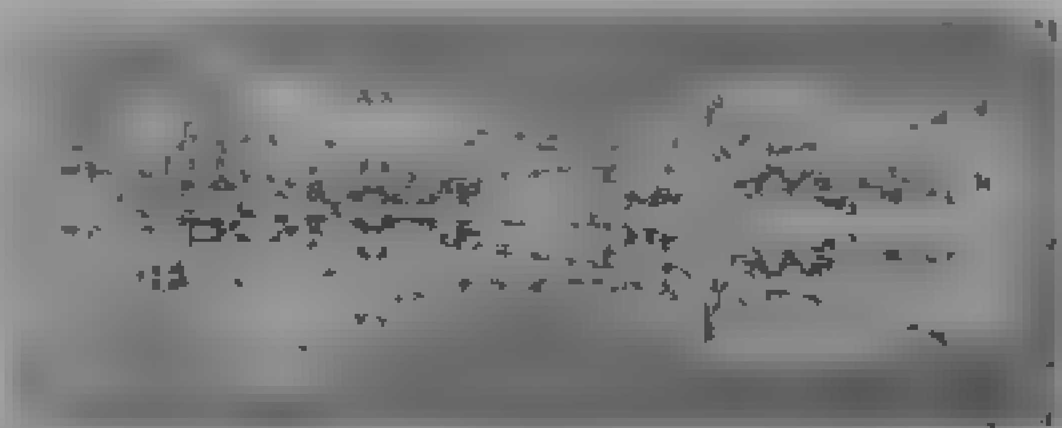
SPECIFIC FUEL CONSUMPTION:

Max T-O, TV3-117V	96.3 µg/J (0.57 lb/h/shp)

VERIFIED

TV7-117

Described as a third generation engine, the TV7-117 has a modular core incorporating advanced features and materials and envisaged as the basis for various jet and shaft engines. The initial turboprop version was flight tested on two Il-76s and the prototype Il-114. Drives Stupino SV-34 propeller with six composite blades. To have been certificated August 1992, with series production at Chernyshov and Mars (Omsk).



Longitudinal section of Klimov TV7-117V helicopter turboshaft

1999

TV7-117S. Turboprop version, selected (as **TV7-117-3**) to power the Il-114, produced in collaboration with Polish industry.

TVD-117E. Turboprop tailored to Ekranoplan propulsion, rated at 1,840 kW (2,467 shp). Three power the Raketa 2.2.

TV7-117V. Turboshaft version. Flat rated at 1,728 kW (2,318 shp) to 2,700 m (8,860 ft). OEI contingency 2,610 kW (3,500 shp) at S/L only. Powers Mi-38. Subject of agreement with Eurocopter (see Mil in aircraft section).

L-3000. Uprated version for Chinese aircraft at present powered by WJ5.

A growth core with two centrifugal stages is under development. Output will be in the 2,237 kW (3,000 shp) class, and will be unaffected by sand or dust. Other developments include liquefied gas fuels and a turbofan with T-O rating of 15.68 kN (3,527 lb st).

The following description refers to the basic Il-114 engine.

TYPE: Free turbine turboprop

COMPRESSOR: Annular ram inlet around reduction gear tapers to entry to five-stage axial compressor, with variable inlet guide vanes and next two stators, followed by centrifugal stage on same shaft. Pressure ratio 16

COMBUSTION CHAMBER: Annular folded reverse flow. Minimum pollution with wide range of fuels, including LNG and LPG

TURBINES: Two-stage gas generator turbine with cooled blades. Entry temperature 1,242°C. Two-stage power turbine

REDUCTION GEAR: Planetary type, with new tooth profiles and anti-vibration mountings

CONTROL SYSTEM: Full authority electronic, with separate automatic control for ground and flight operation

STARTING: Pneumatic air turbine, mass flow 0.2 kg (0.44 lb)/s

DIMENSIONS:

Length	2,143 mm (84.37 in)
Height	940 mm (37.0 in)
Width	886 mm (34.88 in)

WEIGHT, DRY: 520 kg (1,146 lb)

PERFORMANCE RATINGS:

Max T-O	1,839 kW (2,466 shp) to 35°C and 250 m (820 ft)
Cruise (6,000 m; 19,685 ft at 270 kts, 500 km/h, 311 mph)	1,342 kW (1,800 shp)

SPECIFIC FUEL CONSUMPTION:

Cruise, as above	67.09 µg/J (0.397 lb/h/shp)

VERIFIED

Klimov TV7-117-3 (117C) turboprop with six blade propeller for Ilyushin Il-114 *(Piotr Butowski)*

1994

TV7-46

Tupolev gave this as the designation of the large turbofan, burning refrigerated LNG fuel, chosen to power the Tu-306 wide-body transport project. No relation to TV7 turboprop.

NEW ENTRY

PK6A

Licensed P&WC PT6A turboprops include the PK6A-65B for the Be-32, PT6K-62 for PZL Orlik, PT6K-25A for Euromil TVA-3000, PT6K-66 for Myasishchev M-102 and PT6K-67

NEW ENTRY

PK100

The first of this family is the PK127, for export versions of An-140. A more powerful (turboshaft) version will be an option on the Mi-38 helicopter

NEW ENTRY

RD-33

The contract for this important fighter engine was won in competition with two other engine bureaux, and it was designed before Isotov's death. Detail design began in 1968, meeting the requirements of the MiG-29, and the first bench run took place in 1972. Deliveries were initiated in 1976, and mass production at Chernyshov and Omsk followed in 1981. It powers all known MiG-29 versions and is offered as the engine of an upgraded MiG-21.

RD-33K. Uprated version, with greater air flow and increased turbine entry temperature, 86.0 kN (19,335 lb st). Powers MiG-29K and -29M.

RD-33/191 Hot-end improvements to extend TBO from 800 to 1,200 hours. Adopted by Luftwaffe.

The following refers to the original production RD-33

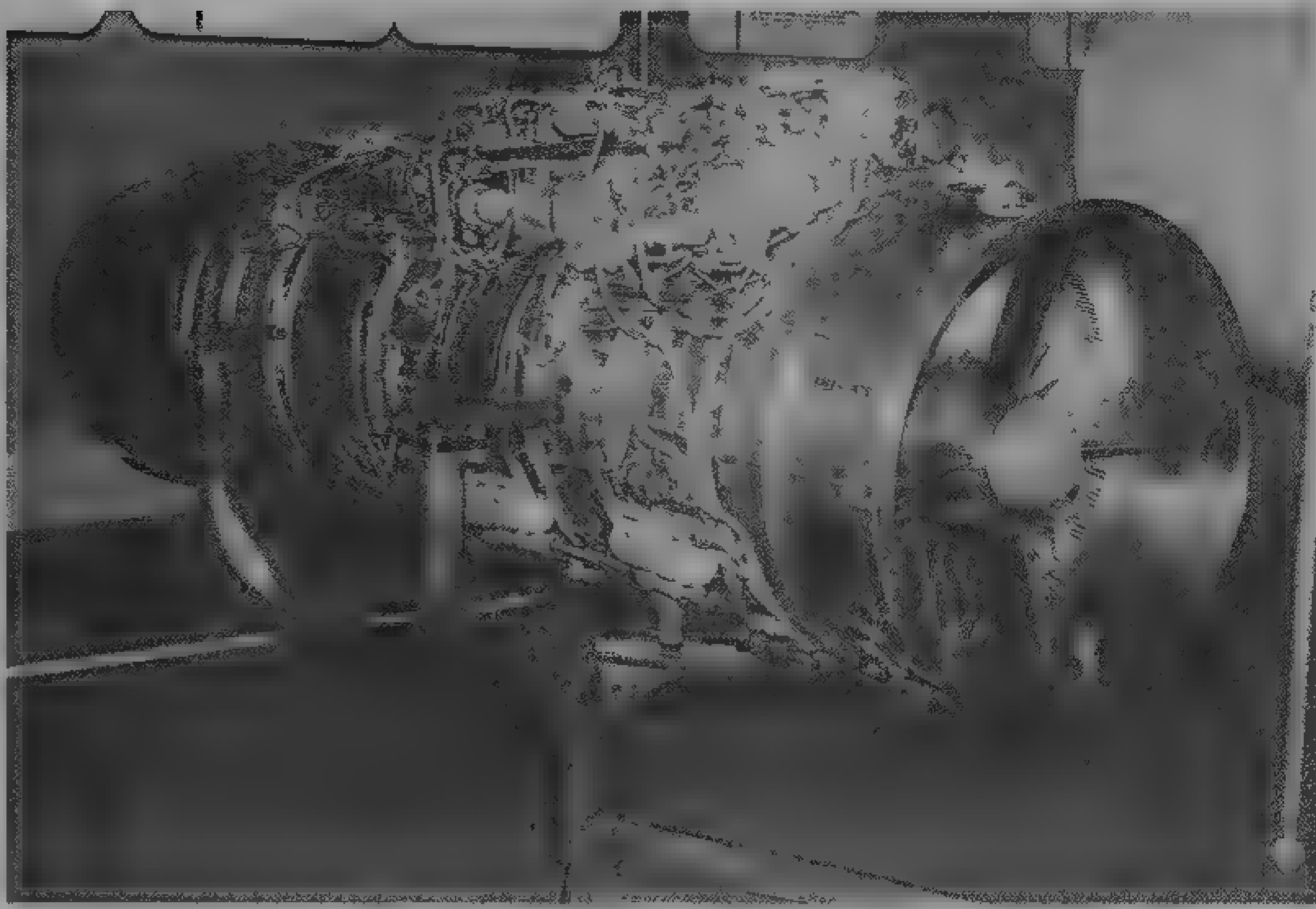
TYPE: Two-shaft afterburning bypass turbojet (low ratio turbofan)

LP COMPRESSOR: Four stages. Front bearing carried in four-strut nose, but no inlet guide vanes. Maximum air flow 76.0 kg (167.5 lb)/s. Bypass ratio 0.4

HP COMPRESSOR: Nine stages. Overall pressure ratio 20

COMBUSTION CHAMBER: Annular with air-blast fuel nozzles giving generally smokeless combustion of a range of fuels

TURBINES: Single-stage HP turbine with single-crystal cooled blades. Entry gas temperature 1,397°C. Single-stage LP turbine



Klimov RD-33 augmented bypass turbojet *(Paul Jackson)*

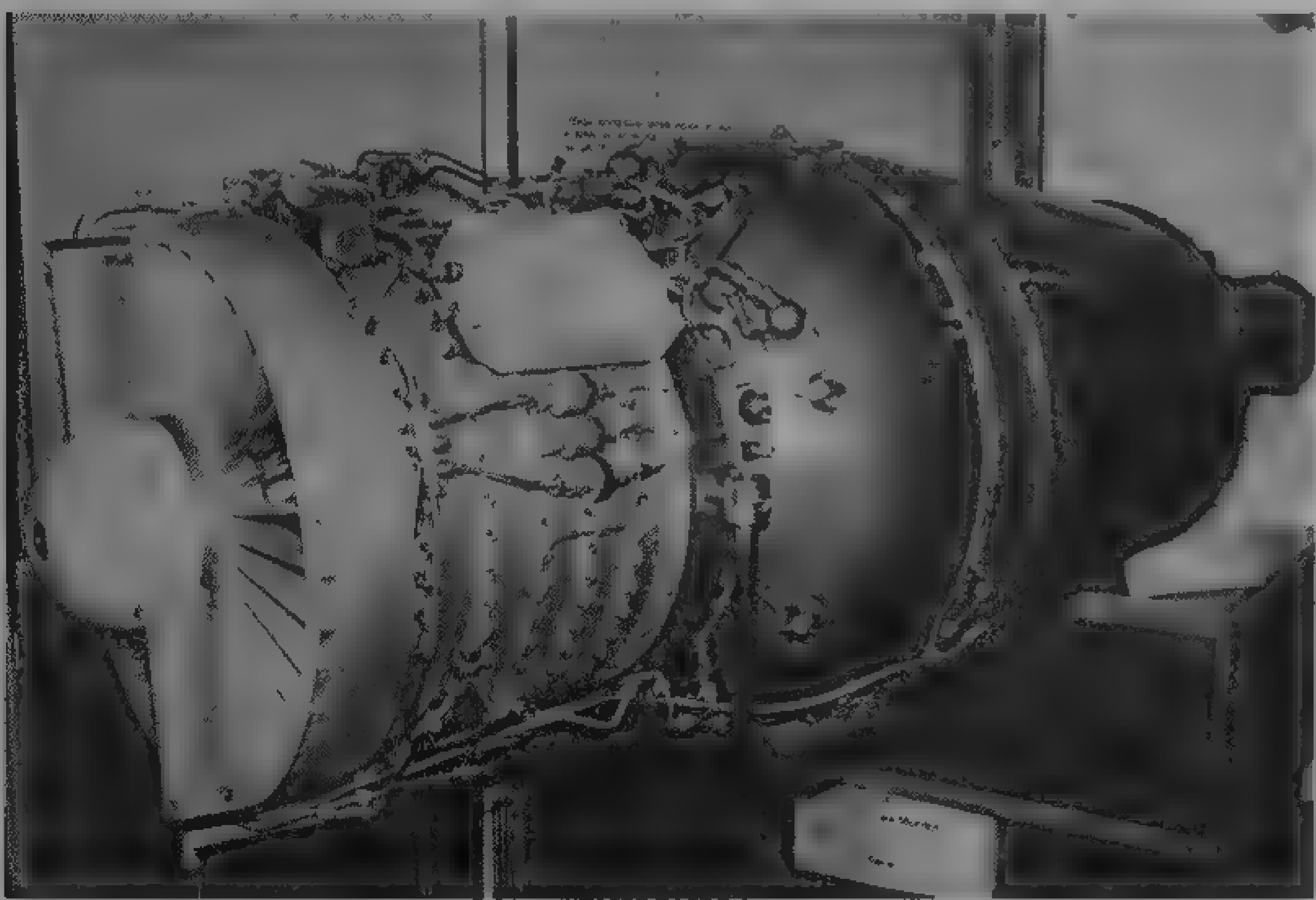
1995

AFTERBURNER: Combustion in both core and bypass flows. Nozzle with fully variable area and profile in primary and secondary flows. Outer nozzle has 24 flaps. Vectoring nozzles under preliminary development by CIAM and Soyuz

ACCESSORIES: Oil tank, hydromechanical fuel control and auxiliaries grouped above engine to reduce cross-section. Closed lubrication system functions under all positive or negative g-loads. Multipurpose self-diagnostic system

DIMENSIONS	
Length	4,229 mm (166.5 in)
Max diameter	1,000 mm (39.37 in)
WEIGHT, DRY	
Bare engine	1,055 kg (2,326 lb)
Complete power plant	1,217 kg (2,683 lb)
PERFORMANCE RATINGS (S/L)	
Max augmented	81.4 kN (18,300 lb st)
Max dry	49.4 kN (11,110 lb st)
SPECIFIC FUEL CONSUMPTION	
Max augmented	58.06 mg/Ns (2.05 lb/h/lb st)
Max dry, S/L	20.95 mg/Ns (0.74 lb/h/lb st)

VERIFIED



Klimov RD-60A two-shaft turbofan *(Piotr Butowski)*

1992

RD-93

Reported designation for power plant of Chengdu FC-1 fighter, revealed June 1995 and stated to be development of RD-33. Chinese sources quote augmented thrust of 81.4 kN (18,300 lb st)

NEW ENTRY

KLIMOV/AEROSUD SMR-95

This fighter engine is a derivative of the RD-33, with identical thrust values, developed in partnership with Aerosud of South Africa. It is part of a larger collaboration including Mikoyan and Atlas. The SMR-95 is being tested in a Mirage F1, and is aimed at this aircraft, as well as the Cheetah D (flight trials due 1995) and upgrades of the MiG-2

NEW ENTRY

KLIMOV RD-60A

In 1990 the RKBM (Novikov) RD-60 was developed into the RD-60A two-shaft turbofan of 24.21 kN (5,511 lb st) for use in a future advanced trainer to replace the Czech L-29 and L-39, for which five airframe OKBs were competing in 1992. In the MiG-AT this engine has now been replaced by the French Turbomeca-SNECMA Larzac, an engine dating from 1968

VERIFIED

KOBCHYENKO — *see Mars and Soyuz*

KOLIESOV — *see RKBM*

KUZNETSOV

Kuibyshev

Nikolai D. Kuznetsov was deputy to General V. Ya. Klimov during the Second World War. In the late 1940s his own bureau developed large turboprops and turbofans. A selection of these engines are described under KKBM and Samara/Trud

VERIFIED

LOTAREV — *see ZMKB Progress under Ukraine*

LYULKA — *see Saturn*

OMSK AIRCRAFT ENGINE DESIGN BUREAU 'MARS'

644021 Omsk 21
Telephone: 7 (3812) 33 49 81, 33 00 84
Telegraph. Omsk 21 MARS
Teletype. Omsk 3274 MARS
Telex. 133112 + MARS SU

This bureau was formerly headed by Glushenkov. Development, in partnership with CIAM (Central Institute for Aviation Motors) began in 1957. The first product was the 224 kW (300 hp) GTD-1, followed by the GTD-5 and -5M, which continue in production. The first major engine for aircraft propulsion was the GTD-3, produced from 1964 as a twin package plus common reduction gear for helicopters. In 1970 came the TVD-10 turboprop. Apart from APUs, the latest Mars engines are the TVD-20 and TV-O-100 (see Soyuz).

The associated Omsk (OMKB) production factory produces several types of engine, including the RD 33 and TV7-117.

VERIFIED

TVD-10

Military designation GTD-3

This free turbine engine was developed to power the Kamov Ka-25 helicopter. The civil turboshaft was licensed to Poland for production, and a description appears under WSK-PZL Rzeszow. Ka-25 engines were made in the Soviet Union, the **GTD-3F** being rated at 671 kW (900 shp) and the **GTD-3BM** at 7[illegible] kW (990 shp).

The **TVD-10B** is the turboprop version selected to power the An-28 and Aeroprogress/Roks-Aero T-101, and is a candidate engine for the T-106 and T-501. This engine is produced in Poland as the **TWD-10B**, as described under WSK-PZL Rzeszów. The Omsk design bureau is developing the **TVD-10BA**, rated at 790 kW (1,060 shp) for the An-28A for Polar operations.

UPDATED

TVD-20

This turboprop was to be fitted to the production An-3, and has been selected to power the Aeroprogres Roks-Aero T-101V. It uses a derivative of the TVD-10B gas generator, with a zero stage (to a total of seven) on the compressor and a second stage on the power turbine.

COMPRESSOR: Seven axial stages plus one centrifugal. Inlet faces aft.

COMBUSTION CHAMBER: As TVD-10B.

TURBINES: Two-stage gas-generator turbine. Two-stage free power turbine.

PROPELLER DRIVE: Quill shaft leads forward from power turbine to drive two-stage gearbox with accessory drives above. Drive to AV-17 reversible-pitch propeller incorporates brake for safe loading of chemicals with engine running.

ACCESSORIES: Two 27 V electric starters, provision for dusting or spraying pumps.

DIMENSIONS:

Length	1,770 mm (69.7 in)
Width	850 mm (33.5 in)
Height	845 mm (33.3 in)
WEIGHT, DRY:	285 kg (628 lb)

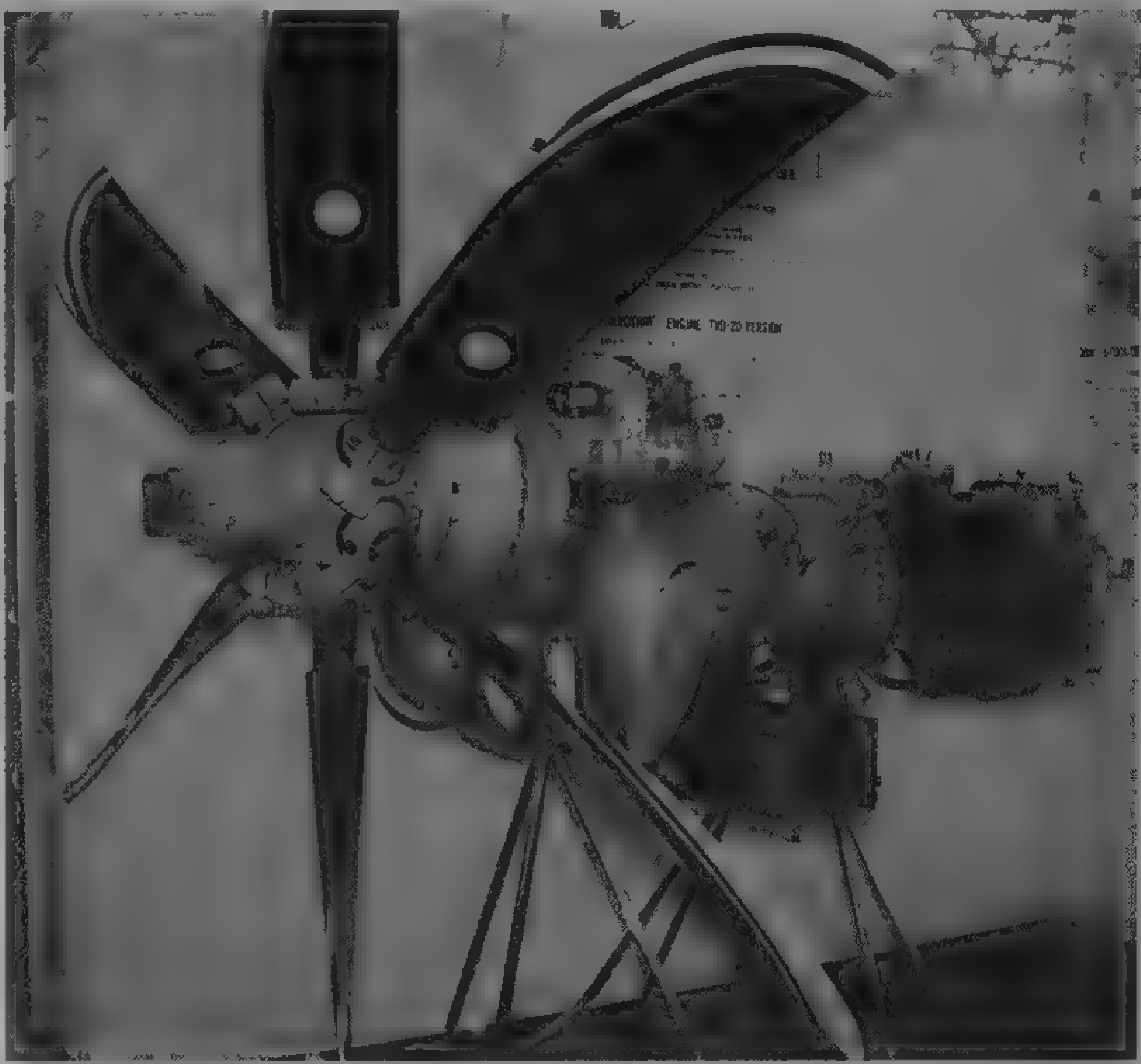
PERFORMANCE RATING (S/L):

T-O	1,029 kW (1,380 shp)

SPECIFIC FUEL CONSUMPTION:

T-O as above	85.4 μg/J (0.506 lb/h/shp)

UPDATED



Omsk MKB 'Mars' TVD-20 turboprop *(Piotr Butowski)*

1994

METSKHVARISHVILI — *see Soyuz*

MIKULIN

A. A. Mikulin was a leading designer of engines from 1916. The bureau is today called Soyuz.

VERIFIED

MNPK — *see Soyuz*

MOTOROSTROITEL — *see ZMKB Progress under Ukraine*

NOVIKOV — *see RKBM*

OMSK, OMKB — *see Mars*

PERM — *see JSC 'Aviadvigatel'*

PROGRESS — *see ZMKB Progress under Ukraine*

RKBM (RYBINSK ENGINE-BUILDING DESIGN OFFICE)

179 Lenin Avenue, 152903 Rybinsk, Jaroslavskaya oblast
Telephone: 7 (0855) 599301
Fax: 7 (0855) 520495
Telex: Start
MANAGING DIRECTOR AND CHIEF DESIGNER
Aleksandr S Novikov

This large design office has produced more than 50 types of engine under four General Designers (V A Dobrynin, P A. Kolesov, V I. Gal gazov and A S Novikov). It has a large research effort on non-metallic materials, especially carbon composites, silicon nitride and silicon carbide

UPDATED

DOBRYNIN VD-7

This large single-shaft turbojet was designed for the 3M (NATO 'Bison')

VD-7B Powered several production versions of 3M, rated at up to 127.5 kN (28,660 lb st). A different version was used as the outboard engines of the M-50 (NATO 'Bounder'). Ten (eight at the front for starting, two on the tail for cruise) powered the giant KM and *Lun* Ekranoplans in 1967-72

VD-7M. Version designed for supersonic flight, with afterburner for prototype Tu-105 and Tu-22 (NATO 'Blinder') and inboard positions of M-50; maximum rating 156.9 kN (35,275 lb st)

RD-7M-2 Developed engine for the production Tu-22 maximum rating 161 8 kN (36,376 lb st)

VD-7D RD-7M-2 with afterburner removed to give 105.4 kN (23,700 lb st) for VM-T *Atlant*

UPDATED

DOBRYNIN VD-19

Development of VD-7 with reduced diameter, to power Tu-28-80 prototype interceptors. Maximum rating with afterburner 127.5 kN (28,660 lb st)

UPDATED

KOLESOV RD-36-35

This was the first Soviet lift jet to go into production

RD-36-35FVR. Lift engine of Yak-36M (Yak-38), in twin installation

RD-36-35PR. Lift engine of Bartini VVA-14, two batteries of six

RKBM RD-36-51A turbojet (*Flight International*)

1990

TYPE: Single-shaft turbojet for operation in vertical attitude
COMPRESSOR: Six stages Air flow 45 3 kg (100 lb)/s
COMBUSTION CHAMBER: Annular, with 30 burners
TURBINE: Single-stage, with air impingement starting
NOZZLE: Fixed area and direction (usually 15° backward), no provision for vectoring

WEIGHT DRY	201 5 kg (444 lb)
PERFORMANCE RATING	29 9 kN (6,725 lb st)

VERIFIED

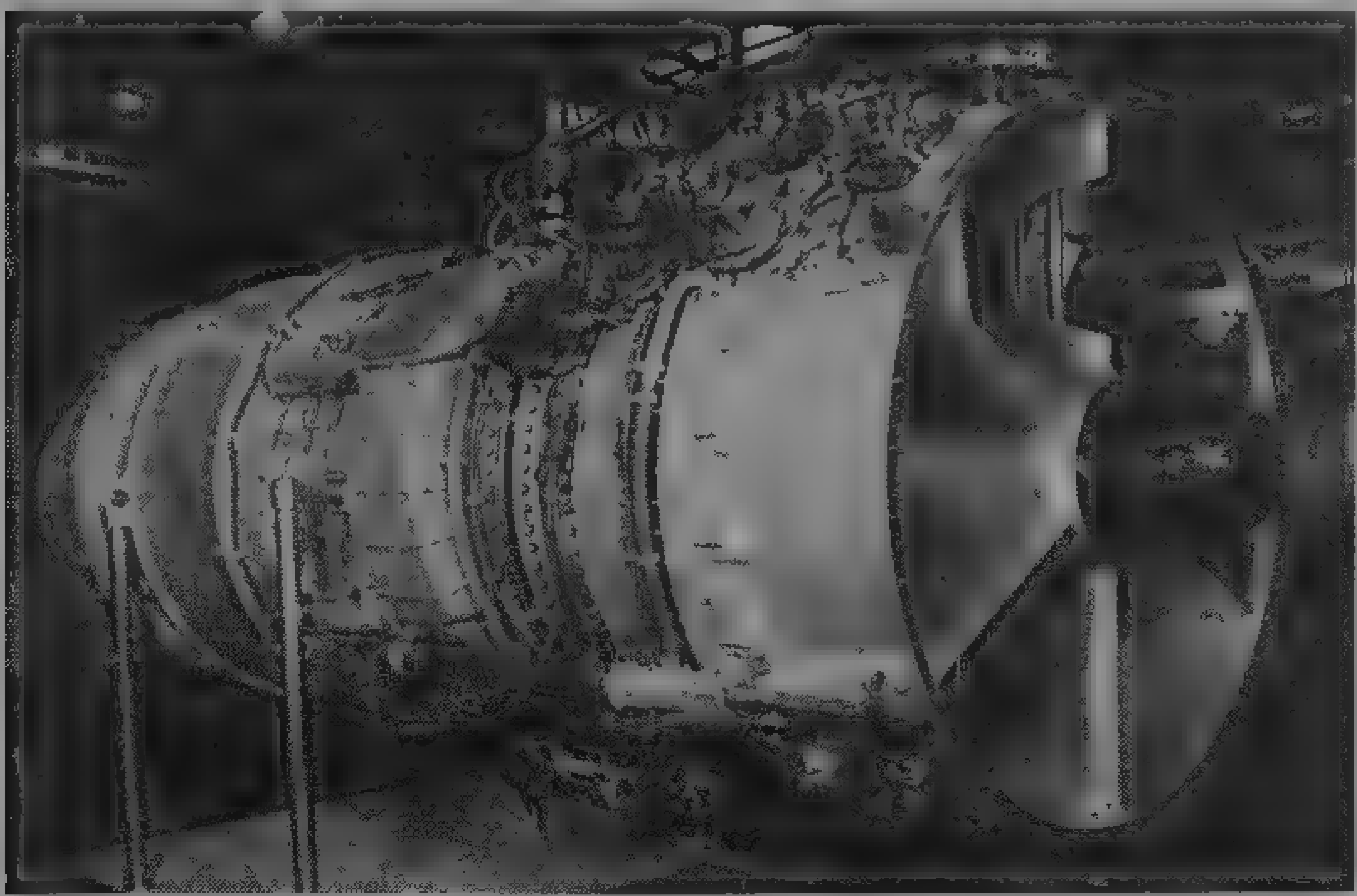
KOLESOV RD-36-51

Despite the similarity of designation, this engine has no connection with the RD-36-35

RD-36-51A. Designed for Tu-144D, cruising at Mach 2 2 *Following description applies to this version*

RD-36-51V. Simplified version with fixed nozzle, rated at only 68 6 kN (15 430 lb st) Powers Myasishchev M-17 Stratosfera

TYPE: Single-shaft turbojet
COMPRESSOR: Fourteen-stage axial with variable inlet vanes and first five and last five stator stages



RKBM Dobrynin VD-7 turbojet (without afterburner)

1993

Cutaway RKBM RD-36-35FVR lift turbojet (*Flight International*)

1990

COMBUSTION CHAMBER: Tubo-annular with 16 burners

TURBINE: Three-stage axial with cooled blades. Entry temperature 1,160°C

NOZZLE: Laval type with adjustable spike

ACCESSORIES: Airframe-mounted, driven via tower shaft and gearbox.

DIMENSIONS

Length	5,228 mm (205 8 in)
Diameter	1,415 mm (55 7 in)
WEIGHT DRY	4,125 kg (9,094 lb)
PERFORMANCE RATING (T-O)	196.12 kN (44,090 lb st)
SPECIFIC FUEL CONSUMPTION (M 2 2 cruise, hi-alt)	34.8 mg/Ns (1 23 lb/h/lb)

UPDATED

GALIGUZOV RD-38

This is the lift engine of the Yak 38M. Turbine entry gas temperature increased to 1,097°C

WEIGHT DRY	231 kg (509 lb)
PERFORMANCE RATING	31 87 kN (7,165 lb st)

VERIFIED

NOVIKOV RD-41

This lift engine was developed for the Yak-141 supersonic V/STOL aircraft. It is a fresh design, though owing something to the RD-36-35FVR Design began in 1982, and nearly 30 engines were produced before work was halted in late 1991.

TYPE: Single-shaft lift turbojet

COMPRESSOR: Seven stages. Made of titanium alloy with some composites. Air flow 53 5 kg (117 9 lb)/s

COMBUSTION CHAMBER: Minimum length annular, with fuel/air mixing taking place upstream. Material (except flame tube) titanium

TURBINE: Single-stage with high-nickel blades inserted in titanium disc Entry gas temperature 1,207°C

NOZZLE: Axi-symmetric, with two hydraulic rams on each side (four per engine), operating on aircraft fuel, to vector nozzle ±12 5° fore/aft

CONTROL SYSTEM: Three engines of Yak-141 are interlinked by three-channel FADEC During take-off and landing no pilot inputs to engines are needed Auxiliary hydromechanical control

DIMENSIONS

Length	1,594 mm (62 75 in)
Inlet diameter	635 mm (25 0 in)
WEIGHT DRY:	290 kg (639 lb)
PERFORMANCE RATING (ISA, S/L):	40.21 kN (9,040 lb st)

UPDATED

RKBM RD-41 lift turbojet *(Piotr Butowski)*

1992

RKBM exhibit showing future engines based on a common core *(Flight International)*

1990

NOVIKOV RD-60

This turbojet is a derivative of the RD-36-35FVR modified for operation in the horizontal attitude, with a long-life lubrication system and other changes It is the take-off booster fitted to the prototype Beriev A-40

PERFORMANCE RATING	29 85 kN (6,581 lb st)

VERIFIED

RKBM PROJECT

In 1990 RKBM revealed plans for a range of engines based on a core already developed This single-shaft core has a nine-stage compressor driven by a single-stage turbine. Mass flow is 22 5 kg (49 6 lb)/s, pressure ratio 12 4 and TET 1,547°C. Three derived engines would be: a helicopter turboshaft rated at 4 480 to 5,970 kW (6,000 to 8,000 shp), a high-bypass ratio turbofan in the 12 tonne (117 5 kN, 26,455 lb st) class, and an advanced propfan, with three core booster stages, giving a thrust of 12 to 15 tonnes (117 5 to 147 1 kN 26.455 to 33 070 lb st)

UPDATED

TVD-1500

This new gas generator has been developed as a core suitable to power turboshaft, turboprop and turbofan engines. Features include minimal number of parts, advanced materials (new titanium alloys, new refractory materials and new composites), full-authority digital control and modular construction Prototypes are running of the shaft and propeller versions. There is no immediate plan to build a turbofan, but this would be in the 7 85 to 9 81 kN (1,764 to 2,205 lb st) class

The basic engine powers the Antonov An-38. Certification in this application was scheduled for 1995 The **TVD-1500S** turboprop would power the Sukhoi S-80. The **TVD-1500SKh** would power the Antonov SKhS agricultural aircraft. The **TVD-1500T** pusher propfan would power the Ilyushin Il Kh Two **RD-600S (TVD-1500A)** turboshaft engines would be installed in the rear fuselage of the Myasishchev Yamal amphibian, driving (via shafts) a pusher propeller behind the rudder. The **TVD-1500V** turboshaft (also described as **RD-600**) will power the Kamov V-62 helicopter, a near-term programme, and the later Ka-52

TYPE: Free turbine turboshaft or turboprop

COMPRESSOR: Three axial stages with inlet guide vanes and both stators variable, followed by one centrifugal Pressure ratio 14 4 Electrochemically machined blades, electron-beam welded rotors and precision-cast casing.

COMBUSTION CHAMBER: Annular reverse-flow Multifuel capability.

TURBINES: Two-stage compressor turbine with monocrystal or directionally solidified blades Entry temperature 1,267°C. Two-stage power turbine with shaft passing through the engine to front drive

REDUCTION GEAR: On turboprop, two-stage spur gear followed by single-stage planetary

DIMENSIONS

Width	620 mm (24.4 in)
Height	760 mm (29 9 in)
Length, Turboprop	1,965 mm (77.4 in)
Turboshaft	1,250 mm (49 2 in)
WEIGHT DRY	
Turboprop	240 kg (529 lb)
PERFORMANCE RATINGS (S/L)	
T-O	970 kW (1,300 shp)
Contingency (TVD-1500V)	1,156 kW (1,550 shp)
Cruise (7,500 m, 24,600 ft, Mach 0 65)	559 kW (750 shp)
SPECIFIC FUEL CONSUMPTION	
Cruise, as above	63 2 µg/J (0 374 lb/h/hp)

UPDATED

DN-200

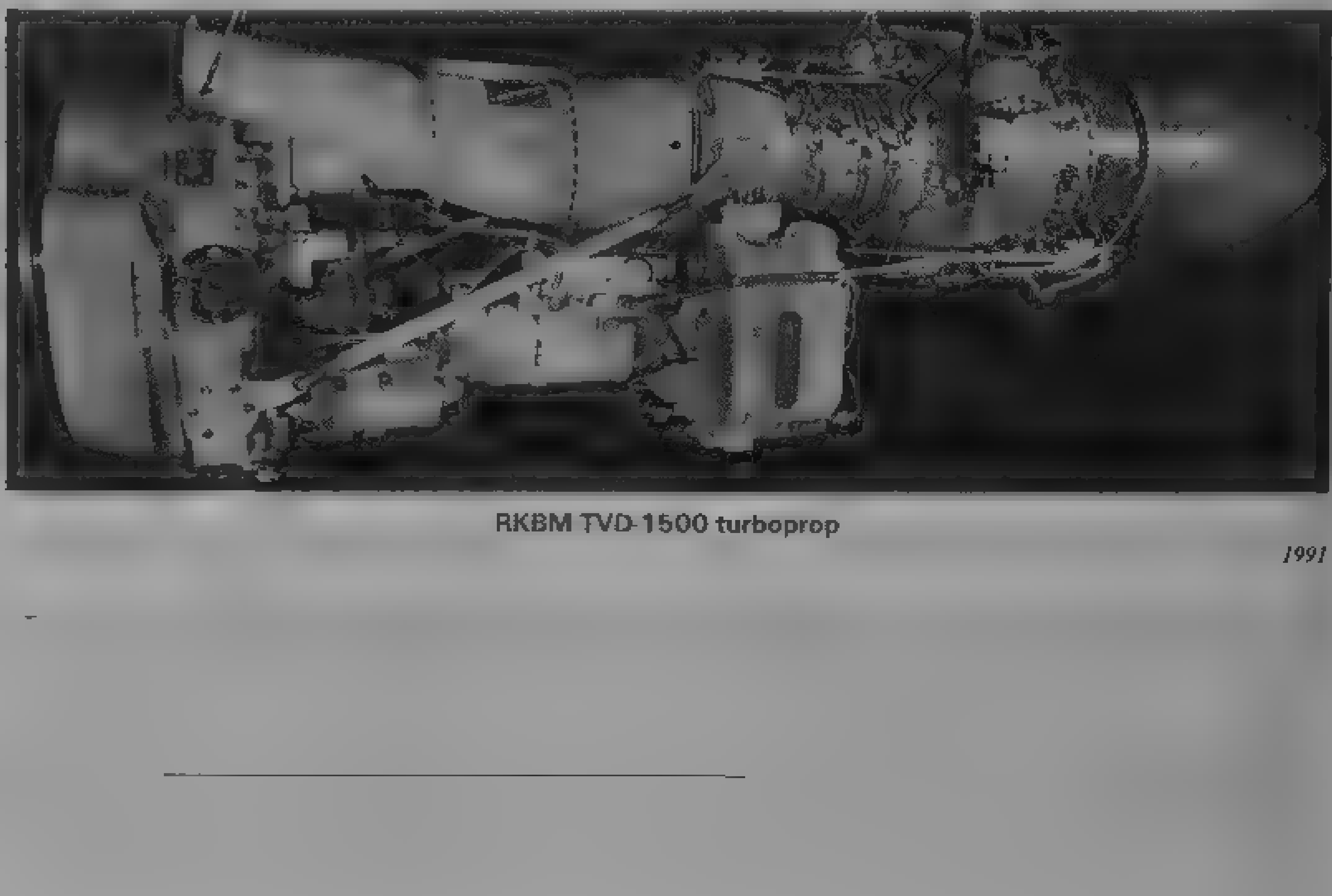
Designated for Diesel Novikov, this unusual piston engine is hoped to be the most economical in the world It is being designed to replace American engines in light aircraft, though beginning with the Yak-112 Five single-cylinder test engines had been built by 1991 to assist in reaching the target fuel consumption The first DN-200 ran in 1991, and certification was due in 1994-95

TYPE: Two-stroke liquid-cooled diesel piston engine.

CYLINDERS: Opposed pistons driving crankshafts along each side Bore 72 mm (2,835 in) Stroke of each piston 72 mm (2 835 in) Capacity 1,759 cc (107 3 cu in)

WEIGHT, DRY	105 kg (231 lb)
PERFORMANCE RATING (S/L)	
T-O	110 kW (147.5 hp)
Cruise	73 5 kW (98 6 hp)
SPECIFIC FUEL CONSUMPTION	
T-O	75.5 µg/J (0.44 lb/h/hp)

UPDATED



RKBM TVD-1500 turboprop

1991

RYBINSK — *see RKBM*

SALYUT

This name (good health) is that of the MMPO (production factory) making the Saturn/Lyulka AL-31F

VERIFIED

SAMARA

SAMARA STATE SCIENTIFIC & PRODUCTION ENTERPRISE

443026 Samara 36 (Kuibyshev)

PRESIDENT: Evgenii A. Gritsenko

This company, also known as SSPE Trud (labour or toil), is the successor to the large KB formerly headed by Kuznetsov (which see), and it has retained his NK initials on engines whose design was begun under his direction. See also KKBM

VERIFIED

SAMARA NK-88

Samara/Trud has been working since about 1968 on the use of LH/LNG (liquid hydrogen and liquefied natural gas) for various gas-turbine engines. A particularly important development programme was the conversion of an NK-8-2 engine (see KKBM) to burn either of the two new liquids, and of the tankage, piping and control system of a Tu-154 to accept such an engine. The result was the Tu-155 aircraft, which on 15 April 1988 became the first aircraft to fly with an engine burning liquid hydrogen. This was fed to the modified engine, designated an **NK-88**, installed in the right-hand (not centre) position. After 12 flights the aircraft was converted to feed LNG to the test engine, thereafter flying to Nice, Hanover and Berlin. Samara would like to test these fuels on an A310 with JT9D engines, followed by PW4000s

VERIFIED

SAMARA NK-92

This is a variant of the NK-93 described below. It could be used on the projected twin-engined 150/220-seat Il-90

VERIFIED

SAMARA NK-93

This is the most powerful propfan known to be under development anywhere in the world. Parametric studies began in 1985, and confirmed a 7 per cent advantage in propulsive efficiency for a two-stage contrarotating ducted propfan over open-rotor and ducted single-stage propfans. The NK-93 entered preliminary design in 1988. The first complete engine, incorporating both the gas generator and the propfans, went on test in December 1989. By early 1992 five complete engines had run, with about 15 more expected to be required to complete certification. Samara/Trud describe the NK-93 as similar in concept to the MTU/Pratt & Whitney CRISP, but much later in the stage reached, possible co-operation is being discussed.

The immediate applications envisaged for the NK-93 include the Il-96M and Tu-204. Flight development was scheduled to begin in 1994, with a single engine mounted on an Il-76 testbed aircraft. Certificated series produced NK-93 engines are planned for 1997

TYPE: Three-shaft geared contrarotating shrouded propfan

FAN: Two stages, contrarotating, same directions as Tu-95 ('Bear') propellers. Front fan (40 per cent power) eight blades, rear (60 per cent power) 10 blades. Blades swept 30°, pitch range 110°. Prototype blades solid magnesium production blades (by Stupino propeller factory) solid sparless graphite-epoxy composite retained by short steel root slotted into disc. Blade length 1,050 mm (41.34 in). Mass flow (cruise rpm, S/L) 1,000 kg (2,205 lb)/s. Bypass ratio 17

GEARBOX: Planetary, transmitting 22 370 kW (30 000 shp) through seven satellite pinions. Designed for service life of 20,000 hours

COMPRESSORS: Seven-stage LP, titanium discs and blades. Eight-stage HP, first five titanium, last three steel. Pressure ratio 37

COMBUSTION CHAMBER: Fully annular with vaporising burners. Being studied for use of LNG (liquefied natural gas) fuel

TURBINES: Single-stage HP with cooled single-crystal blades drives HP compressor. Single-stage IP drives LP compressor. Three-stage LP drives propfan gearbox

DIMENSIONS:

Length	about 5,500 mm (216.5 in)
Inlet diameter	1,455 mm (57.28 in)
Propfan diameter	2,900 mm (114.2 in)
Shroud external diameter	3,150 mm (124.0 in)
WEIGHT, DRY:	3,650 kg (8,047 lb)
PERFORMANCE RATING (ISA, S/L):	
Max T-O	176.5 kN (39,683 lb st)
SPECIFIC FUEL CONSUMPTION (cruise, 11,000 m, 36,090 ft, M 0.75)	13.89 mg/Ns (0.49 lb/h/lb)

VERIFIED

SAMARA NK-321

This carefully planned long range bomber engine is the power plant of the Tupolev Tu-160 ('Blackjack'). It was designed entirely by the Samara/Trud team, and was derived from the NK-32 gas generator. Design began around 1977, and the first prototype NK-321 went on test in 1980. It has been in production since 1986, and is still being made at a modest rate

TYPE: Three-shaft bypass augmented turbojet (low bypass ratio turbofan)

COMPRESSORS: Three-stage LP (fan), five-stage IP, seven-stage HP. Designed for maximum efficiency and highest overall pressure ratio. First stage also designed for minimal radar reflectivity of any radiation managing to reach it. Materials titanium, steel and (final stages) high-nickel alloy. Mass flow 365 kg (805 lb)/s. Pressure ratio (T-O) 28.4. Bypass ratio 1.4

COMBUSTION CHAMBER: Annular, vaporising burners, no visible smoke and near perfect uniformity of temperature at HP turbine face

TURBINES: Single-stage HP, diameter about 1,000 mm (39.34 in), cooled blades of single crystal material. Entry gas temperature 1,630°K (1,357°C). Single-stage IP, DS blades. Two-stage LP, DS blades

AFTERBURNER: Designed for peak efficiency and maximum thrust for lowest gas temperature to minimise IR signature. No visible smoke. Downstream of multi-lobe flow mixer. Fully variable con/di nozzle

CONTROL SYSTEM: Electrical, with hydromechanical back-up. Studies in progress for later switch to FADEC

DIMENSIONS:

Length	about 6,000 mm (236 in)
Inlet diameter	1,460 mm (57.5 in)
WEIGHT, DRY:	about 3,400 kg (7,496 lb)
PERFORMANCE RATINGS (ISA, S/L):	
Max T-O	245 kN (55,077 lb st)
Max dry	137.2 kN (30,843 lb st)

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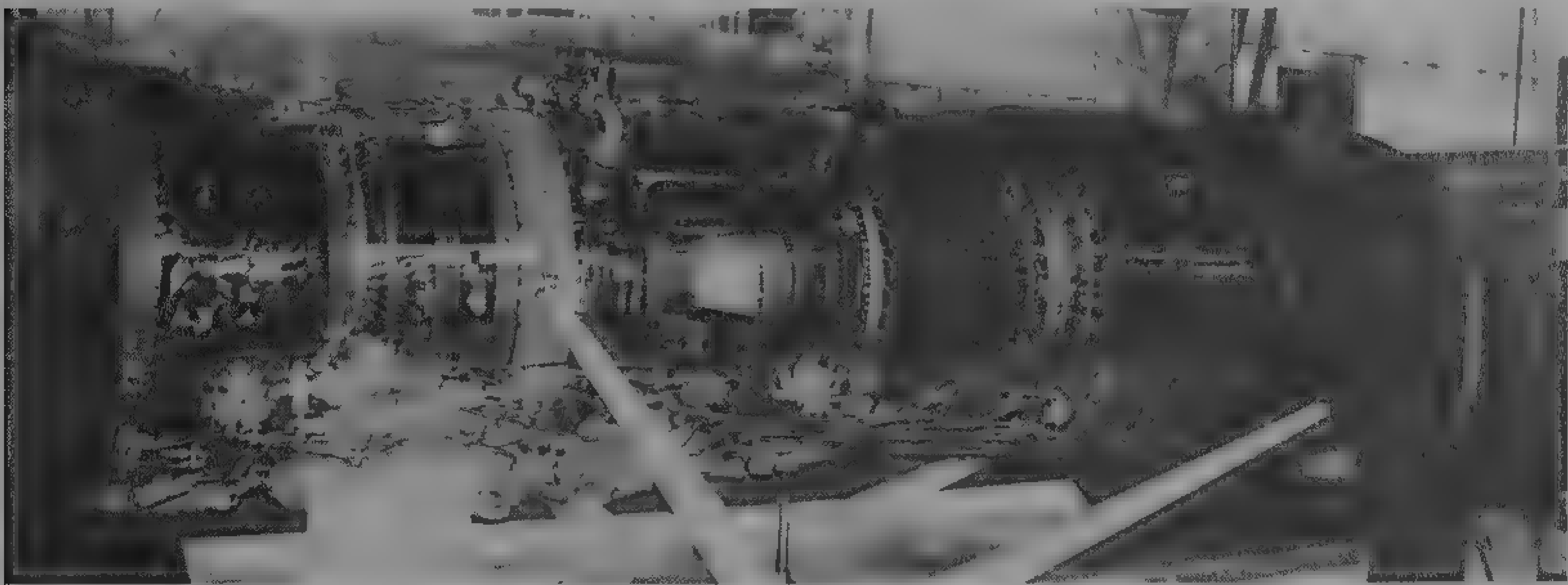
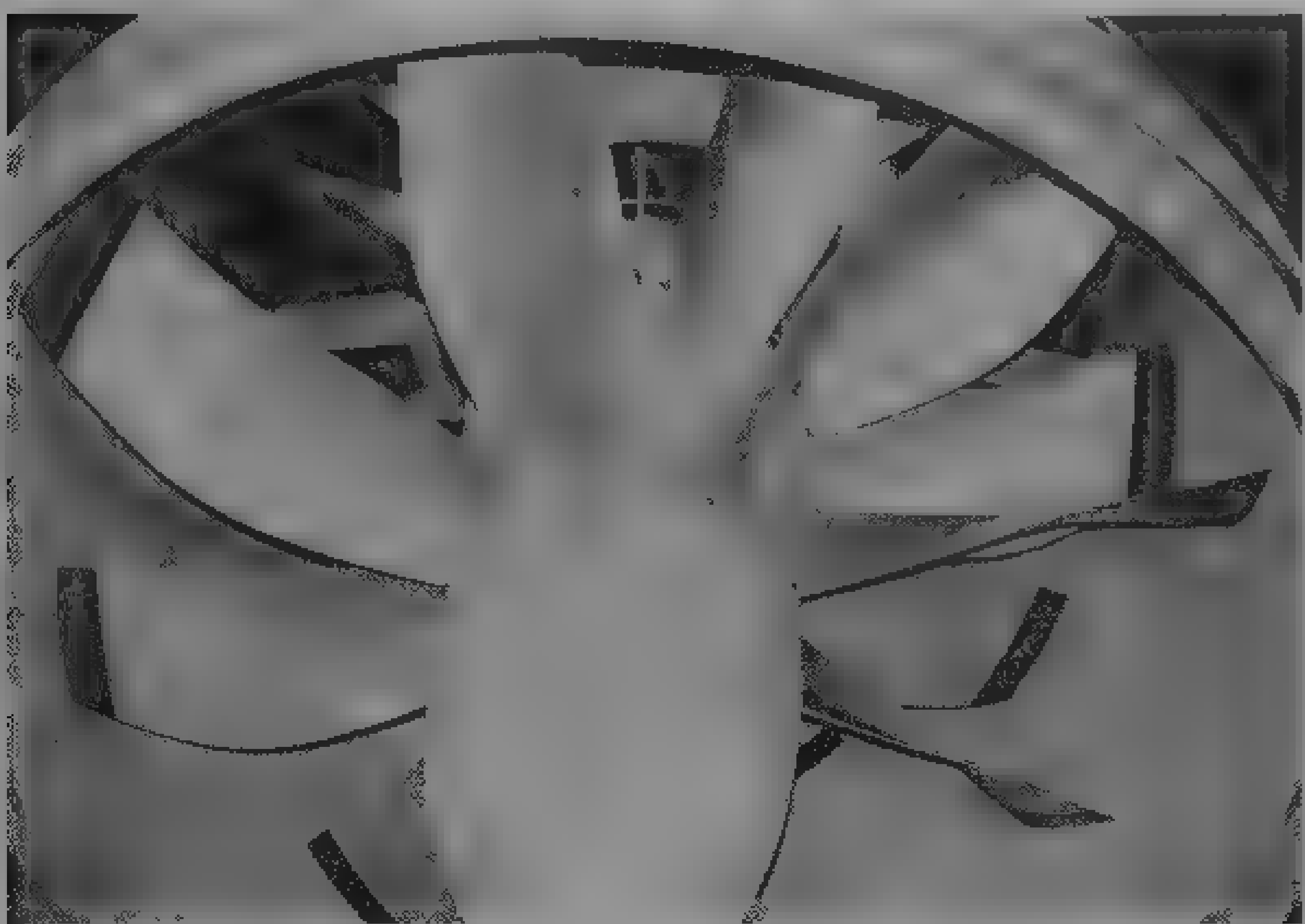
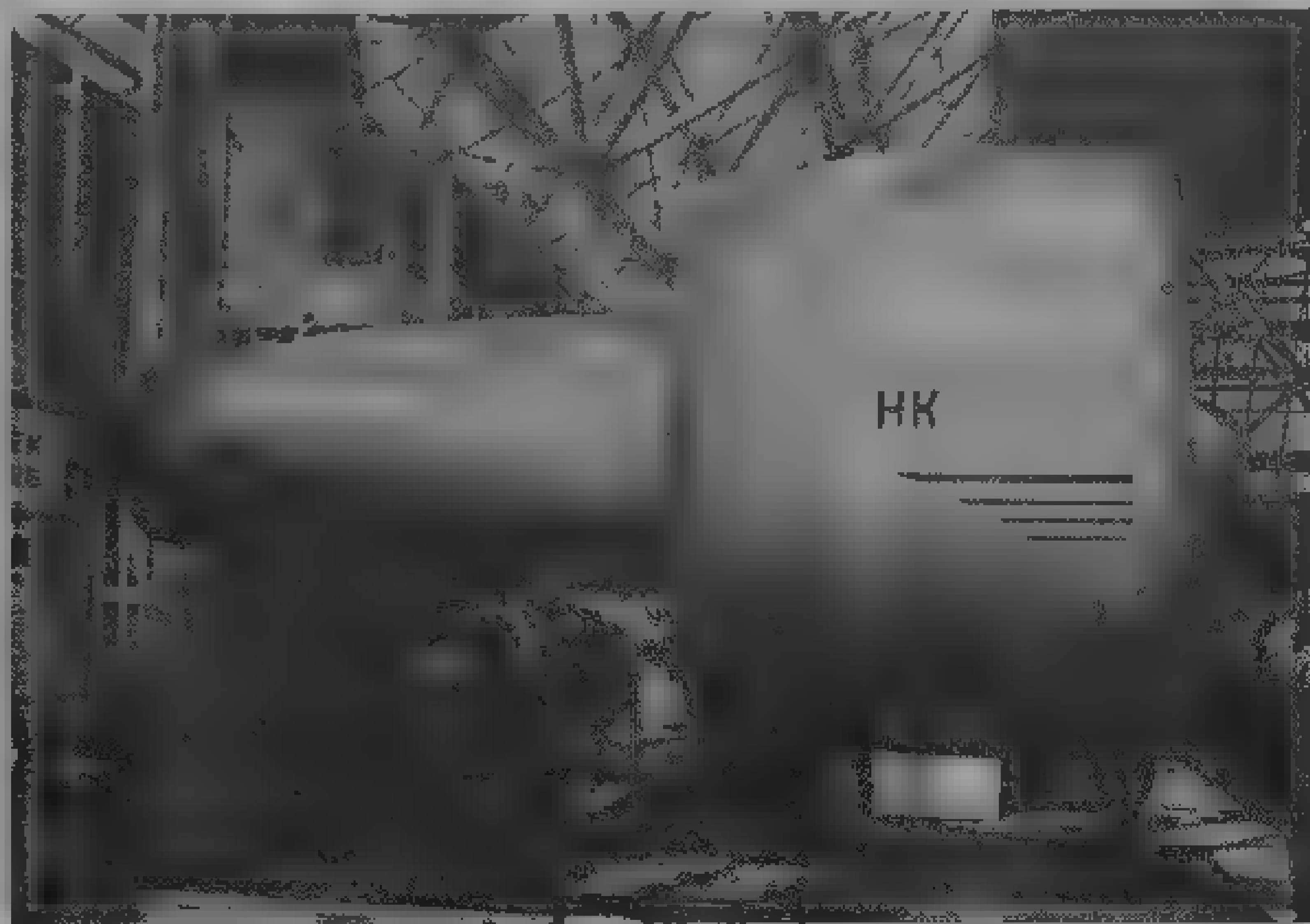


Plastic-covered cutaway Samara NK-321 augmented turbofan *(Piotr Butowski)* *1992*



Samara NK-93 propfan assembly *(Stephane Guilbaud)* *1992*



Samara NK-93 contrarotating propfan *(Piotr Butowski)* *1994*

SATURN

NPO SATURN

13 Kasatkin St, 129301 Moscow
Telephone: 7 (095) 283 9493 and 283 1374
Fax: 7 (095) 286 7566
PRESIDENT: Dr Viktor M. Chepkin

This bureau was previously named for its famous founder, Arkhip M. Lyulka. In addition to the engines listed below this bureau is responsible for the D-57 reusable LH_2/LO_2 rocket engine for space vehicles (40 t thrust, engine life 800 s) and the TP-22 engine which drives hydraulic pumps on the Energiya vehicle, running on GH_2 from main engine cooling (20 to 150 kW).

VERIFIED

AL-7

Details of this widely used turbojet appeared in the 1993-94

VERIFIED

AL-21

This important engine, in various **AL-21F-3** versions, has been produced in thousands for such aircraft as the MiG-23, Su-24 and Su-17/20/22. Developed from the AL-7 in the 1960s and cleared for production in 1970-74, it is noteworthy for its major advances in the design of the compressor, combustion chamber, turbine and afterburner.

TYPE: Single-shaft turbojet, with afterburner.

COMPRESSOR: Fourteen-stage axial. Inlet frame carries front bearing, with hot-air de-icing of fixed inlet vanes. Variable stators downstream pivoted to casing and central bullet. Variable stators ahead of first five stages. Parallel HP section with independently scheduled variable stators ahead of stages 10, 11, 12, 13 and 14. Mass flow 104 kg (229 lb)/s. Pressure ratio 14.75.

COMBUSTION CHAMBER: Can annular type, with 12 flame tubes each with duplex downstream burners.

TURBINE: Three stages with air-cooled first stage blades. Entry temperature 1,112°C. Rotor assembly supported by rear bearing held in eight-strut rear frame and drives via cone coupled to rear of compressor shaft.

Saturn (Lyulka) AL 31F two-shaft augmented bypass turbojet

1996

AFTERBURNER: Rapid combustion downstream of three injector/flameholder rings. Corrugated insulated liner with ceramic coating. Fully variable nozzle with 24 flaps driven by six rams. Full regime control giving smooth light-up and modulated power over whole range from flight idle to maximum afterburner.

DIMENSIONS:

Length	5,160 mm (203 in)
Inlet inner diameter	885 mm (34.8 in)

WEIGHT, DRY: 2,005 kg (4,420 lb)

PERFORMANCE RATINGS (S/L):

Military power	76.5 kN (17,200 lb st) at 8,316 rpm
Max afterburner	110.5 kN (24,800 lb st)

SPECIFIC FUEL CONSUMPTION (S/L):

Military power	21.47 mg/Ns (0.76 lb/h/lb st)
Max afterburner	52.5 mg/Ns (1.86 lb/h/lb st)

VERIFIED

AL-31

This was A. Lyulka's last and greatest engine. With afterburner, as the **AL 31F**, it powers all the initial production versions of the Su-27, for which it entered series production in 1984. Slightly modified engines might power the prototype Sukhoi S-21 SSBJ. Engines designated **R-32** (the Service designation for AL-31 engines) were fitted to the P-42, an Su-27 development aircraft, which set rate of climb records in 1986. A high proportion of the engine is titanium or stainless steel. Production by Salyut MMPO.

AL 31FM. Developed version offering higher thrust and better fuel economy. Powers initial version of Su-35. T-O rating 130.4 kN (29,320 lb st). Data for AL-31F.

TYPE: Two-shaft augmented turbofan.

FAN: Inlet has 23 variable guide vanes. Four fan stages slotted into discs. Bypass ratio 0.6.

COMPRESSOR: Variable inlet guide vanes followed by nine-stage HP spool with first three stators variable. Easy field replacement of damaged blades. Mass flow 110 kg (243 lb)/s. Overall pressure ratio 23.

COMBUSTION CHAMBER: Annular, with 28 downstream burners fed from inner manifold. Auto continuous ignition during missile launch.

TURBINES: Single-stage HP with cooled blades, using air/air heat exchanger in bypass duct. Entry gas temperature up to 1,427°C. Two-stage LP with cooled blades. Both turbines have active tip clearance control.

JETPIPE: Short mixer section to combine core and bypass flows upstream of afterburner.

AFTERBURNER: Two flameholder rings downstream of multiple radial spray bars. Interlinked primary and secondary multiflap nozzles are angled about 5° downwards.

CONTROL SYSTEM: Hydromechanical full regime control giving smooth power from flight idle to maximum afterburner in all manoeuvre conditions. Auto elimination of surge 'at Mach numbers 2 to 2.5 when normal, flat and inverted spins occur'. Linked via software to Su-27 fly-by-wire flight control system. All accessories grouped above engine.

DIMENSIONS:

Length	4,950 mm (195 in)
Diameter	1,220 mm (48.0 in)

WEIGHT, DRY: 1,530 kg (3,373 lb)

PERFORMANCE RATINGS:

Max augmented	122.6 kN (27,560 lb st)
Max dry	79.43 kN (17,857 lb st)

SPECIFIC FUEL CONSUMPTION:

Max dry	18.98 mg/Ns (0.67 lb/h/lb st)

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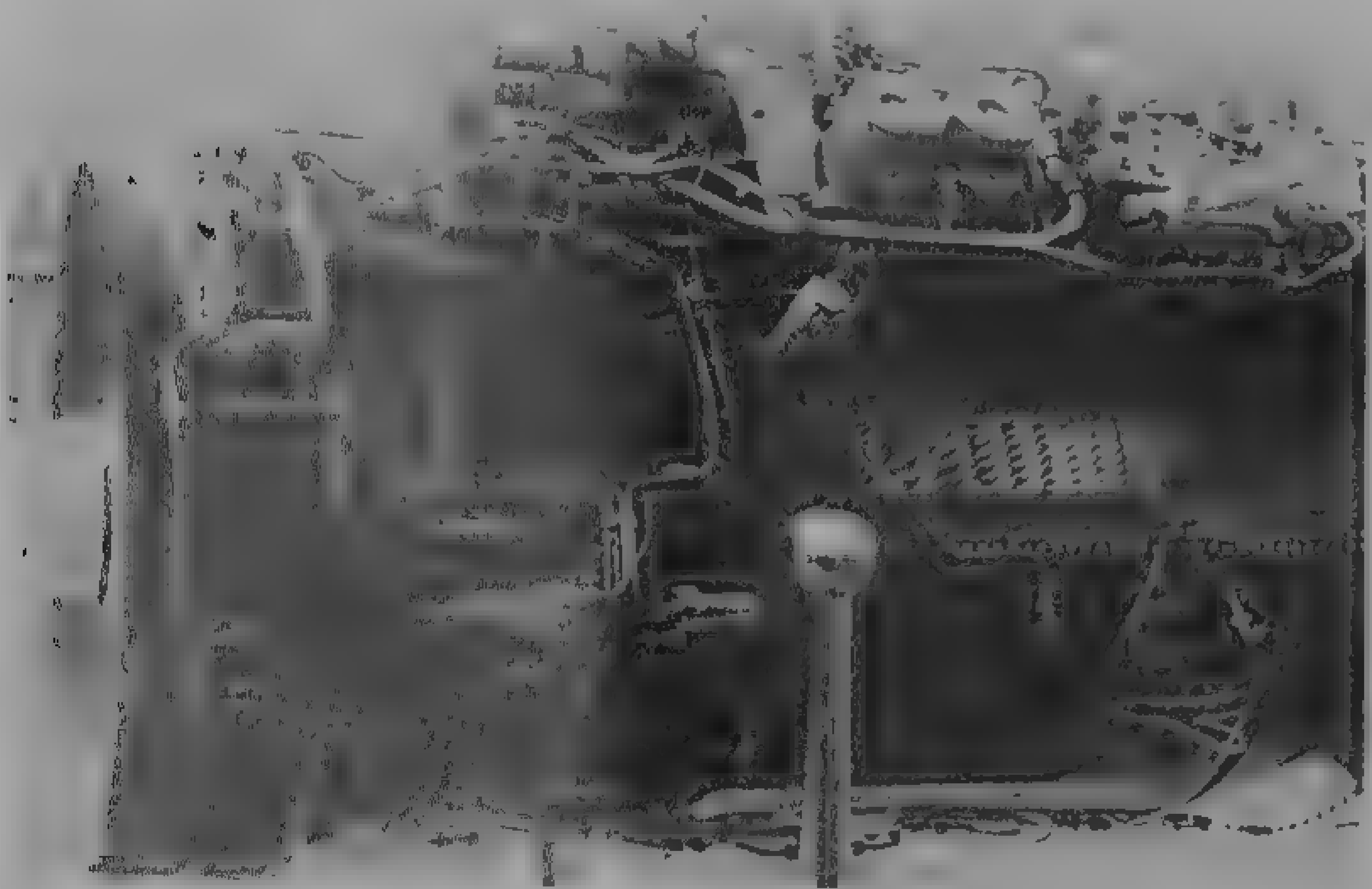


Saturn (Lyulka) AL 31F sectioned display engine (*Piotr Butowski*)

1996

Cutaway drawing of Saturn (Lyulka) AL-21F-3 single-shaft afterburning turbojet

1996

AL-34

This turboprop in the 410 kW (550 shp) class was reported in 1990 to have been selected to power the Sukhoi S-86 executive aircraft (rated at 522 kW, 700 shp). In the S-86, the AL-34 would drive a pusher contraprop.

UPDATED

AL-35

Two AL-35F engines, each rated at 133 kN (29,900 lb st), power the Su-32FN and Su-35 (see AL-31FM).

UPDATED

SAT-41

This completely new engine in the 20 tonne class is being developed to power advanced tactical fighters of the late 1990s. It will provide for long term sustained supersonic flight, STOL, enhanced combat manoeuvrability and economical operation with low specific weight. Features include a small parts count (for example by using few stages of compression), an advanced combustion chamber with 'effective mixture formation and cooling', a highly loaded turbine with single-crystal blades incorporating 'a new cooling concept' and a multimode variable nozzle.

VERIFIED

SATURN RTWD-14

The RTWD-14 is the primary source of shaft power on the Buran spacecraft. Three are installed, two active and one on standby. These engines run on hydrazine and are rated at 10 to 150 kW (13.4 to 201 shp).

VERIFIED

SHVETSOV

FOUNDER OF BUREAU: Arkadiya Dmitrievich Shvetsov

A. D. Shvetsov was responsible for the M-11 five-cylinder air-cooled radial engines made in enormous numbers in 1928-59 at powers from 74.6 kW (100 hp) to 149 kW (200 hp). He later developed larger radials, the most important being the ASh-82, which at ratings up to 1,491 kW (2,000 hp) powered Lavochkin fighters, the Tu-2 and Tu-4 bombers, Il-12 and -14 transports and Mi-4 and Yak-24 helicopters. The ASh-62 was made in large numbers at ratings in the 750 kW (1,000 hp) class for the Li-2 and An-2. The ASh-62M agricultural version, developed by Vedeneyev, and all An-2 engines after 1952, were transferred to Poland (see WSK-PZL Kalisz and WSK-PZL Rzeszów).

Another important engine was the 545 kW (730 hp) ASh-21 fitted to the Yak-11. All these have been described in earlier editions. The ASh-62 and ASh-82 have been produced under licence in China, as described in appropriate Chinese entries in this section. Today the bureau is PNPP Perm, which see for later engines.

VERIFIED

SOLOVIEV — *see AO 'Aviadvigatel'*

SOYUZ

Luzhnetskaya nab. 2/4, 119048 Moscow
Telephone: 7 (095) 242 9468
Fax: 7 (095) 242 5702
Teletype: 207022 Kabina

GENERAL DESIGNER: Vassili K. Kobchyenko

This design bureau is today known as the AMNTK Moscow Scientific Production Corporation 'Soyuz' (Alliance). The longest established engine KB in Russia, it was founded in 1943 by A. A. Mikulin, who was General Constructor until 1955 during the design of the AM-3. He was succeeded, successively, by Tumansky (1955-73), Favorski (1973-87) and now by V. K. Kobchyenko. Their engines, totalling over 26,000, have flown over 28 million hours and set over 100 world records. The names of several Chief Designers appear in the entries listing their engines.

UPDATED

TUMANSKY R-11

Service designation: R-37

This turbojet powered many versions of the MiG-21, Yak-28 and Su-15, some 20,000 were delivered. Details were given in the 1993-94 *Jane's*. The WP7 version is described under LM and LMC of China.

UPDATED

GAVRILOV R-13

This two-spool turbojet powered versions of MiG-21, Su-15 and Su-25. Fuller details will be found in the entry on the Chinese WP13.

GAVRILOV R-195

This simple turbojet was developed from the R-13 to power the Su-25 and Su-28 family of attack and training aircraft from 1979. The entire engine was designed to resist 23 mm gunfire, and to continue to operate after suffering damage in eight places.

TYPE: Two-shaft turbojet.
LP COMPRESSOR: Three stages. No inlet guide vanes or variable stators.
HP COMPRESSOR: Five stages. No variable stators, but auto bleed valves.
COMBUSTION CHAMBER: Can-annular with multiple duplex burners. Cleared for kerosene, diesel oil and MT petrol.
TURBINES: Single-stage HP, single-stage LP.
JETPIPE: No afterburner, simple fixed-area nozzle.
DIMENSIONS:

Length	3,300 mm (130 in)
Diameter	914 mm (36 in)

WEIGHT, DRY: 990 kg (2,183 lb)
PERFORMANCE RATING:

T-O	44.13 kN (9,921 lb st)

VERIFIED

Tumansky R-11F2S-300 two-shaft turbojet, with afterburner removed

1978

Gavrilov R-195 two-shaft turbojet
(Flight International)
1990

TUMANSKY R-15

This single-shaft afterburning turbojet was developed from 1959 for supersonic applications. Details appeared in the 1993-94 *Jane's*.

VERIFIED

TUMANSKY RU-19

Service designation: TRD-29

This single-shaft turbojet has been used to power aircraft and as an APU and emergency booster (in the An-26). Details appeared in the 1993-94 *Jane's*.

VERIFIED

GAVRILOV R-25

This two-spool turbojet was a new design and its compressor of higher (9.55) pressure ratio confers a markedly lower sfc than the R-13. The R-25 has redesigned accessory systems but is installationally interchangeable with the R-13. The first LP compressor stage has 21 titanium blades of large chord. The afterburner has two stages (the R-11 and R-13 having one) and so can be used in combat at high altitudes. The **R-25-300** powers the Su-15bis and MiG-21bis, with ratings of 40.26 kN (9,050 lb st) dry and 69.62 kN (15,650 lb st) with afterburner. No longer made, except under licence by HAL of India for MiG-21bis.

VERIFIED

R-27

This engine was a natural growth development from the R-11, -13, -25 series. It entered production in 1970 to power the initial series versions of the MiG-23.

R-27F2M-300. Engine of MiG-23MF, MS and UB. Developed under Khachaturov. Fitted with afterburner and water injection.

R-27V-300. Afterburner replaced by bifurcated nozzles each rotating through about 100° (cycle time 8 seconds), driven by two hydraulic motors linked by cross-shaft with spring synchronisation. Provides lift/cruise propulsion of Yak-38. Developed under Tumansky.

TYPE: Two-shaft turbojet.

LP COMPRESSOR: Five stages. No inlet guide vanes or variable stators. Circulation bleed over first-stage rotor.

HP COMPRESSOR: Six stages. No variable stators.

COMBUSTION CHAMBER: Annular, burners fed from inner manifold. Water injection with maximum afterburner.

TURBINES: Single-stage HP with air-cooled blades, single-stage LP.

JETPIPE: Afterburner with profiled multiflap primary and secondary nozzles. R-27V, plenum chamber and two vectoring nozzles.

DIMENSIONS:

Length: R-27	4,850 mm (191 in)
R-27V	3,706 mm (145.9 in)
Diameter: R-27	1,060 mm (41.73 in)
R-27V	1,012 mm (39.84 in)

WEIGHT, DRY:

R-27	1,500 kg (3,300 lb)
R-27V	1,350 kg (2,976 lb)

PERFORMANCE RATINGS:

R-27F2M-300 max T-O	98 kN (22,045 lb st)
R-27F2M-300 max dry	63.725 kN (14,320 lb st)
R-27V-300 max T-O	65.70 kN (14,770 lb st)

UPDATED

FAVORSKI R-28

Previously designated R-27VM-300, this is the lift/cruise engine of the Yak-38M; the air flow is increased.

PERFORMANCE RATING:

Max T-O	68.0 kN (15,300 lb st)

UPDATED

KHACHATUROV R-29

This augmented turbojet is simpler than the corresponding American F100, with fewer compressor stages and a lower pressure ratio; but it is more powerful and costs much less. Different subtypes were fitted to former MiG-23 and MiG-27 versions former Warsaw Pact front-line use, and to the Su-22. In all these aircraft water injection is used on take-off, the MiG-23MF water tank having a capacity of 28 litres (7.4 US gallons; 6.2 Imp gallons).

The following versions have been identified:

R-29-300. Original full rated production engine for MiG-23MF and related versions.

R-29PN. This replaced the R-29B as the standard engine of non-export MiG-23 aircraft.

R-29B-300. Simplified engine with small afterburner and short two-position nozzle for subsonic low-level operation. Fitted to all MiG-27 versions, with fixed or variable inlet ducts.

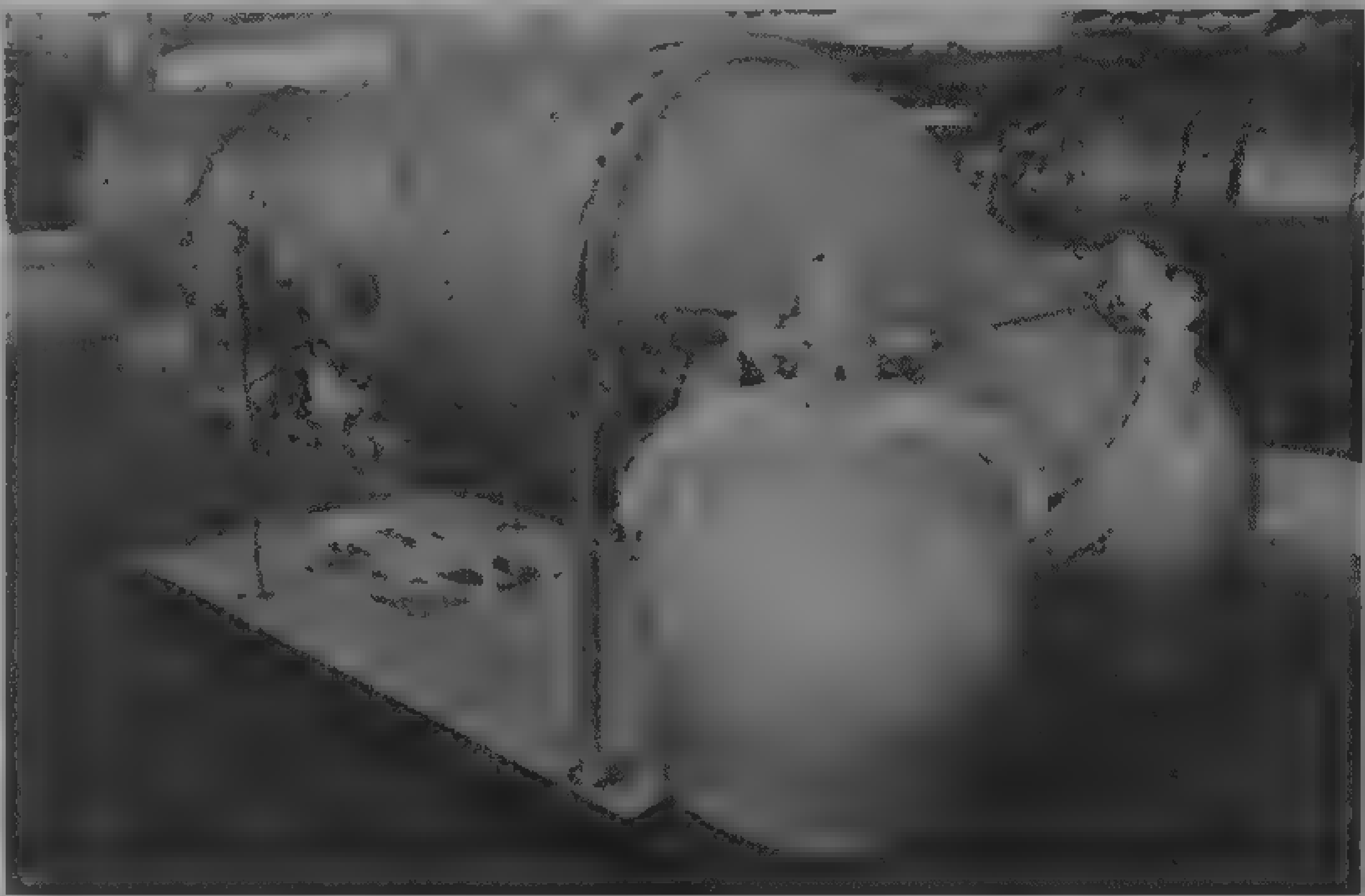
R-29BS-300. This is the engine of the Su-22 (export Su-17 versions).

COMPRESSOR: Five-stage LP, six-stage HP. Overall pressure ratio (29B) 12.4, (29-300) 13.1. Mass flow (29B) 105 kg (235 lb)/s, (R-29-300) 110 kg (242.5 lb)/s.

COMBUSTION CHAMBER: Annular, vaporising burners.

Gavrilov R-25-300 afterburning turbojet (*Flight International*)

1992



Khachaturov R-27V-300 vectored-thrust turbojet (box above left nozzle is added for demonstration purposes) (*Flight International*)

1994

TURBINES: HP has single-stage with air-cooled blades, maximum 8,800 rpm. Single-stage LP, maximum 8,500 rpm.

AFTERBURNER: Fuel rings with separate light-up give modulated fully variable augmentation. Fully variable nozzles differ in different installations (see variants).

DIMENSIONS (R-29-300):

Length	4,960 mm (195 in)
Max diameter	912 mm (35.9 in)

WEIGHT, DRY:

R-29B	1,760 kg (3,880 lb)
R-29-300	1,880 kg (4,145 lb)

PERFORMANCE RATINGS:

Max S/L unaugmented	78.45 kN (17,635 lb st)
Min with afterburner	97.1 kN (21,825 lb st)
Max T-O, wet (R-29B-300)	112.8 kN (25,350 lb st)
Max T-O, wet (R-29-300)	122.3 kN (27,500 lb st)

UPDATED

KHACHATUROV R-35

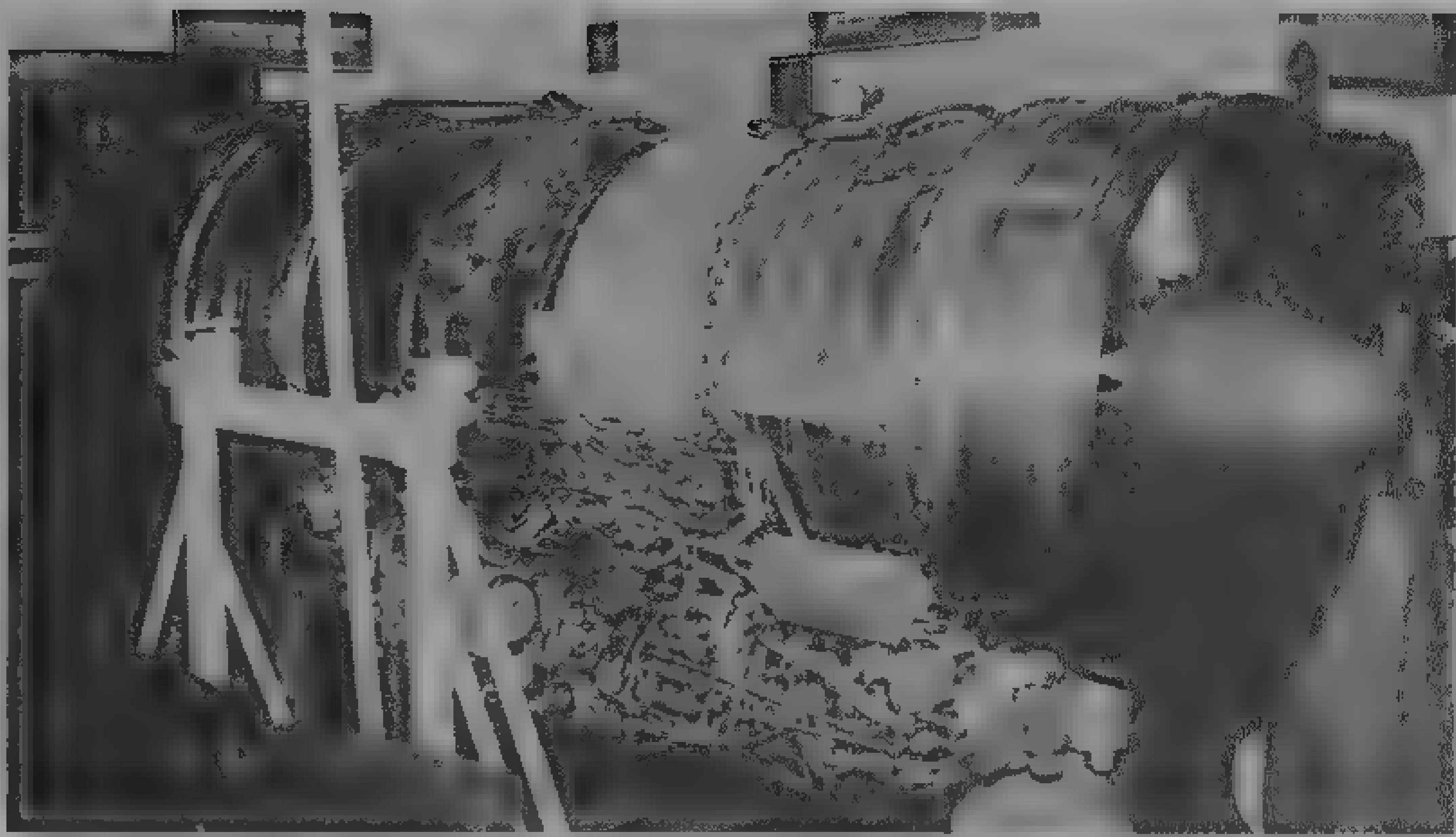
A team led by Khachaturov produced this advanced development of the R-29B. The **R-35-300** powers the

Khachaturov R-29-300 afterburning turbojet (*Piotr Butowski*)

1992

Vectoring tailpipe and nozzle of Kobchyenko R-79 augmented turbofan *(Piotr Butowski)*

1992



Khachaturov R 35 augmented turbojet *(Piotr Butowski)*

1992

MiG-23ML, MLA and MLD Mass flow and pressure ratio as for R-29-300, but dry weight is 1,765 kg (3,891 lb) and maximum thrust 83 85 kN (18 850 lb st) dry and 127 46 kN (28,660 lb st) with maximum afterburner

VERIFIED

KOBCHYENKO R-79

This engine was built to a new design as the lift/cruise power plant of the Yak 141. Though development of this supersonic carrier-based VTOL aircraft was suspended in 1991, development of the R-79 is continuing – according to Mr Kobchyenko, "with funds from sources outside the Russian government"

By 1993 the 12 engines had run about 3,500 hours, including over 500 hours in flight Engine fitted to the Yak-141 is designated **R-79V-300** Work is also proceeding on the upgraded **R-79M**, rated at about 176 2 kN (39,600 lb st), with FADEC control new combustion chamber, and (for STOL applications) a fixed axi-symmetric nozzle limited to vector angles of 20° up and 20° down for flight-control augmentation

TYPE. Two-shaft augmented turbofan with vectoring nozzle

COMPRESSOR. Five-stage LP (fan). Mass flow 120 kg (265 lb)/s. Six-stage HP Bypass ratio 1 0. HP bleed from two stages to provide aircraft hover control power

COMBUSTION CHAMBER Annular with vaporising burners fed from an inner manifold, giving very low emissions. Non-traditional double-zone design

TURBINES Single-seat HP with air-cooled single-crystal blades. Maximum entry gas temperature exceeds 1,600°C HP/LP turbines rotate in different directions

AFTERBURNER. Fuel burner rings just behind LP turbine light up in sequence to give fully modulated variable augmentation Can be used with the nozzle in the 95° position for hovering flight

NOZZLE Convergent/divergent type with variable primary and secondary profile and area. Connected to bypass duct periphery by two tapering-wedge pipe sections which rotate in opposite directions to vector nozzle from 0° (forward flight) to 63° (STO) and 95° (VL and hovering)

Kostogriz TV-O-100 turboshaft *(Piotr Butowski)*

1994

CONTROL SYSTEM. Three-channel electronic, with duplicated hydromechanical units. Automatically varies engine thrust to trim aircraft in pitch, supplies modulated air to roll and yaw control jets, supplies bleed air to start lift engines, and controls main engine fuel flow and drives to main hydraulic and electric power

DIMENSIONS

Inlet (fan) diameter	1,100 mm (43 31 in)
Max diameter (external)	1,716 mm (67 56 in)
Length	5,229 mm (205 87 in)

WEIGHT DRY about 2,750 kg (6 063 lb)

PERFORMANCE RATINGS (ISA, S/L)

Max dry	107 63 kN (24,200 lb st)
Max afterburner	152 0 kN (34 170 lb st)
Max (full aircraft control bleed)	137 3 kN (30,864 lb st)

SPECIFIC FUEL CONSUMPTION

Max dry, as above	8 70 mg/Ns (0 66 lb/h/lb st)

UPDATED

KOSTOGRIZ TV-O-100

This engine, was developed to provide a modern core in the 537 kW (720 shp) class Its initial application is in the single turbine Ka-126 helicopter Series production is by Mars at Omsk Future development of the engine to 619 kW (830 shp), with pressure ratio about 10 2 and turbine entry temperature of 1 077°C, may be carried out in collaboration with that country A derated version (530 kW, 710 shp) is a candidate engine for the Ka-118 The **TVD 100** turboprop version could be a candidate for the twin-engined Sukhoi S-86 and Aeroprogress/Roks-Aero T 610 It could drive tractor or pusher propellers. CIAM, the national aero-engine research organisation, is testing a heat exchanger with which specific fuel consumption may be reduced by 15 to 20 per cent

TYPE Free turbine turboshaft Modular construction

COMPRESSOR Inlet above engine leads via large dust/sand extractor to two-stage axial compressor, with inlet and intermediate stator stages variable, and single centrifugal stage. Pressure ratio 9 2

COMBUSTION CHAMBER Annular folded reverse flow

TURBINES Single-stage gas generator turbine with uncooled blades Turbine entry temperature 1,027°C Single-stage power turbine

CONTROL SYSTEM Dual-channel electronic

OUTPUT SHAFT Central quill shaft drives gear train at front with triple spur gears to 6,000 rpm output shaft at top

DIMENSIONS

Length	1,275 mm (50 2 in)
Width	780 mm (30 7 in)
Height	735 mm (28 9 in)

WEIGHT DRY (equipped): 160 kg (353 lb)

Kobchyenko R-79 augmented, vectored turbofan (nozzle horizontal) *(Piotr Butowski)*

1992

PERFORMANCE RATINGS (S/L):
Max 537 kW (720 shp)
Cruise 343 kW (460 shp)
SPECIFIC FUEL CONSUMPTION:
Cruise 109.2 µg/J (0.646 lb/h/shp)

UPDATED

SOYUZ GTE-400

This new turboshaft, rated at 298 kW (400 shp), has been selected for the twin-engined version of the Ka-118.

SOYUZ TVD-450

This turboprop may use the same core as the GTE-400. A twinned version, driving through a coupling gearbox to a single propeller, powers the Sukhoi S-86, as an alternative to the Saturn AL-34. Each power section is rated at 336 kW (450 shp).

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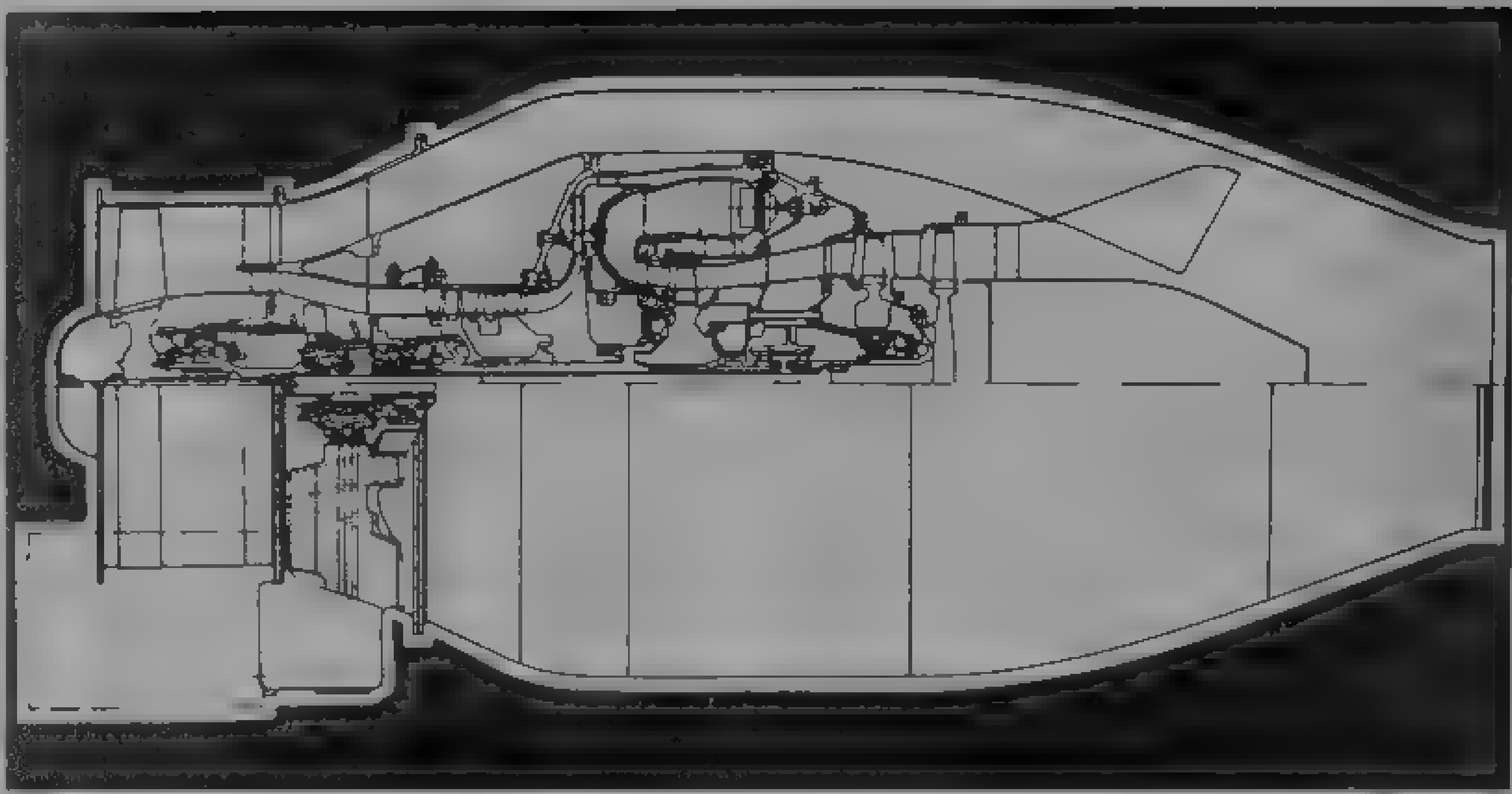


Longitudinal section of Soyuz R123-300 (provisional)

1992

SOYUZ R123-300

Projected engine for low-cost propulsion of light high subsonic aircraft.
TYPE: Two-shaft turbofan.
FAN: Single-stage. Bypass ratio about 6.
COMPRESSOR: Two axial stages, with variable inlet vanes, and single centrifugal.
COMBUSTION CHAMBER: Annular folded reverse flow.
TURBINES: Single-stage HP, single-stage LP.
JETPIPE: Mixer leads to combined nozzle.
PERFORMANCE RATING: To be agreed, probably in 13.4 to 14 kN (3,000 to 3,150 lb st) class.

SOYUZ R126-300

This engine is intended for large business jets and regional transports. Tupolev has selected it for the projected Tu-324.
TYPE: Two-shaft turbofan.
FAN: Single stage.
COMPRESSOR: Five axial stages with variable stators, one centrifugal.
COMBUSTION CHAMBER: Annular folded reverse flow.
TURBINES: Two-stage HP, three-stage LP.
JETPIPE: Mixer leading to combined nozzle. Provision for reverser.
PERFORMANCE RATING (ISA, S/L):
T-O 39.2 kN (8,818 lb st)

NEW ENTRY

SOYUZ R127-300

This engine is intended for smaller business jets.
TYPE: Two-shaft turbofan.
FAN: Single stage. Mass flow 31 kg (68.3 lb)/s. Bypass ratio 4.8.
COMPRESSOR: Two centrifugal stages.
COMBUSTION CHAMBER: Annular folded reverse-flow.
TURBINES: Two-stage HP, two-stage LP.
JETPIPE: Mixer leading to combined nozzle. Provision for reverser.
PERFORMANCE RATING (ISA, S/L):
T-O 8.83 kN (1,985 lb st)

NEW ENTRY

SVERDLOV

This is the name of the production factory at Perm, the principal source of helicopter engines of Klimov design.

TRUD

SSPE TRUD

443026 Samara 36

Meaning labour or toil, this is the name of the production factory on the Samara river at Kuibyshev for Kuznetsov engines. See Samara and KKBM.

TUMANSKY

Academician Sergei Konstantinovich Tumansky, who died in 1973, was a noted designer of piston engines. His RD-9 axial turbojet went into production in 1953. On Mikulin's disgrace in 1956, Tumansky was appointed head of the bureau. Production of his subsequent engines exceeded 40,000. His engines are produced by Soyuz and UMKPA (which see).

UPDATED

UMKPA

CHIEF DESIGNER: Alexei Ryzhov

The Ufa Engine-Manufacturing Production Association is a principal source of engines designed by the Tumansky (Soyuz) KB. Their catalogue and exhibit material lists engines as 'products'. **Product 25-11** (69.2 kN, 15,555 lb st combat rating) is the R-25-300; **Product 55B** (117 kN, 26,300 lb st combat rating) is the R-35F-300, **Product 95-I** (64.5 kN, 14,500 lb st 'first reheat rating') is the R-13-300; and **Product 95-III** (T-O 40.2 kN, 9,037 lb st) is the R-195.

VERIFIED

VAZ

The Togliatti (Fiat) car plant has designed two RC (rotary combustion) Wankel type engines for surface applications, and has now produced a fresh design for aircraft.

VERIFIED

VAZ-413

This twin-rotor engine is rated at 103 kW (138 hp). Two power the Volga-2 Ekranoplan.

VERIFIED

D-200/VAZ-430

This liquid-cooled twin-rotor aircraft engine has been developed from the VAZ-4304 automotive engine designed by the RPD NTS VAZ bureau. Its first application is the Mi-34V helicopter, in which the Vedeneyev M-14V radial is replaced by two rotary engines. Mil general designer Marat Tishchenko said "We could not find a gas turbine small enough". As the D-200 this engine is being produced by JSC 'Aviadvigatel', which see.

VERIFIED

VEDENEYEV — *see VOKBM*

VOKBM

VORONEZHSKOYEOPYTNO-KONSTRUKTORSKOYE BYURO MOTOROSTROYENIYA

Voroshilova 22, 394086 Voronezh
Telephone: 7 (0732) 571194
Fax: 7 (0732) 334137
Telex: 412535 Motor

In 1960 Ivan M Vedeneyev was appointed General Constructor of this bureau to develop the M 14 originally designed by Ivchyenko. Since 1973 the General Constructor has been Professor A. G Bakanov, who developed the following engines

VERIFIED

VOKBM M-3

This air-cooled radial is essentially an M-14 with six cylinders removed, thus, capacity is 3 387 litres (206.5 cu in). Diameter 985 mm (38.79 in), length 624 mm (24.57 in) and dry weight 119 kg (262 lb) T O rating is 77 2 kW (103 5 hp) at 2,800 rpm, with sfc 80 0 µg/J (0 473 lb/h/hp). Fitted to SL-90

NEW ENTRY

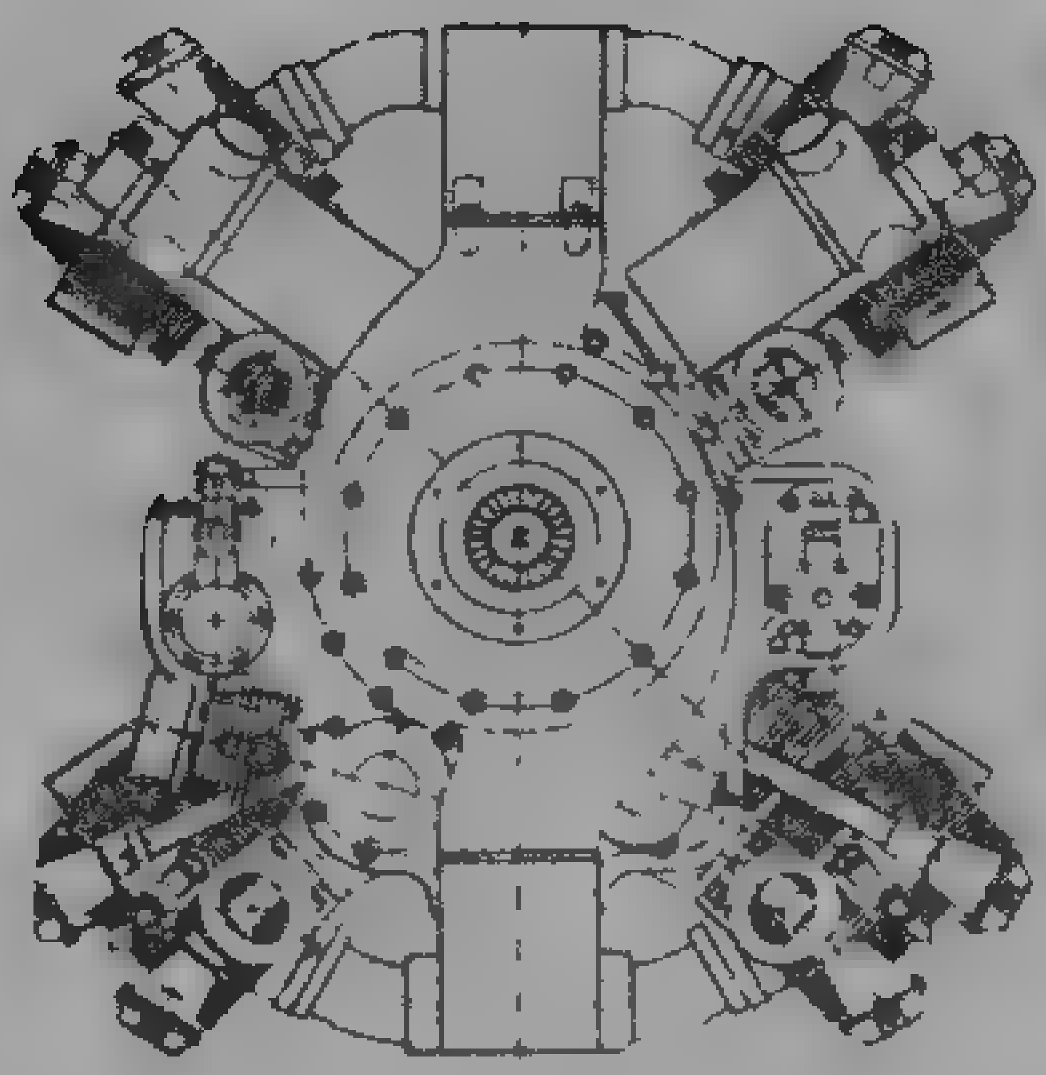
VOKBM M-14P

All versions of this engine are air cooled radial four-stroke piston engines, with a diameter of 985 mm (38 78 in) and nine cylinders with a bore of 105 mm (4 125 in), stroke of 130 mm (5 125 in) and capacity of 10 16 litres (620 cu in)

M-14PF: Fully aerobatic, length 924 mm (36 37 in), weight 214 kg (472 lb), T-O rating 294 kW (394 hp). Fitted to Su-26M Su 29 and Su-31

M-14PM Pusher, direct drive, length 924 mm (36 37 in), weight 214 kg (472 lb), T-O rating 232 kW (311 hp). Fitted to Molniya-1 and various sledges and boats

VOKBM M-14PF radial piston engine
(Piotr Butowski)
1994



Head-on view of VOKBM M-16
1995

M-14PM-1: Pusher, geared drive, length 1014 mm (39 92 in), weight 215 kg (474 lb), T O rating 265 kW (355 hp). Fitted to Molniya-1

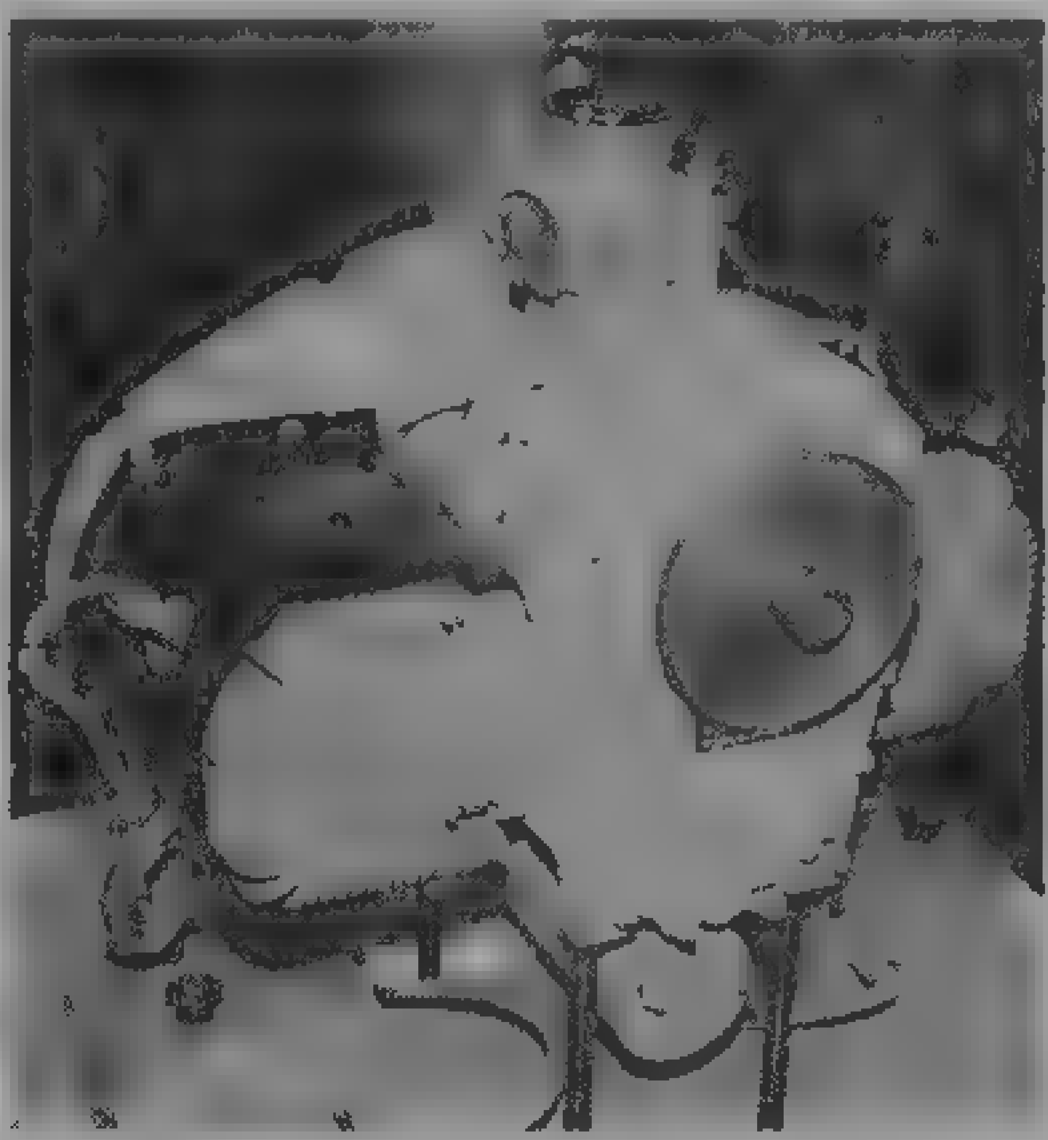
M 14PT Pusher, geared drive with 5 kW (6 8 hp) power takeoff, length 970 mm (38.19 in), weight 217 kg (478 lb), T-O rating 265 kW (355 hp). Fitted to Yak-58 and sledges

M-14NTK Redesignated M 25

M 14V2 Gearbox giving 90° output (vertical) for helicopters, with shrouded cooling fan. Diameter as before but length 1102 mm (43 4 in) and dry weight 254 kg (560 lb) T O rating 294 kW (394 hp). Fitted to Mi-34A and Bars air cushion vehicle

M-14V26 Similar to V2 but with lateral output shaft for Ka-26 helicopter and airships Dry weight 220 kg (485 lb), T-O rating 239 kW (320 hp)

UPDATED



VOKBM M-18-02 flat-twin piston engine
(Piotr Butowski)
1994

VOKBM M 17F flat four piston engine
(Piotr Butowski)
1994

VOKBM M-16

This engine has eight air-cooled cylinders with low-pressure fuel injection and direct drive to a tractor propeller Length 950 mm (37.4 in), width and height both 720 mm (28 35 in), dry weight 150 kg (330 7 lb) T O rating 220 kW (295 hp) at 2,800 rpm. Fitted to Yak 56 and Yak 57 from 1996

NEW ENTRY

VOKBM M-17

Air-cooled four-stroke piston engine with four opposed cylinders with low-pressure fuel injection Electric starter Dimensions 550 × 830 × 1000 mm (21 6 × 32.7 × 39 4 in), weight 118 kg (260 lb), T-O rating 129 kW (173 hp) at 2,950 rpm. Fitted to Be-103, Il-103 and Yak-112 **M-17F**, 149 kW (200 hp), weight 130 kg (287 lb) Fitted to Be-103, Il-103 Yak-112, Tu-34 (piston-engined version) and ekranoplans

UPDATED

VOKBM M-18

Air-cooled two-stroke carburetted piston engine with two opposed cylinders Dimensions 550 × 500 × 350 mm (19.7 × 19 7 × 13.8 in), weight 28 kg (61 7 lb) T-O rating, **M-18-01**, 29 4 kW (39 hp), **M-18-02**, 40.5 kW (54 hp)

VERIFIED

VOKBM M-25

This nine-cylinder radial was originally the M-14NTK (it bears no relationship to the licensed Wright Cyclone, which had the same designation). Features include fuel injection, improved cooling, an automatic control system and electric or compressed air starting The **M-25-01** can be fitted with a turbosupercharger Length 1150 mm (45 28 in), weight 215 kg (474 lb), T-O rating 320 kW (429 hp) with sfc 68.9 µg/J (0.408 lb/h/hp) Fitted to Finist, M-500, T-401, Su 26 and Yak 18T, 54, 55M and 58

NEW ENTRY

VOKBM M-29

This is a two-stroke with four opposed air-cooled cylinders Dimensions 570 × 450 × 450 mm (22 4 × 17 7 × 17 7 in), dry weight 35 kg (77 lb) T-O rating 55 kW (74 hp) at 2,500 rpm Cruise sfc 130 µg/J (0 77 lb/h/hp). Fitted to many air vehicles including Aviatika 890 light aircraft

NEW ENTRY

VOLSZHSKY

This design bureau has produced the following small piston engine.

VERIFIED

BAZ-21083

Apart from the T-O rating of 59 7 kW (80 hp), nothing is yet known of this engine, of which two will drive pusher propellers in the Phoenix-Aviatechnica LKhS-4 biplane

VERIFIED

ZAPOROZHYE — *see ZMKB Progress under Ukraine*

SINGAPORE

SA

SINGAPORE AEROSPACE LTD

ADDRESSES See Aircraft section

SA manufactures engine parts for General Electric and Turbomeca. It has 2 per cent of the PW4000 programme and is sole source of 11 high-precision parts, mainly in the compressor section

SLOVAKIA

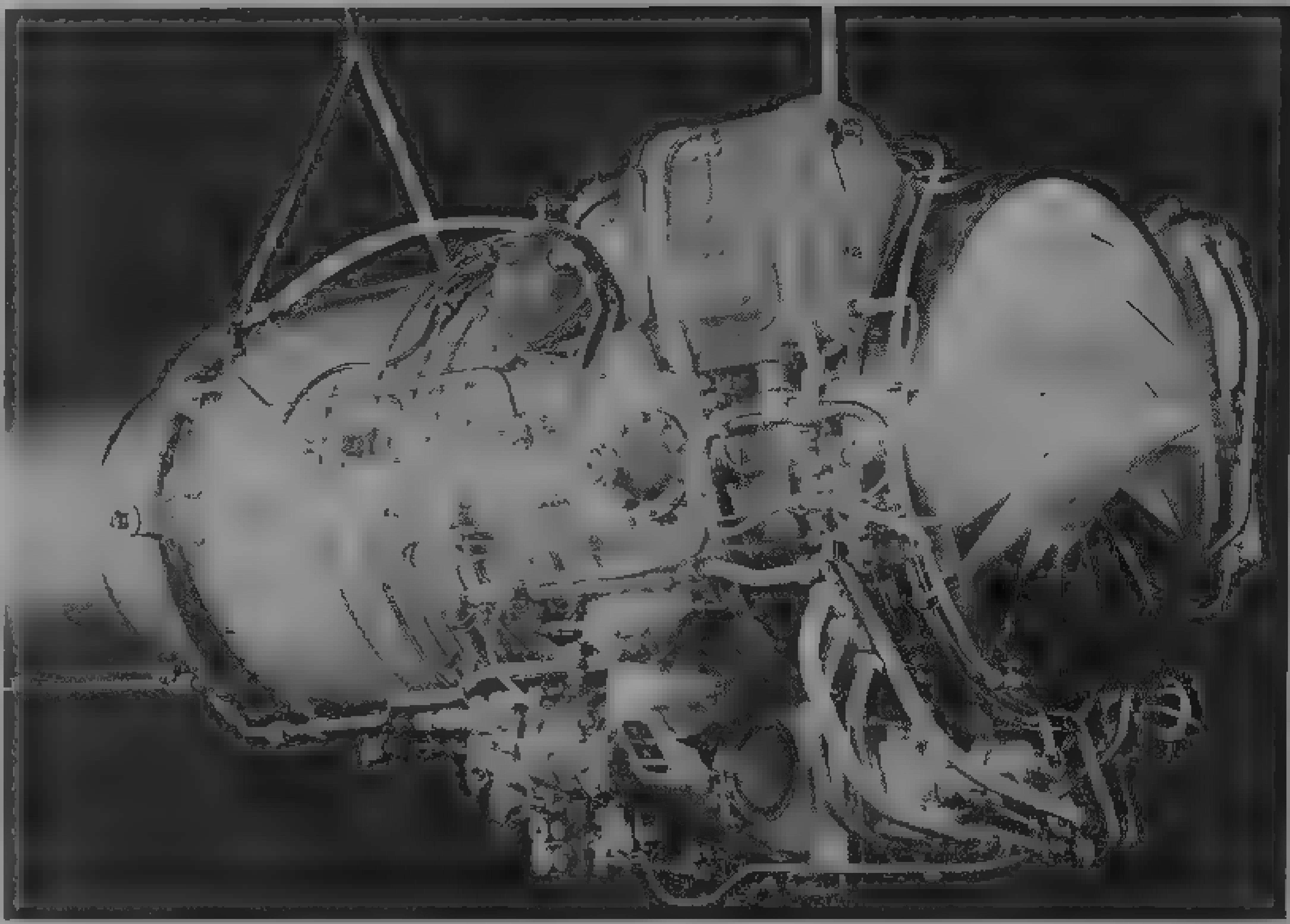
PS

POVAŽSKÉ STROJÁRNE
Aero-Engine Division

01734 Považská Bystrica
Telephone: 42 (822) 23037
Fax: 42 (822) 23778
Telex: 075233, 075316
DIVISION EXECUTIVE MANAGER: Jan Pirč
CHIEF DESIGNER: E. Jiří Bednář

PS-AED succeeded ZVL, a major new design bureau which also included the VLM research institute. It partnered the Progress/Lotarev (ZMKB) bureau in the former Soviet Union (which see under Ukraine) in designing the DV 2 described under ZMKB. By January 1994 25 prototype engines had been produced by both partners (as noted under PS ZMKB in the International section) and PS-AED had produced five experimental and 72 series engines. Initial TBO is 500 hours, service life being calculated at 4,000 h.

VERIFIED



PS-ZMKB DV-2 two-shaft turbofan
1994

SOUTH AFRICA

ATLAS

ATLAS AVIATION
(A member of Simera Division of Denel (Pty) Ltd)

PO Box 11, Atlas Road, Kempton Park 1620, Transvaal
Telephone: 27 (11) 927 9111
Fax: 27 (11) 395 1103
Telex: 724403
CEO: J. J. Eksteen

Atlas is manufacturing the Rolls-Royce Viper 540 turbojet under sublicence from Piaggio of Italy, for use in Atlas Impala attack trainers.

VERIFIED

SPAIN

ITP

INDUSTRIA DE TURBO PROPULSORES SA

Edificio 300, Parque Tecnologico, E-48016 Zamudio (Vizcaya)
Telephone: 34 (94) 489 2100
Fax: 34 (94) 489 2193
COMMERCIAL OFFICE: Traves ía Costa Brava 6 (Carretara Colmenar Viejo), E-28034 Madrid
Telephone: 34 (91) 384 8000
Fax: 34 (91) 384 8001

ITP was formed in 1989 as Spain's aero-engine company to participate in the design, development, manufacture, sale and support of gas-turbine engines. Shareholders are IBV Corporation (4 per cent), Rolls-Royce plc (45 per cent) and Turbo 2000 SA (51 per cent), the latter being in turn owned by Bazan (Spanish government) and Sener (private sector). The Ajalvir plant near Madrid, acquired from CASA, overhauls engines and accessories (GE, PWC, AlliedSignal, Turbomeca, SNECMA and Allison). The newly constructed Zamudio plant near Bilbao manufactures components for civil and military engines. Deliveries began December 1991. ITP is the Spanish participant (13 per cent) in the EJ200 engine programme to power the Eurofighter 2000. It also participates in the Trent, BR710 and 715, and produces components for the RB211-524, RR535 and V2500.

UPDATED

SWEDEN

VOLVO

VOLVO AERO CORPORATION

S-461 81 Trollhättan
Telephone: 46 (520) 94000
Fax: 46 (520) 34010
Telex: 420 40 VOLFA S
PRESIDENT: Arne Wittlöv

Volvo Aero produces aircraft engines and space propulsion components. Since 1980 it has been a risk- and revenue-sharing partner with General Electric on the CF6-80A and 80C for wide-body transports. Volvo also participates in development and production of the Garrett TFE731-5 turbofan and TPE331-14/15 turboprop. The company also has agreements with Pratt & Whitney on the JT8D-200, PW2000 and V2500, and with Rolls-Royce on the Tay, making combustors for the Tay 650-650 and compressor intermediate casings for the Mk 670. In Malmö Volvo Aero Turbines develops and markets small gas turbines. Volvo Aero Engine Services is a commercial maintenance company, and in Arboga Volvo Aero Support maintains military engines, such as the RM8 (1992-93 *Jane's*).

UPDATED

Volvo RM12 two-shaft augmented turbofan
1994

VOLVO RM12

The RM12 is a version of the F404 developed jointly by General Electric and Volvo to power the JAS 39 Gripen. General Electric retains rights to the design, and supplies approximately 60 per cent by value of parts.

Volvo Aero is a partner in all F404 applications. It supplies parts to General Electric similar to those parts that it manufactures for the RM12.

The RM12 thrust improvement has been achieved by increasing the turbine inlet temperature by up to 105°C and by increasing fan air flow. The fan meets more stringent bird strike requirements, and this has required changes to the control system, with built in redundancy to ensure get-home power. Increased temperature and pressure have required changes to hot section materials. RM12 testing started at GE in June 1984, and the Gripen first flew on 9 December 1988. Eight flight-rated prototypes and seven production engines had been delivered by September 1994 from over 150 then on order.

Studies were under way in 1994 into a possible 'RM12+' with turbine and afterburner improvements for the third production batch of Gripens.

Sectioned drawing of Volvo RM 12

1995

The following are features of the RM12:

FAN: Variable first-stage stator. Air flow 68 kg (150 lb)/s. Bypass ratio 0.28

WEIGHT, DRY: 1,050 kg (2,315 lb)

PERFORMANCE RATINGS:

Max T-O dry	54 kN (12,140 lb st)
augmented	80.5 kN (18,100 lb st)

UPDATED

TURKEY

TEI

TUSAŞ ENGINE INDUSTRIES

Muttalip Mevkii Mrk. PK 610 Eskişehir
Telephone: 90 (222) 322 2030
Fax: 90 (222) 322 2057
MANAGING DIRECTOR: Nadi Koklü

TEI was formed in January 1985 as a joint venture between the Turkish government (53.78 per cent) and US General Electric (46.2 per cent). The factory produces the F110 fighter engine, and had delivered 172 F110-100 engines by the end of 1993; it is now producing the F110-129. TEI also produces more than 50 types of aircraft engine components, particularly for GE but also for Pratt & Whitney, SNECMA and CFM.

VERIFIED

UKRAINE

IVCHENKO PROGRESS ZMKB

IVCHENKO PROGRESS ZAPOROZHYE MACHINE-BUILDING DESIGN BUREAU

330068 Zaporozhye
Telephone: 7 (612) 650327
Fax: 7 (612) 654697
Telex: 127464 Bolt UX
GENERAL DESIGNER: Fyodor Mikhailovich Muravchenko
CHIEF DESIGNER: Vladimir Ivanovich Kolesnikov
FOREIGN ECONOMIC RELATIONS ADVISER:
Alexander Vladimirovich Gavrishenko
Telephone: 7 (612) 656105

Zaporozhye Machine-Building Design Bureau was founded by Ivchenko in May 1945. From 1968 it was headed by Lotarev, and since 1988 by Muravchenko.

Until 1991 Progress was a member of the group of enterprises of the USSR Aviation Industry Ministry. Now it is a state enterprise of Ukraine.

Progress carries out the complete cycle of creation of gas-turbine engines, the cycle comprising the design, development, manufacture of the development batch and certification, as well as supervision of series production and operation. Series production of engines designed and developed by ZMKB Progress is carried out by the Motor Sich enterprise (formerly, Zaporozhye Industrial Association Motorostroitel).

Not including Ivchenko's AI-14 and AI-26 piston engines (see PZL Kalisz and Rzeszów in Polish section), over 20 types of Progress engines are in service on 42 types of aircraft. These engines are in service in 60 countries. The total of more than 30,000 Progress aircraft gas-turbine engines has accumulated over 300 million hours in service.

UPDATED

PROGRESS AI-20

This turboprop was the first gas-turbine engine designed by Zaporozhye collective, headed by Ivchenko. AI-20 was developed in 1955-57 as a competitor of the NK-4 by Kuznetsov design bureau for the Il-18 aircraft, using the experience of Mikulin design bureau in developing the AM-3M engine, and the expertise of CIAM. Mass production of AI-20 began in 1958 for Il-18 and An-10A. Several modifications were developed.

AI-20K. For Il-18V, An-10A and An-12. Rated at 2,983 ekW (4,000 ehp) at S/L, ISA. Produced at SMPMC in China as WJ6.

AI-20M. Known as AI-20 Series 6. Initial T-O rating 3,126 ekW (4,192 ehp), later increased to 3,169 ekW (4,250 ehp). Fitted to An-12 and Il-18/20/22/38. Differs from AI-20 by shrouded turbine blades.

AI-20DK. Known as AI-20D Series 3. Rated at 3,124 ekW (4,190 ehp), navalised for An-8 and Beriev Be-12.

AI-20DM. Known as AI-20D Series 4. Rated at 3,863 ekW (5,180 ehp). Fitted to An-8 and Be-12.

AI-20D Series 5. Developed for An-32 with 3,863 ekW (5,180 ehp), to operate from −60 to +55°C with automatic variation of propeller pitch.

Service life and TBO of different modifications depend on service conditions and are: service life from 6,000 hours (AI-20DM) to 20,000 hours (AI-20M); TBO 7,000 hours (AI-20M).

The following description refers to the AI-20M:

TYPE: Single-shaft turboprop.

COMPRESSOR: Axial, 10 stages, with four bypass valves, which are used at starting and transient ratings. Pressure ratio from 7.6 at T-O (ground) to 9.2 (cruise). Mass flow 20.7 kg (45.6 lb)/s. Stator casing of sheet stainless steel.

COMBUSTION CHAMBER: Annular with 10 burner cones and two pilot burners and igniter plugs. The casing is one of the load-carrying elements of the engine.

TURBINE: Axial, three stages. Rotor blades shrouded at inner and outer ends and installed in pairs in slots of air-cooled discs. First guide vanes and discs are cooled by secondary air from combustion chamber. Maximum entry temperature is 900°C at S/L (937°C for AI-20DM). Rotor speed 12,300 rpm, except 10,400 at ground idle.

REDUCTION GEAR: Planetary type, two-stage, incorporating a six-cylinder torquemeter and negative-thrust transmitter (IKM type). Reduction ratio 0.08732.

LUBRICATION: Pressure-feed type with full recirculation.

OIL GRADE: 75 per cent MK-8 or MK-8P to GOST-6457-66 (DERD 2490 or MIL-O-6081B) and 25 per cent MS-20 or MK-22 to GOST 21743-76 (DERD 2472 or MIL-O-6082B).

STARTING: Two electric starter/generators, Type STG-12 TMO-1000, supplied from ground or TG-16 or AI-8 APU.

FUEL GRADE: T-1, TS-1, T-2, RT, to GOST-10227-86 (DERD 2494, JP-1 to MIL-F-5616).

DIMENSIONS:

Length	3,096 mm (121.89 in)
Width	842 mm (33.15 in)
Height	1,180 mm (46.46 in)

WEIGHT, DRY: 1,040 kg (2,293 lb)

PERFORMANCE RATINGS:

T-O (S/L, static)	3,169 ekW (4,250 ehp)
Max cruise (340 kts, 630 km/h, 391 mph at 8,000 m 26,250 ft)	1,938 ekW (2,600 ehp)

SPECIFIC FUEL CONSUMPTION:

T-O	89.42 μg/J (0.529 lb/h/ehp)
Cruise, as above	73.3 μg/J (0.434 lb/h/ehp)

UPDATED

Progress (Ivchenko) AI-20M single-shaft turboprop

1972

PROGRESS AI-24

This turboprop was designed in 1960 to power the An-24 and its derivatives. There are four main versions:

AI-24 (Series 2). Installed on An-24A, An-24B, An-24V, An-24T and An-24PV. Rotor 15,100 rpm except 13,900 at ground idle. Production began in 1964. The description relates to this version.

AI-24P. Multifuel version for Ekranoplan cruise propulsion. Rated at 1,840 kW (2,467 shp). One powers the SM-6 series and two power Meteor 2.

AI-24T. Powers the An-24A, -24B and -24T with water injection. T-O rating 2,103 ekW (2,820 ehp). Rotor 15,800 rpm except 14,050 at ground idle. Production from 1966.

AI-24VT. Powers the An-26 and An-30. Production began in 1970.

TYPE: Single-shaft turboprop.

COMPRESSOR: Ten-stage axial. Pressure ratio, 7.55 (AI-24T) 7.85. Mass flow 13.1 kg (28.9 lb)/s (AI-24T, 14.4 kg, 31.7 lb/s).

COMBUSTION CHAMBER: Annular, with eight simplex burners and two starting units, each comprising a body, pilot burner and igniter plug.

FUEL GRADE: T-1, TS-1 to GOST 10227-86 (DERD 2494 or MIL-F-5616).

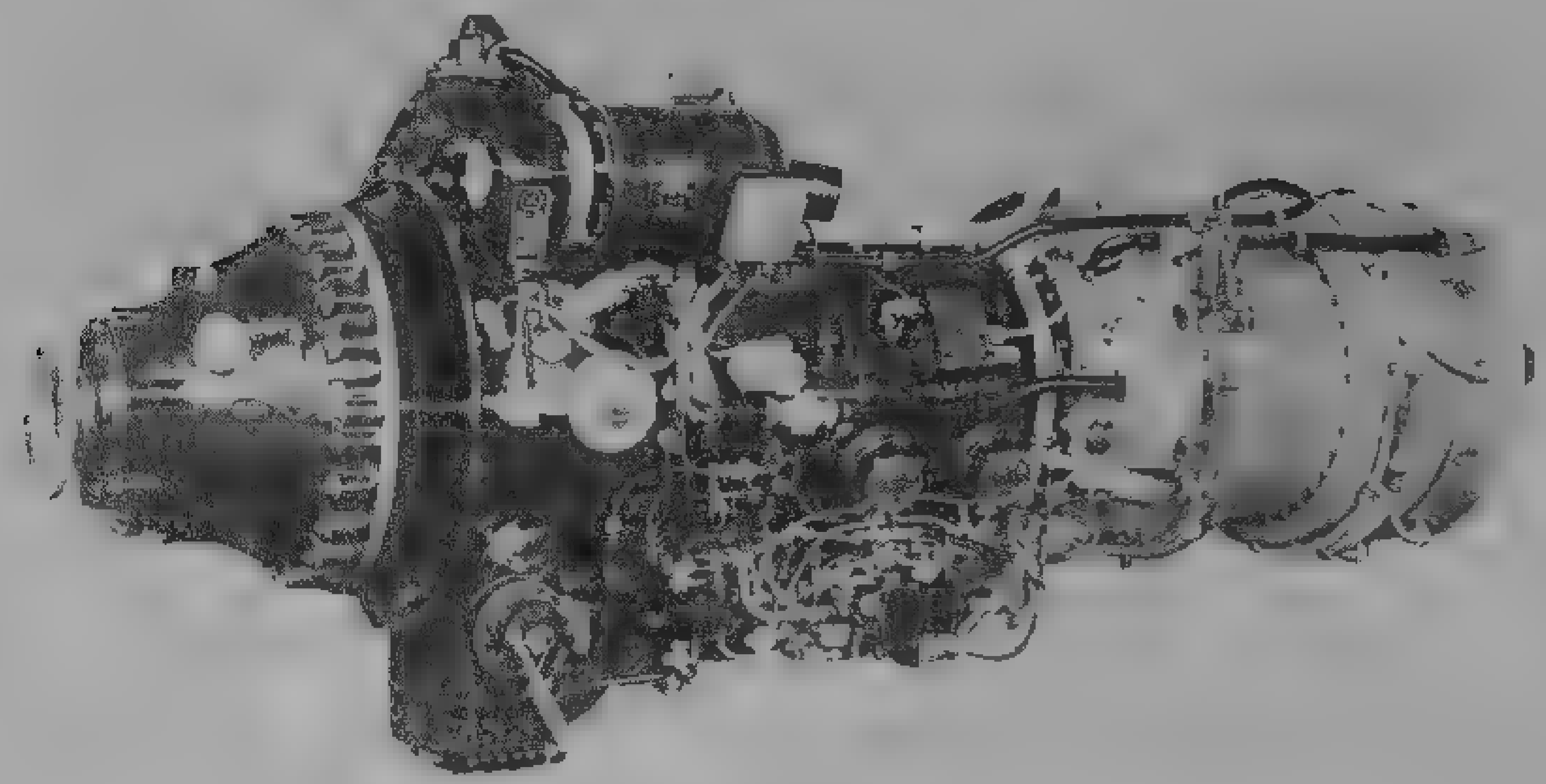
TURBINE: Three-stage axial with solid blades. Rotor/stator sealing effected by soft inserts mounted in grooves in nozzle assemblies. Entry temperature 877°C.

REDUCTION GEAR: Planetary type, incorporating hydraulic torquemeter and electromagnetic negative thrust transmitter for propeller autofeathering. Type AV-72 propeller (AI-24T, AV-72T). Ratio 0.08255.

LUBRICATION: Pressure circulation system.

OIL GRADE: 75 per cent GOST 6457-66 or MK-8 (DERD 2490 or MIL-O-6081B) and 25 per cent MS-20 or MS-22 (DERD 2472 or MIL-O-6082B).

ACCESSORIES: Mounted on front casing are starter/generator, alternator, aerodynamic probe, ice detector, negative thrust



Progress (Ivchenko) AI-24 single-shaft turboprop

1972

feathering valve, torque transmitter, oil filter, propeller speed governor and centrifugal breather Below casing are oil tank, air separator, LP and HP fuel pumps and drives to hydraulic pump and tachometer generators

STARTING. Electric STG-18TMO starter/generator supplied from ground power or from TG-16 APU

DIMENSIONS

Length overall	2,346 mm (92.36 in)
Width	677 mm (26.65 in)
Height	1 075 mm (42.32 in)
WEIGHT DRY:	600 kg (1,323 lb)
PERFORMANCE RATINGS	
T-O	1,901 ekW (2,550 ehp)
Cruise rating at 243 kts (450 km/h; 280 mph) at 6,000 m (19 685 ft)	1 208 ekW (1,620 ehp)
SPECIFIC FUEL CONSUMPTION	
At cruise rating	86.0 µg/J (0 509 lb/h/ehp)
OIL CONSUMPTION	0 85 kg (1 87 lb)/h

UPDATED

PROGRESS AI-25

This bypass engine powers the Yak-40 Series production began in 1967

TYPE Two-shaft bypass engine Bypass ratio 2 1

FAN Three-stage axial subsonic; drum-and-disc with pin jointed blades. Pressure ratio 1 7 at 10,560 rpm

COMPRESSOR Eight-stage, drum-and-disc rotor Pressure ratio 4 7 at 16,640 rpm Total pressure ratio at T-O rating (S/L) 8

COMBUSTION CHAMBER. Annular, with 12 centrifugal fuel nozzles

HP TURBINE Single-stage, shrouded, with cooled nozzle guide vanes. Maximum rotor inlet temperature 933°C

LP TURBINE Two-stage, shrouded, cooled discs

CONTROL SYSTEMS: Automatic hydromechanical, main and emergency

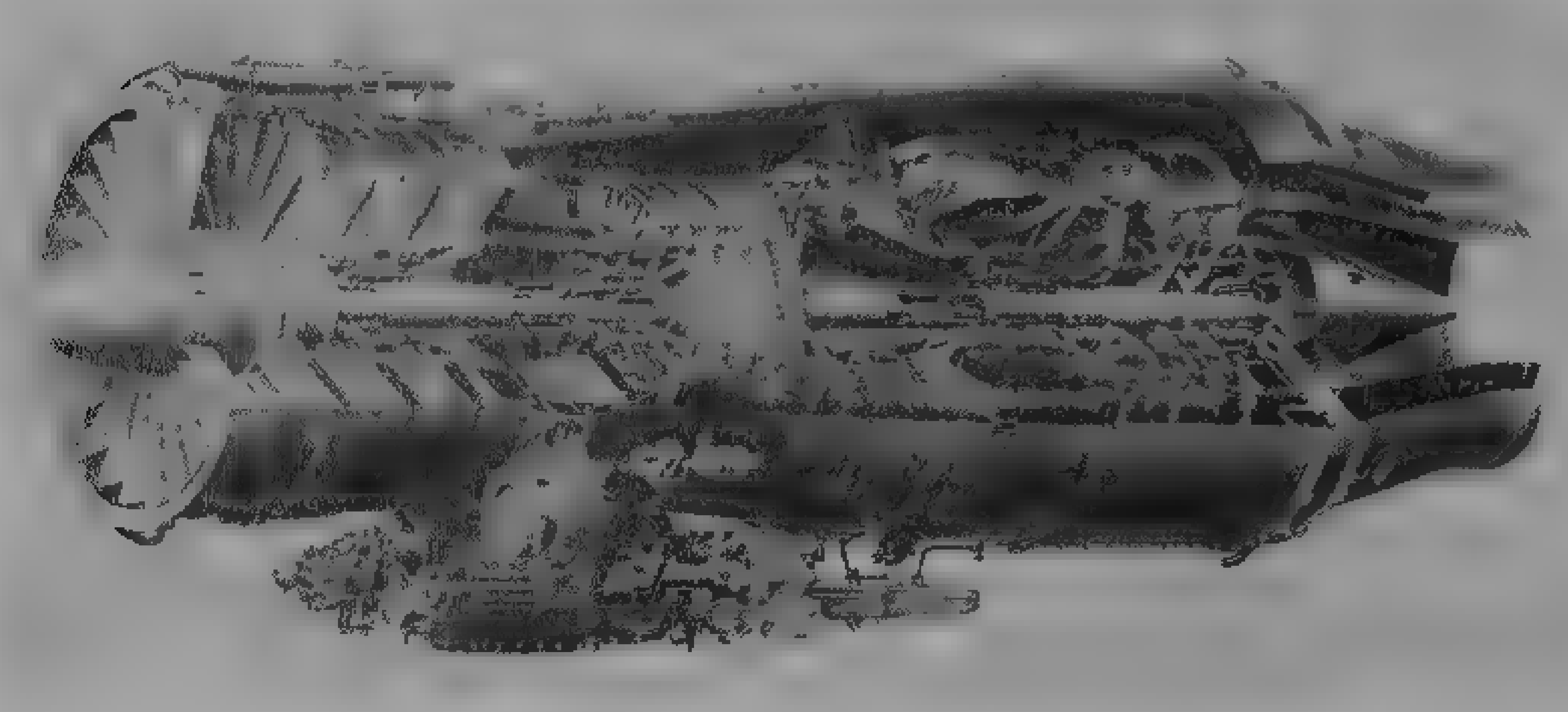
STARTING: SV-25 air starter

OIL SYSTEMS Autonomous, recirculation type

DIMENSIONS

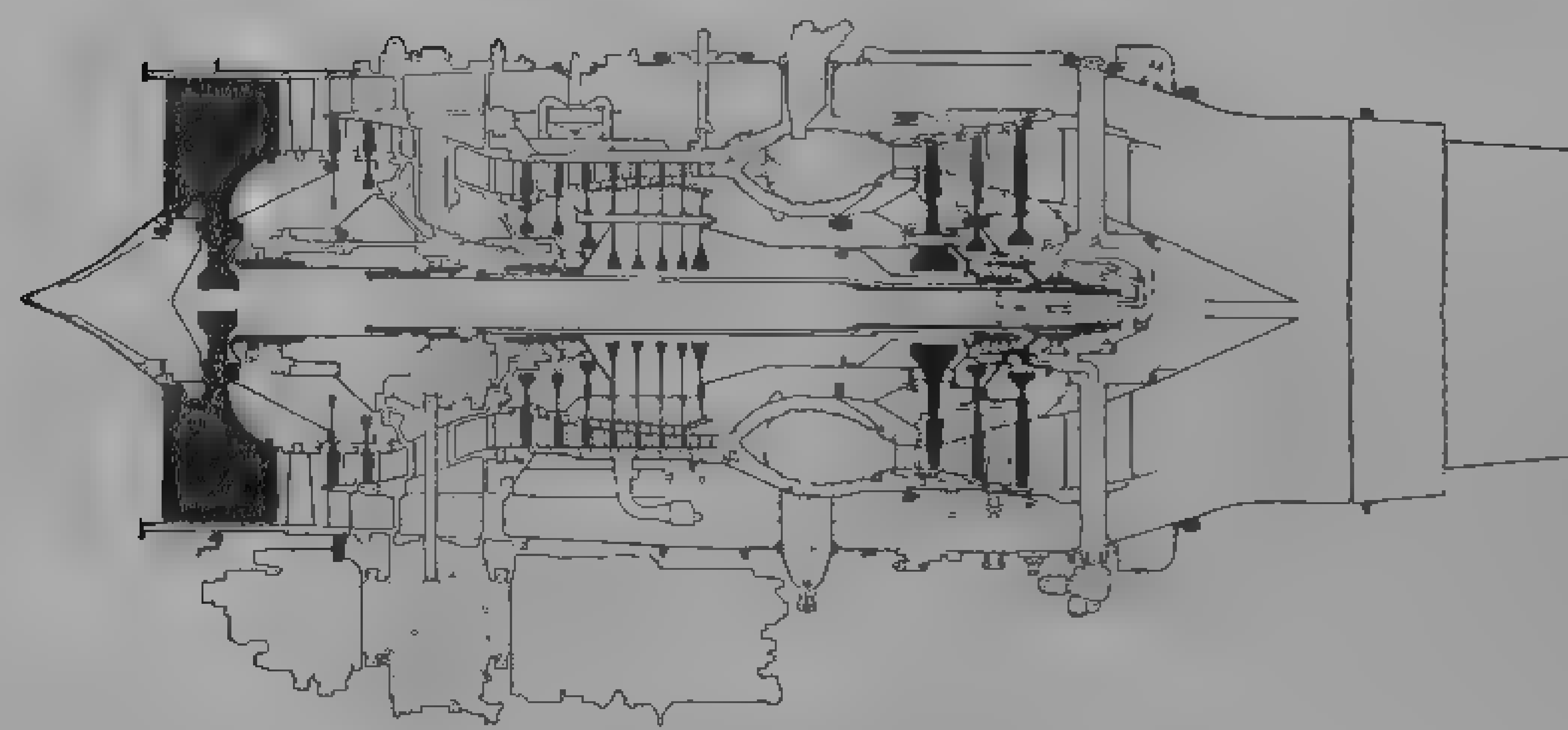
Length	1,993 mm (78.46 in)
Width	820 mm (32.28 in)
Height	896 mm (35 28 in)
WEIGHT, DRY:	320 kg (705 lb)
PERFORMANCE RATINGS	
T-O (S/L)	14 71 kN (3,307 lb st)
Long-range cruise (296 kts, 550 km/h, 342 mph at 6,000 m, 20,000 ft)	4 34 kN (976 lb)
SPECIFIC FUEL CONSUMPTION	
T-O	16.14 mg/Ns (0.57 lb/h/lb st)
Cruise as above	22.51 mg/Ns (0.795 lb/h/lb)

UPDATED



Cutaway drawing of Progress AI-25 turbofan

1992



Longitudinal section through Progress DV 2 turbofan

1992

PROGRESS AI-25TL

This modified engine powers the L-39 trainer Series production began in 1973 Bypass ratio 2 Differs from the AI 25 by

COMPRESSOR. Nine-stage. Total pressure ratio at maximum continuous rating (S/L, ISA) 9 5

HP TURBINE: Single-stage, cooled, maximum rotor inlet temperature 1,037°C.

EXHAUST UNIT Extension pipe, common nozzle.

CONTROL SYSTEM. Hydromechanical Duplicated by a standby and an autonomous emergency system

WEIGHT DRY:	350 kg (772 lb)
PERFORMANCE RATING	
T-O (S/L, ISA)	16.87 kN (3,792 lb st)
SPECIFIC FUEL CONSUMPTION	
T-O	17 00 mg/Ns (0 60 lb/h/lb st)

UPDATED

PROGRESS DV 2

This small turbofan was designed by Progress and developed jointly with ZVL (now PS, which see under Slovakia) to replace the AI 25TL as the engine of the Aero L-59 (previously L-39 MS) trainer The engine was designed to fit the existing engine bay, so that L-39s can be re-engined.

The same core is to be used in several engines.

DV 2 Basic turbofan The description below applies to this engine Powers L-59 and selected to power Yak-130, Il 108 business jet and Chinese NAMC K 8 single-engined trainer/attack aircraft

DV-2B Larger fan, with bypass ratio 2. T-O rating 24 03 kN (5,401 lb st) to +30°C, sfc 15.17 mg/Ns (0 536 lb/h/lb st); dry weight about 500 kg (1,102 lb)

DV-2F Afterburning engine for supersonic applications. Bypass ratio 1.46, maximum thrust 36 09 kN (8,113 lb st); sfc 64.5 mg/Ns (2 28 lb/h/lb st); dry weight about 630 kg (1,389 lb)

DV-12. Turboshaft for helicopters and tilt-rotor aircraft. Large curved jetpipe to side, free turbine driving rear gearbox and output shaft. Maximum contingency power 5,595 kW (7,500 shp), sfc 70 8 µg/J (0.419 lb/h/shp); dry weight 675 kg (1,488 lb)

DV-22. Turbofan for transport aircraft. Mass flow 140 kg (309 lb)/s; bypass ratio 5, T-O thrust 37 95 kN (8 532 lb st) to 30°C; sfc 10 5 mg/Ns (0 37 lb/h/lb st); dry weight 700 kg (1,543 lb). Also called **AI-22**

TYPE: Two-shaft turbofan

FAN: Single stage, overhung, supersonic, made as blisk of aluminium alloy with blades of large chord, without snubbers, hub/tip ratio 0.37, bypass ratio 1 46. Diameter 645 mm (25 4 in). Mass flow 49 5 kg (109 lb)/s. Pressure ratio 2 3

LP COMPRESSOR Two stages, rotating with fan

HP COMPRESSOR. Seven stages. Two-position IGVs, stators cantilevered stages 3 to 6. Three bypass valves. Overall pressure ratio 13 5

COMBUSTION CHAMBER. Annular, 16 fuel nozzles, giving low emissions

HP TURBINE: Single stage, convective cooling, maximum gas temperature 1,147°C

LP TURBINE: Two-stage, first nozzle vanes cooled

STARTING Air turbine

CONTROL SYSTEM Main electronic-hydromechanical, with digital block, plus reserve and emergency hydromechanical systems. System developed jointly with Yugostroy (Czech), which makes production system

LUBRICATION. Autonomous, recirculating, aerobatic

DIMENSIONS.

Length	1,721 mm (67.75 in)
Width	994 mm (39.1 in)
Height	1,037 mm (40 8 in)
WEIGHT DRY:	450 kg (992 lb)
PERFORMANCE RATING (S/L, T-O):	21 58 kN (4,852 lb st)
SPECIFIC FUEL CONSUMPTION.	16 84 mg/Ns (0 595 lb/h/lb st)

UPDATED

PROGRESS D-36

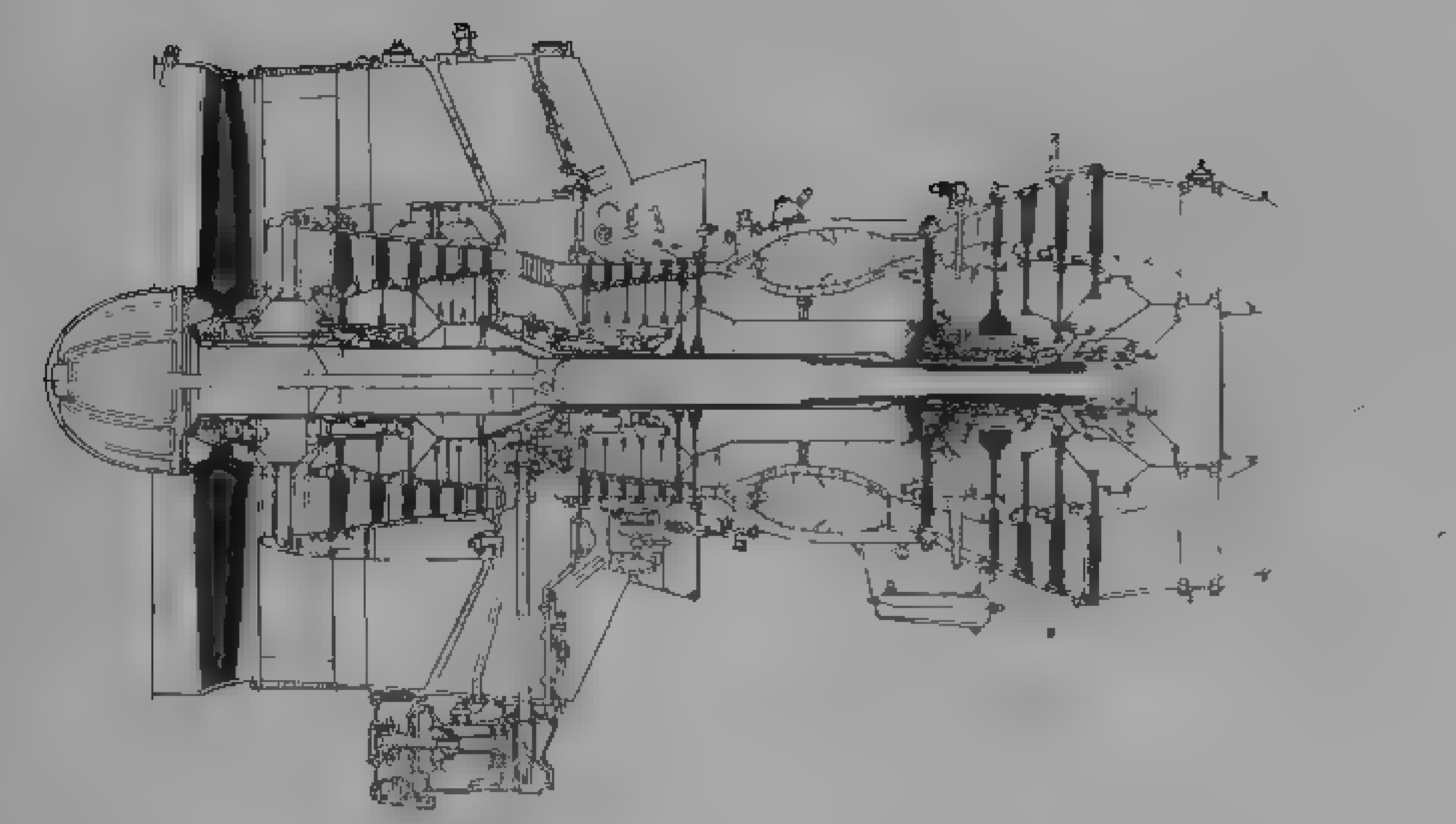
The D-36 was the first Soviet engine with a high bypass ratio. Bench tests began in 1971, flight tests in 1974, and series production in 1977

It is the base engine for a whole family: the **D-136** turboshaft; **D-236** propfan demonstrator; **D-336** industrial engine; and **D-436K/T**, **D-436T1/T2** turbofans. The D 36 was also used as a model for attaining design objectives of the D-18T. The D-36 powers the Yak-42 (three), and An-72 and An-74 and the Kometa 2 and Vykhr 2 Ekranoplans (all two each).

TYPE Three-shaft turbofan

CONFIGURATION Three-shaft, with minimum number of bearings (6) and without intershaft bearings. The bearings are resilient and resilient/damping Their oil cavities have contact radial face seals. Made of 12 modules. Bypass ratio 6 3

FAN. Single stage, transonic, 29 titanium blades with part-span shrouds, 48 outlet guide vanes (the number of blades and vanes chosen for minimum noise). Blade containment by winding Kevlar fibre on the fan casing Maximum speed 5,400 rpm. Mass flow 255 kg (562 lb)/s



Longitudinal section through Progress D-36 turbofan

1992

IP COMPRESSOR: Six stages with inlet guide vanes adjusted on the bench, then fixed in position. Three blow-off valves. Discs and rotor blades of titanium, stator vanes of steel. Maximum speed 10,500 rpm.

HP COMPRESSOR: Seven-stage, with adjustable inlet guide vanes. Three blow-off valves. Rotor blades and discs of two aft stages of steel. Maximum speed 14,170 rpm. Pressure ratio (overall) 18.7.

INTERMEDIATE CASE: Cast magnesium alloy. Forms connecting duct from LPC to HPC and bypass duct, and used for locating HPC front bearing and mounting LPC and HPC casings. Inside is a drive from HP rotor to accessory gearbox on intermediate case under nacelle cowl. The front engine mount is attached to the case.

COMBUSTION CHAMBER: Annular, with 24 burners and two igniters. Integral with HPT nozzle guide vanes (they form a single module). Combustion chamber case made by explosion stamping. Flame tube elements rolled and welded into one unit.

HP TURBINE: Single stage. Maximum inlet 1,137°C. Rotor blades tip-shrouded, convective-film cooling system, attached by fir-tree with two blades in each groove. Nozzle vanes have convective cooling.

IP TURBINE: Single stage. Uncooled, tip-shrouded, rotor blades. Nozzles guide vanes cooled by third-stage HPC air.

TURBINE SUPPORT HOUSING: Module located between HPT and IPT rotors and combined with wide IPT nozzle vanes. Outer casing attached to inner casing by spokes passing through wide hollow nozzle vanes. Inner casing carries rear bearings of HP and IP rotors. Oil supplied through hollow nozzle vanes.

FAN (LP) TURBINE: Three-stage with tip-shrouded blades, air-cooled discs.

EXHAUST UNIT: Consists of rear-bearing housing and main duct nozzle. Rear engine mount attached to housing.

MOUNTING: Universal under and over the wing, in the fuselage and on both sides without changing engine.

CONTROL SYSTEM: Hydromechanical, with inner redundancy and electronic unit controlling gas temperature and rotor speeds. Compressor blow-off valves controlled by independent pneumonic (bubble memory) system located near the valves. Engine compressor air is the operating medium. The D-36 is provided with sensors sufficient for FADEC control. Testing with DSIC FADEC began August 1992.

STARTING: By air-turbine starter, on accessory gearbox, from ground source, APU or operating engine. In-flight starting can be assisted by starter.

COWLING: On Yak-42, nacelle with short fan duct. On An-72 and An-74 nacelle has common nozzle of fan and core ducts.

DIMENSIONS:

Length	3,470 mm (136.6 in)
Diameter	1,373 mm (54.06 in)

WEIGHT, DRY: 1,109 kg (2,445 lb)

PERFORMANCE RATINGS (ISA):

T-O static	63.74 kN (14,330 lb st)
Max cruise at 8,000 m (26,250 ft) at Mach 0.75	15.7 kN (3,527 lb)

SPECIFIC FUEL CONSUMPTION:

T-O	10.195 mg/Ns (0.360 lb/h/lb st)
Max cruise, as above	18.4 mg/Ns (0.65 lb/h/lb)

UPDATED

PROGRESS D-136

This turboshaft engine was designed for the Mi-26 transport helicopter. Bench testing started in 1977, and series production in 1982. It is composed of 10 modules, each of which (except for main module) can be removed and replaced without disturbing neighbouring modules on installed engine. Five gas-generator modules are identical with those of D-36.

TYPE: Two-spool free turbine turboshaft.

GAS GENERATOR: As D-36 but with redesigned intermediate case between LPC and HPC (no fan duct). Accessory gearboxes at top and bottom on intermediate case. Speed (maximum): LPC 10,950 rpm, HPC 14,170 rpm.

FREE TURBINE: Two-stage with uncooled nozzle guide vanes and tip-shrouded blades, with air-cooled discs. Combined as separate module with support housing, outer and inner casings connected by 11 wide load-bearing struts. Inner casing contains front roller and rear ball bearings of free turbine. Struts carry oil pipes and speed sensor drive.

DRIVE SHAFT: Flexibly mounted shaft at rear, transmits torque from free turbine rotor to helicopter transmission by splines.

EXHAUST NOZZLE: Curved to side.

STARTING: By air turbine starter.

CONTROL SYSTEM: Hydromechanical speed governor of free turbine with power synchroniser of both Mi-26 engines. Free turbine speed maintained at 8,300 rpm, changed by pilot command in range of ±300 rpm. Electronic control of gas temperature and speed of free turbine and gas generator rotors. Compressor blow-off valves controlled by self-contained pneumonic system. On Mi-26, engine is equipped with particle separator.

DIMENSIONS:

Length	3,715 mm (146.26 in)
Width	1,403 mm (55.24 in)
Height	1,133 mm (44.61 in)

WEIGHT, DRY: 1,050 kg (2,315 lb)

PERFORMANCE RATINGS (ISA, S/L):

Max contingency	8,500 kW (11,400 shp)
T-O	74.57 kW (10,000 shp)
Max cruise	6,338 kW (8,500 shp)

SPECIFIC FUEL CONSUMPTION: 77.09 μg/J (0.456 lb/h/shp)

UPDATED

PROGRESS D-236

This propfan demonstrator was designed on the base of the D-36 core, but it incorporates a reduction gearbox to drive the SV-36 contrarotating propfan. Design began in 1979. The aim is to create a demonstrator for studying the geared propfan. Bench tests began in 1985, and the tests in the Il-76 flying testbed began in 1987.

The Yakovlev design bureau has been working on propfan integration since 1987. The Yak-42E-LL flying testbed with a D-236 replacing one D-36 first flew in March 1991.

CONFIGURATION: Three-shaft, the propfan being driven by a separate turbine.

GAS GENERATOR: Generally as D-136.

REDUCTION GEAR: Planetary, single-stage, ratio 5.64; contra-rotating output shafts, ratio of outer to inner shaft torque is 41 to 59 per cent.

PROPFAN TURBINE: Three-stage, shrouded rotor blades.

CONTROL SYSTEM: D-36 type, hydromechanical with electronic unit limiting gas temperature and rotor speeds. Independent pneumonic (bubble memory) system controlling compressor blow-off valves.

PROPFAN: SV-36, by Stupino Design Bureau of Machine-Building. Blades of composites without metal elements. Front propeller eight, rear propeller six blades. Rotation speed, T-O 1,100 rpm, cruising ratings 960 rpm, ground idle 500 to 600 rpm. Front and rear propeller speeds maintained equal at all ratings. Blade angle control, digital electronic with hydraulic back-up. At maximum cruise rating (as below) propeller efficiency 0.87, at take-off rating thrust to power ratio 0.94. Propfan diameter 4.20 m (165.4 in).

PERFORMANCE RATINGS:

T-O (S/L, ISA)	8,090 kW (10,850 shp)
Max cruise (11,000 m, 36,100 ft, Mach 0.7)	4,730 ekW (6,340 ehp)

SPECIFIC FUEL CONSUMPTION:

T-O, as above	78.1 μg/J (0.462 lb/h/shp)
Cruise, as above	60.67 μg/J (0.359 lb/h/shp)

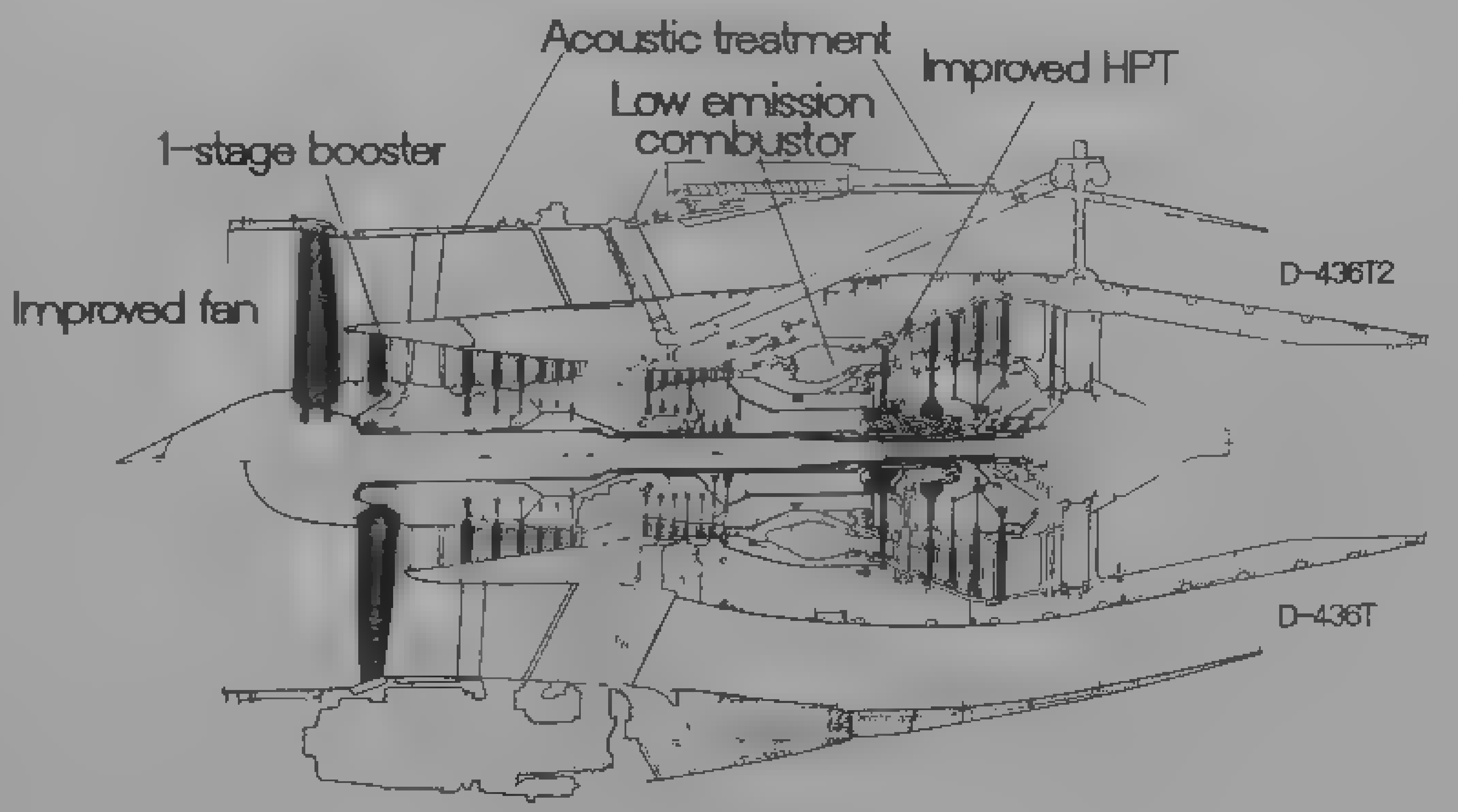
UPDATED

PROGRESS D-436

A growth version of the D-36. The initial version, in accordance with preliminary requirements of the Antonov

Longitudinal section through Progress D-136 turboshaft

1992



Design differences between ZMKB Progress D-436T and D-436T2

1992

D-436 VARIANTS

	D-436K	D-436T	D-436T1	D-436T2
Fan diameter mm (in)	1,373 (54.06)	1,373 (54.06)	1,373 (54.06)	1,373 (54.06)
Weight, dry kg (lb)	1,250 (2,756)	1,250 (2,756)	1,450 (3,197)	1,450 (3,197)
		Take-off rating		
Conditions	S/L, static +15°C		S/L, static, +30°C	
Thrust (ideal) kN (lb)	73.53 (16,535)	73.53 (16,535)	75.0 (16,865)	80.39 (18,078)
Max HP rotor inlet temperature °K (°C)	1,470 (1,197)	1,470 (1,197)	1,483 (1,210)	1,520 (1,247)
		Max cruise rating		
	8,000 m (26,250 ft) 0.75 M, ISA	11,000 m (36,100 ft) 0.75 M, ISA		
Thrust (ideal) kN (lb)	18.63 (4,189)	12.75 (2,866)	14.71 (3,307)	15.3 (3,439)
SFC mg/Ns (lb/h/lb)	18.4 (0.65)	17.8 (0.63)	17.28 (0.61)	17.28 (0.61)
Bypass ratio	6.2	6.0	4.95	4.9
Pressure ratio	21.0	21.9	25.2	26.2

and Yakovlev design bureaux for further development of the An-72, An-74 and Yak-42, was designated **D-436K**

This first ran in 1985, when the total service time of the D-36 was 1 million hours. In 1987 the D-436K was certificated in accordance with USSR airworthiness regulations.

Later, the **D-436T** and derivatives, for the Tu-334-1, were developed in accordance with more precise requirements. They differ from the D-436K in the accessory gearbox design and mix of accessories, the provision of the D-18T type reverser on the D-436T and some changes in the aerodynamics of components.

The D-436T has been bench tested since the beginning of 1990. The following description refers to this version.

TYPE: Three-shaft turbofan.

CONFIGURATION: Six rotor bearings without intershaft bearings. Bearings are resilient and resilient/damping.

FAN: As D-36, with improved performance. Fan speed increased to 5,850 rpm.

COMPRESSORS AND INTERMEDIATE CASING: Modules same as D-36. Speeds and pressure ratio increased.

COMBUSTION CHAMBER: Redesigned for increased gas temperature, reduced emissions and easier high-altitude start. 18 single-orifice nozzles, some with pneumatic atomisers.

HP TURBINE: As D-18T.

IP AND FAN TURBINES: Almost identical to D-36.

REVERSER: As D-18T.

CONTROL SYSTEM: As D-36.

STARTING: Pneumatic, as D-36.

MOUNTING: Universal, as D-36.

Taking into consideration the requirements of Western aircraft manufacturers for regional and medium-range aircraft, the **D-436T1/T2** modification was proposed in 1991. D-436T1 and D-436T2 are practically the same in design, but differ in performance and date of certification. Changes in D-436T1/T2 compared with D-436T are:

FAN: D-18T type but higher performance. Diameter as D-436, but speed increased.

COMPRESSOR: Compressor booster stage driven by fan shaft. Total pressure ratio of core increased, while HP and IP rotor speeds remain unchanged.

COMBUSTION CHAMBER: Changed to ensure moderate gas temperature rise, and reduction of emissions to meet most strict requirements.

HP TURBINE: Aerodynamics changed. Three-dimensional airfoils of nozzle guide vanes. Blade and disc cooling system improved.

IP TURBINE: Some improvement in nozzle guide vane aerodynamics.

FAN TURBINE: Disc strengthened for increased speed.

ACOUSTIC LINING: Area of acoustic panels in bypass duct and air intake is twice that of D-36. Noise level meets latest requirements.

CONTROL SYSTEM: Sensors on engine allow a FADEC system.

COWLING: Nacelle of 3/4 type, as D-18T.

UPDATED

PROGRESS D-18T

The D-18T is a large HBPR turbofan. It powers the An-124 Ruslan) and An-225 (Mriya). This engine incorporates design and technological improvements achieved during design, development and operation of the D-36 engine.

D-18T design began in 1977, and a single spool core engine was tested in 1979. A two-spool core engine was developed, and the first run of a full-scale engine was accomplished in September 1980. First flight on the Il-76T flying testbed was carried out in March 1982. On 24 December 1982 the An-124 made its first flight.

TYPE: Three-shaft turbofan.

CONFIGURATION: Each of the three rotors is carried on two bearings (total 6). The bearings are resilient and resilient/damping. Oil cavities of the fan and IPC bearings are provided with labyrinth seals, others with radial-face contact seals. The engine comprises 17 modules.

FAN: Single-stage, supersonic, with 33 titanium blades with part-span shrouds. Stator has 56 carbon-glass composite plastic vanes, with epoxide matrix and inner and outer titanium shrouds. Leading-edge protected by stainless-steel strip. Containment of separated blade provided by winding Kevlar-type fibre on the inside surface of the case. Blades attached by fir-tree roots in disc slots. Speed (maximum) 3,450 rpm. Mass flow 765 kg (1,687 lb)/s. Bypass ratio 5.6.

IP COMPRESSOR: Seven-stage, transonic, with variable inlet guide vanes and eight blow-off valves on case. Titanium blades and steel vanes. Speed (maximum) 5,900 rpm.

HP COMPRESSOR: Seven-stage with adjustable inlet guide vanes. Blades of first four stages of titanium, remainder of steel. Speed (maximum) 9,100 rpm. Overall pressure ratio (T-O) 25, (cruise) 27.5.

INTERMEDIATE CASE: Intended to form transition path from IPC to HPC and fan duct as well as attachment of HPC bearing and IPC and HPC cases. Drive from HP rotor to accessory gearbox in lower part of case. Front engine mounts attached to inner case. Aluminium outer shell riveted. Inner shell and struts of titanium.

COMBUSTION CHAMBER: High temperature, annular, with 22 main fuel nozzles and two igniters. Integrated with HPT NGVs (a separate module). Case consists of outer and inner shells. Cooling air (for IPT) passes between them. Combustion chamber specially modified for low emissions.

HP TURBINE: Single-stage with tip-shrouded blades with convection-film air cooling. Blades mounted by fir-tree roots (a pair in each slot). Turbine support housing with IP and HP rotor bearings. Vanes air-cooled.

IP TURBINE: Single stage with tip-shrouded blades with convective air cooling.

FAN TURBINE (LPT): Four-stage with uncooled blades with tip shrouds. Rotor of drum-disc type. Outer case cooled by air from fan duct.

EXHAUST UNIT: Comprises rear support case with LPT bearing and rear engine mount, and core nozzle. Struts shaped to untwist turbine outlet flow.

REVERSER: Attached to rear flange of intermediate case, with 12 doors pulled inwards and blocking fan duct by axial movement of translating cowl section, which simultaneously opens peripheral cascade rings. Control and drives are hydromechanical, using engine oil.

LUBRICATION SYSTEM: Self-contained continuous circulation under pressure.

CONTROL SYSTEM: Similar to D-36. Self-contained pneumatic system controls blow-off valves and HPC inlet guide vanes. Engine control provides automatic starting and maintaining given rating over complete operating range.

ACCESSORIES: Accessory gearbox drives constant speed generator and two hydraulic pumps.

DIMENSIONS:

Length	5,400 mm (212.6 in)
Fan diameter	2,330 mm (91.73 in)
Width	2,792 mm (109.9 in)
Height	2,937 mm (115.6 in)

WEIGHT, DRY: 4,100 kg (9,039 lb)

PERFORMANCE RATINGS:

T-O (S/L, ISA+13°C)	229.8 kN (51,660 lb st)
Max cruise (11,000 m, 36,100 ft, Mach 0.75, ISA)	47.67 kN (10,716 lb)

SPECIFIC FUEL CONSUMPTION:

T-O	10.195 mg/Ns (0.360 lb/h/lb st)
Cruise, as above	16.142 mg/Ns (0.570 lb/h/lb)

UPDATED

PROGRESS D-18T1

The D-18T1 is intended to power the An-218. It is a derivative of the production D-18T Series 3. Differences from the basic engine are:

The engine has a maximum contingency rating used in the event of failure of the other engine during take-off.

FADEC type control is provided.

Some units (including accessory gearbox, thrust reverser, engine aircraft attachment panels, pipes and electric connections) have been modified.

DIMENSIONS, WEIGHT: As D-18T

PERFORMANCE RATINGS:

Max contingency (S/L, 30°C, 730 mm Hg)	255.0 kN (57,320 lb st)
T-O (S/L, 30°C, 730 mm Hg)	214.2 kN (48,148 lb st)
Max cruise (11,000 m, Mach 0.8, ISA +10°C)	51.58 kN (11,596 lb st)

SPECIFIC FUEL CONSUMPTION:

Max cruise	17.42 mg/Ns (0.615 lb/h/lb)

NEW ENTRY

PROGRESS D-18TM and D-18TR

The D-18TM is intended to power the An-218. The D-18TR is a further modification. The two engines are of the same design, but have different ratings.

TYPE: Three-shaft turbofan.

CONFIGURATION: Each of the three rotors is carried on two bearings (total six).

FAN: Single stage, with 35 shrouded titanium blades.

IP COMPRESSOR: Seven-stage, with variable inlet guide vanes and first- and second-stage stator vanes, and blow-off valves behind the third-stage.

HP COMPRESSOR: Seven-stage, with blow-off valves behind the 4th stage.

HP TURBINE: Single-stage.

IP TURBINE: Single-stage.

FAN TURBINE: Four-stage.

CONTROL SYSTEM: FADEC type.

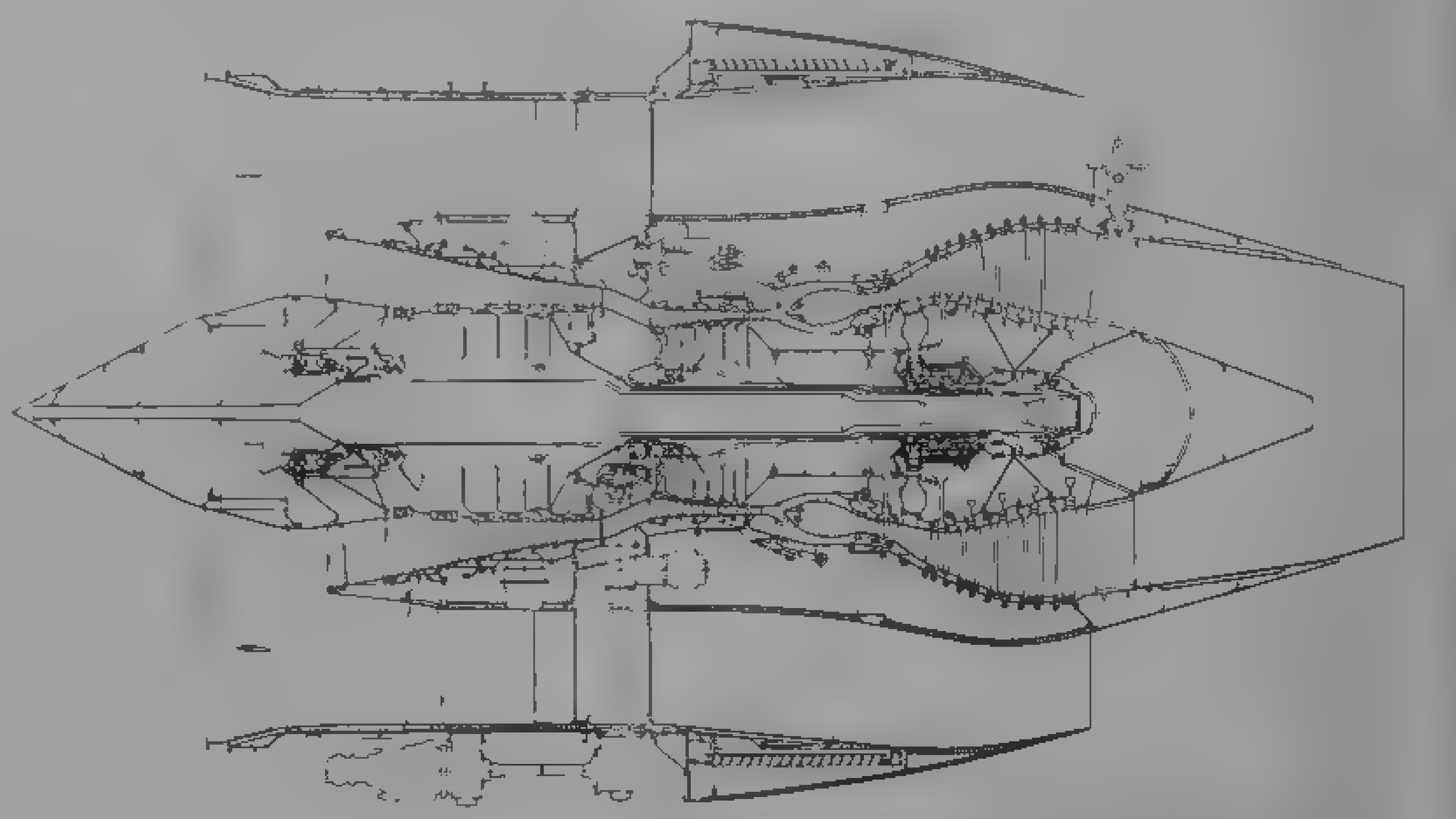
DIMENSIONS:

Length	5,700 mm (224.5 in)
Width	2,982 mm (117.4 in)
Height	2,986 mm (117.6 in)

WEIGHT, DRY: 4,750 kg (10,472 lb)

PERFORMANCE RATINGS:

T-O: D-18TM (Series 3) (S/L, +30°C, 730 mm Hg) 248.1 kN (55,777 lb st)



Longitudinal section through Progress D-18TM turbofan (D-18TR similar)

1995

D-18TR (Series 3) 269.7 kN (60,627 lb st)
Max cruise, D-18TM (Series 3) (11,000 m, Mach 0.8, ISA) 51.49 kN (11,574 lb)
D-18TR (Series 3) 54.33 kN (12,213 lb)

SPECIFIC FUEL CONSUMPTION:
Max cruise, as above 16.57 mg/Ns (0.585 lb/h/lb)

NEW ENTRY

PROGRESS D-27

Since 1985 work has been under way to create a gas generator (named later 27) with high cycle parameters intended to create a family of medium-size engines (similar to the D-36 family). Specific fuel consumption is 25 to 30 per cent lower than current turbofans.

The design envisages the creation of engines of different configuration with minimum changes to the core.

The D-27 has SV-27 contrarotating tractor propfans developed by Stupino Design Bureau of Machine Building. This engine is intended for cargo and passenger aircraft, with improved take-off and landing performance.

In comparison with the SV-36 installed on the D-236 demonstrator, the SV-27 has blades of greater sweep, higher efficiency at cruising ratings and improved acoustics. Rotational speed: (T-O) 1,000 rpm, (cruise) 850 rpm.

The tractor installation is used on the An-70T, which first flew on 16 December 1994, and is specified for the An-180.

PERFORMANCE RATING:
T-O (S/L, 30°C, 730 mm Hg) 10,440 ekW (14,000 ehp)

UPDATED

Progress D-27 propfan with SV-27 propeller (*Piotr Butowski*) *1994*

PROGRESS D-127

The D-127 turboshaft engine is intended to improve the performance of the Mi-26 helicopter and its modifications, as well as to power new advanced heavy-weight helicopters. It is a two-spool gas engine with a free power turbine. The core is based on the gas generator of the D-27 propfan.

The D-127 is of modular design and has automatic FADEC control.

PERFORMANCE RATING:
T-O 10,700 kW (14,350 shp)

NEW ENTRY

Longitudinal section through Progress D-27 propfan *1995*

PROGRESS D-727

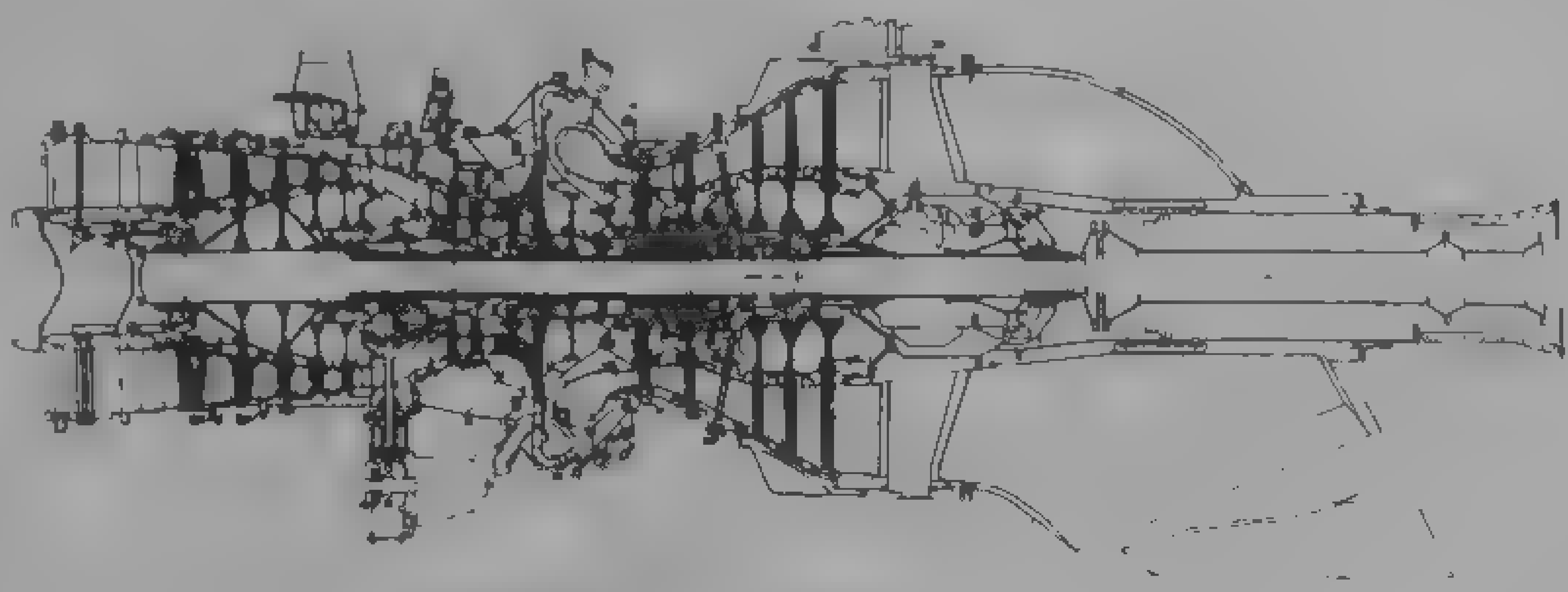
The D-727 turbofan with super high-bypass ratio is intended to power long-range passenger and cargo aircraft. It is being developed on the base of the D-27 propfan two-spool gas generator. The D-727 fan has wide-chord unshrouded blades, and is driven by a three-stage turbine through a reduction gear. Such a configuration allows a bypass ratio of 13.

When designing the D-727 substantiated technical solutions were used which minimised risk and shortened development time. The engine is of modular design and has automatic FADEC control.

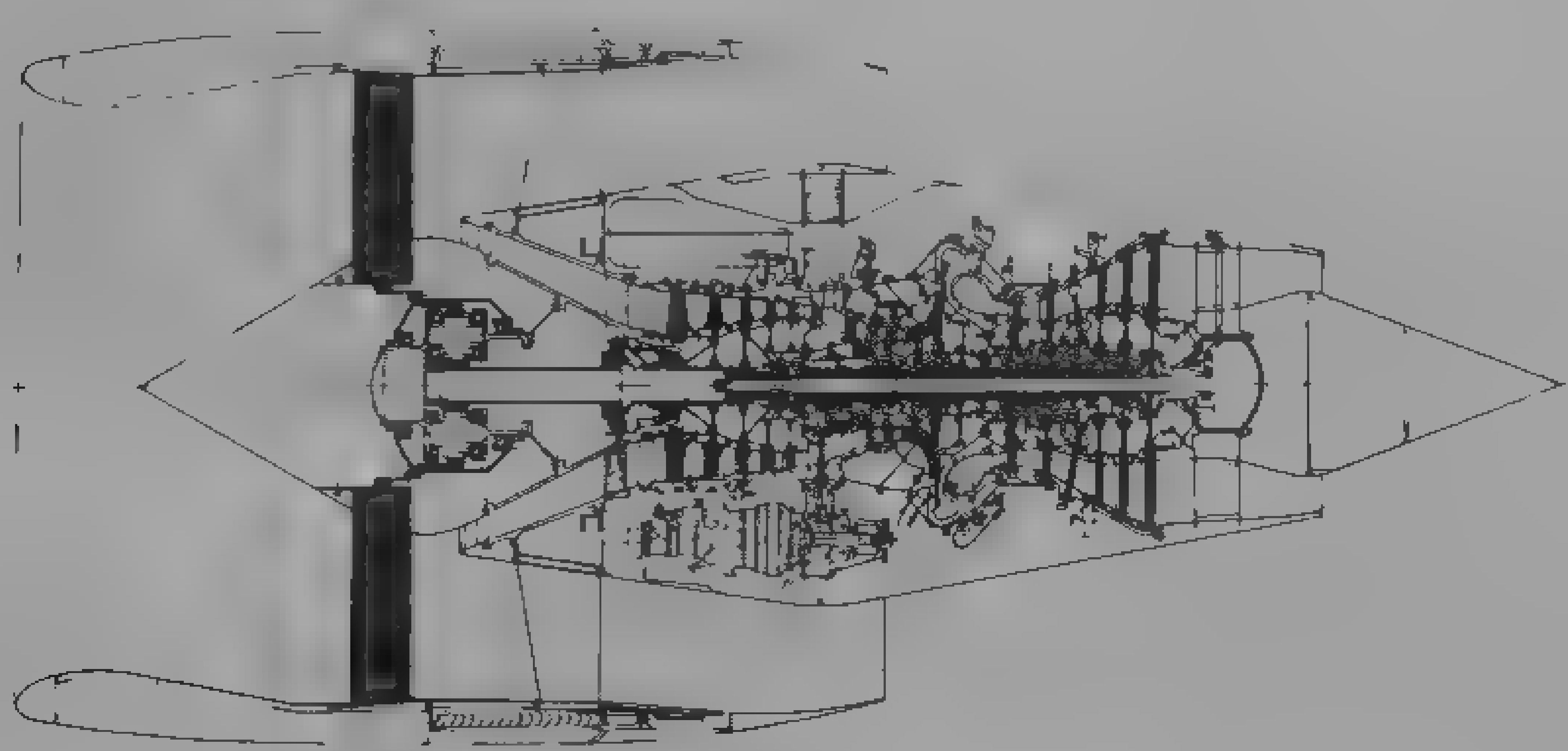
A modification is being developed with a T-O rating of 113.0 kN (25,397 lb st), with a maximum contingency rating of 131.0 kN (29,453 lb st). The increased thrust is achieved by modifying the LP compressor.

PERFORMANCE RATING:
T-O, S/L 98.0 kN (22,046 lb st)

NEW ENTRY



Longitudinal section through Progress D-127 turboshaft *1995*



Longitudinal section through Progress D-727 high-BPR turbofan *1995*

UNITED KINGDOM

MWAE

MID WEST AERO-ENGINES

Hangar 38, Staverton Airport, Gloucestershire GL51 6SR
Telephone: 44 (1452) 857456
Fax: 44 (1452) 856519
TECHNICAL DIRECTOR: Peter Watts

This company has taken over the Hewland piston engine fitted to the Opus 280, as well as single- and twin-rotor engines for manned aircraft previously developed by Norton. Details of the **MW90** twin-rotor engine appeared in the 1992-93 *Jane's*.

VERIFIED

MWAE75

This engine was designed by the Hewland company. It powers the Opus 280. The AE45 is a two-cylinder version. Certificated JAR E and BCAR C.

TYPE: Three-cylinder in-line two-stroke.
CYLINDERS: Liquid-cooled. Capacity 748 cc (45.5 cu in).
WEIGHT, DRY:
With geared drive, starter and generator 50 kg (110 lb)
RATING: 57.4 kW (77 hp) at 6,750 rpm

VERIFIED

MWAE100R

TYPE: Wankel-type twin-rotor.
ROTORS: Air-cooled (housing water/glycol), total capacity 558 cc (35.9 cu in).
WEIGHT, DRY: 52.0 kg (114.6 lb)
RATING: 74.6 kW (100 hp) at 7,000 rpm

VERIFIED

ROLLS-ROYCE

ROLLS-ROYCE plc

65 Buckingham Gate, London SW1E 6AT
Telephone: 44 (171) 222 9020
Fax: 44 (171) 233 1733
Telex: 918091
MAIN LOCATIONS:
PO Box 31, Moor Lane, Derby DE24 8BJ
Telephone: 44 (1332) 242424
Fax: 44 (1332) 249936/7
PO Box 3, Filton, Bristol BS12 7QE
Telephone: 44 (117) 9791234
Fax: 44 (117) 9797575
CHAIRMAN: Sir Ralph Robins
CEO: Dr Terry Harrison
DIRECTOR OF PUBLIC AFFAIRS: Peter Barnes-Wallis

Rolls-Royce is a world leader in the design, development and manufacture of aero, industrial and marine gas turbines. It is also involved in product fields as diverse as power generation, nuclear engineering and materials handling. The two business groups, Aerospace and Industrial Power, employ 40,700.

Rolls-Royce civil and military aero gas turbines are used by more than 320 airlines, 120 armed forces and 640 executive customers. Aero gas-turbine activities are based at Derby, Glasgow, Bristol and Coventry. Rolls-Royce is involved with several collaborative partners in joint ventures such as BMW Rolls-Royce, Rolls-Royce Turbomeca, MTR, Eurojet, IAE, Turbo-Union and Williams Rolls Inc.

On 24 March 1995 Rolls-Royce announced that it had completed the purchase of Allison Engine Company (see under USA in this section). The £331 million acquisition was to be financed with equity.

UPDATED

ROLLS-ROYCE TURBOMECA ADOUR and RTM 322

See the International part of this section

VERIFIED

TURBO-UNION RB199

See the International part of this section

VERIFIED

EUROJET EJ 200

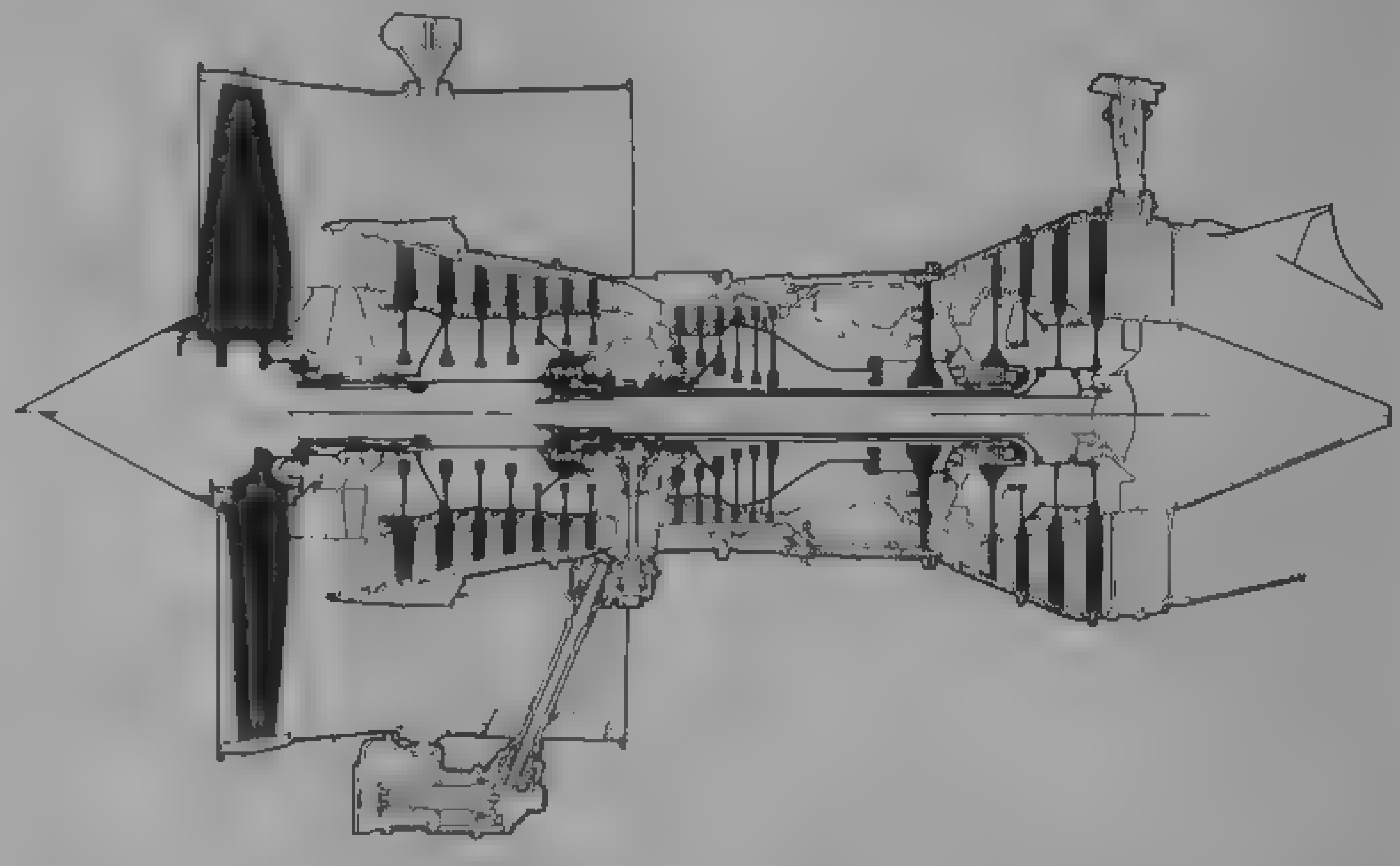
See the International part of this section

VERIFIED

IAE V2500

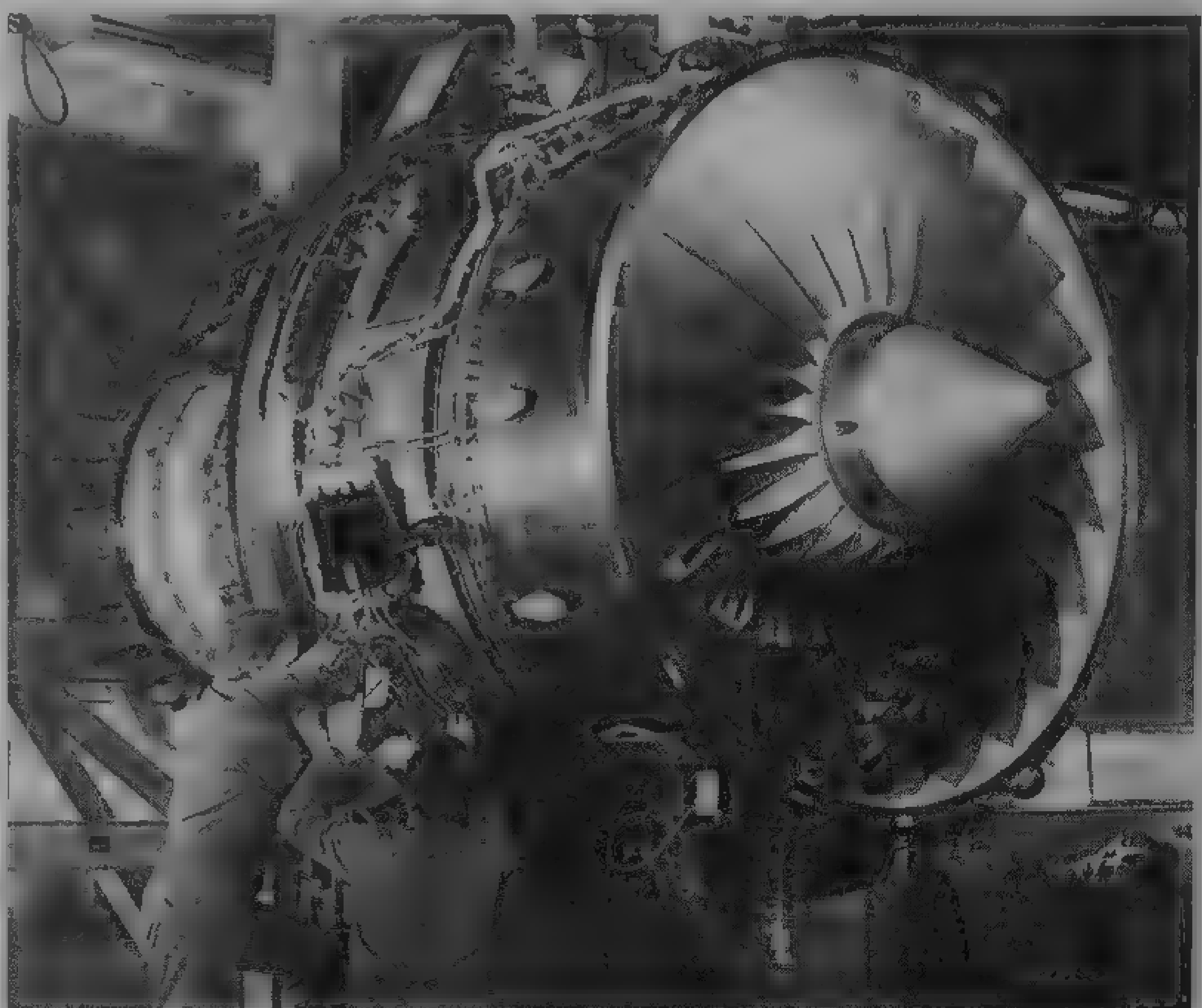
See the International part of this section

VERIFIED



Longitudinal sections of the Rolls-Royce RB211-524G (upper half) and RB211-524D4 (lower)

1987



Rolls-Royce RB211-524G three-shaft turbofan

1989

ROLLS-ROYCE RB211

The designation RB211 applies to a family of three-shaft turbofans of high bypass ratio and high-pressure ratio, ranging in thrust from 166.4 kN (37,400 lb st) to over 445 kN (100,000 lb st). Service experience exceeds 60 million hours. The derived 535 and Trent, are described separately. For all applications Rolls-Royce retains responsibility for the complete propulsion system.

The **RB211-22B** fitted to the L-1011-1 and -100 TriStar is flat rated at 186.8 kN (42,000 lb st) to 29°C. Certificated in February 1972 by the CAA and in April 1972 by the FAA. Production ceased in 1982 with over 670 engines delivered.

The **RB211-524** series of engines was developed from the RB211-22B and covers a range of thrusts from 222.4 kN (50,000 lb st) to 269.6 kN (60,600 lb st). The -524 entered airline service in 1977 with the L-1011 and 747. By the end of 1994 over 1,000 engines had been delivered.

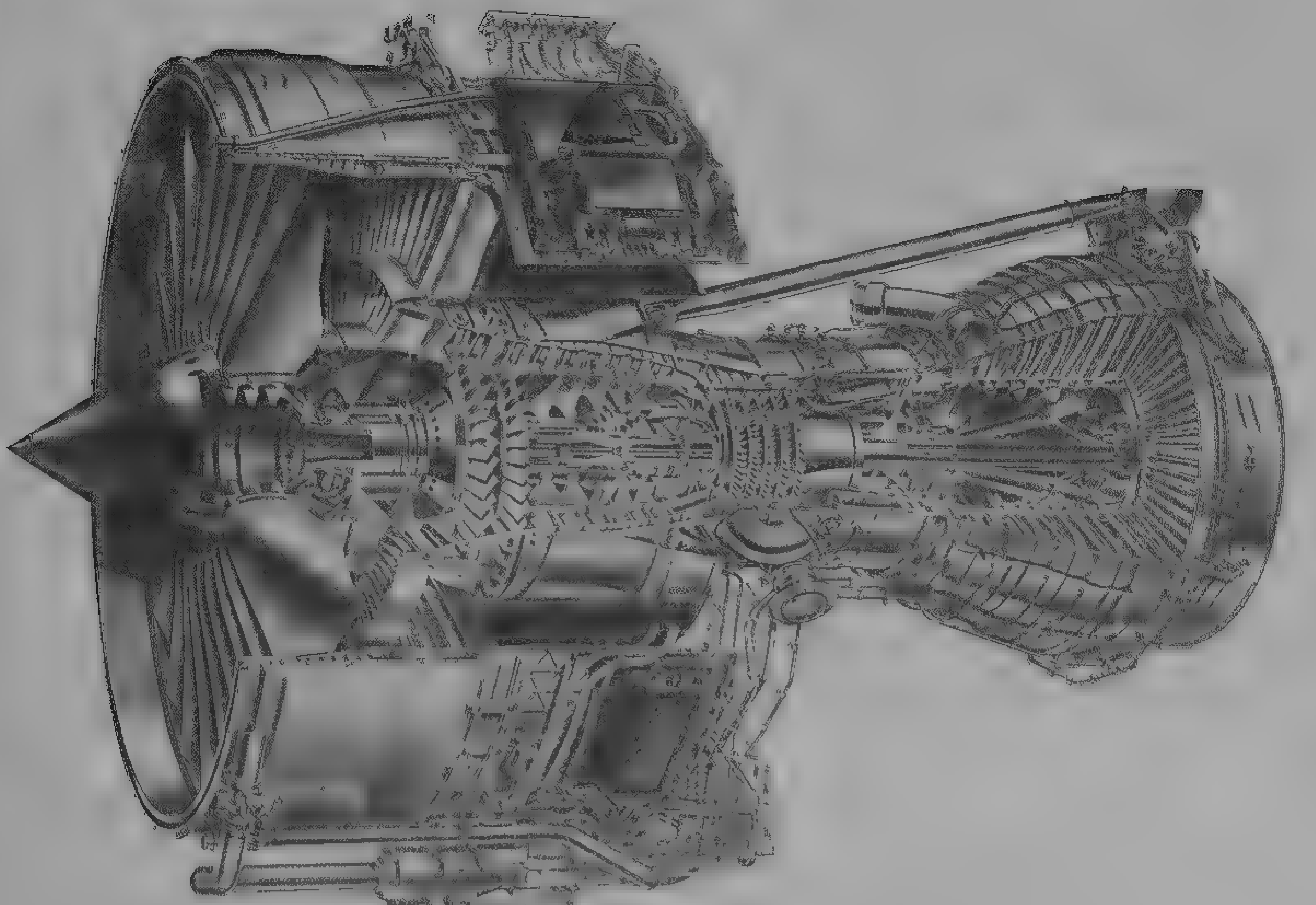
The **RB211-524B**, which powers the L-1011-200, L-1011-500 and 747, is certificated at 222.4 kN (50,000 lb st) to 28.9°C. A 524B4 completed over 27,500 hours on a Delta L-1011 without removal - an industry record.

The **RB211-524C** offers increased thrust ratings for the 747. It entered service in April 1980 with a rating of 229.1 kN (51,500 lb st).

The **RB211-524D4** is an improved engine rated at 235.75 kN (53,000 lb st) for the 747.

The **RB211-524G** incorporates advanced features proven on the 535E4, such as the wide-chord fan, 3D aerodynamics, directionally solidified HP and IP turbine blades and integrated mixer nozzle. Another new feature is a full-authority digital control system. The engine can operate at G rating (258 kN, 58,000 lb st) or H rating (269.6 kN, 60,600 lb st) and powers the 747-400 and 767-300, with 180 minute ETOPS clearance.

The **RB211-524H**, rated at 269.6 kN (60,600 lb st) entered service on the Boeing 747-400 and 767-300 in February 1990, and is mechanically identical to the 524G.



Cutaway drawing of Rolls-Royce Trent 800

1995

The following description relates to the RB211-524G/H

TYPE: Three-shaft axial turbofan. Overall pressure ratio 33

FAN: Single-stage overhung, driven by LP turbine. Composite nosecone, 24 hollow wide-chord blades in titanium alloy, controlled diffusion outlet guide vanes. Aluminium casing with Armco containment ring. Mass flow 728 kg (1,604 lb)/s. Bypass ratio 4.3.

IP COMPRESSOR: Seven-stage, driven by IP turbine. Two drums, one of titanium discs welded together and the other of welded steel discs, bolted to form one rotor, carrying titanium blades. Aluminium and steel casings carry steel stator blades. Single-stage titanium variable inlet guide vanes

HP COMPRESSOR: Six-stage, driven by HP turbine. Welded titanium discs, single steel disc and welded nickel alloy discs bolted together carrying titanium, steel and nickel alloy blades. Steel casing carries steel and Nimonic stator blades

COMBUSTION CHAMBER: Fully annular, with steel outer casings and nickel alloy combustor. Downstream fuel injection by 18 airspray burners with annular atomisers. High-energy igniter plugs in Nos 8 and 12 burners

HP TURBINE: Single stage, with directionally solidified nickel alloy rotor blades, both convection- and film-cooled, mounted in nickel alloy disc by fir tree roots

IP TURBINE: Single stage, with directionally solidified nickel alloy rotor blades fir-tree-mounted in nickel alloy disc.

LP TURBINE: Three-stage, with nickel alloy rotor blades fir tree-mounted in steel discs.

EXHAUST NOZZLE: Integrated nozzle with deep-chute forced mixer

ACCESSORY DRIVES: Radial drive from HP shaft to gearbox on fan casing. Accessories include integrated drive generator and aircraft hydraulic pumps

LUBRICATION SYSTEM: Continuous circulation dry sump system supplying oil to four bearing chambers with a combination of ball and roller bearings. 27 litre (57.6 US pint; 48 Imp pint) oil tank integral with gearbox

DIMENSIONS:

Length overall

RB211-22B, -524C2	3,033 mm (119.4 in)
RB211-524B4, -524D4	3,106 mm (122.3 in)
RB211-524G, -524H	3,175 mm (125.0 in)

Fan diameter

RB211-22B, -524C2	2,154 mm (84.8 in)
RB211-524B4, -524D4	2,180 mm (85.8 in)
RB211-524G, -524H	2,192 mm (86.3 in)

WEIGHT, DRY:

RB211-22B	4,171 kg (9,195 lb)
RB211-524B4, B4 Improved	4,452 kg (9,814 lb)
RB211-524C2	4,472 kg (9,859 lb)
RB211-524D4, D4 Upgrade, -524G/H	4,479 kg (9,874 lb)

PERFORMANCE RATINGS:

T-O: see model listings

Cruise at 10,670 m (35,000 ft) and Mach 0.85 (uninstalled)

RB211-22B	42.2 kN (9,495 lb)
RB211-524B4, B4 Improved	48.9 kN (11,000 lb)
RB211-524C2	51.1 kN (11,490 lb)
RB211-524D4 (all models)	50.0 kN (11,230 lb)
RB211-524G, -524H	52.5 kN (11,813 lb)

SPECIFIC FUEL CONSUMPTION (cruise):

RB211-22B	17.79 mg/Ns (0.628 lb/h/lb)
RB211-524B4	17.56 mg/Ns (0.620 lb/h/lb)
RB211-524B4 Improved	17.16 mg/Ns (0.606 lb/h/lb)
RB211-524C2	18.21 mg/Ns (0.642 lb/h/lb)
RB211-524D4	17.48 mg/Ns (0.617 lb/h/lb)
RB211-524D4 Upgrade (1987)	17.02 mg/Ns (0.601 lb/h/lb)
RB211-524G, -524H	16.15 mg/Ns (0.570 lb/h/lb)

UPDATED

ROLLS-ROYCE TRENT

This is the most powerful Rolls-Royce aircraft engine. Its detailed engineering design began in 1988 to meet the propulsion requirements of the Airbus A330 and Boeing 777. To meet the requirements for these aircraft a range of Trent engines has been developed

Trent Designation	Take-off Thrust	Application
764	284.7 kN (64,000 lb st)	MD-12
768	300.3 kN (67,500 lb st)	A330
772	316.3 kN (71,100 lb st)	A330
775	334.3 kN (75,150 lb st)	A330
875	346.53 kN (77,900 lb st)	777
877	356.23 kN (80,080 lb st)	777
884	384.8 kN (86,500 lb st)	777
890	406.14 kN (91,300 lb st)	777

The Trent features an increased diameter, improved wide chord fan, increased-flow compressors and FADEC. The core incorporates proven advanced technology for high reliability and lowest cost operation

The Trent first ran in August 1990, and since then a total of eight engines have entered the Trent 700 Development Programme, with thrust levels in excess of 80,000 lb st having been regularly achieved. This is in excess of the thrust required for growth versions of the A330. Flight testing continued through 1994, with aircraft certification completed by December and 90 minute ETOPS approved in February 1995. The Trent 800 began engine testing in September 1993, and demonstrated a world record 106,087 lb st on 28 January 1994. The engine was certified in January 1995, three months early, and with thrust increased from 84,000 to 90,000 lb, the first in the world at this level. The first Boeing 777 with Trent 800 engines flew in June 1995, and service entry is due in January 1996

By late 1994 orders and options for the Trent stood at over 200 engines. Risk- and revenue-sharing partners for the Trent are BMW Rolls-Royce, Hispano Suiza, Ishikawajima Harima Heavy Industries (IHI), Industria de Turbo Propulsores (ITP), Kawasaki Heavy Industries (KHI), Lucas and Simera

FAN: Single-stage with 26 wide-chord blades of titanium. Blades made by superplastic forming and diffusion bonding to form a hollow blade with integral canted spars running from root to tip

IP COMPRESSOR: Eight stages, giving increased core air flow. Variable inlet guide vanes and first two stator stages

HP COMPRESSOR: Six-stage design offering high efficiency with improved tip clearance control based on V2500 technology

COMBUSTION CHAMBER: Based on latest technology, optimised for reduced emissions

HP TURBINE: Fitted with single-crystal blading of the latest three-dimensional design

IP TURBINE: Increased annulus design with single-crystal uncooled blades on both versions

LP TURBINE: Trent 700 has four stages with three-dimensional aerodynamically designed blading. Trent 800 has five stages

GEARBOX: Single-piece casing with gears and bearings individually replaceable without disturbance of adjacent gears. Separate oil tank and filler

REVERSER: Four door type on 700, cascade type on 800.

MOUNTING: Trent 700 core-mounted. Trent 800 front fan case mount. Rear core mount with thrust struts to front of core. Design for enhanced rigidity: reduced distortion of fan case and reduced engine weight

ENGINE CONTROL: Full-Authority Digital Engine Control (FADEC). Gives improved fuel consumption, better engine control and reduces pilot workload by interaction with aircraft computers.

DIMENSIONS:

Length overall:

700	3,912 mm (154 in)
800	4,369 mm (172 in)

Fan diameter:
700 2,474 mm (97.4 in)
800 2,794 mm (110 in)

WEIGHT, DRY:
700 4,785 kg (10,550 lb)
800 5,957 kg (13,133 lb)

PERFORMANCE RATINGS:
T-O see above
Cruise (10,670 m, 35,000 ft, Mach 0.82 (0.83 for Trent 800)
700 51.16 kN (11,500 lb)
800 57.83 kN (13,000 lb)

SPECIFIC FUEL CONSUMPTION:
700 16.00 mg/Ns (0.565 lb/h/lb)
800 15.77 mg/Ns (0.557 lb/h/lb)

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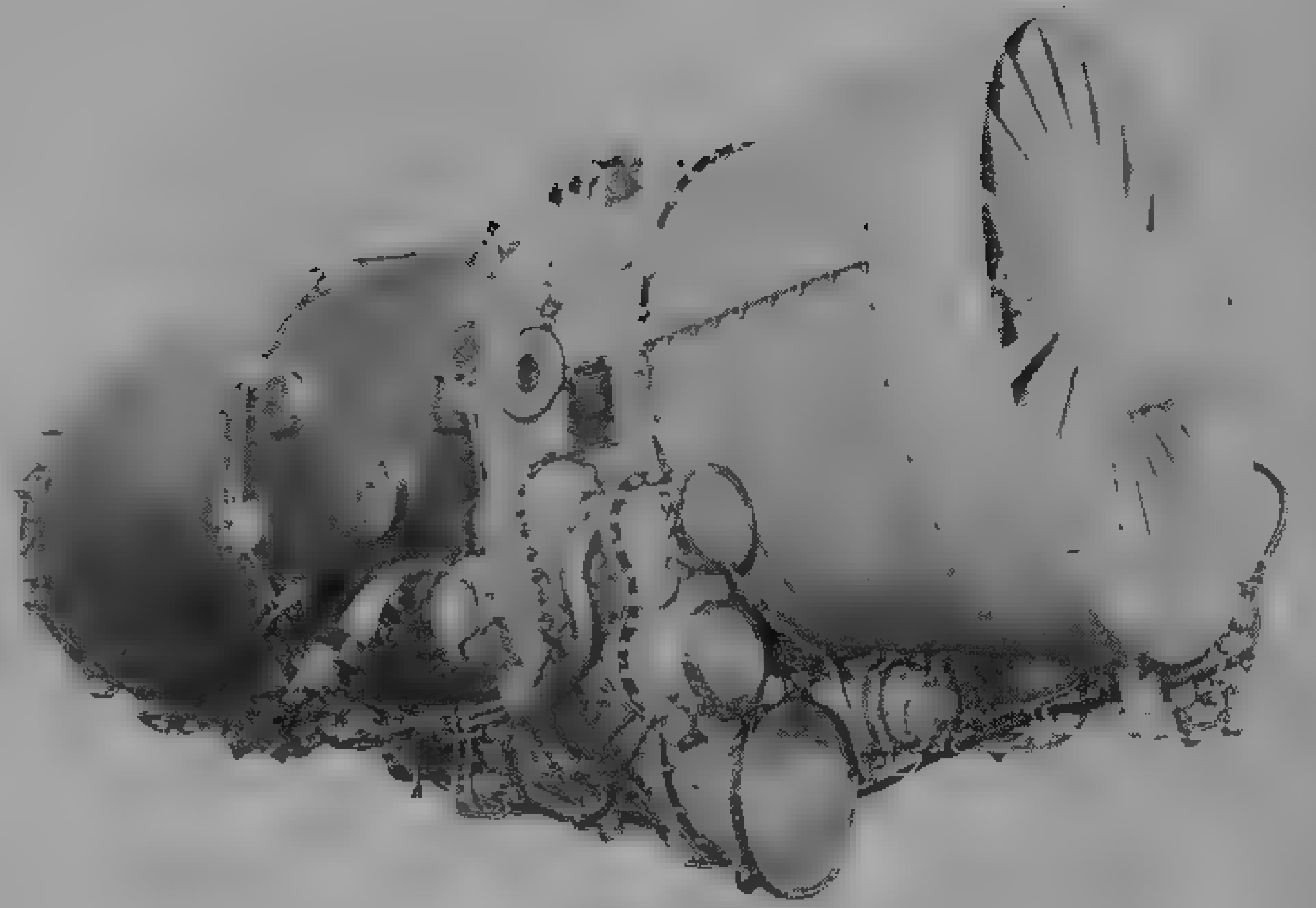


Rolls-Royce Spey Mk 807 two-shaft turbofan

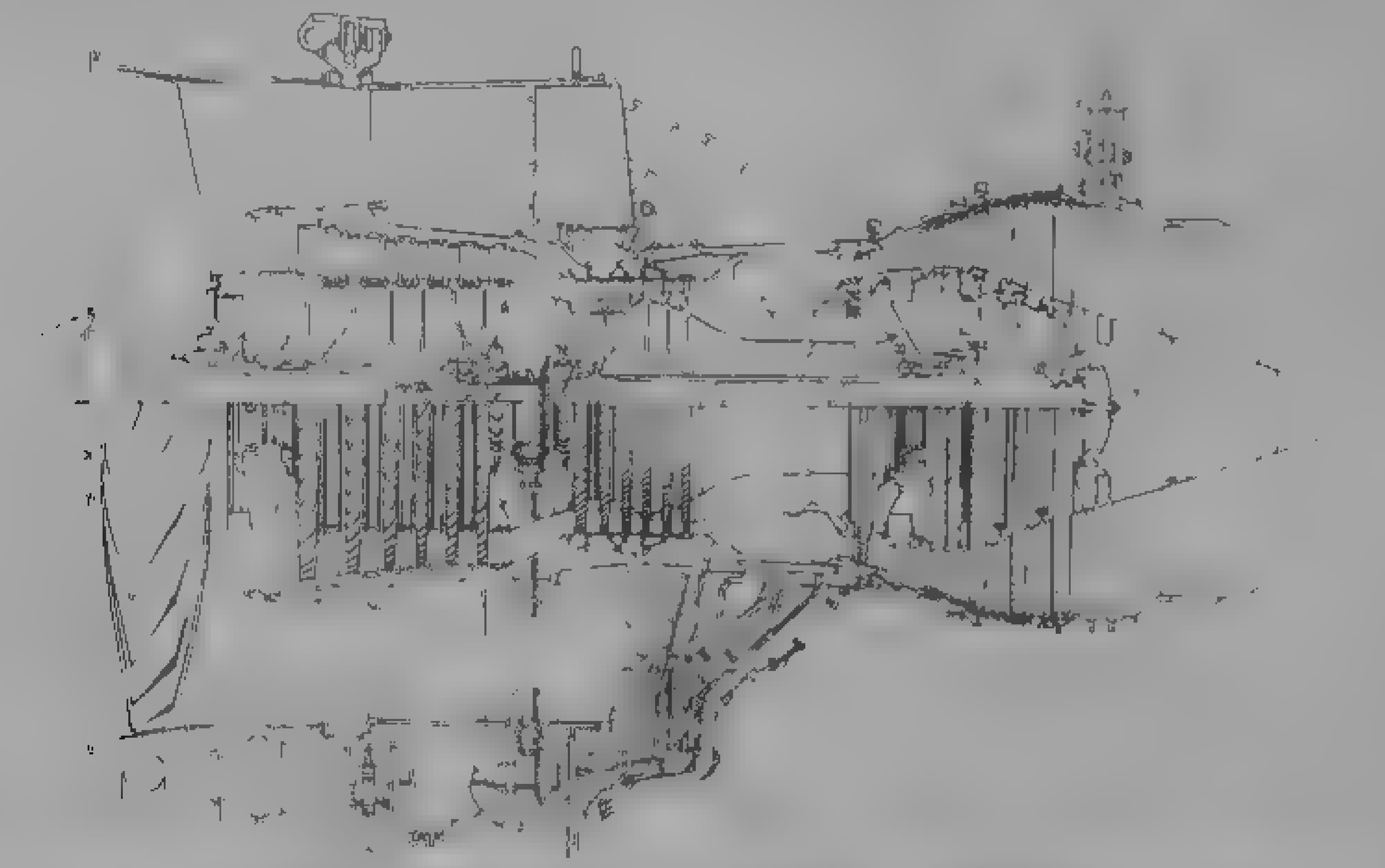
1983

ROLLS ROYCE 535

The **535C** was launch engine for the Boeing 757. It has an HP module based on the RB211 22B, six-stage IP compressor without variable stator vanes, and a scaled down -524 fan. Fan air flow is 18 per cent lower than that of the -22B and core air flow 12 per cent lower. The 535C entered service on 1 January 1983.

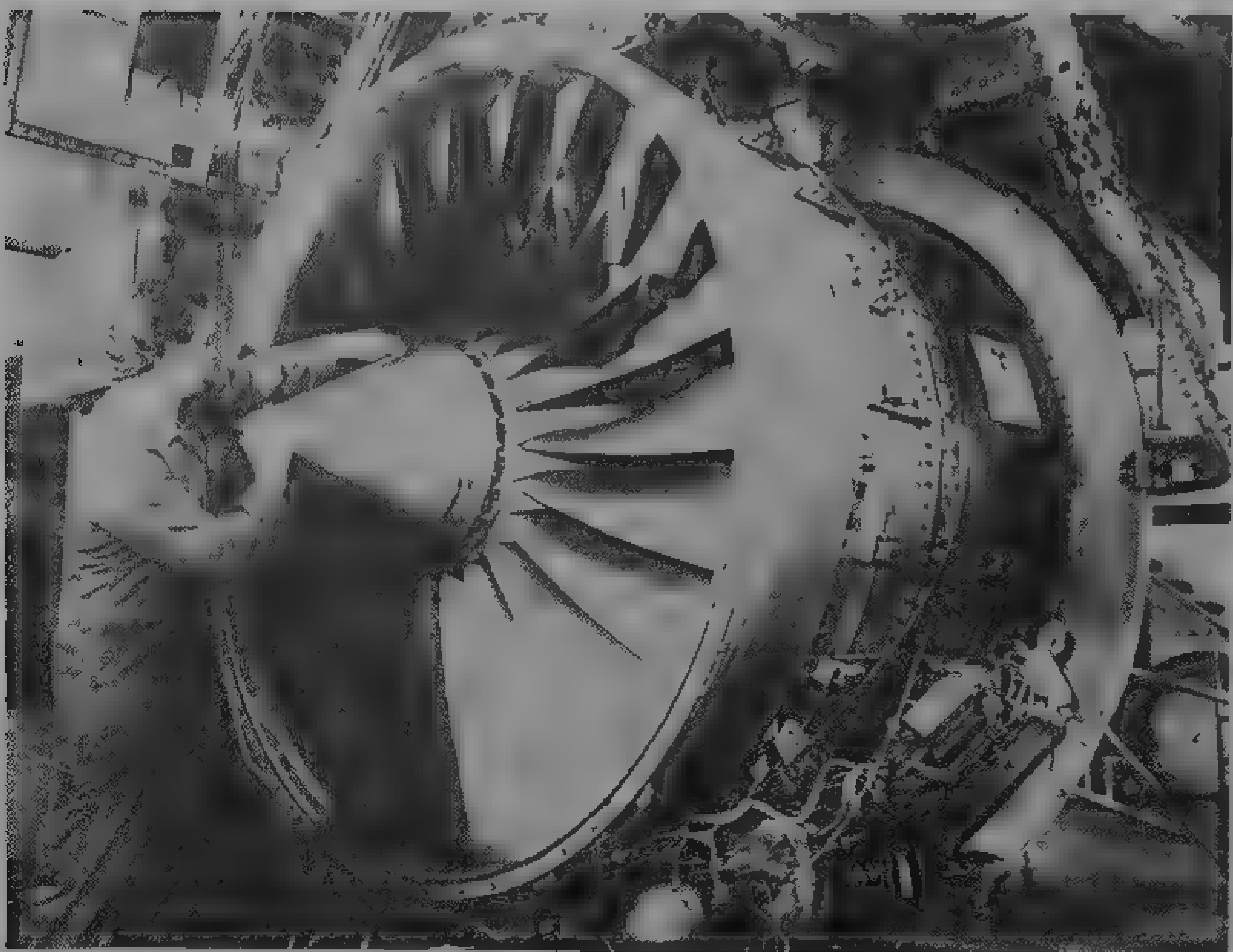
The **535E4** is an advanced version offering increased thrust, together with reduced fuel consumption relative to the 535C. The E4 allowed 757s powered by it to be cleared for 120 minute ETOPS in December 1986, extended to 180 minutes in 1990.

An uprated 535E4 entered service in August 1989. Its T-O rating of 192 kN (43,100 lb st) enables the 757 to carry heavier payloads from the most noise-sensitive airports. By April 1995 over 50 operators had exceeded 10 million hours on 535 engines, including over 1 million for ETOPS fleets. An America West engine was overhauled in 1995 after 24,100 hours of uninterrupted operation in 8,742 flights.



Longitudinal section and cutaway of Rolls-Royce 535E4

1989



Rolls-Royce 535E4 three-shaft turbofan

1984

The following description relates to the 535E4:

TYPE: Three-shaft turbofan.

FAN: Single stage, with only 22 wide-chord blades, without snubbers, each of activated diffusion bonded titanium skins on titanium honeycomb core. Fan case of Rohrbond with Kevlar containment. Mass flow 522 kg (1,150 lb)/second. Bypass ratio 4.3 (535C, 4.4).

IP COMPRESSOR: Six stages of controlled diffusion design. No variable vanes.

HP COMPRESSOR: Six stages of end-bend blading, with stage 4, 5 and 6 discs in titanium super alloy. Low expansion casing for improved tip clearance control. Overall engine pressure ratio 25.8 (535C, 21.1).

COMBUSTION CHAMBER: Annular, 18 airspray nozzles, flexible liner mountings, heatshields and thermal barrier coatings.

HP TURBINE: Single stage. Rotor blades, directionally solidified, cast with HP leading-edge cooling, HP and LP internal air cooling passages both with triple pass system. Nozzle guide vanes with curved stacking, highly cooled and with thermal barrier coating on platforms.

IP TURBINE: Single stage. Cooled NGVs with multilean stacking for improved air flow onto high-aspect ratio blades.

LP TURBINE: Three stages. All turbine casings double wall and cooled.

JETPIPE: Core and bypass flows mixed in integrated nozzle.

REVERSER: Fan reverser only. Jacks move translating cowl to rear, blocker deals seal fan duct and uncover cascade vanes. Over expansion reduces core thrust.

GEARBOX: Mounted under fan case, driven from HP spool.

DIMENSIONS:
Length: 535C 3,010 mm (118.5 in)
535E4 2,995 mm (117.9 in)
Inlet diameter: 535C 1,877 mm (73.9 in)
535E4 1,892 mm (74.5 in)

WEIGHT, DRY:
535C 3,309 kg (7,294 lb)
535E4 3,295 kg (7,264 lb)

PERFORMANCE RATINGS (note: flexible T-O ratings involving considerable derating are used in operation):
T-O (S/L, ISA): 535C 166.4 kN (37,400 lb st)
535E4 178.4-192 kN (40,100-43,100 lb st)
Max climb (10,670 m, 35,000 ft, Mach 0.80):
535C 40.1 kN (9,023 lb)
535E4 41.4 kN (9,300 lb)
Max cruise (10,670 m, 35,000 ft, Mach 0.80):
535C 37.6 kN (8,453 lb)
535E4 38.7 kN (8,700 lb)

SPECIFIC FUEL CONSUMPTION (cruise, as above):
535C 18.30 mg/Ns (0.646 lb/h/lb)
535E4 16.94 mg/Ns (0.598 lb/h/lb)

UPDATED

ROLLS-ROYCE RB168 SPEY

The RB168 military versions of the Spey are as follows:

Mk 101. Developed from civil Mk 505. Fitted to BAe Buccaneer.

Mk 202/203. Supersonic fighter engine with augmentation. Fitted to Phantom FG 1/FGR 2 and to Chinese H-7 (B-7) prototypes.

Mk 250/251. Fully marinised. Fitted to BAe Nimrod MR 1, R 1 and MR 2.

Mk 807. Mk 101 rotors within Mk 555 structure. Produced under licence in Italy with Brazilian participation for AMX aircraft.

DIMENSIONS:
Length: Mk 101 2,911 mm (114.6 in)
Mk 202, 203 5,204 mm (204.9 in)
Mk 250, 251 2,972 mm (117.0 in)
Mk 807 2,456 mm (96.7 in)
Diameter 825 mm (32.5 in)

WEIGHT, DRY
Mk 101 1,121 kg (2,471 lb)
Mk 202, 203 1,857 kg (4,093 lb)
Mk 250, 251 1,243 kg (2,740 lb)
Mk 807 1,096 kg (2,417 lb)
PERFORMANCE RATINGS (max T-O)
Mk 101, 807 49 1 kN (11,030 lb st)
Mk 202, 203: dry 54 5 kN (12,250 lb st)
augmented 91 2 kN (20,515 lb st)
Mk 250, 251 53 3 kN (11,995 lb st)

VERIFIED

ROLLS-ROYCE TAY

The Tay turbofan is designed around the core and external gearbox of the RB183 Mk 555. The LP system has been tailored to complement this by maintaining core inlet and outlet conditions similar to those of the original engine. The wide-chord fan and three-stage IP compressor are driven by a three-stage LP turbine which uses the latest proven technology. The cold bypass air and hot exhaust are combined in a forced mixer The bypass duct is carbonfibre composite The engine is completely modular

The initial production versions are the **Tay 611** and **620** The **Tay 650** gives a 9 per cent increase in maximum take-off thrust and a 15 per cent increase in maximum continuous, climb, and cruise thrusts, achieved by a small increase in fan diameter and an advanced HP turbine

The initial versions received certification from the CAA in June 1986 Over 1,200 Tay engines had accumulated 3 8 million hours in service by 1 January 1995. Certification of the Tay 650 was achieved ahead of schedule in June 1988

The Tay easily meets all current emission standards, and enables aircraft to comply with FAR Pt 36 Stage 3 noise requirements with large margins In six years of operation the Tay has been more reliable than any other civil engine

Tay 611. Selected for Gulfstream IV

Tay 620-15. Selected for Fokker 70 and 100

Tay 650-14. Selected to re-engine BAe One-Eleven

Tay 650-15. Specified for higher performance versions of Fokker 100 Entered service October 1989

Tay 651-54. Selected to re-engine 727-100

TYPE: Two-shaft turbofan

FAN: Single-stage with wide-chord blades. Diameter (620) 1,118 mm (44 in), (650) 1,138 mm (44.8 in)

LP COMPRESSOR: New design with three stages on fan shaft

HP COMPRESSOR Twelve-stage axial (RB183 Mk 555)

COMBUSTION CHAMBER Tubo-annular with 10 flame tubes each with one burner

FUEL SYSTEM: As RB183 Mk 555 but with improved fuel control unit

HP TURBINE All Mks except 650 and 651, two stages as RB183 Mk 555 Tay 650 and 651 advanced two-stage design.

LP TURBINE New design with three stages

BYPASS DUCT Carbonfibre composite

MIXER Forced deep chute type with 12 lobes

DIMENSIONS
Length: Tay 611, 620, 650, 651 2,405 mm (94 7 in)
Fan diameter: Tay 611, 620 1,118 mm (44 0 in)
Tay 650 1,138 mm (44 8 in)
WEIGHT DRY
Tay 611 1,422 kg (3,135 lb)
Tay 620 1,445 kg (3,185 lb)
Tay 650 1,515 kg (3,340 lb)
Tay 651 1,533 kg (3,380 lb)
PERFORMANCE RATING (T-O)
Tay 611, 620-15 61 61 kN (13 850 lb st) to 30°C
Tay 650 67 17 kN (15,100 lb st) to 30°C
Tay 651 68 51 kN (15 400 lb st) to 28°C
SPECIFIC FUEL CONSUMPTION (cruise)
Tay 611 (13,100 m; 43,000 ft, Mach 0 8)
20 1 mg/Ns (0.71 lb/h/lb)
Tay 620 and 650 (9,145 m, 30,000 ft, Mach 0.73)
19 5 mg/Ns (0 69 lb/h/lb)
Tay 651 (10,669 m: 35,000 ft, Mach 0 78)
19 5 mg/Ns (0 69 lb/h/lb)

UPDATED

ROLLS-ROYCE TYNE

The 4,549 ekW (6,100 ehp) Tyne two-shaft turboprop was produced by a consortium comprising SNECMA, MTU Techspace Aero and Rolls-Royce The Mk 21 engine powers the Atlantique and the Mk 22 the Transall. Upgrades are being considered

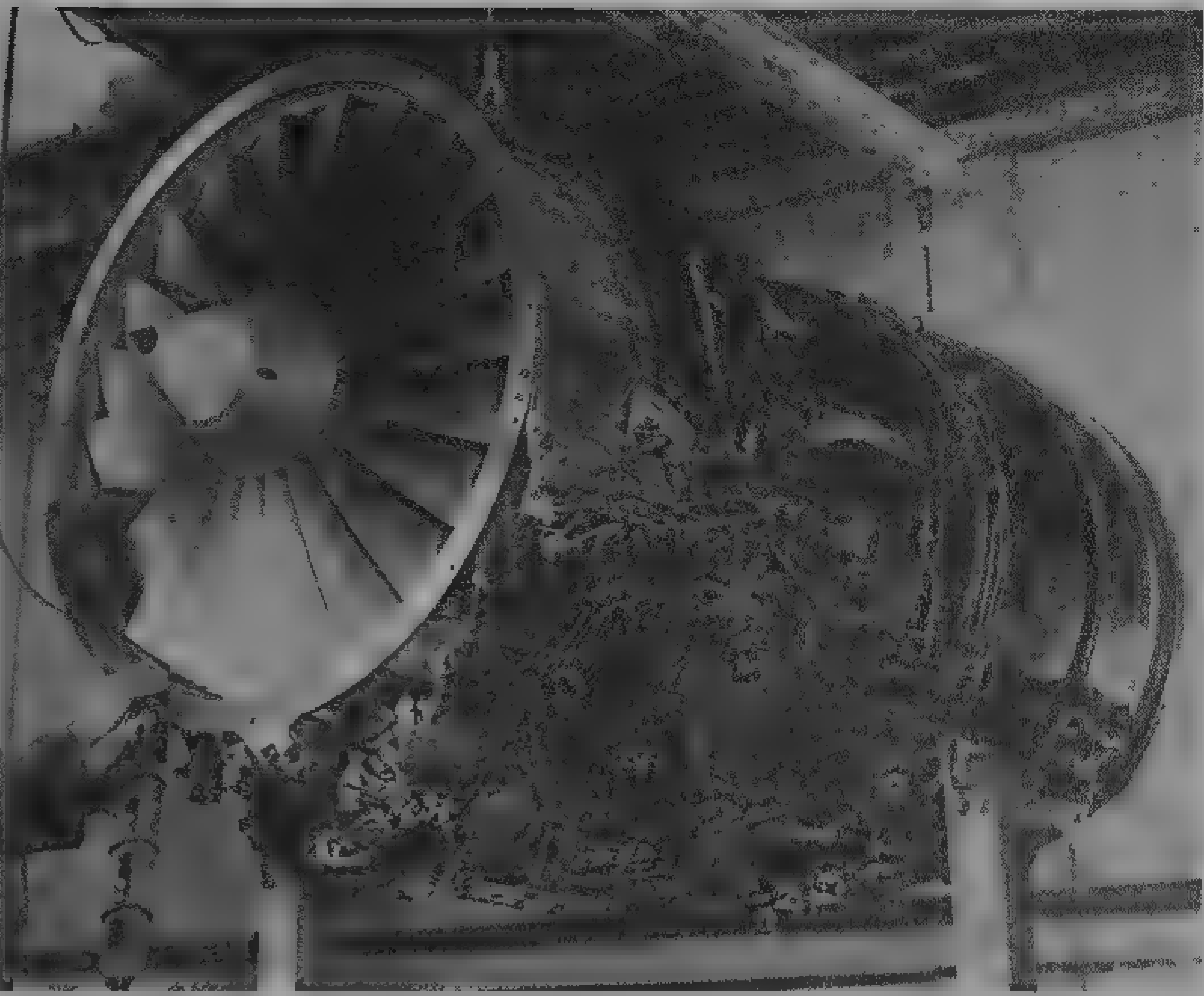
UPDATED

ROLLS-ROYCE VIPER

This turbojet remains in production More than 5,000 are in civil and military operation

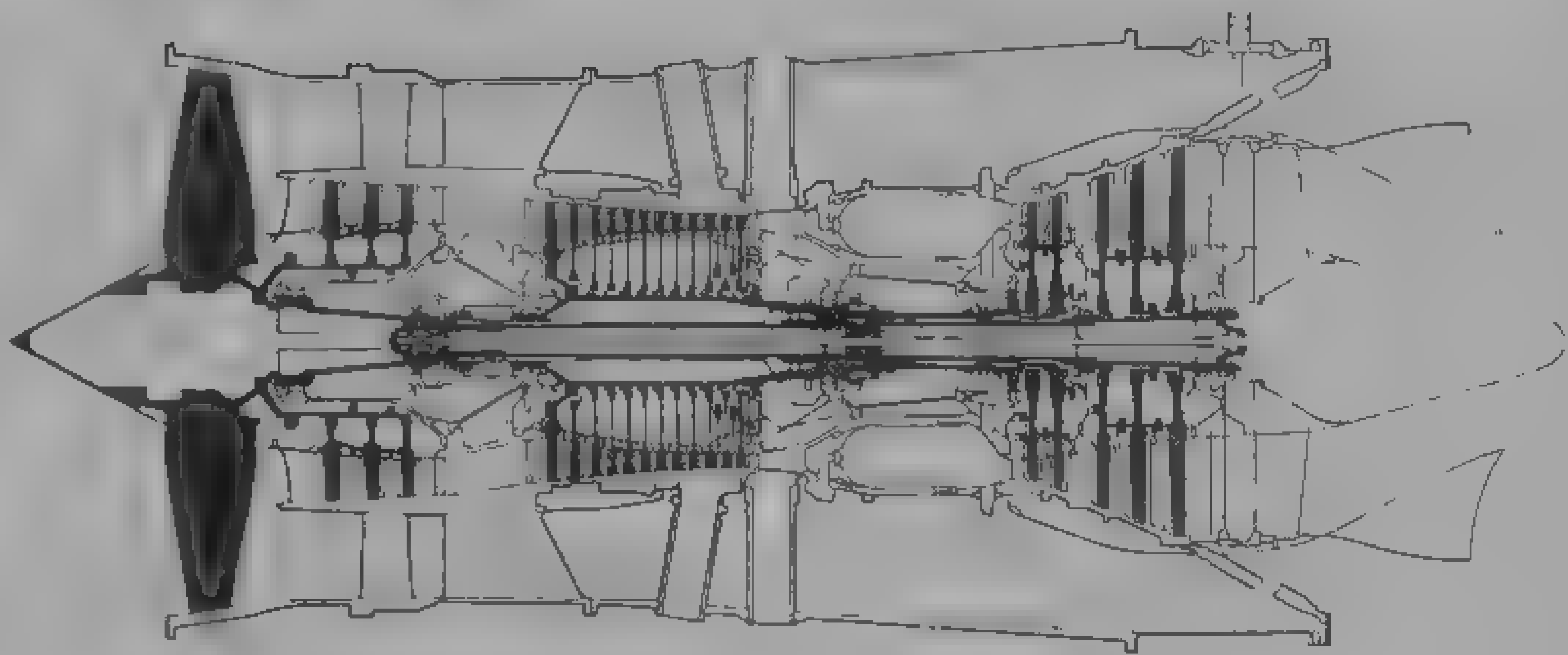
Current versions are as follows

Viper 11 (Mk 200 Series). Single-shaft seven stage axial compressor driven by single-stage turbine Mass flow 20 kg (44 lb)/s. Type tested at 11.12 kN (2,500 lb st) and powers Jindivik Mk 3 drone, Jet Provost T 4 and 5, SOKO Galeb and HJT-16 Kiran Mk I/IA Viper 202s from Jet Provosts are being converted to Mk 210C to power 18 new Jindivik targets from 1996



Rolls-Royce Tay two-shaft turbofan

1990



Longitudinal section of Rolls-Royce Tay 650 two-shaft turbofan

1995

A Viper 11 version, the 22 1, was built under licence in Italy by Piaggio and HDH of Australia for the Aermacchi MB-326

Viper 500 Series. Development with zero stage on compressor. Major applications include early HS 125 (Mks 521, 522) and PD 808 executive aircraft (Mk 526), and Strikemaster (Mk 535), MB-326 (Mk 540) and Jastreb (Mk 531) training and light combat aircraft. Mk 540 built under licence by Piaggio

Viper 600 Series. Eight stage compressor driven by two-stage turbine, annular vaporising combustion chamber Take-off rating 16.7 kN (3,750 lb st) civil and 17.8 kN (4,000 lb st, military Agreement signed with Fiat (Italy) in July 1969 for technical collaboration (see FiatAvio)

The civil Viper 601 powers the BAe 125-600; the military 632 is fitted to the G-4 Super Galeb, MB-326K and MB-339 The 632-41 powers the Orao/IAR-93A and IAR-99. The 632 is built under licence in Italy, Romania and former Yugoslavia. The 633 has an afterburner of the two-gutter type with hot streak ignition, rating 22 3 kN (5 000 lb st

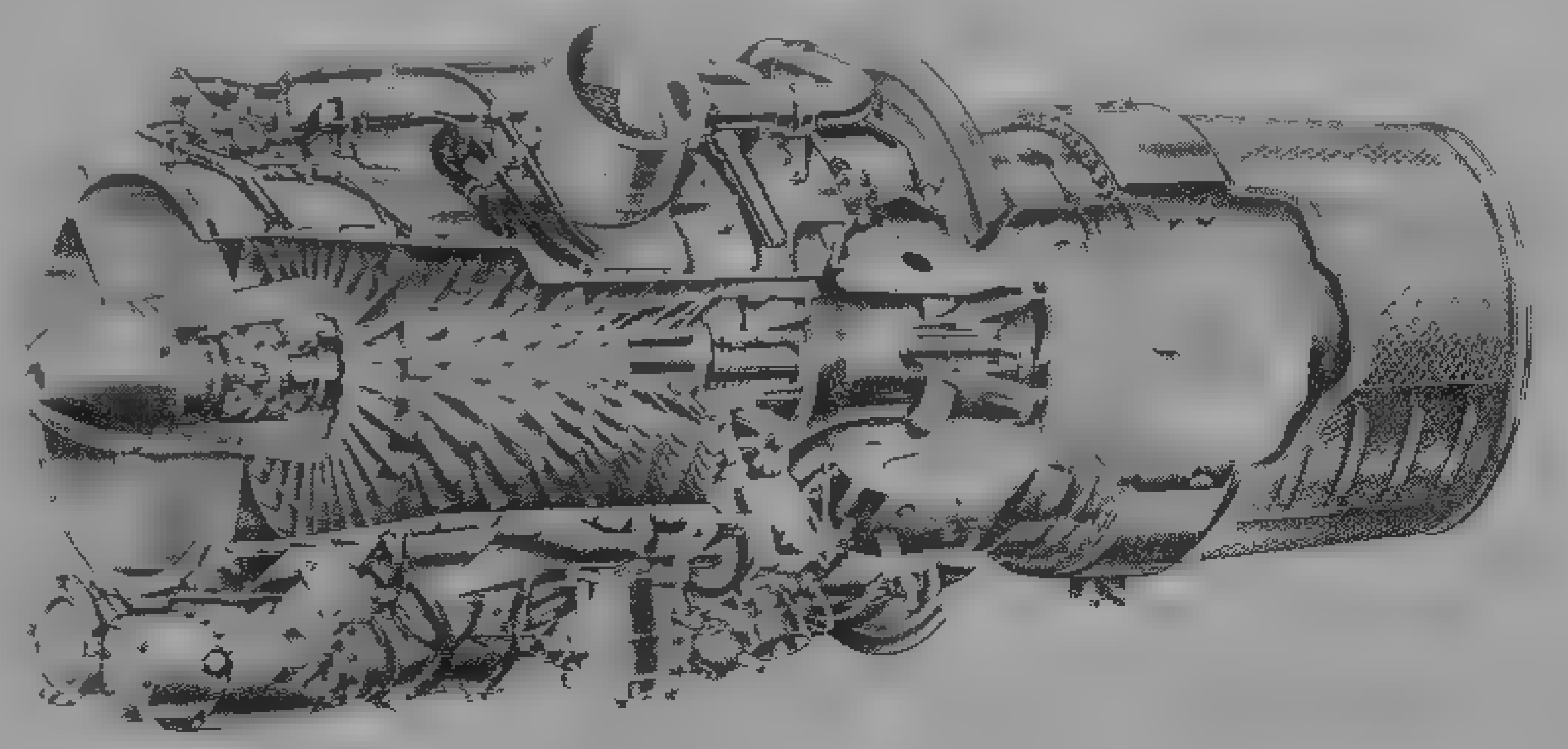
The **Viper 680** is the latest variant for the MB-339 It produces 10 per cent more thrust than the Viper 632

The following details apply to the Viper 600 Series

TYPE Single-shaft axial turbojet

COMPRESSOR. Eight-stage. Steel drum type rotor with disc assemblies. Magnesium alloy casing with blow-off valve

COMBUSTION CHAMBER Short annular type with 24 vaporising burners and six starting atomisers Electric ignition



Cutaway drawing of Rolls-Royce Viper 632 single-shaft turbojet

1980

FUEL SYSTEM: Hydromechanical, with pump, barometric control and air/fuel control
TURBINE: Two-stage axial. Shrouded blades attached to discs by fir-tree roots and locking strips
ACCESSORY DRIVES: Gearbox driven from front of compressor by bevel gear
LUBRICATION SYSTEM: Self-contained recirculatory system. Military version fully aerobatic
STARTING: 24 V starter/generator
DIMENSIONS:

Length (flange to flange)	
Viper 531, 535, 632, 680	1,806 mm (71.1 in)
Max width	749.3 mm (29.5 in)
Height	901.7 mm (35.5 in)

WEIGHT, DRY:

Viper 11	281 kg (620 lb)
Viper 531, 535, 540	358 kg (790 lb)
Viper 601, 632	376.5 kg (830 lb)
Viper 680	379 kg (836 lb)

PERFORMANCE RATINGS (T-O):

Viper 11	11.12 kN (2,500 lb st)
Viper 531	13.9 kN (3,120 lb st)
Viper 535, 540	14.9 kN (3,360 lb st)
Viper 601	16.7 kN (3,750 lb st)
Viper 632	17.66 kN (3,970 lb st)
Viper 680	19.39 kN (4,360 lb st)

SPECIFIC FUEL CONSUMPTION (T-O):

Viper 11	30.3 mg/Ns (1.07 lb/h/lb st)
Viper 500 series	28.3 mg/Ns (1.00 lb/h/lb st)
Viper 601	26.9 mg/Ns (0.95 lb/h/lb st)
Viper 632	27.5 mg/Ns (0.97 lb/h/lb st)

UPDATED

ROLLS-ROYCE PEGASUS

USMC designation: F402

The Pegasus is a two-shaft turbofan designed for short take-off/vertical landing (STOVL) applications. It powers all versions of the Harrier attack aircraft. The Pegasus provides both lift and propulsive thrust through four swivelling exhaust nozzles which vector engine thrust from horizontal for conventional (wingborne) flight, to vertical, for jetborne flight. To minimise aircraft control problems in jetborne flight, thrust is divided between the engine nozzles to ensure the resultant thrust passes through a fixed point irrespective of nozzle angle. LP and HP spools rotate in opposite directions, to minimise gyroscopic effects, and HP bleed air is used for aircraft stabilisation.

The Pegasus entered service in the BAe Harrier in 1969 as the Pegasus 6 Mk 101, progressing through Pegasus 10 Mk 102 in 1971 to **Pegasus 11 Mk 103** by 1974.

The Pegasus 11-21 was developed for the McDonnell Douglas/BAe Harrier II. Developed from the Pegasus 11, the 11-21 provided much improved reliability, a substantially reduced maintenance burden and offered a small thrust increase. Delivery of Pegasus 11-21 began in December 1984. Since 1986 Pegasus 11-21 engines for the Harrier II AV-8B and GR.5/7 have been fitted with FADEC.

The latest production version is the 11-61, offering higher thrust, up to 15 per cent more than 11-21 at high ambient temperatures. To reduce the cost of engine ownership the 11-61 has twice the overhaul life of the 11-21. Maintenance activity is minimised through use of proven digital engine control and engine monitoring systems, improved inspection facilities and modular construction.

Total Pegasus experience exceeds 1 million hours on over 1,000 engines. Principal in-service engine designations:

Engine Mark	Operator	Designation
Pegasus 11	Royal Navy	Mk 103
		Mk 104
	Spanish Navy	Mk 150
	Indian Navy	Mk 151-32
Pegasus 11-21	Royal Air Force	Mk 105
	Royal Navy	Mk 106
	US Marine Corps	F402-RR-406A
	Spanish Navy	Mk 152-42
Pegasus 11-61	US Marine Corps, Spanish Navy and Italian Navy	F402-RR-408A

The following details apply to the Pegasus 11-61.
TYPE: Two-shaft vectored thrust turbofan.
FAN: Three-stage, overhung ahead of front bearing. Titanium alloy blades with advanced circumferential snubbers.
HP COMPRESSOR: Eight-stage with titanium alloy rotor blades and discs.
COMBUSTION SYSTEM: Annular with 'T shaped' fuel vaporisers.
FUEL SYSTEM: FADEC comprising duplicated digital engine control units (DECU) and a hydromechanical fuel metering unit (FMU). FMU includes a cockpit selectable manual fuel control system.
TURBINES: Two-stage cooled HP turbine incorporating single-crystal blading. Two-stage uncooled LP turbine with single-crystal material in first stage.
THRUST NOZZLES: Two fabricated steel zero-scarf front (cold) nozzles and two Nimonic rear (hot) nozzles rotated simultaneously by bleed air driven air motor under pilot command.
LUBRICATION SYSTEM: Self-contained with fuel-cooled oil cooler.
STARTING: Gas-turbine starter/APU driving through engine gearbox.
DIMENSIONS:

Width, including nozzles	2,510 mm (98.8 in)
Length, including nozzles	3,485 mm (137.2 in)
Diameter, intake	1,222 mm (48.1 in)
WEIGHT, DRY (including nozzles):	1,932 kg (4,260 lb)
PERFORMANCE RATING (T-O, S/L, static):	
Pegasus 11-61	106 kN (23,800 lb st)

UPDATED

Rolls-Royce Pegasus 11-61 (F402-RR-408) vectored-thrust turbofan

1984

ROLLS-ROYCE ADVANCED STOVL

Rolls-Royce continues to invest in STOVL and ASTOVL technologies. In addition to independent research and development effort, Rolls-Royce is working with Pratt & Whitney on derivatives of the F119 and with General Electric on derivatives of the F120 in current ASTOVL power plant studies.

VERIFIED

MTU-TURBOMECA-RR MTR 390

See the International part of this section.

VERIFIED

ROLLS-ROYCE GEM

The Gem was developed for the Westland Lynx helicopter. Current applications are in the Westland Super Lynx and Agusta A 129. The Gem 41 series has been civil certified. The choice of a two-spool gas generator gives fast response to power demand without the need for a complex control system. There are seven major modules, each assembled, tested and released as an interchangeable unit.

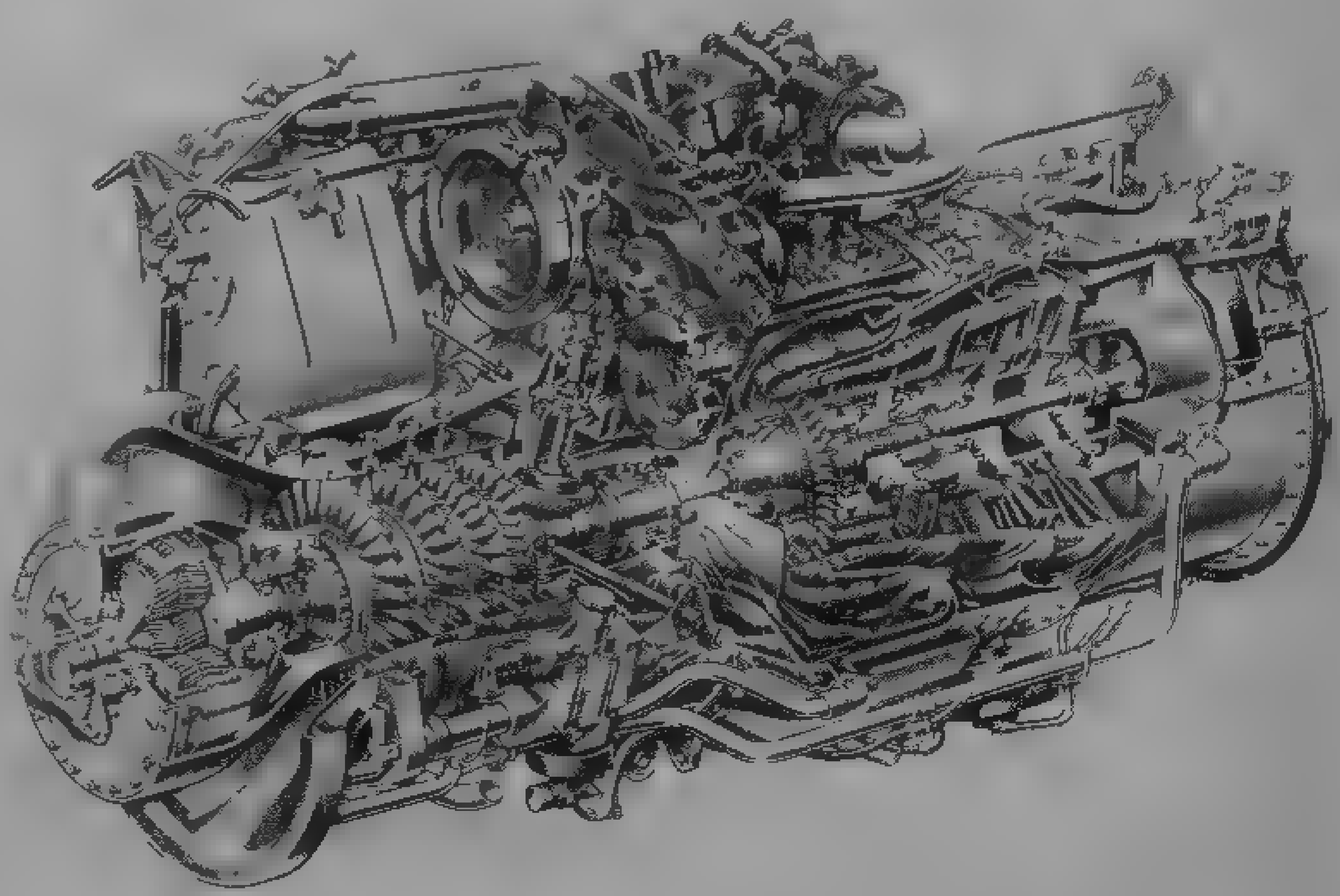
The following versions are in use:

Gem 2 Series. Mk 1001 for Brazilian Navy; no longer in production. Mk 1004 for A 129. Direct drive in place of reduction gearbox and electronic instead of hydromechanical control. Production under licence by Piaggio. Rated at 671 kW (900 shp).

Gem 41 Series. Modified compressor to increase mass flow by about 10 per cent plus small increase in TET. Mk 202 for French Navy (converting to Gem 42). Mk 101 for German Navy. Rated at 746 kW (1,000 shp). Engines no longer in production.

Gem 42 Series. Improved reliability and power retention over Gem 41. Current production standard for Westland Super Lynx. Mks 204, 205 for British forces (new and conversion engines). Mk 1017 in service from new with two operators and following conversion with four more. Rated at 746 kW (1,000 shp).

Gem 43 Series. As Gem 41 with added electronic engine control. Mk 1020 for Nigerian Navy. Rated at 746 kW (1,000 shp).



Cutaway drawing of Rolls-Royce Gem 42 free turbine turboshaft

1985

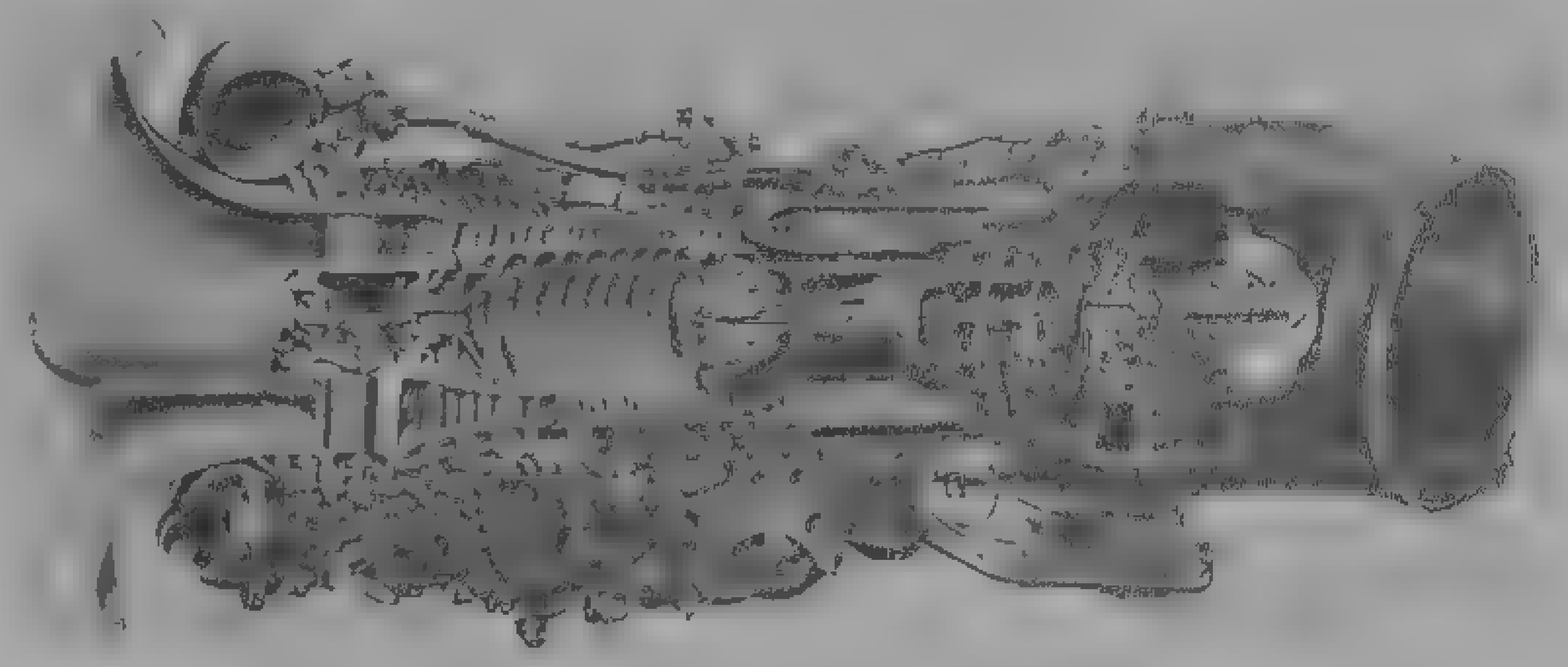
GEM ENGINE RATINGS, kW (shp) ISA S/L STATIC

Designation	Date In Service	One Engine Inoperative: Emergency (20 s)	Max Contingency (2½ min)	Intermediate Contingency (60 min)	Max (T-O) (30 min)	Normal Twin Operation: Max (T-O) (5 min)	Max Continuous
Gem 2, Mk 1001	1976	n/a	671 (900)	619 (830)	n/a	619 (830)	559 (750)
RR 1004	1990	759 (1,018)	704 (944)	657 (881)	657 (881)	n/a	615 (825)
Gem 41-1, Mk 1014	1978	n/a	835 (1,120)	790 5 (1,060)	n/a	746 (1,000)	664 (890)
Gem 42, Mk 1017	1987	n/a	835 (1,120)	790 5 (1,060)	n/a	746 (1,000)	664 (890)
Gem 60-3/1 Mk 530	1983	n/a	897 (1,203)	844 (1,132)	n/a	844 (1,132)	821 75 (1,102)

n/a Not applicable

The following description relates to the Gem 42 Series.
TYPE Free turbine turboshaft
SHAFT DRIVE: Single-stage double-helical reduction gear with rotating planet cage carried by ball bearing at front and roller bearing at rear
LP COMPRESSOR Four-stage axial
HP COMPRESSOR: Single-stage centrifugal Overall pressure ratio 12 0.
COMBUSTION CHAMBER Annular reverse flow with air atomiser fuel sprays. High-energy ignition
HP TURBINE: Single-stage close-coupled to HP impeller.
LP TURBINE Single-stage with shrouded blades.
POWER TURBINE: Two-stage axial with shrouded blades
ACCESSORY DRIVES: Bevel gear on front of HP shaft drives starter/generator, fuel pump, oil cooler fan and other accessories.
FUEL SYSTEM Plessey fluidics automatic control, and power matching for multi engine installation Hamilton Standard electronic control fitted to Mk 1004
LUBRICATION SYSTEM Engine-mounted oil tank and cooler Magnetic chip detectors. Oil filter in accessory wheelcase
DIMENSIONS
Length overall 1,099 mm (43.2 in)
Width overall 575 mm (22 6 in)
Height overall 596 mm (23 5 in)
WEIGHT, DRY
Gem 1001, 2 178 kg (393 lb)
Gem 41, 42 183 kg (404 lb)
RR 1004 163 kg (360 lb)
Gem 60 185 kg (407 lb)
PERFORMANCE RATINGS: see table
SPECIFIC FUEL CONSUMPTION
50 per cent max T-O
Except Gem 60 110 µg/J (0 65 lb/h/shp)
Gem 60 103 µg/J (0 61 lb/h/shp)

UPDATED


Cutaway drawing of Rolls-Royce Gnome H.1400-1 free turbine turboshaft
1979

ROLLS-ROYCE GNOME

General Electric T58 developed by Rolls-Royce under licence. More than 2 300 have been delivered in the following versions

H 1000 Initial version, rated at 783 kW (1,050 shp) for Whirlwind and Agusta-Bell 204B

H 1200. Rated at 932 kW (1,250 shp) Used in Agusta-Bell 204B, Boeing 107 and some Kawasaki KV107-II 5s Coupled version for Wessex comprises two H 1200s driving through a coupling gearbox

H.1400. Rated at 1,044 kW (1,400 shp). Based on the H 1200, with modified compressor to increase air flow

H 1400-1. Rated at 1,145 kW (1,535 shp) Increased gas-generator speed and improved gas-generator turbine blades In production for Sea King and Commando

H 1400-1T. Tropical model, turbine nozzle adjusted for better high-ambient performance

The following description refers to the H 1400-1
TYPE Free turbine turboshaft
COMPRESSOR: Ten-stage axial Variable inlet guide vanes and first three stator rows. Mass flow 6.26 kg (13 8 lb)/s
COMBUSTION CHAMBER Annular with 16 Simplex injectors, eight on each of two sets of manifolds One Lodge high-energy igniter
FUEL SYSTEM. Lucas hydromechanical controlled by HSDE computer
FUEL GRADE DERD 2452, 2453, 2454, 2486, 2494 and 2498 (NATO F44, F34, F40, F35 and F43)
GAS PRODUCER TURBINE Two-stage
POWER TURBINE Single-stage free turbine
REDUCTION GEAR Optional double helical gear providing reduction from nominal 19,500 rpm power turbine speed to 6,600 rpm at left or right output shaft
ACCESSORY DRIVES. Fuel and lubrication systems mounted beneath compressor casing. Power take-off shaft up to 100 shp
LUBRICATION Scavenged gear pumps Serck oil cooler
STARTING Rotax electric starter in nose bullet
DIMENSIONS (H 1400-1)
Length 1,392 mm (54.8 in)
Max height 549 mm (21 6 in)
Max width 577 mm (22 7 in)
WEIGHT DRY
H 1400-1 148 kg (326 lb)
PERFORMANCE RATINGS (at power turbine shaft)
Max contingency (2½ min, multi-engine aircraft only)
H 1400-1 1,238 kW (1,660 shp)
H 1400-1T 1 092 kW (1 465 shp) to 45°C
Max one hour (single engine)
H 1400-1 1,145 kW (1,535 shp)
H 1400-1T 1,030 kW (1,380 shp) to 45°C
Max continuous
H 1400-1 932 kW (1,250 shp)
H 1400-1T 783 kW (1,050 shp) to 45°C
SPECIFIC FUEL CONSUMPTION
At max contingency rating
H 1400-1 102 75 µg/J (0 608 lb/h/shp)
H 1400-1T (30°C) 105 8 µg/J (0 626 lb/h/shp)

VERIFIED

UNITED STATES OF AMERICA

ALLIEDSIGNAL

ALLIEDSIGNAL INC

2525 West 190th St, Torrance, California 90504-6099
Telephone 1 (310) 323 9500

AlliedSignal is parent company of numerous aerospace operating divisions, including the turbine engine companies previously known as Garrett and Textron Lycoming

ALLIEDSIGNAL ENGINE CO

111 South 34th Street, PO Box 52181, Phoenix, Arizona 85072 2181
Telephone: 1 (602) 231 1000
Fax: 1 (602) 231 7722
PRESIDENT James A. Robinson

This company manages the plant at the above address making what were marketed as Garrett engines It is also a partner in two collaborative enterprises, LHTEC which produces the T800 helicopter engine and CFE which produces the CFE738 turbofan, both of which are listed alphabetically in this section.

NEW ENTRY

ALLIEDSIGNAL ATF3

US military designation: F104-GA-100

The ATF3 was the first engine to combine three-spool design with a reverse flow combustion system and turbines, and mixed flow exhaust A total of 216 were delivered Details appeared in the 1994-95 *Jane's*

UPDATED

ALLIEDSIGNAL TFE109

US military designation: F109-GA-100

Based on the core of the T76/TPE331 turboprops, with performance improvements, this turbofan was selected in July 1982 as the engine of the US Air Force's Fairchild T-46A This was subsequently cancelled, but the engine was certificated and a small number of production engines delivered Details appeared in the 1994-95 *Jane's*

UPDATED

ALLIEDSIGNAL TFE731

Announced in April 1969, the TFE731 is a two-spool geared turbofan designed for business jet aircraft. Use of a geared fan confers flexibility in operation and yields optimum performance at up to 15,545 m (51,000 ft).

TFE731-2. First production model Deliveries for the Falcon 10 took place in August 1972. Also powers CASA C-101, IA 63 and AT-3 Dash 2A powers Chinese K 8 and -2B powers Pampa 2000, in each case with digital control.

TFE731 3 Increased turbine temperature First delivered in 1974 for re-engined JetStar II Also selected for the Learjet 54/56, Cessna Citation III, Dassault Falcon 50, BAe 125-700, IAI Westwind 1 and 2 and Astra, Rockwell International's Sabreliner 65A, CASA C 101 and IA 63

TFE731 4 Powers Citation VII Certificated late 1991 Powers Czech L-139 with digital control

TFE731-5. Higher bypass ratio fan, driven by new LP turbine. Digital control Certificated in November 1983 for BAe (Hawker) 125-800 and CASA C 101

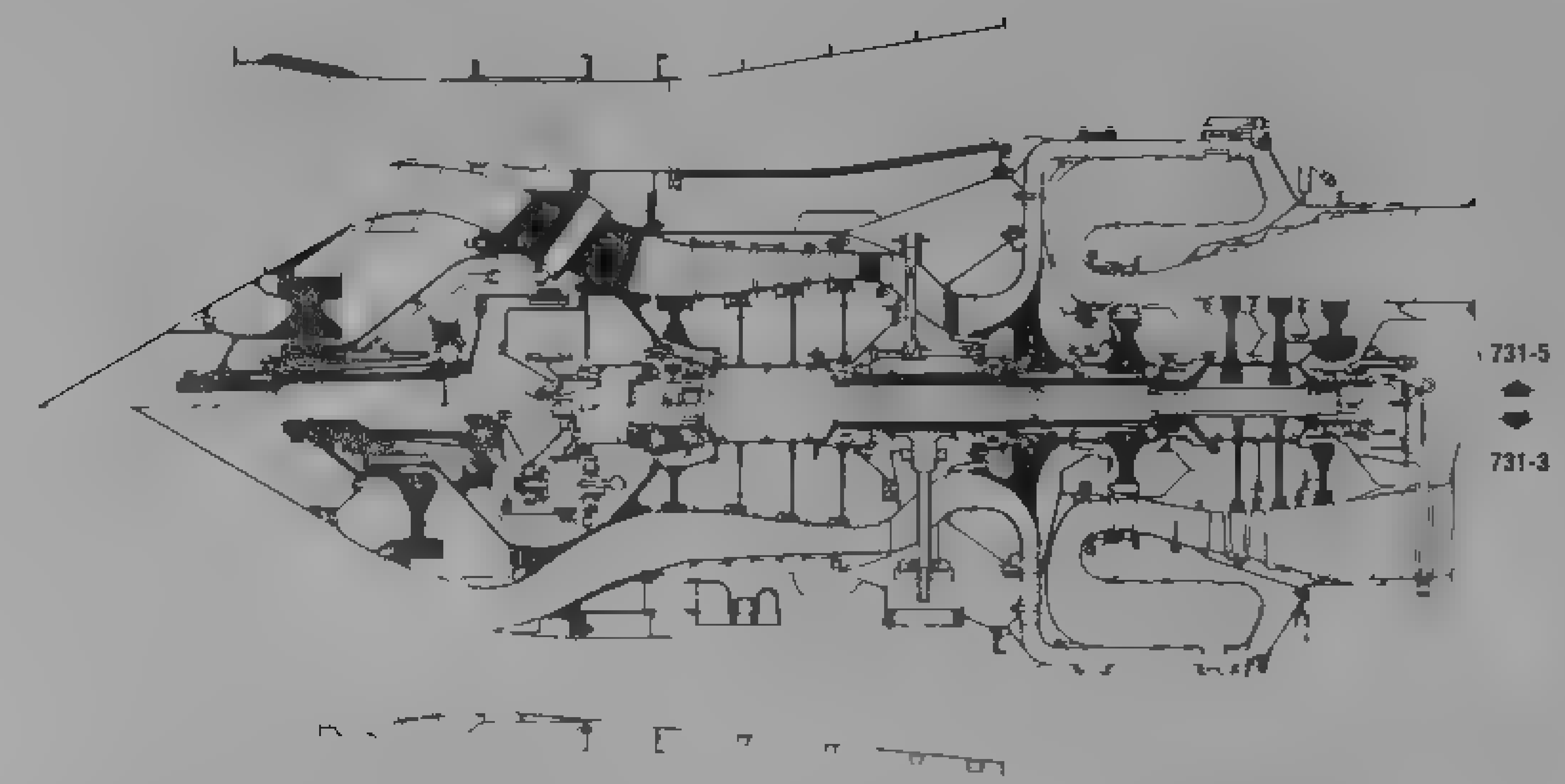
TFE731-5A. Mixer nozzle reducing sfc and raising standard thrust to that of the APR rating Certificated in December 1984 for Dassault Falcon 900, and offered as retrofit for Falcon 20 Volvo Aero has a 5 6 per cent share of the 731 5 production programme.

TFE731 5B Uprated version, certificated in 1990 for Falcon 900B and Falcon 20 retrofit 5BR for Hawker 800XP

TFE731 20 First of new series scheduled for certification 1995 Changes include smaller 5 fan, new HP compressor, HP turbine and gearbox, FADEC. Selected for Learjet 45.

Over 7,020 engines in service by early 1994 had flown a total of 27,100,000 hours

TYPE Turbofan with two shafts and geared front fan
FAN Single stage axial titanium fan, with inserted blades. The fan shaft is connected directly to the planetary gearbox ring gear. Mass flow, sea level static, TFE731-2, 51 25 kg (113 lb)/s; 3, 53.7 kg (118 3 lb)/s; -5, 64 86 kg (143 lb)/s, 20, 55 8 kg (123 lb)/s Bypass ratio, -2, 2 66, 3, 2 80; -5, 3.48, -20, 3 70



Longitudinal section of AlliedSignal TFE731-5 (top half) and TFE731-3 (bottom half) geared turbofans *1985*

COMPRESSOR. Four-stage LP, followed by centrifugal HP on separate shaft running at higher speeds. Overall pressure ratio (S/L, static): -2, 14.0; -3, 14.6; -20, 14.3

COMBUSTION CHAMBER: Annular reverse flow type, with 12 nozzles injecting tangentially. Meets EPA/FAA emission requirements

FUEL SYSTEM. Hydro-electronic, with single lever control; -20, FADEC. All engines have hydromechanical back-up

TURBINES. Single-stage HP and three-stage LP. Average HP turbine gas temperature (S/L, maximum T-O, -2, 860°C; -3 [illegible]; -5 [illegible]; -20, 941°C

ACCESSORY DRIVES. Pads provided for hydraulic pump, starter/generator or starter motor and alternators. Pads on rear side of drive fuel control and oil pump

DIMENSIONS

Length overall: -2, -3 — 1,520 mm (59.83 in)
-3A, -3B — 1,517 mm (59.70 in)
-4 — 1,477 mm (58.15 in)
-5 — 1,665 mm (65.54 in)
-5A, -5B — 2,314 mm (91.10 in)
-20 — 1,515 mm (59.65 in)
Fan diameter — 716 mm (28.20 in)
Width: -2, -3, -3A, -3B, -4, -20 — 869 mm (34.20 in)
-5, -5A, -5B — 858 mm (33.79 in)
Height overall
-2, -3, -3A, -3B, -4, -20 — 1,000 mm (39.36 in)
-5, -5A, -5B — 1,029 mm (40.52 in)

WEIGHT, DRY:
-2 — 337 kg (743 lb)
-3 — 342 kg (754 lb)
-3A — 352 kg (775 lb)
-3B — 349 kg (769 lb)
-4 — 373 kg (822 lb)
-5 — 387 kg (852 lb)
-5A — 402 kg (884 lb)
-5B — 408 kg (899 lb)
-20 — 379 kg (836 lb)

PERFORMANCE RATINGS
Max T-O (S/L): -2 — 15.57 kN (3,500 lb st) to 22.2°C
-3, -3A — 16.46 kN (3,700 lb st) to 24.4°C
-3B — 16.24 kN (3,650 lb st) to 21.1°C
-4 — 18.15 kN (4,080 lb st) to 24.4°C
-5 — 19.15 kN (4,304 lb st) to 23°C
-5A — 20.02 kN (4,500 lb st) to 23°C
-5B — 21.13 kN (4,750 lb st) to 23°C
-20 — 15.57 kN (3,500 lb st) to 33.9°C
Max T-O (APR, auto performance reserve)
-3, -3A, -3B — 17.13 kN (3,850 lb st)
-5, -5A — 20.02 kN (4,500 lb st)
-4, -5B as above
-20 — 16.24 kN (3,650 lb st)
Cruise (12,200 m, 40,000 ft at Mach 0.8)
-2 — 3.36 kN (755 lb)
-3 — 3.64 kN (817 lb)
-3A — 3.73 kN (838 lb)
-3B — 3.75 kN (844 lb)
-4 — 4.13 kN (929 lb)
-5 — 4.25 kN (955 lb)
-5A — 4.39 kN (986 lb)
-5B — 4.68 kN (1,052 lb)
-20 — 3.90 kN (876 lb)

SPECIFIC FUEL CONSUMPTION
Cruise (as above): -2 — 23.08 mg/Ns (0.815 lb/h/lb)
-3 — 23.65 mg/Ns (0.835 lb/h/lb)
-3A — 23.30 mg/Ns (0.823 lb/h/lb)
-3B — 23.11 mg/Ns (0.816 lb/h/lb)
-4 — 22.55 mg/Ns (0.796 lb/h/lb)
-5 — 22.72 mg/Ns (0.802 lb/h/lb)
-5A — 21.84 mg/Ns (0.771 lb/h/lb)
-5B — 21.41 mg/Ns (0.756 lb/h/lb)
-20 — 20.62 mg/Ns (0.728 lb/h/lb)

UPDATED

ITEC TFE1042-70

US military designations: Dry F124-GA-100, afterburning F125-GA-100

This engine was developed by the ITEC (International Turbine Engine Co) as the power plant of the AIDC Ching Kuo IDF (Indigenous Defensive Fighter). Fully modular, it has matured as a family of engines to be marketed by AlliedSignal. The basic engine, the 1042-70, had by 1994 completed over 18 000 hours of testing. Initial flight release was achieved in February 1989, with full qualification in September 1991; production deliveries began a month later.

The following are existing and planned versions:

TFE1042-70. Basic version, in production by ITEC for Ching-Kuo IDF. Description below applies to this version.

F125-GA-100. Similar to TFE1042-70. Being marketed at 26.8 kN (6,025 lb st) intermediate thrust and 41.15 kN (9,250 lb st) maximum.

F125X. Near-term growth version. Maximum rating 54.49 kN (12,250 lb st).

F125XX. Long-term growth engine. Maximum thrust 71.17 kN (16,000 lb st).

F124-GA-100. A non-afterburning version of the F125, the F124 is being offered for advanced trainer and light combat aircraft. Air flow 42.7 kg (94.1 lb)/s, length 1,925 mm (75.8 in), T-O rating 28.02 kN (6,300 lb st). Selected for export Aero L-39.

F124X. F124 near-term growth engine. Maximum thrust 36.12 kN (8,120 lb st).

F124XX. F124 long-term growth engine. Maximum thrust 51.16 kN (11,500 lb st).

Data for 1042-70:

TYPE: Two-shaft augmented turbofan

FAN: Three stages with rotating spinner. Maximum air flow 43.29 kg (95.4 lb)/s. Bypass ratio 0.3

COMPRESSOR: Four axial stages followed by one centrifugal

COMBUSTION CHAMBER: Annular

TURBINES. Single-stage air-cooled HP and LP turbine.

AUGMENTOR. Reheat in bypass and core flows. Three mechanical actuators drive 10-flap variable nozzle.

DIMENSIONS
Inlet diameter — 591 mm (23.25 in)
Length — 3,561 mm (140.2 in)
Max nozzle diameter — 782 mm (30.8 in)

WEIGHT, DRY: — 617 kg (1,360 lb)

PERFORMANCE RATINGS
Intermediate — 26.80 kN (6,025 lb st)
Max augmented — 41.15 kN (9,250 lb st)

SPECIFIC FUEL CONSUMPTION
TFE1042-70 (intermediate) — 22.66 mg/Ns (0.80 lb/h/lb st)

UPDATED

ALLIEDSIGNAL TPE331

US military designation: T76

Based upon experience with APUs, this was the first Garrett engine for aircraft propulsion. Deliveries of all versions exceed 13,000.

The following are major versions:

TPE331 series I, II. FAA certificated in February 1965. Rated at 451 ekW, 429 kW plus 0.33 kN (605 ehp, 575 shp plus 75 lb st). Redesignated **TPE331-25/61** and **-25/71** and produced until 1970. Powers MU-2 (A to E models), Porter, Jet Liner, Super Turbo 18, FU-24, Hawk Commander and 680, and Turbo Beaver.

TPE331-1 series. Certificated December 1967 at 526 ekW, 496 kW plus 0.44 kN (705 ehp, 665 shp plus 100 lb st). Powers MU-2 (F and G), Turbo-Porter and AU-23A Peacemaker, CJ600, Turboliner, Interceptor 400, Turbo Commander and (customer option) Thrush Commander, Merlin IIB and Fletcher 1284, Turbo Thrush and Turbo Ag-Cat.

TPE331-2 series. Certificated in December 1967 at 563 ekW; 533 kW plus 0.45 kN (755 ehp, 715 shp plus 102 lb st). Powers Skyvan, CASA 212 preseries, Turbo Goose and Turbo Beaver.

TPE331-3 series. Certificated in March 1970 at 674 ekW, 626 kW plus 0.71 kN (904 ehp, 840 shp plus 159 lb st). Uprated gas generator with increased air flow and pressure ratio, but same turbine temperature as in original TPE331. Powers Merlin III, IV and Metro, and Jetstream III.

TPE331-5/6 series. The -5 was certificated in March 1970; this matches the gas generator of the -3 with the 715 shp gearbox, and is flat rated to 2,135 m (7,000 ft). Powers MU-2, King Air B100 (-6), CASA 212 (-5), Dornier 228 (-5), and Commander 840/900. The -5 designation indicates output speed of 1,591 rpm; the -6 has an output speed of 2,000 rpm.

TPE331-8. Matches compressor and gearbox of -3 with new turbine section. Thermodynamic power of 676 ekW, 645 kW (905 ehp; 865 shp) plus 0.47 kN (105 lb st), but flat rated at 533 kW (715 shp) to 36°C. Certification was received in November 1976. Powers Conquest II.

TPE331-9. Thermodynamic rating 645 kW (865 shp).

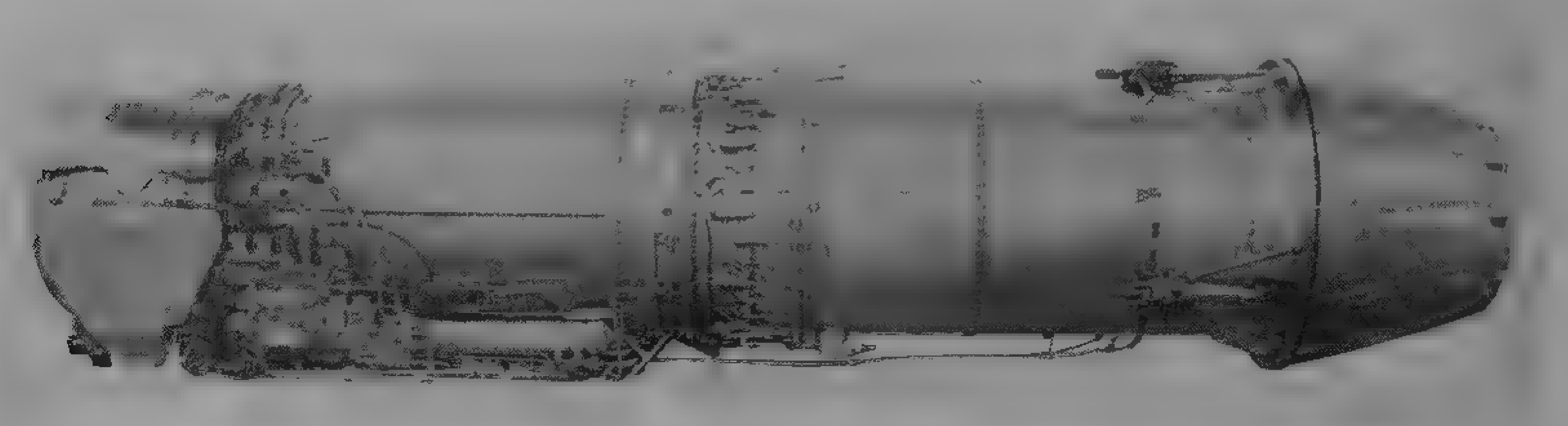
TPE331-10. Rated at 746 kW (1,000 shp). Certificated January 1978. Powers Marquise and Solitaire, Commander 980/1000, Merlin IIIC, CASA 212-200 and Jetstream 31.

TPE331-11. Certificated 1979. Higher gearbox limit, wet rating 820 kW (1,100 shp). Powers Metro III.

TPE331-12. Same size as -10 but offers 834 kW (1,100 shp). Certificated December 1984. Powers Jetstream Super 31 and Metro 23. The **TPE331-12B** powers the Shorts Tucano. Rolls-Royce made 30 per cent by value of engines for Shorts, and supports RAF engines in service.

TPE331-14/15. Scaled-up models, with thermodynamic power in the 1,227 kW (1,645 shp) class. The -14 was certificated in April 1984 and is flat rated at 746 kW (1,000 shp) for the Cheyenne 400. TPE331-15AW powers one version of re-engined S-2 Tracker.

TPE331-14GR/HR. Handed (clockwise/anti-clockwise) for Jetstream 41 and candidate for An-38. T-O rating 1,312 kW (1,759 shp); APR rating 1,462 kW (1,960 shp).



ITEC 1042-70 augmented turbofan *1994*

T76 Military engine, with gas generator similar to TPE331-1 but with front end inverted, to give inlet above spinner. All models power OV-10 Bronco.

Except for the TPE331-14/15, all versions are of similar frame size, and the following data apply generally to all:

TYPE: Single-shaft turboprop.

PROPELLER DRIVE: Two-stage reduction gear, one helical spur and one planetary, with overall ratio of 20.865 or 26.3.

COMPRESSOR: Tandem two-stage centrifugal made from titanium. Mass flow, 2.61 kg (5.78 lb)/s for -25/61, -25/71; 2.81 kg (6.2 lb)/s for -1, 2.80 kg (6.17 lb)/s for -2 and T76, 3.52 kg (7.75 lb)/s for -5, and 3.54 kg (7.8 lb)/s for -3. Pressure ratio 8.0 for 25/61, 25/71, 8.34 for -1, 8.54 for -2 and T76, 10.37 for -5 and -3.

COMBUSTION CHAMBER: Annular, with capacitor discharge igniter plug on turbine plenum.

FUEL SYSTEM: Woodward or Bendix control. Maximum fuel pressure 41.4 bars (600 lb/sq in).

FUEL GRADE (TPE331): ASTM designation D1655-64T types Jet A, Jet B and Jet A-1, MIL-F-5616-1 Grade JP-1.

TURBINE: Three-stage axial. In early models blades cast integrally with disc. In -10, -11, -12 first-stage disc with inserted blades. In -14/-15 inserted blades in all three stages. Inlet gas temperature, 987°C for 25/61, 25/71, 993°C for T76, 1,005°C for all other models.

ACCESSORIES: AND 20005 Type XV-B tachometer generator, AND 20002 Type XII-D starter/generator, AND 20010 Type XX-A propeller governor and AND 20001 Type XI-B hydraulic pump.

LUBRICATION SYSTEM: Medium pressure dry sump system. Normal oil supply pressure 6.90 bars (100 lb/sq in).

OIL SPECIFICATION: MIL-L-23699-(1) or MIL-L-7808.

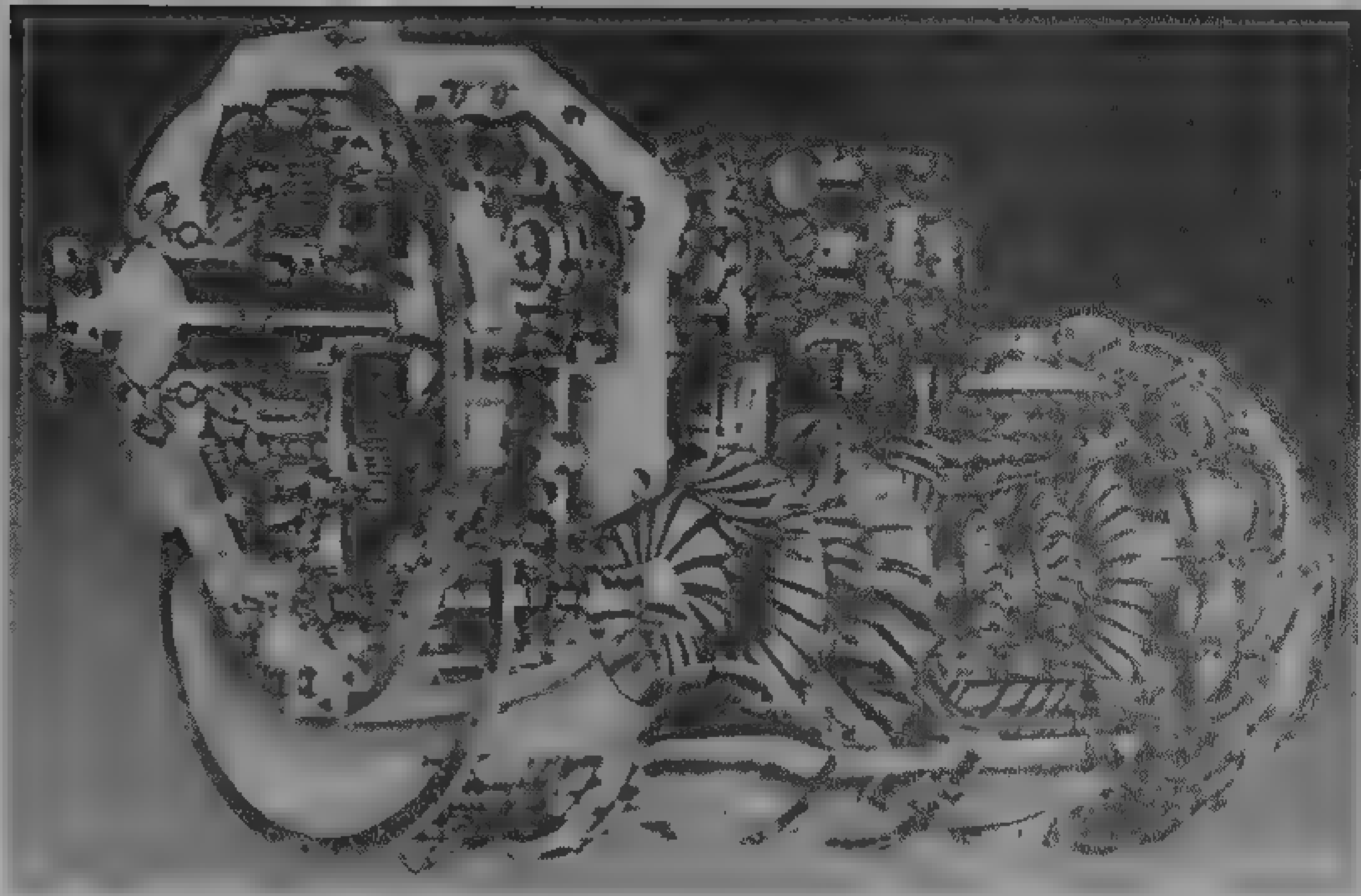
STARTING: Pad for 399A starter/generator.

DIMENSIONS (approx):

Length overall:	
TPE331	1,092-1,333 mm (43-52.5 in)
T76	1,118 mm (44 in)
Width: TPE331	533 mm (21 in)
T76	483 mm (19 in)
Height: TPE331	660 mm (26 in)
T76	686 mm (27 in)

WEIGHT, DRY:

TPE331-25/61, 71	152 kg (335 lb)
TPE331-1, -2	152.5 kg (336 lb)
T76	155 kg (341 lb)
TPE331-3	161 kg (355 lb)
TPE331-5	163 kg (360 lb)
TPE331-8	168 kg (370 lb)
TPE331-10	172 kg (380 lb)
TPE331-11	181 kg (400 lb)
TPE331-12	181 kg (400 lb)
TPE331-14, 14GR, -15	281 kg (620 lb)



Cutaway drawing of AlliedSignal TPE331-14 turboprop

1987

PERFORMANCE RATINGS:

T-O: see under model listings

Military (30 min): T76-G-410/411: 533 kW, 563 ekW (715 shp, 755 ehp)

Normal: T76-G-410/411: 485 kW, 514.5 ekW (650 shp, 690 ehp)

Max cruise (ISA, 3,050 m, 10,000 ft and 250 kts, 463 km/h, 288 mph):

TPE331-25/61, 71	332 kW (445 shp)
TPE331-1	404 kW (542 shp)
TPE331-2, T76	430 kW (577 shp)
TPE331-3, -5	530 kW (710 shp)

SPECIFIC FUEL CONSUMPTION:

At T-O rating:

TPE331-25/61, 71	111.5 µg/J (0.660 lb/h/shp)
TPE331-1	102.2 µg/J (0.605 lb/h/shp)
TPE331-2	99.4 µg/J (0.588 lb/h/shp)
TPE331-3	99.7 µg/J (0.590 lb/h/shp)
TPE331-5	101.7 µg/J (0.602 lb/h/shp)
TPE331-8	96.7 µg/J (0.572 lb/h/shp)
TPE331-10	94.6 µg/J (0.560 lb/h/shp)
TPE331-11	94.3 µg/J (0.558 lb/h/shp)
TPE331-12	92.5 µg/J (0.547 lb/h/shp)
TPE331-14/-15	84.8 µg/J (0.502 lb/h/shp)
T76-G-410/411	101.4 µg/J (0.600 lb/h/shp)

OIL CONSUMPTION:

Max: 0.009 kg (0.02 lb)/h

UPDATED

ALLIEDSIGNAL TPF351

This free turbine turboprop was being developed initially as the **TPF351-20** for pusher installation in the Embraer/FAMA CBA-123. On abandonment of the CBA-123 programme in 1994 prior to construction of a prototype, AlliedSignal decided to discontinue the TPF351. Details of the engine appeared in the 1994-95 *Jane's*.

UPDATED

LYCOMING TURBINE ENGINES

550 Main Street, Stratford, Connecticut 06497
Telephone: 1 (203) 385 2000
Fax: 1 (203) 385 3255

Formerly owned by Textron, this division was purchased by AlliedSignal in 1994. When part of Textron an agreement was reached with GE for joint development of shaft-drive gas turbines for aero and surface applications. Another agreement was reached with Russia's Yakovlev Corporation for developments of the Yak-40.

NEW ENTRY

ALLIEDSIGNAL ALF 502

The ALF 502 was launched in 1969, primarily for commercial and executive aircraft. The core is the T55, and construction is modular.

Current versions are as follows:

ALF 502L First commercial version. FAA certificated in February 1980. Powers Canadair Challenger 600 in ALF 502L-2 form. L-2A, L-2C and L-3 certificated 1982-3.

ALF 502R. Reduced rating. FAA certificated January 1981 as R-3 to power BAe 146. Improved R-3A, R-4 and R-5 certificated 1982-3. R-6 certificated 1984.

By 1994 ALF 502 engines had flown over 8 million hours. The ALF 502 and LF 507 operate on-condition.

TYPE: High-bypass ratio, two-shaft geared turbofan.

FAN MODULE: Cast frame includes four engine mounts 90° apart, and may carry reverser. Fan rotor blades are base and part span shrouded. Mounted directly behind rotor (6,700 lb st engines) is a single or (7,500 lb st engines) two stages of compression. Anti-icing of LP compressor inlet by bleed air. Accessory gearbox on fan frame takes HP shaft power. Reduction gear couples LP turbine to fan. Bypass ratio: 502R-3, 5.71; 502R-5, 5.6, 502L, 5.0.

COMPRESSOR: HP compressor has seven stages and single centrifugal. Acceleration bleed between stages 6 and 7 operated by main fuel control. Overall pressure ratio: R-3, 11.6, R-5, 12.0; L-2, 13.6.

TURBINE: HP has two air-cooled stages. LP has two stages. All rotor blades base shrouded. LP tip shrouded.

COMBUSTION CHAMBER: One-piece annular combustor wraps around turbine. Atomising nozzles inserted through outer chamber at rear. Disconnecting permits removal of combustor/turbine module, providing access to HP turbine.

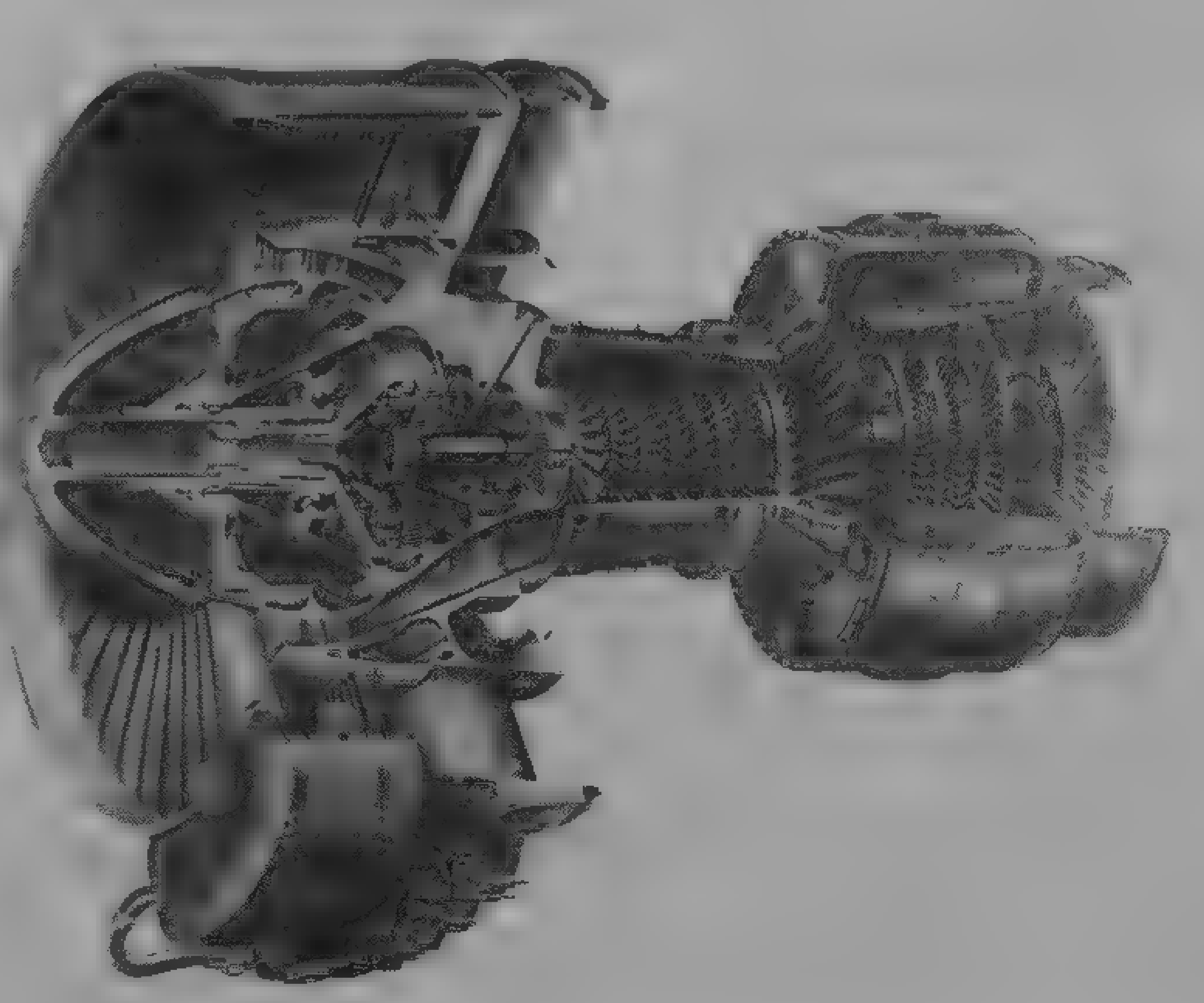
ACCESSORY DRIVES: Accessory gearbox carries main fuel control, oil pump and filter, tachometer (if required) and provisions for customer accessories.

DATA: See table.

UPDATED

ALLIEDSIGNAL LF 500

This family of commercial turbofans is based on the ALF 502R, using the same core. The engines will range from 31.14 kN (7,000 lb st) to 62.28 kN (14,000 lb st), the most powerful versions requiring an increase in fan diameter. The **LF 507-1H**, the first engine in the family, was certificated in



Cutaway drawing of AlliedSignal LF 507 geared turbofan

1980

ALLIEDSIGNAL ALF 502, LF 500, LTC1/T53 and LTC4/T55 ENGINES

Manufacturer's and civil designation	Military designation	Type*	T-O Rating kN (lb st) or max kW (hp)	SFC µg/J: ‡mg/Ns (lb/h/hp: ‡lb/h/lb st)	Weight, Dry less tailpipe kg (lb)	Max diameter mm (in)	Length overall mm (in)	Remarks
T5311A	—	ACFS	820 kW (1,100 shp)	115 (0 68)	225 (496)	584 (23)	1,209 (47.6)	Bell 204B
T5313B	—	ACFS	1,044 kW (1,400 shp)	98 (0 58)	245 (540)	584 (23)	1,209 (47.6)	Bell 205A, A-1
T5317A	—	ACFS	1,119 kW (1,500 shp)	99 7 (0 59)	256 (564)	584 (23)	1,209 (47.6)	Bell 205A-1, Kaman K-Max
—	T53-L-13B	ACFS	1,044 kW (1,400 shp)	98 (0.58)	245 (540)	584 (23)	1,209 (47 6)	UH-1H
—	T53-L-703	ACFS	1,343 kW (1,800 shp)	101 4 (0.60)	247 (545)	584 (23)	1,209 (47 6)	Bell AH-1F/S/E/P, UH-1H
LTC1K-4K	—	ACFS	1,156 kW (1,550 shp)	98.7 (0.584)	234 (515)	584 (23)	1,209 (47 6)	Bell XV-15
—	T53-L-701	ACFP	1,082 ekW (1,451 ehp)	101 4 (0 60)	312 (688)	584 (23)	1,483 (58.4)	Grumman OV 1D, AIDC (Taiwan) T CH 1
—	YT55 L 9	ACFP	1,887 ekW (2,529 ehp)	102.7 (0.608)	363 (799)	615 (24 2)	1,580 (62 2)	Piper Enforcer
	T55 L 7C	ACFS	2,125 kW (2,850 shp)	101 4 (0.60)	267 (590)	615 (24 2)	1,118 (44)	
T5508D (LTC4B 8D)	—	ACFS	2,186 kW (2,930 shp) flat rated at 1,678 kW (2,250 shp)	100.1 (0.592) 106.0 (0.628)	274 (605)	610 (24)	1,118 (44)	Bell 214A/B/C
—	T55-L-712†	ACFS	3,267 kW (4,378 shp)	89 6 (0.53)	340 (750)	615 (24 2)	1,181 (46 5)	Boeing CH-47D, Chinook HC Mk 2/3
AL5512	—	ACFS	3,039 kW (4,075 shp)	89 6 (0.53)	355 (780)	615 (24 2)	1,118 (44)	Boeing 234, 360
	T55-L-714	ACFS	3,629 kW (4,867 shp)	85 0 (0.503)	363 (800)	615 (24 2)	1,181 (46.5)	Boeing MH 47E
ALF 502R-3	—	ACFF	29 8 kN (6,700 lb)	‡11 64 (‡0.411)	606 (1,336)	1,059 (41.7)	1,443 (56 8)	BAe 146
ALF 502R-3A		ACFF	31 0 kN (6,970 lb)	‡11 55 (‡0.408)	606 (1,336)	1,059 (41.7)	1,443 (56 8)	BAe 146
ALF 502R-5	—	ACFF	31 0 kN (6,970 lb)	‡11 55 (‡0.408)	606 (1,336)	1,059 (41 7)	1,443 (56 8)	BAe 146
ALF 502R-6		ACFF	33 36 kN (7,500 lb)	‡11 73 (‡0.415)	606 (1,336)	1,059 (41.7)	1,487 (58 56)	BAe 146
ALF 502L-2	—	ACFF	33 36 kN (7,500 lb)	‡12.10 (‡0 428)	595 (1,311)	1,059 (41.7)	1,487 (58 56)	Canadair Challenger 600
ALF 502L-2A	—	ACFF	33 36 kN (7,500 lb)	‡11 70 (‡0.414)	595 (1,311)	1,059 (41 7)	1,487 (58 56)	
ALF 502L-3		ACFF	33 36 kN (7,500 lb)	‡11 73 (‡0 415)	595 (1,311)	1,059 (41.7)	1,487 (58 56)	
LF 507-1F	—	ACFF	31 14 kN (7,000 lb)	‡11 50 (‡0.406)	628 (1,385)	1,059 (41 7)	1,487 (58.56)	Avro Int. RJ
LF 507-1H	—	ACFF	31.14 kN (7,000 lb)	‡11 50 (‡0.406)	624 (1,375)	1,059 (41 7)	1,487 (58.56)	Avro Int. RJ

*ACFS = axial plus centrifugal, free turbine shaft, ACFP = axial plus centrifugal, free turbine propeller; ACFF = axial plus centrifugal, free turbine fan
‡Emergency rating (60 minutes) 3,472 kW (4,652 shp), contingency rating (2½ minutes) 3,780 kW (5,069 shp)

October 1991. The **LF 507 1F** was certificated in March 1992 and entered airline service with the Avro RJ85 in April 1993. Over 150 engines had been produced by 1994

Features include an additional supercharger stage, machined combustor liner, cast fourth nozzle, reduced turbine inlet temperature, steel compressor casing, improved reduction gear lubrication and FADEC. Data, see table

UPDATED

ALLIEDSIGNAL LP512

This turboprop/turboshaft engine in the 5,593 kW (7,500 shp) class was announced in February 1994 The turboprop version is described as 'several feet shorter and much lighter' than competitor engines

UPDATED

ALLIEDSIGNAL LTC1

US military designation: T53

The T53 was developed under a joint US Air Force/Army contract. More than 19,000 have logged over 46 million hours since 1956

Licences for manufacture of the T53 are held by BMW Rolls-Royce in Germany, Piaggio in Italy, Kawasaki in Japan, and in Taiwan

Current versions are as follows

T53-L-13 Uprated L-11 Redesigned 'hot end' and initial stages of compressor Four turbine stages, compared with two in earlier models, and variable inlet guide vanes combined with redesigned first two compressor stages. Atomising combustor to facilitate operation on a wider range of fuels. Powers Bell UH-1M and UH-1H and AH-1F HueyCobra. The **T5313A** commercial version has been superseded by the **T5313B**

T53-L-701. Turboprop incorporating 'split power' reduction gear

T53-L-703. Improved durability L-13 Thermodynamic rating 1,343 kW (1,800 shp)

LTC1K-4K. Direct drive L-13 suitable for operation from 105° nose up to 90° nose down

T5317A. Improvements over L-13 include improved cooling of first gas producer turbine nozzle plus air-cooled blades in first turbine rotor

The following details apply to the T53 L-13 and L-701

TYPE Free turbine turboshaft

COMPRESSOR Five axial stages followed by single centrifugal stage. Variable inlet guide vanes. Pressure ratio 7 2 Mass flow 5 53 kg (12 2 lb)/s at 25,150 gas producer rpm

COMBUSTION CHAMBER Annular reverse flow, with 22 atomising injectors

FUEL CONTROL SYSTEM Chandler Evans TA-2S and TA-7 system with one dual fuel pump, 41.4 bars (600 lb/sq in) Interstage air bleed control

FUEL GRADE: ASTM A-1, MIL-J-5624, MIL-F-26005A, JP-1, JP-4, JP 5, CITE

TURBINE. First two stages, driving compressor, use hollow air-cooled stator vanes and cored-out cast steel rotor blades Second two stages, driving reduction gearing, have solid steel blades

ACCESSORIES. Electric starter or starter/generator. Bendix-Scintilla TGLN high-energy ignition unit

LUBRICATION. Recirculating system, with gear pump, 4 83 bars (70 lb/sq in)

OIL GRADE MIL-L-7808, MIL-L-23699

DATA: See table

UPDATED

ALLIEDSIGNAL LTC4

US military designation: T55

This engine is based on the T53 with higher mass flow Total operating time by 1993 on 4,416 engines was over 6 million hours

Current versions are as follows

LTC4B 8D Modified T55 L-7C

T5508D Commercial version of LTC4B 8D

T55-L-11 (LTC4B-11B) series. Uprated L-7, with variable inlet guide vanes and two-stage compressor turbine.

T55-L-712. Improved L-11D. Wide-chord compressor blades without inlet guide vanes, and one-piece rotor.

AL5512. Commercial L-712, with engine out contingency rating of 3,250 kW (4,355 shp)

T55-L-714. Growth version with cooled gas-generator turbine blades, FADEC and improved torquemeter. OEI rating (contingency) 3,780 kW (5,069 shp); maximum continuous 3,108 kW (4,168 shp)

T55-L-714A. L-714 plus latest RAM-D improvements, such as marinization and longer-life rotating parts

The following description applies to the T55-L-714

TYPE Free turbine turboshaft

COMPRESSOR: Seven axial stages followed by single centrifugal stage. Pressure ratio 9 3, Mass flow 13.19 kg (29 08 lb)/s

COMBUSTION CHAMBER Annular reverse flow Twenty-eight atomizing nozzles

FUEL SYSTEM Chandler Evans FADEC type EMC-32T-2, consisting of hydromechanical unit with gear type pump and DECU

FUEL GRADE MIL-J-5624L grade JP-4, JP-5, MIL-T-83133 grade JP-8 or CITE.

TURBINE Gas-generator turbine has two stages with cooled blades and cooled shrouds to give tip clearance control Two-stage power turbine

ACCESSORIES: Electric starter or starter/generator, or air or hydraulic starter. Bendix-Scintilla TGLN high-energy ignition unit. Four igniter plugs

LUBRICATION Recirculating Integral tank and cooler

OIL GRADE. MIL-L-7808, MIL-L-23699

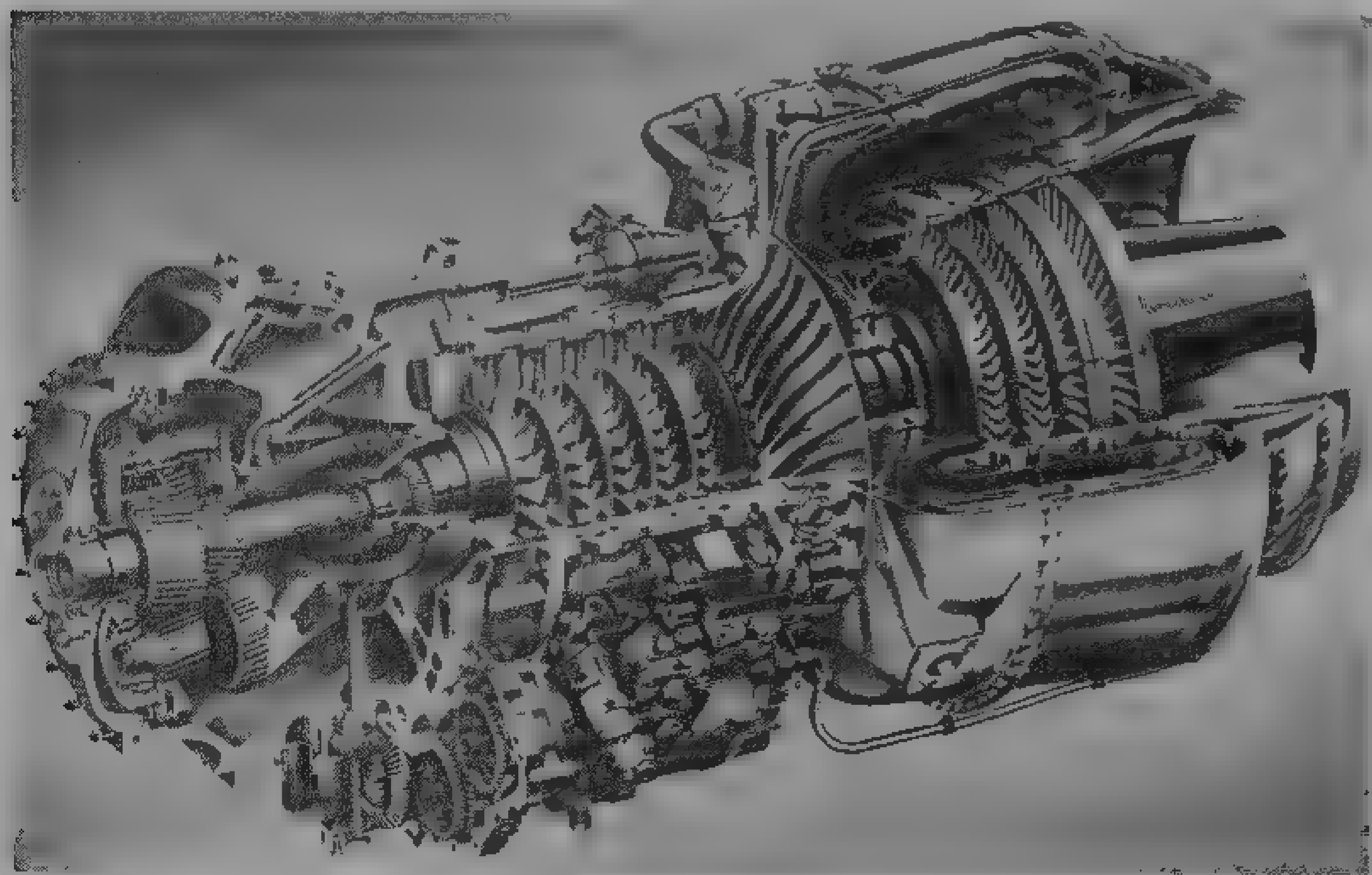
DATA See table on this page

UPDATED

ALLIEDSIGNAL LT 101

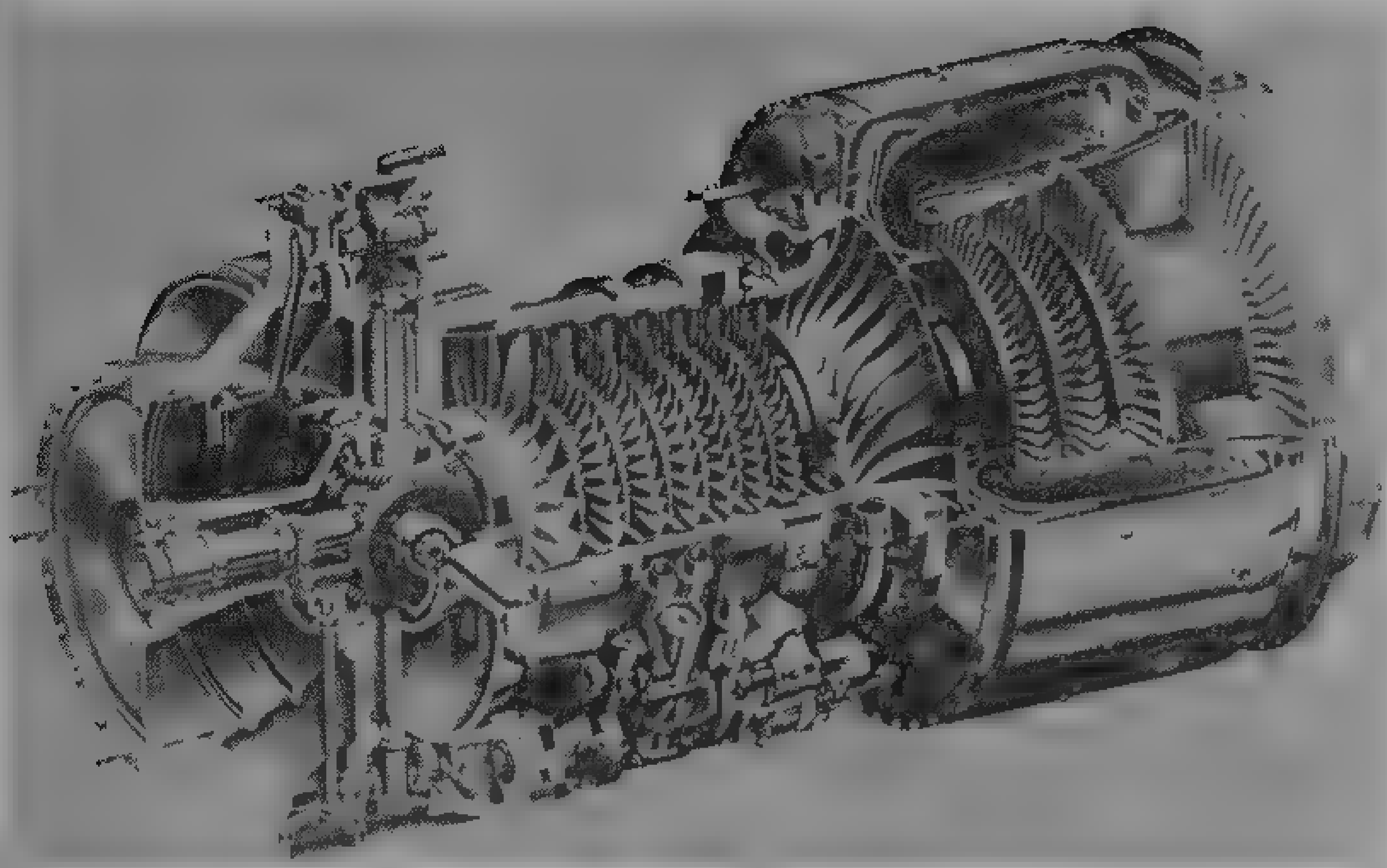
US military designation YT702-LD-700

The LT 101 is designed for low life cycle costs and fuel efficiency. Each engine comprises an accessory reduction gearbox, gas generator and combustor/power turbine module The engine has a single axial compressor stage followed by a single centrifugal stage, a reverse flow annular combustor, a single-stage gas-generator turbine, and a single-stage power turbine. Front gearboxes provide output speeds of 1,925, 6,000 or 9,545 rpm. The 6,000 rpm gearbox has both forward



Cutaway drawing of AlliedSignal T53-L-13B free turbine turboshaft

1975



Cutaway drawing of AlliedSignal T55-L-714 (military) or AL5512 (commercial) free turbine turboshaft *1980*

ALLIEDSIGNAL LTS 101 ENGINES

Engine Model	Performance Rating (T-O, S/L) kW (shp)	SFC µg/J (lb/h/shp)	Weight, Dry kg (lb)	Length mm (in)	Diameter mm (in)
LTS 101-600A-2	459 (615)	96.5 (0.571)	115 (253)	785 (30.9)	599 (23.6)
LTS 101-600A-3	459 (615)	98.4 (0.582)	120 (265)	800 (31.5)	599 (23.6)
LTS 101-650B-1	410 (550)	97.5 (0.577)	124 (273)	790 (31.1)	470 (18.52)
LTS 101-650C-2/C-3/C-3A	470 (630)	96.7 (0.572)	109.5 (241)	795 (31.3)	574 (22.6)
LTS 101-750B-1	410 (550)	97.5 (0.577)	135 (297)	795 (31.3)	470 (18.52)
LTS 101-750B-2	515 (690)	96.3 (0.570)	123 (271)	795 (31.3)	470 (18.52)
LTS 101-750C-1	510 (684)	97.5 (0.577)	125 (276)	795 (31.3)	574 (22.6)

and aft drives. The engine has either a scroll or radial inlet. Mass flow is 2.31 kg (5.1 lb)/s, and pressure ratio 8.5.

Current production versions include turboshaft (LTS) and turboprop (LTP) models, with maximum power in the 459 to 548 kW (615 to 735 shp) range. All are certificated under FAR Pt 33 for 2,400 hours TBO or on-condition maintenance. During 1994 **LT101 Plus I** introduced a forged axial rotor, single-crystal gas-generator turbine blades, insertable power turbine blades and a new fuel manifold. **Plus II** embodies further detail improvements.

UPDATED

ALLIEDSIGNAL LTS 101

The **LTS 101-600A-2** is a 6,000 rpm power plant for the Eurocopter AS 350D AStar. The **650C-2/C-3** is a 9,545 rpm power plant for the Bell 222. The **650B-1**, a 6,000 rpm engine with a radial inlet for the Eurocopter/Kawasaki BK117A. The **750B-1** powers the BK117B. The **600A-3** powers the AS 350D Mk 3. A growth version, the **750C-1**, powers the Bell 222B and 222UT. The **750B-2**, with radial inlet, powers the AS 366/HH-65A Dolphin.

DATA: See table on this page

UPDATED

ALLIEDSIGNAL LTP 101

The LTP 101 turboprop incorporates a free power turbine, provisions for tractor or pusher installation, hydraulic propeller governor, radial screened inlet and anti-icing protection. Output speed is 1,700 to 1,950 rpm. The **LTP 101-600A-1A** and **-700A-1A** power the P 166-DL3, Air Tractor and Cresco agricultural aircraft, Riley Cessna 421 and Page Turbo Thrush and Ag-Cat. It has flown in Piper Brave, Turbine Islander and Dornier 128-6 prototypes.

DIMENSIONS:
Length 949 mm (37.37 in)
Diameter 592 mm (23.3 in)
WEIGHT, DRY: 147 kg (325 lb)
PERFORMANCE RATINGS (T-O, S/L):
LTP 101-600 462 ekW (620 ehp)
LTP 101-700 522 ekW (700 ehp)
SPECIFIC FUEL CONSUMPTION (T-O, S/L):
LTP 101-600, -700 92 µg/J (0.544 lb/h/ehp)

UPDATED

Left to right: AlliedSignal LTS 101-750B-1 turboshaft, LTP 101-700A-1A turboprop and LTS 101 750C-1 turboshaft *1994*

ALLISON

ALLISON ENGINE COMPANY

PO Box 420, Indianapolis, Indiana 46206-0420
Telephone: 1 (317) 230 2000
Fax: 1 (317) 230 3562
CHAIRMAN AND CEO: Dr F Blake Wallace
DIRECTOR PUBLIC RELATIONS: Eric Q Dickerson

Following a management buyout from its previous owners, General Motors, the resulting Allison Engine Company was itself purchased for $525 million by Rolls-Royce plc, the purchase being agreed in November 1994. The UK company intends to continue and expand Allison without change in name, programmes or workforce.

Allison Engine has 4,400 employees producing gas-turbine engines and components for aircraft, vehicular and industrial/marine applications.

A major research effort is in hand to develop a lift fan for the future Lockheed ASTOVL aircraft driven by hot gas from a P&W/RR F119 derived engine. Collaboration on the T800 engine with Garrett (AlliedSignal) is described under LHTEC on a later page.

UPDATED

ALLISON 250

US military designations: T63 and T703

The Allison 250 is a small turboshaft/turboprop. Deliveries exceed 25,000, logging over 89 million hours.

A development contract for the T63 military version was received by Allison in June 1958. Details of early versions last appeared in the 1978-79 *Jane's*, the following are current models.

T63-A-720. Military turboshaft engine with hot-end improvements, increasing T-O rating to 313 kW (420 shp), for the Bell OH-58C.

T703-AD-700. Military turboshaft engine corresponding to 250-C30R, for Bell OH-58D.

250-B17. Uprated version of B15 turboprop. The **B17B** operates at 17°C higher turbine gas temperature with hot-end improvements which maintain full power at high ambient temperatures. Produced from 1974 for Turbostar 402 conversions, Turbostar 414, ASTA Nomad N22 and 24, SIAI Marchetti SM 1019E and various agricultural aircraft. **B17C** introduced improved gearbox allowing use of 313 kW (420 shp) on T-O. Produced for Nomad N22 and 24, SF.260TP and 600TP, Turbostar 402/414, Allison Bonanza, LoPresti Piper SwiftFury, AASI Jetcruzer prototype, Glasair III, Advanced Airship ANR, BN-2T Turbine Islander, Composite Eagle, AP 68TP Viator and Maule MX 7. **B17D** produced for SF 260TP, Aucán, Redigo, Fuji T-5, HTT-34 and Mentor 420. **B17F**, with new compressor as in -C20R for increased T-O power, introduced in 1985 for BN-2T, SF 600TP, HX-1, Redigo, Turbine P-210 and A36 Bonanza.

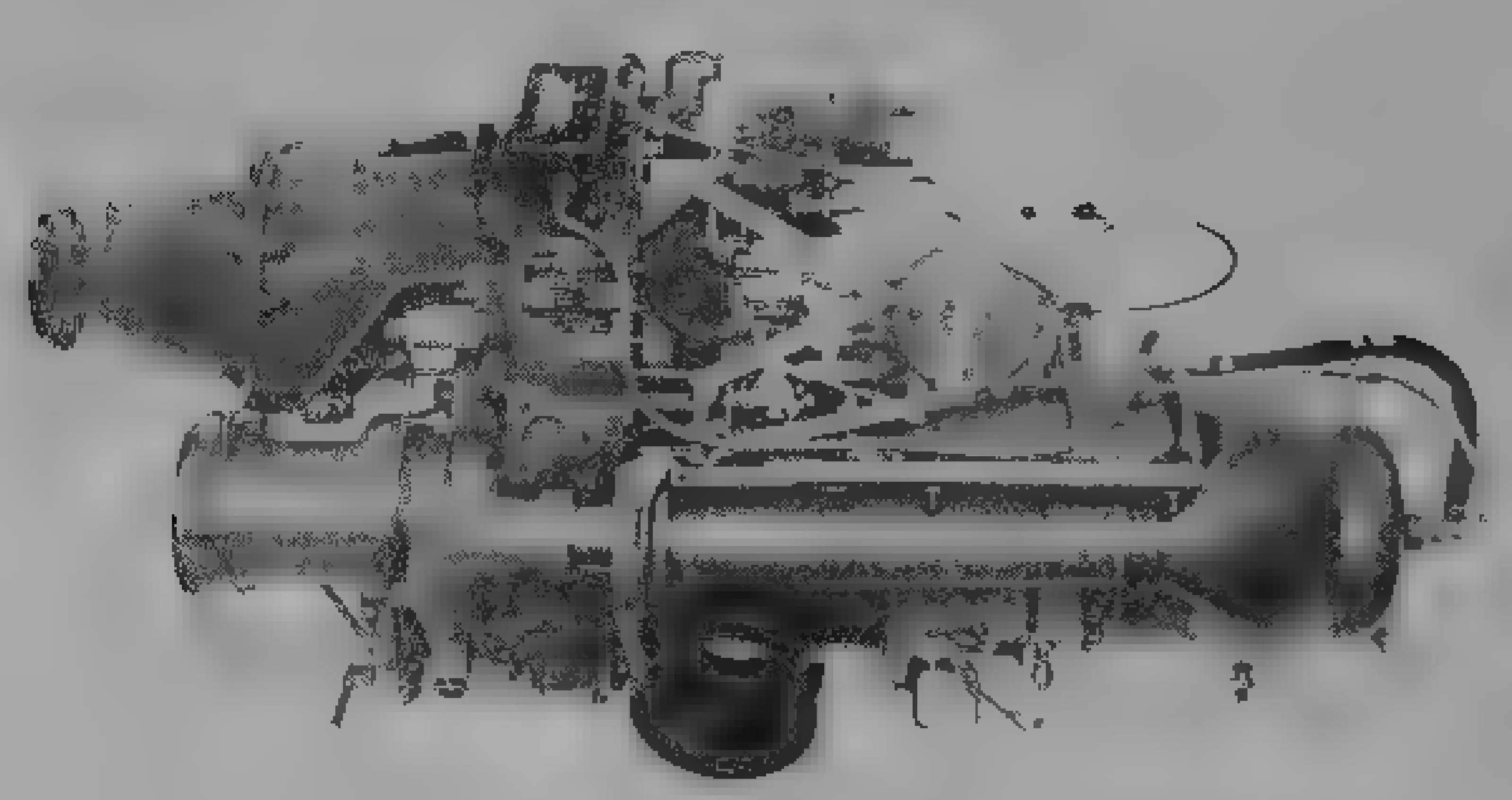
250-C20B. Introduced 1974, and rated at 313 kW (420 shp). For Bell and Agusta-Bell 206B JetRanger III and 206L LongRanger, MD 500D, BO 105CBS and E, Kitty Hawk, FH-1100 and UH-12E, Ka 226, RFB Fantrainer 400 and Bell 47G conversions.

250-C20F. For AS 355 Ecureuil 2/TwinStar.

250-C20J. For Bell and Agusta Bell 206B JetRanger III.

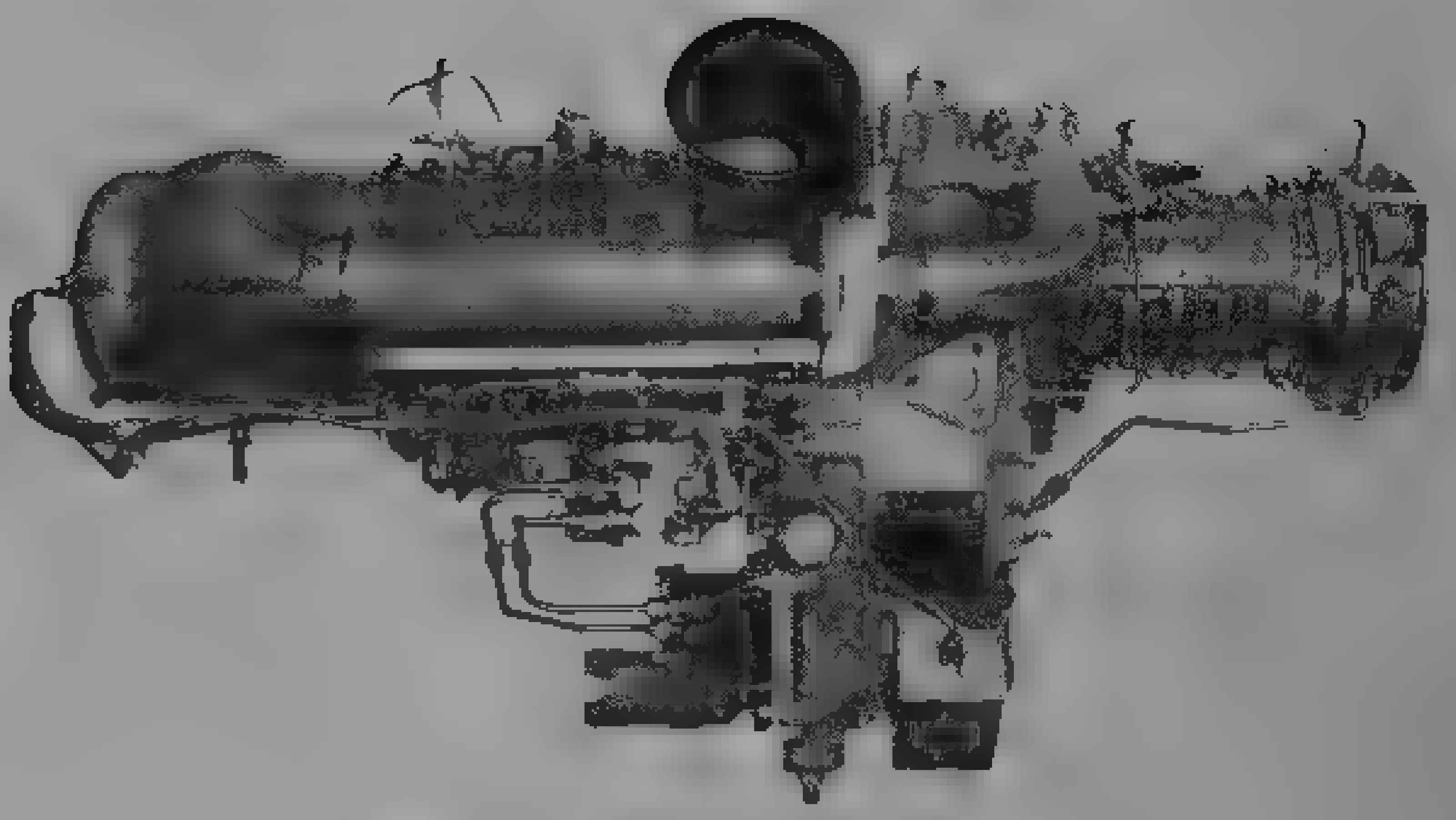
250-C20R. Derivative of C20B with new axial-centrifugal compressor. **C20R/1** with redundant overspeed system for twin-engine applications certificated September 1986 for A 109A Mk II and Gemini ST. **C20R/2** for single-engine helicopters certificated early 1987 for MD 500ER, JetRanger III, LongRanger and MD 520N. **C20R/9** with improved gas path and FADEC. In flight test on A 109A.

250-C20S. Turboprop for Soloy Turbine Pac conversions of Cessna 185, 206 and 207. **C20W** powers Schweizer TH-330 and Enstrom 480.



Allison 250-B17C free turbine turboprop

1984



Allison 250-C20R free turbine turboshaft

1987

250-C22 Improved gas path and FADEC

250-C28 Major redesign with single centrifugal compressor only, with increased air flow. Reduced noise and emissions and minimal infra-red signature. New main gearbox. Certificated December 1977

250-C28B. With particle separator; 2½ minute rating of 410 kW (550 shp). Powers Bell LongRanger I

250-C28C. Improved model with plain inlet, 2½ minute rating of 410 kW (550 shp). Powers BO 105 LS

250-C30. Advanced single-stage compressor and dual ignition. Initial rating 485 kW (650 shp), with a 2½ minute rating of 522 kW (700 shp). Certification completed March 1978. Produced for S-76 and MD 530G

250-C30G. Produced for Heli-Air Bell 222, C30G2 for Bell 230

250-C30L. With digital control, produced for Bell 406CS

250-C30M Produced for AS 350

250-C30P Produced for LongRanger III and IV

250-C30R. With digital control, produced for AHIP OH-58D. **C30R/1** increased air flow for uprated hot-day power for OH-58D; certificated early 1994. **C30R/2** better turbine cooling and simpler shaft drive for further hot-day improvement

250-C30S Produced for S-76A

250-C40 As C30R/2 but uprated gearbox and FADEC for Bell 430

250-C47. C40 variant for Bell 407

TYPE: Light turboshaft or turboprop

COMPRESSOR: C20, C20B and B17B have six axial stages and one centrifugal. B17F and C20R have four axial stages and one centrifugal. C28 and C30 models have single-stage centrifugal compressor only. Pressure ratio: C20B, B17 7.2; C28B/C, C30, 8.4. Mass flow: C20B, B17C, 1.56 kg (3.45 lb)/s; C28B/C, 2.02 kg (4.45 lb)/s; C30, 2.54 kg (5.6 lb)/s

COMBUSTION CHAMBER: Single can type at rear. Single duplex fuel nozzle in rear face. One igniter on C20B, B17C, C28B/C and C30L/M/P/R. Dual igniters on C30 and C30S, optional on C28B/C

TURBINES: Two-stage gas-generator turbine and two-stage free power turbine. Integrally cast rotor blades and wheels

CONTROL SYSTEM: Pneumatic-mechanical system (B17C hydromechanical, C20B, C28, C30/30M/P/S, pneumatic mechanical, C30L, C30R, supervisory electronic; C20R/9 and C40 FADEC)

FUEL: Primary fuels are ASTM-A or A-1 and MIL-T-5624 JP-4, JP-5, JP-8, DF 1 and -2 and Arctic Diesel

LUBRICATION: Dry sump

OIL SPECIFICATION: MIL-L-7808 and MIL-L-23699

DIMENSIONS:

Length: B17C	1,143 mm (45.0 in)
C20B, R	985 mm (38.8 in)
C28C	1,201 mm (47.3 in)
C30	1,041 mm (41.0 in)
Width: B17C, C20B	483 mm (19.0 in)
C28, C30	557 mm (21.94 in)
Height: B17C	572 mm (22.5 in)
C20B	589 mm (23.2 in)
C28, C30	638 mm (25.13 in)

WEIGHT, DRY: B17C	88.4 kg (195 lb)
C20B	71.5 kg (158 lb)
C20R	76.0 kg (168 lb)
C28	99.3 kg (219 lb)
C28B, C	104 kg (230 lb)
C30	109.3 kg (240 lb)

PERFORMANCE RATINGS (S/L, ISA):

T-O:	
B17C, C20B, C20J, C20S (5 min)	313 kW (420 shp)
B17F, C20R (5 min to 26.7°C)	335 kW (450 shp)
C20F	313 kW (420 shp)
C28, 28B, 28C (30 min)	373 kW (500 shp)
C30 (5 min)	485 kW (650 shp)
Max continuous: B17C (cruise)	275 kW (369 shp)
C20B	276 kW (370 shp)
C20R	283 kW (380 shp)
C28	368 kW (494 shp)
C30	415 kW (557 shp)
Cruise B (75 per cent): B17C	206 kW (277 shp)
C20B	207 kW (278 shp)
C20R	236 kW (317 shp)
C28	274 kW (367 shp)
C30	312 kW (418 shp)

SPECIFIC FUEL CONSUMPTION:

At T-O rating: B17C	111 μg/J (0.657 lb/h/shp)
C20B	110 μg/J (0.650 lb/h/shp)
C20R	103 μg/J (0.608 lb/h/shp)
C28	102.5 μg/J (0.606 lb/h/shp)
C30	100 μg/J (0.592 lb/h/shp)
At cruise B rating: B17C	120.8 μg/J (0.715 lb/h/shp)
C20B	120 μg/J (0.709 lb/h/shp)
C20R	112.5 μg/J (0.666 lb/h/shp)
C28	112 μg/J (0.664 lb/h/shp)
C30	111 μg/J (0.657 lb/h/shp)

UPDATED

ALLISON T56 and 501

US military designation: T56

Current versions of the T56 are as follows:

T56-A-14. Rated at 3,661 ekW (4,910 ehp). Generally similar to T56-A-15, but seven-point suspension and detail changes. Powers the P-3B and C Orion

T56-A-15 Rated at 3,661 ekW (4,910 ehp). Introduced air-cooled turbine blades. Powers current C-130H and related variants

T56-A-423 and **A-16**. Rated at 3,661 ekW (4,910 ehp). Powers US Navy versions of the C-130

T56-A-425. Rated at 3,661 ekW (4,910 ehp). Powers C-2A Greyhound and early E-2C Hawkeye

T56-A-427. Rated at 3,915 kW (5,250 shp) with 13 per cent improvement in specific fuel consumption. Digital electronic supervisory control and modified propeller drive to maintain 1,106 rpm output with 14,239 power section rpm. Powers E-2C delivered since 1987

501-D22A. Rated at 3,490 ekW (4,680 ehp). Commercial version of T56-A-15. Powers Lockheed L-100

501-D22G. Powers Super-580 and Kelowna CV-5800

Including the Allison 501 commercial engines, production of these engines reached 15,250 by 1994, flying over 170 million hours

The following details apply to the T56-A-15:

TYPE: Axial flow turboprop

PROPELLER DRIVE: Combination spur/planetary gear type. Overall gear ratio 13.54. Power section rpm 13,820. Weight of gearbox approximately 249 kg (550 lb) with pads on rear face for accessory mounting

COMPRESSOR: Fourteen-stage axial flow. Pressure ratio 9.5. Mass flow 14.70 kg (32.4 lb)/s. Constant speed 13,820 rpm

COMBUSTION CHAMBER: Six stainless steel can-annular type perforated combustion liners within one-piece stainless steel outer casing. Two ignitors in diametrically opposite combustors

FUEL SYSTEM: High-pressure type. Bendix control system. Water/alcohol augmentation system available

FUEL GRADE: MIL-J-5624, JP-4, JP-5 or JP-8

TURBINE: Four stage. Rotor assembly consists of four stainless steel discs, with first stage having hollow air-cooled blades, secured by fir tree roots. Gas temperature before turbine 1,076°C

ACCESSORY DRIVES: Accessory pads on rear face of reduction gear housing

LUBRICATION SYSTEM: Low pressure. Dry sump. Pesco dual-element oil pump. Normal oil supply pressure 3.8 bars (55 lb/sq in)

OIL SPECIFICATION: MIL-L-7808

MOUNTING: Three-point suspension

STARTING: Air turbine, gearbox mounted

DIMENSIONS:

Length (all current versions)	3,708 mm (146 in)
Width (all current versions)	686 mm (27 in)
Height: A-15, A-16, A-425, D-22A	991 mm (39 in)
A-14	1,118 mm (44 in)
WEIGHT, DRY: A-14	855 kg (1,885 lb)
A-15	828 kg (1,825 lb)
A-16	835 kg (1,841 lb)
A-425	860 kg (1,895 lb)
D22A	832 kg (1,834 lb)

PERFORMANCE RATINGS (S/L, ISA, static):

T-O: A-14, A-15, A-16, A-423, A-425
3,661 ekW, 3,424 kW (4,910 ehp, 4,591 shp)

501-D22A: 3,490 ekW (4,680 ehp)

Normal: A-14, A-15, A-16, A-425, D22A
3,255 ekW; 3,028 kW (4,365 ehp; 4,061 shp)

SPECIFIC FUEL CONSUMPTION:

At max rating:	
A-14, A-15, D22A	84.67 μg/J (0.501 lb/h/ehp)
At normal rating:	
A-14, A-15	87.4 μg/J (0.517 lb/h/ehp)

OIL CONSUMPTION:

A-14, A-15:
1.3 litres (0.35 US gallon, 0.29 Imp gallon)/h

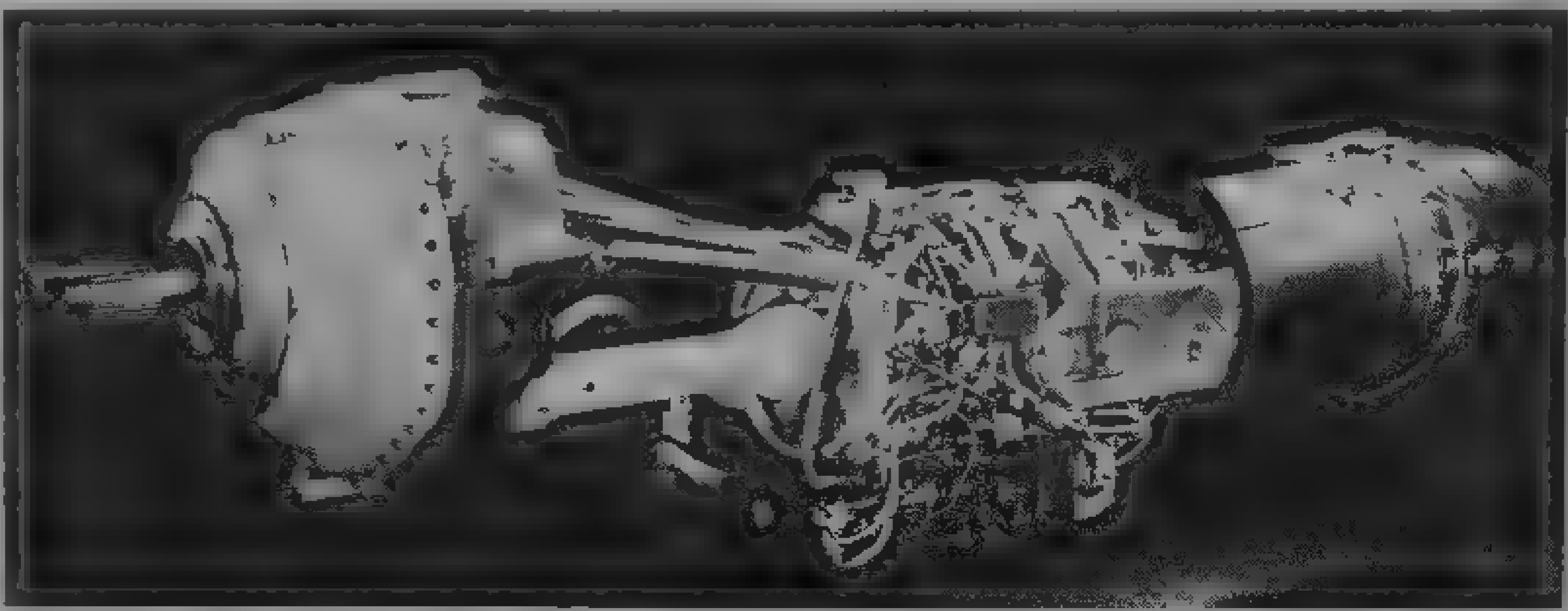
UPDATED

ALLISON AE 1107

US military designation: T406-AD-400

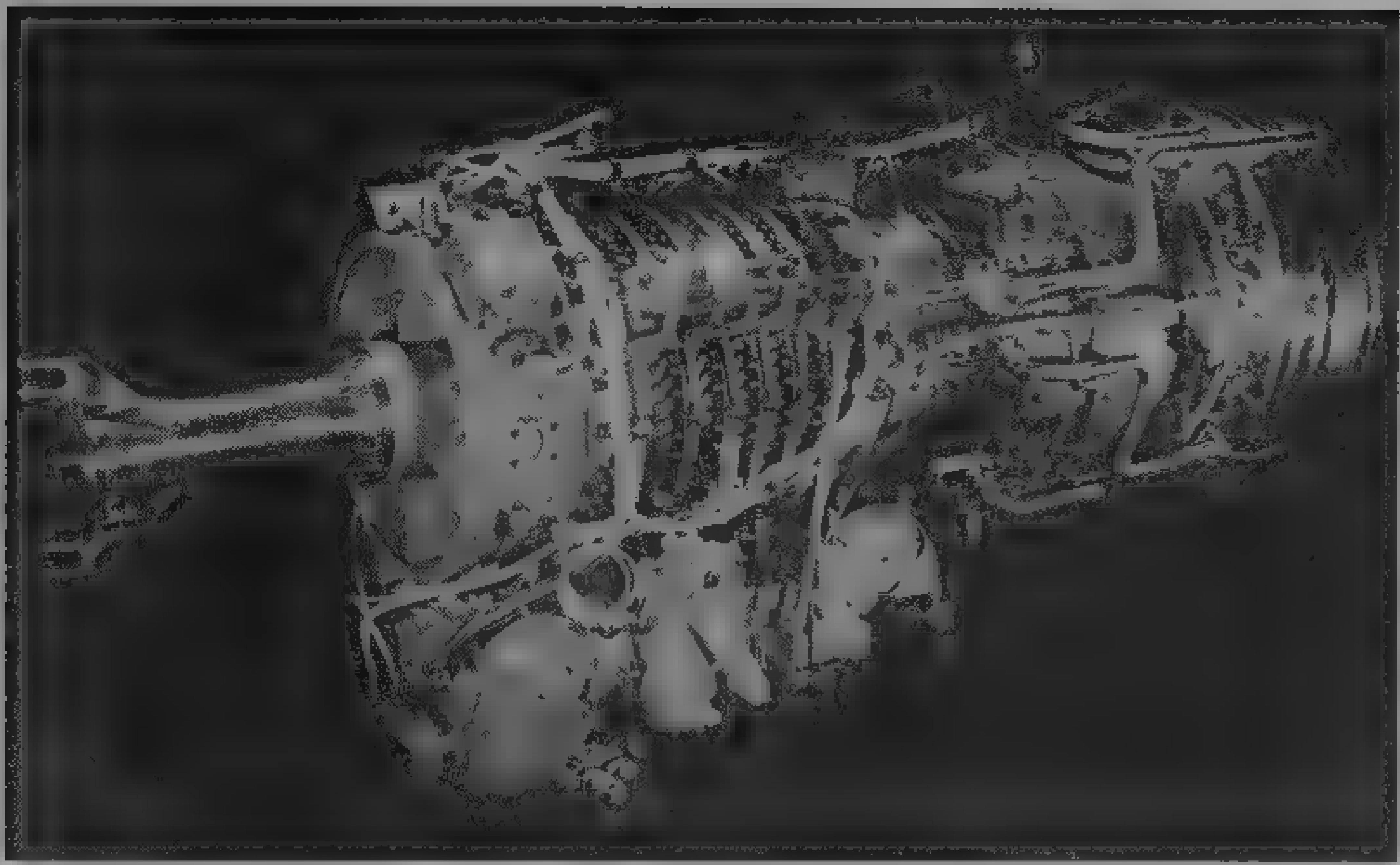
The T406 turboshaft, developed for the tilt-rotor V-22 Osprey, was derived from the T56/501. It is the basis for the AE 1107 turboshaft, AE 2100 turboprop and AE 3007 turbofan. The last two are described separately.

The T406-AD-400 is a free turbine, front drive 4,588 kW (6,150 shp) turboshaft incorporating high-efficiency components and reduced maintenance features required for operation in the V-22 Osprey. It features six rows of variable compressor stators, dual full authority digital electronic fuel controls, self-contained oil system capable of engine operation in the vertical position and modular construction. The T406 has completed its flight rating tests and 21 engines were



Allison T56-A-427 single-shaft turboprop

1984



Allison T406-AD-400 free turbine turboshaft

1994

delivered for the V-22 flight test programme, a further 12 are to be delivered in 1997

The T406 is applicable to other helicopter and tilt rotor aircraft as the **AE 1107**. This engine is undergoing FAA certification

TYPE: Axial flow turboshaft

COMPRESSOR: Fourteen-stage axial flow, with variable inlet guide vanes and first five stator rows. Pressure ratio 16.7. Mass flow 16.1 kg (35.5 lb)/s

COMBUSTOR: Annular effusion-cooled, with 16 airblast-type fuel nozzles providing smoke-free operation. Dual capacitor discharge ignition

CONTROL SYSTEM: Full-authority digital

FUEL GRADE: MIL-T-5624, grades JP-4, JP-5 and MIL-T-83188; JP 8

TURBINE: Gas-generator turbine has two axial stages with air cooled single-crystal blading, both stages overhung to the rear of the gas-generator thrust bearing. Power turbine has two axial stages on a straddle-mounted shaft which runs the entire length of the engine. Film-damped bearings eliminate the need for a centre bearing

OUTPUT: Power turbine forward shaft drives a torquemeter assembly which is directly coupled to the V-22 rotor gearbox. The torque tube housing serves as the front engine mount

ACCESSORY DRIVES: An engine accessory gearcase is mounted beneath the air inlet housing. It provides for engine starter generator, oil pump and fuel pump metering unit drives

LUBRICATION SYSTEM: Self-contained, featuring positive scavenging sumps, 3 µm filtration, and a bottom mounted, all attitude oil reservoir with service scuppers on each side of the engine

OIL GRADE: MIL-L-7808 or MIL-L-23699

DIMENSIONS:

Length overall, without gearbox	1 958 mm (77 08 in)
Length from inlet flange	1,521 mm (59 88 in)
Width	671 mm (26 40 in)
Height	864 mm (34 00 in)

WEIGHT, DRY: 440 4 kg (971 lb)

PERFORMANCE RATINGS:

Max power (S/L) 4 586 kW (6,150 shp) to 43°C

Max continuous power (static 1,219 m, 4 000 ft) 3,253 kW (4,362 shp) to 25°C

SPECIFIC FUEL CONSUMPTION:

Max cont power as above 72.0 µg/J (0 426 lb/h/shp)

UPDATED

ALLISON AE 2100

The AE 2100 turboprop has been developed for high speed regional aircraft as well as military transports and maritime patrol aircraft. It combines the T406 power section with a new propeller reduction gearbox based on the T56/501 design. It was selected by Saab (derated to 3,096 kW, 4,152 shp) to power the Saab 2000, by Lockheed for the L-100J/C-130J and by IPTN to power the N 250-100

AE 2100A The first AE 2100 went on test in June 1988. A prototype engine successfully completed flight testing on a P-3A aircraft in late 1990. The prototype consisted of a T406 power section, the new reduction gearbox and a flange-mounted Dowty Aerospace six-bladed propeller. Ten flight test and 33 production engines had been delivered by January 1995. FAA certification for the Saab 2000 was gained on 23 April 1993

AE 2100C. This version powers the Indonesian IPTN N 250-100, for which production flight test engines have been delivered

AE 2100D3. Engine for C-130J matched with Dowty R391 six bladed propeller. Test installation on C-130J demonstrator rebuilt by Marshall Aerospace, on flight test from 24 March to May 1994. Ordered for Royal Air Force

The AE 2100 is also a candidate engine for P-3 Orion fleet modernization and for several high speed 70-passenger projects

TYPE: Free turbine, axial flow turboprop

COMPRESSOR: Fourteen-stage, axial flow, with variable inlet guide vanes and first five stator rows

COMBUSTOR: Annular design with 16 airblast fuel nozzles

CONTROL SYSTEM: Full authority digital (FADEC), co-ordinating engine and propeller functions

HP TURBINE: Two-stage axial design with air cooled single-crystal blading

POWER TURBINE: Two uncooled stages on straddle-mounted shaft

PROPELLER DRIVE: Completely new design saving 68 kg (150 lb) weight, with life of 30,000 hours. Accessories grouped on rear face

DIMENSIONS:

Diameter overall	1,151 mm (45 3 in)
Length overall	2 743 mm (108 in)

WEIGHT, DRY: 702.2 kg (1 548 lb)

PERFORMANCE RATINGS:

S/L, T-O 4,474 kW (6,000 shp)

SPECIFIC FUEL CONSUMPTION:

S/L, T-O 69 31 µg/J (0 41 lb/h/shp)

UPDATED

ALLISON AE 3007

The AE 3007 turbofan is being developed to power regional airliners and medium/large business jets. The engine utilises the high-pressure spool from the T406/2100 with a new low-pressure spool. The 3007 was selected in 1990 by Embraer to power the EMB-145, and by Cessna for the Citation X. Growth versions are planned with ratings exceeding 62.3 kN (14,000 lb st), see AE 3012

The first AE 3007 went on test in July 1991. Additional development during 1992 included full altitude calibration, acoustic tests, initial endurance testing and initiation of flight testing on a Cessna Citation VII. Eleven active engines in the programme had accumulated over 3,500 hours by 1995, five were involved in the Citation X flight programme which began in December 1993. Certified early 1995

TYPE: Two-shaft subsonic turbofan

FAN: Single-stage, direct drive featuring wide-chord, clapperless blades. Bypass ratio of 5 0. Blades replaceable on aircraft. Diameter 978 mm (38.5 in)

HP COMPRESSOR: Fourteen stage axial flow, with variable inlet guide vanes and first five stator rows, all steel. Overall pressure ratio 23

Allison AE 2100 free turbine turboprop

1994

Allison AE 3007 turbofan

1994

COMBUSTOR: Annular design with 16 airblast fuel nozzles. Dual capacitor discharge ignition
CONTROL SYSTEM: Full-authority digital (FADEC)
HP TURBINE: Two-stage axial with air-cooled single-crystal blading
LP TURBINE: Three-stage axial uncooled design
BYPASS DUCT: Single-piece full length composite with provisions for thrust reverser
DIMENSIONS:

Diameter overall	1,105 mm (43.5 in)
Length	2,705 mm (106.5 in)

WEIGHT, DRY (with bypass duct) 717.1 kg (1,581 lb)

PERFORMANCE RATINGS:
S/L, T-O 32.03 kN (7,200 lb st) to 30°C
SPECIFIC FUEL CONSUMPTION:
S/L, T-O 9.35 mg/Ns (0.33 lb/h/lb st)

UPDATED

ALLISON AE 301X/3012

The 301X is a high-thrust development of the 3007 with a new core, which will be used in the definitive AE 3012. The core has a CastCool HP turbine designed for higher temperatures. There are no changes in frame size or weight. The 301X is rated in the 44.48 kN (10,000 lb st) class, and has been on test since September 1994.

The AE 3012 will combine this core with a new LP spool having a 1,117 mm (44.0 in) fan and two-stage core booster (intermediate compressor) driven by a four-stage turbine. The 3012 will be in the 62.3 kN (14,000 lb) thrust class, and is scheduled for certification in 1998. It is proposed for the Canadair CRJ-X.

NEW ENTRY

CFE

CFE COMPANY

111 South 34th Street, PO Box 62332, Phoenix, Arizona 85082-2332
Telephone: 1 (602) 231 3285
Fax: 1 (602) 231 7722
PRESIDENT: Ron S. Harrelson

This company was formed jointly by Garrett Engine Division (now AlliedSignal Engine Co) and General Electric Aircraft Engines in June 1987. It is managing all phases of the development, manufacture, marketing and support of the CFE738 turbofan.

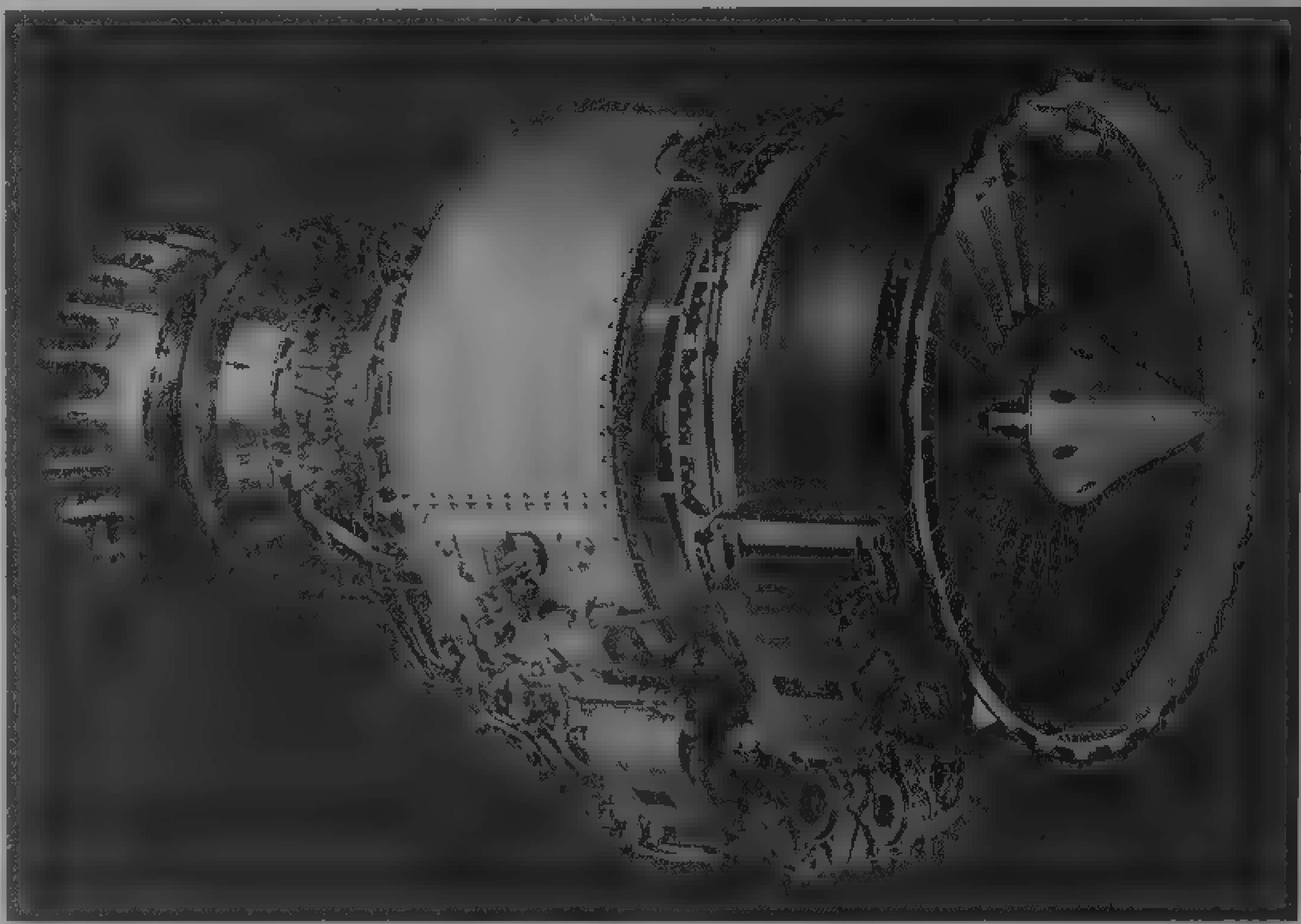
UPDATED

CFE738

This turbofan is being produced to power regional airliners and large business jet aircraft. The CFE738 is being designed to the latest airline standard technology, with modular construction for 'on wing' maintenance. Its core is essentially that of the GE27, developed under the US Army's MTDE (Modern Technology Demonstrator Engine) programme and part of the T407/GLC38 programme. Engine cores are shipped from GE to Phoenix complete with the engine control system. Garrett AlliedSignal is responsible for the fan, LP turbine and accessory gearbox, and for engine assembly and test. Complete engine testing for certification programmes will be shared equally by the two partners. The first version, CFE738-1, was FAA certificated on 17 December 1993. First Jet veries were then made to power the Dassault Falcon 2000.

The following data relate to the CFE738-1B. Growth versions are planned with thrust ratings exceeding 31.1 kN (7,000 lb).

TYPE: Two-shaft subsonic turbofan
FAN: Single stage with 28 inserted titanium blades with part-span dampers and rotating pointed spinner. Front end of LP shaft held in large-capacity ball bearing. Mass flow 95.3 kg (210 lb)/s. Pressure ratio 1.7. Bypass ratio 5.3
HP COMPRESSOR: Five axial stages followed by one centrifugal. First three stator stages variable. Overall pressure ratio, S/L 23, top of climb 35
COMBUSTION CHAMBER: Centrifugal diffuser leads into annular chamber with 15 fuel injectors



CFE738 two-shaft turbofan *1995*

HP TURBINE: Two stages with cooled blades
LP TURBINE: Three stages. Inter-turbine temperature (cruise) 861°C
JETPIPE: Fixed mixer assembly with 20 chutes for combining the hot and cold flows from core and bypass duct. Provision for reverser
CONTROL SYSTEM: Dual FADEC
DIMENSIONS:

Length	2,514 mm (99.0 in)
Width	1,092 mm (43.0 in)
Height	1,219 mm (48.0 in)

WEIGHT, DRY: 601 kg (1,325 lb)
PERFORMANCE RATINGS (uninstalled):
S/L, T-O 25.47 kN (5,725 lb st) to 30°C (86°F)
Cruise, 12,200 m (40,000 ft), Mach 0.8 6.51 kN (1,464 lb)
SPECIFIC FUEL CONSUMPTION:
S/L, T-O 10.54 mg/Ns (0.372 lb/h/lb st)
Cruise (as above) 18.13 mg/Ns (0.64 lb/h/lb)

UPDATED

GENERAL ELECTRIC

GE AIRCRAFT ENGINES

One Neumann Way, Evendale, Ohio 45215 6301
Telephone: 1 (513) 243 5805
Fax: 1 (513) 786 1568
Telex: 212078 GEAEG UR
PRESIDENT AND CEO: E. F. Murphy

Current products of GE Aircraft Engines include the F103, F110, F118, F404, F414, T64, T700 and TF34 for military use, and the GE90, CF6, CF34, CT7 and GLC38 for the commercial and general aviation market. A new turbofan is being developed in partnership with AlliedSignal and appears under CFE. In partnership with SNECMA of France a company was formed to develop and market the CFM56 turbofan, as described in the International part of this section under CFM International.

Details of the CF700, CJ610, F101, J79, J85, T58 and TF39 engines, which are no longer in production, can be found in earlier editions of *Jane's*.

UPDATED

GENERAL ELECTRIC F404

In May 1975 the US Navy selected McDonnell Douglas/Northrop to develop its F/A-18 Hornet, powered by two F404-GE-400 engines.

First F404 engine test took place in December 1976. Preliminary flight rating test took place in May 1978, first F/A-18 flight in November 1978 and MQT (model qualification test) in June 1979. The first production delivery took place in December 1979.

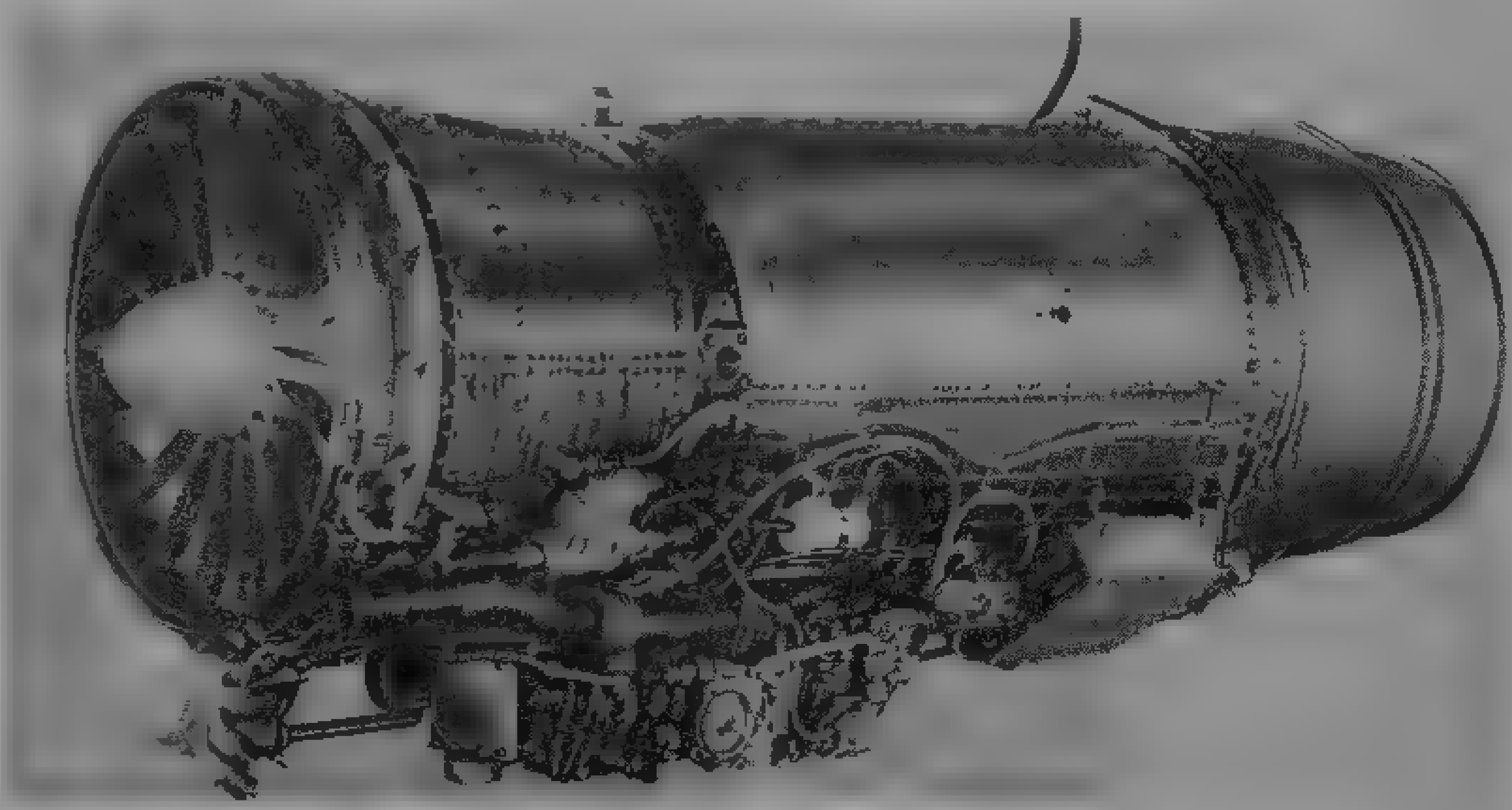
The following are current versions of the F404.

F404-GE-400. Original production engine for approximately 1,100 F/A-18A/B/C/D Hornets, including exports to Australia, Canada and Spain. Also powered Grumman X-29 and Rockwell/MBB X-31. Maximum rating 71.2 kN (16,000 lb st).

F404-GE-402. Enhanced Performance Engine (EPE) in the 79 kN (17,700 lb st) class; combines a 2,000 hour hot section with up to 25 per cent increase in thrust, achieved through higher temperature, increased fan speed and improved design and materials in the turbines and afterburner. In production for F/A-18C/D since 1991 (first flight, first Kuwaiti Hornet, 19 September 1991), US Navy from early 1992, plus exports to Finland, Malaysia and Switzerland.

F404-GE-100D. A 49 kN (11,000 lb st) non-afterburning derivative of F404-GE-400 with modified single-engine control system for Singapore Air Force A-4SU Super Skyhawk.

F404-GE-F1D2. A non-afterburning turbojet derivative



General Electric F404-GE-100D unaugmented turbofan *1990*

of the F404-GE-400 rated at 44.5 kN (10,000 lb st), powering the US Air Force F-117A

F404/RM12 An 80 kN (18,100 lb st) F404 derivative. Redesigned fan handles 10 per cent greater air flow and has increased resistance to foreign object damage. Increased turbine inlet temperature provides operating margin for lower right hand corner of flight envelope. Modified single-engine control system for JAS 39 Gripen. Selected to flight test Indian Light Combat Aircraft. See Volvo Aero, Sweden

F404-GE-400D. Unaugmented version of F404-GE-400 rated at 48.0 kN (10,800 lb st). Powered Grumman A-6F prototype

The following description applies to the F404-GE-402

TYPE: Two-shaft augmented low-bypass ratio turbofan (turbojet with continuous bypass bleed)

FAN: Three-stage. Bypass ratio 0.27. Mass flow 66.2 kg (146 lb)/s

HP COMPRESSOR: Seven-stage. Overall pressure ratio, 26 : 1 class

COMBUSTION CHAMBER: Single-piece annular

HP TURBINE: Single stage with air-cooled blades

LP TURBINE: Single stage

EXHAUST SYSTEM: Close coupled afterburner. Convergent-divergent exhaust nozzle with hydraulic actuation

CONTROL SYSTEM: Electrical hydromechanical

DIMENSIONS

Length overall	4,030 mm (158.8 in)
Max diameter	880 mm (34.8 in)
WEIGHT, DRY	1,035 kg (2,282 lb)
PERFORMANCE RATING	
Max T-O	79 kN (17,700 lb st)

GENERAL ELECTRIC F414

The F414 is the engine for the US Navy's F/A-18E/F Hornet multimission aircraft. Derived from the F404, the **F414-GE-400** is rated at 97.86 kN (22,000 lb st). Production qualification is planned for 1996, and shipments are due in 1998

VERIFIED

GENERAL ELECTRIC ASTOVL

A family of engines based on the YF120 low-bypass fighter turbofan for advanced STOVL aircraft. Various low spools are being mated with the YF120 core to provide propulsion for each candidate lift concept, including augmented lift (gas and shaft driven), direct lift and lift plus lift/cruise

GENERAL ELECTRIC TF34

This turbofan won a 1965 US Navy competition. In August 1972 the **TF34-GE-2**, the initial variant for the Lockheed S-3A Viking, completed its model qualification test (MQT) and entered fleet service in February 1974. In January 1975 GE began shipment of the **TF34-GE-400A/B**, which replaced the GE-2 as S-3A engine. In 1970 the TF34 was selected to power the A-10A attack aircraft as the **TF34-GE-100**, with a long fan duct and side mountings. In 1974 a third version was selected to provide auxiliary (thrust) power for the Sikorsky S-72 research aircraft

TYPE: Two-shaft high bypass ratio turbofan

FAN: Single-stage fan has blades forged in titanium. Mass flow (TF34-400A/B) 153 kg (338 lb)/s at 7,365 rpm with pressure ratio 1.5. Bypass ratio 6.2

COMPRESSOR: Fourteen-stage axial on HP shaft. Inlet guide vanes and first five stators variable. First nine rotor stages titanium, remainder high nickel alloy. Performance at maximum S/L rating, core air flow 21.3 kg (47 lb)/s at 17,900 rpm with pressure ratio 14, overall pressure ratio 21

COMBUSTION CHAMBER: Annular Hastelloy liner and front dome, with 18 carburetting burners.

TURBINE: Two-stage HP; four-stage LP with tip-shrouded blades. EGT 1,225°C maximum

FUEL SYSTEM: Hydromechanical with electronic amplifier. Fuel grade JP-4 or JP-5

DIMENSIONS

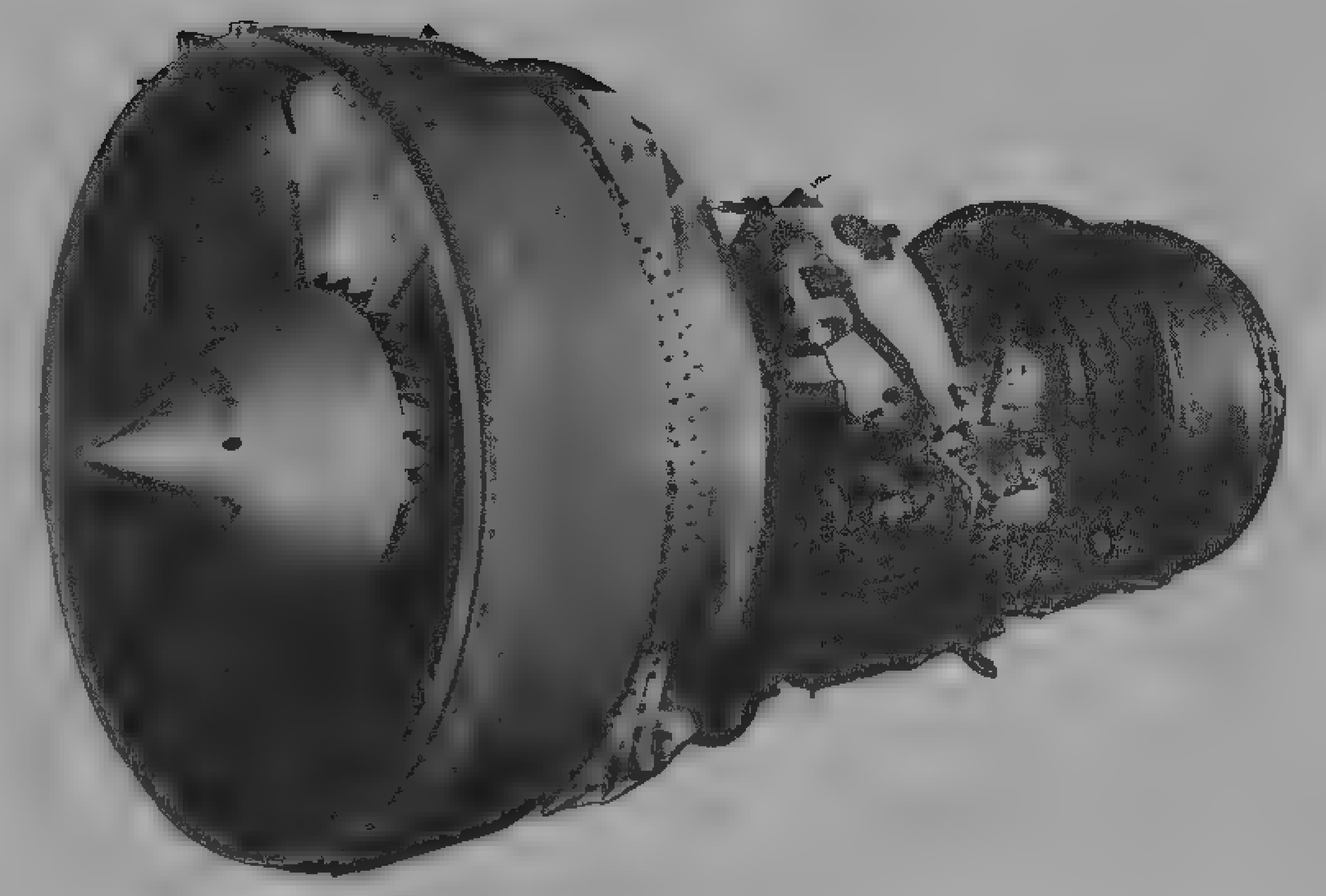
Max diameter:	
TF34-GE-400A/B	1,321 mm (52.0 in)
TF34-GE-100	1,245 mm (49.0 in)
Basic length (both)	2,540 mm (100.0 in)
WEIGHT, DRY	
TF34-GE-400A/B	670 kg (1,478 lb)
TF34-GE-100	653 kg (1,440 lb)
PERFORMANCE RATING (max T-O; S/L static)	
TF34-GE-400A/B	41.3 kN (9,275 lb st)
TF34-GE-100	40.3 kN (9,065 lb st)
SPECIFIC FUEL CONSUMPTION (max T-O, S/L static)	
TF34-GE-400A/B	10.3 mg/Ns (0.363 lb/h/lb st)
TF34-GE-100	10.5 mg/Ns (0.370 lb/h/lb st)

VERIFIED

GENERAL ELECTRIC CF34

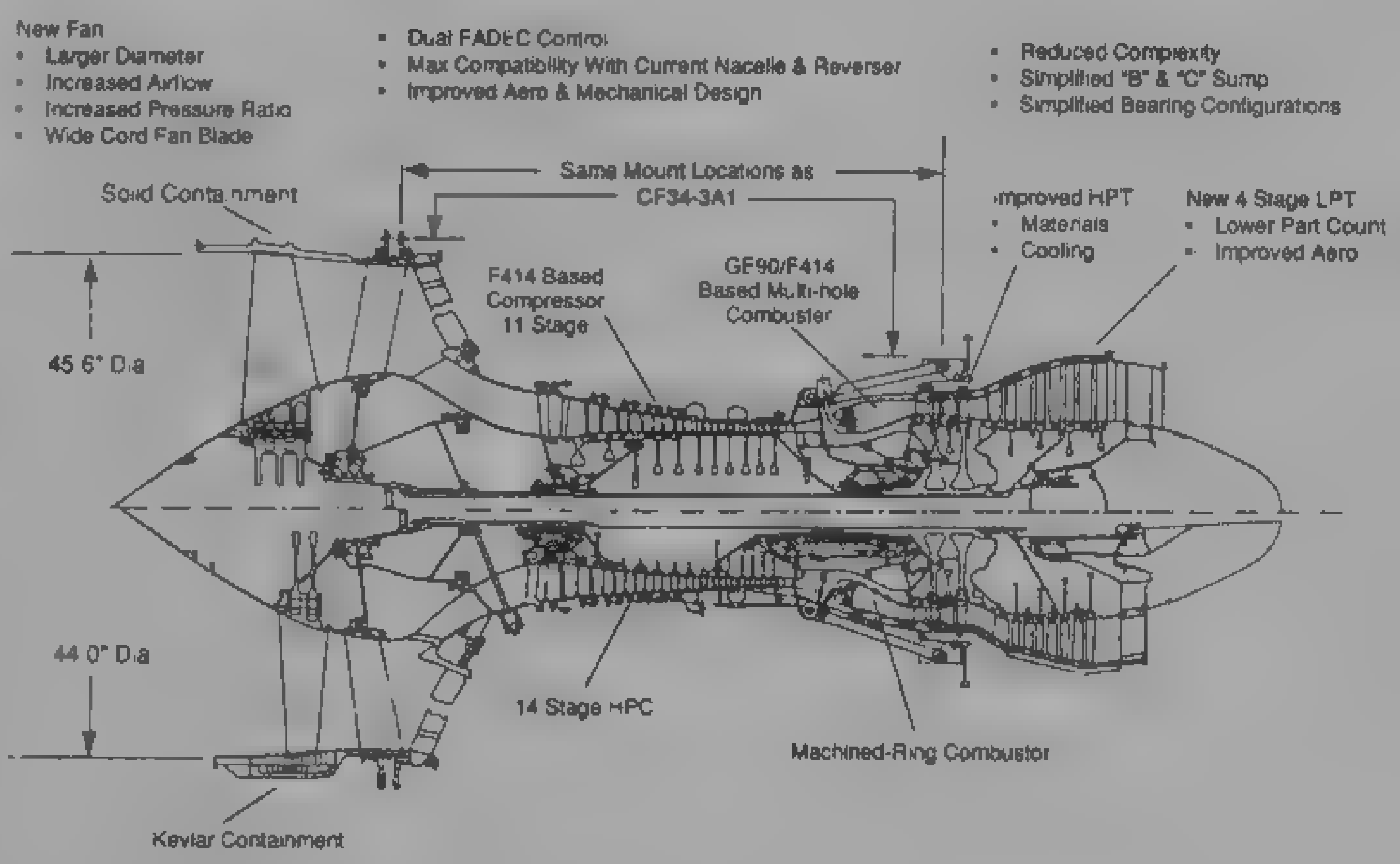
The CF34 is a commercial adaptation of the TF34. Total air flow at take-off power with automatic power reserve (APR) is 151 kg (332 lb)/s. Bypass ratio is 6.3

CF34-1A. Certificated August 1982. Powers Challenger 601-1A. Rated at 38.48 kN (8,650 lb st)



General Electric CF34-3A1 two-shaft turbofan

1985



Comparative sections through CF34-3A1 (bottom half) and CF34-8C (top half)

1995

CF34-3A. Powers Challenger 601-3A. Rated at 41.0 kN (9,220 lb st) with APR, or 38.8 kN (8,729 lb st) without

CF34-3A1. Powers Canadair RJ and Challenger 601-3R. Data below for this

CF34-3B. T-O rating as -3A1 but maintained to 30°C (86°F); climb and cruise thrusts increased; sfc 9.80 mg/Ns (0.346 lb/h/lb st). Certified in May 1995 for service entry on CL-604 in first quarter of 1996

CF34-3B1. CF34-3B with airline ratings. Was to be certified concurrently with CF34-3B

CF34-8C. Major upgrade with significant differences shown in section drawing. Most of the HP compressor comes from the F414, with most stage's blisks welded into pairs or groups. Likewise, the new LP turbine will probably be inertia-welded into two two-stage wheels. Control will be by two-channel FADEC. Specific fuel consumption is intended to be 8 per cent lower than the CF34-3A1. The Dash 8C is to have an initial T-O rating of 57.82 kN (13,000 lb st), with growth potential to 80.06 kN (18,000 lb st). Selected for Canadair CRJ-X

DIMENSIONS

Length overall	2,616 mm (103.0 in)
Max diameter (at mounts)	1,245 mm (49.0 in)
PERFORMANCE RATINGS (S/L, static)	
T-O (APR)	41.0 kN (9,220 lb st)
T-O (Normal)	38.8 kN (8,729 lb st)
SPECIFIC FUEL CONSUMPTION (as above)	
T-O (Normal)	10.11 mg/Ns (0.357 lb/h/lb st)

UPDATED

GENERAL ELECTRIC GE90

On 16 January 1990 GE announced that it was developing a high-bypass turbofan with thrust in the range 333 to 444 kN (75,000 to 100,000 lb st) capable of powering all new and derivative wide-body aircraft that may enter the market in the mid-1990s. The first GE90 to run reached the then record thrust of 468 kN (105,400 lb st) on 3 April 1993. Flight testing in a 747 began in September 1993

The GE90 was scheduled for certification at 388.8 kN (87,400 lb st) in May 1994 and entry into service at 350.1 kN (78,700 lb st) on the Boeing 777 in third quarter 1994. This schedule slipped seriously, certification finally being achieved in March 1995. Further delay was then caused by two fan failures, one in a blade-root severance test and the other in a simulated large bird strike

This new design is based on a compressor scaled directly from GE's Energy Efficient Engine programme, a joint GE/NASA-funded project aimed at establishing a technology base for engines of the 1990s. It features the largest fan yet built, with composite wide-chord blades

The large fan diameter increases the bypass ratio to 8.4, higher than that of any engine yet developed. The higher bypass ratio is claimed to achieve a 10 per cent improvement in specific fuel consumption compared to today's large turbofan engines, while providing reduced noise levels.

Improvements to the combustor design will result in significantly improved emissions (oxides of nitrogen)

The engine features a fan case mount with an integrally stiffened system that bypasses thrust loads around the short, stiff core. This system, in conjunction with the straddle-mounted core, will deliver improved performance retention and reduced airline operating costs

The compressor permits a shorter, lighter, stifter engine with a high overall cycle pressure ratio that also contributes to the significantly improved specific fuel consumption. The double-dome combustor was designed specifically for low NO_x emissions. Under low thrust, the outer combustor nozzles are used, as thrust is increased, the inner set of main nozzles begins operation. The high-pressure turbine features single-crystal blades, and the turbine discs are boltless, with smooth side plates for low windage losses

GE's partners include SNECMA, FiatAvio and IHI. Among the GE90's features are

General Electric GE90 two-shaft turbofan

1994

FAN: Low speed, low-pressure ratio with bypass ratio of 8.4 to 9.0; composite, unshrouded wide-chord rotor blades. Structural outlet guide vanes. Blade/vane quantities and spacing optimised for low acoustics.

LP COMPRESSOR: Three stages, low speed, moderate pressure ratio, low noise features.

HP COMPRESSOR: Ten stages, pressure ratio 23, derived from GE/NASA Energy Efficient Engine (E^3) technology demonstrator. Overall pressure ratio over 39.3 to 45.5.

COMBUSTOR: Double annular design for low NO_x emissions.

HP TURBINE: Two stages with monocrystal blades and powdered metal discs.

LP TURBINE: Six stages with relatively low stage loading for improved efficiency, low noise features.

FUEL SYSTEM: FADEC control of fuel flow, variable geometry and active clearance control systems.

DIMENSIONS:

Fan diameter	3,124 mm (123 in)
Length, flange to flange	4,902 mm (193 in)

WEIGHTS: Not stated

PERFORMANCE RATINGS:

Max T-O (S/L)	
GE90-76B	339.9 kN (76,400 lb st) to 32.8°C
GE90-85B	376.8 kN (84,700 lb st) to 30°C
Max climb (both, 10,670 m (35,000 ft), Mach 0.8)	83.68 kN (18,100 lb)
Max cruise (both, 10,670 m (35,000 ft), Mach 0.8)	77.85 kN (17,500 lb)

SPECIFIC FUEL CONSUMPTION:

Both (cruise, as above, bucket target) 14.73 mg/Ns (0.52 lb/h/lb)

UPDATED

GENERAL ELECTRIC CF6

US military designation (CF6-50E): F103-GE-100

On 11 September 1967 General Electric announced the commitment of corporate funding for development of the CF6 turbofan for wide-body transports. The CF6-6D for the DC-10-10 was launched on 25 April 1968. Details of this and other early versions appeared in the 1987-88 *Jane's*. The following are current versions:

CF6-50C2/E2. Rated 233.5 kN (52,500 lb st) to 30°C. Certification 1978. Military -50C2 powers KC-10; -50E2 powers Boeing E-4.

CF6-80A/A3. Improved sfc and performance retention, with length and weight reduced by elimination of turbine mid-frame and reduction in combustor and diffuser length. Engine rated at 213.5 kN (48,000 lb st) as the -80A/A1, and 222.4 kN (50,000 lb st) as the -80A2/A3. Fitted to 767 and A310. Programme launched November 1977, first engine ran October 1979 and certification October 1981. Production split between GE and SNECMA. The -80A and -80C2 on the 767 were first to receive FAA approval (January 1989) for 180 min ETOPS operations.

CF6-80C2. Described separately.

The following data relate to the CF6-50C2/E2, with -80 differences noted:

TYPE: Two-shaft high bypass ratio turbofan.

FAN: Single-stage with three-stage LP compressor both driven by LP turbine. The 38 fan rotor blades have antivibration shrouds at two-thirds span. Blades, discs, spool of titanium, exit guide vanes of aluminium, fan frame and shaft of steel, spinner and fan case of aluminium alloy. Total air flow 591 kg (1,303 lb)/s, bypass ratio 5.7. CF6-80A/A1 has better efficiency and birdstrike resistance, with Kevlar containment in fan case. Fan diameter 2,195 mm (86.4 in). Mass flow, CF6-80A/A1, 651 kg (1,433 lb)/s, -80A2/A3, 663 kg (1,460 lb)/s. Bypass ratio, -80A/A1, 4.7, -80A2/A3, 4.6.

LP COMPRESSOR: Three core booster stages, 12 bypass doors maintain flow matching between fan/LP and core by opening at low power settings, closed during take-off and cruise.

HP COMPRESSOR: Fourteen-stage with inlet guide vanes and first six stator rows having variable incidence. Core air flow 125 kg (276 lb)/s. Forward titanium and aft Inco 718 casings are horizontally split. CF6-80A series incorporate bore cooling for blade/casing clearance control, and a horizontally split full-length steel casing with insulated aft stages and short diffuser section. Overall pressure ratio (T-O), 29.13 (-50C), 30.1 (-50E), 28.0 (-80A/A1), 29.0 (-80A2/A3).

COMBUSTOR: Fully annular. CF6-80A has rolled ring combustor, 152 mm (6.0 in) shorter, mounted at aft flange.

HP TURBINE: Two-stage air-cooled, TET 1,330°C. CF6-80A has no turbine mid-frame and eliminates one main bearing, and HP case has active clearance control.

LP TURBINE: Four-stage constant tip diameter with nominal 871°C inlet temperature. Rotor blades tip-shrouded and not air-cooled. CF6-80A, new turbine with active clearance control.

THRUST REVERSER (FAN): Rear portion of fan outer cowl translates aft on rotating ballscrews to uncover cascade vanes. Blocker doors (16) flush-mounted in cowl on link arms hinged in inner cowl, rotate inwards to expose cascade vanes and block fan duct. CF6-80A1/A3 (A310) similar, 767 reverser by Boeing.

ACCESSORY DRIVE: Inlet gearbox in forward sump transfers energy from the core. Transfer gearbox on fan frame delivers power to the accessory gearbox on the core with starter, fuel pump, main engine control, lubrication pump, alternator and pads for aircraft hydraulic pumps and constant-speed drive. CF6-80A1/A3 gearbox on fan case.

FUEL SYSTEM: Hydromechanical, schedules acceleration and deceleration fuel flow, variable stator vane position and LP compressor variable bypass doors. CF6-80, electronic trimming.

FUEL GRADES: Fuels conforming to ASTM-1655-65T, Jet A, Jet A1 and Jet B, and MIL-T-5624G2 grades JP-4 or JP-5 are authorised, but Jet A is primary specification.

LUBRICATION SYSTEM: Dry sump centre-vented nominal pressure is 2.07-6.21 bars (30-90 lb/sq in).

STARTING: Air turbine starter mounted on the rear of core-mounted accessory gearbox. CF6-80A1/A3 starter in on the front of the fan-case gearbox.

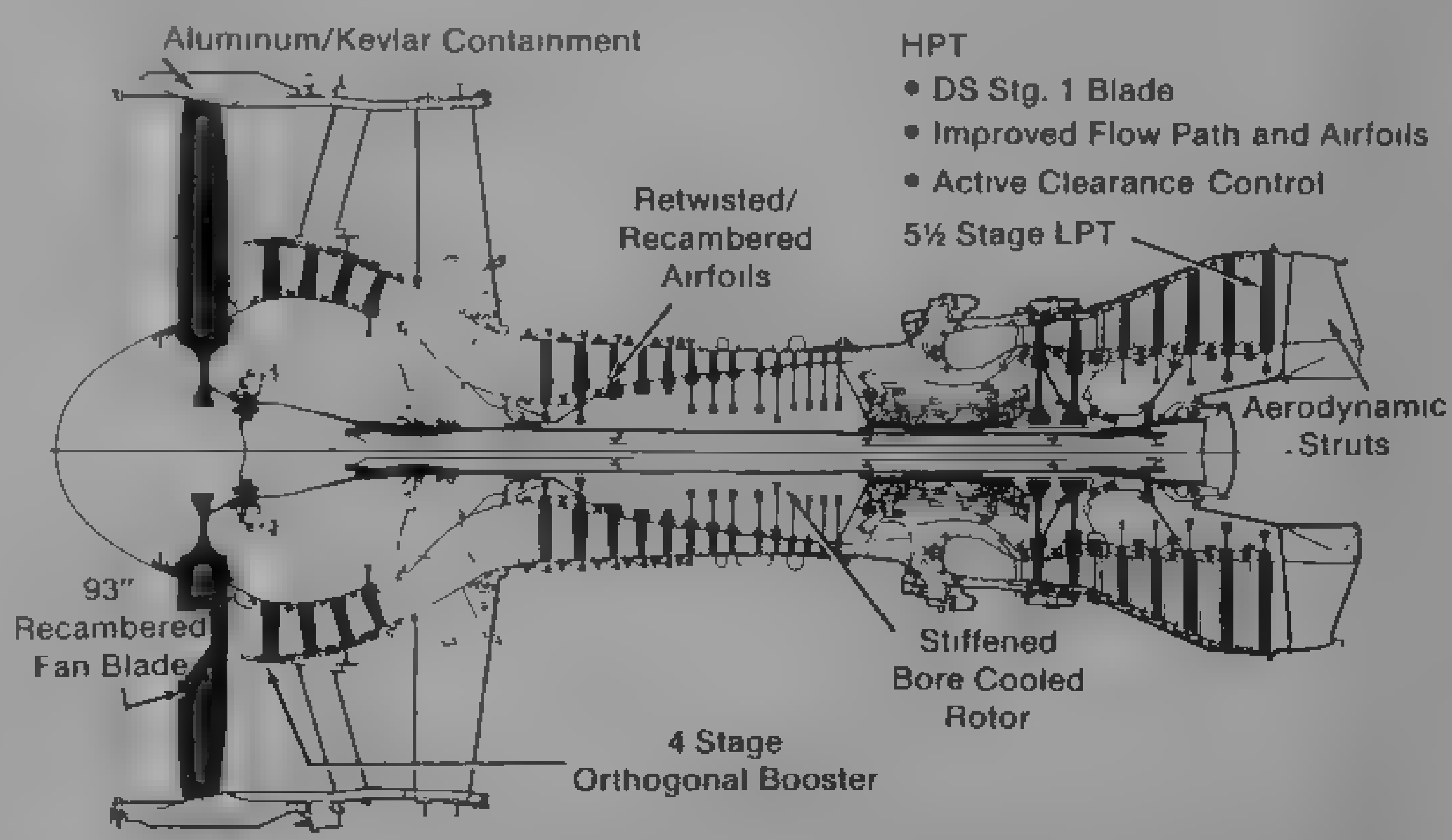
NOISE SUPPRESSION: Acoustic panels integrated with fan casing, fan front frame and thrust reverser.

DIMENSIONS:

Max height (over gearbox)	2,675 mm (105.3 in)
Length overall (cold)	
CF6-50 series	4,394 mm (173.0 in)
CF6-80A	3,998 mm (157.4 in)

CF6-80C2 and 80E1 MODELS

Model	Thrust: Ideal nozzle	Thrust: Real nozzle	Application
CF6-80C2A1	262.5 kN (59,000 lb)	257.4 kN (57,860 lb) to 30°C	A300-601
CF6-80C2A2	238.0 kN (53,500 lb)	233.4 kN (52,460 lb) to 43.9°C	A310-200, -300
CF6-80C2A3	267.8 kN (60,200 lb)	262 kN (58,950 lb) to 30°C	A300-600
CF6-80C2A5, A5F	272.7 kN (61,300 lb)	267.3 kN (60,100 lb) to 30°C	A300-600R, -600F
CF6-80C2A8	262.5 kN (59,000 lb)	257.4 kN (57,860 lb) to 35°C	A310-300, -600 SAT
CF6-80C2B1	252.2 kN (56,700 lb)	249 kN (55,980 lb) to 30°C	747-200, -300
CF6-80C2B1F	258.0 kN (58,000 lb)	254.3 kN (57,160 lb) to 32.2°C	747-400
CF6-80C2B1F1, B1F2	270.5 kN (60,800 lb)	267.0 kN (60,030 lb) to 30°C	747-400
CF6-80C2B2	233.5 kN (52,500 lb)	229.5 kN (51,590 lb) to 32.2°C	767-200ER, -300LR
CF6-80C2B2F, B3F	234.4 kN (52,700 lb)	231.4 kN (52,010 lb) to 32.2°C	767-300ER, 747-400D
CF6-80C2B4	257.6 kN (57,900 lb)	254.4 kN (57,180 lb) to 32.2°C	767-300ER, -300ER
CF6-80C2B4F	258.4 kN (58,100 lb)	254.8 kN (57,280 lb) to 32.2°C	767-300ER
CF6-80C2B6	270.5 kN (60,800 lb)	267.2 kN (60,070 lb) to 30°C	767-300ER
CF6-80C2B6F, B6FA, B7F	270.5 kN (60,800 lb)	267.0 kN (60,030 lb) to 30°C	767-300ER, -300 Freighter, 767 AWACS
CF6-80C2D1F	275.6 kN (61,960 lb)	270.0 kN (60,690 lb) to 30°C	MD-11
CF6-80E1A1	286.9 kN (64,500 lb)	281.5 kN (63,290 lb) to 30°C	A330
CF6-80E1A2	292.7 kN (65,800 lb)	287.0 kN (64,530 lb) to 30°C	A330
CF6-80E1A3	309.2 kN (69,500 lb)	303.6 kN (68,240 lb) to 30°C	A330
CF6-80E1A4	302.9 kN (68,100 lb)	297.5 kN (66,870 lb) to 30°C	A330



Features of General Electric CF6-80C2 two-shaft turbofan

1987

WEIGHT DRY
Basic engine

CF6-50C2	3,960 kg (8,731 lb)
CF6-50E, -E1	3,851 kg (8,490 lb)
CF6-50E2	3,977 kg (8,768 lb)
CF6-80A, -80A2	3,854 kg (8,496 lb)
CF6-80A3	3,819 kg (8,420 lb)

Reverser

CF6-50H	962 kg (2,121 lb)

PERFORMANCE RATINGS
Max T-O, uninstalled, ideal nozzle: See under model listings
Max cruise at 10,670 m (35,000 ft), Mach 0.85, flat rated to ISA + 10°C, uninstalled, real nozzle

CF6-50C2, -E2	50.3 kN (11,300 lb)
CF6-80A, -80A1	45.9 kN (10,320 lb)

SPECIFIC FUEL CONSUMPTION
At T-O thrust, as above

CF6-50E	10.65 mg/Ns (0.376 lb/h/lb st)
CF6-50C2, -E2	10.51 mg/Ns (0.371 lb/h/lb st)
CF6-80A	9.74 mg/Ns (0.344 lb/h/lb st)

OIL CONSUMPTION: 0.9 kg (2.0 lb)/h

UPDATED

GENERAL ELECTRIC CF6-80C2

This engine is a major redesign for higher thrust and improved sfc, based on the CF6-80A1/A3 but with a 2,362 mm (93 in) diameter fan. It has a four-stage LP compressor and LP turbine redesigned aerodynamically with 5½ stages. The first CF6-80C2 ran in May 1982, and exceeded 276 kN (62,000 lb st) corrected thrust. Flight test on an A300 took place between August and December 1984, leading to certification on 28 June 1985. The engine entered revenue service on 5 October 1985.

Programme sharing agreements have been signed with SNECMA of France, MTU of Germany, Volvo Aero of Sweden and FiatAvio of Italy. Applications are shown in the table on the previous page.

The CF6-80C2 differs from earlier CF6 engines in the following features:

FAN: Single stage, with integrally mounted four-stage booster (LP compressor). Mainly titanium except for steel mid-fan shaft, aluminium spinner and blade-containment shroud of layers of Kevlar around aluminium case. Eighty composite exit guide vanes canted for better aerodynamic efficiency. Mass flow 802 kg (1,769 lb)/s, bypass ratio 5.05.

LP COMPRESSOR: Four stages with blades and vanes mounted orthogonally, with dovetail offset from centre of pressure to reduce bending.

HP COMPRESSOR: Fourteen-stage, with inlet guide vanes and first five stator rows with variable incidence. Blades in stages 1-5 titanium, 6-14 steel, vanes all steel. One-piece steel casing with insulated aft stages. Core air flow 154 kg (340 lb)/s. Overall pressure ratio 30.4.

COMBUSTOR: Annular, rolled ring construction, aft-mounted with film cooling.

HP TURBINE: Two-stage. Stage one blades directionally solidified. Casing with active and passive clearance control. No mid-frame.

LP TURBINE: Five stages, with cambered struts in rear frame to reduce exit swirl, effectively producing another half stage. Rear hub heated by exhaust gas to reduce thermal stress.

FUEL SYSTEM: FADEC or hydromechanical fan speed control with electronic supervision, one throttle position corresponds to each engine rating in all flight conditions.

ACCESSORY DRIVE: Drive enhanced on CF6-80C2B6FA to accommodate two 150 kVA alternators.

DIMENSION:
Length: 4,087 mm (160.9 in)

WEIGHT DRY: 4,144 kg (9,135 lb)

PERFORMANCE RATINGS (uninstalled, ideal nozzle)
Max T-O: See table
Max cruise (10,670 m, 35,000 ft, Mach 0.85): 50.4 kN (11,330 lb)

SPECIFIC FUEL CONSUMPTION
T-O, as above: 9.32 mg/Ns (0.329 lb/h/lb st)

UPDATED

GENERAL ELECTRIC CF6-80E1

This engine is a major redesign for higher thrust, based on the CF6-80C2 but with a 2,438 mm (96 in) diameter fan. It has a four stage LP compressor and LP turbine redesigned aerodynamically with 5½ stages. The first CF6-80E1 ran in December 1990 at over 320.3 kN (72,000 lb st) corrected thrust. Flight tested on an A300 early 1992, certified 25 May 1993. Entered service on A330 17 January 1994, JAA approved for 180-minute ETOPS 6 February 1995.

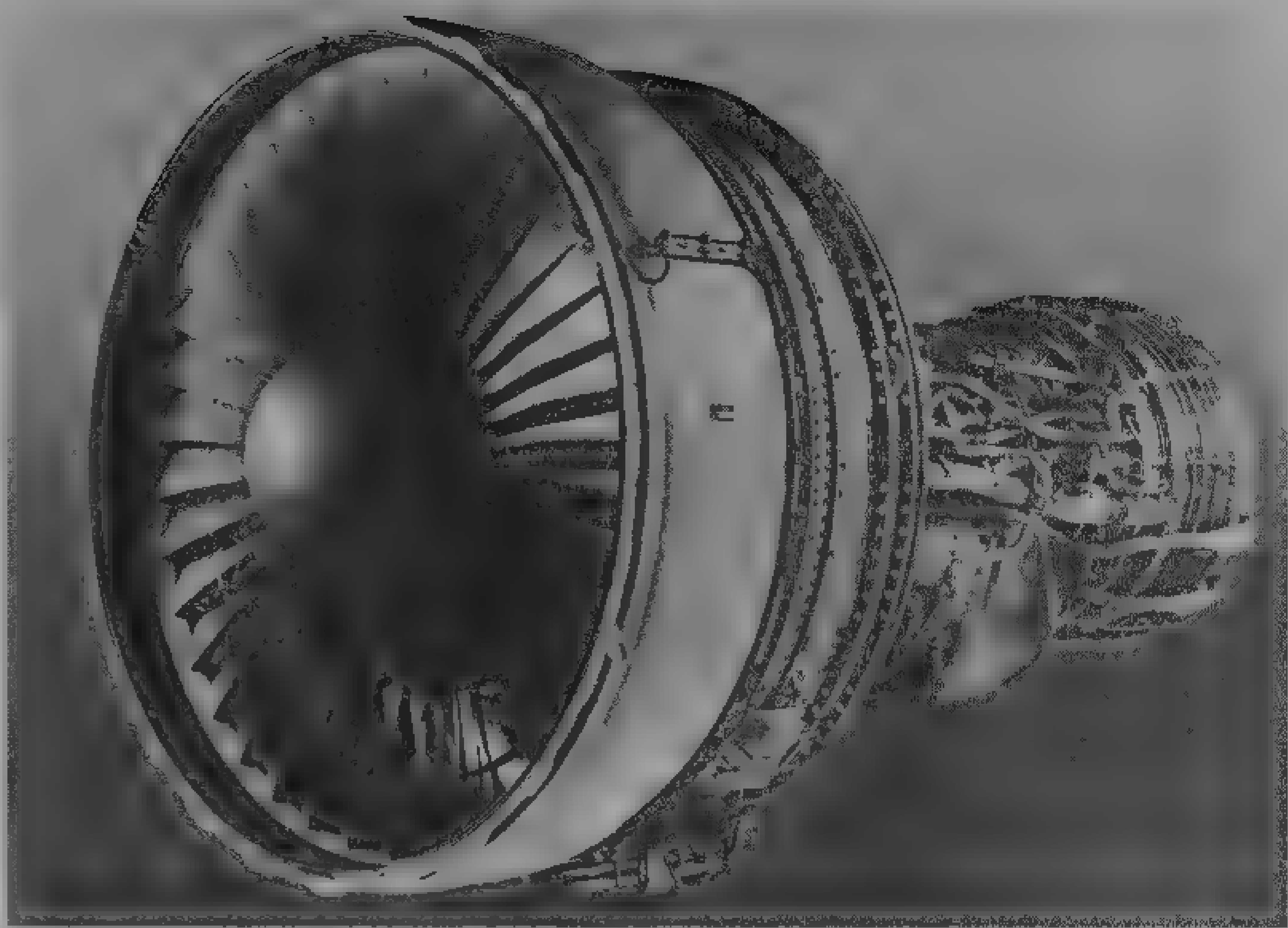
The CF6-80E1 development is being shared with SNECMA of France, MTU of Germany, Volvo Aero of Sweden, and FiatAvio of Italy.

The CF6-80E1 differs from the CF6-80C2 in the following features:

FAN: Diameter increased, number of blades reduced from 38 to 34.

LP COMPRESSOR: Flow capacity increased 9 per cent at a 12 per cent increased pressure ratio.

HP COMPRESSOR: High-temperature alloys in last stage. Overall pressure ratio: E1A2, 32.6, E1A3, 34.6.



General Electric CF6-80C2 two-shaft turbofan

1985

COMBUSTOR: No change.

HP TURBINE: High-temperature alloys and improved cooling.

LP TURBINE: High-temperature alloys, improved cooling changes and aerodynamic changes.

FUEL SYSTEM: Increased-capacity system with on-wing programmable FADEC.

DIMENSIONS

Length: Engine	4,405 mm (173.5 in)
Propulsion system	7,356 mm (289.6 in)

WEIGHT, DRY:

Engine	5,075 kg (11,189 lb)
Propulsion system	6,733 kg (14,844 lb)

PERFORMANCE RATINGS: See table

SPECIFIC FUEL CONSUMPTION (Max T-O):

E1A2	9.26 mg/Ns (0.327 lb/h/lb st)
E1A3	9.63 mg/Ns (0.340 lb/h/lb st)

UPDATED

GENERAL ELECTRIC F110

The **F110** (previously F101 DFE) is a fighter engine derivative of the F101. The first ran in late 1979. In early 1984 the USAF selected the F110 to power majority of future F-16 aircraft.

The following are current versions of the F110:

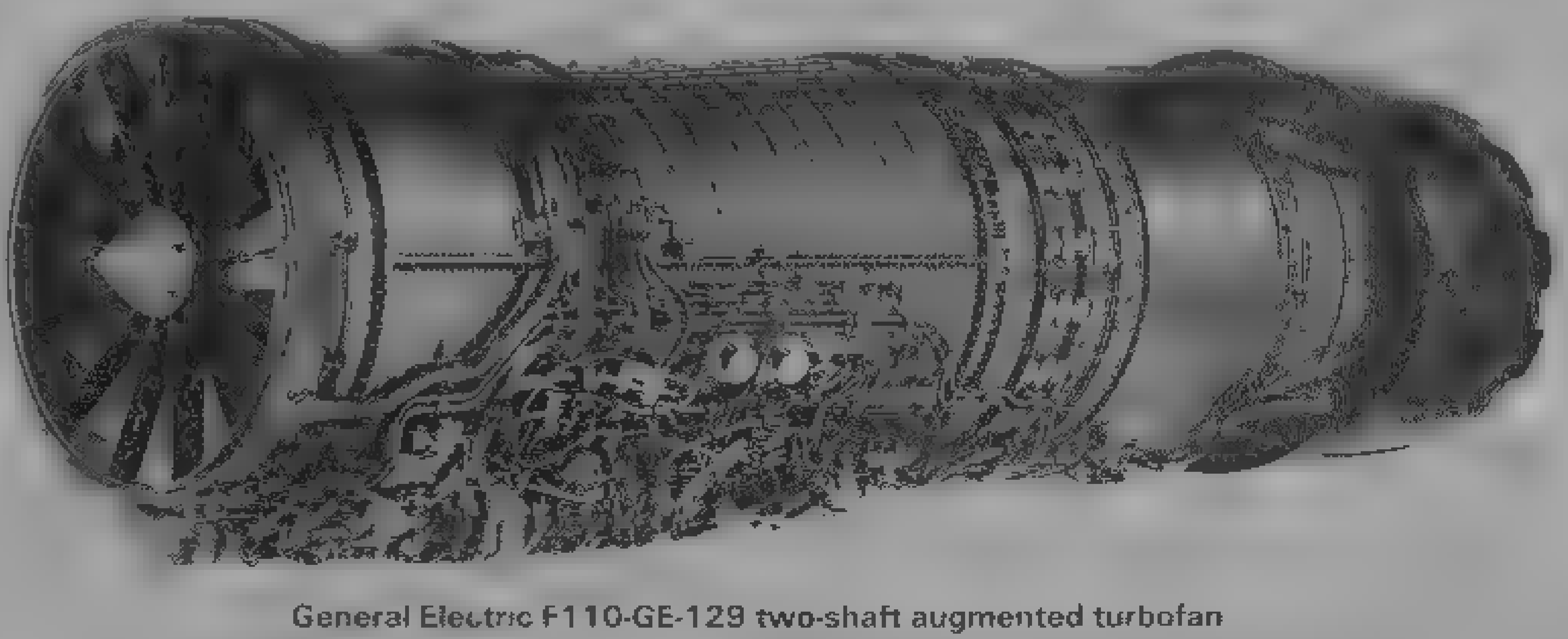
F110-GE-100. Initial USAF engine, also selected by Bahrain, Egypt, Greece, Israel and Turkey. Delivery of production F-16C/D aircraft with F110 engines began in mid-1986. The US Navy selected the Dash-100 to power its F-16Ns for the adversary role in its Top Gun programme. By 1995 over 1,400 engines had flown 1.4 million hours.

F110-GE-100A. Modification of -100 by Bet-Shemesh in Israel, giving additional emergency thrust at low level.

F110-GE-100B. Upgraded engine with FADEC and improved combustor and turbine. Inspection interval to be 4,000 cycles.

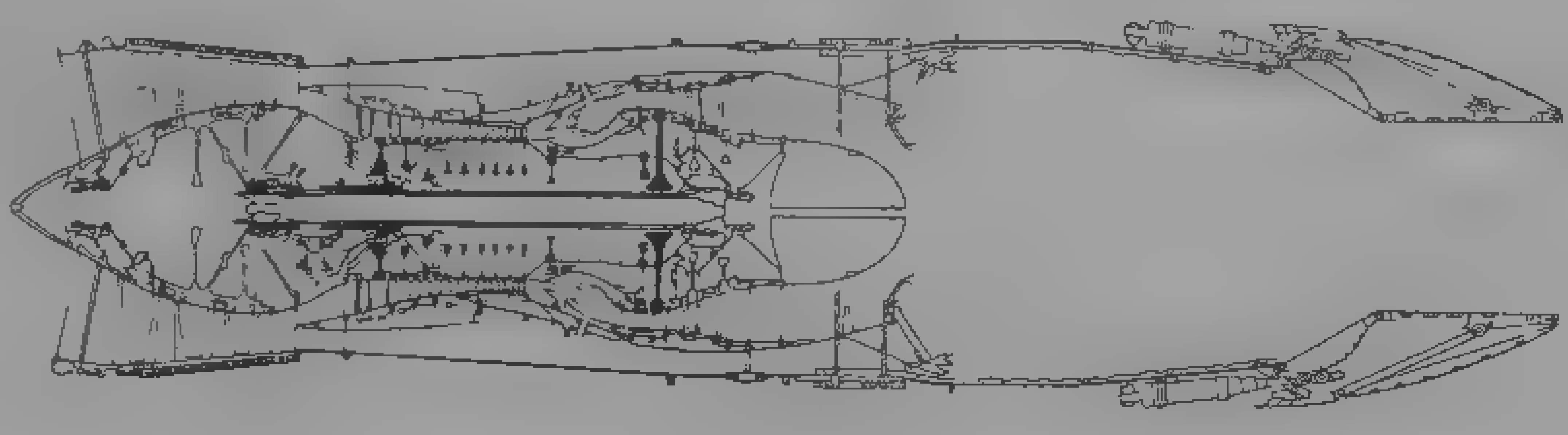
F110-GE-400. Powers F-14A (Plus) and F-14D Tomcat for the US Navy. First production aircraft with this engine delivered to Navy in November 1987. Tomcats powered with this engine show a significant improvement in fuel consumption and the ability to catapult launch without use of an afterburner, resulting in a 61 per cent time-to-climb reduction and a 62 per cent improvement in mission range. Ratings are maximum 120.2 kN (27,000 lb st), dry 71.2 kN (16,000 lb st).

F110-GE-129. Rated at 129 kN (29,000 lb st), the GE IPE (Improved Performance Engine) is the successor to the F110-GE-100. Through the use of improved design and materials, higher operating temperatures, speeds and pressures, the GE IPE increases thrust levels by as much as 30 per cent in certain areas of the flight envelope, while retaining more than 80 per cent parts commonality. The IPE's digital electronic control has 50 per cent fewer parts than previous controls, and offers substantially improved reliability. The IPE first flew in an F-16C/D in August 1988, and a very successful USAF field service evaluation programme was completed in mid 1992. Service entry was achieved in 199 . The engine has also been ordered by Egypt, Greece and Turkey and selected to power Japan's FS-X fighter.



General Electric F110-GE-129 two-shaft augmented turbofan

1995



Longitudinal section of General Electric F110 two-shaft augmented turbofan

1987

The following refers to the F110-GE-129:
FAN: Three stages. Bypass ratio 0.76. Air flow 122 kg (270 lb)/s
HP COMPRESSOR: Nine stages. Overall pressure ratio, 31 class
COMBUSTOR: Annular scroll
HP TURBINE: Single-stage with air cooled blades
LP TURBINE: Two stages, drives fan
AUGMENTOR: Close coupled mixed flow linear thrust afterburner
EXHAUST NOZZLE: Convergent/divergent exhaust nozzle with hydraulic actuation
DIMENSIONS:

Length	4,620 mm (181.9 in)
Diameter	1,180 mm (46.5 in)

PERFORMANCE RATINGS (S/L):

T-O	129 kN (29,000 lb st)
Max dry	75.7 kN (17,000 lb)

UPDATED

GENERAL ELECTRIC F118

This unaugmented turbofan has been developed under USAF contract to meet the demanding propulsion requirements of the Northrop Grumman B-2A bomber. An 84.52 kN (19,000 lb st) class derivative of the F101 and F110 engines, the non-afterburning **F118-GE-100** employs new long-chord fan technology with the compressor and turbine used on the F110. The F118 has a higher air flow and increased pressure ratio than the F110, resulting in higher dry thrust. The engine was qualified in 1987, powered the B-2A in the USAF flight test programme since July 1989, and has accumulated more than 28,000 hours including service with the 509th Bomb Wing. A feature is the use of common F101/F110 production tooling for low cost.

The accompanying photograph shows the actuation ring for the trailing flaps of the inlet guide vanes, a large inlet bleed-air de-icing pipe, and the ribbed bypass duct. The cooled jets issue across what appear to be carbon areas above the B-2A wing.

In Autumn 1989 a Lockheed U-2R began a flight test programme powered by a derivative of the F118, designated **F118-GE-101**. This engine is lighter and shorter but delivers more dry thrust than the J75-P-13B originally fitted. It has been retrofitted to the fleet, upgrading aircraft to U-2S.

UPDATED

GENERAL ELECTRIC T64

The T64 was developed initially for the US Navy. It is available as a turboshaft or turboprop. Current versions are:

T64-GE-100. -7A with improved turbine. Powers MH-53J.

T64/T4C2. T64-100 with changed HP turbine. Powers RH-35D.

T64-GE-413. Powers CH-53D.

T64-GE-415. Improved combustion liner and turbine cooling. Powers RH-53D.

T64-GE-416. As -415 with changed fuel control. Powers CH/MH-53E.

T64-GE-416A. As -416, improved turbine.

T64-GE-419. As -416A, with integral fuel/oil heat exchanger, and OEI emergency power on a 32.2°C day. To power MH-53E from 1995.

CT64-820-4. Turboprop, powers DHC-5D.

T64/P4D. Turboprop, powers G222 and C-27A. Production by FiatAvio, supported by Alfa Romeo Avio from 1975.

TYPE: Free turbine turboshaft/turboprop.
COMPRESSOR: Fourteen-stage axial flow, single-spool steel rotor for -820/-1/2/3, titanium and steel compressor for -100, T4C2, -413, -415, -416, -416A, -419, -P4D and CT64-820-4. Inlet guide vanes and first four stages of stator vanes variable, air mass flow per second: -100, T4C2, -413, -415, -416, -416A, -419, 13.3 kg (29.4 lb); -820-4 11.9 kg (26.2 lb); P4D, 12.2 kg (27.0 lb). Pressure ratio: -820-4, 12.5; -100, T4C2, -413, -415/-416/-416A, -419 14.0; P4D, 13.0.
COMBUSTION CHAMBER: Annular type. Double fuel manifold feeds 12 duplex type fuel nozzles.
GAS GENERATOR TURBINE: Two-stage, coupled directly to compressor rotor by spline connection. Engines rated 3,265 kW (4,380 shp) or over have air cooled first-stage blades.
POWER TURBINE: Two-stage, independent of gas generator.
REDUCTION GEAR: Remotely mounted for turboprop, offset and accessible for inspection and replacement. Ratio 13.44.
STARTING: Mechanical, airframe supplied.
DIMENSIONS:
Length: T64-GE-100, T4C2, -413, -415, -416, -416A, -419 2,006 mm (79 in)
T64/P4D, CT64-820-4 2,793 mm (110 in)
Width: T64-GE-100, T4C2, -413, -415, -416, -416A, -419 660 mm (26.0 in)
T64/P4D, CT64-820-4 683 mm (26.9 in)
Height: T64-GE-100, T4C2, -413, -415, -416, -416A, -419 825 mm (32.5 in)
T64/P4D, CT64-820-4 1,167 mm (46 in)
WEIGHT, DRY:
T64-GE-100, T4C2, -413, -415, -416, -416A 327 kg (720 lb)

General Electric F118-GE-100 two-shaft unaugmented turbofan

1990

T64-GE-419	343 kg (755 lb)
CT64-820-4	520 kg (1,145 lb)
T64/P4D	538 kg (1,188 lb)

PERFORMANCE RATINGS (max rating (S/L)):

T64-GE-100	3,229 kW (4,330 shp) to 29.4°C
T64-GE-413	2,927 kW (3,925 shp)
T64-GE-415, -416, -416A	3,266 kW (4,380 shp)
T64-GE-419	3,542 kW (4,750 shp)
CT64-820-4	2,336 kW (3,133 shp)
T64/P4D	2,535 kW (3,400 shp)

SPECIFIC FUEL CONSUMPTION (max rating (S/L)):

T64-GE-100, -413, -415, -416, -416A, -419	79.4 µg/J (0.47 lb/h/shp)
CT64-820-4, T64/P4D	81 µg/J (0.48 lb/h/shp)

UPDATED

GENERAL ELECTRIC T700

The T700 was selected in 1971 to power the US Army's utility tactical transport aircraft system (UTTAS). The first T700 went to test in 1973, and in 1976 it was the first turboshaft to pass current US military qualification standards. The engine went into production in 1978. Of the following models, only the 401, 401C and 701C are in production.

T700-GE-700. First production model delivered from early 1978. Following description refers to this version, except where otherwise noted. Powers UH-60A Black Hawk.

T700-GE-701. First-step growth derivative. Powers AH-64 Apache.

T700-GE-401. Navalised first-step growth derivative. Powers SH-60B Seahawk, SH-2G Super Seasprite and AH-1W SuperCobra.

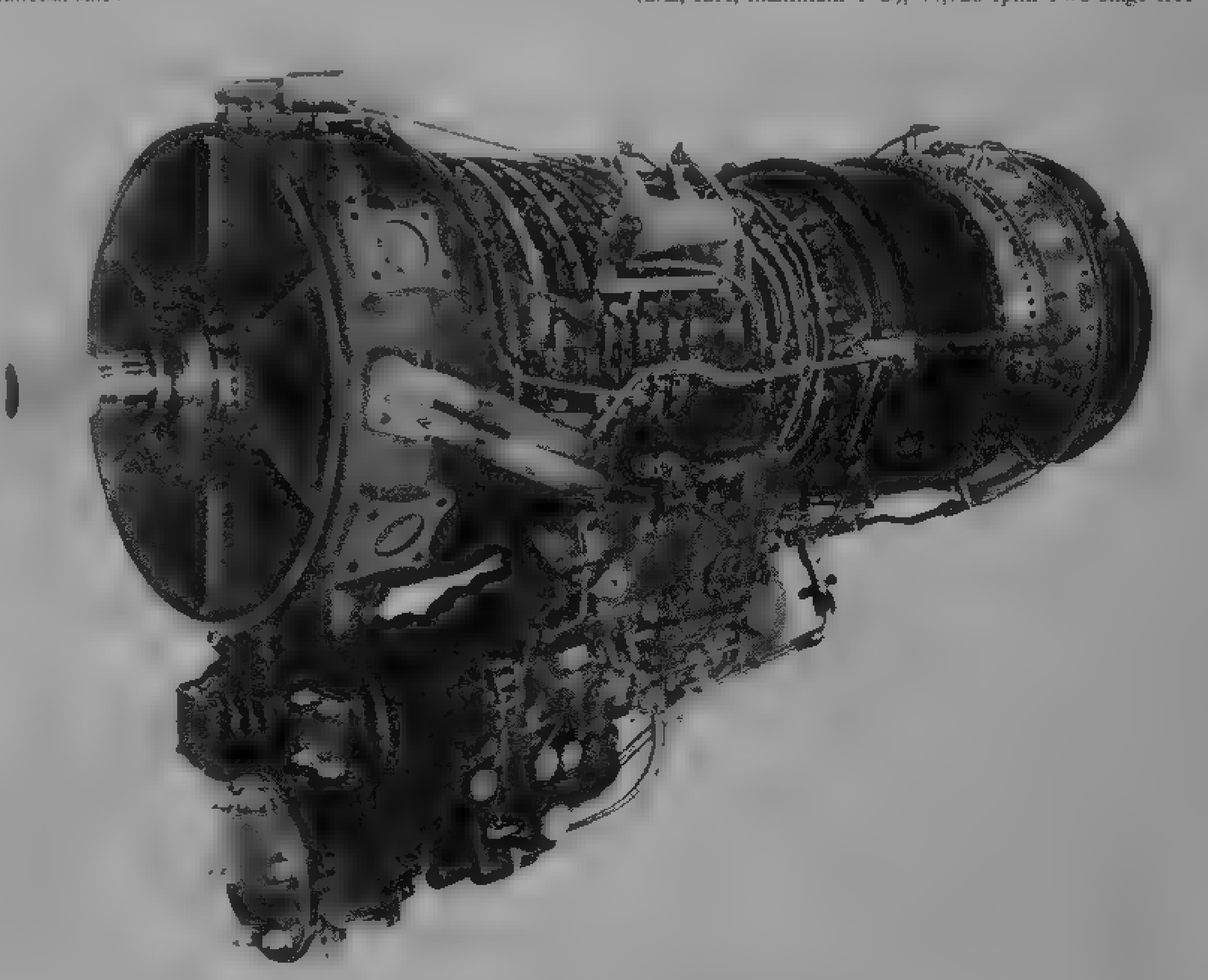
T700-GE-701C. Second-step growth derivative. Went into production in 1989 for Black Hawk and Apache. Offered for future S-70/WS-70 Black Hawk derivatives for international sales.

T700-GE-401C. Navalised second-step growth derivative. Chosen by US Navy for Seahawks and derivatives. First production engines delivered in 1988 to power HH-60H. Royal Australian Navy also a launch customer.

T700/T6A. A step-3 growth engine co-developed by GE, Alfa Romeo Avio, and FiatAvio. Qualified for military configurations of the EH 101 helicopter.

GE has entered into a number of international agreements relative to the sale, production, and maintenance of T700 and CT7 engines for both rotor and fixed-wing aircraft. Co-production and maintenance agreements have been struck with EGT (European Gas-Turbine) in the UK, Alfa Romeo Avio in Italy, IHI (Ishikawajima-Harima Heavy Industries) in Japan, KAL (Korean Airlines) and SSA (Samsung Aerospace) in Korea, and HDH (Hawker de Havilland) in Australia, maintenance agreements, with H+S Aviation in the UK, IPTN of Indonesia and FFV (Scania) in Sweden, and sales agreements, with FiatAvio and Alfa Romeo Avio in Italy, Derlan in Canada, and IPTN in Indonesia.

TYPE: Ungeared free turbine turboshaft engine.
INTAKE: Annular, with anti-iced separator designed to remove 95 per cent of sand, dust and foreign object ingestion. Extracted matter discharged by blower driven from accessory gearbox.
COMPRESSOR: Combined axial/centrifugal. Five axial stages and single centrifugal stage mounted on same shaft. Each axial stage is one-piece 'blisk' (blades plus disc) in AM355 steel highly resistant to erosion. Inlet guide vanes and first two stator stages variable. Pressure ratio about 15. Mass flow about 4.5 kg (10 lb)/s at 44,720 rpm.
COMBUSTION CHAMBER: Fully annular. Central fuel injection to maximise acceptance of contaminated fuel and give minimal smoke generation. Ignition power from separate winding on engine-mounted alternator serves dual plugs.
TURBINE: Two-stage gas generator (HP) turbine. Rated speed (S/L, ISA, maximum T-O), 44,720 rpm. Two-stage free



General Electric T64-GE-415/416 turboshaft

1990

power turbine, with tip shrouded blades and segmented nozzles. Output speed, 21,000 rpm

CONTROLS: Hydromechanical control can be replaced in less than 12 minutes. Electrical control provides multi-engine speed and torque matching

ACCESSORIES: Grouped at top of engine, together with engine control system. Integral oil tank, plus emergency mist lubrication. Torque sensor provides signal to electrical control

DIMENSIONS:

Length overall	1,168 mm (46.0 in)
Width	635 mm (25 in)
Height overall	584 mm (23 in)

WEIGHT, DRY (with particle separator):

T700-700	198 kg (437 lb)
T700-401	197 kg (434 lb)
T700-701C	207 kg (456 lb)
T700-401C	208 kg (458 lb)

PERFORMANCE RATINGS (ISA, S/L, static):

T700-700: intermediate	1,210 kW (1,622 shp)
continuous	987 kW (1,324 shp)
T700-701: contingency	1,285 kW (1,723 shp)
intermediate	1,266 kW (1,698 shp)
continuous	1,126 kW (1,510 shp)
T700-401: contingency	1,285 kW (1,723 shp)
intermediate	1,260 kW (1,690 shp)
continuous	1,072 kW (1,437 shp)
T700-701C: max	1,409 kW (1,890 shp)
intermediate	1,342 kW (1,800 shp)
continuous	1,239 kW (1,662 shp)
T700-401C: contingency	1,447 kW (1,940 shp)
intermediate	1,342 kW (1,800 shp)
continuous	1,239 kW (1,662 shp)

SPECIFIC FUEL CONSUMPTION (ISA, S/L, static):

T700-700 continuous	79.41 µg/J (0.470 lb/h/shp)
T700-701 continuous	78.73 µg/J (0.466 lb/h/shp)
T700-401 continuous	79.60 µg/J (0.471 lb/h/shp)
T700-701C continuous	77.56 µg/J (0.459 lb/h/shp)
T700-401C continuous	77.56 µg/J (0.459 lb/h/shp)

UPDATED

GENERAL ELECTRIC CT7

Commercial engine based on the T700. Certification in April 1977. The **CT7-2A** turboshaft powers the Bell 214ST. The **CT7-2D** and **-2D1** power the Sikorsky S-70. The CT7-2D is the commercial equivalent of the -701/-401. The CT7-2D1 is the commercial equivalent of the -701C/-401C and received FAA certification in June 1989.

The **CT7-6** is a Step 3 growth engine, co-developed by Alfa Romeo Avio, FiatAvio and GE for the EH 101 and other helicopter applications, such as the NH 90. First delivery for the EH 101 took place in April 1988, first flight of a CT7-6 powered EH 101 took place in September 1988. The marinised **CT7-6A** powers the Italian Navy's EH 101 prototype. The CT7-6/-6A has received FAA certification, as well as RAI and BCAA validation.

The same core is used in the CT7 turboprop, which has a remote propeller gearbox. This engine received FAA certification in August 1983 and is in production as the **CT7-5A** for the Saab 340 and as the **CT7-7A** for the Airtech CN-235.

CT7 turboprop growth engines include the **CT7-9B** and **-9C** flat rated at 1,394 kW (1,870 shp). Increased power is obtained by improvements in aerodynamics, materials and turbine cooling. These engines power later versions of the CN-235, Saab 340 and Sukhoi S-80. The -9D is the power plant for the Let L-610G.

Data below are for the current turboshaft versions; see adjacent table for turboprop models.

DIMENSIONS:

Length	1,194 mm (47.0 in)
Diameter (max envelope)	660 mm (26.0 in)

WEIGHT, DRY: CT7-2A, 2D	201 kg (442 lb)
CT7-2D1	212 kg (466 lb)
CT7-6	220 kg (485 lb)

PERFORMANCE RATINGS (S/L, static, 15°C):

Contingency (2½ min OEI)

CT7-2A, -2D, -2D1	1,286 kW (1,725 shp)
CT7-6	1,491 kW (2,000 shp)

T-O (5 min) and en route contingency (30 min)

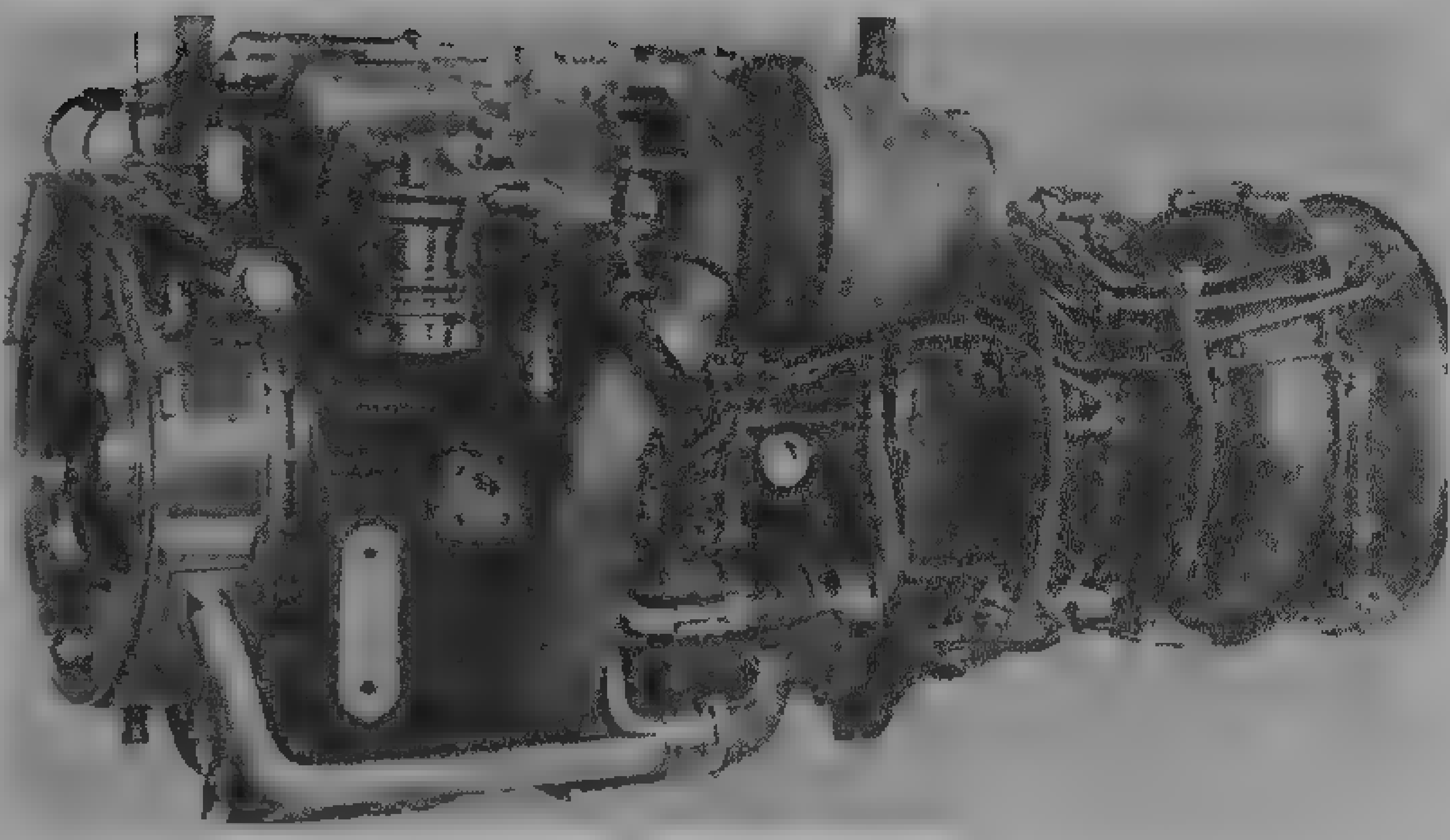
CT7-2A, 2D, 2D1	1,212 kW (1,625 shp)
CT7-6	1,491 kW (2,000 shp)

SPECIFIC FUEL CONSUMPTION:

Max continuous

CT7-2A, -2D, -2D1	79.9 µg/J (0.473 lb/h/shp)
CT7-6 (15°C)	79.4 µg/J (0.470 lb/h/shp)

UPDATED

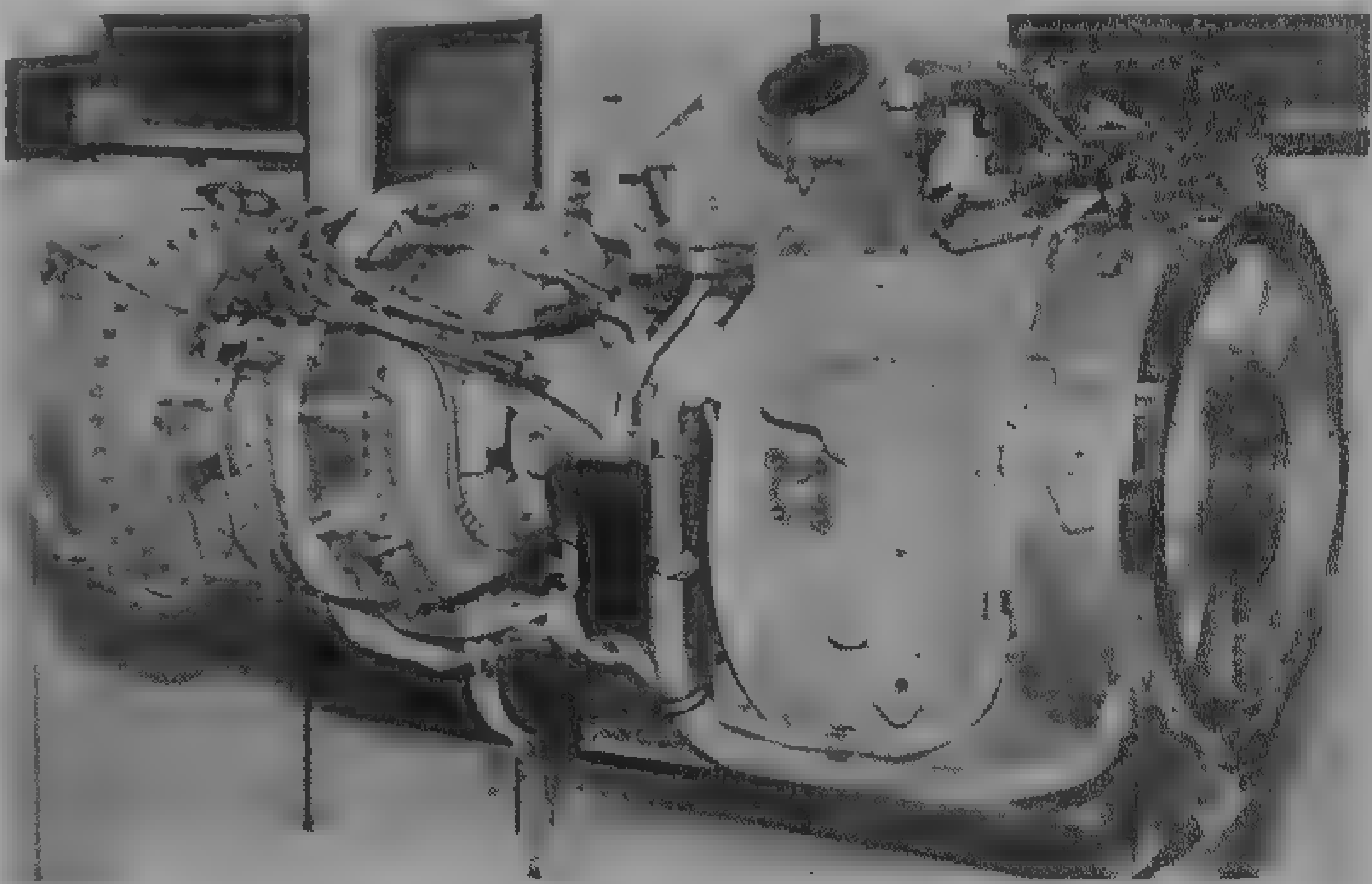


General Electric T700-401 free turbine turboshaft

1985

CT7 turboprops

	5A	-7A	-9B	-9C	-9D
Length mm (in)	2,438 (96)	2,438 (96)	2,438 (96)	2,438 (96)	2,438 (96)
Max diameter mm (in)	737 (29)	737 (29)	737 (29)	737 (29)	737 (29)
Weight, dry kg (lb)	356.3 (783)	356.3 (783)	366.3 (805)	366.3 (805)	366.3 (805)
PERFORMANCE RATINGS					
S/L T-O kW (shp)	1,294 (1,735)	1,268 (1,700)	1,305 (1,750)	1,305 (1,750)	1,305 (1,750)
APR auto power reserve kW (shp)			1,394 (1,870)	1,394 (1,870)	1,447 (1,940)
Max cruise at 4,575 m (15,000 ft) ekW (ehp)	978 (1,312)	978 (1,312)	1,052 (1,411)	1,118 (1,499)	1,052 (1,411)



Full-scale model of General Electric CT7-6 turboshaft *(Brian M. Service)*

1987

General Electric CT7-9 free turbine turboprop

1990

LHTEC

LIGHT HELICOPTER TURBINE ENGINE COMPANY

The Paragon Building, Suite 400, 12400 Olive Boulevard, St Louis, Missouri 63141
Telephone: (314) 576 5419
Fax: (314) 576 5973
MEMBER COMPANIES: **Allison Engine Company**
PO Box 420, Indianapolis, Indiana 46206-0420
Telephone: (317) 230 6515
Fax: (317) 230 3410
AlliedSignal Engines
PO Box 52181, Phoenix, Arizona 85072-2181
Telephone: (602) 231 4844
Fax: (602) 231 5671

These two companies jointly developed the Army Qualified T800-LHT 800 975 kW (1,300 shp) class turboshaft engine for the RAH-66 Comanche programme. The CTS800 is an FAA Certified version for commercial applications.

VERIFIED

LHTEC T800-LHT-800

This fully metric, high power density helicopter engine stems from programmes that the two partners started prior to 1983. AlliedSignal's core engine based on the F109 had extensive running time. Allison's engine was developed under the Army's Advanced Technology Demonstrator Engine (ATDE) programme. The blending of these two engines produced the T800 technology prototypes, which exceeded 940 kW (1,260 shp) in December 1984, with lower than specified fuel consumption. After fierce competition, LHTEC was selected by the US Army in October 1988 to continue the engine development and subsequent production.

The CTS800/T800 is designed for unprecedented reliability, maintainability and supportability, tilt-rotor compatibility and low specific fuel consumption. Its basic design philosophy includes module/LRU removal and replacement times of less than 15 minutes using six basic hand tools, and on-condition maintenance.

In 1993 the CTS800/T800 became the first engine concurrently to satisfy FAA Certification and Army Qualification requirements. Over 17,000 full-up, engine test hours have been completed. In December 1992 the US Army awarded LHTEC a growth contract to increase power by 17 per cent, to over 1,044 kW (1,400 shp). The first growth engine (-801) began testing in March 1994. By the end of 1994, the -801 engine had accumulated over 1,200 hours of development testing. Turboprop, ground power and vehicle derivatives are expected.

Since 1988 the Agusta A 129 has been involved in an active flight test programme using twin CTS800 engines, and the engine has also flown in a Lynx, Panther and HH-65. In 1993, the Global Huey800 (UH-1H+T800 engine) demonstrator established a world point-to-point record flying 1,714 n miles (3,175 km, 1,973 miles) in 13 hours and 6 minutes. This demonstrator has now logged over 480 hours performing flight demonstrations worldwide. Based on this proven concept, LHTEC began work in 1994 to deliver five re-engined UH-1H helicopters to the US Border Patrol for border surveillance and drug interdiction. LHTEC is also under contract to perform a CTS800 study on the Advanced Light Helicopter (ALH) manufactured by Hindustan Aeronautics.

INLET: Annular, with solids extracted by particle separator of over 97 per cent efficiency.

COMPRESSOR: Two centrifugal stages in tandem. One-piece titanium impellers.

COMBUSTION CHAMBER: Annular reverse-flow.

COMPRESSOR TURBINE: Two axial stages with single-pass cooling.

POWER TURBINE: Two axial stages with tip shrouds.

LUBRICATION SYSTEM: Self-contained, with tank of 4.1 litres (1.08 US gallons, 0.90 Imp gallon), air/oil heat exchanger.

OIL GRADES: MIL-L-7808, MIL-STD-23699.

FUEL GRADES: MIL-T-5624, MIL-T-83133, JP-4, JP-5, JP-8 (emergency DF-A, DF-1, DF-2).

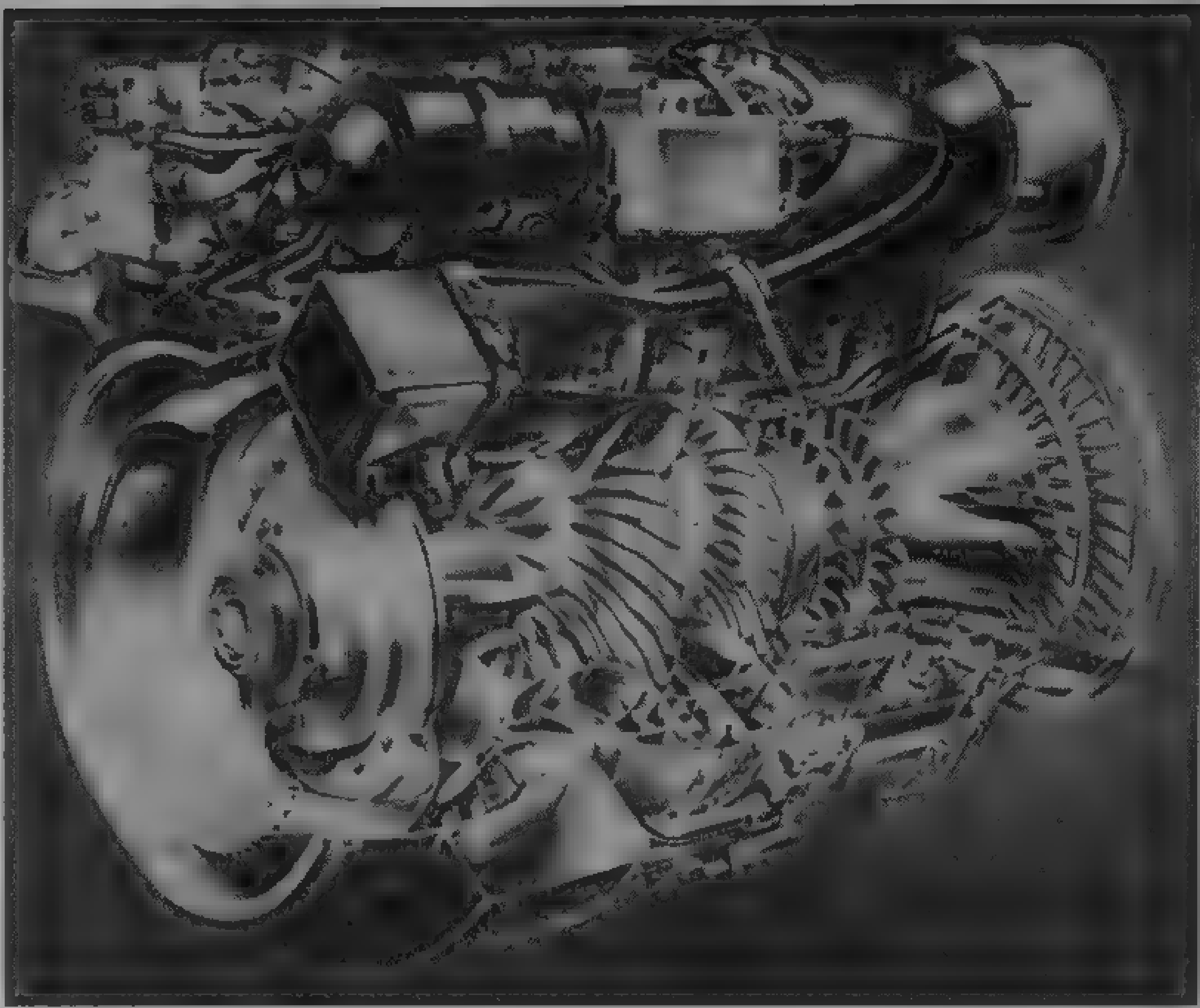
CONTROL SYSTEM: FADEC.

ACCESSORIES: Mounted above engine with drive from core. Self-contained electrical system.

REDUCTION GEAR: Drive at 23,000 rpm to front or rear. Reduction gearbox gives output at 6,000 to 6,600 rpm.

DIMENSIONS:	
Length	843.3 mm (33.2 in)
Width	550.1 mm (21.7 in)
Height	662.1 mm (26.1 in)
WEIGHT, DRY: T800	143 kg (315 lb)
CTS800 with gearbox (estimated)	182.3 kg (401.9 lb)
PERFORMANCE RATINGS:	
Contingency (2 min)	1,044 kW (1,399 shp)
T-O (5 min)	995 kW (1,334 shp)
T-O (30 min)	924 kW (1,239 shp)
Continuous	774 kW (1,038 shp)
FUEL FLOW:	
Contingency	284.4 kg (627 lb)/h
5 min	272.2 kg (600 lb)/h
30 min	255.4 kg (563 lb)/h
Continuous	220.4 kg (486 lb)/h

UPDATED



Cutaway drawing of LHTEC T800 free turbine turboshaft

1990

LPE

LIGHT POWER ENGINE CORPORATION

PO Box 3350, Morgantown, West Virginia 26505
Telephone: 1 (304) 291 3843
Fax: 1 (304) 292 1902

This company is marketing a wide range of ZM water-cooled 90° V-8 piston engines. Entirely of original design these have capacities of 400, 500 or 600 cu in (6.56, 8.2 or 9.84 litres), and are available upright or inverted, with direct fuel injection, with or without reduction gear or turbocharger. Direct drive engines weigh 168 to 202 kg (370 to 446 lb) and are rated at 171.5 to 283 kW (230 to 380 hp) at 2,700 rpm. Geared engines weigh from 195 to 225 kg (430 to 496 lb) and are rated at 313 to 447 kW (420 to 600 hp) at 4,300 or 4,500 rpm. TBO is uniformly 2,200 hours.

UPDATED

LPE ZM piston engine

1995

NELSON

NELSON AIRCRAFT CORPORATION

420 Harbor Drive, Naples, Florida 33940
Telephone: 1 (813) 263 1670
Fax: 1 (813) 261 8345
PRESIDENT: Charles R Rhoades

Nelson Aircraft Corporation, among its many industrial activities, produces to order the Nelson H-63 four-cylinder two-cycle air-cooled engine, which is certificated by the FAA as a power unit for single-seat helicopters, and is also available as a power plant for propeller-driven aircraft.

VERIFIED

NELSON H-63

US military designation: YO-65

Developed originally as a power unit for single-seat helicopters, the H-63 is available in two versions, as follows:

H-63C. Helicopter power unit for vertical installation. Battery/electronic ignition and direct drive.

H-63CP. Without clutch, fan and shroud. Intended for installation in horizontal position, with direct drive to propeller.

Full details of these engines appeared in the 1992-93 *Jane's*.

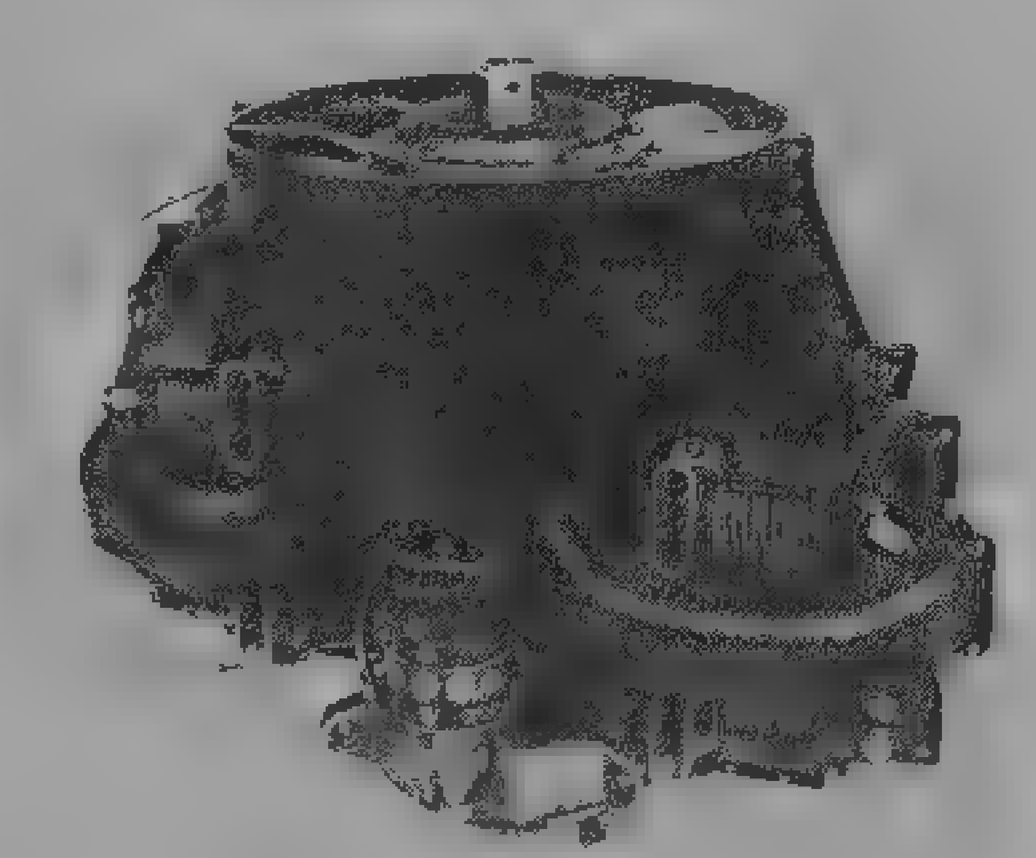
Nelson H-63CP four-cylinder engine

1994

POWER RATINGS

T-O: H-63C	32 kW (43 hp) at 4,000 rpm
H-63CP	35.8 kW (48 hp) at 4,400 rpm
Max continuous: H-63C	32 kW (43 hp) at 4,000 rpm
H-63CP	33.6 kW (45 hp) at 4,000 rpm

VERIFIED



Nelson H-63C four-cylinder two-stroke engine
1993

PRATT & WHITNEY

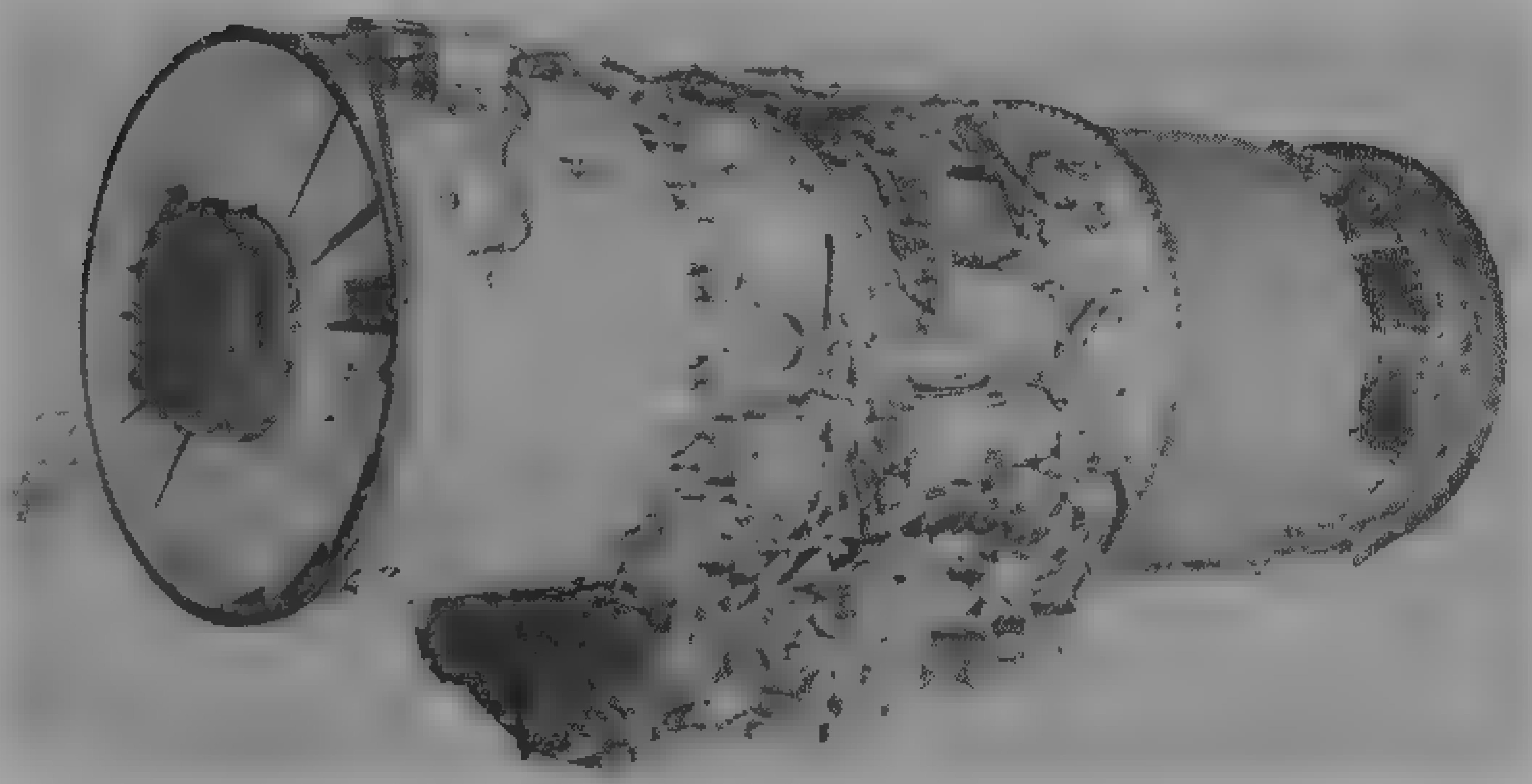
UNITED TECHNOLOGIES PRATT & WHITNEY

HEADQUARTERS: 400 Main Street, East Hartford, Connecticut 06108
Telephone: 1 (203) 565 4321
Fax: (PR) 1 (203) 565 8896
PRESIDENT: Karl J Krapek
EXECUTIVE VICE-PRESIDENT LARGE COMMERCIAL ENGINES: Robert A Wolfe
DIRECTOR PUBLIC RELATIONS: Mark Sullivan

Government Engines and Space Propulsion
PO Box 109600, West Palm Beach, Florida 33410-9600
Telephone: (PR) 1 (407) 796 7885
Fax: (PR) 1 (407) 796 7258
EXECUTIVE VICE-PRESIDENT: John P Balaguer
VICE-PRESIDENT COMMUNICATIONS: Robert G Carroll III

Pratt & Whitney Aircraft was formed in 1925 and today is the world's largest producer of gas-turbine engines. Excluding P&W Canada (which see) it has delivered some 68,000 aircraft gas-turbines, including more than 27,000 airline jet engines.

UPDATED



Pratt & Whitney J52-P-408 two-shaft turbojet
1980

PRATT & WHITNEY JT8

US military designation: J52

The J52 is a two-spool turbojet, with 12 compressor stages, a can-annular combustion system fed by 36 dual orifice injectors and single-stage HP and LP turbines. The P-408 has two position inlet guide vanes and air-cooled first-stage turbine vanes and blades. New production P-409 offers higher thrust and increased life.

J52-P-6A, 6B, 8A, 8B. Rated at 37.8 kN (8,500 lb st) (6A, 6B) or 41.4 kN (9,300 lb st) (8A, 8B). Powers A-4 and A-6.

J52-P-408/P-408A. Rated at 49.8 kN (11,200 lb st). Powers A-4F, A-4M, some export A-4 versions, EA-6B.

J52-P-409. Rated at 53.4 kN (12,000 lb st). Powers EA-6B ADVCAP, available for upgraded A-6E.

Data below are for the P-408:

DIMENSIONS

Diameter	814.3 mm (32.06 in)
Length	3,020 mm (118.9 in)
WEIGHT, DRY	1,052 kg (2,318 lb)

PRATT & WHITNEY JT8D

This turbofan was developed to power the Boeing 727. Military versions have been developed in Sweden by Volvo Aero (see RM8 in that company's entry). Almost 12,000 were delivered. Details appeared in the 1994-95 *Jane's*.

UPDATED

PRATT & WHITNEY JT8D-200 SERIES

This reduced noise derivative of the JT8D combines the HP compressor, HP turbine spool and combustion section of the JT8D-9 with advanced LP technology. It offers increased thrust with reduced noise and specific fuel consumption. The fan has increased diameter. The new six-stage LP compressor, integral with the fan, offers increased pressure ratio. The LP turbine has 20 per cent greater annular area and achieves a higher efficiency. Surrounding the engine is a new bypass duct. The exhaust system includes a 12-lobe mixer. FAA certification of the JT8D-209 was awarded in June 1979. Over 2,500 engines have been delivered of the following series:

JT8D-209. Rated at 82.2 kN (18,500 lb st) to 25°C, and 85.6 kN (19,250 lb st) following loss of thrust on any other engine. Entered service in October 1980, powering the MD-81.

JT8D-217. Rated at 88.96 kN (20,000 lb st), and 92.75 kN (20,850 lb st) following loss of thrust on any other engine. Powers MD-82.

JT8D-217A. T-O thrust available to 28.9°C or up to 1,525 m (5,000 ft). Powers MD-82.

JT8D-217C. Incorporates JT8D-219 performance improvements to reduce sfc. Powers MD-82 and -87.

JT8D-219. Rated at 93.4 kN (21,000 lb st), with a reserve thrust of 96.5 kN (21,700 lb st). Powers MD-83 and other MD-80 aircraft.

TYPE: Two-spool turbofan.

FAN: Single-stage front fan has 34 titanium blades, with part span shrouds. Mass flow: -209, 213 kg (469 lb)/s; -217 (all), 219 kg (483 lb)/s; -219, 221 kg (488 lb)/s. Bypass ratio: -209, 1.78; -217 (all), 1.73; -219, 1.77.

LP COMPRESSOR: Six-stage axial, integral with fan.

HP COMPRESSOR: Seven-stage axial. Overall pressure ratio: -209, 17.1; -217 (all), 18.6; -219, 19.2.

COMBUSTION CHAMBER: Nine can-annular low-emissions burners with aeration fuel nozzles.

HP TURBINE: Single-stage. Air-cooled blades in -217, -217C and -219.

LP TURBINE: Three-stage.

DIMENSIONS

Diameter	1,250 mm (49.2 in)
Length	3,911 mm (154 in)

WEIGHT, DRY

JT8D-209	2,056 kg (4,533 lb)
JT8D-217, -217A	2,072 kg (4,524 lb)
JT8D-217C, -219	2,092 kg (4,612 lb)

PERFORMANCE RATINGS

T-O (S/L static): see model descriptions

Max cruise thrust (10,670 m, 35,000 ft) at Mach 0.8

JT8D-209	22.0 kN (4,945 lb)
JT8D-217, -217A, -217C	23.31 kN ([illegible] lb)
JT8D-219	23.35 kN ([illegible] lb)

SPECIFIC FUEL CONSUMPTION

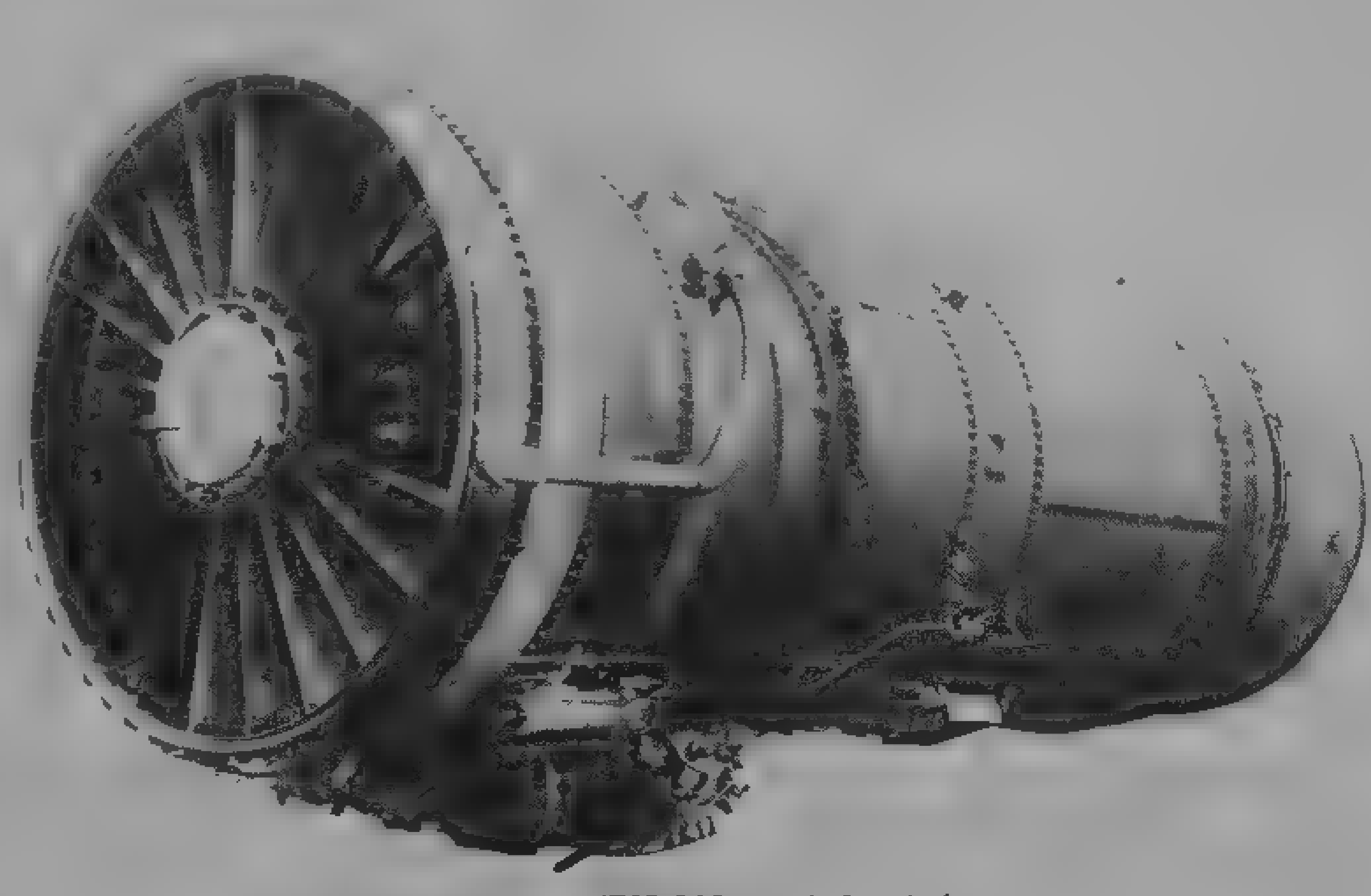
Max cruise rating, as above

JT8D-209	20.50 mg/Ns (0.724 lb/h/lb)
JT8D-217, -217A	21.32 mg/Ns (0.753 lb/h/lb)
JT8D-217C	20.84 mg/Ns (0.736 lb/h/lb)
JT8D-219	20.87 mg/Ns (0.737 lb/h/lb)

VERIFIED

PRATT & WHITNEY PW4000

The PW4000 is a third-generation turbofan for wide-body transports. Ratings range from 222.4 kN (50,000 lb st) to 373.7 kN (84,000 lb st). The first engine achieved 275 kN (61,800 lb st) during initial testing in April 1984. First flight test on an A300B took place on 31 July 1985. Certificated



Pratt & Whitney JT8D-219 two-shaft turbofan
1987

July 1986 at 249 kN (56,000 lb st) and in 1988 at 266.9 kN (60,000 lb st). Entered service on Pan Am A310 on 20 June 1987. The last two numbers denote thrust (thus, the initially certificated 56,000 lb st engine is the PW4056). Programme sharing agreements have been signed with Techspace Aero (Belgium), FiatAvio (Italy), Norsk Jet Motors (Norway), Kawasaki (Japan), Samsung (South Korea), Eldim (Netherlands), Mitsubishi (Japan) and Singapore Aircraft Industries.

Fuel consumption was initially reduced 7 per cent compared with the JT9D-7R4. There are about half as many parts, promising reductions in maintenance cost exceeding 25 per cent. HP compressor pressure ratio is increased by 10 per cent and the HP rotor operates at 27 per cent higher speed.

The PW4000 incorporates single-crystal turbine blades, aerodynamically enhanced aerofoils, and a full-authority digital electronic engine control (FADEC). The PW4000 was the first FADEC engine approved for ETOPS operations beyond 180 minutes from alternates.

PW4168. For A330, fan diameter increased to 2,535 mm (99.8 in) and an extra stage on the LP compressor and LP turbine. Initial A330 deliveries were at 302.5 kN (68,000 lb st) in 1994. Cleared for 120 minute ETOPS in February 1995, 180 minutes in July 1995.

PW4084. For Boeing 777, fan diameter again increased to 2,845 mm (112 in) diameter (using new hollow titanium blades without part-span clappers), with six-stage LP compressor and seven stage LP turbine. The first PW4084 achieved 400.3 kN (90,000 lb st) in August 1992. Certified April 1994 at 376.3 kN (84,600 lb st). Cleared 180 minute ETOPS May 1995. In service 7 June 1995 at 343 kN (77,000 lb st).

PW4090. Improved HP compressor and increased temperatures for 777. To be certified in June 1996 at 400.3 kN (90,000 lb st).

PW4098. Based on 4090 core with additional LP compressor stage, improved fan aerodynamics (still 2,845 mm, 112 in) and increased flow. To be certificated in September 1997 at 435.9 kN (98,000 lb st).

By 1995 over 70 airlines had ordered more than 2,600 PW4000 engines.

The following data apply to the basic PW4000, except where indicated:

TYPE: Two-shaft turbofan.

FAN: Single-stage. Titanium alloy hub retains 38 titanium alloy blades with aft part-span shrouds. Diameter 2,377 mm (93.6 in). Data for 249 kN (56,000 lb st) rating: mass flow 773 kg (1,705 lb)/s. Fan pressure ratio 1.7. Bypass ratio 4.85.

LP COMPRESSOR: Four stages with controlled diffusion aerofoils.

HP COMPRESSOR: Eleven stages with first four vane rows variable. Clearance control accomplished via rotor/case thermal matching. Overall pressure ratio at 251.5 kN rating 30.3.

COMBUSTOR: Annular, forged nickel alloy roll-ring with double-pass cooling, 24 airblast anti-coking injectors. Segmented Floatwall burner liner introduced in 1993.

HP TURBINE: Two stages with air-cooled blades cast as single-crystal (PWA 1480) in first row and directional crystal (PWA 1422) in second row, retained in double-hub nickel alloy rotor with active clearance control. Vane aerofoils thermal barrier coated.

LP TURBINE: Four stages with active clearance control.

CONTROL SYSTEM: Full-authority digital electronic with dual channel computer.

DIMENSIONS:

Length: PW4000	3,371 mm (132.7 in)
PW4168	4,143 mm (163.1 in)
PW4084	4,868 mm (191.7 in)
Fan case diameter: PW4000	2,463 mm (96.98 in)
PW4168	2,718 mm (107.0 in)
PW4084	3,048 mm (120.0 in)

WEIGHT, DRY:

Basic PW4000	4,264 kg (9,400 lb)
PW4168 (complete system)	6,509 kg (14,350 lb)
Basic PW4084	6,335 kg (13,965 lb)

RATINGS: See table

SPECIFIC FUEL CONSUMPTION (ISA, ideal nozzle Mach 0.8 10,670 m, 35,000 ft):

PW4056	15.21 mg/Ns (0.537 lb/h/lb)

UPDATED

PRATT & WHITNEY JT9D

This was the first of the new era of large, high-bypass ratio turbofans on which the design of wide-body commercial transports rests. First run was in December 1966. The first flight of the Boeing 747 was on 9 February 1969.

Current versions include:

JT9D-3A. Water injection rating of 200.8 kN (45,150 lb) to 26.7°C. Powers 747-100 and -200B.

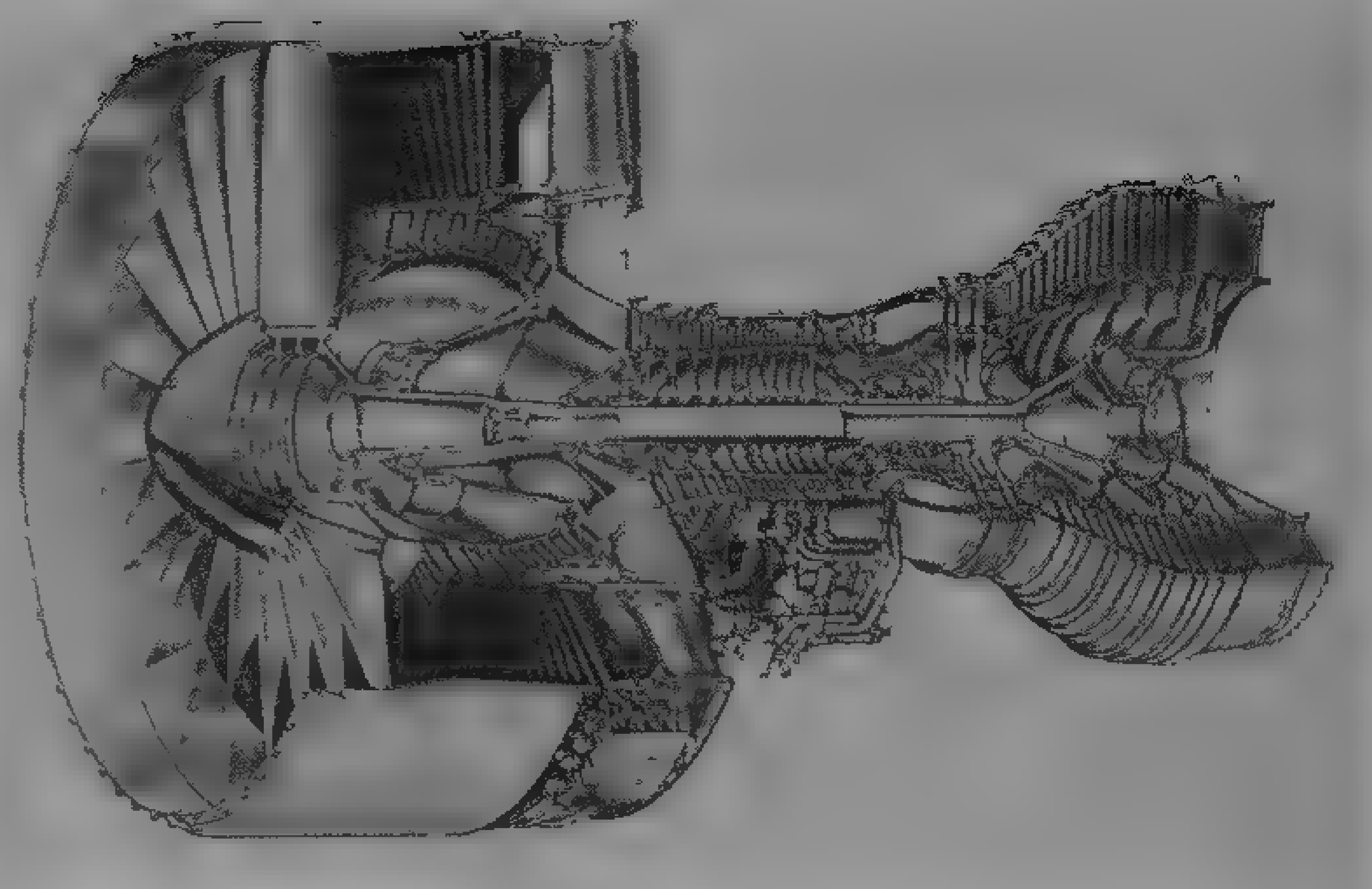
JT9D-7. Higher thrust version with air-cooled DS HP turbine blades, powers 747-200B, C, F and SR.

JT9D-7A. Aerodynamic improvements, powers 747-200 and 747SP.

JT9D-7F, -7J. Improved DS blades, 7J with shower head cooled first stage, giving -7F T-O rating without water injection.

JT9D-7Q, -7R. Described later.

JT9D-20, -20J. D-7A and D-7J with accessory gearbox under fan case. Powers DC-10-40.



Pratt & Whitney PW4084 turbofan

1995

PW4000 MODELS

Model	Thrust (ideal nozzle)	Application
PW4152	231.3 kN (52,000 lb) to 42.2°C	A310-300
PW4156	249.1 kN (56,000 lb) to 30°C	A300-600/A310-300
PW4158	258.0 kN (58,000 lb) to 30°C	A300-600R
PW4168	302.5 kN (68,000 lb) to 30°C	A330
PW4052	232.2 kN (52,200 lb) to 33.3°C	767-200/-200ER
PW4056	252.4 kN (56,750 lb) to 33.3°C	767-300/-300ER/747-400
PW4060	266.9 kN (60,000 lb) to 33.3°C	767-300ER/747-400
PW4062	275.8 kN (62,000 lb) to 30°C	767-300ER/747-400
PW4074	329.2 kN (74,000 lb) to 30°C	777
PW4077	342.5 kN (77,000 lb) to 33.3°C	777
PW4084	373.7 kN (84,000 lb) to 30°C	777
PW4090	400.3 kN (90,000 lb) to 30°C	777
PW4098	435.9 kN (98,000 lb) to 30°C	777
PW4460	266.9 kN (60,000 lb) to 30°C	MD-11
PW4462	275.8 kN (62,000 lb) to 30°C	MD-11

Ratings are S/L static, no bleed or power extraction

JT9D-59A, -70A. Fan diameter approximately 25.4 mm (1 in) larger, with re-profiled blades. LP compressor has zero (fourth) stage and is redesigned, burners recontoured, No. 3 bearing carbon seal added, HP blades directionally solidified and HP annulus larger. Both configured for common nacelle for 747 (-70A) or DC-10 and A300B (-59A).

JT9D-7Q, -7Q3. As -59A and -70A but configured like -7 for 747-200 nacelle. Thrust 236 to 249 kN (53,000 to 56,000 lb).

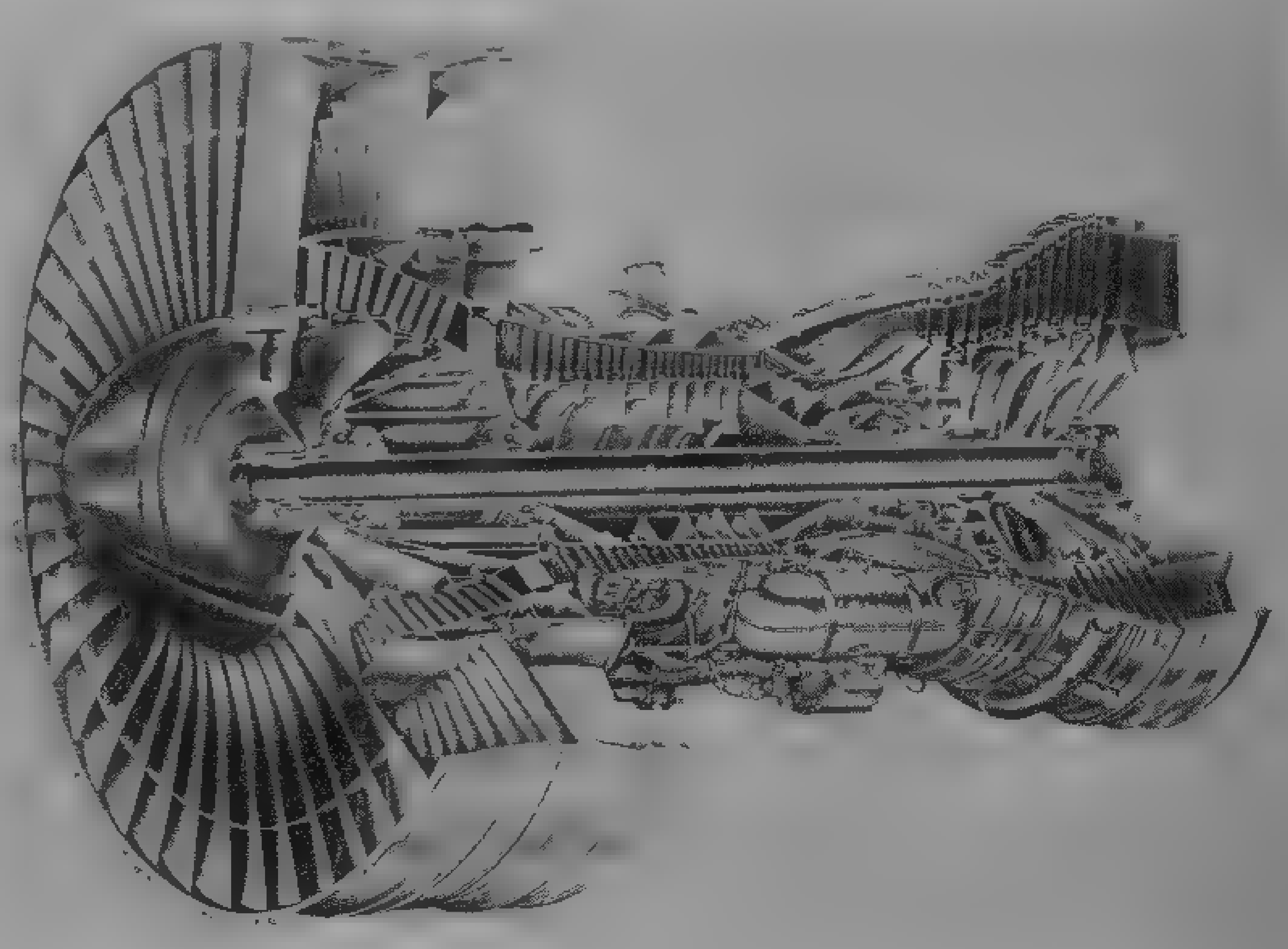
JT9D-7R4 Series. Seven models (7R4D to 7R4H1), with larger fan with wide-chord blades, zero stage on LP compressor, improved combustor, H1 has single-crystal HP turbine blades, increased diameter LP turbine, supervisory electronic fuel control and many smaller changes. 7R4D, 7R4E and 7R4E4 for Boeing 767, 7R4D1 and 7R4E1 for A310, -7R4G2 for 747-300, -7R4H1 for the A300B 600.

Deliveries were completed at 3,265 in 1990, of which about 2,800 are still in use. Flight time by early 1995 was in excess of 130 million hours. Full details appeared in the 1992-93 *Jane's*.

DIMENSIONS:

JT9D-3A, -7, -7A, -7F, -7J, -20:

Diameter	2,427 mm (95.56 in)
Length, flange to flange	3,255 mm (128.15 in)



Cutaway drawing of Pratt & Whitney JT9D-7R4 two-shaft turbofan

1985

JT9D-59A, -70A, -7Q, -7Q3:
Diameter 2,464 mm (97.0 in)
Length 3,358 mm (132.2 in)
JT9D-7R4D to H: Diameter 2,463 mm (96.98 in)
Length 3,371 mm (132.7 in)

WEIGHT, DRY:
Guaranteed, incl standard equipment:
JT9D-3A 3,905 kg (8,608 lb)
JT9D-7, -7A, -7F, -7J 4,014 kg (8,850 lb)
JT9D-20 3,833 kg (8,450 lb)
JTRD-20J 3,883 kg (8,560 lb)
JT9D-59A 4,146 kg (9,140 lb)
JT9D-70A 4,153 kg (9,155 lb)
JT9D-7Q 4,216 kg (9,295 lb)
JT9D-7R4D, E, E4 4,039 kg (8,905 lb)
JT9D-7R4D1, E1 4,029 kg (8,885 lb)
JT9D-7R4G2 4,143 kg (9,135 lb)
JT9D-7R4H1 4,029 kg (8,885 lb)

PERFORMANCE RATINGS (ideal nozzle):
T-O, dry: JT9D-3A 193.9 kN (43,600 lb st) to 26.7°C
JT9D-7 202.8 kN (45,600 lb st) to 26.7°C
JT9D-7A 205.7 kN (46,250 lb st) to 26.7°C
JT9D-7F 213.5 kN (48,000 lb st) to 26.7°C
JT9D-7J, -20J 222.4 kN (50,000 lb st) to 30°C
JT9D-20 206.0 kN (46,300 lb st) to 28.9°C
JT9D-59A, -70A, -7Q
236.0 kN (53,000 lb st) to 30°C
JT9D-7R4D, D1 213.5 kN (48,000 lb st) to 33°C
JT9D-7R4E, E1 222.4 kN (50,000 lb st) to 33°C
JT9D-7R4E4 222.4 kN (50,000 lb st) to 45.6°C
JT9D-7R4G2 243.4 kN (54,750 lb st) to 30°C
JT9D-7R4H1 249.0 kN (56,000 lb st) to 30°C
T-O, wet: JT9D-3A 200.8 kN (45,150 lb st) to 26.7°C
JT9D-7 210.0 kN (47,200 lb st) to 30°C
JT9D-7A 212.4 kN (47,750 lb st) to 30°C
JT9D-7F 222.4 kN (50,000 lb st) to 30°C
JT9D-20 220.0 kN (49,400 lb st) to 30°C
Max cruise, 10,670 m (35,000 ft) at Mach 0.85:
JT9D-3A, -7 45.4 kN (10,200 lb)
JT9D-7A 48.2 kN (10,830 lb)
JT9D-7F, -7J 49.2 kN (11,050 lb)
JT9D-20, -20J 47.5 kN (10,680 lb)
JT9D-59A, -70A, -7Q 53.2 kN (11,950 lb)
JT9D-7R4D, D1 50.0 kN (11,250 lb)
JT9D-7R4E, E1 52.0 kN (11,700 lb)
JT9D-7R4G2, H1 54.5 kN (12,250 lb)

SPECIFIC FUEL CONSUMPTION (ideal nozzle):
Max cruise, ISA + 10°C, Mach 0.85 at 10,670 m (35,000 ft):
JT9D-3A 17.67 mg/Ns (0.624 lb/h/lb)
JT9D-7 17.55 mg/Ns (0.620 lb/h/lb)
JT9D-7A 17.69 mg/Ns (0.625 lb/h/lb)
JT9D-7F, -7Q, -59A, -70A
17.87 mg/Ns (0.631 lb/h/lb)
JT9D-20, -20J 17.67 mg/Ns (0.624 lb/h/lb)
JT9D-7R4D, D1 17.42 mg/Ns (0.615 lb/h/lb)
JT9D-7R4E, E1 17.55 mg/Ns (0.620 lb/h/lb)
JT9D-7R4G2 18.10 mg/Ns (0.639 lb/h/lb)
JT9D-7R4H1 17.79 mg/Ns (0.628 lb/h/lb)

UPDATED

PRATT & WHITNEY PW2000

US military designation: F117

The PW2000 is a third-generation turbofan upon which major changes have been made since 1972. In mid-1980 it was scaled up to be compatible with the Boeing 757-200, at 170.1 kN (38,250 lb st). The first model was given the designation **PW2037**, the last two digits denoting thrust in thousands of pounds. The first engine test run took place in December 1981. FAA certification was achieved in December 1983, and the first flight was made on the prototype 757 on 14 March 1984. FAA 120 minute ETOPS received December 1989, 180 minutes received April 1992.

Companies participating are MTU of Germany and FiatAvio of Italy. Pratt & Whitney bears 70.8 per cent of the programme, MTU 21.2 per cent and FiatAvio 4 per cent. A collaboration agreement between these companies was signed in July 1977. In 1987 Volvo Aero of Sweden joined the programme as a 4 per cent manufacturing partner.

Pratt & Whitney PW2000 series two-shaft turbofan

1994

Current applications are in versions of the Boeing 757 and McDonnell Douglas C-17A. The PW2037-powered 757 was certificated on 25 October 1984 and entered revenue service on 1 December. An uprated engine, the **PW2040**, was certificated in January 1987 and entered service in September 1987. The C-17A is powered by four **F117-PW 100** engines similar to the PW2040. The F117 was certificated in December 1988 and entered USAF service in June 1993.

Four **PW2337** engines rated at 170.1 kN (38,250 lb st) began flight testing in the Ilyushin Il-96M in April 1993, with certification scheduled for 1995. In June 1995 an unspecified version was granted FAA certification at 191.2 kN (43,000 lb st).

Nearly 650 PW2000 engines have been delivered, accumulating 5.2 million flight hours. In March 1994 the first Improved PW2000 engines entered service, with new fan blades, new HP turbine blades and new fan-duct acoustic treatment. In 1995 a major upgrade package was marketed, concentrating on the HP system.

TYPE: Two-shaft turbofan of high bypass ratio.

FAN: Single-stage. Titanium forged hub, with 36 inserted titanium alloy blades with part-span shrouds. Tip diameter 1,994 mm (78.5 in). Mass flow 608 kg (1,340 lb)/s. Pressure ratio 1.7. Bypass ratio 6.0.

LP COMPRESSOR: Four stages, with controlled diffusion aerofoils with thick leading- and trailing-edges.

HP COMPRESSOR: Twelve stages, with controlled diffusion aerofoils. Variable vanes on first five stages and active clearance control on last eight stages. Overall cruise pressure ratio 31.8.

COMBUSTION CHAMBER: Annular, with flame tube fabricated in nickel alloy. Single-pipe fuel nozzles.

HP TURBINE: Two stages with air-cooled blades cast as single crystals in PW 1480 and PW 1484 alloy. Rotors with active clearance control. Both discs of PW1100 nickel based powder.

LP TURBINE: Five stages, with active clearance control.

CONTROL SYSTEM: Full-authority digital electronic with two redundant computers.

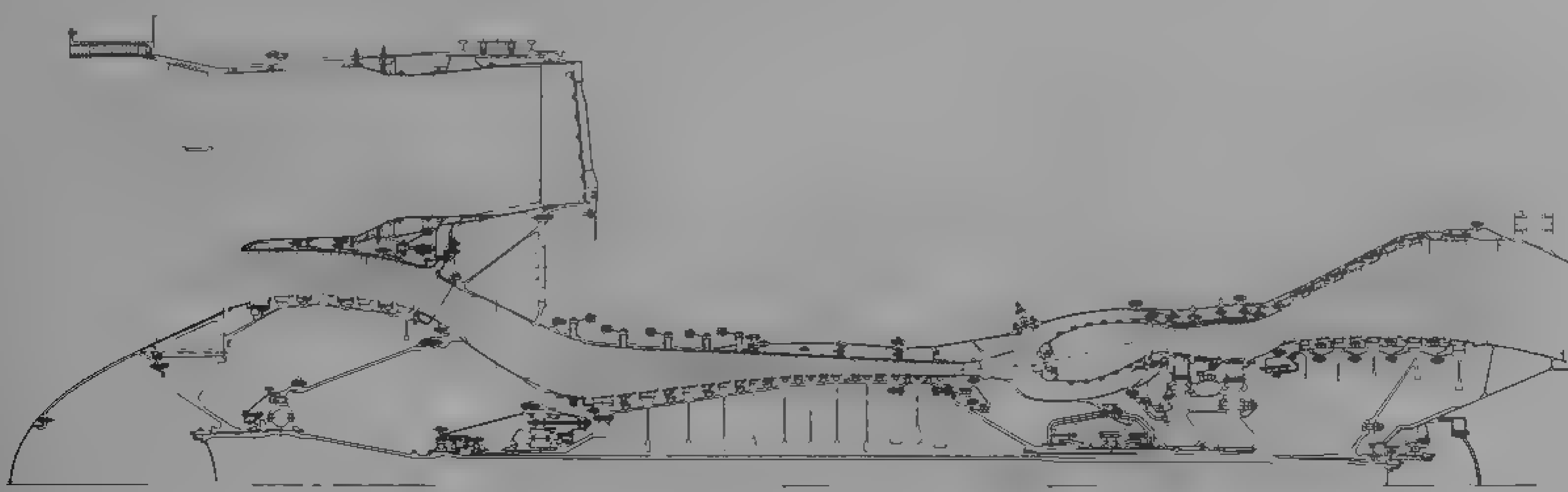
DIMENSIONS:
Length 3,729 mm (146.8 in)
Fan case diameter 2,154 mm (84.8 in)

WEIGHT, DRY:
PW2000 3,311 kg (7,300 lb)
F117 3,220 kg (7,100 lb)

PERFORMANCE RATING (T-O, S/L):
PW2037 170.1 kN (38,250 lb st)
PW2040 185.5 kN (41,700 lb st)

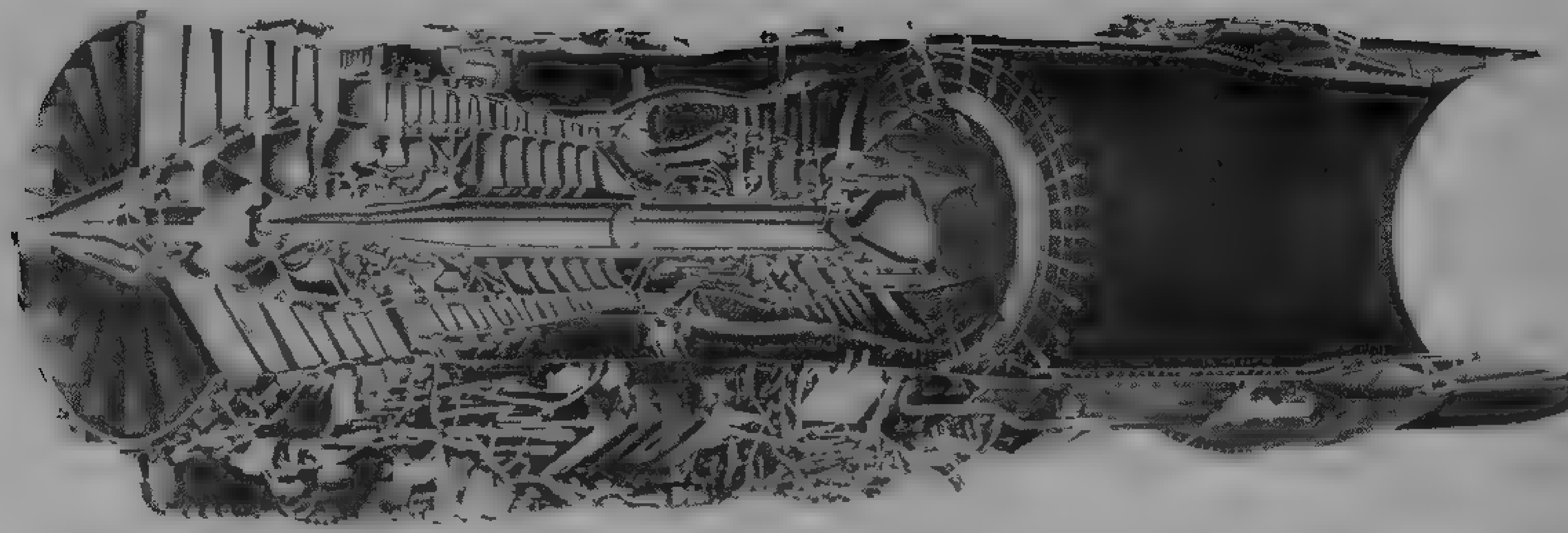
SPECIFIC FUEL CONSUMPTION (ideal nozzle, cruise at Mach 0.8 at 10,670 m, 35,000 ft) 15.95 mg/Ns (0.563 lb/h/lb)

UPDATED



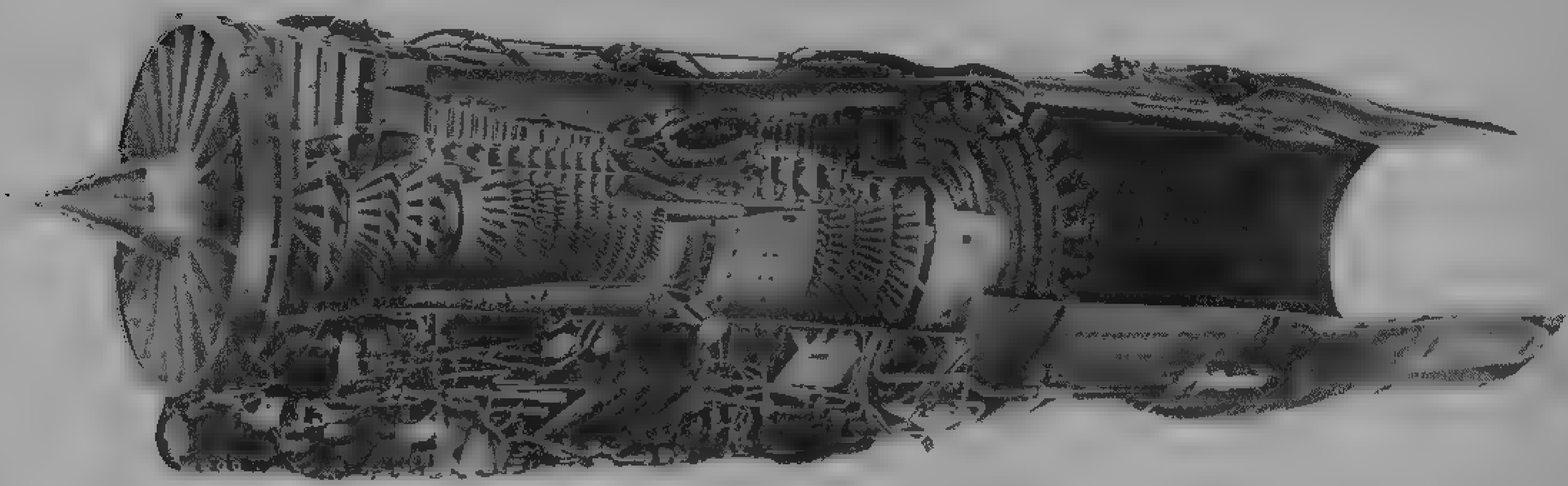
Longitudinal section of Pratt & Whitney PW2000 two-shaft turbofan

1985



Cutaway drawing of Pratt & Whitney F100-PW-229 two-shaft augmented turbofan

1987



Cutaway drawing of Pratt & Whitney F100-PW-220 two-shaft augmented turbofan

1987

PRATT & WHITNEY F100

Family of afterburning turbofan fighter engines. Versions listed below for the F-15 and F-16 are now leading to a 160.1 kN (36,000 lb st) version for possible use in advanced US combat aircraft. Nearly 6,000 have flown nearly 10 million hours since 1974.

F100-PW-100 Powered all early versions of F-15.

F100-PW-200. Modified for early versions of F-16.

F100-PW-220 Redesigned to incorporate new technology including digital control and later material and heat transfer concepts for extended life and improved safety and maintainability. Entered Alternate Fighter Engine competition for combined future F-15 and F-16 production.

F100-PW-220E. Conversion of earlier engines by kit providing all advanced features of PW-220. USAF plans to upgrade all PW-100/-200 engines during 1990s.

F100-PW-229 Most advanced production version, incorporating further new technology. Installed in some later production F-16C/Ds.

F100-PW-220P Being developed to incorporate Dash-229 technology into earlier engines, notably advanced fan, augmentor fuel management and digital control.

The following refers to the PW-229.

TYPE: Two-shaft axial turbofan with mixed-flow afterburner (augmentor).

FAN: Damage-tolerant three-stage with mid-span shrouds on stages 1 and 2. Inlet diameter 886.5 mm (34.9 in). Bypass ratio 0.36.

COMPRESSOR: Damage-tolerant 10-stage, with variable stators on first three stages. Overall pressure ratio 32.

COMBUSTOR: Smokeless annular with Floatwall film cooling. 24 airblast nozzles and continuous capacitor discharge ignition.

HP TURBINE: Two stages with single-crystal air-cooled blades. Inspection interval 4,300 cycles (seven to nine years).

LP TURBINE: Two stages with uncooled directionally solidified blades. Inspection interval 4,300 cycles.

AFTERBURNER: Eleven-segment mixed flow with advanced fuel management and high-energy ignition.

NOZZLE: Variable-area convergent/divergent with balanced beam multiflap construction.

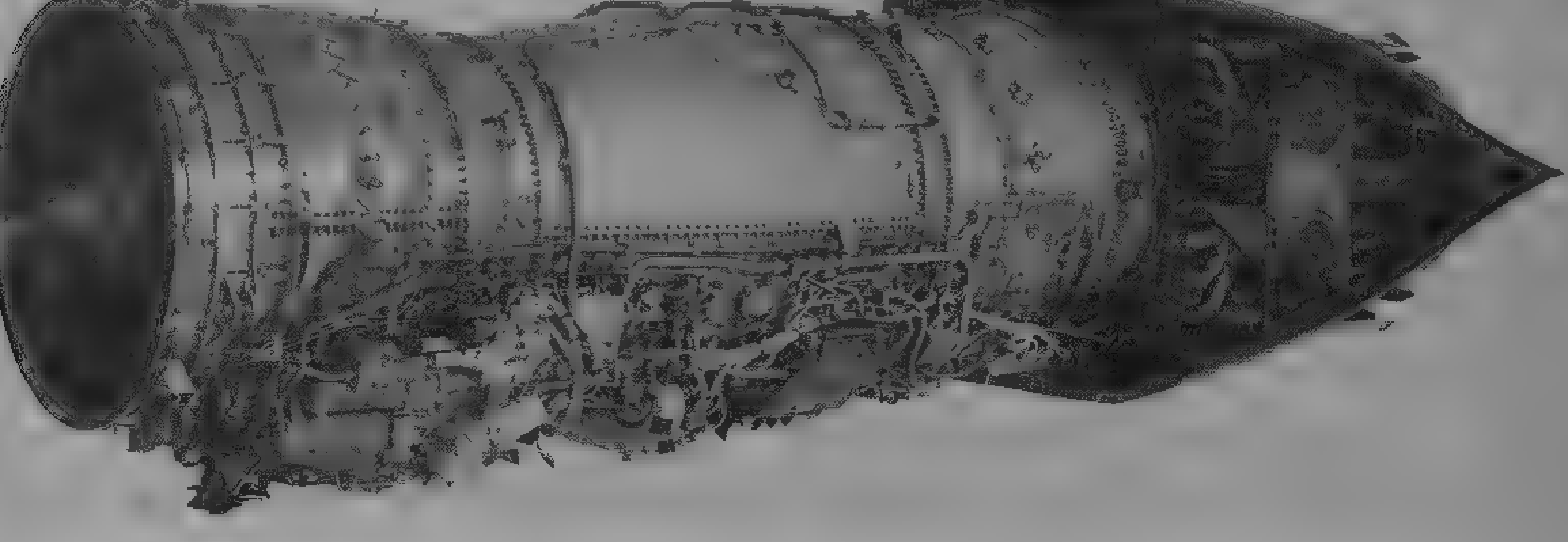
CONTROL SYSTEM: FADEC with integrated diagnostics and aircraft control system interactive capability.

DIMENSIONS:	
Length	4,855 mm (191.15 in)
Diameter overall	1,181 mm (46.5 in)
WEIGHT, DRY:	
PW-220	1,451 kg (3,200 lb)
PW-220E	1,429 kg (3,151 lb)
PW-229	1,681 kg (3,705 lb)
PW-220P	1,526 kg (3,365 lb)
PERFORMANCE (S/L static):	
Military (dry)	
PW-220, 220E	65.26 kN (14,670 lb st)
PW-229	79.18 kN (17,800 lb st)
PW-220P	74.29 kN (16,700 lb st)
Max (afterburner)	
PW-220, 220E	106.0 kN (23,830 lb st)
PW-229	129.45 kN (29,100 lb st)
PW-220P	120.1 kN (27,000 lb st)

UPDATED

PRATT & WHITNEY F119

This advanced augmented turbofan was selected by the US Air Force over the rival General Electric F120 to power the Lockheed F-22A Advanced Tactical Fighter in April 1991. Basic requirements were the simplest and most robust design for maximum reliability and maintainability, supercruise (supersonic persistence) capability without afterburner and a 2D (two-dimensional) nozzle incorporating limited thrust vectoring. The rival companies began formal development of their competing designs in 1983. From the outset Pratt & Whitney chose to offer a mature low-risk engine, even if in some respects it might appear to be less advanced than the rival F120. This philosophy was followed when, as the result of weight growth in the competing ATF aircraft, the thrust



Pratt & Whitney F119, with two-dimensional nozzle and fairing as fitted in YF-22

1994

requirements were upgraded in early 1988. By this time the design had long been fixed and the first YF119 demonstrator was about to run. The decision was taken not to change the engine, but to meet the extra thrust requirement by a subsequent slight increase in fan diameter, leaving the rest of the engine unaltered.

Bench testing began in December 1988. In the Summer of 1990, F119 engines made 65 flights totalling 153 hours, with no stalls or shutdowns. By April 1991, engines on ground test had run over 3,000 hours, including 1,500 with the two-dimensional nozzle. Production engines are due for delivery from 1997, the full programme total exceeding 1,500 engines priced at over $12 billion.

In partnership with Rolls Royce, a derivative of the F119 is being developed as a candidate engine for the Lockheed Martin JAST combat aircraft, with gas drive to an Allison lift fan. A simpler vectored-thrust version would power the Boeing contender.

TYPE: Two-shaft low-bypass ratio augmented turbofan.
FAN: Three stages of snubberless wide-chord blades.
COMPRESSOR: Multistage spool with integrally bladed rotors turning in opposition to the fan.
COMBUSTION CHAMBER: High intensity short annular with smokeless burning.
TURBINES: Single-stage contrarotating HP and LP turbines.
CASING: Integrally stiffened bypass duct and inner compressor casing both split for easy maintenance access.
AUGMENTOR: Single spray ring for combustion downstream of both bypass duct and core.
NOZZLE: Two-dimensional (rectangular) with external flaps to meet aircraft aerodynamic and LO (low observables) requirements and internal flaps to match engine operating parameters. Hydraulic control to ±20°. No reversing capability.
ACCESSORIES: Grouped for immediate access from below. All LRUs mounted one-deep. FADEC control.
DIMENSIONS: Generally similar to PW1129.
PERFORMANCE RATING (S/L): 155.6 kN (35,000 lb st) class

UPDATED

ROTORWAY

ROTORWAY INTERNATIONAL

4141 West Chandler Boulevard, Chandler, Arizona 85226
Telephone: 1 (602) 961 1001
Fax: 1 (602) 961 1514

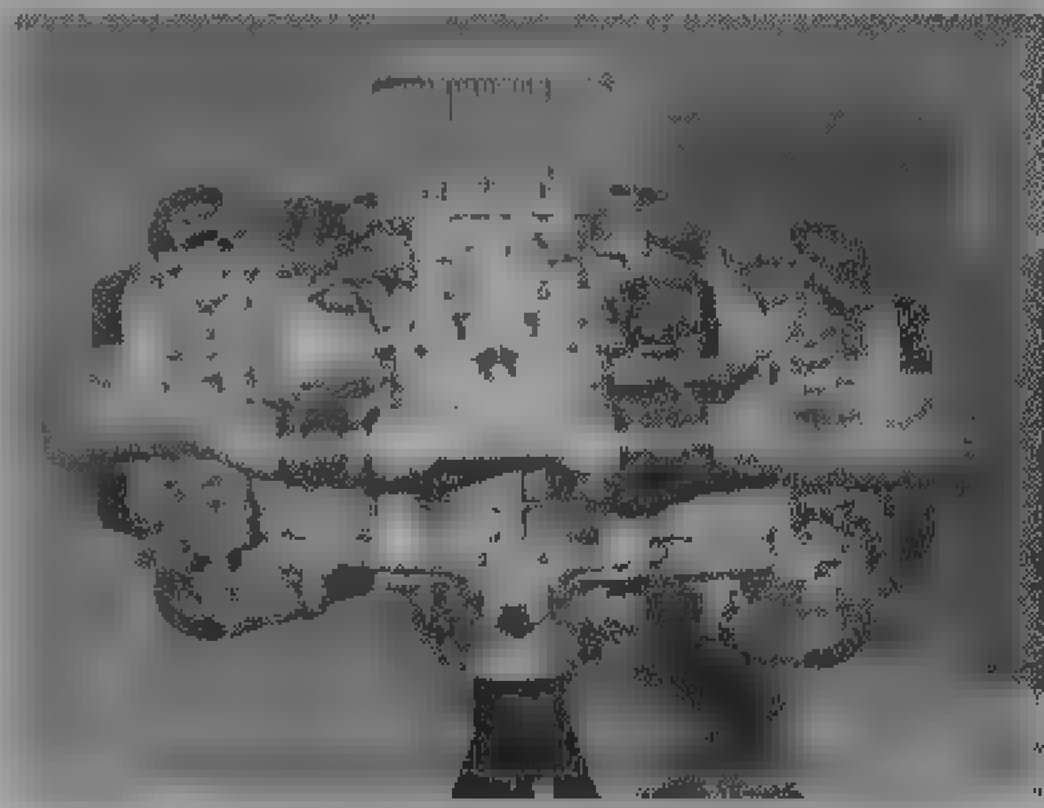
RotorWay International produces its own liquid-cooled aircraft power plant.

VERIFIED

ROTORWAY RI 162

TYPE: Horizontally opposed, water cooled, four-cylinder four-stroke piston engine. Crankshaft vertical.
CYLINDERS: Offset left and right for plain connecting rods side by side. Capacity 2.66 litres (162 cu in). Compression ratio 9.6.
INDUCTION: Single two-barrel downdraught carburettor with integral manifold heating.
IGNITION: Dual direct fire electronic with redundant coils, sensors, timing processors and plugs.
FUEL GRADE: Autogas 92 octane or Avgas 100LL.
WEIGHT, DRY (with starter): 77.1 kg (170 lb)
PERFORMANCE RATING: 113 kW (152 hp) at 4,400 rpm

VERIFIED



RotorWay RI 162 four-cylinder helicopter engine
1990

SOLOY

SOLOY CORPORATION

450 Pat Kennedy Way SW, Olympia, Washington 98502
Telephone: 1 (206) 754 7000
Fax: 1 (206) 943 7659
PRESIDENT: Joe I. Soloy

Leader in field of engineering and certificating turbine engine installations for aircraft originally powered by reciprocating engines, develops and manufactures turbine conversion kits for Bell 47 and Hiller UH-12E helicopters and Cessna 206 and 207 light aircraft. Patented Dual Pac combining gearbox technology, now applied in contract development of Tridair Gemini ST twin-engined version of Bell 206L-3 LongRanger III; also used in PT6 Dual Pac twin engine/single propeller power plant being developed jointly with Pratt & Whitney Canada. ENAER T-35 Turbo Pillan (which see) developed and tested by Soloy under contract to Empresa Nacional de Aeronautica, Chile.

Further details of conversions given in *Jane's* up to and including 1991-92 edition; can now be found in *Jane's Aircraft Upgrades*.

VERIFIED

Soloy 206 Turbine Pac free turbine turboprop
1985

SOLOY TURBINE PAC

The Soloy Turbine Pac is an FAA Supplemental Type Certificate approved turboprop engine assembly, rated at 312 kW (418 shp) with a propeller rpm range of 1,450 to 1,810. Its Allison 250-C20S turboshaft engine is combined with Soloy's propeller gearbox and other components to produce a turboprop configured for single-engined aircraft. Its high thrust line and rear inlet suit it particularly to bush aircraft. The engine assembly includes propeller governing and overspeed systems, and a self-contained lubrication system. Customised models are available in pusher configuration and can utilise the 485 kW (650 shp) Allison 250-C30 engine for tractor or pusher configurations.

VERIFIED

SOLOY DUAL PAC INC

Address as Soloy Corporation

SOLOY DUAL PAC

The first production model of the Soloy Dual Pac multi-engine system utilises two Allison 250-C30S turboshaft engines, each rated at 522 kW (700 shp). The Soloy combining gearbox is rated at 1,119 kW (1,500 shp) to accommodate possible future power increases for the Allison engine. In 1992 a Dual Pac Cessna Caravan conversion was offered using a pair of PT6A-114A engines. The -114A Dual Pac rated at 991 kW (1,329 shp), selected in 1994 for Washington Aeroprogress T-720DP Korshun. The Dual Pac's redundancy, separation, and isolation of engine and drive train systems allows it to satisfy FAA requirements for designation as a twin engine, and Dual Pac-powered aircraft to be defined as multi-engined. Patented free-wheeling units at the final stage drive train provide automatic disengagement in the event of an engine shutdown, with no adverse effect on aircraft drag or thrust symmetry.

The Dual Pac is designed for tractor or pusher configuration, and is planned for use in both single-propeller and multipropeller aircraft. The first stretched Cessna Grand Caravan, with twin PT6A-114A power sections, was expected to fly in September 1995.

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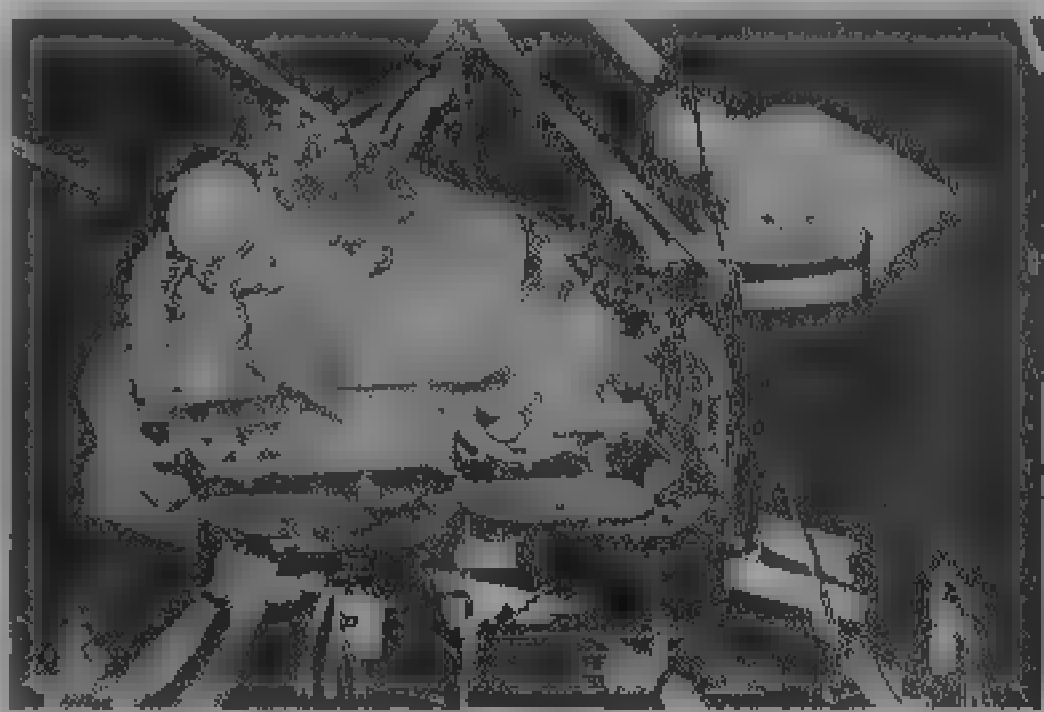


Installing the Dual Pac in the prototype Grand Caravan
1995

TCAE

TCAE TURBINE ENGINES

1330 Laskey Rd, PO Box 6971, Toledo, Ohio 43612 0971
Telephone: 1 (419) 470 3000
Fax: 1 (419) 470 3052

This company, a division of Teledyne Ryan Aeronautical, produces small gas turbines for training aircraft, missiles and UAVs. Its last production engine for manned aircraft was the J69-T-25A. Further details appeared in the 1987-88 *Jane's*.

NEW ENTRY

TCM

TELEDYNE CONTINENTAL MOTORS (Aircraft Products)

PO Box 90, Mobile, Alabama 36601
Telephone: 1 (205) 438 3411
Fax: 1 (205) 432 2922
Telex: 505519
PRESIDENT: Bryan L. Lewis
DIRECTOR, PUBLIC RELATIONS: Susan Brane

TCM produces piston, rotary combustion and turboprop engines for general aviation.

TELEDYNE CONTINENTAL O-200 SERIES

The O-200-A is a four-cylinder horizontally opposed air-cooled engine. It is fitted with a single updraught carburettor, dual magnetos and starter and generator. The O-200-B is designed for pusher installation.

For other details, see table on page 769.

VERIFIED

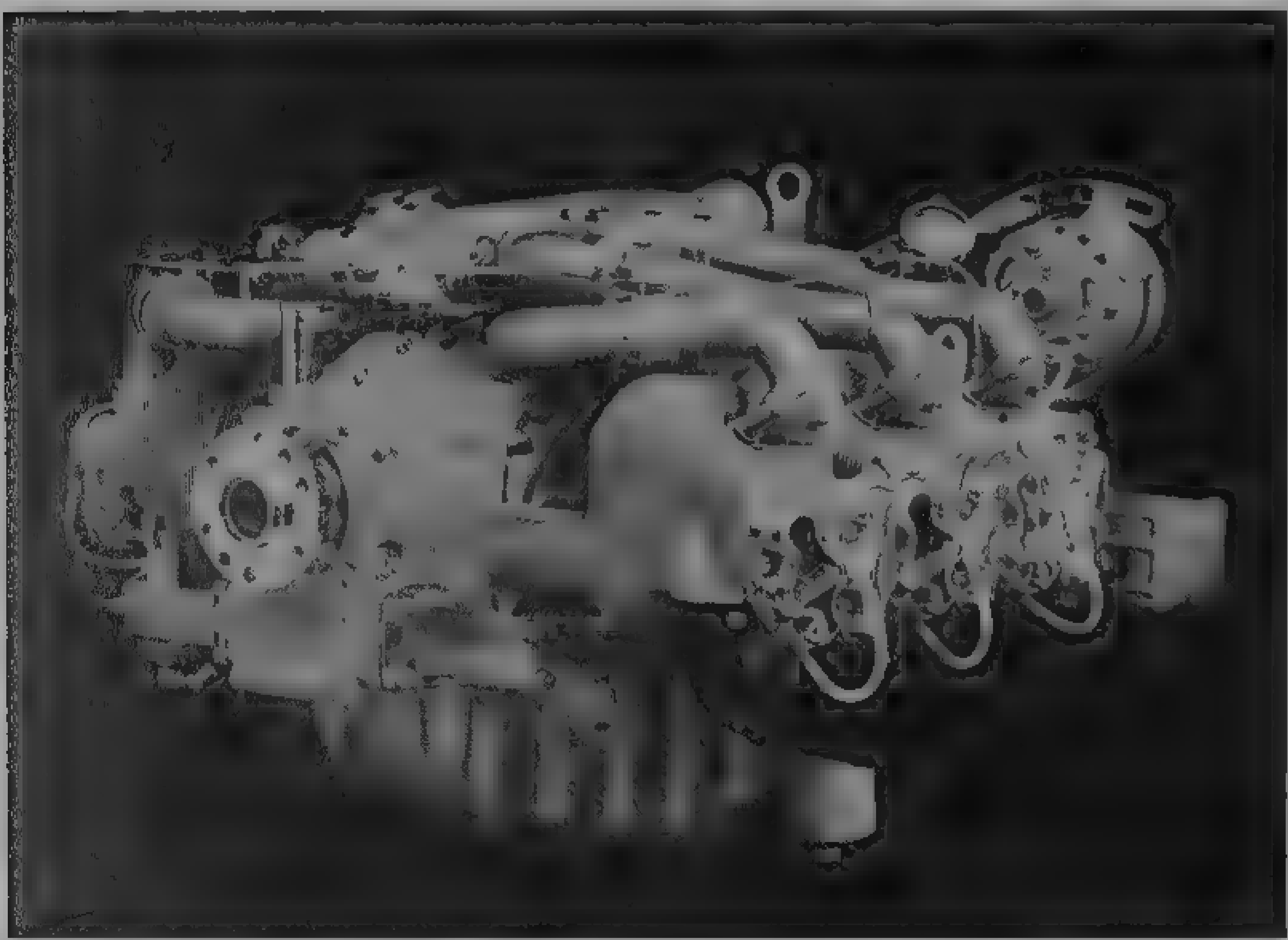
TELEDYNE CONTINENTAL IO-240

This four-cylinder engine stems from a design by former licensee Rolls-Royce. For details, see table on page 769.

VERIFIED

Teledyne Continental IO-240 four-cylinder air-cooled engine

1994



Teledyne Continental IO-360ES six-cylinder air-cooled engine

1994

TELEDYNE CONTINENTAL O-360

These engines use six cylinders of the same size as the IO-240

VERIFIED

TELEDYNE CONTINENTAL IO-520 SERIES

These engines are similar to the earlier IO-360, but with cylinders of larger bore. They are fitted with an alternator driven either by a belt or by a face gear on the crankshaft. The TSIO-520 series are turbocharged. In 1981 TCM announced a lightweight series of engines with magnesium replacing aluminium in some areas, modified camshaft and cylinder heads (with parallel valves or inclined valves of larger diameter) and a range of turbocharging options. The GTSIO-520 series is geared

VERIFIED

TELEDYNE CONTINENTAL IO-550

In 1984 this series of fuel-injected engines was introduced, similar to the IO-520 but with greater stroke. It is marketed naturally aspirated and turbocharged to OEMs and converters. Initial applications were the Beechcraft Baron and Bonanza

VERIFIED

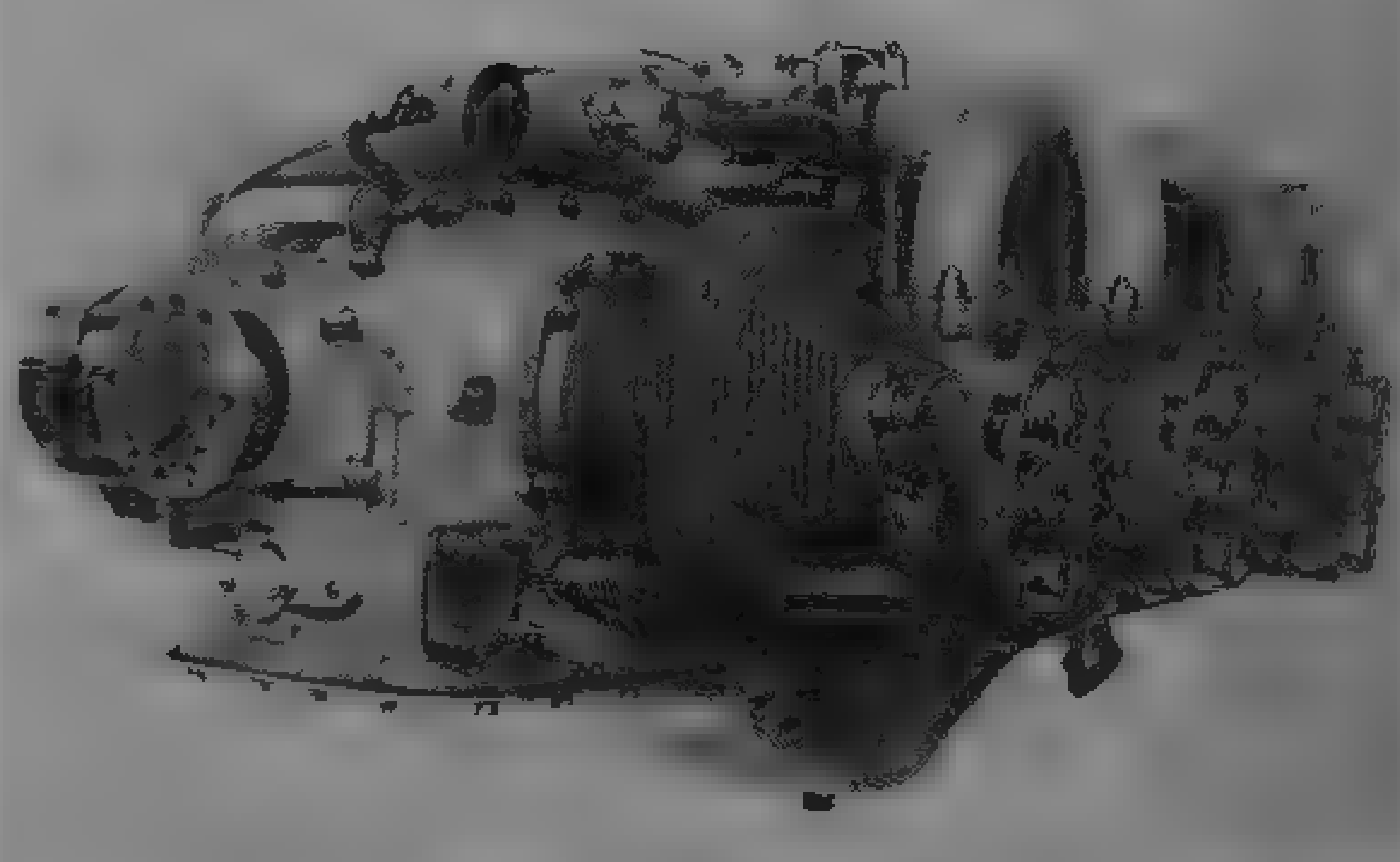
TELEDYNE CONTINENTAL VOYAGER 550

The 550 cu in family are the only liquid-cooled engines still produced by TCM. The T-550 was designed for Bonanza conversions and the geared GT-550 for the Chieftain

UPDATED

Teledyne Continental Voyager T-550 six-cylinder liquid-cooled engine

1990



Teledyne Continental IO-550G six-cylinder air-cooled engine

1994

REPRESENTATIVE TCM HORIZONTALLY OPPOSED ENGINES

Engine Model	No. of Cylinders	Bore and Stroke mm (in)	Capacity litres (cu in)	Power Ratings kW (hp) at rpm: Take-off	Power Ratings kW (hp) at rpm: M. E. T. O.	Compression Ratio	Dry Weight* kg (lb)	Dimensions: Length mm (in)	Dimensions: Width mm (in)	Dimensions: Height mm (in)	Octane Rating
O-200-A	4	103.2×98.4 (4 1/16×3 7/8)	3.28 (201)	74.5 (100) at 2,750	74.5 (100) at 2,750	7.0	99.8 (220)	725 (28.53)	802 (31.56)	589 (23.18)	80/87
IO-240	4	112.7×98.4 (4 7/16×3 7/8)	3.94 (240)	93 (125) at 2,800	93 (125) at 2,800	8.5	113 (250)	749 (29.5)	839 (33.03)	592 (23.31)	100/ 100LL
IO-360-ES	6	112.7×98.4 (4 7/16×3 7/8)	5.9 (360)	157 (210) at 2,800	157 (210) at 2,800	8.5	158.8 (350)	923 (36.32)	839 (33.03)	598 (23.52)	100/ 100LL
IO-360-KB	6	112.7×98.4 (4 7/16×3 7/8)	5.9 (360)	145.5 (195) at 2,600	145 (195) at 2,600	8.5	148.3 (327)	864 (34.03)	841 (33.11)	781 (30.74)	100/130
TSIO-360-GB-C, D	6	112.7×98.4 (4 7/16×3 7/8)	5.9 (360)	168 (225) at 2,800	168 (225) at 2,800	7.5	136 (300)	910† (35.84)	839 (33.03)	603 (23.75)	100/130
LTSIO-360-EB TSIO-360-FB	6	112.7×98.4 (4 7/16×3 7/8)	5.9 (360)	149 (200) at 2,575	149 (200) at 2,575	7.5	175 (385)	1,437 (56.58)	795 (31.30)	672 (26.44)	100/130
TSIO-360-GB, LB	6	112.7×98.4 (4 7/16×3 7/8)	5.9 (360)	157 (210) at 2,700	157 (210) at 2,700	7.5	175 (386)	902 (35.52)	795 (31.30)	699 (27.53)	100/130
LTSIO-360-KB	6	112.7×98.4 (4 7/16×3 7/8)	5.9 (360)	164 (220) at 2,800	164 (220) at 2,800	7.5	178 (392)	1,437 (56.58)	795 (31.30)	672 (26.44)	100/130
TSIO-360-MB	6	112.7×98.4 (4 7/16×3 7/8)	5.9 (360)	156.5 (210) at 2,700	157 (210) at 2,700	7.5	186.9 (412)	1,087 (42.78)	873 (34.37)	834 (32.82)	100LL
IO-520-D	6	133×101.6 (5 1/4×4)	8.5 (520)	224 (300) at 2,850	213 (285) at 2,700	8.5	208.2 (459)	949 (37.36)	901 (35.46)	604 (23.79)	100/130
IO-520-L	6	133×101.6 (5 1/4×4)	8.5 (520)	224 (300) at 2,850	213 (285) at 2,700	8.5	211.7 (466.7)	1,039 (40.91)	852 (33.56)	591 (23.25)	100/130
IO-520-M, -MB	6	133×101.6 (5 1/4×4)	8.5 (520)	213 (285) at 2,700	213 (285) at 2,700	8.5	188 (415)	1,189 (46.80)	852 (33.56)	518 (20.41)	100/130
TSIO-520-AF	6	133×101.6 (5 1/4×4)	8.5 (520)	231 (310) at 2,700	213 (285) at 2,600	7.5	198 (436)	1,039 (40.91)	852 (33.56)	598 (23.54)	100/130
TSIO-520-B, -BB	6	133×101.6 (5 1/4×4)	8.5 (520)	213 (285) at 2,700	213 (285) at 2,700	7.5	219 (483)	1,490 (58.67)	852 (33.56)	516 (20.32)	100/130
TSIO-520-BE	6	133×101.6 (5 1/4×4)	8.5 (520)	231 (310) at 2,600	231 (310) at 2,600	7.5	?	1,083 (42.64)	1,079 (42.5)	851 (33.5)	100LL
TSIO-520-CE	6	133×101.6 (5 1/4×4)	8.5 (520)	242 (325) at 2,700	242 (325) at 2,700	7.5	237 (527)	1,039 (40.91)	852 (33.56)	598 (23.54)	100LL
TSIO-520-C	6	133×101.6 (5 1/4×4)	8.5 (520)	213 (285) at 2,700	213 (285) at 2,700	7.5	208 (458)	1,039† (40.91)	852 (33.56)	509 (20.02)	100/130
TSIO-520-E, -EB	6	133×101.6 (5 1/4×4)	8.5 (520)	224 (300) at 2,700	224 (300) at 2,700	7.5	219 (483)	1,010† (39.75)	852 (33.56)	527 (20.74)	100/130
TSIO-520-J, N, -JB, -NB	6	133×101.6 (5 1/4×4)	8.5 (520)	231 (310) at 2,700	231 (310) at 2,700	7.5	221 (48 8)	997 (39.25)	852 (33.56)	516 (20.32)	100/130
TSIO-520-L, -LB	6	133×101.6 (5 1/4×4)	8.5 (520)	231 (310) at 2,700	231 (310) at 2,700	7.5	244.5 (539)	1,286 (50.62)	852 (33.56)	508 (20.02)	100/130
TSIO-520-M, P, R	6	133×101.6 (5 1/4×4)	8.5 (520)	231 (310) at 2,700	213 (285) at 2,600	7.5	198 (436)	1,039† (40.91)	852 (33.56)	598 (23.54)	100/130
TSIO-520-T	6	133×101.6 (5 1/4×4)	8.5 (520)	231 (310) at 2,700	231 (310) at 2,700	7.5	193 (426)	970 (38.2)	852 (33.56)	819 (32.26)	100/130
TSIO-520-UB	6	133×101.6 (5 1/4×4)	8.5 (520)	224 (300) at 2,700	224 (300) at 2,700	7.5	191.6 (422.5)	1,136 (44.5)	852 (33.56)	733 (28.86)	100/130
TSIO-520-VB	6	133×101.6 (5 1/4×4)	8.5 (520)	242 (325) at 2,700	242 (325) at 2,700	7.5	207 (456.7)	997 (39.25)	852 (33.56)	518 (20.4[illegible])	100/130
TSIO-520-WB	6	133×101.6 (5 1/4×4)	8.5 (520)	242 (325) at 2,700	242 (325) at 2,700	7.5	189 (416)	1,286 (50.62)	852 (33.56)	509 (20.02)	100/130
GTSIO-520-D, H	6	133×101.6 (5 1/4×4)	8.5 (520)	280 (375) at 3,400	280 (375) at 3,400	7.5	250 (550.4)	1,081 (42.56)	880 (34.04)	680 (26.78)	100/130
GTSIO-520-F, K	6	133×101.6 (5 1/4×4)	8.5 (520)	324 (435) at 3,400	324 (435) at 3,400	7.5	272.0 (600)	1,426 (56.12)	880 (34.04)	664 (26.15)	100/130
GTSIO-520-L, M, N	6	133×101.6 (5 1/4×4)	8.5 (520)	280 (375) at 3,350	280 (375) at 3,350	7.5	228 (502)‡	1,114 (43.87)	880 (34.04)	671 (26.41)	100/130
LTSIO-520-AE	6	133×101.6 (5 1/4×4)	8.5 (520)	186.5 (250) at 2,400	186.5 (250) at 2,400	8.5	172.2 (379.6)	967 (38.07)	846 (33.29)	543 (21.38)	100/130
Voyager 550	6	133×108 (5 1/4×4 1/4)	9.0 (550)	261 (350) at 2,700	261 (350) at 2,700	7.5	228.6 (504)				100/ 100LL
Voyager T 550	6	133×108 (5 1/4×4 1/4)	9.0 (550)	224 (300) at 2,500	224 (300) at 2,500	7.5	204 (450)				100LL

REPRESENTATIVE TCM HORIZONTALLY OPPOSED ENGINES *Continued*

Engine Model	No. of Cylinders	Bore and Stroke mm (in)	Capacity litres (cu in)	Power Ratings kW (hp) at rpm Take-off	M.E.T.O.	Compression Ratio	Dry Weight* kg (lb)	Dimensions Length mm (in)	Width mm (in)	Height mm (in)	Octane Rating
Voyager GT 550	6	133×108 (5¼×4¼)	9.0 (550)	298 (400)	298 (400)	7.5	249.5 (550)				100LL
IO-550-B	6	133×108 (5¼×4¼)	9.0 (550)	224 (300) at 2,700	224 (300) at 2,700	8.5	207.9 (462)	964 (37.97)	852 (33.56)	694 (27.32)	100LL
IO-550-C, E	6	133×108 (5¼×4¼)	9.0 (550)	224 (300) at 2,700	224 (300) at 2,700	8.5	196.4 (433)	1,100 (43.31)	852 (33.56)	502 (19.78)	100LL
IO-550-F, L	6	133×108 (5¼×4¼)	9.0 (550)	224 (300) at 2,700	224 (300) at 2,700	7.5	191.9 (423)	1,039 (40.91)	852 (33.56)	516 (20.32)	100LL
IO-550-G	6	133×108 (5¼×4¼)	9.0 (550)	209 (280) at 2,500	209 (280) at 2,500	7.5	210.9 (465)	1,189 (46.80)	852 (33.56)	518 (20.41)	100LL
TSIO-550-B	6	133×108 5¼×4¼	9.0 (550)	261 (350) at 2,700	261 (350) at 2,700	7.5	257 (566)	1,086 (42.75)	1,072 (42.20)	853 (33.60)	100/ 100LL

*With accessories, †Not including turbocharger.
†N weight 220 kg (486 lb)

VERIFIED

TEXTRON LYCOMING

652 Oliver Street, Williamsport, Pennsylvania 1770.
Telephone: 1 (717) 327 704
Fax: 1 (717) 327 7022

Following the 1994 sale of Textron Lycoming's turbine engine division to AlliedSignal (which see) its Pennsylvania operation was retained and continues to be the world's largest producer of piston engines for general aviation.

UPDATED

TEXTRON LYCOMING O-235 SERIES

Four cylinders of 111 mm (4⅜ in) bore and 98.4 mm (3⅞ in) stroke. The high-compression O-235-N is the most recent production version of the O-235, used in several trainers. It requires 100 octane fuel.

TEXTRON LYCOMING O-320 and IO-320 SERIES

Cylinder bore increased to 130 mm (5⅛ in). The O-320 is an engine in the 112 to 119 kW (150 to 160 hp) class. Both carburetted and fuel injected versions are produced in low and high-compression models for use with 80/87 or 100 octane minimum grade fuels, respectively. Fully aerobatic models are available.

VERIFIED

TEXTRON LYCOMING O-360 and IO-360 SERIES

The O-360 series is basically the same as the O-320 except for an increase in stroke to 111 mm (4⅜ in). Like the O-320 this engine is manufactured with low- or high-compression, with carburettor or fuel injection. The various models include aerobatic capability, a specific design for helicopters and turbocharged versions. The IO-360-A has fuel injection, tuned induction and high-output cylinders, while the IO-360-B has continuous flow port injection and standard cylinders. In the TIO-360-C the turbocharger is pilot controlled.

VERIFIED

TEXTRON LYCOMING O-540 and IO-540 SERIES

The O-540 is a direct drive, six-cylinder version of the four-cylinder O-360. It is available in low- and high-compression versions, and the VO-540 is a helicopter power plant with crankshaft vertical. Fuel injected IO-540 models are manufactured with ratings of 186 to 224 kW (250 to 300 hp). An aerobatic version is available.

VERIFIED

TEXTRON LYCOMING TIO-540 SERIES

This is a turbocharged version of the fuel-injected IO-540, some of which have tuned induction. It is manufactured for unpressurised and pressurised aircraft, and several models incorporate an intercooler.

VERIFIED

TEXTRON LYCOMING TIO-541 SERIES

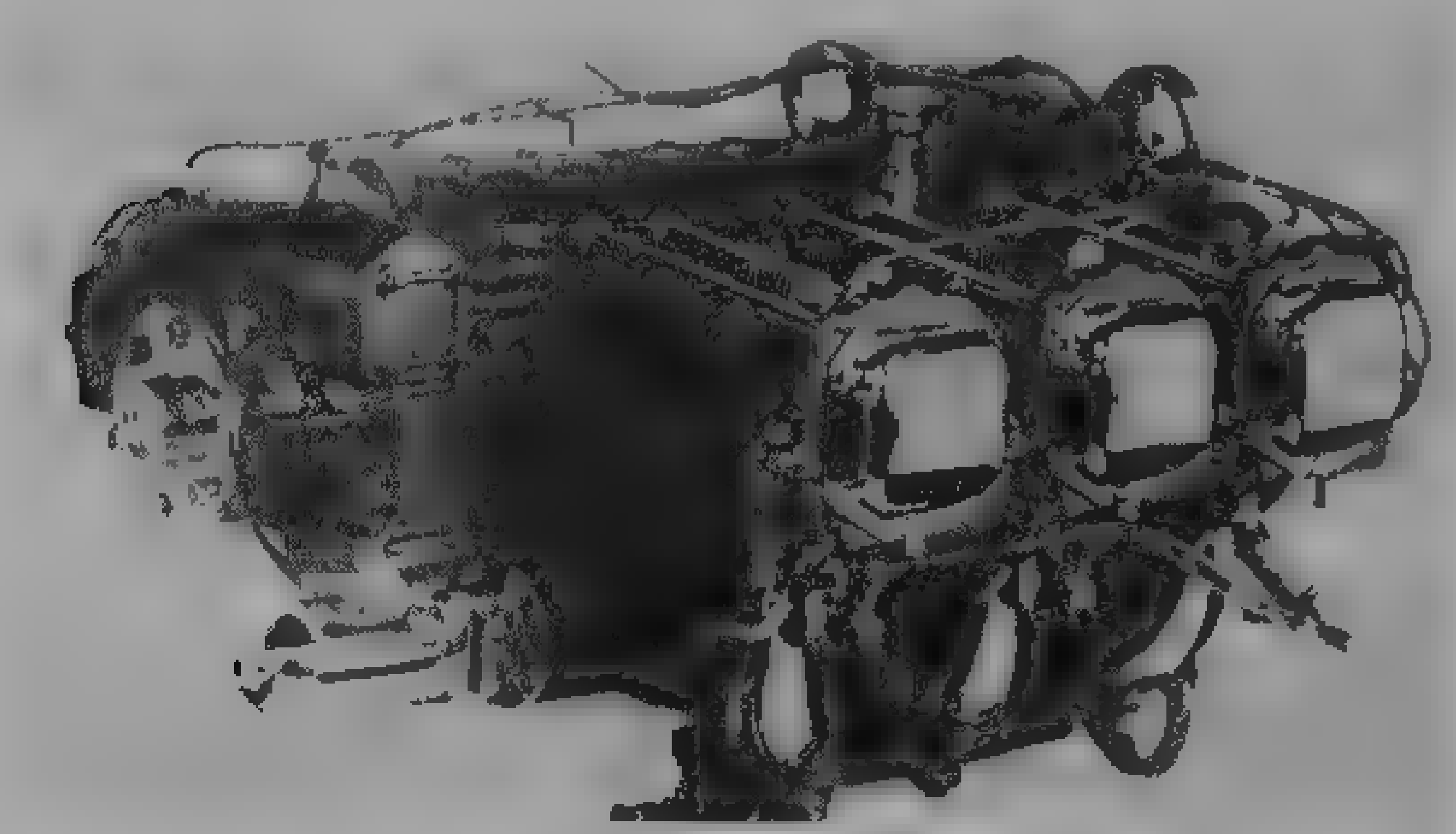
Although the displacement of this turbocharged, six-cylinder series is the same as that of the TIO-540, the TIO-541 and geared TIGO-541 are totally redesigned. The TIO-541-E is rated at 283 kW (380 hp) and the geared TIGO-541-E at 317 kW (425 hp). A double scroll blower is available to provide cabin pressurisation.

VERIFIED

TEXTRON LYCOMING IO-720 SERIES

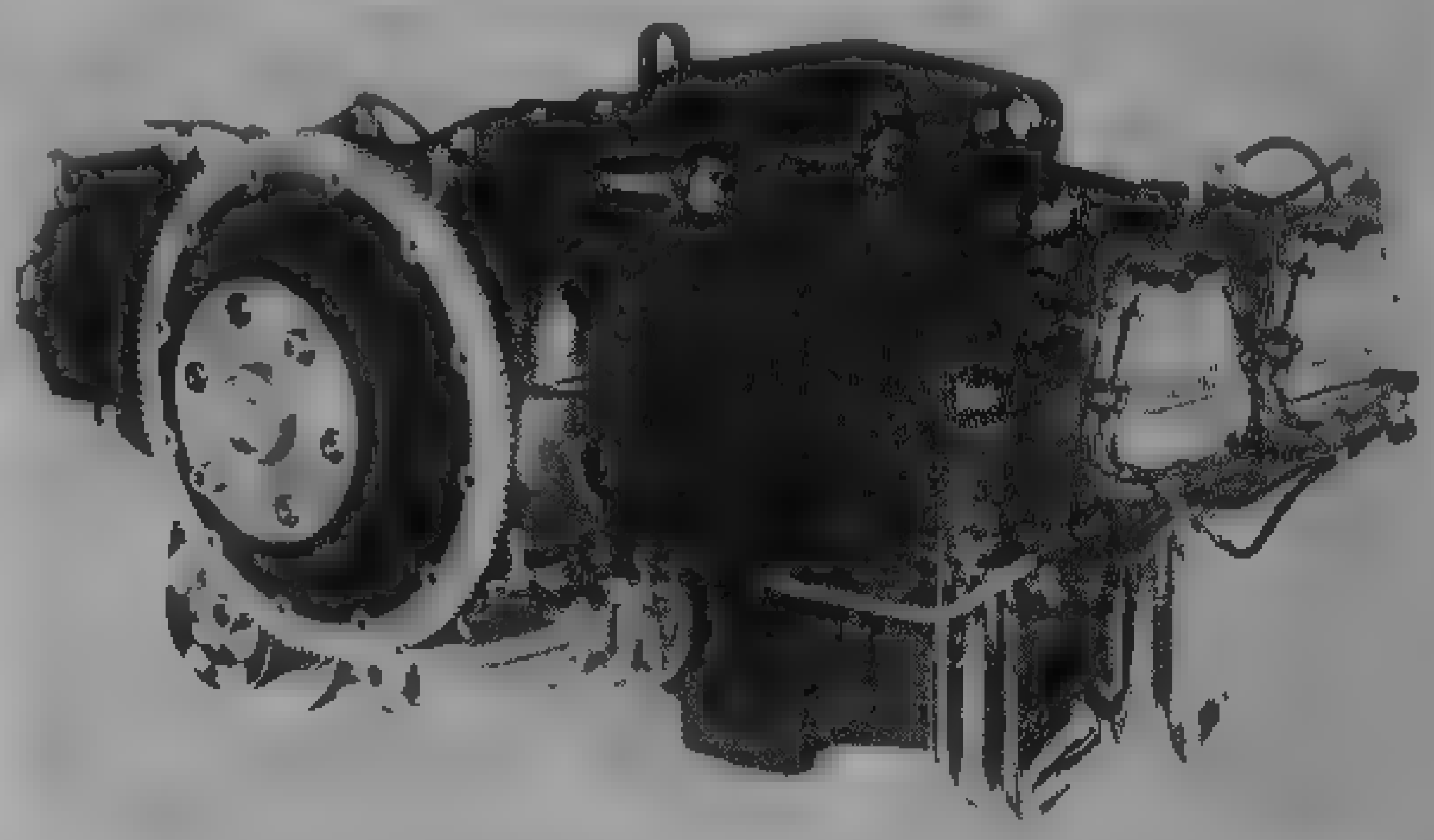
This eight-cylinder version of the IO-540 is used at ratings from 280 to 298 kW (375 to 400 hp).

VERIFIED



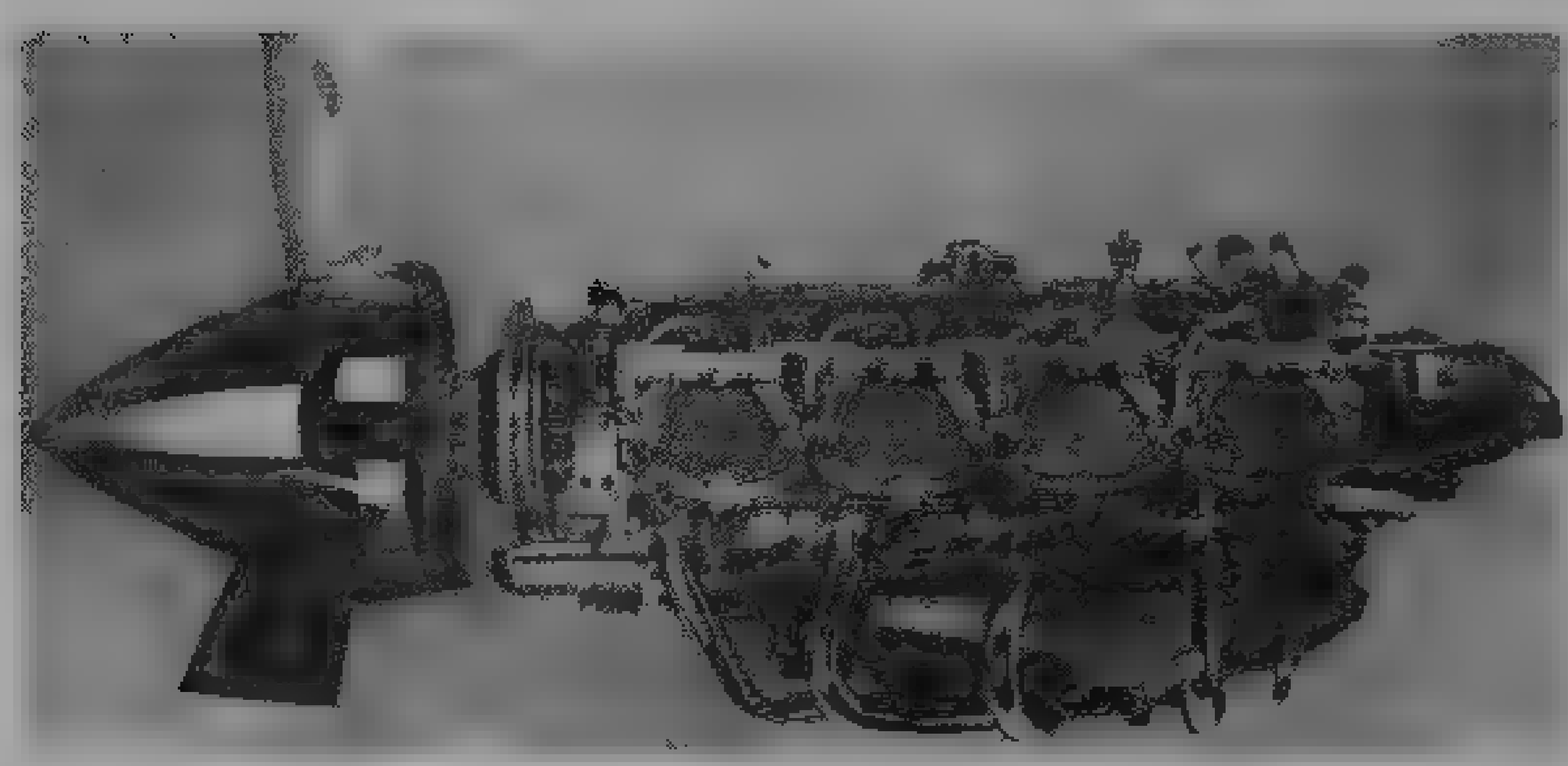
Textron Lycoming O-540 six-cylinder piston engine

1990



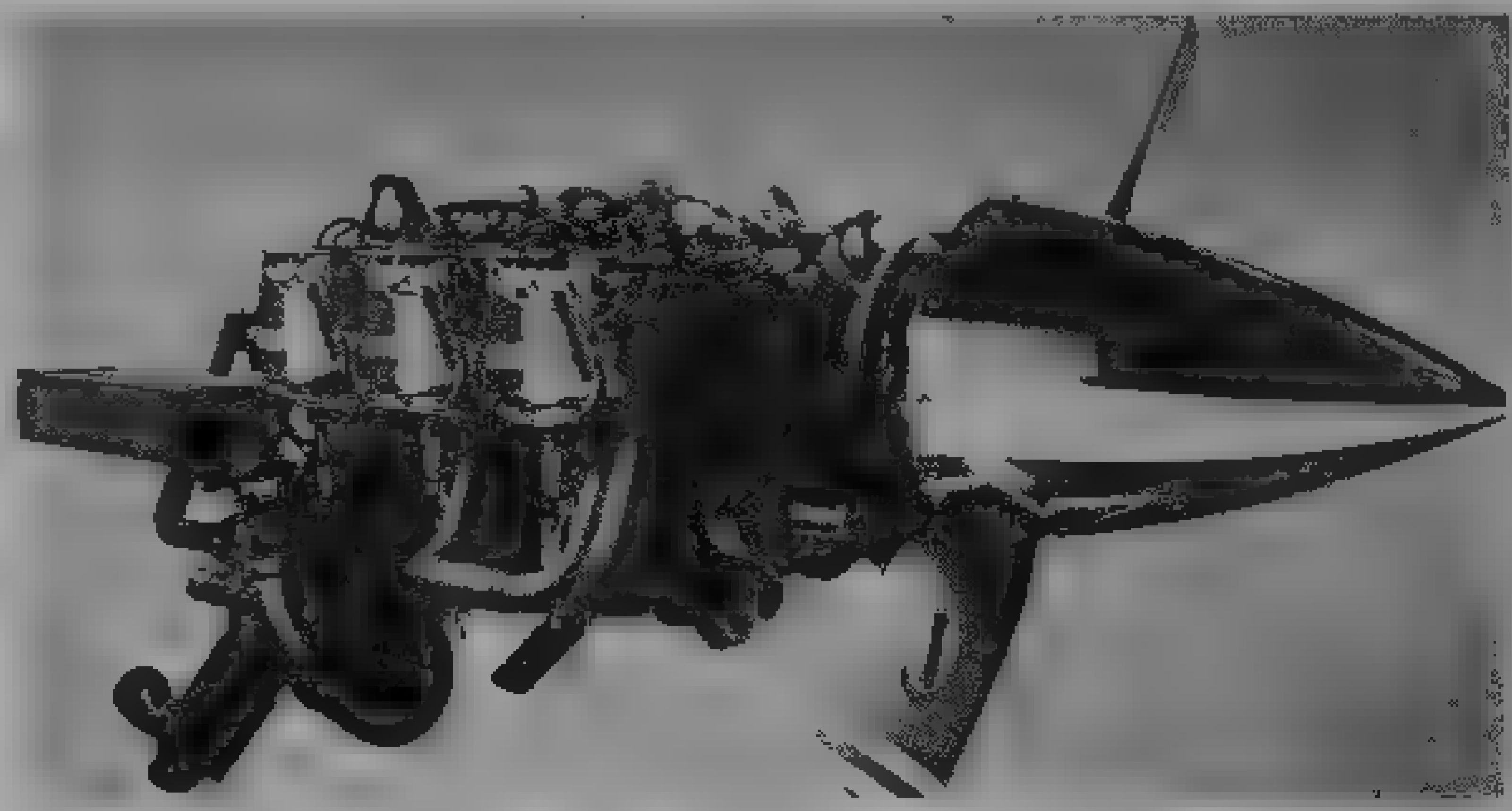
Textron Lycoming IO-360 four-cylinder piston engine

1990



Textron Lycoming TIO-540-AE2A turbocharged piston engine

1990



Textron Lycoming IO-720 eight-cylinder piston engine

1990

TEXTRON LYCOMING HORIZONTALLY OPPOSED PISTON ENGINES

Engine Model*	No. of Cylinders	Rated Output at Sea Level kW (hp) at rpm	Capacity litres (cu in)	Compression Ratio	Fuel grade Min	Weight, Dry kg (lb)	Length Overall mm (in)	Width Overall mm (in)	Height Overall mm (in)	Gear Ratio†
O-235-C	4	86 (115) at 2,800	3.85 (233)	6.75	80/87	97.5 (215)	751 (29.56)	812 (32.00)	569 (22.40)	D
O-235-L, M	4	88 (118) at 2,800 78 (105) at 2,400	3.85 (233)	8.5	100	98 (218)	738 (29.05)	812 (32.00)	569 (22.40)	D
O-235-N, P	4	87 (116) at 2,800	3.85 (233)	8.1	100	98 (218)	738 (29.05)	812 (32.00)	569 (22.40)	D
O-320-A, E	4	112 (150) at 2,700	5.2 (319.8)	7.0	80/87	110 (243)	751 (29.56)	819 (32.24)	584 (22.99)	D
(H)IO-320B2C	4	119 (160) at 2,700	5.2 (319.8)	8.5	91/96	115 (255)	751 (29.56)	819 (32.24)	584 (22.99)	D
O-320-D	4	119 (160) at 2,700	5.2 (319.8)	8.5	91/96	114 (253)	808 (31.82)	819 (32.24)	488 (19.22)	D
AEIO-320-D	4	119 (160) at 2,700	5.2 (319.8)	8.5	100	123 (271)	780 (30.70)	819 (32.24)	589 (23.18)	D
AEIO-320-E	4	112 (150) at 2,700	5.2 (319.8)	7.0	80/87	117 (258)	738 (29.05)	819 (32.24)	584 (22.99)	D
(L)IO-320B, C	4	119 (160) at 2,700	5.2 (319.8)	9.0	100	117.5 (259)	853 (33.59)	830 (32.68)	488 (19.22)	D
(L)O-360-A	4	134 (180) at 2,700	5.92 (361)	8.5	91/96	120 (265)	808 (31.82)	848 (33.37)	488 (19.22)	D
O-360-F	4	134 (180) at 2,700	5.92 (361)	8.5	100	122 (269)	808 (31.81)	859 (33.38)	507 (19.96)	D
TO-360-C, F	4	157 (210) at 2,575 to 3,050 m (10,000 ft)	5.92 (361)	7.3	100	154 (343)	876 (34.50)	921 (36.25)	534 (21.02)	D
IO-360-A	4	149 (200) at 2,700	5.92 (361)	8.7	100	133 (293)	757 (29.81)	870 (34.25)	491 (19.35)	D
IO-360-B	4	134 (180) at 2,700	5.92 (361)	8.5	100	121.5 (268)	757 (29.81)	848 (33.37)	631 (24.84)	D
LIO-360-C	4	149 (200) at 2,700	5.92 (361)	8.7	100	134 (298)	855 (33.65)	870 (34.25)	495 (19.48)	D
TIO-360-C	4	157 (210) at 2,575 to 3,050 m (10,000 ft)	5.92 (361)	7.3	100	158 (348)	910 (35.82)	921 (36.25)	550 (21.65)	D
HIO-360-D1A	4	142 (190) at 3,200 to 1,280 m (4,200 ft)	5.92 (361)	10.0	100	146 (321)	894 (35.23)	904 (35.62)	495 (19.48)	D
(L)HIO-360-F1AD	4	142 (190) at 3,050	5.92 (361)	8.0	100	133 (293)	797 (31.36)	870 (34.25)	507 (19.97)	D
AEIO-360-A	4	149 (200) at 2,700	5.92 (361)	8.7	100	139 (307)	780 (30.70)	870 (34.25)	492 (19.35)	D
AEIO-360-B	4	134 (180) at 2,700	5.92 (361)	8.5	91/96	125 (277)	738 (29.05)	848 (33.37)	631 (24.84)	D
O-540-B	6	175 (235) at 2,575	8.86 (541.5)	7.2	80/87	166 (366)	945 (37.22)	848 (33.37)	624 (24.56)	D
O-540-E	6	194 (260) at 2,700	8.86 (541.5)	8.5	91/96	167 (368)	976 (38.42)	848 (33.37)	624 (24.56)	D
O-540-A	6	186 (250) at 2,700	8.86 (541.5)	8.5	91/96	161 (356)	976 (38.42)	848 (33.37)	624 (24.56)	D
O-540-J	6	175 (235) at 2,400	8.86 (541.5)	8.5	100	162 (357)	989 (38.93)	848 (33.37)	519 (20.43)	D
IO-540-A1A5	6	201 (270) at 2,700	8.86 (541.5)	7.3	80/87	217 (479)	999 (39.34)	880 (34.70)	498 (19.60)	D
IO-540-S	6	224 (300) at 2,700	8.86 (541.5)	8.7	100	200 (441)	997 (39.24)	880 (34.70)	498 (19.60)	D
IO-540-C	6	186 (250) at 2,575	8.86 (541.5)	8.5	91/96	170 (375)	976 (38.42)	848 (33.37)	622 (24.46)	D
IO-540-K	6	224 (300) at 2,700	8.86 (541.5)	8.7	100	201 (443)	999 (39.34)	870 (34.25)	498 (19.60)	D
IO-540-T4A5D	6	194 (260) at 2,700	8.86 (541.5)	8.5	100	187 (412)	989 (38.93)	848 (33.37)	546 (21.50)	D
IO-540-W1A5	6	175 (235) at 2,400	8.86 (541.5)	8.5	100	166 (367)	989 (38.93)	848 (33.37)	492 (19.35)	D
AEIO-540-D	6	194 (260) at 2,700	8.86 (541.5)	8.5	91/96	174 (386)	999 (39.34)	848 (33.37)	621 (24.46)	D
AEIO-540-L	6	224 (300) at 2,700	8.86 (541.5)	8.0	100	202 (445)	989 (38.93)	870 (34.25)	622 (24.46)	D
TIO-540-AF1A	6	201 (270) at 2,575 to 4,575 m (15,000 ft)	8.86 (541.5)	7.3	100	223 (491)	1,022 (40.24)	848 (33.37)	727 (28.62)	D
TIO-540-AE2A	6	261 (350) at 2,600	8.86 (541.5)	7.3	100	249 (549)	1,067 (42.02)	1,182 (46.52)	705 (27.75)	D
TIO-540-C	6	186 (250) at 2,575 to 4,575 m (15,000 ft)	8.86 (541.5)	7.2	100	205 (456)	1,026 (40.38)	848 (33.37)	770 (30.33)	D
TIO/LTIO-540-F	6	242 (325) at 2,575 to 4,575 m (15,000 ft)	8.86 (541.5)	7.3	100	233 (514)	1,304 (51.34)	870 (34.25)	570 (22.42)	D
TIO/LTIO-540-J	6	261 (350) at 2,575 to 4,575 m (15,000 ft)	8.86 (541.5)	7.3	100	235 (518)	1,308 (51.50)	870 (34.25)	573 (22.56)	D
TIO-540-S	6	224 (300) at 2,700 to 3,660 m (12,000 ft)	8.86 (541.5)	7.3	100	228 (502)	1,004 (39.56)	915 (36.02)	667 (26.28)	D
TIO/LTIO-540-U	6	261 (350) at 2,500 to 4,575 m (15,000 ft)	8.86 (541.5)	7.3	100	248 (547)	1,204 (47.40)	870 (34.25)	574 (22.59)	D
TIO/LTIO-540-V	6	269 (360) at 2,600 to 5,485 m (18,000 ft)	8.86 (541.5)	7.3	100	248 (547)	1,352 (53.21)	886 (34.88)	621 (24.44)	D

*Model designation code: AE, Aerobatic engine; G, Geared; H, Helicopter; I, Fuel injected; L, Left hand rotation crankshaft, O, Opposed cylinders, S, Supercharged, T, Turbocharged. †D, Direct drive.

TEXTRON LYCOMING HORIZONTALLY OPPOSED PISTON ENGINES *Continued*

Engine Model*	No. of Cylinders	Rated Output at Sea Level kW (hp) at rpm	Capacity litres (cu in)	Compression Ratio	Fuel grade Min	Weight, Dry kg (lb)	Length Overall mm (in)	Width Overall mm (in)	Height Overall mm (in)	Gear Ratio†
TIO-541 E	6	283 (380) at 2,900 to 4,575 m (15,000 ft)	8.86 (541 5)	7 3	100	270 (596)	1,282 (50.70)	905 (35 66)	640 (25.17)	D
TIGO-541-E	6	317 (425) at 3,200 to 4,575 m (15,000 ft)	8.86 (541.5)	7 3	100	319 (704)	1,462 (57.57)	885 (34.86)	575 (22.65)	0.667
IO-720-A, B, D	8	298 (400) at 2,650	11.84 (722)	8 7	100	258 (568)	1,179 (46 41)	870 (34 25)	573 (22 53)	D

*Model designation code AE, Aerobatic engine; G, Geared; H, Helicopter; I, Fuel injected; L, Left hand rotation crankshaft, O, Opposed cylinders; S, Supercharged, T, Turbocharged. †D, Direct drive

UPDATED

WILLIAMS

WILLIAMS INTERNATIONAL

2280 West Maple Road, PO Box 200, Walled Lake, Michigan 48390
Telephone. 1 (313) 624 5200
Fax: 1 (313) 624 5345
VICE-PRESIDENT BUSINESS DEVELOPMENT
Raymond C. Preston
PUBLIC RELATIONS Christina J Pearce
Telephone: 1 (313) 960 2409
Fax. 1 (313) 669 3790

Details of the engines manufactured by Williams for unmanned applications can be found in the 1987-88 *Jane's*

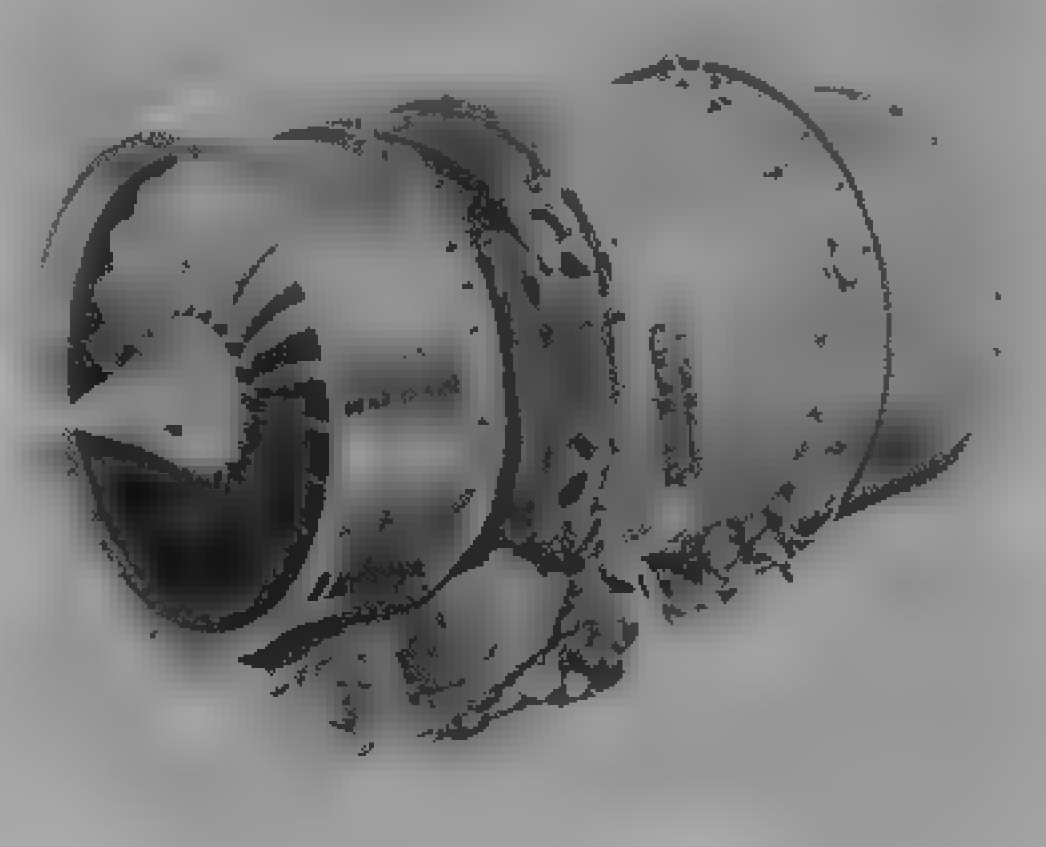
VERIFIED

WILLIAMS-ROLLS FJ44

US military designation F129

Rolls-Royce joined Williams as a partner on the FJ44 in 1989 Williams is the design authority, with Rolls-Royce providing its expertise for certain components as well as assisting in product support. In production, the majority of manufacturing and final assembly is being accomplished at the Williams facility in Ogden, Utah, while Rolls-Royce manufactures the LP turbine shaft and the three turbine rotors. The engine is marketed and supported worldwide by Williams-Rolls Inc, a joint business arrangement between Williams International and Rolls-Royce

The FJ44, with its low acquisition and maintenance cost, low specific fuel consumption, and high reliability, made feasible a new category of light business jets and trainers. It completed FAA certification on schedule in March 1992, with the first production engines being delivered in June 1992 The Cessna CitationJet is in production, and other aircraft either in development or certification include the Swearingen SJ30, the Promavia twin-engine ATTA trainer, the Promavia single-engine Squalus trainer, and the AASI



Williams-Rolls FJ44 two-shaft turbofan *1992*

Stratocruzer business jet. The Royal Swedish AF has ordered 240 engines to re-engine Sk60 trainers. All FJ44 engines are assembled at and shipped from Williams' Ogden, Utah facility

Intended applications include the Romanian NOGA VI business jet

Williams International announced during 1993 details of its military version of the FJ44, the **F129** A derated version of this engine was selected by Cessna for its JPATS twin-engine trainer

FAN: Single-stage wide-chord axial Bypass ratio 3.28
COMPRESSOR Single-stage axial on LP shaft followed by a single-stage centrifugal on HP shaft
COMBUSTION CHAMBER: Annular radial outflow
TURBINES Single-stage axial HP turbine Two-stage axial LP turbine. All three rotors with inserted blades
CONTROL SYSTEM. Hydromechanical
NOZZLE. Full-length fan duct Common fan and core exhaust.
DIMENSIONS
Length 1,024 mm (40 3 in)
Max diameter 602 mm (23 7 in)
WEIGHT DRY 203 kg (447 lb)
PERFORMANCE RATINGS (uninstalled)
T-O (S/L) to 22°C 8.45 kN (1,900 lb st)
Max continuous (11,000 m, 36,090 ft, Mach 0.7) 2 25 kN (506 lb)
SPECIFIC FUEL CONSUMPTION
T-O (S/L) 13 45 mg/Ns (0.475 lb/h/lb st)
Max continuous (as above) 21 47 mg/Ns (0 758 lb/h/lb)

UPDATED

YUGOSLAVIA

Aero-engine manufacture in Yugoslavia had a long tradition. Over 1,200 engines of indigenous or licensed design were built in the country between 1923-1941

The group of aero-engine makers was integrated within the Business Association of the Yugoslav Aerospace Industry. They manufactured under collaborative or counter-purchase arrangements The group also performed modifications, upgrades, repair and overhaul of engines and their components. There was also a Business Association of Air Depots. The fate of the engine factories in the war was not known as this edition went to press. The *Jane's* enquiries for the 1995-96 edition were all returned undeliverable because of international sanctions or military blockade

UPDATED

DMB

DVADESETPRVI MAJ BEOGRAD

Ul Oslobodjenja 1, YU-11090 Belgrade
Telephone 38 (11) 593685 and 593982
Fax: 38 (11) 593982 and 594985
Telex. 71084 DMB YU

Manufactured Turbomeca turboshaft and turboprop and parts of RR Viper turbojet

VERIFIED

MOMA STANOJLOVIĆ

MOMA STANOJLOVIĆ AIR DEPOT

Nesvrstanih Zemalja 164, YU-11273 Batajnica
Telephone: 38 (11) 618987
Fax: 38 (11) 619483
Telex 11675 VZ MOMA YU

The Moma Stanojlović Air Depot used to co-operate with DMB in the manufacture of the Turbomeca Astazou III and Astazou XIV turboshaft engines and overhaul military engines

UPDATED

ORAO

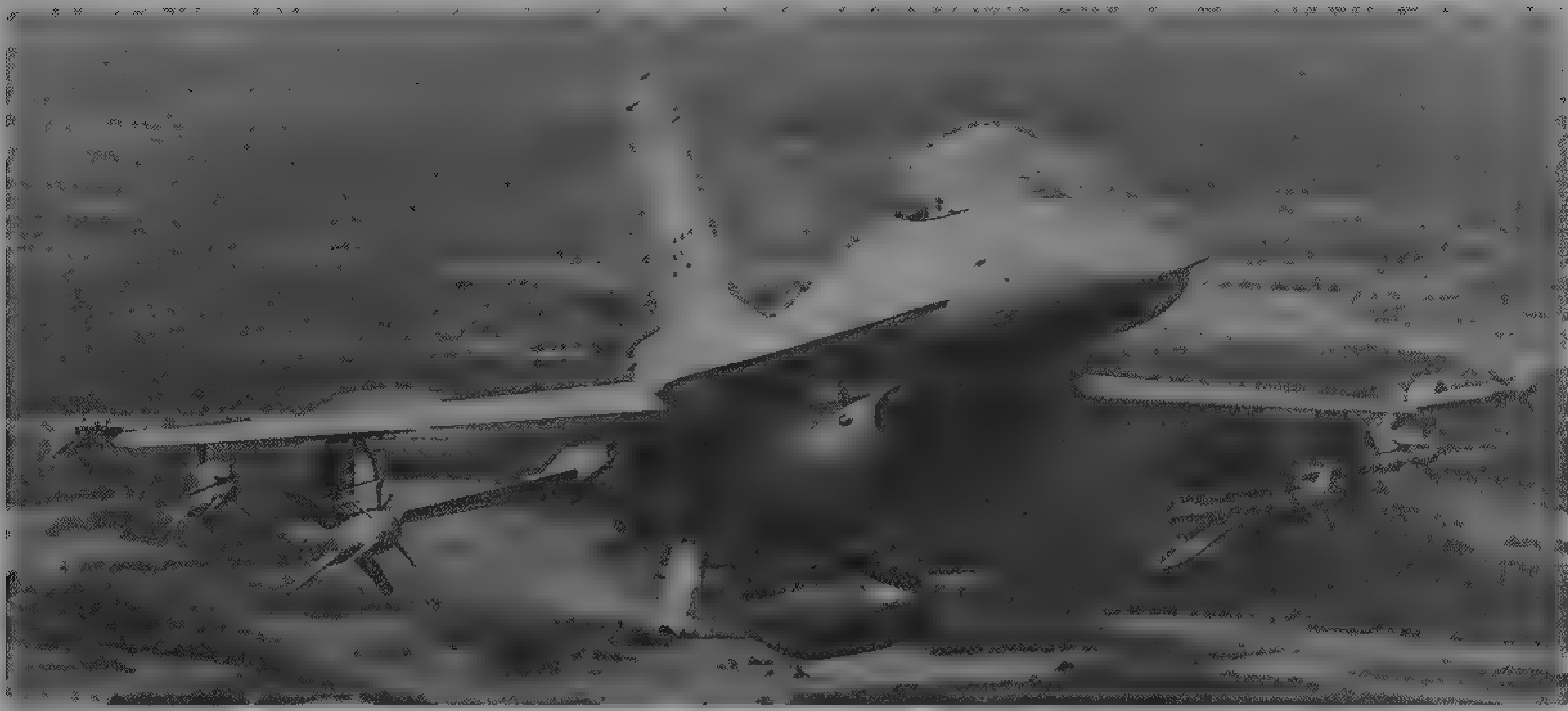
ORAO AIR DEPOT

YU-71163 Rajlovac
Telephone 38 (71) 455444
Fax: 38 (71) 455383
Telex: 41230

Depot overhauled Viper turbojets and made parts for GE, RR and SNECMA engines.

UPDATED

AIR-LAUNCHED MISSILES



Two NFT Penguin Mk 3 anti-ship missiles are carried on the inner wing pylons of a Royal Norwegian Air Force No 334 Squadron F-16A Fighting Falcon, augmented by four Bodensee-built AIM-9L Sidewinder AAMs outboard

1995

This section returns to *Jane's*, having last appeared in the 1987-88 edition. Meanwhile, missiles and related devices released from, and carried within, aircraft have been covered in detail by our sister publications, currently the *Jane's Air-Launched Weapons* binder, to which the reader is referred for full descriptions.

It is, therefore, the purpose of the following pages to support the Armament paragraphs of aircraft descriptions in this book by explaining in brief how the potential of individual aircraft is enhanced by their missile armament. Coverage is restricted to missiles carried by, or applicable to, aircraft in the current edition; for this reason, some older missiles are excluded, as are future projects still in the early stages of definition. Contents do include certain anti-tank and shoulder-launched anti-aircraft missiles which have airborne applications, mostly on helicopters.

To expedite retrieval of data, missiles are listed in alphabetical order of name or designation, with full cross-references to alternative epithets. In many instances, the 'manufacturer' of Chinese and Russian missiles is actually the export sales agency.

Key

Roles

AAM	Air-to-air missile
ARM	Anti-radiation missile
ASM	Air-to-surface missile
AShM	Anti-ship missile
ATM	Anti-tank missile
LGB	Laser-guided bomb
SOM	Standoff missile

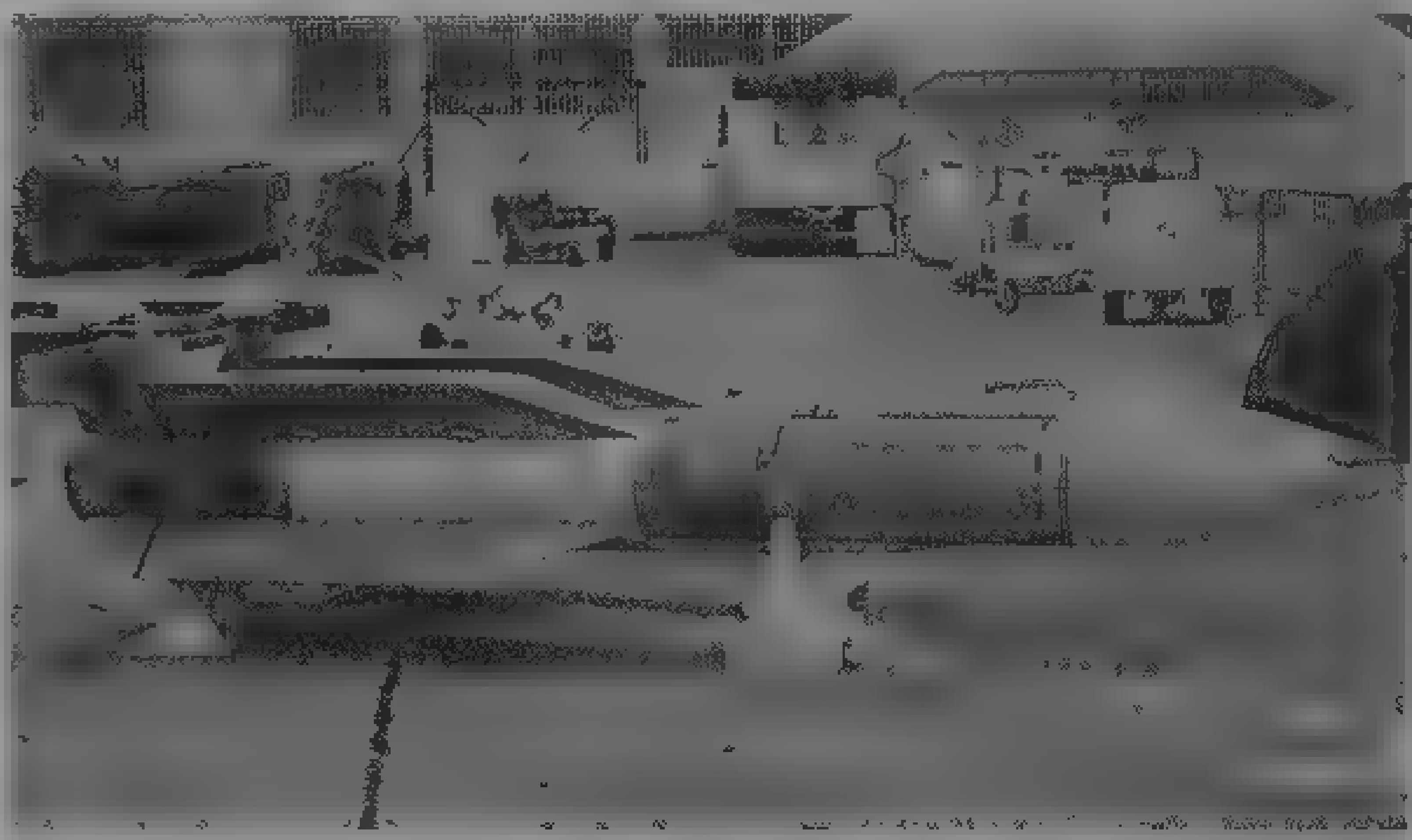
Guidance

AL	Active laser	LR	Laser radar
AP	Autopilot	PR	Passive radar
A/P	Active/passive radar	RC	Radio command
ARH	Active radar homing	RF	Radio frequency
I	Inertial	SARH	Semi-active radar homing
IR	Infra-red	T	Terrain reference
L	Laser	TV	Television

Name/designation	Role	Manufacturer/country	Length	Diameter	Weight	Guidance	Range
3M80 see Moskit							
9M14 see 'Sagger'							
9M17 see 'Swatter'							
9M32 see 'Grail'							
9M36 see 'Gremlin'							
9M39 see 'Grouse'							
9M114 see 'Spiral'							
9M120 see AT 9							
9M313 see 'Gimlet'							
AA-6 see 'Acrid'							
AA-7 see 'Apex'							
AA-8 see 'Aphid'							
AA-9 see 'Amos'							
AA 10 see 'Alamo							
AA 11 see 'Archer'							
AA-12 see 'Adder'							
AAM-3, Type 90	AAM		2.60 m		70 kg	IR/AR	5 km
AAM 4	AAM	Mitsubishi/Japan				ARH	medium
AAM-L, KS-172	AAM	Novator/Russia	7.40 m		750 kg	I/ARH	long
AARGM	ARM	nil/USA				A/P	15+ km
Ababil	ASM	unknown/Iraq	6.00 m		1,000 kg		500 km
ACM, AGM 129	ASM	Hughes/USA	6.35 m	0.70 m	1,250 kg	I/LR	3,000 km
'Acrid', AA-6/R-40R	AAM	Spetztekhnika/Russia	6.20 m	0.36 m	475 kg	I/SARH	30 km
'Acrid', AA-6/R-40TD	AAM	Spetztekhnika/Russia	6.20 m	0.36 m	475 kg	I/IR	
'Adder', AA 12/R 77	AAM		3.60 m	2.00 m	175 kg	I/ARH	150 km
AGM-45 see Shrike							
AGM-65 see Maverick							
AGM 78 see Standard							
AGM 84 see Harpoon/SLAM							
AGM-86 see ALCM							
AGM 88 see HARM							
AGM 114 see Hellfire							

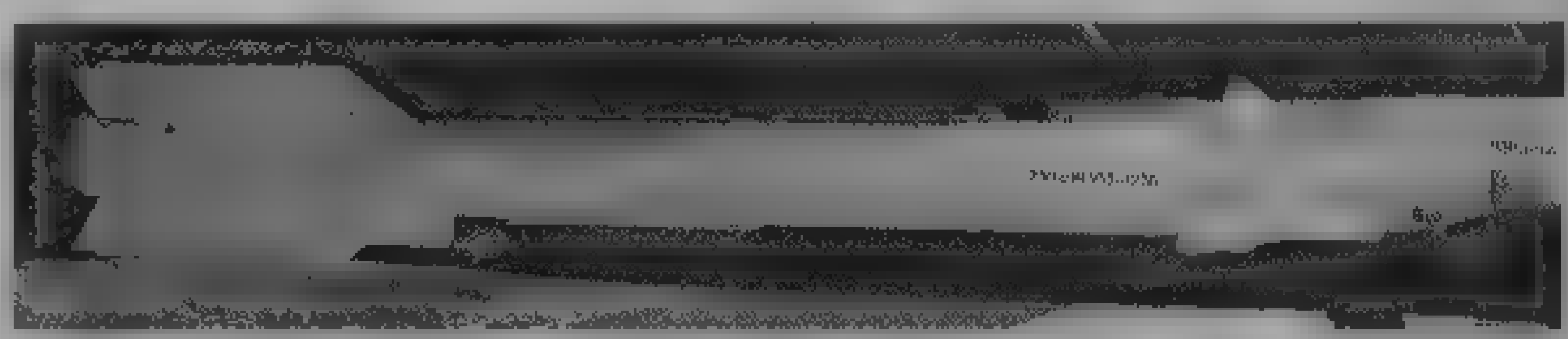
Name/designation	Role	Manufacturer/country	Length	Diameter	Weight	Guidance	Range
AGM 119 see Penguin							
AGM 122 see Sidearm							
AGM 123 see Skipper							
AGM 129 see ACM							
AGM 130	LGB	Rockwell/USA	3.94 m	0.46 m	1,323 kg	TV, IIR	45 km
AGM 142 see Popeye							
AIM 7 see Sparrow							
AIM 9 see Sidewinder							
AIM 120 see AMRAAM							
AIM 132 see ASRAAM							
ALADA	ASM	CASA/Spain					
'Alamo', AA-10/R-27AE	AAM	Spetztekhnika/Russia	4.78 m	0.26 m	350 kg	I/ARH	80 km
'Alamo', AA-10/R-27EM	AAM	Spetztekhnika/Russia	4.78 m	0.26 m	350 kg	I/SARH	110 km
'Alamo', AA-10/R-27ER	AAM	Spetztekhnika/Russia	4.70 m	0.26 m	353 kg	I/SARH	75 km
'Alamo', AA-10/R-27ET	AAM	Spetztekhnika/Russia	4.50 m	0.26 m	343 kg	I/IR	70 km
'Alamo', AA-10/R-27R	AAM	Spetztekhnika/Russia	4.00 m	0.23 m	253 kg	I/SARH	50 km
'Alamo', AA-10/R-27T	AAM	Spetztekhnika/Russia	3.70 m	0.23 m	254 kg	I/IR	40 km


R-27R is the radar-guided version of AA-10 'Alamo' *(Paul Jackson)*
1995


R-33 (AA-9 'Amos') long-range AAM *(Paul Jackson)*
1995

Name/designation	Role	Manufacturer/country	Length	Diameter	Weight	Guidance	Range
ALARM	ARM	BAe/UK	4.30 m	0.22 m	268 kg	PR	45 km
AM 39 see Exocet							
'Amos' AA-9, R-33	AAM	Spetztekhnika/Russia	4.15 m	0.38 m	490 kg	I/SARH	100 km
AMRAAM, AIM-120	AAM	Hughes & Raytheon/USA	3.65 m	0.18 m	157 kg	I/ARH	50 km
ANS/ANF	AShM	consortium/Europe	5.80 m	0.36 m	900 kg	I/ARH	180 km
APACHE	SOM	Matra/France	5.10 m		1,230 kg	I/ARH	150 km
'Apex', AA-7/R-24R	AAM	Spetztekhnika/Russia	4.46 m	0.20 m	235 kg	SARH	20 km
'Apex', AA-7/R-24T	AAM	Spetztekhnika/Russia	4.16 m	0.20 m	215 kg	IR	20 km
'Aphid', AA-8, R-60	AAM	MMPP/Russia	2.08 m	0.13 m	65 kg	IR	3 km
'Aphid', AA-8/R-60M	AAM	MMPP/Russia				AL	5 km
'Archer', AA-11/R-73M	AAM	Spetztekhnika/Russia	2.90 m	0.17 m	105 kg	I/IR	20 km
'Archer', AA-11/R-73M2	AAM	Spetztekhnika/Russia	2.90 m	0.17 m	110 kg	I/IR	30 km

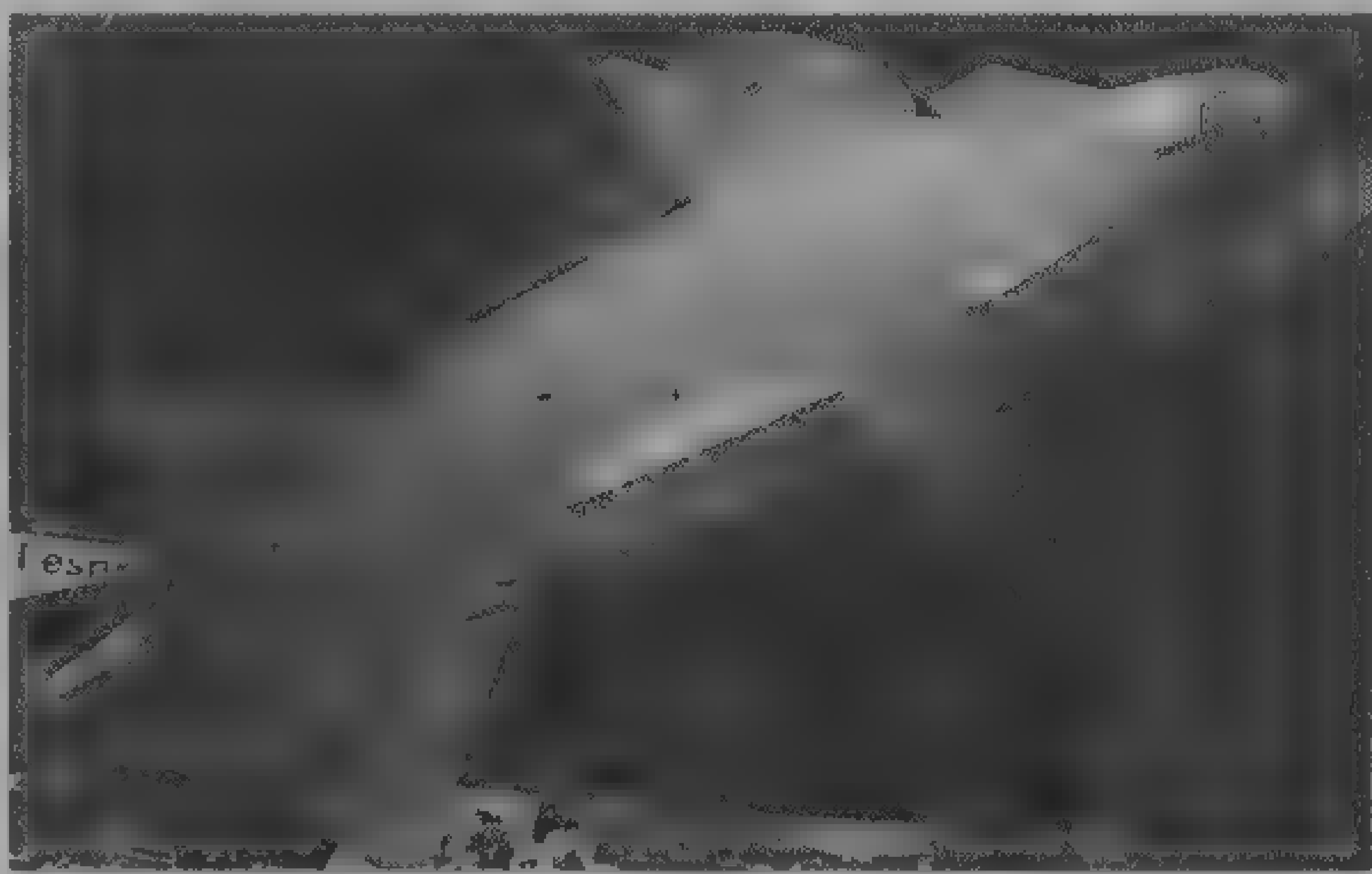

'Aphid' is an agile short-range AAM, R 60T illustrated *(Paul Jackson)*
1995


R-73 (AA-11 'Archer') has a range of 30 km *(Paul Jackson)*
1995

Name/designation	Role	Manufacturer/country	Length	Diameter	Weight	Guidance	Range
ARMAT	ARM	Matra/France	4.15 m	0.40 m	550 kg	I/PR	90 km
AS-4 see 'Kitchen'							
AS-6 see 'Kingfish'							
AS-7 see 'Kerry'							
AS-9 see 'Kyle'							
AS-10 see 'Karen'							
AS-11 see 'Kilter'							
AS-12 see 'Kegler'							
AS-13 see 'Kingbolt'							
AS-14 see 'Kedge'							
AS-15 see 'Kent'							
AS-15TT	AShM	Aerospatiale/France	2.30 m	0.18 m	96 kg	Radio	15 km
AS-16 see 'Kickback'							
AS-17 see 'Krypton'							
AS-18 see 'Kazoo'							
AS-19 see 'Koala'							
AS 30L	ASM	Aerospatiale/France	3.65 m	0.34 m	520 kg	I/SAL	10 km
AS 34 see Kormoran							
AS 37 see Martel							
ASLP	SOM	Aerospatiale/France	5.10 m	–			1,200 km
ASM-1, Type 80	AShM	Mitsubishi/Japan	4.00 m	0.34 m	610 kg	I ARH	50 km
ASM-2, Type 88	AShM	Mitsubishi/Japan				I/IIR	150 km
ASMP	SOM	Aerospatiale/France	5.38 m	0.38 m	860 kg	I/T	250 km
Aspide 1	AAS	Alenia/Italy	3.70 m	0.20 m	220 kg	SARH	35 km
Aspide 2	AAM	Alenia/Italy	3.65 m	0.21 m	230 kg	ARH	40 km
ASRAAM (AIM 132)	AAM	BAe/UK	2.90 m	0.17 m	87 kg	IIR	10 km
AT 2 see 'Swatter'							
AT-3 see 'Sagger'							
AT 6 see 'Spiral'							
AT-9 9M120 Vikhr	ATM	unknown/Russia	1.20 m	0.13 m	17 kg	L	4 km
AT X 16	ATM	unknown/Russia	2.90 m	0.13 m	60 kg	SAL	8 km
BGM-71 see TOW							
Burya see 'Kitchen'							
C 101	AShM	CPMIEC/China	7.50 m	0.54 m	1,500 kg	I ARH	45 km
C-201, HY 4	AShM	CPMIEC/China	7.36 m	0.76 m	1,740 kg	AP/ARH	150 km

Name/designation	Role	Manufacturer/country	Length	Diameter	Weight	Guidance	Range
C-601, CAS-1 'Kraken'/YJ-6	AShM	CPMIEC/China	7.36 m	0.76 m	2,440 kg	AP/ARH	110 km
C-801, YJ-1	AShM	CPMIEC/China	4.65 m	0.36 m	655 kg	I/ARH	40 km
C-802, YJ-2	AShM	CPMIEC/China	6.40 m	0.36 m	715 kg	I/ARH	120 km
CAS-1 see C-601							
Darter, V-3C	AAM	Denel/South Africa	2.75 m	0.16 m	90 kg	IR	5 km
DWS24/DWS39	SOM	DASA/Germany	3.5 m		600 kg	I	10 km
Exocet, AM 39	AShM	Aerospatiale/France	4.70 m	0.35 m	670 kg	I/ARH	50 km
FIM-92 see Stinger							
Gabriel 3AS	AShM	IAI/Israel	3.85 m	0.34 m	560 kg	I/ARH	150 km
Gabriel 4LR	AShM	IAI/Israel	4.70 m	0.44 m	960 kg	I/ARH	200 km
'Gimlet', SA-16/9M313 Igla 1	AAM	Kolomna/Russia	1.69 m	0.07 m	11 kg	IR	5 km
'Grail', SA-7/9M32 Strela 2	AAM	Turopov/Russia	1.22 m	0.07 m	10 kg	IR	5 km
'Gremlin', SA-14/9M36	AAM	Turopov/Russia	1.47 m	0.07 m	11 kg	IR	5 km
'Grouse', SA-18/9M39 Igla	AAM	Kolomna/Russia	1.69 m	0.07 m	11 kg	IR	5 km
Hakim see PGM							
HARM, AGM-88	ARM	Texas Instruments/USA	4.17 m	0.25 m	254 kg	PR	15 km
Harpoon, AGM-84A	AShM	McDonnell Douglas/USA	3.90 m	0.34 m	530 kg	I/ARH	120 km
Have Nap see Popeye							
Have Slick	ASM	not announced	4.60 m	0.70 m	1,400 kg	IIR/ARH	35 km
Hellfire, AGM-114A	ATM	Rockwell/USA	1.63 m	0.18 m	46 kg	SAL	8 km
Hellfire, AGM-114B/C	ATM	Rockwell/USA	1.73 m	0.18 m	48 kg	SAL, IIR or RF+IR	8 km
Helstreak (Starstreak)	AAM	Shorts/UK	1.40 m	0.13 m	16 kg	RC	6 km
HJ-8A	ATM	Norinco/China	0.88 m	0.12 m	11 kg	Wire	3 km
HJ-8B	ATM	Norinco/China	1.00 m	0.12 m	13 kg	Wire	4 km
HOT 1	ATM	Euromissile/Europe	1.27 m	0.14 m	24 kg	Wire	4 km
HOT 2/3	ATM	Euromissile/Europe	1.30 m	0.15 m	24 kg	Wire	4 km
Hsiung Feng 2	AShM	Chung Shan/Taiwan	3.90 m	0.34 m	520 kg	I/ARH+IIR	80 km
HVM	ASM	Loral/USA	2.92 m	0.10 m	32 kg	L or RC	3 km
HY-4 see C-201							
Igla see 'Grouse' and 'Gimlet'							
'Karen', AS-10/X-25MR	ASM	Zvezda/Russia	4.04 m	0.28 m	300 kg	RC	10 km
'Karen', AS-10/X-25ML	ASM	Zvezda/Russia	4.04 m	0.28 m	300 kg	SAL	20 km
'Kazoo', AS-18/X-59M Ovod M	ASM	Raduga/Russia	5.69 m	0.38 m	920 kg	I/TV	115 km
'Kedge', AS-14/X-29L	ASM	Spetztekhnika/Russia	3.90 m	0.40 m	660 kg	SAL	10 km
'Kedge', AS-14/X-29T	ASM	Spetztekhnika/Russia	3.90 m	0.40 m	680 kg	TV	12 km

X-25ML is the laser-guided version of AS-10 'Karen' (*Paul Jackson*)
1995



The TV guided AS-14 'Kedge' is designated X-29T (*Paul Jackson*)
1995

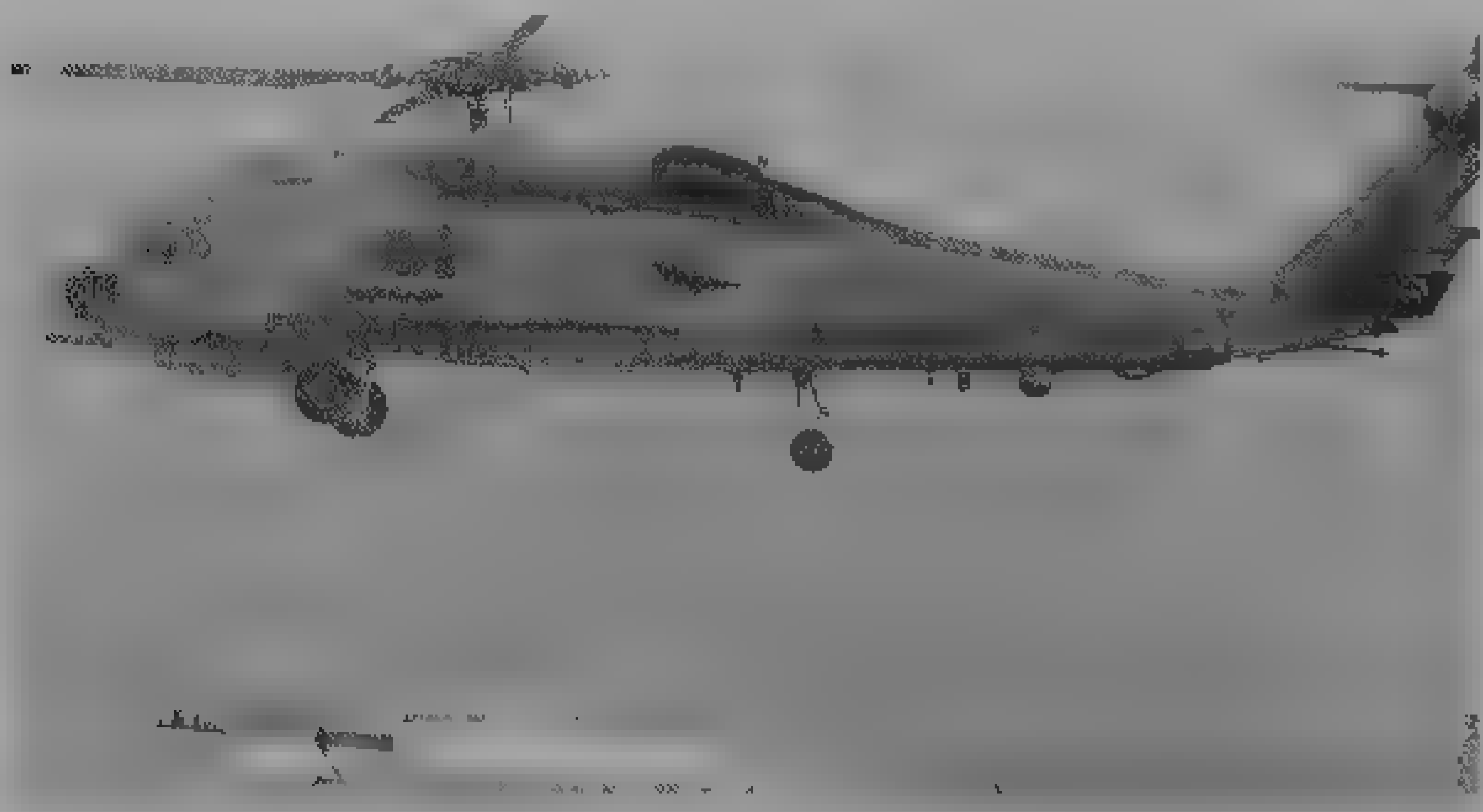
Name/designation	Role	Manufacturer/country	Length	Diameter	Weight	Guidance	Range
'Kegler', AS-12/X-25MP	ASM	Zvedza/Russia	4.36 m	0.28 m	310 kg	I/PR	60 km
'Kent', AS-15/X-55/X-65	SOM	Raduga/Russia	7.10 m	0.51 m	1,500 kg	I/T	3,000 km
'Kerry', AS-7/X-23	ASM	Zvezda/Russia	3.53 m	0.28 m	287 kg	SAL or RC	5 km
Kh- see X							
'Kickback', AS-16/X-25	ASM	Raduga?/Russia	4.78 m	0.46 m	1,200 kg	I/PR or I/ARH	150 km
'Kingfish', AS-6	SOM	Raduga?/Russia	10.56 m	0.92 m	4,500 kg	I/PR or I/ARH	300 km
'Kitchen', AS-4/X-22 Burya	SOM	unknown/Russia	11.30 m	1.00 m	5,900 kg	I/PR or I/ARH	400 km
'Kilter' AS-11/X-58	ARM	Raduga?/Russia	5.00 m	0.38 m	650 kg	I/PR	70 km
'Kingbolt', AS-13/X-59 Ovod	ASM	Raduga?/Russia	5.40 m	0.38 m	800 kg	TV	60 km
'Koala', AS-19 (BL-10)	ASM	reportedly terminated					
Kokon see 'Spiral'							
Kormoran 1, AS 34	AShM	D-Benz/Germany	4.40 m	0.35 m	600 kg	I/ARH	30 km
Kormoran 2, AS 34	AShM	D-Benz/Germany	4.40 m	0.35 m	630 kg	I/ARH	35 km
'Kraken' see C-601							
'Krypton', AS-17/X-31A-1	ASM	Zvezda/Russia	4.70 m	0.36 m	600 kg	I/ARH	50 km
'Krypton', AS-17/X-31A-2	ASM	Zvezda/Russia	5.23 m	0.36 m	600 kg	I/ARH	70 km
'Krypton', AS-17/X-31P-1	ASM	Zvezda/Russia	4.70 m	0.36 m	600 kg	I/PR	150 km
'Krypton', AS-17/X-31P-2	ASM	Zvezda/Russia	5.23 m	0.36 m	600 kg	I/PR	200 km
Kukri, V-3B	AAM	Kentron/South Africa	2.94 m	0.13 m	73 kg	IR	4 km
'Kyle', AS-9/X-28	ARM	unknown/Russia	6.00 m	0.43 m	715 kg	PR	90 km
MAA-1	AAM	Orbita/Brazil	2.82 m	0.15 m	90 kg	IR	5 km
Magic 1, R 550	AAM	Matra/France	2.72 m	0.16 m	89 kg	IR	3 km
Magic 2, R 550	AAM	Matra/France	2.75 m	0.16 m	90 kg	IR	5 km

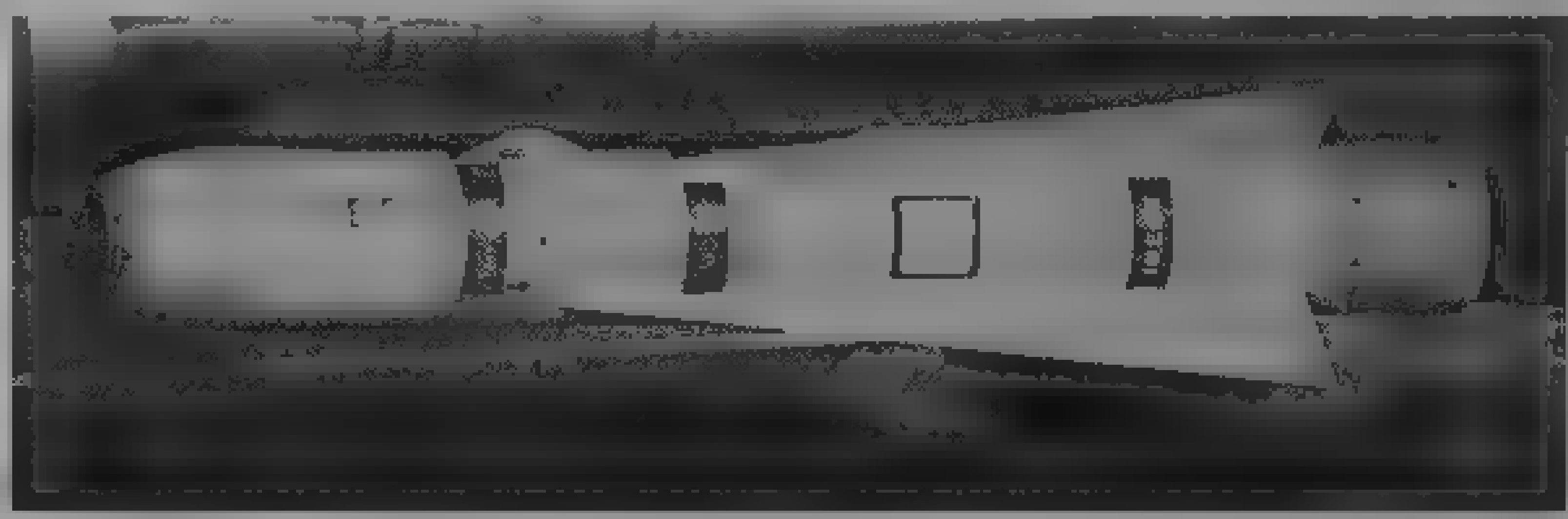
'Krypton' has the Russian designation X-31 (*Paul Jackson*)
1995

Magic 2 on the wingtip rail of a Mirage F1CR (*Paul Jackson*)
1995

Name/designation	Role	Manufacturer/country	Length	Diameter	Weight	Guidance	Range
Marte 2	AShM	OTO Melara/Italy	4.80 m	0.32 m	345 kg	I/ARH	20 km
Marte 2A	AShM	OTO Melara/Italy	3.90 m	0.32 m	260 kg	I/AR	20 km
Marte 2B	ARM	OTO Melara/Italy	3.90 m	0.32 m	260 kg	PR	60 km
Martel, AS 37	ARM	Matra/France	4.20 m	0.40 m	535 kg	PR	55 km

Name/designation	Role	Manufacturer/country	Length	Diameter	Weight	Guidance	Range
Martin Pescador	ASM	CITEFA/Argentina	2.94 m	0.22 m	140 kg	RC	8 km
Mathogo	ASM	CITEFA/Argentina	1.00 m	0.10 m	11 kg	Wire	3 km
Maverick, AGM-65A	ASM	Hughes + Raytheon/USA	2.49 m	0.31 m	210 kg	TV	3 km
Maverick, AGM-65B	ASM	Hughes + Raytheon/USA	2.49 m	0.31 m	210 kg	TV	8 km
Maverick, AGM-65D	ASM	Hughes + Raytheon/USA	2.49 m	0.31 m	220 kg	IIR	20 km
Maverick, AGM-65E	ASM	Hughes + Raytheon/USA	2.49 m	0.31 m	293 kg	SAL	20 km
Maverick, AGM-65F/G	ASM	Hughes + Raytheon/USA	2.49 m	0.31 m	307 kg	IIR	25 km
Maverick, AGM-65H	ASM	Hughes + Raytheon/USA	2.60 m	0.31 m	305 kg	ARH	25 km
MICA	AAM	Matra/France	3.10 m	0.16 m	110 kg	I/ARH or IR	50 km
Mistral, ATAM	AAM	Matra/France	1.80 m	0.09 m	18 kg	IR	5 km
Moskit, X-41/3M80	ASM	Raduga/Russia	9.74 m	0.76 m	4,500 kg	I/ARH or I/PR	250 km
MP-1000	ASM	CITEFA/Argentina	2.94 m	0.22 m	145 kg	Wire	6 km
Nimrod	ASM	IAI/Israel	2.84 m	0.21 m	100 kg	I/SAL	25 km
Ovod see 'Kazoo' and 'Kingbolt'							
Penguin 2, AGM-119B	AShM	NFT/Norway	2.96 m	0.28 m	385 kg	I/IR	30 km
Penguin 3, AGM-119A	AShM	NFT/Norway	3.18 m	0.28 m	370 kg	I/IR	40 km





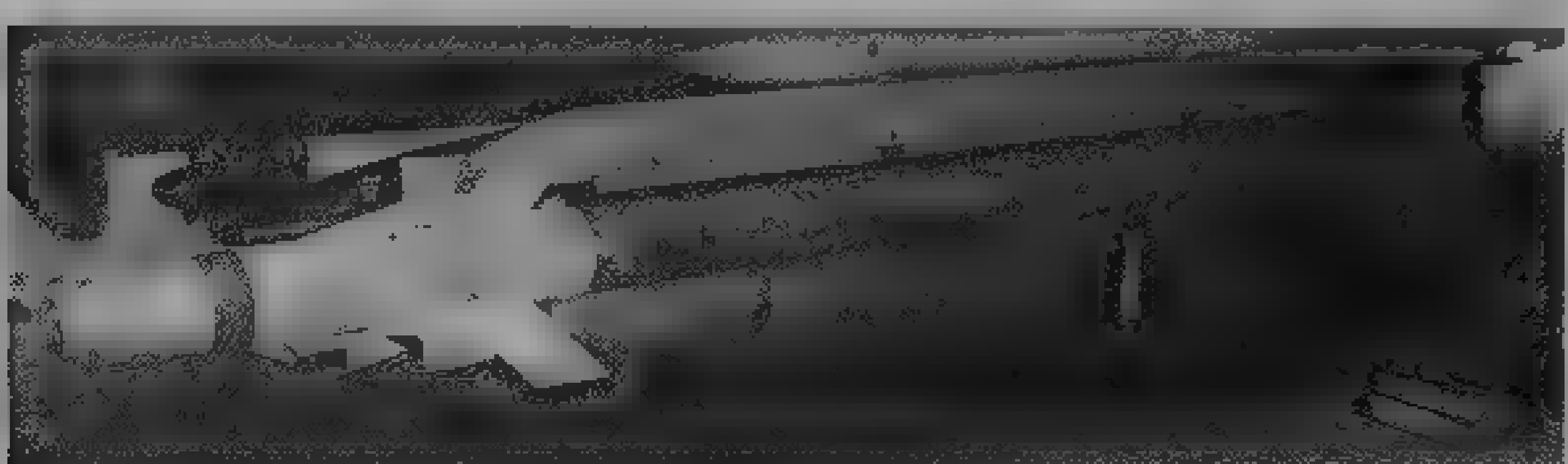
Second member of the growing Maverick family: the magnifying TV-guided AGM-65B *(Paul Jackson)*

1995

Penguin Mk 2 Mod 7 (AGM-119B) has large, folding wings for helicopter launch from US Navy Seahawks

1995

Name/designation	Role	Manufacturer/country	Length	Diameter	Weight	Guidance	Range
PGM-1 Hakim-A	ASM	GEC-Marconi/UK	3.40 m	0.30 m	250 kg	I/SAL	20 km
PGM-2 Hakim-B	ASM	GEC-Marconi/UK	4.70 m	0.38 m	900 kg	I/SAL	20 km
PGM-3A Hakim-C	ASM	GEC-Marconi/UK	3.40 m	0.30 m	250 kg	I/IR	20 km
PGM-3D Hakim-D	ASM	GEC-Marconi/UK	4.70 m	0.38 m	900 kg	I/IR	20 km
PL-2/PL-3	AAM	CATIC/China	2.99 m	0.13 m	76 kg	IR	3 km
PL-5	AAM	CATIC/China	2.89 m	0.13 m	85 kg	IR	3 km
PL-7	AAM	CATIC/China	2.75 m	0.16 m	90 kg	IR	3 km
PL-8	AAM	CATIC/China	3.00 m	0.16 m	120 kg	IR	5 km
PL-9	AAM	CATIC/China	2.99 m	0.16 m	120 kg	IR	5 km
PL-10	AAM	CATIC/China	3.99 m	0.29 m	300 kg	SARH	15 km
Popeye, AGM-142 Have Nap	ASM	Rafael/Israel	4.57 m	0.53 m	1,360 kg	I/TV or I/IR	25 km
Python 3	AAM	Rafael/Israel	3.00 m	0.16 m	120 kg	IR	5 km
Python 4	AAM	Rafael/Israel			105 kg	IR	
R-24 see 'Apex'							
R-27 see 'Alamo'							
R-33 see 'Amos'							
R-37	AAM	Spetztekhnika/Russia	4.20 m	0.38 m	600 kg	I/ARH	150 km
R-40 see 'Acrid'							
R-60 see 'Aphid'							
R-73 see 'Archer'							
R-77 see 'Adder'	AAM						
R-530 see Super 530							
R-550 see Magic							
RB 04	AShM	Saab/Sweden	4.25 m	0.50 m	600 kg	I/AR	30 km
RB 05	ASM	Saab/Sweden	3.60 m	0.30 m	305 kg	RC	8 km
RB 24J Swedish AIM-9J							
RB 71 Swedish Sky Flash							
RB 74 Swedish AIM-9L							
RB 75 Swedish Maverick							
RBS 15F	AShM	Saab/Sweden	4.35 m	0.50 m	598 kg	I/AR	90 km
SA-7 see 'Grail'							
SA-14 see 'Gremlin'							
SA-16 see 'Gimlet'							
SA-18 see 'Grouse'							
'Sagger', AT-3/9M14 Malyutka	ATM	Kolomna/Russia	0.86 m	0.13 m	113 kg	Wire	3 km
SCALP	SOM	Matra/France				I/ARH	
Sea Eagle	AShM	BAe/UK	4.14 m	0.40 m	600 kg	I/ARH	110 km
Sea Skua	AShM	BAe/UK	2.50 m	0.25 m	145 kg	SARH	18 km
Shafrir 2	AAM	Rafael/Israel	2.60 m	0.16 m	95 kg	IR	3 km
Shrike, AGM-45	ARM	Texas Insruments/USA	3.05 m	0.20 m	177 kg	PR	12 km
Sidearm, AGM-122	ARM	Motorola/USA	3.00 m	0.13 m	91 kg	PR	8 km
Sidewinder, AIM-9J	AAM	several/USA	3.05 m	0.13 m	87 kg	IR	8 km
Sidewinder, AIM-9L/M/S	AAM	several/USA & Europe	2.87 m	0.13 m	87 kg	IR	8 km
Sidewinder, AIM-9P	AAM	several/USA	3.07 m	0.13 m	87 kg	IR	8 km
Sidewinder, AIM-9R	AAM	several/USA	2.87 m	0.13 m	87 kg	Visual	8 km
Sidewinder, AIM-9X	AAM	not selected					
Skipper, AGM-123	LGB	ESC/USA	4.33 m	0.36 m	582 kg	SAL	7 km
Sky Flash	AAM	BAe/UK	3.66 m	0.20 m	195 kg	SARH	40 km
Skyshark (unpowered)	ASM	CASMU/Italy	4.76 m		1,050 kg	I	12 km
Skyshark (powered)	ASM	CASMU/Italy	4.76 m		1,170 kg	I	25 km



Similar Sidewinders. AIM-9J (left) has the same guidance fins as -9P, while AIM-9M (right) is in the -9L branch *(Paul Jackson)*

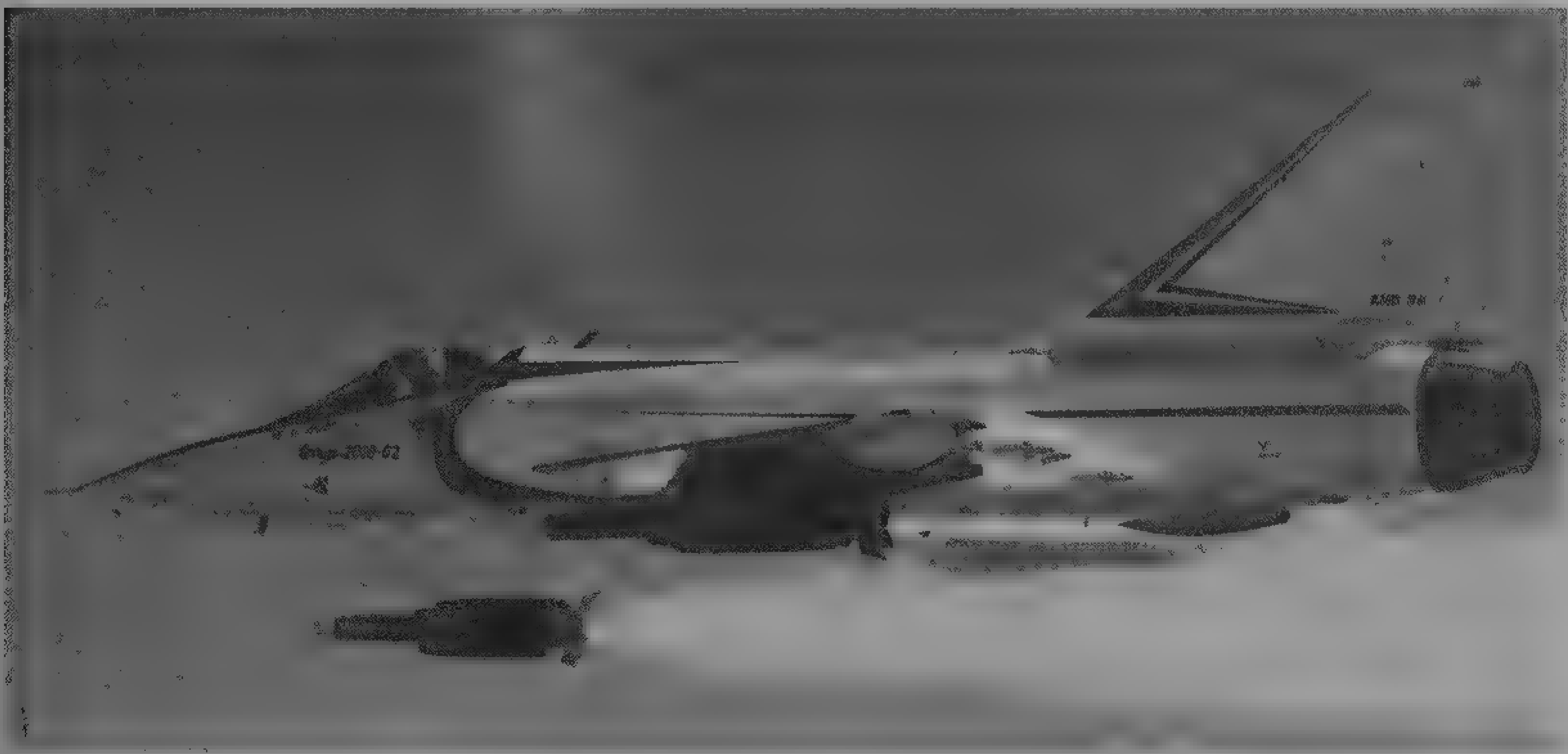
1995

Name/designation	Role	Manufacturer/country	Length	Diameter	Weight	Guidance	Range
Sky Sword (Tien Chien) 1	AAM	Chung Shan/Taiwan	2.87 m	0.13 m	90 kg	IR	5 km
Sky Sword (Tien Chien) 2	AAM	Chung Shan/Taiwan	3.60 m	0.20 m	190 kg	SARH	40 km
SLAM, AGM 84E	ASM	McDonnell Douglas/USA	4.50 m	0.34 m	630 kg	I/GPS/IIR	95 km
Sparrow, AIM-7F	AAM	Hughes + Raytheon/USA	3.66 m	0.20 m	227 kg	SARH	40 km
Sparrow, AIM-7M	AAM	Hughes + Raytheon/USA	3.66 m	0.20 m	230 kg	SARH	45 km
Sparrow, AIM 7P	AAM	Hughes + Raytheon/USA	3.66 m	0.20 m	230 kg	RC/SARH	45 km

SLAM is derived from the Harpoon anti-ship weapon *(Paul Jackson)* *1995*

Unpowered version of Skyshark being launched from an Italian Tornado *1995*

Name/designation	Role	Manufacturer/country	Length	Diameter	Weight	Guidance	Range
'Spiral', AT-6/9M114 Kokon	ATM	Kolomna/Russia	1.83 m	0.13 m	35 kg	RC	5 km
Standard, AGM 78	ARM	Hughes/USA	4.57 m	0.34 m	615 kg	PR	55 km
Starstreak see Helstreak							
Stinger, FIM-92	AAM	Hughes/USA	1.52 m	0.07 m	16 kg	IR	3 km
Super 530D	AAM	Matra/France	3.80 m	0.26 m	270 kg	SARH	40 km
Super 530F1	AAM	Matra/France	3.54 m	0.26 m	245 kg	SARH	25 km
AGM-78 see AGM-78							
'Swatter', AT-2C/9M17 Skorpion	ATM	Nudelman/Russia	1.16 m	0.13 m	30 kg	RC	4 km
Swift, ZT-3	ASM	Denel/South Africa	1.35 m	0.13 m	19 kg	L	4 km
Tien Chien see Sky Sword							
TOW, BGM-71A/B	ATM	Hughes/USA	1.17 m	0.15 m	19 kg	Wire	4 km
TOW, BGM-71C I-TOW	ATM	Hughes/USA	1.45 m	0.15 m	19 kg	Wire	4 km
TOW, BGM-71D TOW 2	ATM	Hughes/USA	1.55 m	0.15 m	22 kg	Wire	4 km
TRIGAT, ATGW-3LR	ATM	consortium/Europe	1.50 m	0.13 m	21 kg	IIR	4 km
Type 80 see ASM 1							
Type 88 see ASM 2							
Type 90 see AAM-3							
U-Darter	AAM	Kentron/South Africa	2.75 m	0.16 m	96 kg	IR	8 km
V-3B see Kukri							
V-3C see Darter							
Vikhr see AT-9							
X-15 see 'Kickback'							
X-22 see 'Kitchen'							
X-23 see 'Kerry'							
X-25 see 'Karen' and 'Kegler'							
X-28 see 'Kyle'							
X-29 see 'Kedge'							
X-35, 'Kh-'35	AShM	Zvezda/Russia	3.75 m	0.42 m	480 kg	I/ARH	130 km
X-41 see Moskit							
X-55/65 see 'Kent							
X-58 see 'Kilter'							
X-59 see 'Kingbolt'							
YJ-1 see C-801							
YJ-2 see C-802							
YJ-6 see C-601							
ZT-3 see Swift							



Launch trials of a Super 530D from a prototype Mirage 2000 *1995*

ADDENDA

AIRCRAFT

AUSTRALIA

GIPPSLAND AERONAUTICS (page 7)

(page 7)

GIPPSLAND GA-8 AIRVAN

TYPE: Single-engined utility transport

PROGRAMME: Design completed 1994, first flight 3 March 1995; certification targeted for mid-1996

DESIGN FEATURES: Strut-braced high-wing monoplane with sweptback vertical tail and fixed tricycle landing gear designed to operate from unprepared strips

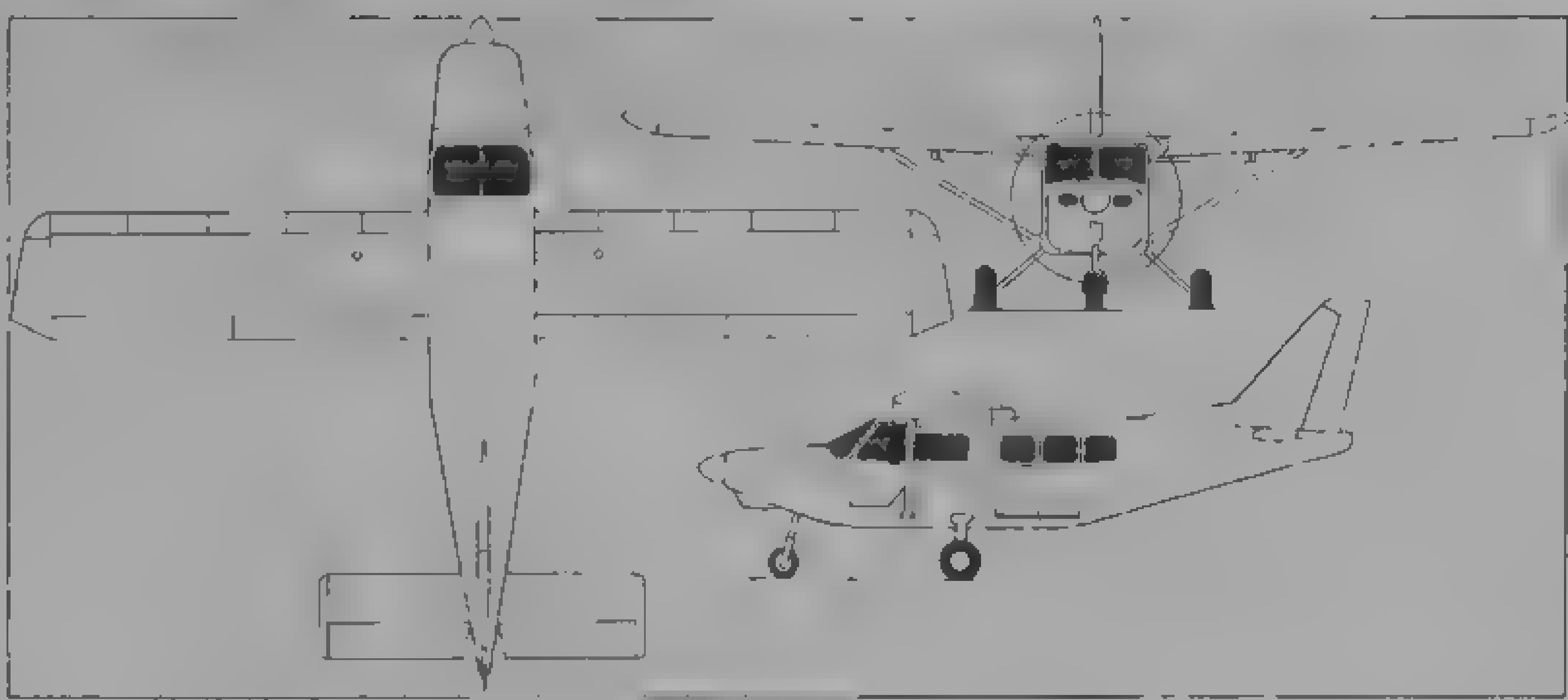
POWER PLANT: Prototype powered by 186.4 kW (250 hp) Textron Lycoming O-540 flat-six engine driving a two-blade propeller; 224 kW (300 hp) IO-540 intended for production aircraft. Fuel capacity 340 litres (89.8 US gallons; 74.8 Imp gallons)

ACCOMMODATION: Pilot and up to seven passengers or equivalent cargo, crashworthy seats. Forward-opening door each side of flight deck, forward-sliding cargo door on port side aft of wing.

DIMENSIONS, EXTERNAL:	
Cargo door: Height	1.08 m (3 ft 6½ in)
Width	1.07 m (3 ft 6 in)
Height to sill	0.89 m (2 ft 11 in)
DIMENSIONS, INTERNAL:	
Cabin: Length, inc. flight deck	4.01 m (13 ft 2 in)
Max width	1.27 m (4 ft 2 in)
Max height	1.19 m (3 ft 11 in)
Floor area: incl flight deck	5.02 m² (54.0 sq ft)
excl flight deck	3.44 m² (37.0 sq ft)
Volume, incl flight deck	5.10 m³ (180.0 cu ft)
WEIGHTS AND LOADINGS:	
Weight empty	862 kg (1,900 lb)
Max payload	816.5 kg (1,800 lb)
Max T-O weight	1,724 kg (3,800 lb)
PERFORMANCE (estimated):	
Range at 120 kts (222 km/h, 138 mph)	680 n miles (1,259 km, 782 miles)

NEW ENTRY

Prototype Gippsland GA-8 Airvan eight seat utility transport
1995



Gippsland GA-8 Airvan (Textron Lycoming IO-540 engine) *(Jane's/Paul Jackson)*
1995

GOAIR
GOAIR PRODUCTS

Hangar 675, Drover Road, Bankstown Airport, NSW 2200
Telephone: 61 (2) 796 3426 or 791 9141
Fax: 61 (2) 791 0354
MANAGING DIRECTOR: Phil Goard

Company manufactures auxiliary fuel tanks and other aviation items. Trainer is first own-design aircraft venture

NEW ENTRY

GOAIR TRAINER

TYPE: Side by side two-seat trainer and tourer

PROGRAMME: Four years in design, public debut at Avalon Air Show March 1995, aimed primarily at flying schools, certification and production dependent upon (initially positive) market response

DESIGN FEATURES: Conventional low wing, fixed gear monoplane (see accompanying illustrations); design goals strength, simplicity, low cost, docile stall characteristics and ease of maintenance; all-metal construction thought more likely to appeal than composites

FLYING CONTROLS: Conventional mechanical

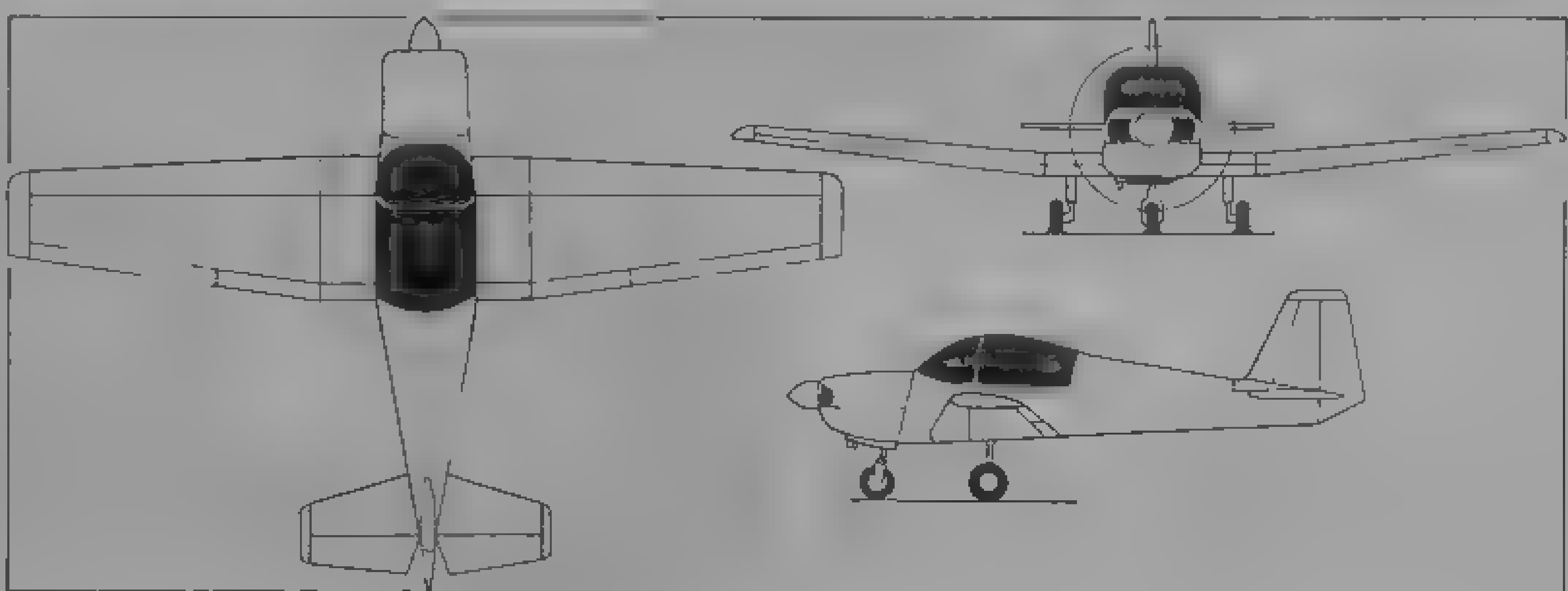
LANDING GEAR: Non-retractable tricycle type

POWER PLANT: One 85.8 kW (115 hp) Textron Lycoming O-235 flat four engine, driving a two-blade metal propeller. Fuel capacity 130 litres (34.3 US gallons, 28.6 Imp gallons)

ACCOMMODATION: Two side by side seats, adjustable fore and aft, dual controls standard. Baggage compartment (0.17 m³; 6 cu ft) behind seats.

AVIONICS: Instrumentation to NVMC standard available

Prototype Goair Trainer at Avalon in March 1995 *(Australian Aviation/Gerard Frawley)*
1995



Goair Trainer (115 hp Textron Lycoming O-235) *(Jane's/Paul Jackson)*
1995

DIMENSIONS, EXTERNAL:
Wing span 8.76 m (28 ft 0 in)
Wing chord at root 1.52 m (5 ft 0 in)
Wing aspect ratio 7.31
Length overall 6.25 m (20 ft 6 in)
Height overall 2.03 m (6 ft 8 in)
AREAS:
Wings, gross 10.50 m² (113.0 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 408 kg (900 lb)
Max T-O weight 680 kg (1,500 lb)
Max wing loading 64.81 kg/m² (13.27 lb/sq ft)
Max power loading 7.94 kg/kW (13.04 lb/hp)
PERFORMANCE (estimated, at 590 kg; 1,300 lb AUW):
Max level speed 115 kts (213 km/h; 132 mph)
Cruising speed 100 kts (185 km/h; 115 mph)
Stalling speed 45 kts (84 km/h; 52 mph)
Max rate of climb at S/L 244 m (800 ft)/min
T-O and landing run 138 m (450 ft)
Endurance 4 h

NEW ENTRY

AUSTRIA

HB FLUGTECHNIK GmbH

Dr Adolf Scharf Strasse 42, PO Box 74, A-4053 Haid-Ansfelden
Telephone: 43 (7229) 79104 or 79117
Fax: 43 (7229) 7910415 or 7911715
MANAGING DIRECTOR: Ing Heino Brditschka

NEW ENTRY

HB FLUGTECHNIK HB-207 ALFA

TYPE: Two-seat light training and touring aircraft, conforms to JAR VLA requirements.

PROGRAMME: First flight (OE-CHC) 14 March 1995.

CURRENT VERSIONS: Offered with several power plant, propeller and avionics options (see relevant paragraphs).

COSTS: Standard aircraft AS399,750 (1995).

DESIGN FEATURES: Constant chord low wings with raked tips, slightly sweptback fin and rudder; one-piece elevator aft of vertical tail.

FLYING CONTROLS: Conventional mechanical (pushrods for ailerons and elevator, cable for rudder). Large central trim tab in elevator. Manual (optionally electric) operation for flaps.

STRUCTURE: Mainly metal primary structure with GFRP skin; moving surfaces have Ceconite covering.

LANDING GEAR: Retractable tricycle type, with size 4.00-4 wheel and tyre on each unit. Main units have brakes and rubber in compression shock-absorption, and retract inward; nosewheel retracts rearward.

POWER PLANT: Standard engine is an 82 kW (110 hp) VW-HB 2400 G/2 flat-four; alternatives can include 59.7 kW (80 hp) Rotax 912A, 74.6 kW (100 hp) Rotax 914, or Limbach or Textron Lycoming engines of similar ratings. Choice of propellers: two-blade wooden fixed-pitch, three-blade adjustable- or variable-pitch, or five-blade adjustable- or variable-pitch. Fuel tank in each wing, combined capacity 80 litres (21 US gallons; 17.6 Imp gallons).

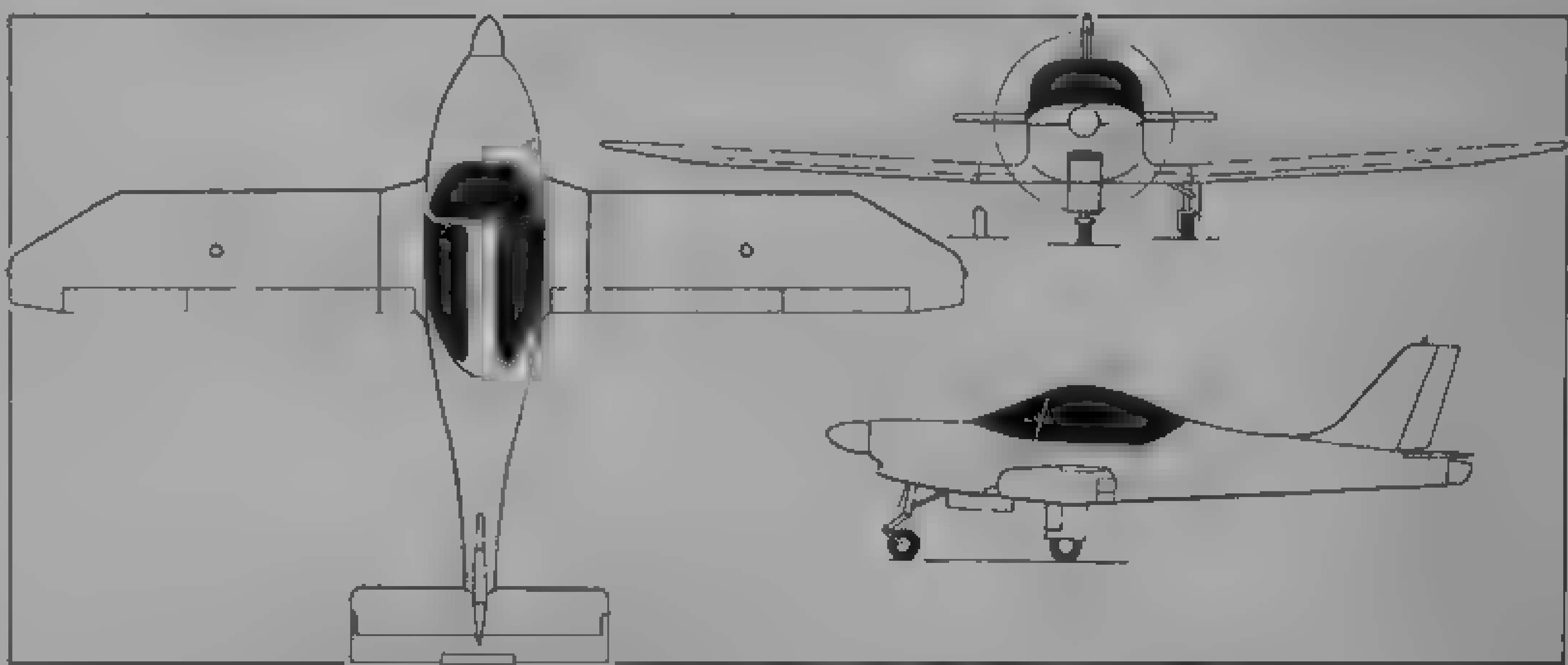
ACCOMMODATION: Two seats side by side under rearward sliding fully transparent canopy.

SYSTEMS: Electrical system: 200 A 15 Ah (optionally 20 Ah) battery.

AVIONICS: *Comms:* Bendix/King 760-channel KX 155 transceiver, KT 76A transponder and ELT optional.
Flight: Bendix/King KX 125 VOR with KI 208 indicator optional.
Instrumentation: VFR flight and engine transmission instrumentation standard.

DIMENSIONS, EXTERNAL:
Wing span 9.00 m (29 ft 6¼ in)
Wing aspect ratio 8.53
Length overall 5.90 m (19 ft 4¼ in)
Height overall 1.95 m (6 ft 4¾ in)
AREAS:
Wings, gross 9.50 m² (102.26 sq ft)
WEIGHTS AND LOADINGS:
Weight empty 430 kg (948 lb)
Max T-O weight 640 kg (1,411 lb)
Max wing loading 67.37 kg/m² (13.80 lb/sq ft)
Max power loading:
VW HB-2400 G/2 7.81 kg/kW (12.83 lb/hp)
Rotax 912A 10.73 kg/kW (17.64 lb/hp)

Austrian HB-207 Alfa two-seat lightplane *1995*



HB Flugtechnik Alfa (Volkswagen engine) *(Jane's/Paul Jackson)* *1995*

PERFORMANCE (at max T-O weight, VW-HB 2400 G/2 engine):
Max level speed 166 kts (308 km/h; 191 mph)
Cruising speed 135 kts (250 km/h; 155 mph)
Stalling speed: flaps up 49 kts (90 km/h; 56 mph)
30° flap 41 kts (75 km/h; 47 mph)
Max rate of climb at S/L 330 m (1,082 ft)/min
T-O run 180 m (591 ft)
T-O to 15 m (50 ft) 350 m (1,149 ft)
Range approx 540 n miles (1,000 km; 621 miles)
g limits: Aerobatic +6/−3
Utility +4.4/−2.2

NEW ENTRY

HOAC (page 11)

HOAC HK-36R SUPER DIMONA

CURRENT VERSIONS: **Super Dimona:** Main production variant.

Super Dimona TS: Introduced 1995, fitted with winglets, increasing span to 16.55 m (54 ft 3½ in); max rate of climb at S/L increased to 270 m (885 ft/min); certified for glider- and banner towing.

NEW ENTRY

Winglets and towing hook are visible in this view of Super Dimona TS prototype OE-9416 *(Paul Jackson)* *1995*

CANADA

BELL HELICOPTER TEXTRON (page 24)

BELL 407

Following are additional preliminary data

POWER PLANT: Usable fuel capacity (407) 477 litres (126 US gallons, 105 Imp gallons) standard, provision for 76 litre (20 US gallon, 16.7 Imp gallon) auxiliary tank

DIMENSIONS, EXTERNAL

Main rotor diameter	10.67 m (35 ft 0 in)
Tail rotor diameter	1.63 m (5 ft 4 in)
Length overall	12.70 m (41 ft 8 in)
Height overall	3.56 m (11 ft 8 in)

WEIGHTS AND LOADINGS

Weight empty, equipped	1,170 kg (2,600 lb)

PERFORMANCE (estimated, at internal load MTOW, ISA):

Max cruising speed: at S/L	128 kts (237 km/h, 147 mph)
at 1,200 m (3,940 ft)	131 kts (243 km/h, 151 mph)
Econ cruising speed: at S/L	116 kts (215 km/h; 134 mph)
at 1,200 m (3,940 ft)	114 kts (211 km/h, 131 mph)
Service ceiling	5,460 m (17,900 ft)
Hovering ceiling: IGE	3,440 m (11,285 ft)
OGE	2,470 m (8,100 ft)
Range at above econ cruising speeds:	
at S/L	328 n miles (608 km; 378 miles)
at 1,200 m (3,940 ft)	361 n miles (669 km; 416 miles)

UPDATED

BELL 430

The following details amend or are additional to those on page 29:

POWER PLANT: Transmission rating 779 kW (1,045 shp) for 5 minutes for T-O, 738 kW (990 shp) maximum continuous. Usable fuel capacity 935 litres (247 US gallons, 206 Imp gallons) in skid version, 710 litres (187.5 US gallons, 156 Imp gallons) in wheeled version; provision in both versions for 182 litre (48 US gallon, 40 Imp gallon) auxiliary tank

DIMENSIONS, EXTERNAL

Length: fuselage (incl tailskid)	13.44 m (44 ft 1 in)
overall, rotors turning	15.39 m (50 ft 6 in)
Fuselage max width over sponsons	3.45 m (11 ft 4 in)
Height to top of rotor head:	
skid version	3.86 m (12 ft 8 in)
wheeled version	3.71 m (12 ft 2 in)

WEIGHTS AND LOADINGS (A: skid version, B: wheeled version):

Weight empty, equipped: A	2,352 kg (5,185 lb)
B	2,388 kg (5,265 lb)
Max external load: A, B	1,586 kg (3,496 lb)
Max T-O weight, internal load: A, B	4,082 kg (9,000 lb)

PERFORMANCE (estimated, at internal load MTOW except where indicated, ISA, A and B as above):

Max cruising speed at S/L:	
A	139 kts (257 km/h, 160 mph)
B	143 kts (265 km/h; 165 mph)
Econ cruising speed at average mid-cruise weight:	
A	122 kts (226 km/h, 140 mph)
B	126 kts (233 km/h, 145 mph)
Service ceiling: A, B	4,450 m (14,600 ft)
Service ceiling, OEI: A, B	1,890 m (6,200 ft)
Hovering ceiling: IGE: A, B	4,180 m (13,715 ft)
OGE: A, B	2,440 m (8,000 ft)
Range at above econ cruising speeds, no reserves:	
A	378 n miles (700 km, 435 miles)
B	293 n miles (543 km, 337 miles)

UPDATED

CANADAIR (page 31)

Cutaway drawing of Canadair Global Express

1995

CHINA, PEOPLE'S REPUBLIC

CAC (page 48)

CHENGDU FC-1

TYPE: Single-seat air superiority fighter and ground attack aircraft

PROGRAMME: Fighter China (FC) programme launched 1991 following cancellation of US participation in development of Chengdu Super-7, which it apparently replaces. Some design assistance from MAPO-Mikoyan OKB. Two static test airframes being built, to begin testing second half of 1996. First of three prototypes due to fly early 1997, followed by service entry in about 2000. Expectation of eventual production rate of approximately 50 per year

CUSTOMERS: Envisaged for air forces of China and Pakistan initially, but costed to be competitive in wider export market. Seen as potential replacement for Shenyang F-6, Northrop F-5 and Dassault Mirage III/5

COSTS: CATIC forecast (1995) of unit cost below $15 million.

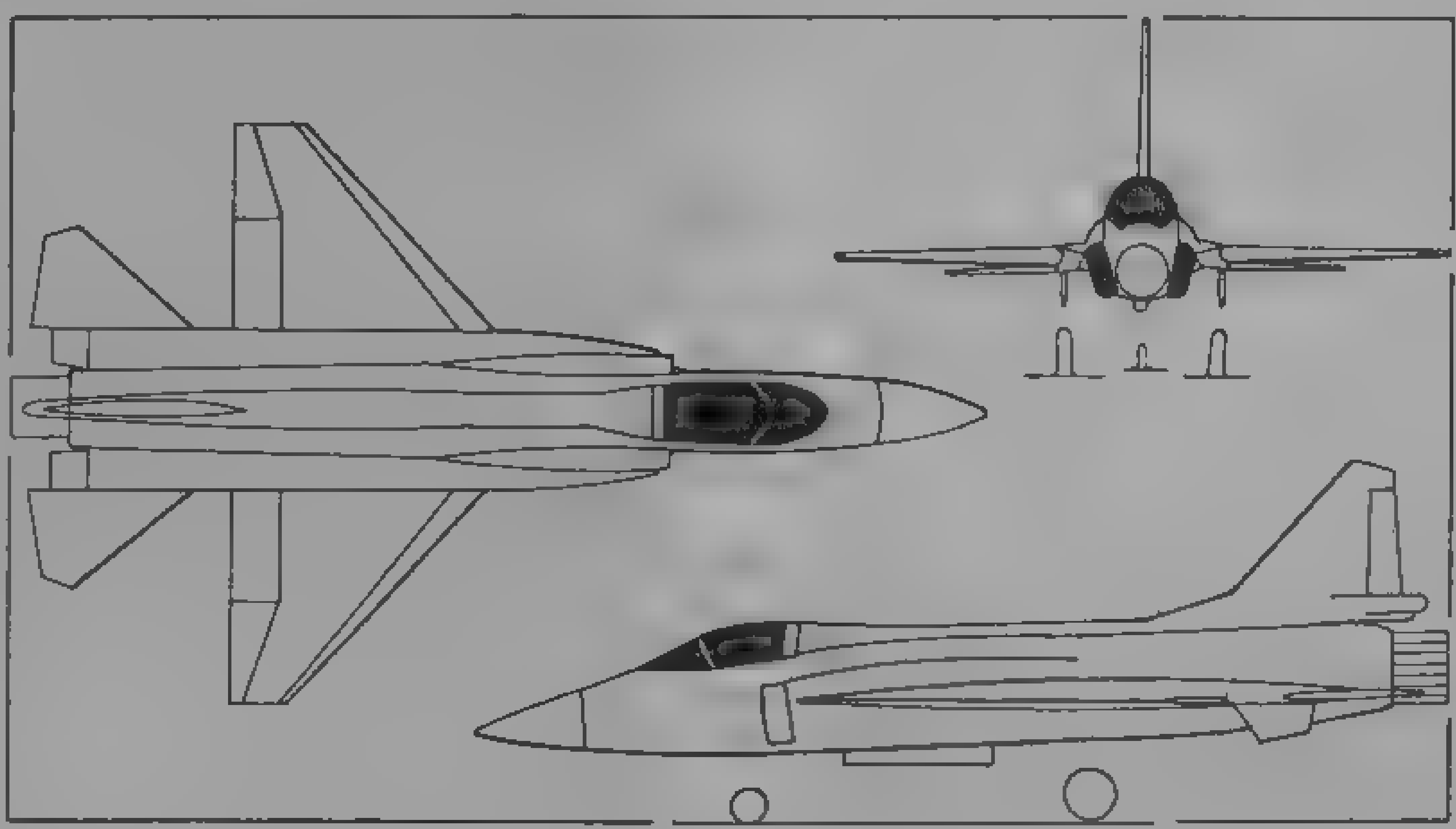
DESIGN FEATURES: Mid-mounted delta wing with narrow wingroot strakes at leading-edge; single turbofan engine, side-mounted twin intakes, with splitter plates, large intake trunks provide space for considerable internal fuel capacity. Large main fin with dorsal fairing; two smaller, uncanted ventral fins.

FLYING CONTROLS: Conventional hydraulic servo-operated control of ailerons, rudder and all moving tailplane initially, with single analog fly-by-wire system for back-up, provision for FBW to become primary system later. Trailing-edge flaps; emphasis on high manoeuvrability probably also indicates use of leading-edge flaps.

STRUCTURE: Primary structure conventional aluminium alloy semi-monocoque. Some components to be manufactured in Pakistan

LANDING GEAR: Retractable tricycle type, with single wheel and oleo shock-absorber on each unit. Mainwheels retract upward into engine intake trunks; nosewheel retracts rearward

POWER PLANT: One Klimov RD-93 (RD-33 derivative) turbofan (81.4 kN; 18,300 lb st with afterburning), possibly to be licence built by Liyang Machinery Corporation for production aircraft. Could have alternative Western engine at customer's option. Substantial internal fuel capacity. Provision for external fuel tanks



Provisional drawing of the Chengdu FC-1 multirole fighter *(Jane's/Paul Jackson)*

1995

ACCOMMODATION: Single seat (Martin-Baker zero/zero Mk 10 in aircraft for Pakistan) under one-piece canopy. Two-seat training versions also planned

AVIONICS: Expected to be of domestic origin for Chinese squadrons and Western type for Pakistan Air Force. Will include pulse Doppler multirole radar

ARMAMENT: Underfuselage centreline station for 23 mm GSh-23-2 twin-barrel cannon or other store, two

attachments under each wing and one at each wingtip. Weapons expected to include PL-7 and/or PL-10 AAMs, ASMs, bombs, gun and rocket pods, or other stores

DIMENSIONS, EXTERNAL:

Wing span over AAMs	9.50 m (31 ft 2 in)
Length overall	13.95 m (45 ft 9¼ in)
Height overall	5.015 m (16 ft 5½ in)
Wheel track	2.30 m (7 ft 6½ in)
Wheelbase	5.135 m (16 ft 10¼ in)

WEIGHTS AND LOADINGS:

Operating weight empty	9,300 kg (20,530 lb)
Max external stores load	3,200 kg (7,055 lb)
Max T-O weight	12,500 kg (27,557 lb)
Max power loading	102.0 kg/kN (1.51 lb/lb st)

PERFORMANCE (estimated):

Max level speed at altitude, clean	Mach 1.6 to 1.8
Service ceiling	16,000 m (52,000 ft)
T-O run	400 m (1,313 ft)
Landing run	600 m (1,969 ft)
Combat radius:	
fighter	648 n miles (1,200 km, 745 miles)
ground attack	378 n miles (700 km, 435 miles)
Max range on internal fuel	864 n miles (1,600 km, 994 miles)

NEW ENTRY

Artist's impression of FC-1 fighter, revealed in June 1995 and due to fly in 1997
1995

Model of projected FC-1 fighter *(Paul Jackson)*
1995

CZECH REPUBLIC

AERO (page 69)

AERO L 159

TYPE: Single-seat light attack aircraft.

PROGRAMME: F124 turbofan selected as power plant mid-1994; avionics contract, competed for by Rockwell Aerospace, Sextant Avionique and Elbit, awarded late 1994 and valued at about $190 million. Czech government development agreement given 7 April 1995 and production commitment later same month. First prototype to be two-seater, to fly second half 1996, followed by second prototype (single-seater) first quarter 1997; production deliveries to Czech Air Force planned to begin late 1998/early 1999 and continue until about 2005.

CUSTOMERS: Czech Air Force (initial commitment for 72).

COSTS: Estimated CKr1,400 million ($50 million) to develop single-seat version (1995).

DESIGN FEATURES: Configuration generally as L-39/59 except for larger, redesigned nose to accommodate radar; fatter rear fuselage; single-seat armoured cockpit; Western avionics; 297 kg (655 lb) additional fuel tank in lieu of second seat.

STRUCTURE: Generally as for L-39/59 except for cockpit armour protection with composites and ceramics.

POWER PLANT: One 28.02 kN (6,300 lb st) AlliedSignal/ITEC F124-GA-100 turbofan.

ACCOMMODATION: Single seat in armoured cockpit. First prototype and some 10 per cent of Czech Air Force initial batch will be two-seaters.

AVIONICS: Systems integration of complete suite by Rockwell Aerospace, all linked to MIL-STD-1553B databus

Comms: Include Bendix/King APX 100 IFF transponder

Radar: FIAR Grifo L multimode pulse Doppler radar

Flight: Honeywell H-764G strapdown ring laser gyro INS with GPS, Bendix/King R/Nav, air data computer and liquid crystal colour MFDs, Mason Electric HOTAS controls, Flight Visions FV 3000 HUD; Lear Astronics autopilot and yaw damper

Mission: Dynamic Control Corporation stores management system. Future possibility of reconnaissance, ECM and night navigation/targeting pods

Self-defence: GEC Marconi Sky Guardian 200 E/J-band RWR, integrated with Vinten Vicon 78 Series 455 ECM

ARMAMENT: Centreline hardpoint for gun pod or other store, plus three stores stations under each wing. Planned weapons include AIM 9 Sidewinder or other air-to-air missiles, AGM-65 Maverick or other air-to-surface missiles; gun and rocket pods, and bombs

DIMENSIONS, EXTERNAL:

Wing span	9.54 m (31 ft 3 in)
Length overall	12.53 m (41 ft 1¼ in)
Height overall	4.77 m (15 ft 7¾ in)

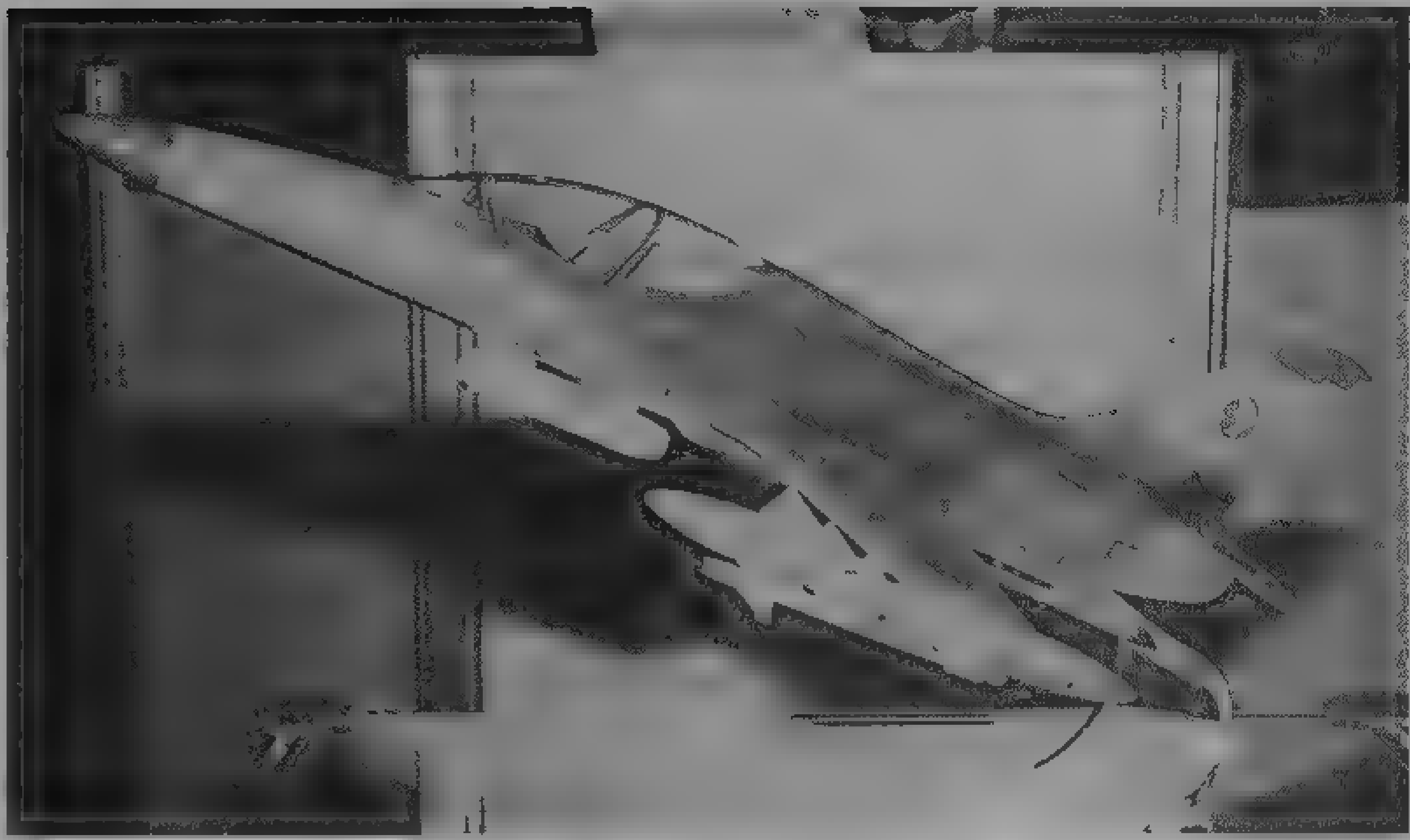
WEIGHTS AND LOADINGS:

Weight empty	4,160 kg (9,171 lb)
Max internal fuel weight, incl wingtip tanks	1,497 kg (3,300 lb)
External fuel weight (four drop tanks)	1,088 kg (2,398 lb)
Max external stores load	2,340 kg (5,159 lb)
Max T-O weight	8,000 kg (17,637 lb)

PERFORMANCE (estimated):

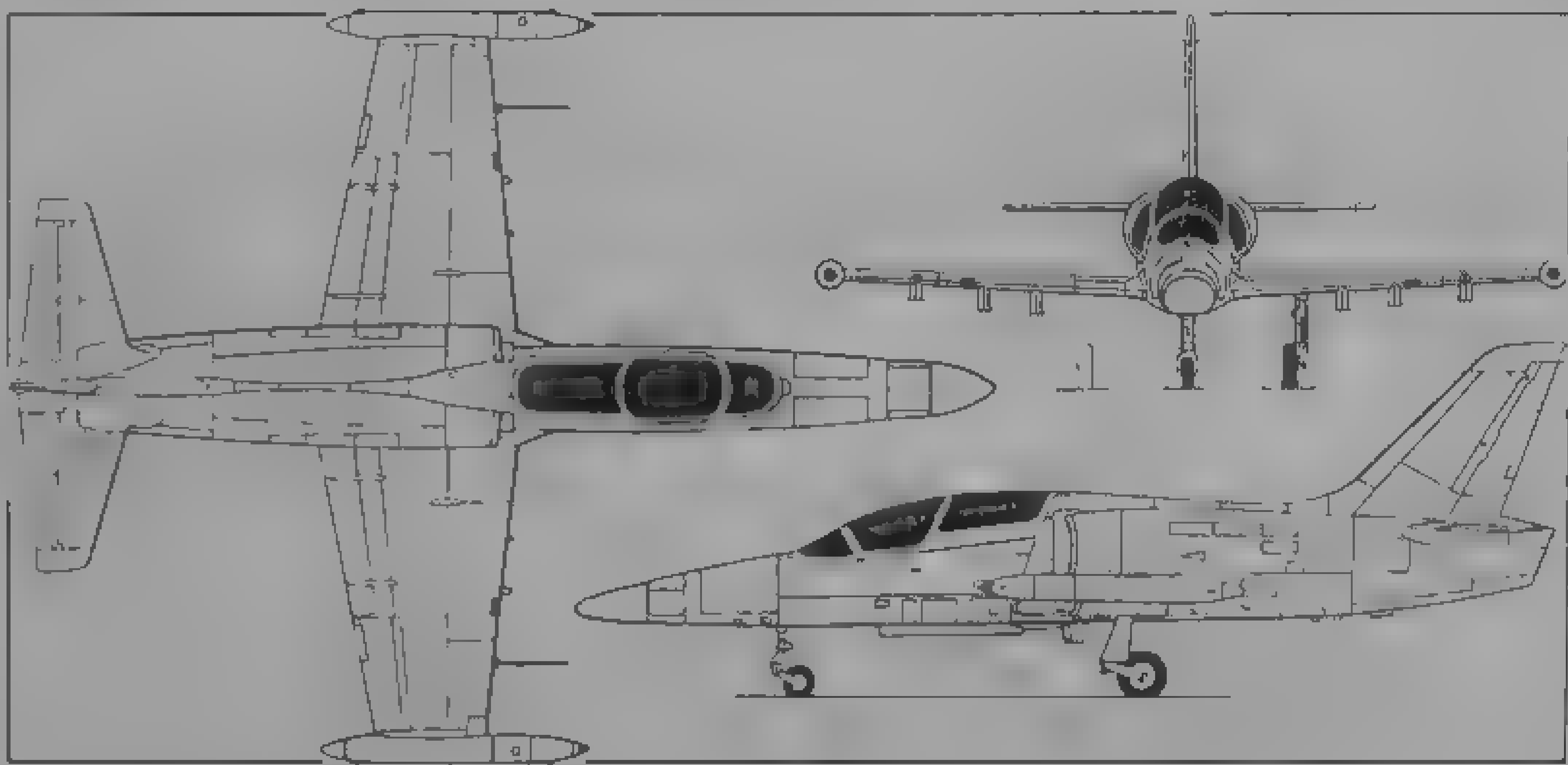
Max level speed at S/L	502 kts (930 km/h, 578 mph)
Max rate of climb at S/L	2,820 m (9,252 ft)/min
Service ceiling	13,200 m (43,300 ft)
T-O run	490 m (1,608 ft)
Max range, internal fuel, 10% reserves	850 n miles (1,574 km, 978 miles)
g limits	+8/−4

NEW ENTRY



Model of radar-equipped Aero L-159 *(Paul Jackson)*

1995



Aero L-159 light attack aircraft *(Jane's/Paul Jackson)*

1995

FRANCE

AERODYN

61 rue Louis Plana, F-31500 Toulouse

NEW ENTRY

AERODYN SKYRANGER

TYPE: Twin-engined seven-seat amphibian

PROGRAMME: Design study

DESIGN FEATURES: High wing, T tail amphibian with fixed floats on struts at about half-span. Design is intended to be to FAR and JAR Pt 23

FLYING CONTROLS: Mechanically operated ailerons, elevator and rudder. Elevator tab for pitch trim

LANDING GEAR: Seaplane fuselage and retractable tricycle type for runways

POWER PLANT: Two 119 kW (160 hp) Lycoming IO-320 flat-four piston engines with five-blade propellers

ACCOMMODATION: Up to seven, including crew. Cargo, ambulance and motor home layouts designed

SYSTEMS: Electrical system: 12 V battery, 14 V alternator

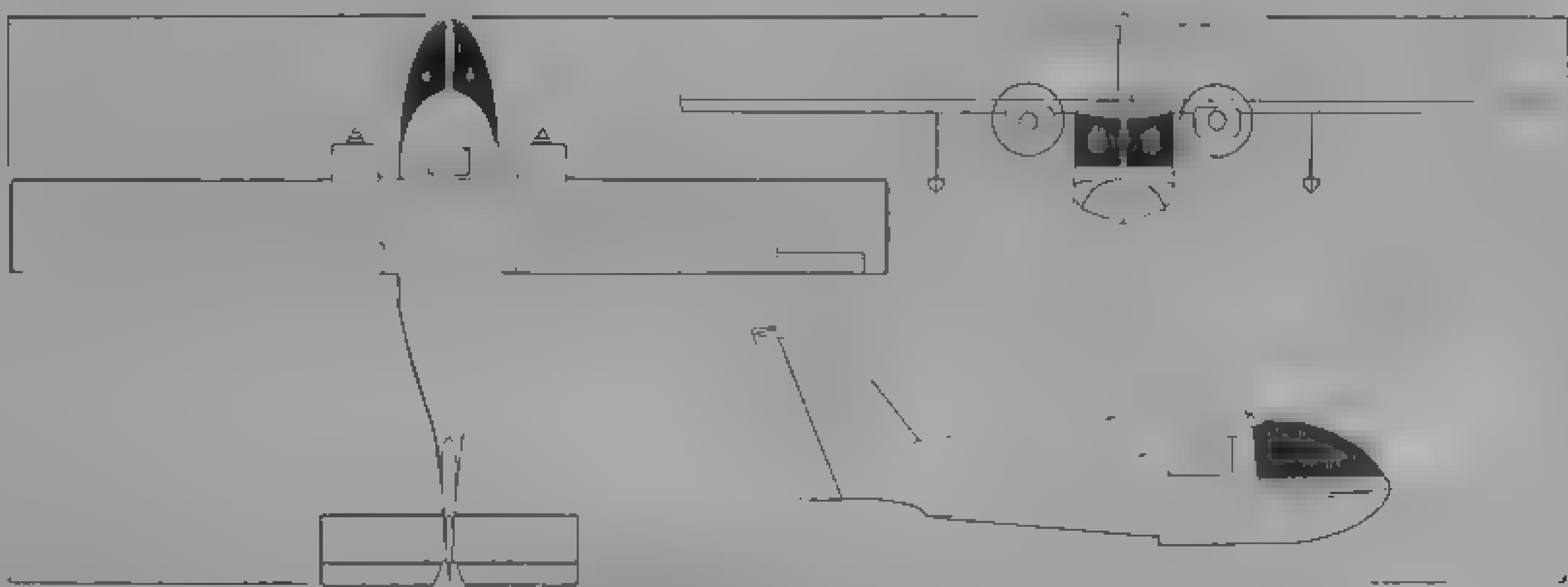
AVIONICS: Customer specified

DIMENSIONS, EXTERNAL:

Wing span	16.90 m (55 ft 5¼ in)
Length overall	10.30 m (33 ft 9½ in)
Height overall	4.70 m (15 ft 5 in)

DIMENSIONS, INTERNAL:

Cabin: Length	7.08 m (23 ft 2¾ in)
Max width	1.70 m (5 ft 6 in)
Max height	1.80 m (5 ft 10¾ in)
Floor area	12.06 m² (129.8 sq ft)
Volume	19.55 m³ (609.4 cu ft)



Aerodyn Skyranger amphibian design study

1995

WEIGHTS AND LOADINGS:

Weight empty	950 kg (2,094 lb)
Max payload	450 kg (992 lb)
Max T-O weight	1,800 kg (3,968 lb)
Max power loading	7.56 kg/kW (12.43 lb/hp)

PERFORMANCE (at max T-O weight, ISA):

Max level speed	140 kts (260 km/h; 161 mph)
Econ cruising speed at 65% power at 1,525 m (5,000 ft)	108 kts (200 km/h, 124 mph)
Service ceiling	4,500 m (14,760 ft)
T-O run: runway	150 m (492 ft)
water	250 m (820 ft)
Landing run, runway and water	160 m (525 ft)
Range with max internal fuel	540 n miles (1,000 km, 621 miles)
Ferry range, two pilots and overload fuel	1,280 n miles (2,370 km; 1,472 miles)

NEW ENTRY

CAMPANA
CAMPANA AVIATION

Aeroport de Tarbes, Pyrène Aéropole, Louey

Telephone: 33 62 32 73 67

Fax: 33 62 32 73 69

NEW ENTRY

CAMPANA AN4

TYPE: Light two-seat aircraft designed to JAR VLA

PROGRAMME: Prototype first flew May 1993, preproduction aircraft (Alhambra F-JBCP) first flew November 1994. Available as quick build version needing engine and instrument panel or as conventional kit taking 250 to 500 man-hours to complete

CURRENT VERSIONS: **AN4**: Basic version *as described*

Alhambra 503: Sporting version, Rotax 503 engine

Observer: For police duties

Whymper: For rough field operations

DESIGN FEATURES: Low-wing monoplane, parallel-chord wing, conventional tail surfaces

FLYING CONTROLS: Mechanically operated ailerons, elevator and rudder. Elevator tab for pitch trim. Fixed tabs on ailerons and rudder. Plain flaps inboard of ailerons

STRUCTURE: Carbon and glassfibre sandwich construction

LANDING GEAR: Tricycle type with spats, tailwheel version available. Cantilever mainwheel legs

POWER PLANT: One 59.7 kW (80 hp) Rotax 912 four-cylinder four-stroke engine driving a variable-pitch three-blade propeller. Fuel capacity total 80 litres (21.1 US gallons; 17.6 Imp gallons) in two wing tanks, alternative total 150 litres (39.6 US gallons; 33.0 Imp gallons) with long-range tanks

ACCOMMODATION: Two side by side seats

SYSTEMS: Electrical system: 12 V 30 Ah battery, 14 V alternator

AVIONICS: Customer specified

DIMENSIONS, EXTERNAL:
- Wing span: 11.08 m (36 ft 4¼ in)
- Wing aspect ratio: 8.58
- Length overall: 6.90 m (22 ft 7¾ in)

DIMENSIONS, INTERNAL:
- Cockpit: Max width: 1.10 m (3 ft 7¼ in)
- Baggage volume: 0.23 m³ (8.2 cu ft)

AREAS:
- Wings, gross: 14.31 m² (154.0 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty: 248 kg (546 lb)
- Max payload: 202 kg (445 lb)
- Fuel weight: basic: 57.6 kg (127 lb)
- long-range tanks: 108.0 kg (238 lb)
- Max T-O weight: 450 kg (992 lb)
- Max wing loading: 31.45 kg/m² (6.44 lb/sq ft)
- Max power loading: 7.54 kg/kW (12.38 lb/hp)

PERFORMANCE (at max T-O weight, ISA):
- Never-exceed speed (VNE): 135 kts (250 km/h; 155 mph)
- Max cruising speed: 113 kts (210 km/h; 130 mph)
- Stalling speed, power off, flaps down: 34 kts (63 km/h; 39 mph)
- Max rate of climb at S/L: 457 m (1,500 ft)/min
- Glide ratio, engine off: 18
- T-O run: 60 m (197 ft)
- Landing run: 80 m (263 ft)
- Range: 918 n miles (1,700 km; 1,056 miles)
- g limits: +3.8/–1.9

NEW ENTRY

Campana AN4 two-seater *(Geoffrey P. Jones)*

1995

CATA
CONSTRUCTION AERONAUTIQUE DE TECHNOLOGIE AVANCEE

Aerodrome de Muret-L'Herm, F-31600 Muret

Telephone/Fax: 33 62 23 03 90

DIRECTORS:
- Yvon Laignel
- Gilbert Mathedy
- Jean Marie Klinka

The LMK designation of the Oryx is from the initials of the firm's directors

NEW ENTRY

CATA LMK.1 ORYX

TYPE: Two-seat high-performance kitplane

PROGRAMME: Design started 1991; ⅓ scale model flew 1992; full scale prototype (F-PLMK) flew September 1994. Permit-to-fly granted by DGAC October 1994. Flown 50 hours by March 1995. Kits produced at one per month from mid-1995, then planned for 30 per year

CUSTOMERS: Three kits to be delivered by June 1995. About 150 expressions of interest

COSTS: About FFr155,000, excluding VAT

DESIGN FEATURES: Designed to FAR Pt 23

FLYING CONTROLS: Mechanically operated ailerons, elevator and rudder. Electrically operated pitch trim and flaps

STRUCTURE: General construction of GFRP

LANDING GEAR: Retractable tricycle type; all legs retract into fuselage. Electrical hydraulic pump with emergency hand pump in cockpit. Castoring nosewheel; directional control by differential toe-operated wheelbrakes

POWER PLANT: One 119 kW (160 hp) Textron Lycoming IO-320B1E with a Mühlbauer MTV11 constant-speed wooden propeller. Fuel capacity 160 litres (42.3 US gallons; 35.2 Imp gallons) in two wing tanks

ACCOMMODATION: Two seats side by side under single-piece, forward-hinged canopy

SYSTEMS: 12 V 30 Ah battery, 14 V alternator

AVIONICS: Customer specified. Space for IFR if required

DIMENSIONS, EXTERNAL:
- Wing span: 7.87 m (25 ft 10 in)
- Wing aspect ratio: 7.65
- Length overall: 6.38 m (20 ft 11¼ in)
- Height overall: 2.06 m (6 ft 9 in)
- Wheel track: 1.07 m (3 ft 6 in)
- Propeller diameter: 1.78 m (5 ft 10 in)

AREAS:
- Wings, gross: 8.10 m² (87.2 sq ft)

WEIGHTS AND LOADINGS:
- Weight empty, equipped: 510 kg (1,124 lb)
- Max payload: 174 kg (383 lb)
- Max fuel weight: 115 kg (253 lb)
- Max T-O weight: 800 kg (1,763 lb)
- Max wing loading: 98.77 kg/m² (20.23 lb/sq ft)
- Max power loading: 6.71 kg/kW (11.02 lb/hp)

PERFORMANCE (at max T-O weight, ISA):
- Never-exceed speed (VNE): 200 kts (370 km/h; 230 mph)
- Max cruising speed at 75% power at 2,440 m (8,000 ft): 180 kts (333 km/h; 207 mph)
- Stalling speed, power off:
  - flaps up: 62 kts (115 km/h; 71 mph)
  - 25° flap: 56 kts (103 km/h; 64 mph)
- Max rate of climb at S/L: 411 m (1,350 ft)/min
- T-O run: 450 m (1,476 ft)
- Landing run: 550 m (1,804 ft)
- Range with max internal fuel: 540 n miles (1,000 km; 621 miles)

NEW ENTRY

CATA LMK.1 Oryx kitplane *(Paul Jackson)*

1995

DASSAULT AVIATION (page 84)

DASSAULT ATLANTIQUE

CURRENT VERSIONS: **Atlantique 3 (ATL-3)**: Developed version, first proposed 1988, renewed promotion in 1995 for UK's Nimrod replacement; features include 50 per cent UK involvement in manufacture; Allison AE 2100 turboprop engines offered as alternative to Rolls-Royce Tyne; high proportion of UK sensors; armament expanded to include provision for four self-protection AAMs

UPDATED

DASSAULT FALCON 50

It was announced on 10 June 1995 that five Falcon 50s in maritime surveillance configuration would be acquired for the French Navy

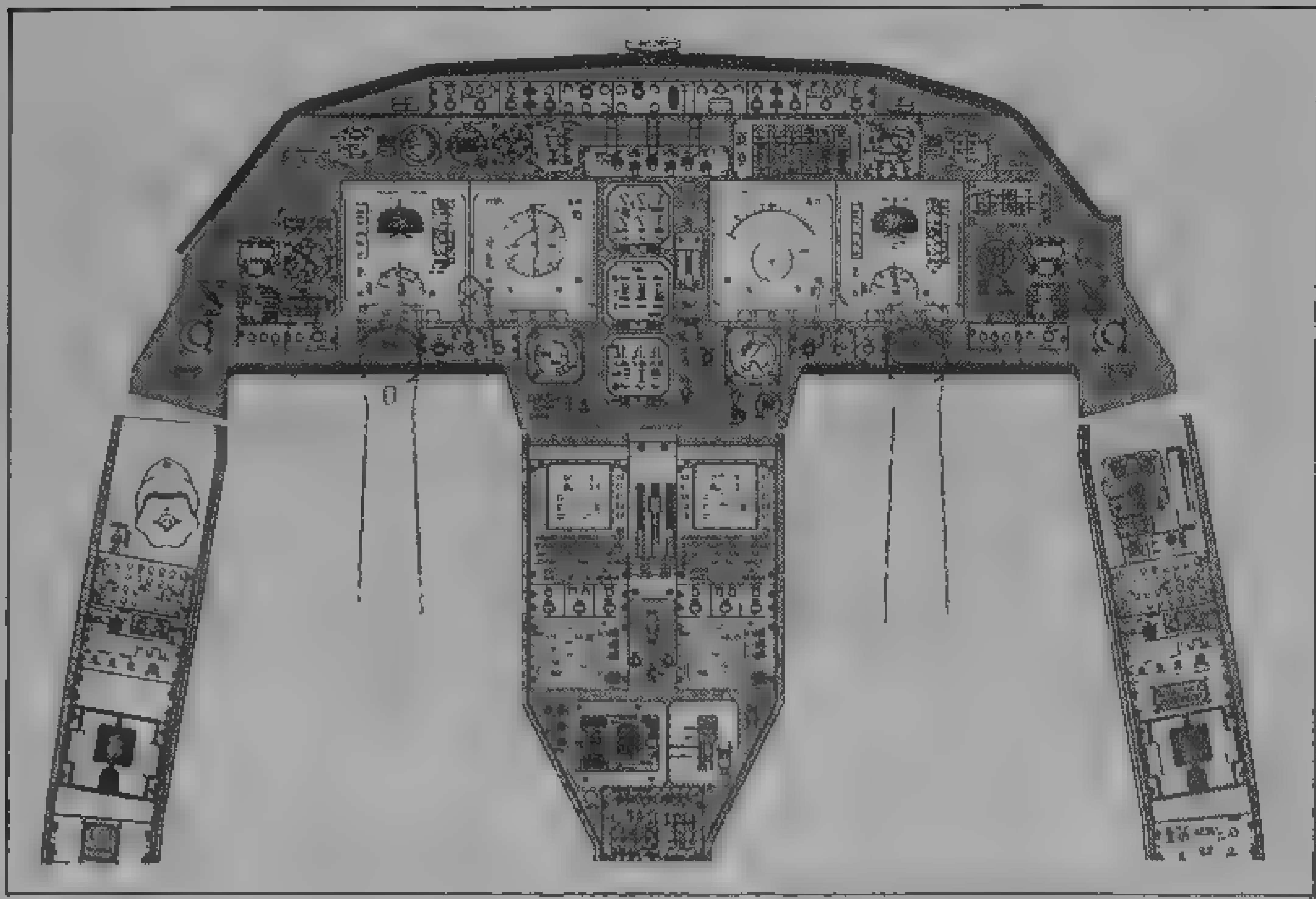
CURRENT VERSIONS: **Falcon 50EX**: Long-range variant announced 26 April 1995, to be powered by three AlliedSignal TFE731-40 turbofans, each rated at 16.46 kN (3,700 lb st), providing a 7 per cent improvement in fuel consumption and a 400 n mile (741 km; 460 mile) increase in maximum range at maximum cruise speed over current model. Maximum cruise speed at 12,200 m (40,000 ft) will increase from Mach 0.75 to Mach 0.80. Time-to-height target is 23 minutes to reach improved initial cruising altitude of 12,500 m (41,000 ft). Falcon 50EX will feature a Collins

Model of Dassault Atlantique 3 *(Paul Jackson)*

1995

Pro Line IV EFIS avionics suite similar to that installed in the Falcon 2000. First two aircraft in production Summer 1995 for first flight in first quarter of 1996, with deliveries beginning in 1997. Unit cost is about $16 million, with estimated market for 150 to 200 over unspecified period. Latécoère, Potez, Reims Aviation, SEFCA and Socata are new subcontractors on programme.

UPDATED



Falcon 50EX flight deck is based on newer Falcon 2000
1995

FOURNIER (page 98)

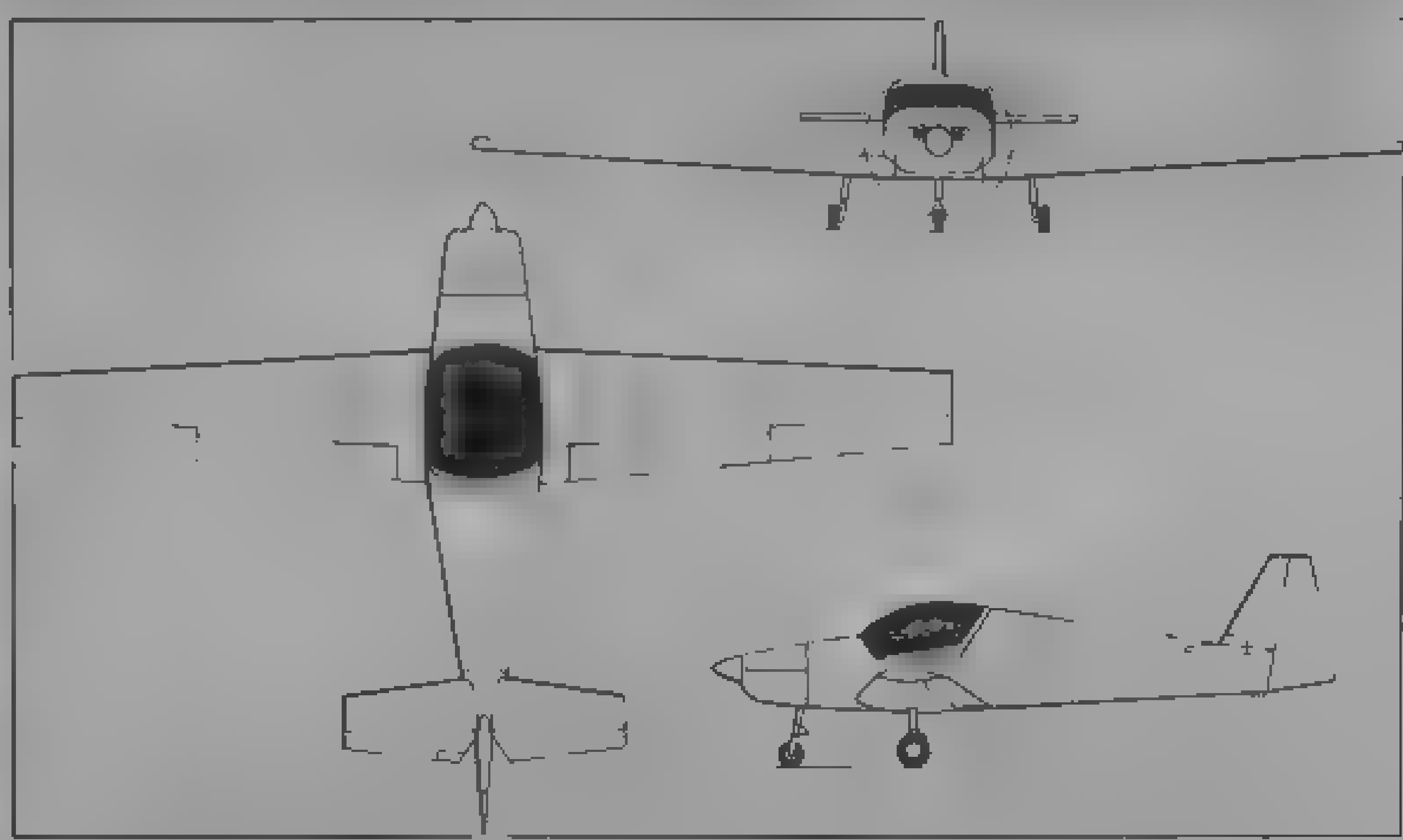
FOURNIER RF-47

COSTS: Export price FFr465,000 (1995) (approximately $93,000). Direct operating costs FFr170 ($35) per hour

UPDATED

Second prototype Fournier RF-47, exhibited at 1995 Paris Air Show *(Paul Jackson)*
1995

Fournier RF-47 cockpit *(Paul Jackson)*
1995



Fournier RF 47 two-seat light aircraft *(Jane's/James Goulding)*
1995

HYDRAVION
HYDRAVION LOURD

Chateau de Belleville, 23 rue de la Garde, F-79100 Sainte-Verge
Telephone: 33 49 66 67 78
Fax: 33 49 96 19 34
PRESIDENT: Philipe Stychef
DIRECTOR-GENERAL: Admiral Yves Goupil
DIRECTOR, DEVELOPMENT: Maurice Goutille
DIRECTOR, COMMERCIAL: Michel Tavernier

NEW ENTRY

HYDRAVION HYDRO 2000

TYPE: Large cargo seaplane
PROGRAMME: Design study stage, 1995
CURRENT VERSIONS: Four-, six- and eight-engined versions proposed, with maximum T-O weights of 800,000 kg (1,763,700 lb); 1,000,000 kg (2,204,600 lb); 1,500,000 kg (3,306,900 lb). *Data follows for six-engined version*
COSTS: Development estimated at $12 billion; unit production cost $400 million
DESIGN FEATURES: Operable in sea conditions with 2 m (6 ft 6 in) wave troughs. High, moderately swept wing with engines mounted on pylons on top of wing to avoid spray. Seaplane fuselage with sponsons below and ahead of wing, and foreplanes above sponsons. T tail
FLYING CONTROLS: Fully powered ailerons, elevator and rudder. Foreplanes above leading edge of sponsons. Fowler flaps
LANDING GEAR: Seaplane hull
POWER PLANT: Six turbofans of 413.7 kN (93,000 lb st) each, options include GE 90, RR Trent 211-52 and PW4087. Fuel capacity 300,000 litres (72,254 US gallons, 65,992 Imp gallons).
ACCOMMODATION: All cargo, one or two loading decks. Up to 114 containers size 2.44 × 2.44 × 3.05 m (8 × 8 × 10 ft); alternatively ISO marine containers: 30 at 12.19 m (40 ft) or 60 at 6.10 m (20 ft).
DIMENSIONS, EXTERNAL (approx):
Wing span 110 m (361 ft)

Wing aspect ratio	9.31
Length overall	108 m (354 ft)
Height overall	25 m (82 ft)

DIMENSIONS, INTERNAL:

Cargo bay: Length	62 m (203 ft)
Max width	8.20 m (26 ft 10¾ in)
Max height	5.70 m (18 ft 8½ in)
Floor area	508.4 m² (5,472 sq ft)
Volume	2,898 m³ (102,338 cu ft)

AREAS:

Wings, gross	1,300 m² (13,993 sq ft)

WEIGHTS AND LOADINGS:

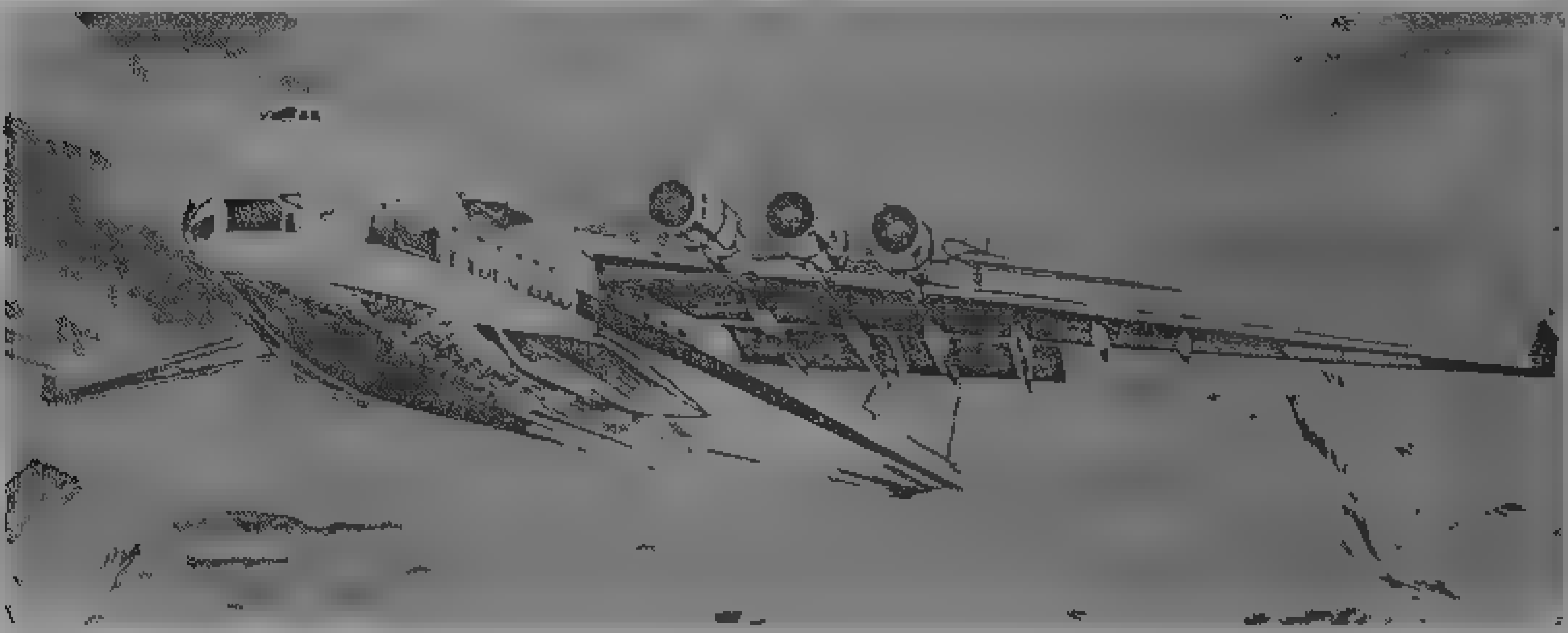
Weight empty	360,000 kg (793,675 lb)
Max payload	400,000 kg (881,850 lb)
Fuel weight	240,000 kg (529,100 lb)
Max T-O weight	1,000,000 kg (2,204,625 lb)
Max wing loading	769.2 kg/m² (157.6 lb/sq ft)
Max power loading	402.8 kg/kN (3.95 lb/lb st)

PERFORMANCE (at max T-O weight, ISA):

Max cruising speed	Mach 0.78
Econ cruising speed	Mach 0.72
T-O run	2,900 m (9,514 ft)
Aborted T-O run	5,000 m (16,404 ft)
Landing run	1,850 m (6,070 ft)

Range with max internal fuel, at Mach 0.72:
400 t (881,849 lb) payload
3,500 n miles (6,482 km; 4,028 miles)
200 t (440,925 lb) payload
7,500 n miles (13,890 km; 8,631 miles)
Ferry range 9,500 n miles (17,594 km; 10,932 miles)

NEW ENTRY



Artist's impression of Hydro 2000 design study in six-engine layout
1995

MONIOT
AVIONS PHILIPPE MONIOT

Issoire Aviation, Zone Industrielle BP 1, F-63501 Issoire Cedex
Telephone: 33 73 55 56 74
Fax: 33 73 89 54 59

NEW ENTRY

MONIOT APM-20 LIONCEAU (LION CUB)

TYPE: Low-wing, side by side two-seat training aircraft.

PROGRAMME: To be certified to JAR-VLA; prototype F-WWMP exhibited at Paris Air Show 1995 prior to first flight. First production aircraft available late Summer 1996.

COSTS: FFr500,000 to 550,000.

DESIGN FEATURES: Low wing, NACA 63618 airfoil, fixed undercarriage, low-mounted tailplane. Designed by Les Industries de Composites d'Auvergne Reunites (ICAR).

FLYING CONTROLS: Mechanically operated ailerons, elevator and rudder. Elevator tab for pitch trim. Fixed tabs on ailerons and rudder. Electrically operated slotted flaps to about two-thirds span.

STRUCTURE: General construction of composites, carbonfibre wing primary structure.

LANDING GEAR: Fixed tricycle type.

POWER PLANT: One 59.6 kW (80 hp) Rotax 912 four-cylinder four-stroke. Fuel capacity 104 litres (27.5 US gallons; 22.9 Imp gallons).

ACCOMMODATION: Two seats side by side.

SYSTEMS: 12 V 30 Ah battery, 14 V alternator.

AVIONICS: Customer specified.

DIMENSIONS, EXTERNAL:

Wing span	8.40 m (27 ft 6¾ in)
Wing aspect ratio	7.67
Length overall	6.25 m (20 ft 6 in)

DIMENSIONS, INTERNAL:

Cabin: Max width	1.10 m (3 ft 7¼ in)

AREAS:

Wings, gross	9.20 m² (99.0 sq ft)

WEIGHTS AND LOADINGS:

Weight empty	324 kg (714 lb)
Max T-O weight	600 kg (1,323 lb)
Max wing loading	65.22 kg/m² (13.36 lb/sq ft)
Max power loading	10.07 kg/kW (16.54 lb/hp)

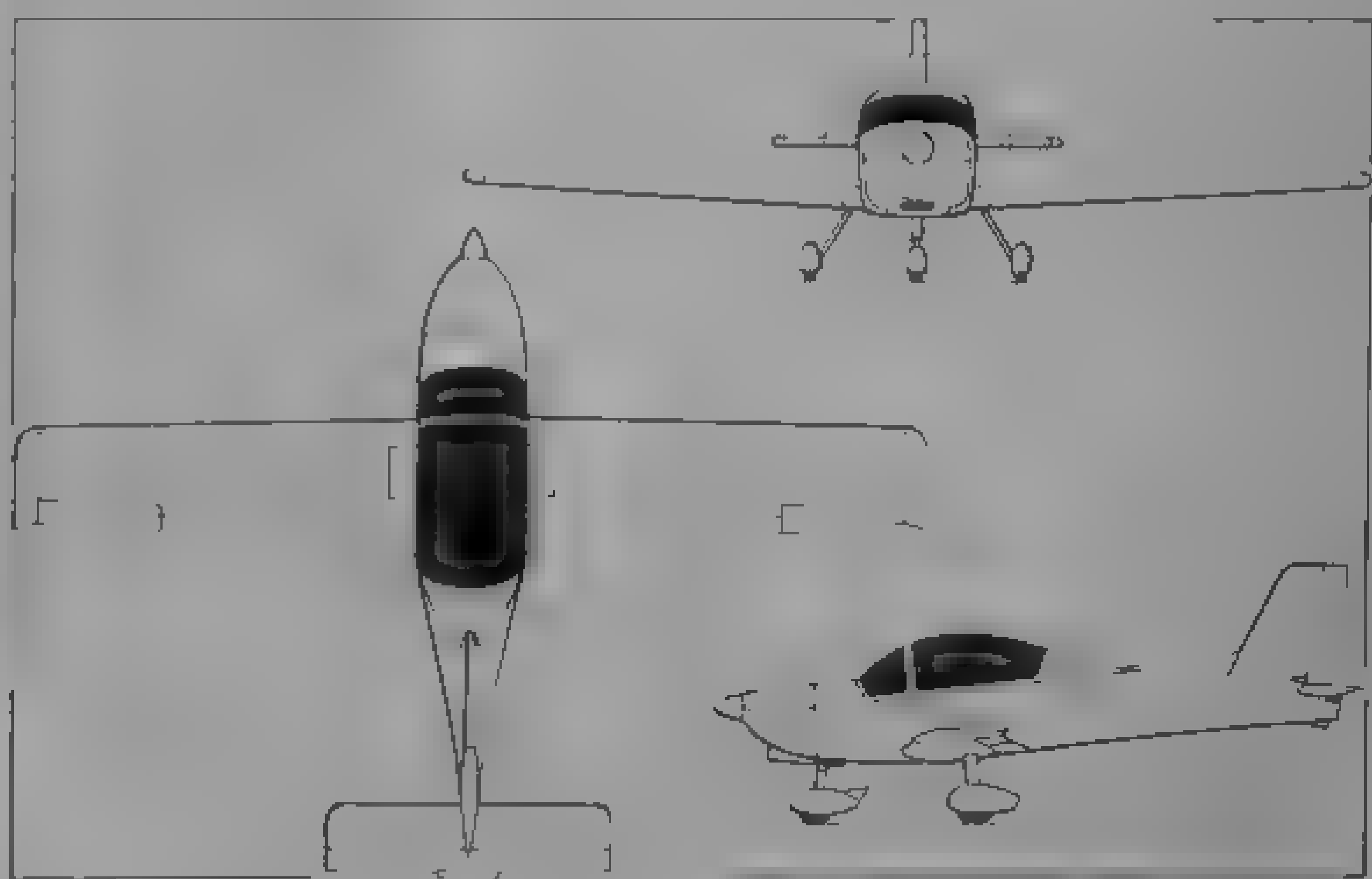
PERFORMANCE (at max T-O weight, ISA):

Max cruising speed	108 kts (200 km/h; 124 mph)
Econ cruising speed	89 kts (165 km/h; 102 mph)

Stalling speed, power off, flaps down
44 kts (82 km/h; 51 mph)
Range with max internal fuel
540 n miles (1,000 km; 621 miles)

NEW ENTRY

Colourfully decorated Moniot APM-20 Lionceau two-seat trainer *(Paul Jackson)*
1995



APM-20 Lionceau (Rotax 912 engine) *(Jane's/James Goulding)*
1995

MUDRY (page 99)

CAP 231 recently supplied to Moroccan Air Force's 'Marche Verte' aerobatic team *(Paul Jackson)*
1995

Seven CAP 232s had been completed by June 1995, of which F-GJGM was most recent *(Paul Jackson)*
1995

ROBIN (page 101)

Robin DR 400/125i with fuel-injected engine and three-blade propeller *(Paul Jackson)* 1995

Robin DR 400/185 V6 prototype flew on 6 June 1995 *(Paul Jackson)* 1995

SOCATA (page 105)

SOCATA HALE

TYPE: High-altitude long-endurance (HALE) surveillance aircraft

PROGRAMME: Design study

DESIGN FEATURES: Intended for both manned and unmanned flight, the latter with increased fuel, range and endurance. Roles include communications and electronic intelligence gathering, optical/radar/IR observation, and, with suitable sensors, datalinks and computers, warning of, and impact point calculations on, incoming ballistic missiles.

Very high aspect ratio single-engined monoplane. Fuselage similar to TBM 700 but with much larger fin and tailplane. Has lift dumpers (spoilers) on each wing to increase rate of descent from operating altitudes.

LANDING GEAR: Retractable tricycle type.

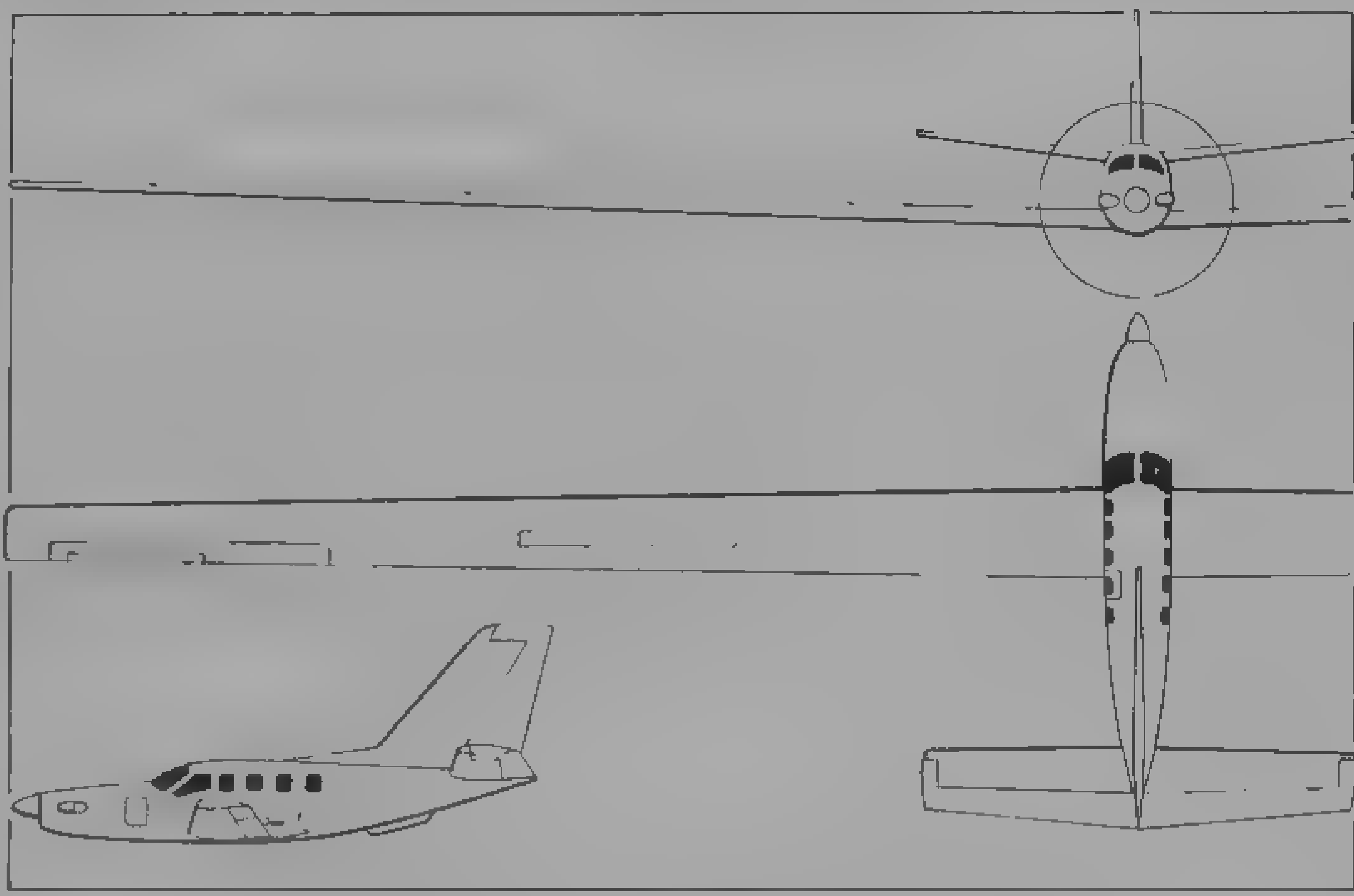
POWER PLANT: One 783 kW (1,050 hp) Pratt & Whitney Canada PW127C turboprop. Fuel capacity: manned flight 1,275 litres (336.8 US gallons, 280.5 Imp gallons), unmanned flight 1,500 litres (396.3 US gallons, 330.0 Imp gallons).

ACCOMMODATION: Two-man crew, maximum crew weight with full fuel 225 kg (496 lb), optionally unmanned.

AVIONICS: Customer specified.

EQUIPMENT: Customer specified, see roles under Design Features.

DIMENSIONS, EXTERNAL:	
Wing span	48.00 m (157 ft 5¾ in)
Wing aspect ratio	32.91
Length overall	10.81 m (35 ft 5 in)
Tailplane span	9.20 m (30 ft 2¼ in)
Propeller diameter	4.00 m (13 ft 1½ in)
DIMENSIONS, INTERNAL:	
Cabin: Pressurised volume	3.50 m³ (123.6 cu ft)
AREAS:	
Wings, gross	70 m² (753 sq ft)
WEIGHTS AND LOADINGS:	
Max payload	400 kg (882 lb)
Fuel weight (JP 5): manned flight	1,037 kg (2,286 lb)
unmanned flight	1,245 kg (2,745 lb)
Max T-O weight	4,500 kg (9,921 lb)
Max wing loading	64.29 kg/m² (13.17 lb/sq ft)
Max power loading	5.75 kg/kW (9.44 lb/shp)
PERFORMANCE (at max T-O weight, ISA):	
Service ceiling	18,300 m (60,000 ft)
Time to: service ceiling	1 h 39 min
15,764 m (55,000 ft)	45 min
Range with max fuel:	
manned	3,185 n miles (5,900 km, 3,666 miles)
unmanned	3,833 n miles (7,100 km, 4,411 miles)
Endurance with max fuel: manned	19 h 42 min
unmanned	23 h 36 min



Socata High-Altitude Long-Endurance aircraft *(Jane's/James Goulding)* 1995

NEW ENTRY

SOCATA TB 320 TANGARA

TYPE: Four-seat twin-engined cabin monoplane.

PROGRAMME: Socata acquired rights in 1995 to manufacture Grumman/Gulfstream American/American General GA-7 Cougar (see 1979-80 *Jane's*). Certified to FAR Pt 23 VFR/IFR. Deliveries from late 1996, mainly intended for training market.

DESIGN FEATURES: Wing section NACA 63A-415 (modified), wing dihedral 5°, sweptback fin.

FLYING CONTROLS: Mechanically operated ailerons, elevator and rudder, each with trim tab. Electrically operated Fowler flaps.

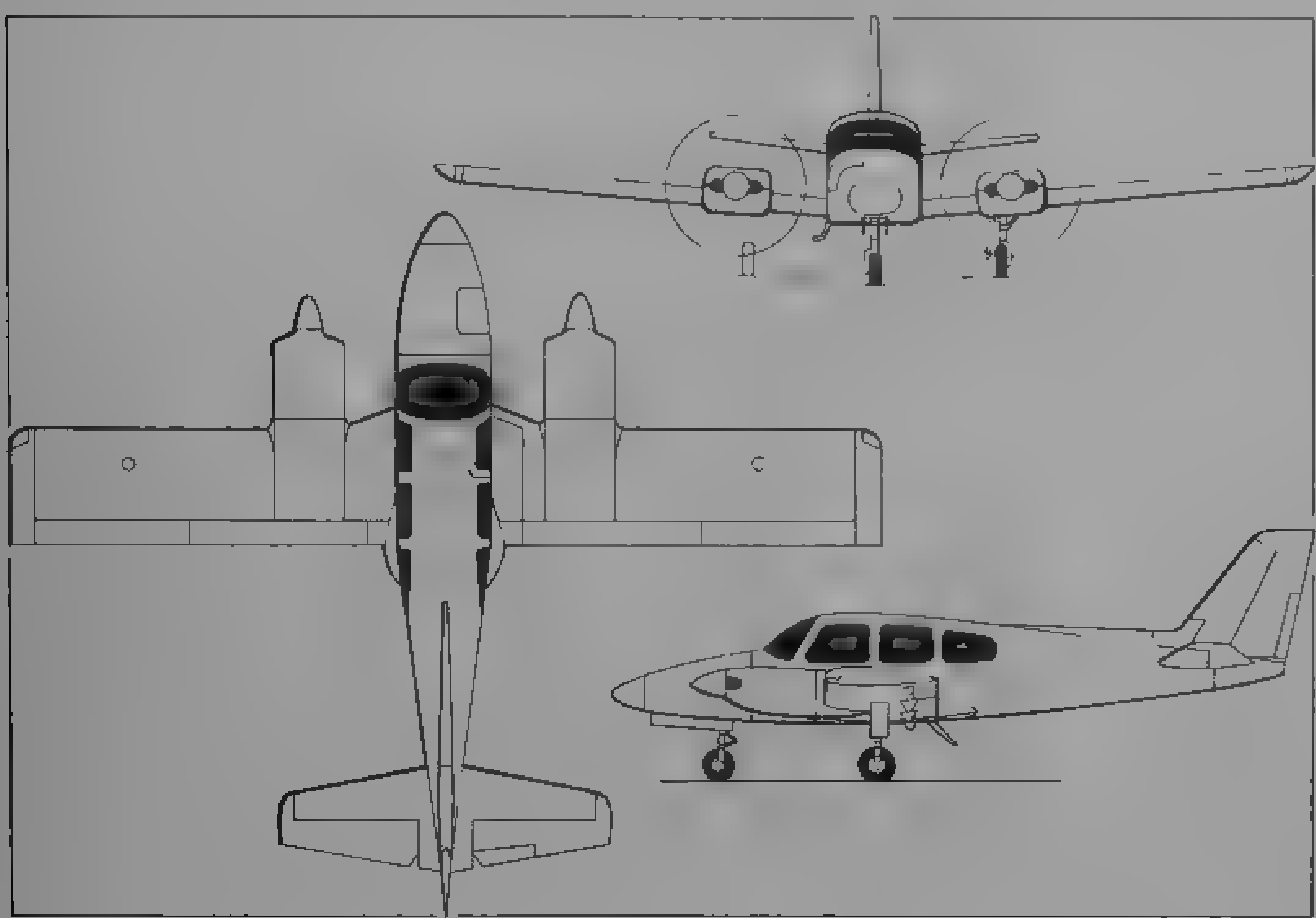
STRUCTURE: Wing has two-spar construction, fuselage is semi-monocoque.

LANDING GEAR: Hydraulically retractable tricycle type with single wheel on each unit. Steerable nosewheel retracts forward, main units outward into undersurface of wing. Oleo-pneumatic shock-absorbers. Free-fall emergency extension system. Main wheels have 17 × 6.00-6 6 ply tyres, nosewheel has 15 × 6.00-6 4 ply tyre. Toe-operated hydraulic brakes. Parking brake.

POWER PLANT: Two 119.3 kW (160 hp) Textron Lycoming O-320-D1D flat-four engines, each driving a Hartzell two-blade constant-speed fully feathering metal propeller. Integral fuel tank in each wing, with a combined capacity of 447 litres (118 US gallons, 98 Imp gallons). Refuelling point on upper surface of each wing. Oil capacity (each engine) 7.6 litres (2.0 US gallons, 1.7 Imp gallons).

ACCOMMODATION: Four seats, in two side by side pairs, in enclosed cabin. Dual controls standard. Overwing door on starboard side of fuselage. Baggage space aft of rear seats with external access door on starboard side. Door on starboard side of nose section to give access to battery and electronics, as well as an additional 0.34 m³ (12 cu ft) of baggage space. Provision for lightweight radar antenna in nosecone.

SYSTEMS: Hydraulic system for landing gear actuation and operation of brakes. Electrical system includes 14 V 60 A engine-driven alternators, 14 V voltage regulators and a



Socata TB 320 Tangara (Textron Lycoming O-320 engines) *(Jane's/James Goulding)* 1995

12 V 25 Ah battery. Heating, ventilation, and windscreen defrosters standard

AVIONICS: Customer specified, full IFR available

DIMENSIONS, EXTERNAL:
Wing span 11.23 m (36 ft 10¼ in)
Wing chord (constant) 1.45 m (4 ft 9 in)
Wing aspect ratio 7.38
Length overall 9.09 m (29 ft 10 in)
Height overall 3.16 m (10 ft 4¼ in)
Tailplane span 4.24 m (13 ft 11 in)
Wheel track 2.03 m (6 ft 8 in)
Wheelbase 3.30 m (10 ft 10 in)
Propeller diameter 1.85 m (6 ft 1 in)

DIMENSIONS, INTERNAL:
Cabin: Length 9.09 m (29 ft 10 in)
Max width 1.14 m (3 ft 9 in)
Max height 1.25 m (4 ft 1 in)

AREAS:
Wings, gross 17.09 m^2 (184 sq ft)
Vertical tail surfaces (total) 1.86 m^2 (20.0 sq ft)
Horizontal tail surfaces (total) 4.46 m^2 (48.0 sq ft)

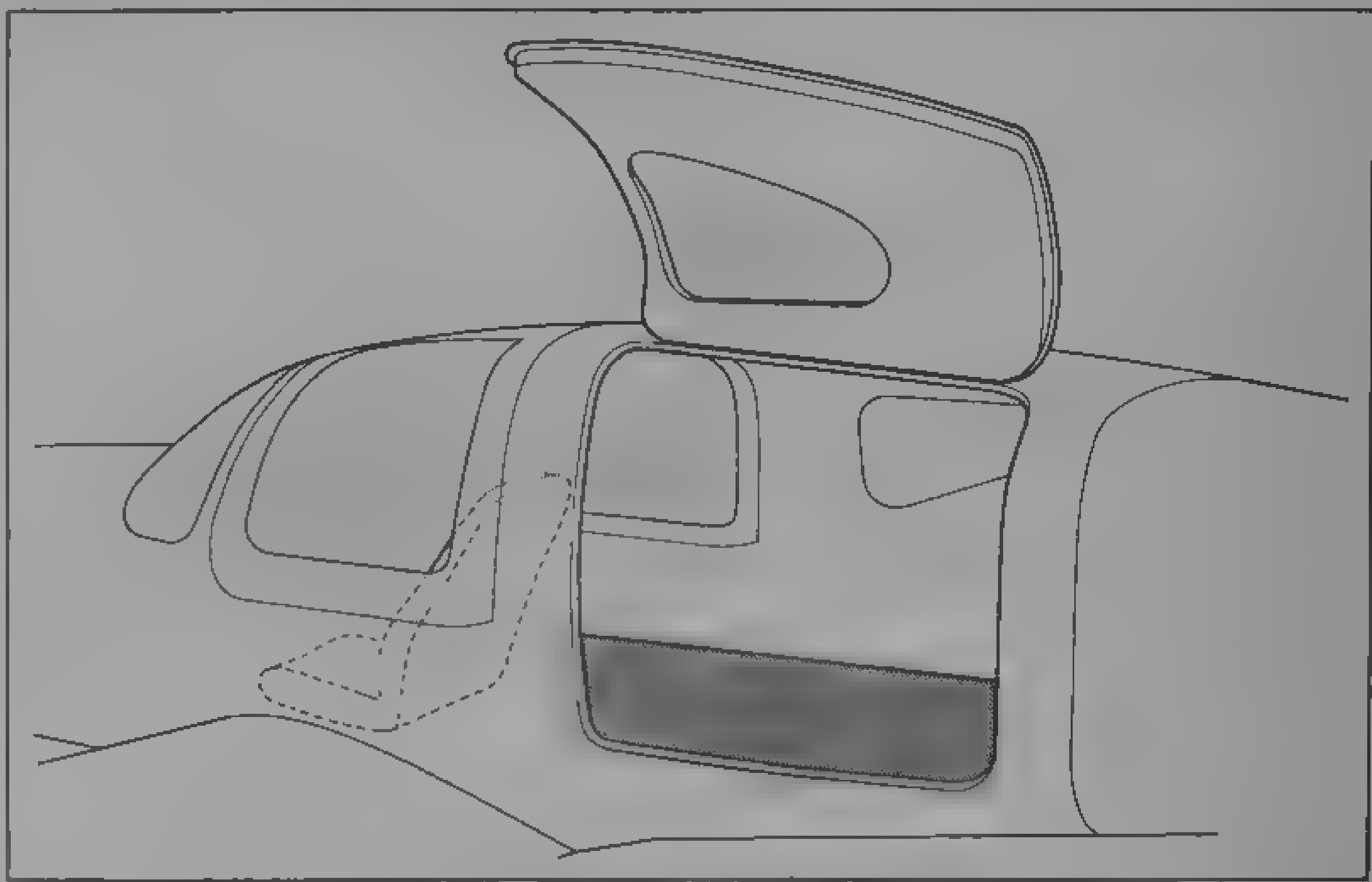
WEIGHTS AND LOADINGS:
Weight empty 1,174 kg (2,588 lb)
Max baggage weight 114 kg (250 lb)
Max T-O and landing weight 1,724 kg (3,800 lb)
Max wing loading 100.8 kg/m^2 (20.65 lb/sq ft)
Max power loading 7.23 kg/kW (11.88 lb/hp)

PERFORMANCE (at max T-O weight):
Max level speed at S/L 168 kts (311 km/h; 193 mph)
Max cruising speed, 75% power at 2,590 m (8,500 ft) 160 kts (296 km/h; 184 mph)
Econ cruising speed, 45% power at 2,590 m (8,500 ft) 109 kts (203 km/h; 126 mph)
Stalling speed, power off:
flaps up 71 kts (132 km/h; 82 mph)
flaps down 63 kts (117 km/h; 72.5 mph)
Min control speed, single engine 61 kts (113 km/h; 70.5 mph)
Max rate of climb at S/L 354 m (1,160 ft)/min
Rate of climb at S/L, OEI 61 m (200 ft)/min
Service ceiling 5,305 m (17,400 ft)
Service ceiling, OEI 1,295 m (4,250 ft)
T-O run 305 m (1,000 ft)
T-O to 15 m (50 ft) 564 m (1,850 ft)
Landing from 15 m (50 ft) 405 m (1,330 ft)
Landing run 216 m (710 ft)
Max crosswind 15 kts (28 km/h; 17 mph)
Range at 2,590 m (8,500 ft), with max fuel, incl allowances for start, taxi, T-O, and reserves for 45 min at 45% power: max cruising speed 840 n miles (1,555 km; 966 miles)
econ cruising speed (45% power) 1,170 n miles (2,166 km; 1,346 miles)

NEW ENTRY

Gulfstream American GA-7 in Socata house colours, pending start of Tangara production

1995



Freight door of Socata TB 20C Trinidad

1995

SOCATA TB 20C TRINIDAD

TYPE: Light freight and medevac aircraft

PROGRAMME: Announced June 1995; version of TB 20 tourer/trainer with port side freight door

Description as TB 20, except the following:

ACCOMMODATION: Pilot only, provision for attendant's seat behind pilot; 2 hour conversion to four/five-seat tourer/transport by removal of freight floor and fitment of bench seat

DIMENSIONS, EXTERNAL:
Freight door: Height 0.85 m (2 ft 9½ in)
Width 0.99 m (3 ft 3 in)

DIMENSIONS, INTERNAL:
Cabin: Width 1.28 m (4 ft 2½ in)
Max height 1.12 m (3 ft 8 in)
Cargo volume (single pilot) 1.65 m^3 (58.27 cu ft)

WEIGHTS AND LOADINGS:
Weight empty 830 kg (1,829 lb)
Max payload (single pilot) 276 kg (608 lb)

NEW ENTRY

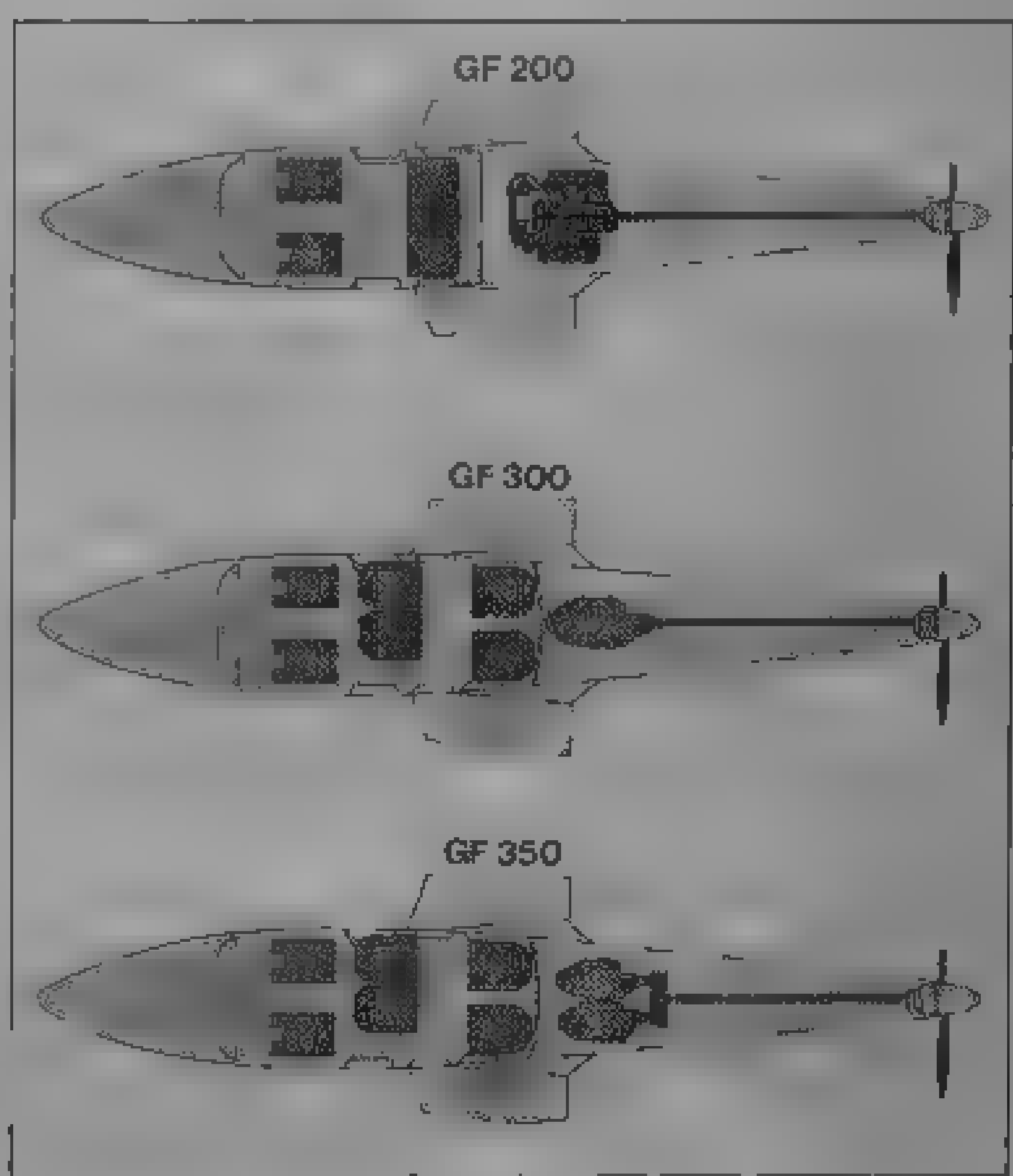
GERMANY

GROB (page 115)

GROB GF 200

DIMENSIONS, EXTERNAL:
Tailplane span 4.405 m (14 ft 5½ in)
Wheel track 2.53 m (8 ft 3½ in)
Wheelbase 3.19 m (10 ft 5½ in)
Fuselage max width 1.305 m (4 ft 3½ in)

UPDATED



Seating and power plant positions in the Grob GF 200 and projected GF 300 and GF 350

1995

AIRBUS (page 135)

Prototype Airbus A319 in final assembly at Hamburg, August 1995
1995

INTERNATIONAL

ATR (page 155)

Prototype ATR 42-400 first flew 12 July 1995 and will be certified in November 1995 after 300 hours of trials, delivery to CSA follows in December
1995

EUROSPACE
EUROSPACE CONSTRUZIONI SRL

Viale Cesare Pavase 77, I-00144 Rome, Italy
Telephone: 39 (6) 502 0554
Fax: 39 (6) 501 6994

SALES DIRECTOR: Michael Feinig

PARTICIPATING COMPANIES:

HOAC: see Austrian section

SOKOL, Nizhniegorodskii Gosudarstvennyi Aviaziostroitelnyi Zabod, Ulitsa Chaadaev, Nizhniy Novgorod 603035, Russia
Telephone: 7 (831) 246 75 03
Fax: 7 (831) 224 79 66

NEW ENTRY

EUROSPACE F.15F EXCALIBUR

TYPE: Single-engined four-seat tourer.

PROGRAMME: Developed from, and slightly larger and heavier than, Procaer/General Avia F 15 Picchio and Delfino designed by Dott Ing Stelio Frati (see Procaer in 1983-84 *Jane's*). Manufacture in Russia by Sokol, airframes to HOAC for completion and delivery. First deliveries planned in 1996.

COSTS: $175,000 (1995).

DESIGN FEATURES: Single-engined low-wing monoplane of conventional layout.

FLYING CONTROLS: Mechanically operated ailerons, elevator and rudder. Elevator tab for pitch trim. Fixed tabs on ailerons and rudder.

LANDING GEAR: Retractable tricycle type. Mainwheels retract inwards, nosewheel rearwards.

POWER PLANT: One 149 kW (200 hp) Textron Lycoming IO-360-A1B6 flat-four piston engine.

ACCOMMODATION: Four seats, two bucket seats in front, bench seat in rear, under rearward-sliding canopy.

SYSTEMS: Electrical system: 12 V 30 Ah battery, 14 V alternator.

AVIONICS: Bendix/King avionics as standard.

Comms: KX 155 com/nav/ISO/AA, KT 76A transponder.

Flight: KI 208 VOR/LOC/CV.

Instrumentation: Full panel with vacuum AH and electric T&S. Engine instruments include hours counter, fuel pressure, suction, and volts.

DIMENSIONS, EXTERNAL:

Wing span	10.28 m (33 ft 8¾ in)
Length overall	7.29 m (23 ft 11 in)
Height overall	3.01 m (9 ft 10½ in)

WEIGHTS AND LOADINGS:

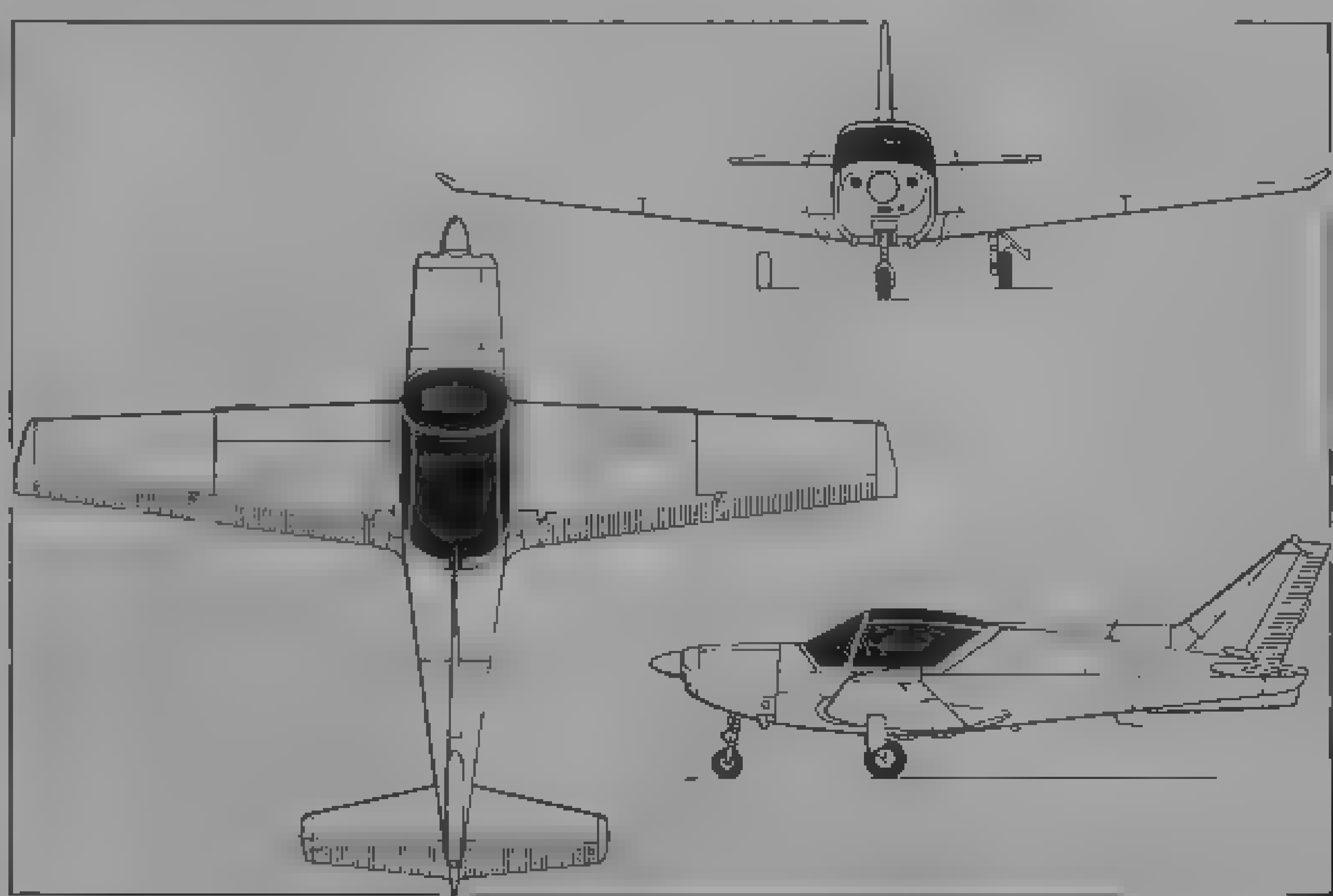
Weight empty	780 kg (1,720 lb)
Max payload	445 kg (981 lb)
Max T-O weight	1,225 kg (2,701 lb)
Max power loading	8.22 kg/kW (13.51 lb/hp)

PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (VNE)	200 kts (370 km/h; 230 mph)
Max level speed	152 kts (281 km/h; 175 mph)
Econ cruising speed at 75% power at 1,980 m (6,500 ft)	145 kts (268 km/h; 170 mph)
Stalling speed, power off, flaps down	58 kts (107 km/h; 67 mph)
Max rate of climb at S/L	288 m (945 ft)/min
Service ceiling	4,575 m (15,000 ft)
T-O run	360 m (1,180 ft)
Range with max internal fuel, 65% power	725 n miles (1,342 km; 834 miles)
Endurance with max internal fuel, 65% power	5 h 30 min

NEW ENTRY

Eurospace F.15F Excalibur demonstrator
1995



F 15F Excalibur, derived from Procaer/General Avia Delfino (*Jane's/James Goulding*)
1995

ITALY

AGUSTA (page 218)

AGUSTA A 119 KOALA

TYPE: Single-turbine light helicopter.

PROGRAMME: First flight (I-KOAL) early 1995, public debut at Paris Air Show June 1995; certification scheduled for late 1995, first deliveries Spring 1996.

DESIGN FEATURES: Fully articulated four-blade composite main rotor with titanium hub, composite materials grips and elastomeric bearings; two-blade tail rotor.

STRUCTURE: Aluminium alloy fuselage.

LANDING GEAR: Fixed skids.

POWER PLANT: First prototype has 596.5 kW (800 shp) Turbomeca Arriel I turboshaft; other 633.8 kW (850 shp) class engines from Allison or Pratt & Whitney Canada may be offered on production aircraft.

ACCOMMODATION: Pilot and passenger in front, six passengers in main cabin, claimed to be 30 per cent larger than that of any current single-turbine light helicopter; flight-accessible baggage compartment in cabin; main baggage compartment in rear fuselage; in EMS configuration can accommodate two stretchers in main cabin without intrusion into cockpit area. Large sliding doors on each side of main cabin, forward-hinged door to cockpit on right side.

EQUIPMENT: Auxiliary equipment, transportable in baggage compartment and requiring no special tools to install, permits quick on-site role conversion.

DIMENSIONS, INTERNAL:

Cabin: Length	2.10 m (6 ft 10¾ in)
Max width	1.61 m (5 ft 3½ in)
Max height	1.28 m (4 ft 2½ in)
Volume	3.45 m³ (121.8 cu ft)

WEIGHTS AND LOADINGS:

Max T-O weight: internal load	2,600 kg (5,732 lb)
external load	2,720 kg (5,997 lb)
Useful load: internal	234 kg (2,720 lb)
external	2,704 kg (5,961 lb)

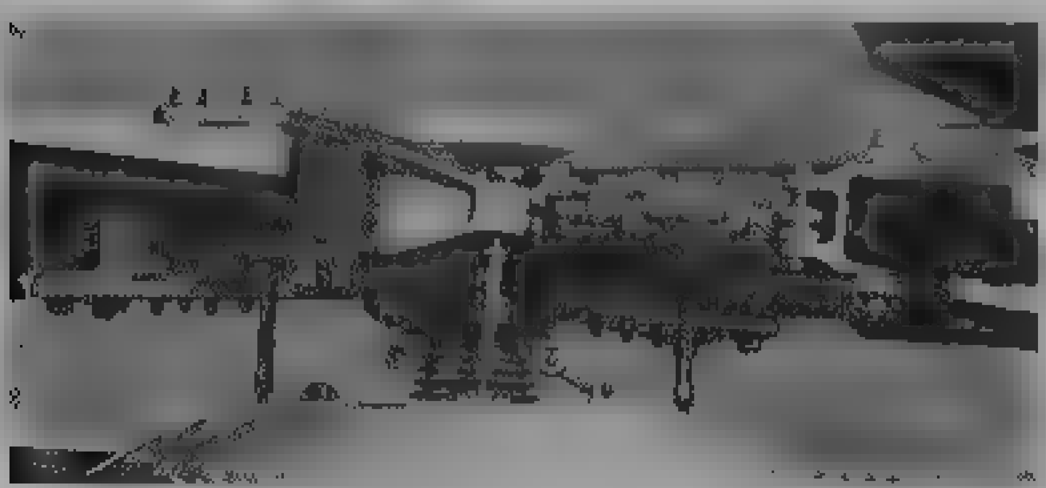
PERFORMANCE (at max T-O weight, ISA):

Never-exceed speed (VNE)	150 kts (278 km/h; 173 mph)
Max cruising speed	133 kts (246 km/h, 153 mph)
Service ceiling	4,240 m (13,911 ft)
Hovering ceiling: IGE	2,400 m (7,874 ft)
OGE	1,230 m (4,035 ft)
Max range	360 n miles (667 km, 414 miles)
Endurance	3 h 48 min

NEW ENTRY

Clearly a close relative of the A 109, Agusta's Koala is pictured preparing for a test flight

1995



Rotor head of the Agusta A 119 Koala

1995

AGUSTA A 109C

CURRENT VERSIONS: **A 109 Power**: New version first flown in early 1995 and announced at Paris Air Show in June, by which time prototype had accumulated more than 60 hours of flight testing and construction of second aircraft well advanced. Based on A 109K2 airframe with new, A 129-derived lightweight, low-maintenance titanium main rotor head connected to composite material grips via single elastomeric bearing on each blade; two Pratt & Whitney Canada PW 206C engines, each rated at 546 kW (732 shp), with FADEC and liquid crystal multifunction displays for engine management, and new landing gear. Weight empty 1,555 kg (3,428 lb); normal T-O weight 2,720 kg (5,997 lb), maximum T-O weight with external load 3,000 kg (6,613 lb), maximum cruising speed 160 knots (296 km/h, 184 mph). Cabin length as for A 109K2, retaining quick-change facility from passenger to EMS operation, but flight deck and cabin wider than previous models. First delivery expected 1996 at IFR-equipped price of $2.7 million, production target of 40 to 45 per year.

NEW ENTRY

Prototype Agusta A 109C Power

1995

DRAGON FLY

DRAGON FLY SRL
Via Raffaello, 1/A, I 22060 Cucciago (Co)
Telephone: 39 (031) 725190
Fax: 39 (031) 787642

Company founded by twin brothers Angelo and Alfredo Castiglioni. Dragon Fly in production by a workforce of 35.

NEW ENTRY

DRAGON FLY

TYPE: Two-seat, very light helicopter.

PROGRAMME: Developed originally by CRAE Elettromeccanica SpA, Dragon Fly srl formed 1993 from substantially same workforce. Design studies and manufacture of single-seat prototype 1985-88, ground and flight testing of this aircraft, 1989-90; two-seat prototype built and tested, 1991-93. Total of two single-seat and three two-seat prototypes, followed by four preseries aircraft; initial production rate (1994) three per month, increased to eight per month at new factory from October 1994.

CUSTOMERS: First delivery in May 1994 to Chinese Civil Protection Volunteers.

COSTS: Lit148 million ($89,000) flyaway, October 1994.

DESIGN FEATURES: Developed and tested by manufacturer to standards approaching FAR Pt 27; initial Italian certification is in ultralight class, but programme for domestic VLR (very light rotorcraft) certification began October 1994. Two-blade, semi-rigid main rotor and two-blade tail rotor; all blades of NACA 0012 aerofoil section; main rotor nominal speed 500 rpm. Can be road-towed on trailer with main blades removed. Optionally available in kit form.

FLYING CONTROLS: Conventional mechanical.

Dragon Fly (Göbler-Hirth F-30A26AK engine)

1995

STRUCTURE: Cabin is welded titanium frame with composites outer shell, aluminium alloy tailboom and landing skids. Full corrosion protection.

LANDING GEAR: Conventional twin-skid type.

POWER PLANT: One 78.3 kW (105 hp) Göbler-Hirth F-30A26AK four-cylinder two-stroke with twin-spark ignition, modified for helicopter use. Transmission driven through centrifugal clutch and two V belts. Fuel capacity 64 litres (16.9 US gallons, 14.1 Imp gallons).

ACCOMMODATION: Side by side seats, with harnesses, for two persons. Dual controls standard. Small baggage compartment aft of seats.

AVIONICS: *Comms:* Provision for transceiver and intercom.

Flight: Optional electric lateral trim.

Instrumentation: Standard equipment and instruments include ground-handling wheels, altimeter, voltmeter, ASI, bank indicator, compass, collective indicator, engine and rotor rpm indicator, engine hour meter, fuel gauge and engine temperature gauge. Provision for fuel pressure gauge, engine fire warning light, fuel shut-off valve and main/tail rotor transmission chip detectors.

DIMENSIONS, EXTERNAL:
Main rotor diameter 6.60 m (21 ft 7¾ in)
Tail rotor diameter 1.12 m (3 ft 8 in)

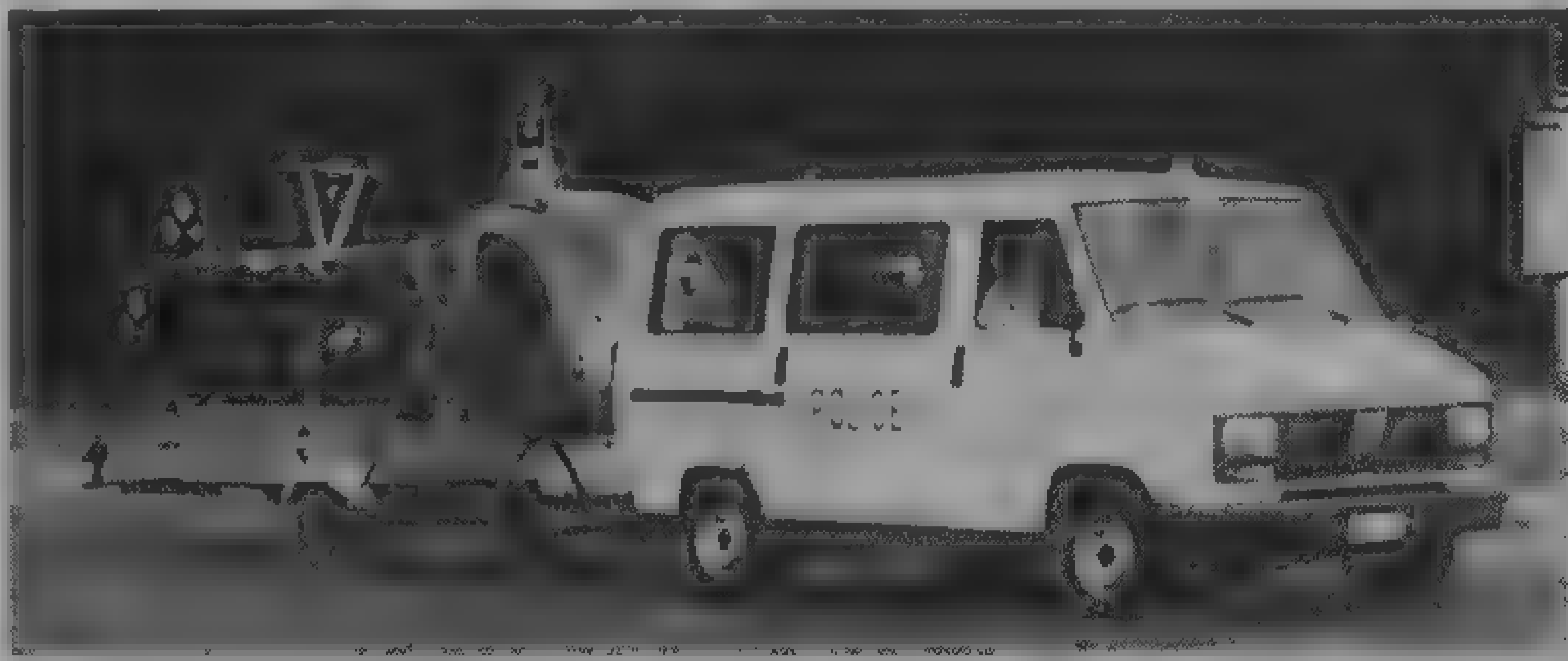
AREAS:
Main rotor disc 34.21 m² (368.25 sq ft)
Tail rotor disc 0.99 m² (10.56 sq ft)

WEIGHTS AND LOADINGS:
Weight empty 230 kg (507 lb)
Max normal T-O weight 450 kg (992 lb)
Max emergency overload T-O weight 500 kg (1,102 lb)

PERFORMANCE:
Never-exceed speed (VNE) 80 kts (148 km/h, 92 mph)
Cruising speed 65 kts (120 km/h, 75 mph)
Max rate of climb at S/L 390 m (1,280 ft)/min
Hovering ceiling: IGE 2,050 m (6,725 ft)
OGE 1,450 m (4,755 ft)
Endurance at above cruising speed 2 h 30 min

NEW ENTRY


Production Dragon Flys (French-registered example in the foreground)
1995


Dragon Fly being road-towed behind a van
1995

RUSSIA

BERIEV (page 310)

BERIEV Be-32

Estimated data for version with Pratt & Whitney Klimov PK6A-65B turboprops.

ACCOMMODATION: Basic seating for two crew and 16 passengers, seat pitch 73.75 cm (29 in). Business layout for seven passengers, with galley. Ambulance for six stretcher patients, 10 seated casualties and one attendant. Alternative payloads include 15 paratroops or 1,900 kg (4,190 lb) cargo in cabin 7.10 m (23 ft 3½ in) long, volume 17 m³ (600 cu ft).

PERFORMANCE (estimated):
Max cruising speed at 3,000 m (9,840 ft) 259 kts (480 km/h, 298 mph)
Econ cruising speed at 3,000 m (9,840 ft) 196 kts (363 km/h, 225 mph)
T-O to 10.7 m (35 ft) 480 m (1,575 ft)
Landing from 15 m (50 ft) 500 m (1,640 ft)
Range, 30 min reserves:
with 1,550 kg (3,417 lb) payload (16 passengers):
at max cruising speed 324 n miles (600 km; 372 miles)
at econ cruising speed 432 n miles (800 km; 497 miles)
Business transport, 7 passengers:
at max cruising speed 781 n miles (1,450 km, 901 miles)
at econ cruising speed 998 n miles (1,850 km, 1,149 miles)
Endurance: Border patrol mission 5 h 24 min

UPDATED

BERIEV A-50

EQUIPMENT: LO-82 IR warning receiver for protection against short-range IR guided air-to-air missiles. New IR launch-warning system detects launch of tactical, medium-range and submarine-launched missiles at ranges up to 540 n miles (1,000 km, 621 miles) with aircraft at 10,000 to 12,000 m (32,800 to 39,370 ft).

UPDATED

ILYUSHIN (page 315)

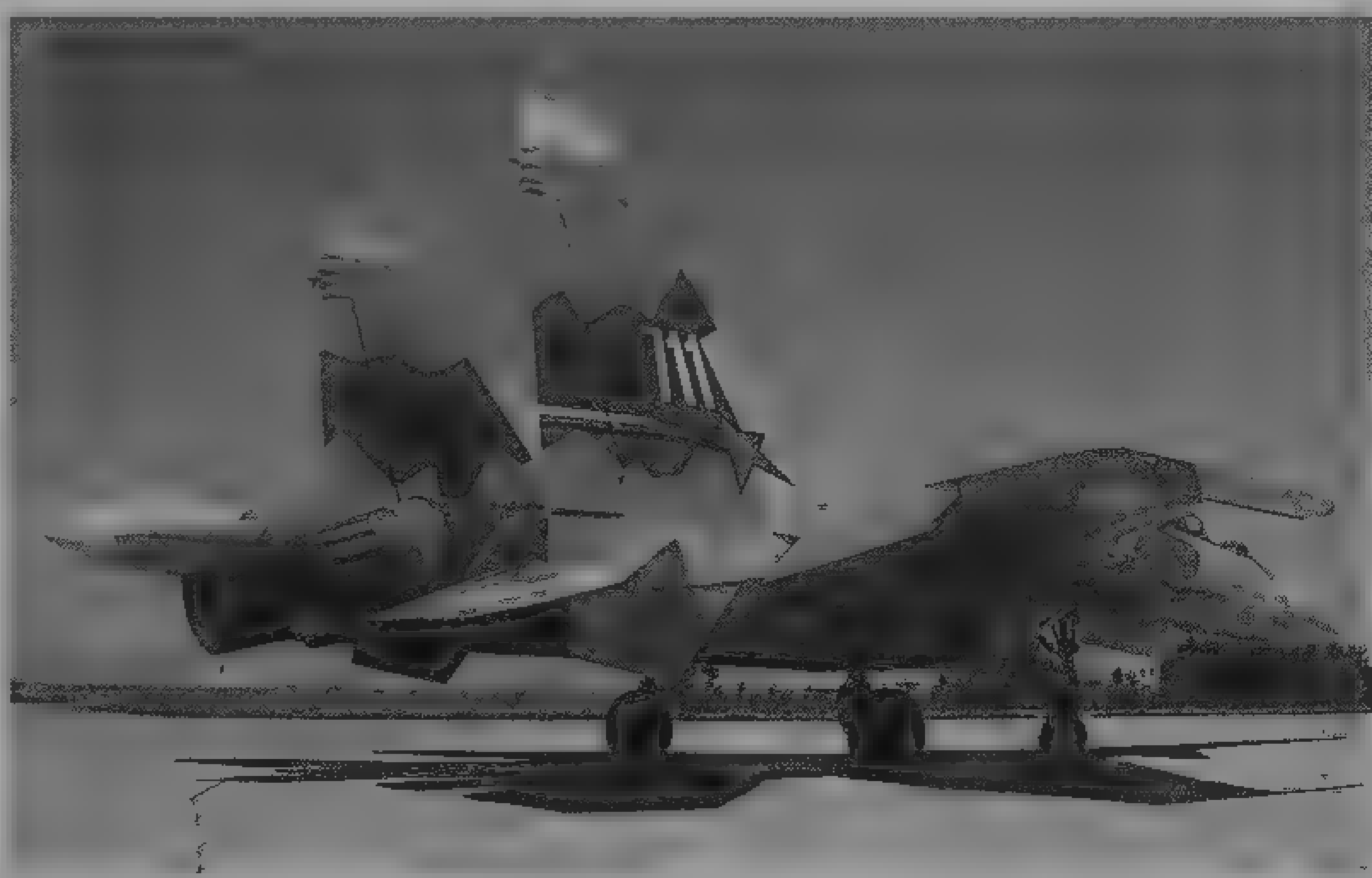
ILYUSHIN Il-114

Additional version announced June 1995.

Il-114PC: With P&WC PW127C turboprops, new avionics and upgraded systems, primarily for export; first flight scheduled for late 1996, certification 1997.

UPDATED

SUKHOI (page 368)


Sukhoi Su-35 '711' at Zhukovsky, showing jet nozzles vectored downward
(Yefim Gordon)
1995

TUPOLEV (page 386)

TUPOLEV Tu-304

Additional information available June 1995

POWER PLANT: Two Rolls-Royce Trent 884 turbofans, each 384.8 kN (86,500 lb st)

DIMENSIONS, EXTERNAL (approx):

Wing span	57 m (187 ft)
Length overall	62 m (203 ft)
Height overall	19 m (62 ft)
Wing sweep	33° 18′
Wing aspect ratio	9.6

WEIGHTS AND LOADINGS:

Max payload	55,000 kg (121,250 lb)
Max fuel	88,000 kg (194,000 lb)
Max T-O weight	245,000 kg (540,125 lb)

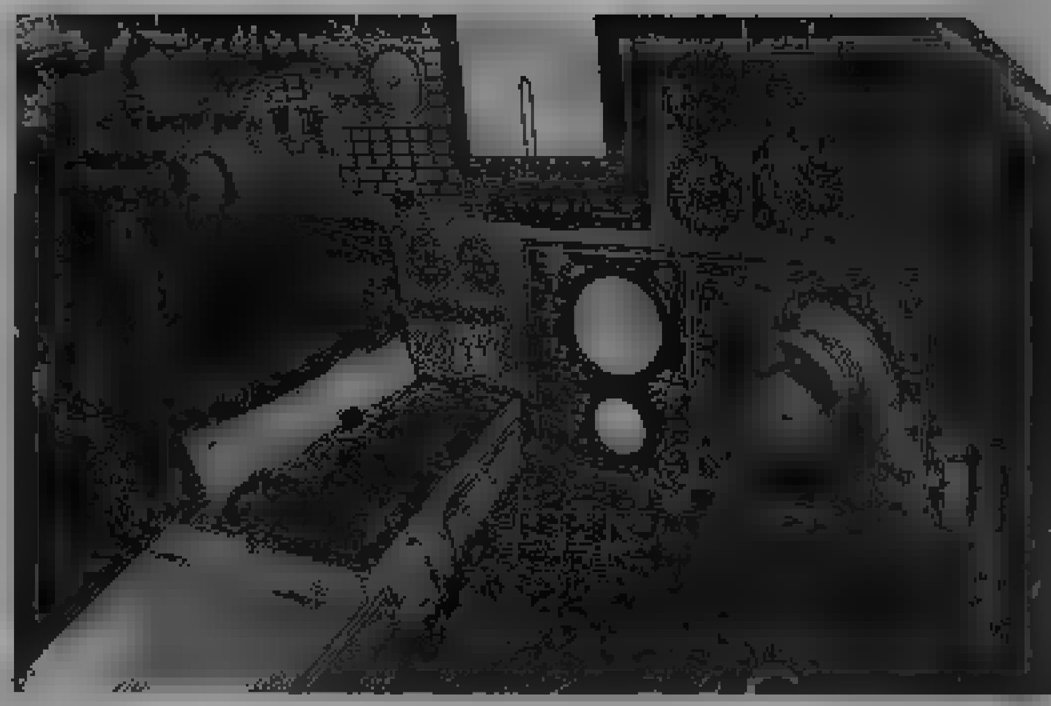
PERFORMANCE (estimated):

Max operating Mach number at 11,000 m (36,000 ft) 0.85

Balanced runway length at 340 m (1,115 ft), 30°C 3,200 m (10,500 ft)

Nominal range with 400 passengers 5,500 n miles (10,200 km; 6,335 miles)

Cockpit of Tupolev Tu-22M-3 ('Backfire-C') *(Yefim Gordon)* *1995*



Navigator's station in Tu-22M-3 *(Yefim Gordon)* *1995*

YAKOVLEV (page 399)

Mockup of the Yakovlev Yak-44E AEW&C aircraft, described in 1994-95 Jane's *(Yefim Gordon collection)* *1995*

UKRAINE

ANTONOV (page 433)

First photograph to become available of complete Antonov AEW&C aircraft ('Madcap'), now known to have been designated An-71, last described in 1991-92 Jane's *(Victor Drushlyakov via Yefim Gordon)* *1995*

UNITED KINGDOM

CLARK-NORMAN

Sandown Airport, Isle of Wight

DIRECTORS:

Alec Clark

Desmond Norman

Clark Norman was formed to design and build the Triloader aircraft described below.

NEW ENTRY

CLARK NORMAN TRILOADER

TYPE: Three-turboprop utility transport.

PROGRAMME: Planned first flight August 1997, certification December 1998. Negotiations under way with a European manufacturer for series production.

DESIGN FEATURES: General layout similar to Desmond Norman's earlier Trislander design but with square-section fuselage designed for palletised cargo, strutted wing supports, and main undercarriage legs mounted on the fuselage instead of the wings.

FLYING CONTROLS: Mechanically operated ailerons, elevator and rudder. Elevator tab for pitch trim and fixed tabs on ailerons and rudder. Plain flaps inboard of ailerons.

LANDING GEAR: Fixed tricycle type; main legs fuselage-mounted.

POWER PLANT: Three 450 kW (603 shp) turboprop engines, one on each wing and one mounted on leading-edge of fin.

ACCOMMODATION: Two crew, up to five LD 3 containers through front loading system. Smaller palletised cargo loaded through side doors.

AVIONICS: Customer specified.
DIMENSIONS, EXTERNAL (approx):
Wing span 24.4 m (80 ft 0 in)
Length overall 19.0 m (62 ft 6 in)

WEIGHTS AND LOADINGS (approx):
Max payload 3,000 kg (6,600 lb)
Max T-O weight 8,350 kg (18,400 lb)
Max power loading 6.19 kg/kW (10.16 lb/shp)
PERFORMANCE (at max T-O weight, ISA):
Econ cruising speed 156 kts (290 km/h; 180 mph)
T-O run 225 m (738 ft)
Range 313 n miles (580 km; 360 miles)

NEW ENTRY

UNITED STATES OF AMERICA

MCDONNELL DOUGLAS (page 579)

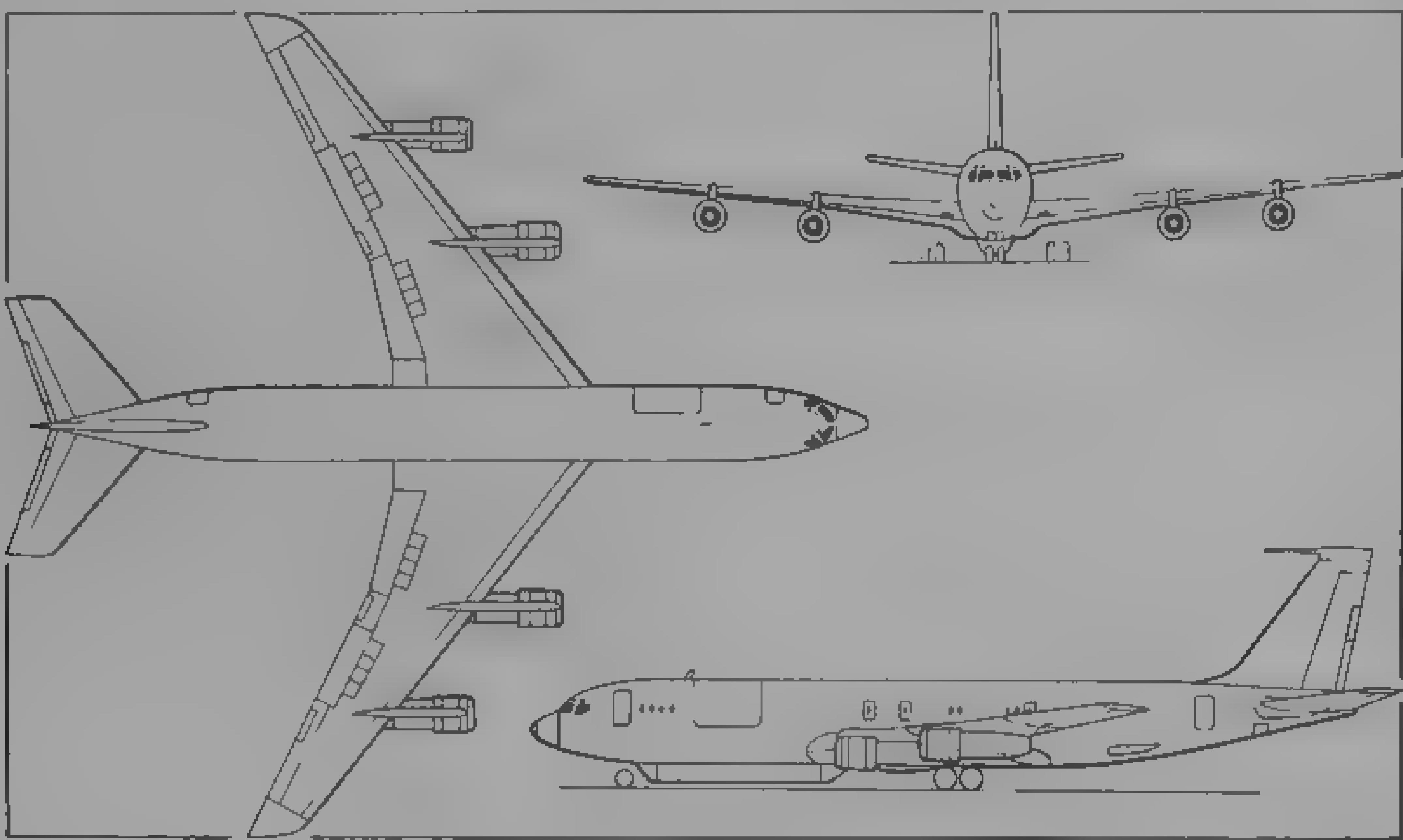
MCDONNELL DOUGLAS F/A-18E/F HORNET

CURRENT VERSIONS: **F/A-18 C²W**: Private venture (McDonnell Douglas and Northrop Grumman) development of F/A-18F as two-seat electronic warfare aircraft, announced 7 August 1995, potential replacement for Grumman EA-6B Prowler; minimal structural changes, wideband receiver pods replace wingtip Sidewinder AAMs, other pods and antennae on weapon pylons, satcom receiver behind cockpit.

NEW ENTRY

Artist's impression of projected McDonnell Douglas F/A-18 C²W Hornet for command and control warfare *1995*

NORTHROP GRUMMAN (page 614)



Northrop Grumman E-8C Joint-STARS surveillance aircraft *(Jane's/James Goulding)* *1995*

REVOLUTION
REVOLUTION HELICOPTER CORPORATION INC

1905 W Jesse James Road, Excelsior Springs, Missouri 64024
Telephone: 1 (816) 637 2800
Fax: 1 (816) 637 7936
PRESIDENT: Dennis Fetters
GENERAL MANAGER: Gus Lanz

NEW ENTRY

REVOLUTION HELICOPTER MINI-500

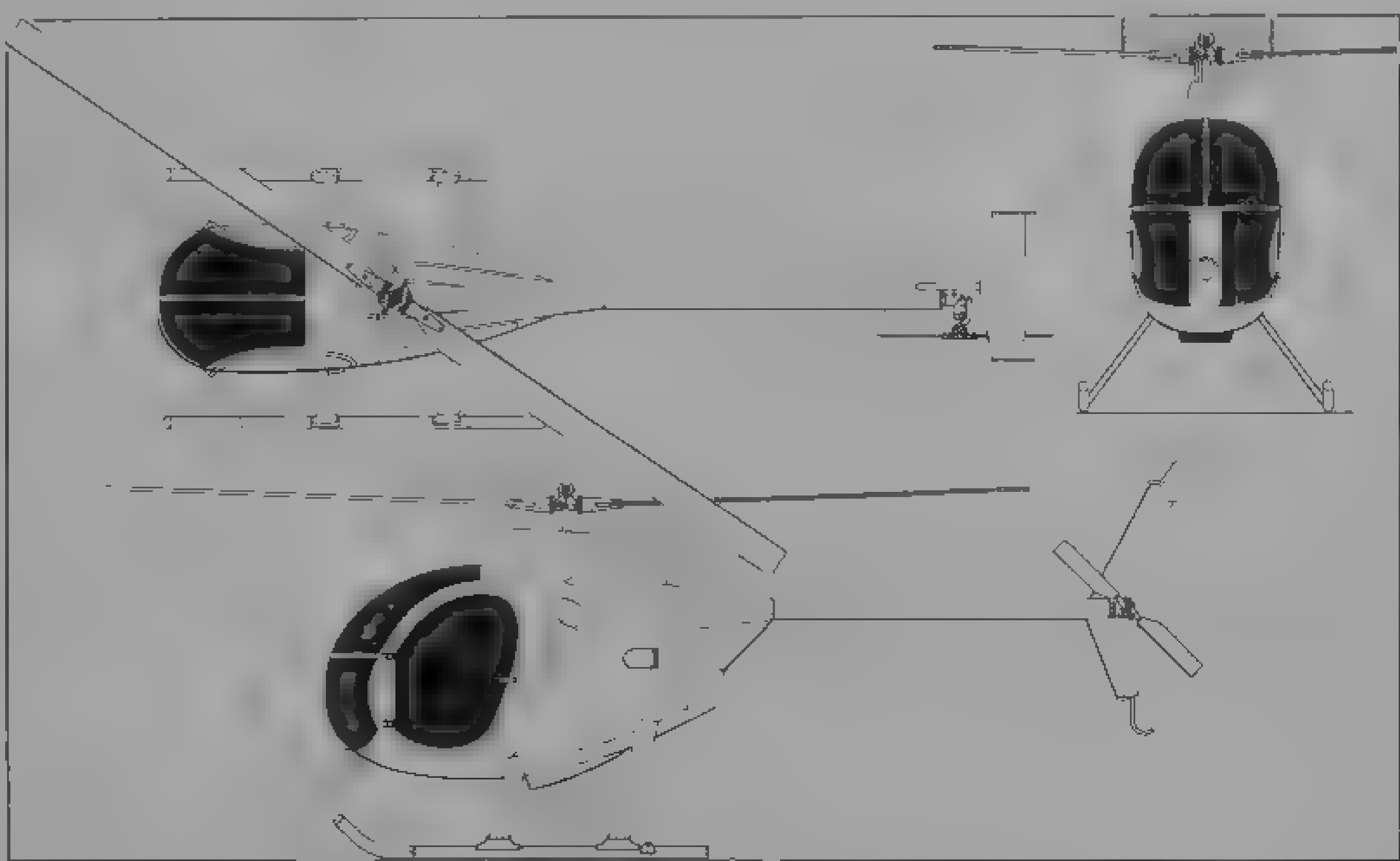
TYPE: Single-seat homebuilt helicopter; scale replica of McDonnell Douglas MD 500.

PROGRAMME: Based on X101 prototype, a single-seat open structure helicopter designed by Argentine Augusto Cicaré and with whom Dennis Fetters established Revolution Helicopters. The Mini-500 in kit form has similar dynamics but incorporates a modified and light structure and features a moulded glassfibre cabin shell and unsupported tailboom with new tail surfaces. Kit assembly in 40 to 60 hours.

COSTS: Kit: $24,500 (1995).

DESIGN FEATURES: Two-blade semi-rigid teetering main rotor, turning at 550 rpm, constructed using aluminium alloy spars and composite skins. Teetering two-blade tail rotor of aluminium alloy and steel construction, turning at 2,671 rpm. Rubber insulators, flex-packs and counterbalances for vibration damping. Optional rotor brake.

STRUCTURE: Welded steel tube structure, with moulded glassfibre cabin enclosure. Twin skid landing gear. Floats and skis optional.



Revolution Mini-500 (Rotax 582 piston engine) *1995*

POWER PLANT: One 50 kW (67 hp) Rotax 582, with belt drive to transmission. Fuel capacity 55.6 litres (14.7 US gallons; 12.25 Imp gallons). Transmission rating 40 kW (53.6 hp) at take-off and 82 kW (110 hp) capacity.

DIMENSIONS, EXTERNAL:
Main rotor diameter 5.79 m (19 ft 0 in)
Main rotor blade chord 0.20 m (8 in)
Tail rotor diameter 1.17 m (3 ft 10 in)

Tail rotor blade chord 0 10 m (4 in)
Length of fuselage 5 49 m (18 ft 0 in)
Length overall (incl main rotor) 6 86 m (22 ft 6 in)
Height overall 2 46 m (8 ft 1 in)
Skid track 1 60 m (5 ft 3 in)
AREAS
Main rotor disc 26 57 m² (286 0 sq ft)
WEIGHTS AND LOADINGS
Weight empty 220 kg (485 lb)
Max payload 161 kg (355 lb)
Max T-O weight 381 kg (840 lb)
PERFORMANCE
Never exceed speed (VNE) 130 kts (241 km/h, 150 mph)
Max level speed at 1,525 m (5,000 ft) 82 kts (153 km/h, 95 mph)
Cruising speed at 1,525 m (5,000 ft) 65 kts (121 km/h, 75 mph)
Max rate of climb at S/L 335 m (1,100 ft)/min
Service ceiling 3,050 m (10,000 ft)
Hovering ceiling IGE 2,135 m (7,000 ft)
OGE 1,525 m (5,000 ft)
Range 195 n miles (362 km; 225 miles)
Endurance 3 h

NEW ENTRY

SCHWEIZER (page 643)

Schweizer RU-38A quiet surveillance aircraft *1995*

TRI R
TRI R TECHNOLOGY

1114 East 5th Street, Oxnard, California 93030
Telephone: 1 (805) 385 3680 or 3682

EUROPEAN AGENCY
Jumpa Sales, The Vines, Robbs Lane, Outwell, Cambridge PE14 8PN, UK
Telephone: 44 (1945) 77386
Fax: 44 (1354) 58288

NEW ENTRY

TRI-R KIS

TYPE: Side by side two-seat homebuilt monoplane

COSTS: Basic kit #11,500 plus VAT without engine, avionics, propeller, spinner, upholstery, battery, instruments and paint (1995)

DESIGN FEATURES: Consistent with designation KIS (keep it simple)

FLYING CONTROLS: Conventional, manually operated Upturned wingtips

STRUCTURE: Constructed of high-temperature epoxy pre-impregnated GFRP/CFRP premoulded components, with either divinycell or honeycomb core All metal components prewelded or premachined

LANDING GEAR: Non-retractable, with single wheels and cantilever main legs, optional spats

POWER PLANT: One 59 7 kW (80 hp) Limbach L2000 engine as standard Alternatives up to 93 kW (125 hp) Teledyne Continental IO-240

DIMENSIONS, EXTERNAL
Wing span standard 7 01 m (23 ft 0 in)
Length overall 6 71 m (22 ft 0 in)
Propeller diameter 1 42 m (4 ft 8 in)

Tri-R KIS kitplane assembled in UK *(Paul Jackson)* *1995*

DIMENSIONS, INTERNAL
Cockpit: Length 1 65 m (5 ft 5 in)
Max width 1 07 m (3 ft 6 in)
Max height 1 02 m (3 ft 4 in)
AREAS
Wings, gross 8 18 m² (88 0 sq ft)
WEIGHTS AND LOADINGS
Weight empty 308 kg (680 lb)
Max T-O weight (Limbach) 544 kg (1,200 lb)
Max wing loading 66 58 kg/m² (13 64 lb/sq ft)
Max power loading (Limbach) 9 13 kg/kW (15 0 lb/hp)
PERFORMANCE
Max level speed more than 130 kts (241 km/h, 150 mph)
Cruising speed 117 kts (217 km/h, 135 mph)
Stalling speed 48 kts (89 km/h, 55 mph)
Max rate of climb at S/L 228 m (750 ft)/min
T-O run approx 305 m (1,000 ft)
Range at cruising speed more than 521 n miles (965 km, 600 miles)
g limits +4.4/−2 2

NEW ENTRY

AIRCRAFT

On this page are aircraft generally identified only by numbers. Most were previously listed as 'Model 707' and so on under M

(For aircraft appearing in previous 10 editions, please see index on tinted paper following this one)

A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Q

R

S

Y

Z

AIRCRAFT – PREVIOUS TEN EDITIONS

On this page are aircraft generally identified only by numbers. Most were previously listed as 'Model 707' and so on under M

B

C

D

E

L

M

Note: Aircraft previously identified as 'Model xxx' are now listed as numbers only at the beginning of the index

W

X

Y

Z

PRIVATE AIRCRAFT

(Incorporating Sport, Homebuilt and Microlight Aircraft)

*Private aircraft retained in the book are now listed in the main Aircraft index. This index mainly covers entries in the preceding ten editions. Private aircraft and manufacturers now covered in the main Aircraft index are indicated thus **

C

D

M

N

O

P

T

U

V

W

X

Y

Z

SAILPLANES

*Some powered gliders are retained in the book and are now listed in the main Aircraft index. This index mainly covers entries in the preceding nine editions, but powered gliders and manufacturers now covered in the main Aircraft index are indicated thus **

HANG GLIDERS

Hang gliders are no longer listed in this book. Those listed below appeared in the 1992-93 and preceding six editions

LIGHTER THAN AIR

(For airships appearing in the previous ten editions, please see the index following this one)

LIGHTER THAN AIR – PREVIOUS TEN EDITIONS

AERO-ENGINES

(For engines appearing in the previous 10 editions, please see the index following this one)

AERO-ENGINES – PREVIOUS TEN EDITIONS

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